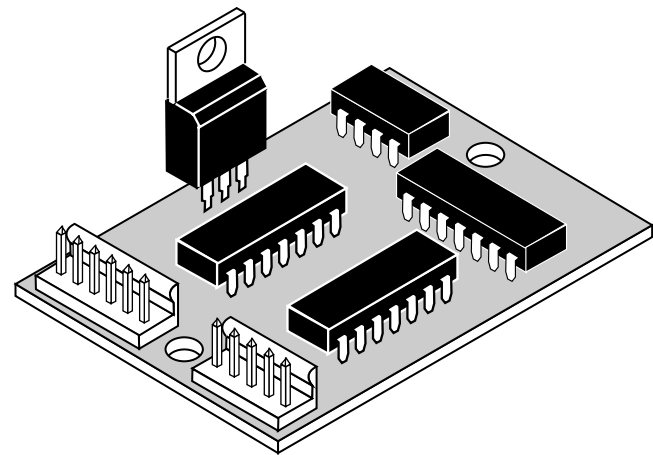


6/15/98

User's Manual

Model 1030

Step Motor Driver



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Applied Motion Products, Inc.

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***Applied
Motion
Products***
motors • drives • controls

Technical Specifications

Amplifiers Dual, bipolar H-bridge, pulse width modulated switching at 20kHz. 12-30 VDC input. 0.2 - 1.0 amp/phase output current, factory configured. 30 watts maximum output power. Automatic idle current reduction, reduces current after one half second.

Inputs Step and direction, optically isolated. Inputs can be wired for sinking, sourcing or differential signals. 5-12V logic configuration has 680 ohms input impedance. 24V logic configuration has 2200 ohms input impedance. Motor steps on rising edge of step line. 10 μ sec minimum low pulse. 50 μ sec minimum set up time for direction signal.

Physical Constructed on .062" thick printed circuit board. Two mounting holes, \varnothing 0.156". *Use plastic standoffs or spacers.* Overall size with vertical headers: 1.6 x 2.25 x 0.77 inches. Overall size with horizontal headers: 1.6 x 2.55 x 0.77 inches. See page 13 for detailed drawing. Ambient temp range (operating): 0 - 70°C.

Connectors Latching, polarized headers.
Vertical header configuration:
Motor: 5 position. Molex/Waldom part number 22-23-2051.
Input: 6 position. Molex/Waldom part number 22-23-2061.
Horizontal header configuration:
Motor: 5 position. AMP part number 640457-5.
Input: 6 position. AMP part number 640457-6.

Mating Connectors *Mating connectors and standoffs are only supplied with samples.*

- Contact: AMP part number 770666-1 (accepts AWG 22-26 wire)
- 5 Position Housing (for motor): AMP number 770602-5
- 6 Position Housing (for inputs): AMP number 770602-6

You will need at least 11 contacts for each drive.

Note: AMP is a connector company, not to be confused with Applied Motion Products, a motion control company. AMP parts can be purchased from an AMP distributor such as Allied (800-433-5700) or Digikey (800-DIGIKEY).

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.

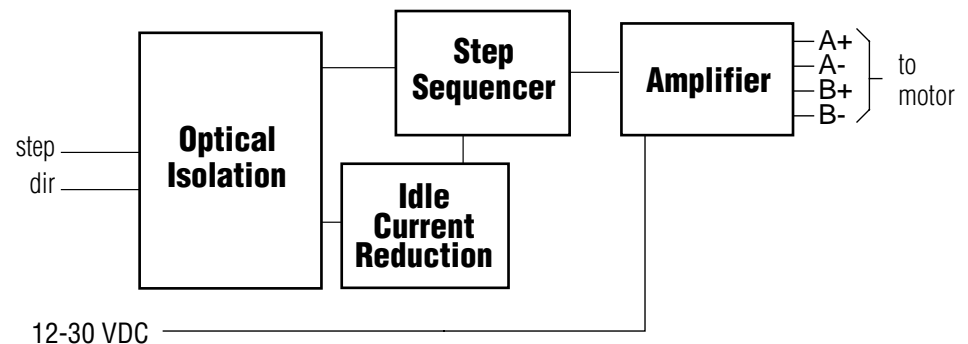
If there's anything we can do to improve our products or help you use them better, please call or fax. We'd like to hear from you. Our phone number is (800) 525-1609 or you can reach us by fax at (408) 761-6544.

You can also find useful information 24 hours a day at our web site: www.applied-motion.com.

