2.2.1. Panel Layout

CAUTION

High voltages are present. The Compumotor Plus Drive has up to 120VAC single phase and up to 170VDC on its screw terminals.

Observe the following rules when mounting Compumotor Plus Series drives in an enclosure:

1. The vertical distance between the Compumotor Plus Drive and other equipment on the top and bottom of the enclosure should be no less than two inches.

2. The horizontal distance between the Compumotor Plus Drive and other equipment on the side walls of the enclosure should be no less than two inches.

3. Because motor/drive products produce more heat than indexers, drives should not be mounted directly below indexers.

4. Large heat-producing equipment should not be mounted directly beneath the Compumotor Plus Drive.

5. Fins must run vertically.

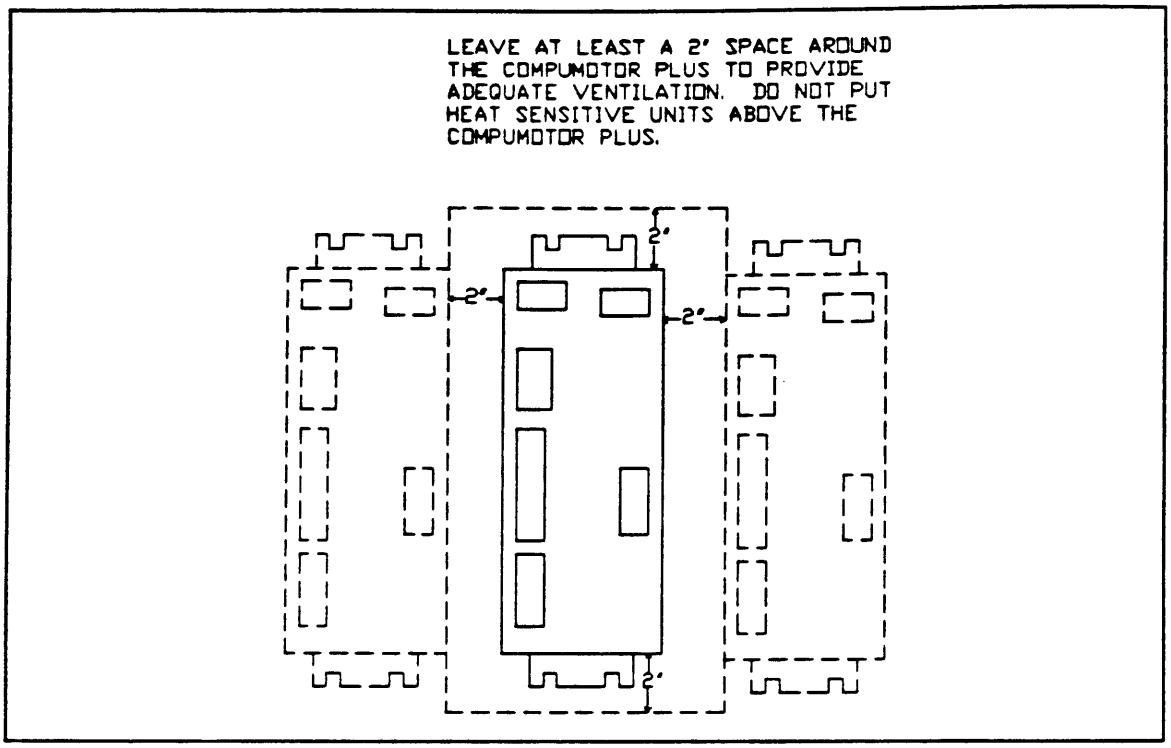

Figure 1: Suggested Panel Layout

2.2.2. Panel Mounting

The Compumotor Plus Drive has L-shaped mounting brackets. They are notched with slots to accept screws on either end to facilitate mounting to flat panel surfaces. Use 10-32 screws with captured nuts to mount drive. If a fan is used, it may create vibrations, so locking the screws is advisable. Since the drive is difficult to manage with one hand, it is advisable to have a power interlock that prevents the drive mountings from being removed with the power on.

