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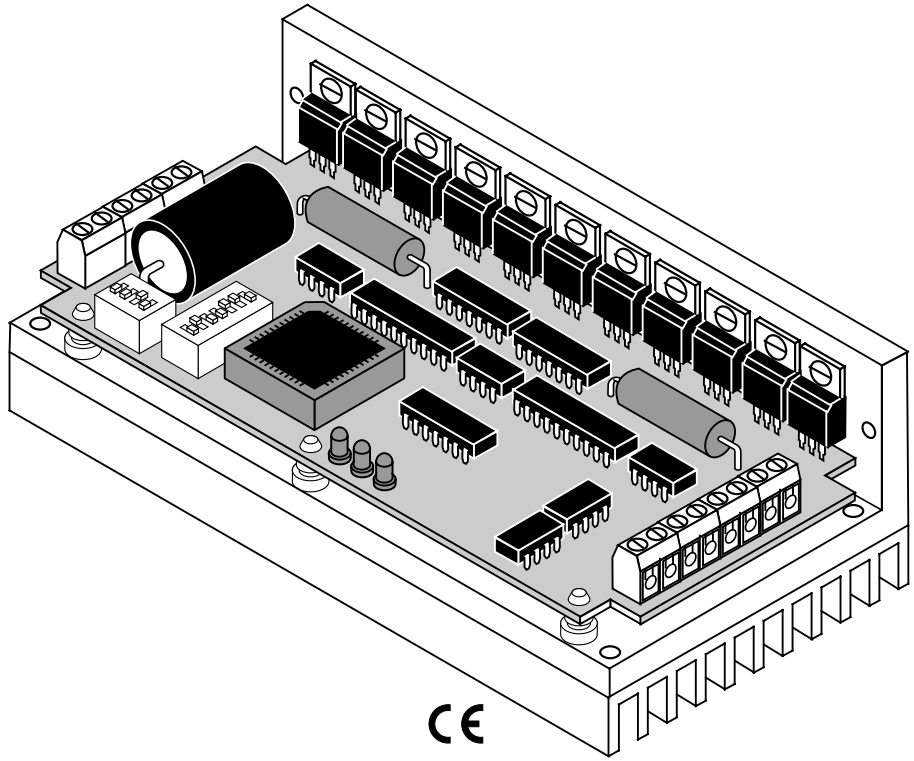
Find the *Applied Motion Products 7080* at our website: ***Click HERE***

9/17/99
7080.ai

User's Manual

7080

Step Motor Driver



CE

Applied Motion Products, Inc.
404 Westridge Drive Watsonville, CA 95076
Tel (831) 761-6555 (800) 525-1609 Fax (831) 761-6544

Applied Motion Products

motors • drives • controls

Technical Specifications

Amplifiers Dual, MOSFET H-bridge, 3 state, pulse width modulated switching at 25 kHz. 18 - 80 VDC input. 0.8 - 7.0 amps/phase output current, switch selectable in 0.2 amp increments. 550 watts maximum output power. Overcurrent and overtemperature protection. Automatic idle current reduction (defeatable), reduces current to 50% of setting after one second.

Inputs Step, direction and enable, optically isolated, 5-12V logic. 2 mA/V/signal, sink requirement. (24V logic can be used with current limiting resistors.) Motor steps on rising edge of step signal current. 0.25 µsec minimum pulse width, 2 MHz max step rate. 2 µsec minimum set up time for direction signal.

Output Fault output, optically isolated, becomes active if an over temperature or overcurrent (short circuit) fault occurs.

Microstepping 16 switch selectable resolutions. Steps per revolution with 1.8 motor: 200, 400, 1000, 2000, 5000, 10000, 12800, 18000, 20000, 21600, 25000, 25400, 25600, 36000, 50000, 50800. Waveform: pure sine standard. Other waveforms available upon request. Other resolutions available upon request.

Self Test Switch selectable self test rotates motor slowly in alternating direction, for testing drive & motor without input signals.