Features

- Drives NEMA motor sizes 14 through 23.
- Pulse width modulation switching amplifiers.
- Phase current from 0.2 to 1.0 amps (factory configured).
- Step and direction inputs, optically isolated, 5-24V logic (factory configured).
- Full, half or 1/4 step (factory configured)
- Automatic idle current reduction (factory configured)

Block Diagram

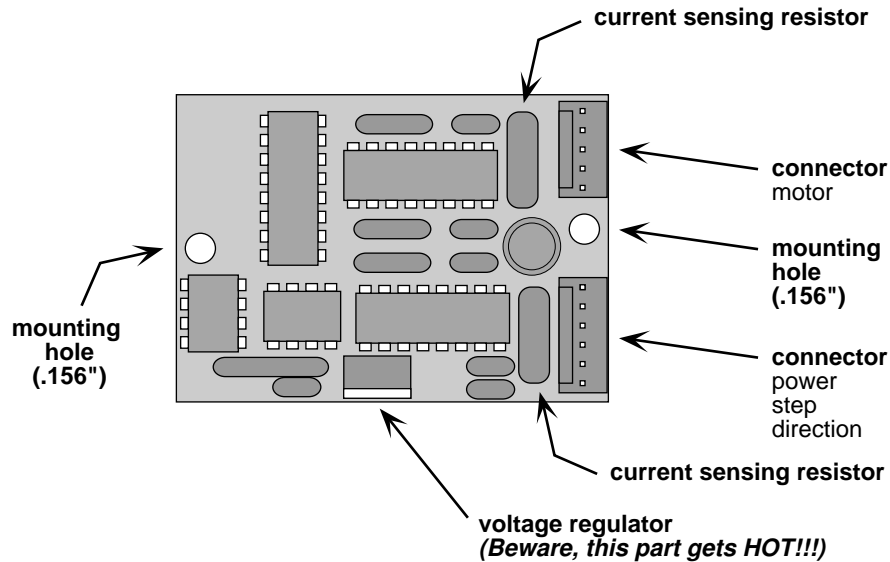


Getting Started

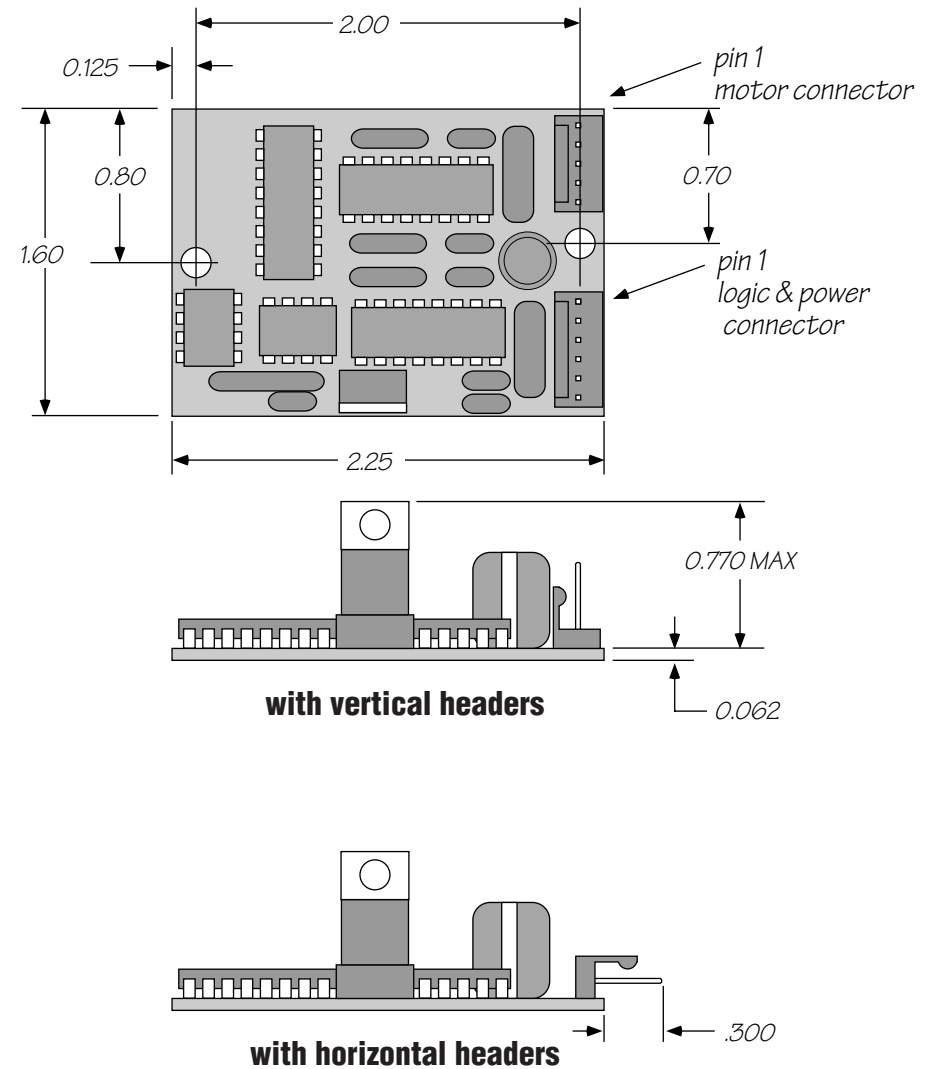
To use your Applied Motion Products motor control, you will need the following:

- a 12-30 volt DC power supply for the motor. Please read the section *Choosing a Power Supply* for help in choosing the right power supply.
- a source of step & direction signals (indexer, oscillator or PLC).
- a source of power to activate the optoisolation circuits. Many indexers & PLCs have power available for this purpose. If not, you may need a small 5 - 24 VDC power supply.
- mating connectors (see page 14)
- plastic spacers or stand-offs for mounting (see page 12)

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



Mechanical Outline



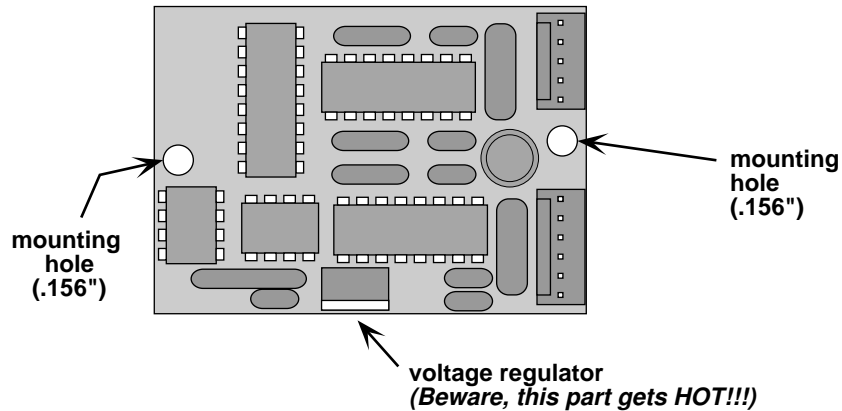
Mounting the Drive

The 1030 has two .156" holes in the circuit board for mounting. In the design of this compact, low cost driver, it was necessary to route some circuit boards traces fairly close to the mounting holes. Therefore, you must **only use plastic standoffs or spacers to support the 1030**.

You can drive #4 screws through the top of the board into a plastic spacer, but only if you **put an insulating washer under the screw heads**.

An excellent way to mount the 1030 in your application is to use two Richco model LCBS-TF-6-01 spacers. The LCBS parts can be secured to your application with #6-32 screws. The 1030 then snaps onto the LCBS spacers, and no metal is in contact with the 1030. We use that configuration here at Applied Motion.

Richco makes a wide variety of innovative pcb mounting hardware. Their phone number is 800-621-1892. Internet address is www.richcoplas.com.



About the voltage regulator

The 1030 requires 52 mA of power at 5 volts DC internally. We derive this 5V from the DC power that you provide for the motor. This is a low cost and compact technique, but does result in some heating of the voltage regulator.

Don't be surprised if the temperature of the regulator reaches 90°C. This will not affect the life of your drive, but if you accidentally touch the part, you won't be happy.

You may add a heat sink to the voltage regulator if you wish. The metal tab is electrically connected to ground (power supply "-").

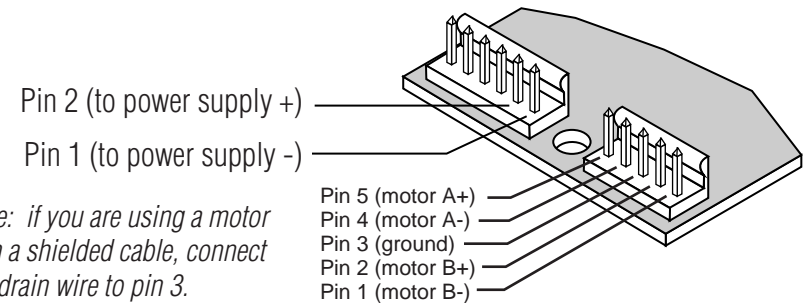
Never use your drive in a space where there is no air flow or where the air temperature is more than 70°C. Never put the drive where it can get wet or where metal particles can get on it.