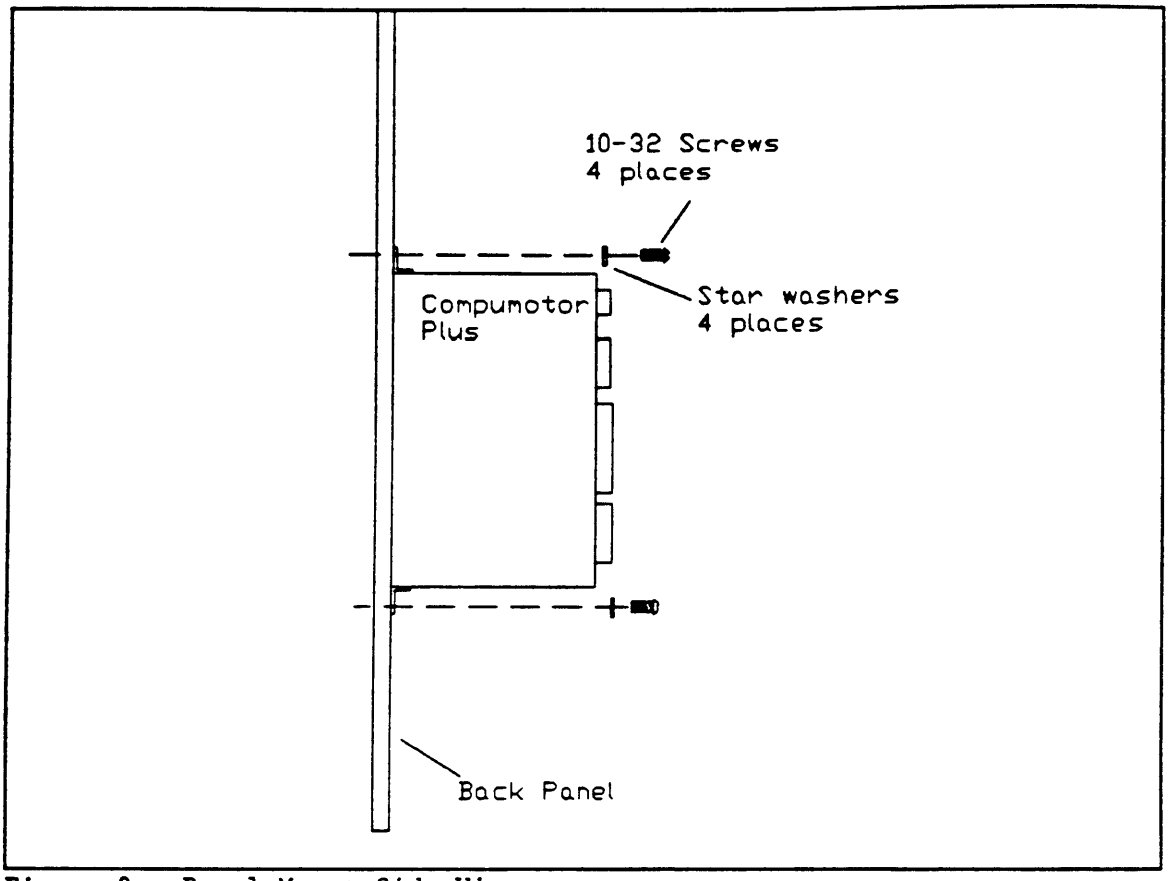

Figure 2: Panel Mount Side View

2.3. MOTOR INSTALLATION

This section provides information intended to ensure the proper installation, trouble-free operation, and long life of your brushless servo motors.

2.3.1. Mounting the Motor

The brushless motor should be mounted using flange bolts and centered by the pilot, or circular raised portion, on the front face. Foot mount configurations of the motor are a less desirable alternative because the torque of the motor is not evenly distributed around the motor case. Any radial load on the motor shaft is multiplied by a much longer lever arm when a foot mount is used rather than a face flange.

CAUTION

Remember, too much electrical noise, a poor enclosure, and improper grounding can affect system performance and safety. For more information about these factors, refer the Troubleshooting section of this manual.