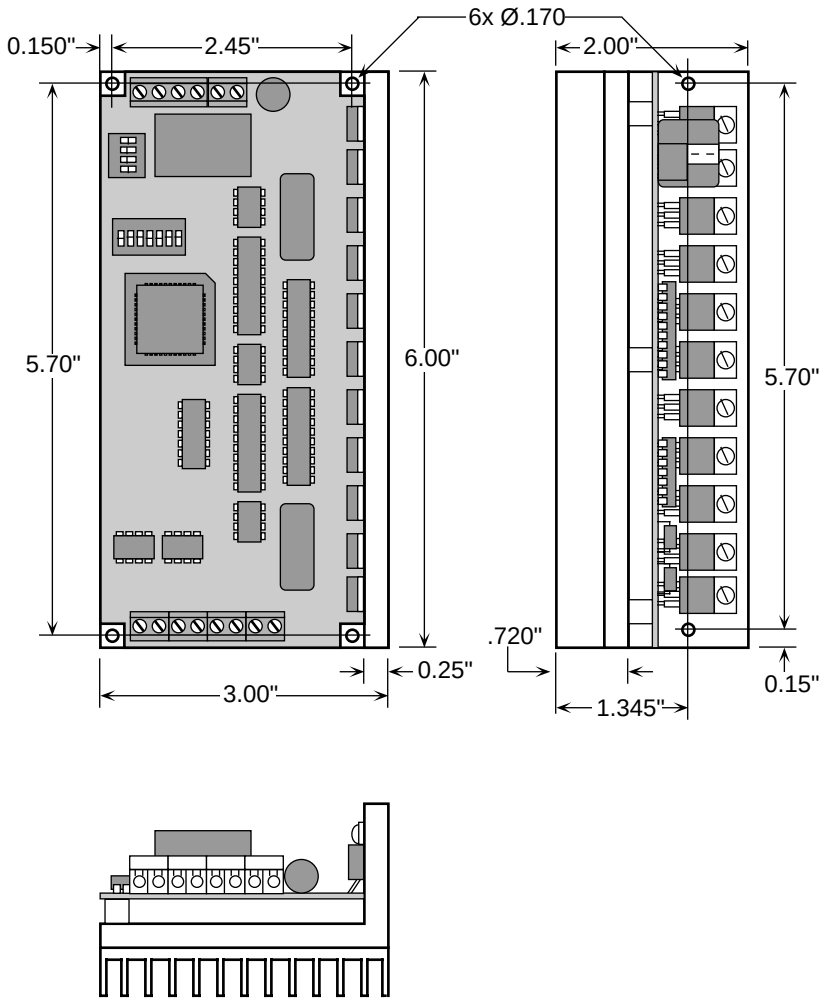
Physical Mounted on 1/4 inch thick black anodized aluminum heatsink/chassis. 2 x 3 x 6 inches overall. Power on and fault indicators. See drawing on page 14 for more information. Maximum chassis temperature: 70 C.

Connectors Screw terminal blocks.
Motor: 4 position, accepts AWG 12-28 wire
DC Input: 2 position, accepts AWG 12-28 wire
Signal Input: 8 position, accepts AWG 16-28 wire

Fuse Wickman 6.3 amp time lag, TR-5 style. Order from Digikey (1-800-DIGIKEY) part number WK4066.