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.

If your power supply does not have a fuse on the output or some kind of short circuit current limiting feature you need to put a 1 amp slow blow fuse between the drive and power supply. Install the fuse on the **positive** power supply lead.

Connect the motor power supply **positive (+)** terminal to pin 2 of the power & logic connector. Connect power supply **return (-)** to pin 1. **Be careful not to reverse the wires.** Reverse connection will destroy your driver, void your warranty and generally wreck your day.



Note: if you are using a motor with a shielded cable, connect the drain wire to pin 3.

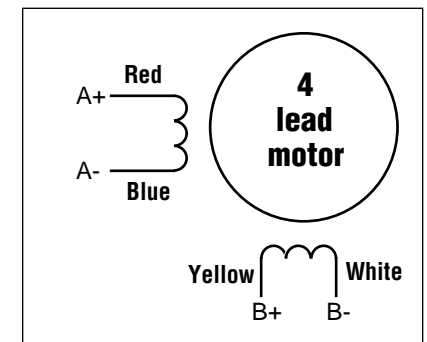
Connecting the Motor

- ✓ **When connecting the motor, be sure that the power supply is off.**
- ✓ **Isolate & secure any unused motor leads.**
- ✓ **Never disconnect the motor while the drive is powered up.**
- ✓ **Never connect motor leads to ground or to a power supply.**
- ✓ **Use a polarized mating connector.**

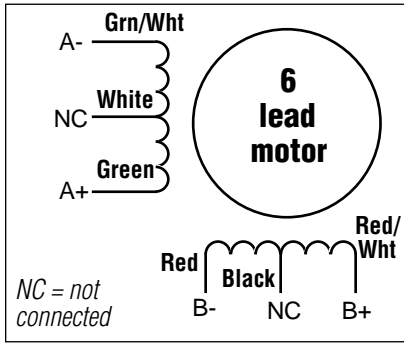
You must now decide how to connect your motor to the drive.

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

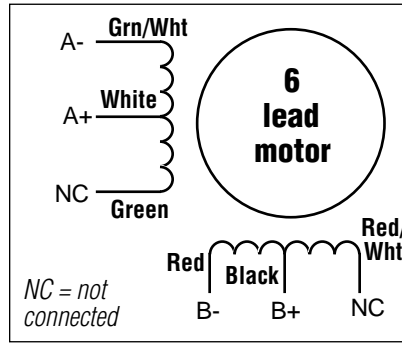
Six lead motors can be connected in series or center tap. In series mode, motors produce more torque at low speeds, but cannot run as fast as in the center tap configuration. In series operation, the motor should be operated at 30% less than the rated current to prevent overheating. Wiring diagrams for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



4 Leads

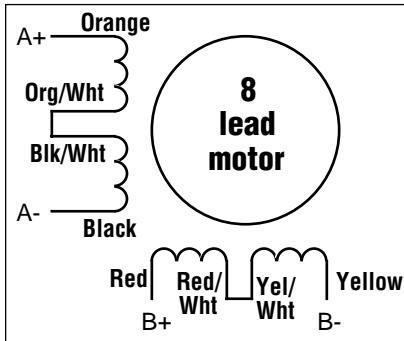


6 Leads Series Connected

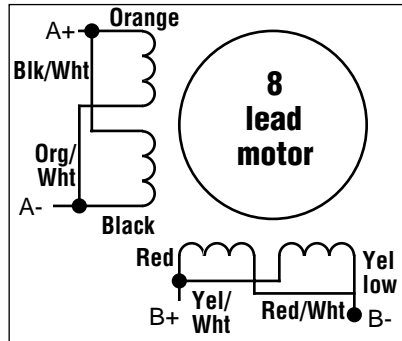


6 Leads Center Tap Connected

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



8 Leads Series Connected



8 Leads Parallel Connected

Step Table (half stepping)

Step 0 is the power up state

Step	A+	A-	B+	B-
0	-	+	0	0
1	-	+	-	+
2	0	0	-	+
3	+	-	-	+
4	+	-	0	0
5	+	-	+	-
6	0	0	+	-
7	-	+	+	-
8	-	+	0	0

DIR=0
CCW
↓

↑
DIR=1
CW

Choosing a Power Supply

Voltage

Chopper drives 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. More is better, the only upper limit being the maximum voltage rating of the drive itself: 30 volts. If you choose an unregulated power supply, do not exceed 24 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.