The motors used with the Compumotor Plus Drive can produce very large torques. These motors can also produce high accelerations. This combination can shear shafts and mounting hardware if the mounting is not up to the task. The high accelerations can produce shocks and vibrations that require much heavier hardware than would be expected for static loads of the same magnitude. The motor, when making certain move profiles, can set up low-frequency vibrations in the mounting structure. These vibrations will cause fasteners to loosen if they are not locked (use an aircraft grade locking nut, such as nylocks). These vibrations can also cause metal fatigue in structural members if harmonic resonances are induced by the move profiles you are using. A mechanical engineer should check the machine design to ensure that the mounting structure is adequate.

2.3.2. Coupling the Motor

2.3.2.1. *Shaft Misalignments*

Special couplings that accommodate different types of misalignments are available. Three of the types of misalignments that may occur are parallel, angular, and end-float misalignments. They can exist in any combination.

Parallel Misalignment: The offset of two mating shaft center lines, although the center lines remain parallel to each other.

Angular Misalignment: When two shaft center lines intersect at some angle other than zero degrees.

End Float: A change in the relative distance between the ends of two shafts.

Special couplings are used to accommodate the above misalignments and to transmit the desired torque. A coupling manufacturer should be consulted to ensure that the coupling is being used within its specified torque capacity and misalignment ranges.

2.3.2.2. *Shaft Couplings*

Shaft couplings may be divided into three types: single-flex, double-flex, and rigid. Like a hinge, a single-flex coupling accepts angular misalignment only. A double-flex coupling accepts both angular and parallel misalignments. Both types, depending on their design, may or may not accept end play. A rigid coupling cannot compensate for any misalignment.

Double-Flex Coupling: Whenever two shafts are joined that are fixed in the radial and angular direction, a double-flex coupling should be used. A single-flex coupling should not be used because it does not permit any parallel misalignment and the only compensation for parallel misalignment will be by bending the shafts, which will cause excessive bearing loads and premature failure.

Single-Flex Coupling: When a single-flex coupling is used, one and only one of the shafts must be free to move in the radial direction without constraint. A double-flex coupling should not be used in this situation because it will allow too much freedom and rotate eccentrically, which will cause large vibrations and immediate failure.

Rigid Couplings: Rigid couplings are not recommended. They should only be used if the motor is on some form of floating mounts that will allow for alignment compensation.

Compumotor recommends low-flex couplings (such as bellows-type) for use with the Compumotor Plus. High-flex, or energy absorbing couplers, while appropriate for many step motor applications, should not be used with this product.

For unusual motor installations contact your Compumotor Applications Engineer for assistance.

2.3.3. Motor Connections

2.3.3.1. *Motor Power*

The Compumotor Plus Drive is supplied with a preassembled motor cable hard wired on the motor end, and 5 leads with a screw terminal connector on the drive end. This cable should be attached to the drive and motor before the AC power is connected. The motor connections on the Compumotor Plus drive are made to a screw terminal block on the front panel. The terminals are marked as:

DRIVE	COLOR
A+	Red
A-	Black
GND	Shield
B+	White
B-	Green

WARNING

Be certain that all AC power is disconnected before attempting to do any wiring. The wiring between the motor and drive should be done with AC power disconnected as there are life threatening voltages on the motor when it is energized. Do not open the drive. There are no user-serviceable components. Hazardous voltages are present.

2.3.4. Motor Connections

2.3.4.1. *Motor Power*

The Compumotor Plus Drive is supplied with a preassembled motor cable. The cable has a MS-type connector on the motor end, and five leads with screw terminals on the drive end. This cable should be attached to both the motor and the drive before the AC power is connected. The motor connections on the Compumotor Plus Drive are made to a screw terminal block on the front panel.