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

Mechanical Outline



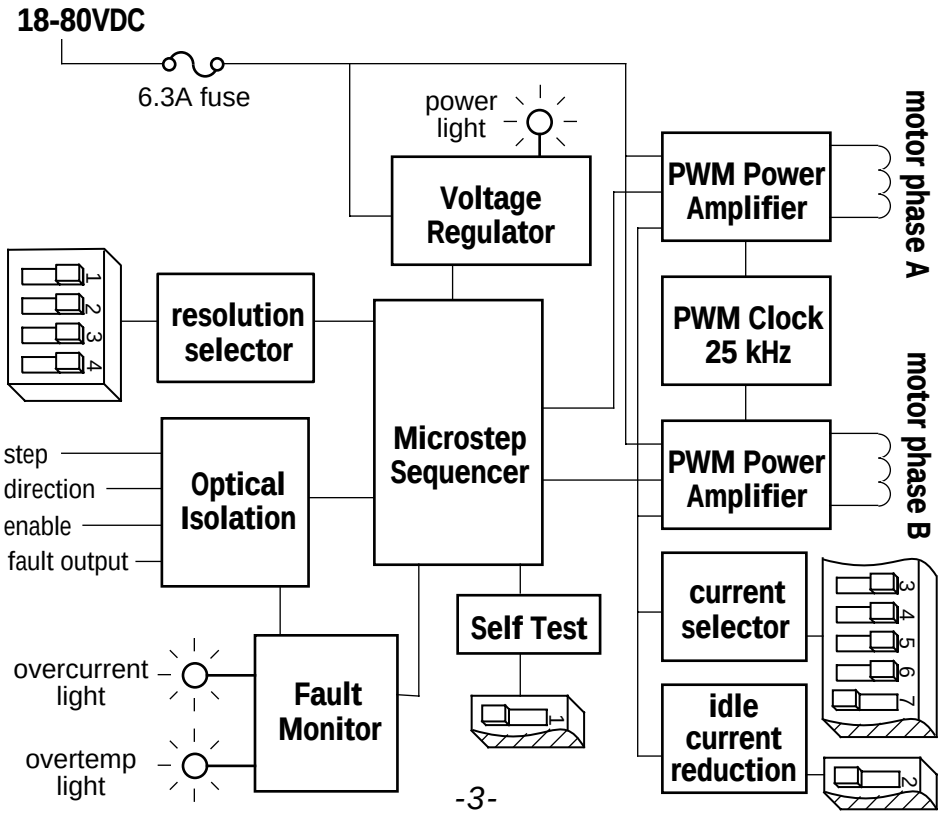
Introduction

Thank you for selecting an Applied Motion Products motor control. 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. Our phone number is (800) 525-1609 or you can reach us by fax at (831) 761–6544.

Features

- Drives NEMA sizes 14 through 42 step motors
- MOSFET pulse width modulation switching amplifiers (3 state)
- Phase current from 0.8 to 7.0 amps/phase (switch selectable, 32 settings)
- Step, direction and amplifier enable inputs, optically isolated
- Microstepping from full step through 1/ 254 (switch selectable, 16 settings)
- Over temperature and over current (short circuit) protection
- Idle current reduction (50% or 0%, switch selectable)
- Fault output, optically isolated