Current

The maximum supply current you will 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 1030 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.

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 two times 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 foldback. When you first power up your drive, the full current of both motor phases will be drawn for a few milliseconds while the stator fields are 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 "foldback" to a lower voltage. With many foldback schemes the voltage returns to normal only after the first motor step and is fine thereafter. In that sense, unregulated power supplies are better. They are also less expensive.

Recommended Motors

The following motors from Applied Motion Products are recommended for use with the 1030. All motors in the list have been tested with the 1030. Dynamic torque data is available.

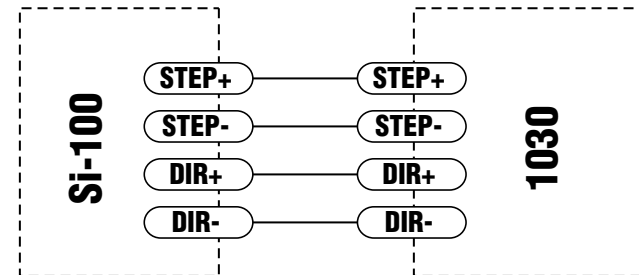
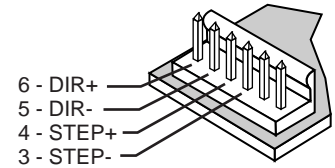
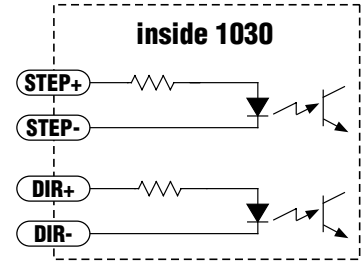
Motor Number	Size inches	Winding Connection	Max Torque oz-in	Current Amps
5014-842	1.38 x 1.38 x 1.57	4 lead	22	1.0
5017-006	1.65 x 1.65 x 1.34	center-end	10	1.0
5017-009	1.65 x 1.65 x 1.54	center-end	17	0.8
5017-013	1.65 x 1.65 x 1.85	center-end	24	0.8
HT17-068	1.65 x 1.65 x 1.30	parallel	22	1.0
HT17-072	1.65 x 1.65 x 1.54	parallel	34	1.0
HT17-076	1.65 x 1.65 x 1.85	parallel	54	1.0
4023-839	2.22 x 2.22 x 1.5	center-end	35	1.0
4023-819	2.22 x 2.22 x 2.0	center-end	56	1.0
HT23-393	2.22 x 2.22 x 1.54	parallel	34	1.0
HT23-396	2.22 x 2.22 x 2.13	parallel	110	1.0
HT23-399	2.22 x 2.22 x 2.99	parallel	140	1.0

Connecting A Pulse Source

The 1030 inputs contain optical isolation circuitry to prevent the electrical noise inherent in switching amplifiers from interfering with your circuits.

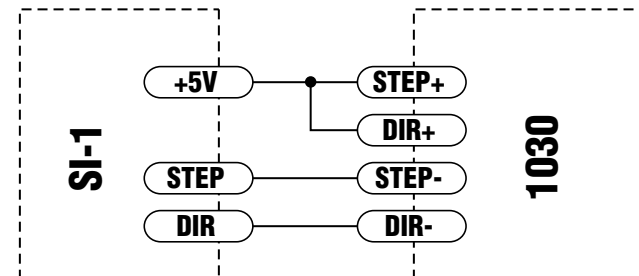
Optical isolation also allows the 1030 to accept step and direction signals ranging from 5 to 24 volts. Furthermore, the input signals can be sourcing (PNP) or sinking (NPN), depending on whether you "common" the STEP+ & DIR+ terminals (sinking) or the STEP- & DIR- signals (sourcing). You can also use differential signals.

A schematic diagram of the input circuit is at the right. The wiring diagrams below show how to connect the drive to various pulse sources.