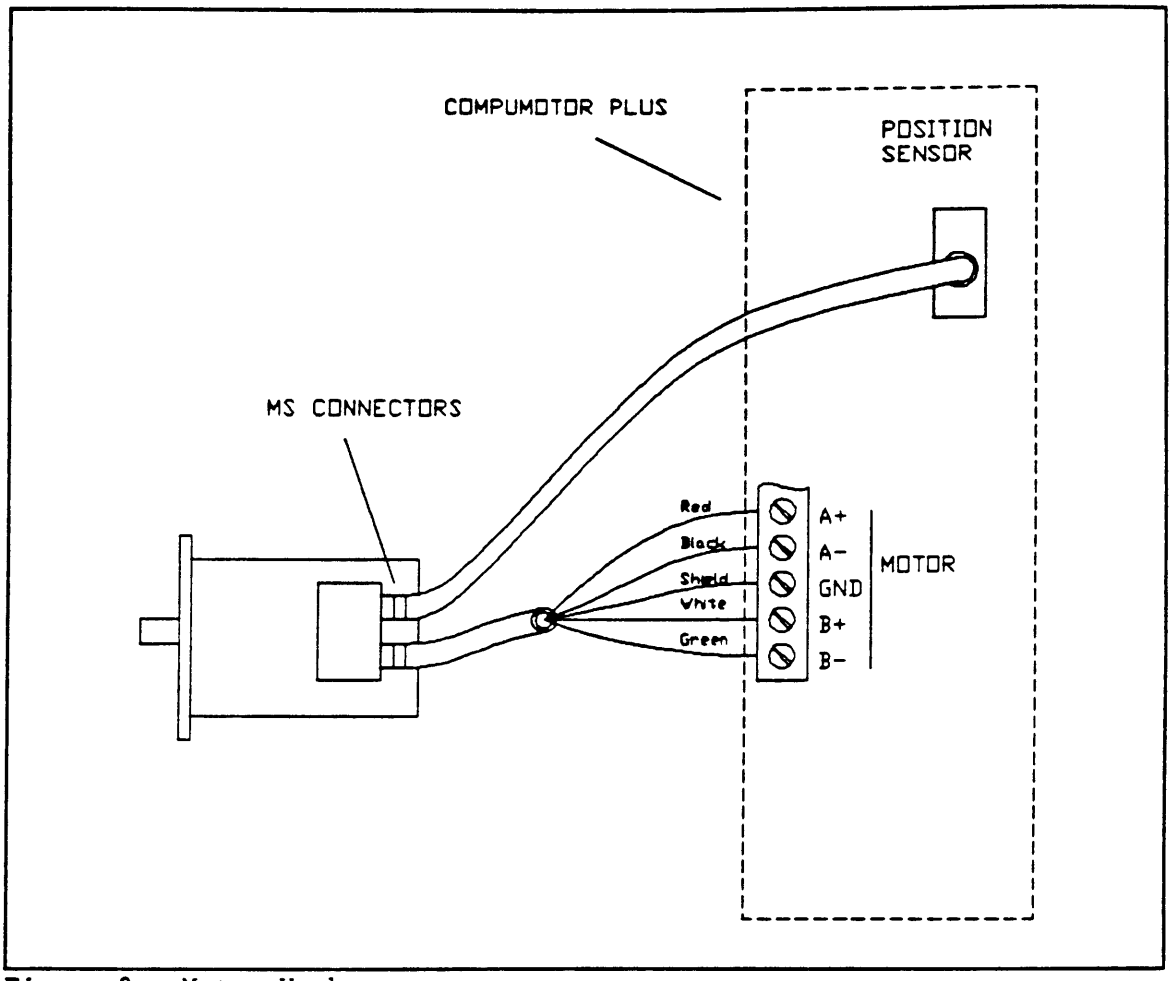

Figure 3: Motor Hookup

2.3.4.2. *Resolver Connections*

This cable has an MS-style connector on the motor/resolver end and a 9-pin, D-type connector on the drive end.

2.3.5. Line Power Connections

The CPH83-150 and CPH106-220 operate on 120VAC single-phase power. AC power is connected to the screw terminal connector on the front panel. The 120VAC single-phase should be connected with 14-gauge or heavier, stranded wire. The wires should be connected to the screw terminals as shown in Figure 4.