Block Diagram

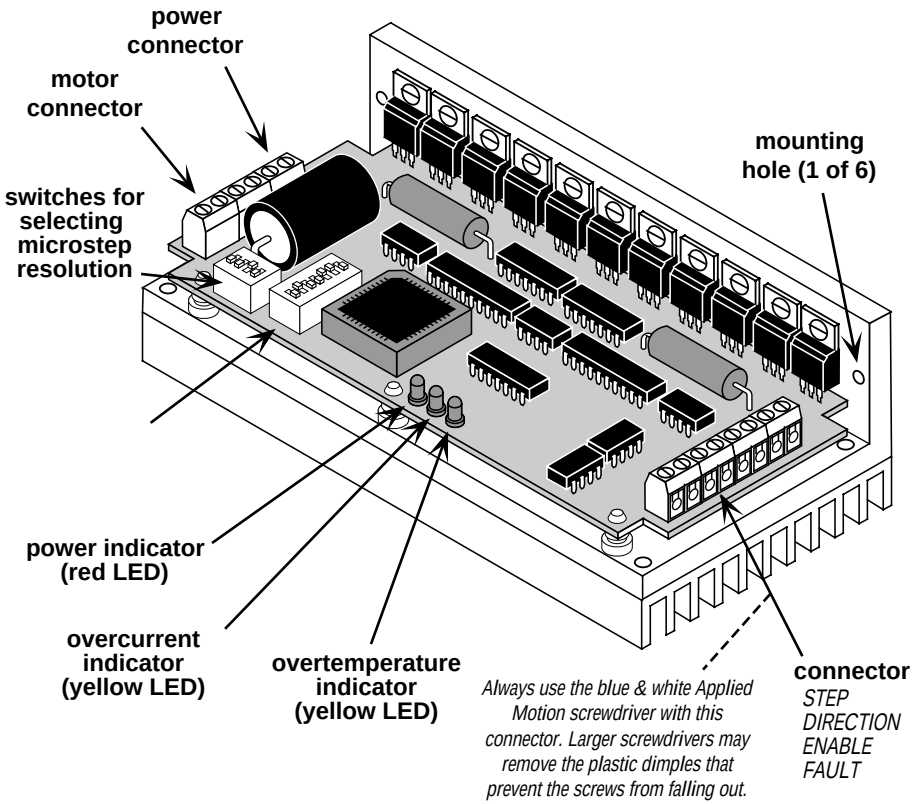


Getting Started

To use your Applied Motion Products motor control, you will need the following:

- a 18-80 volt DC power supply for the motor. Please read the section entitled *Choosing a Power Supply* for help in choosing the right power supply.
- a source of step pulses capable of sinking at least 5 mA
- if your application calls for bidirectional rotation, you'll also need a direction signal, capable of sinking 5 mA
- a compatible step motor
- a small flat blade screwdriver (3/32" or 2.5 mm) for tightening the connectors

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



Choosing a Power Supply

We recommend using an Applied Motion Products power supply with this drive. Two models are available: the PS430 (30 volts DC at 4 amps) and the PS1050 (50 volts DC at 10 amps). The PS430 can also provide 500 mA of well regulated 5 volt power for your logic circuits. If you do not choose an A.M.P. supply, please follow the recommendations below.

Voltage

Chopper drives like the 7080 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 48 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 the 7080 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.

Fault Protection

The 7080 provides protection against reversed power supply polarity, motor short circuits and excessive drive temperature. Under normal operation, you should see one red light, the power light.

If you see no lights either the fuse is blown or you do not have power applied to the drive. If the fuse blows, the + and – leads to the power supply may be reversed. Check to see if the wires connecting the power supply to the drive are reversed.

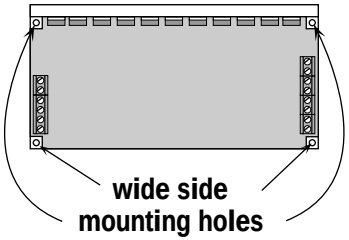
If you see a yellow "short" light the 7080 has detected an overcurrent condition and shut down the amplifiers. The first thing you should do is switch the power supply off. Check the motor wiring carefully. Make sure that the connections to the drive are secure and that any unused motor leads are insulated from the drive and power supply and from each other. Check the motor leads for shorts between phases or shorts to ground.

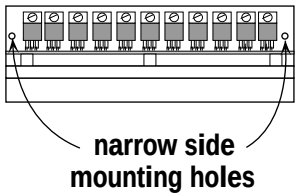
If you see a yellow "temp" light the 7080 has overheated. This means you need more air flow around the drive or additional heat sinking.

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 7080 drive will dissipate heat better if you mount it on the narrow side. Please use narrow side mounting whenever possible.