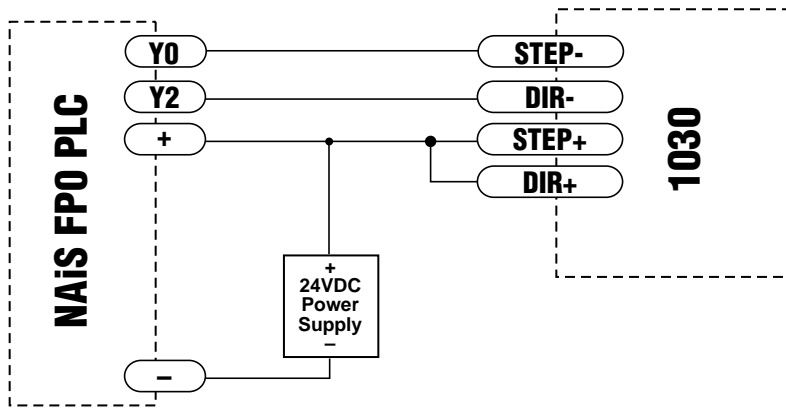
Connecting Applied Motion Si-100

If you are using the Si-100, please purchase the 5V logic version of the 1030



Connecting Applied Motion Si-1

If you are using the Si-1, please purchase the 5V logic version of the 1030



**Connecting Aromat (NAiS) Model FPO PLC.
The FPO has sinking outputs.**

*If you are using a PLC with 24V logic,
please purchase the 24V logic version of the 1030*

Selecting Between Full, Half and 1/4 Step

The 1030 is configured at the factory for full, half or 1/4 step when it is manufactured. It is normally not possible to change this setting.

However, if your 1030 was an engineering sample, we may have put the step sequencer chip in a socket.

If this is the case, and you want to try a different step mode, give us a call - we can probably provide you with a different sequencing chip to put in the socket.

Why would I prefer one mode over another?

Full step mode will give you the most torque at low speeds. Full stepping also allows you to achieve higher speeds than half stepping if the speed of your pulse source is limited. For example, to drive a motor at 25 rev/sec in 1/4 step mode, you must supply step pulses to the 1030 at a rate of 20,000 Hz. To get 25 rev/sec in full step mode, only 5,000 pulses/sec are required.

Half stepping is smoother and quieter than full step, so you should use half step mode whenever possible.

1/4 stepping provides even more precise positioning and smoother motion than half stepping.

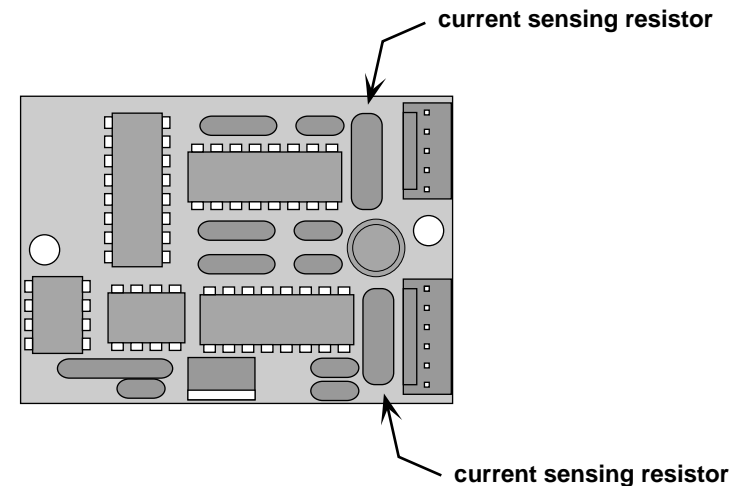
For special options please call the factory.

Setting Phase Current

The phase current is set at the factory when the 1030 is manufactured. The only way to change it in the field is to change the current sensing resistors.

If you feel that you must change the motor current, please follow these rules:

1. You must be skilled at soldering to change the resistors. You will void your warranty by modifying the drive, but at least if you are a skillful solderer, the drive should still work when you're done.
2. Choose the resistor value according to this formula: $R = 0.4 / i$, where R is the sensing resistor you need, and i is the current, in amps, that you want.
3. Use resistors whose value is between 0.39 and 2.0 ohms.
4. Use 1 watt resistors, metal oxide type. **Do not use wirewound resistors.**



Idle Current Reduction

The 1030 includes a feature that automatically reduces the motor current to 60% when the motor is not moving. This is known as idle current reduction.

The idle current reduction is not adjustable by the user. However we can change the amount of current reduction during the manufacturing process. This is accomplished by changing the software in the sequencing chips. On sample drives, these chips are usually socketed, so units can be retrofitted if necessary.

For special options please call the factory.