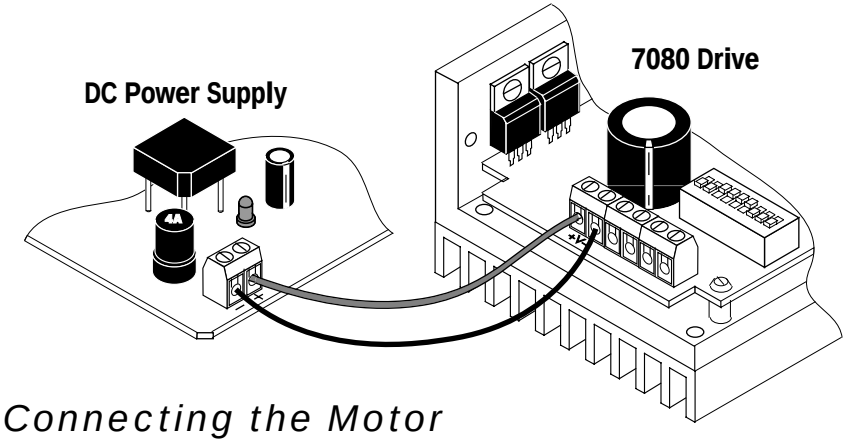


The amplifiers in the 7080 generate heat. To operate the drive continuously at maximum power you may need additional heat sinking or forced air cooling. Never use your drive in a space where there is no air flow or where other devices cause the surrounding air to be more than 50 C. Never put the drive where it can get wet or where metal particles can get on it.

Connecting the Power Supply

If you need information about choosing a power supply, please read *Choosing a Power Supply* located in the back of this manual.

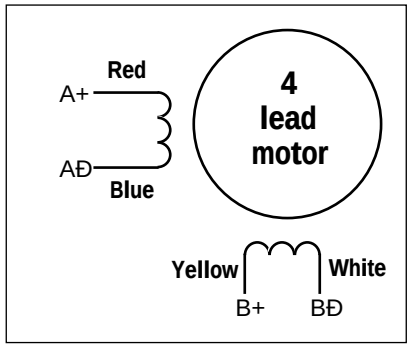
Connect the motor power supply **+** terminal to the driver terminal labeled "**+V**". Connect power supply **–** to the drive terminal labeled "**V–**." Use 18 gauge wire. **Be careful not to reverse the wires.**



Connecting the Motor

When connecting the motor to the driver, be sure that the motor power supply is off. Secure any unused motor leads so that they can't short out to anything. Never disconnect the motor while the drive is powered up. Never connect motor leads to ground or to a power supply!

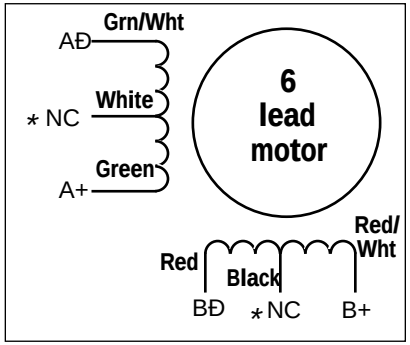
You must now decide how to connect your motor to the drive. The lead colors shown are for Applied Motion Products motors.



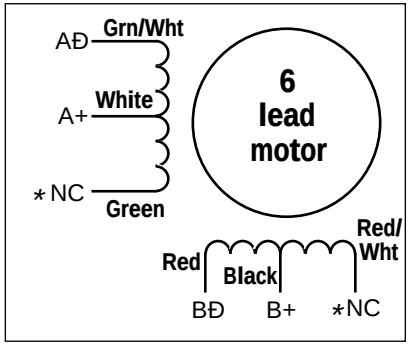
4 Leads

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

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 on the next page.



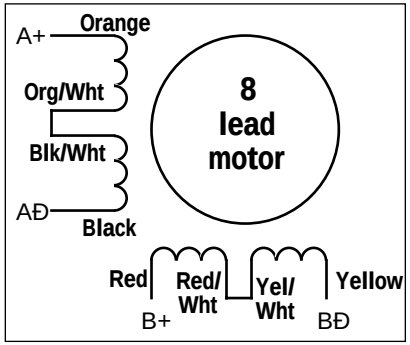
6 Leads Series Connected



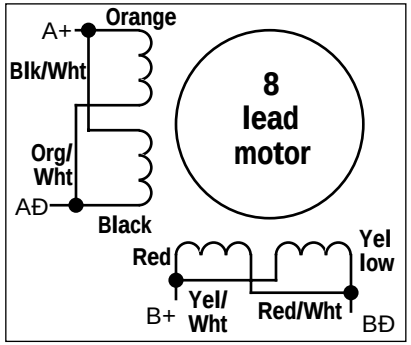
6 Leads Center Tap Connected

** NC = not connected to anything.*

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 over heating. The wiring diagrams for eight lead motors are shown below.



8 Leads Series Connected



8 Leads Parallel Connected

Step Table
(full stepping)

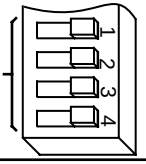
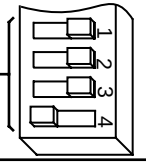
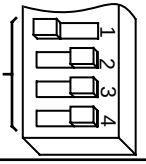
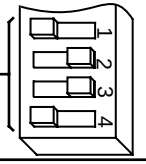
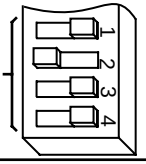
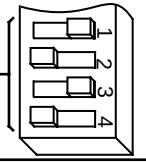
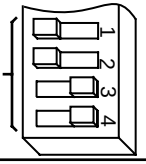
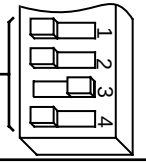
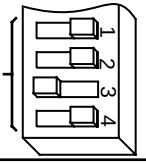
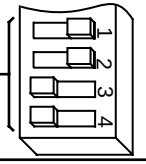
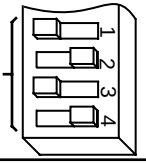
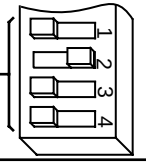
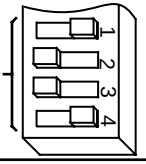
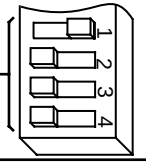
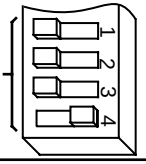
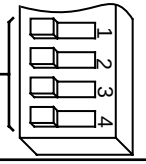
Step	A+	A-	B+	B-
0	+	–	+	–
1	–	+	+	–
2	–	+	–	+
3	+	–	–	+
4	+	–	+	–

DIR=1 (5V) cw

DIR=0 (0V) ccw

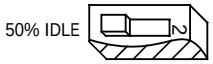
Step 3 is the Power Up State

Selecting Microstep Resolution

200 **STEPS/REV (FULL)** STEP MODE 	20000 **STEPS/REV (1/100)** STEP MODE 
400 **STEPS/REV (HALF)** STEP MODE 	21600 **STEPS/REV (1 arc min)** STEP MODE 
1000 **STEPS/REV (1/5)** STEP MODE 	25000 **STEPS/REV (1/125)** STEP MODE 
2000 **STEPS/REV (1/10)** STEP MODE 	25400 **STEPS/REV (1/127)** STEP MODE 
5000 **STEPS/REV (1/25)** STEP MODE 	25600 **STEPS/REV (1/128)** STEP MODE 
10000 **STEPS/REV (1/50)** STEP MODE 	36000 **STEPS/REV (.01)** STEP MODE 
12800 **STEPS/REV (1/64)** STEP MODE 	50000 **STEPS/REV (1/250)** STEP MODE 
18000 **STEPS/REV (1/90)** STEP MODE 	50800 **STEPS/REV (1/254)** STEP MODE 

Idle Current Reduction

Your drive is equipped with a feature that automatically reduces the motor current by 50% anytime the motor is not moving. This reduces drive heating by about 50% and lowers motor heating by 75%. This feature can be disabled if desired so that full current is maintained at all times. This is useful when a high holding torque is required. To minimize motor and drive heating we highly recommend that you enable the idle current reduction feature unless your application strictly forbids it. Idle current reduction is enabled by sliding switch #2 toward the 50% IDLE label, as shown in the sketch below. Sliding the switch away from the 50% IDLE label disables the reduction feature.



Idle Current Reduction Selected

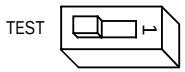


No Current Reduction

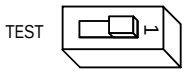
Self Test

The 7080 includes a self test feature. This is used for trouble shooting. If you are unsure about the motor or signal connections to the drive, or if the 7080 isn't responding to your step pulses, you can turn on the self test.

To activate the self test, slide switch #1 toward the TEST label. The drive will slowly rotate the motor, 1/2 revolution forward, then 1/2 rev backward. The pattern repeats until you slide the switch away from the TEST label. The 7080 always uses half step mode during the self test, no matter how you set switches 2 and 3. The self test ignores the STEP and DIRECTION inputs while operating. The ENABLE input continues to function normally.



Self Test ON



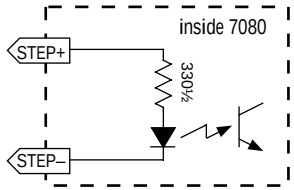
Self Test OFF

Microstepping

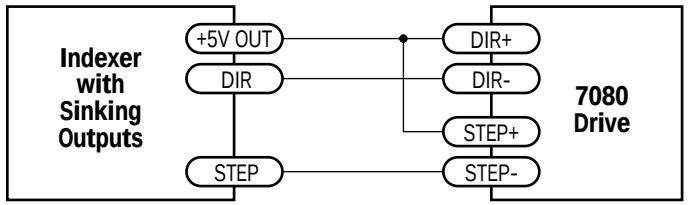
Most step motor drives offer a choice between full step and half step resolutions. In full step mode, both motor phases are used all the time. Half stepping divides each step into two smaller steps by alternating between both phases on and one phase on. Microstepping drives like the 7080 precisely control the amount of current in each phase at each step position as a means of electronically subdividing the steps even further. The 7080 offers a choice of full and half step as well as 14 other 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.

Connecting Logic

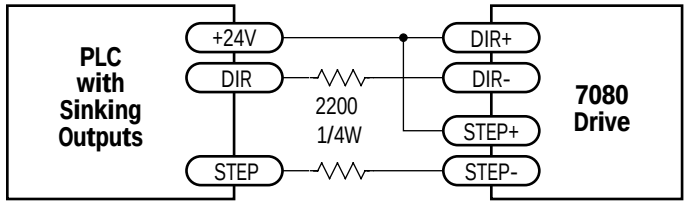
The 7080 contains optical isolation circuitry to prevent the electrical noise inherent in switching amplifiers from interfering with your circuits. Optical isolation is accomplished by powering the motor driver from a different supply than your circuits. There is no electrical connection between the two: signal communication is achieved by infrared light. When your circuit turns on or turns off an infrared LED (built into the drive) it signals a logic state to the phototransistors that are wired to the brains of the drive. A schematic diagram of the input circuit is shown at the right.



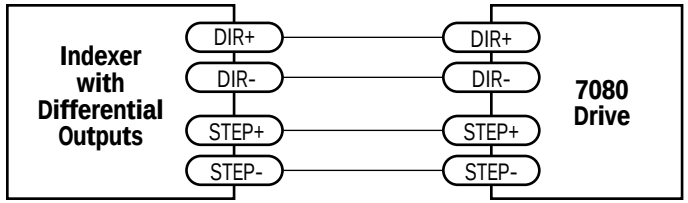
Drive Input Circuit



Connecting to Indexer with Sinking Outputs
(includes Applied Motion SI-1 Indexer)



Connecting to PLC with Sinking Outputs
(Most PLC's use 24 volt logic)



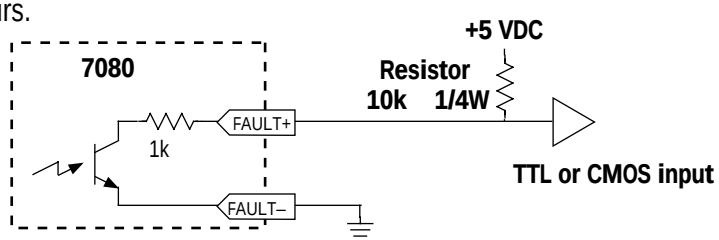
Connecting to Indexer with Differential Outputs
(Many High Speed Indexers have Differential Outputs)

The **ENABLE** input allows the user to turn off the current to the motor by providing a positive voltage between EN+ and EN-. The logic circuitry continues to operate, so the drive "remembers" the step position even when the amplifiers are disabled. However, the motor may move slightly when the current is removed depending on the exact motor and load characteristics. **If you have no need to disable the amplifiers, you don't need to connect anything to the *ENABLE* input.**

Using the Fault Output

The 7080 has a fault output to tell you if the drive has overheated or if a short circuit has occured at the motor outputs. The fault output is optically isolated for noise immunity. This makes it more flexible and more reliable, but also harder to hook up. To connect to 5 volt logic, follow the sketch below. For other connections, consult the factory.

The photo transistor turns on when there is a fault. In circuit below, the signal will be high (near 5 volts) when there is no fault. The signal will go low (0 volts) if a fault occurs.



Setting Phase Current

Before you turn on the power supply the first time, you need to set the driver for the proper motor phase current. The rated current is usually printed on the motor label. The current you set on the 7080 is the peak current, not RMS.

The 7080 drive current is easy to set. If you wish, you can learn a simple formula for setting current and never need the current table again. Or you can skip to the table on the next page, find the current setting you want, and set the DIP switches according to the picture.

Current Setting Formula

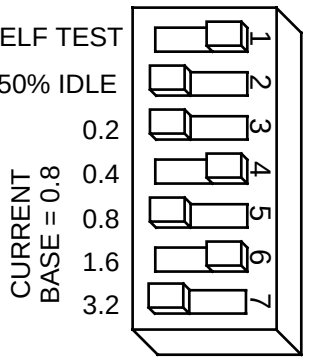
Locate the bank of tiny switches near the motor connector. Five of the switches have a value of current printed next to them, such as 0.4 and 1.6. Each switch controls the amount of current, in amperes (A), that its label indicates. There is always a base of current of 0.8A. To add to that, slide the appropriate switches toward their labels. You may need your small screwdriver for this.

Example

Suppose you want to set the driver for 5 amps per phase. You need the 0.8 A base current plus another 0.2, 0.8 and 3.2 A.

5.0 = 0.2 + 0.8 + 3.2 + 0.8 (base)

Slide the 0.2, 0.8 and 3.2 A switches toward the labels as shown in the figure.



Current Setting Table

0.8 AMPS/ PHASE	2.4 AMPS/ PHASE	4.0 AMPS/ PHASE	5.6 AMPS/ PHASE
1.0 AMPS/ PHASE	2.6 AMPS/ PHASE	4.2 AMPS/ PHASE	5.8 AMPS/ PHASE
1.2 AMPS/ PHASE	2.8 AMPS/ PHASE	4.4 AMPS/ PHASE	6.0 AMPS/ PHASE
1.4 AMPS/ PHASE	3.0 AMPS/ PHASE	4.6 AMPS/ PHASE	6.2 AMPS/ PHASE
1.6 AMPS/ PHASE	3.2 AMPS/ PHASE	4.8 AMPS/ PHASE	6.4 AMPS/ PHASE
1.8 AMPS/ PHASE	3.4 AMPS/ PHASE	5.0 AMPS/ PHASE	6.6 AMPS/ PHASE
2.0 AMPS/ PHASE	3.6 AMPS/ PHASE	5.2 AMPS/ PHASE	6.8 AMPS/ PHASE
2.2 AMPS/ PHASE	3.8 AMPS/ PHASE	5.4 AMPS/ PHASE	7.0 AMPS/ PHASE

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