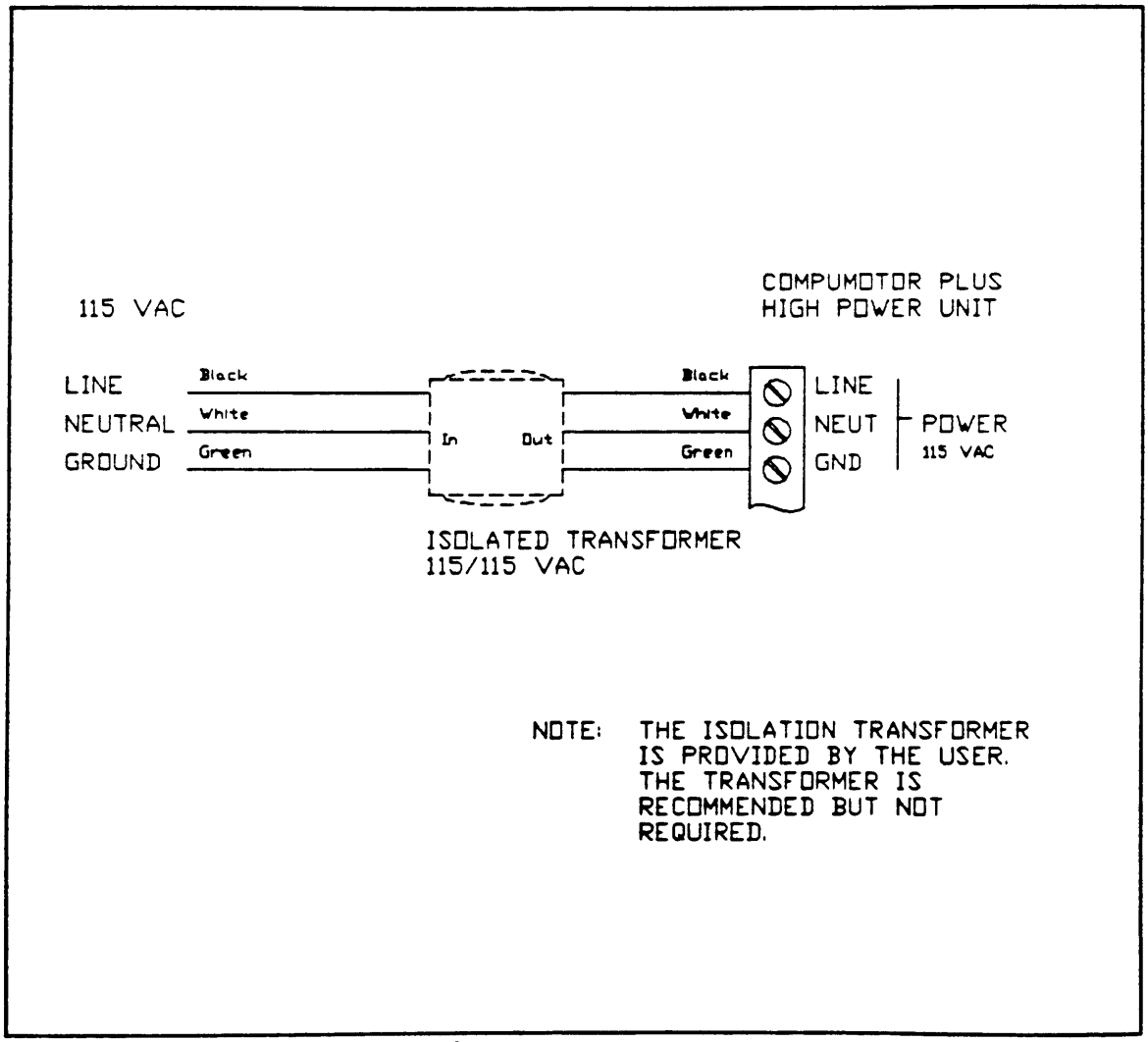

Figure 4: CPH Power Connections

The CPL57-120 and CPL83-150 operate on 36VAC single-phase power. The 36VAC is supplied from a 115/36VAC isolated transformer that is provided with the unit (externally). The connections from the transformer to the indexer/drive are discussed below (see Figure 5).

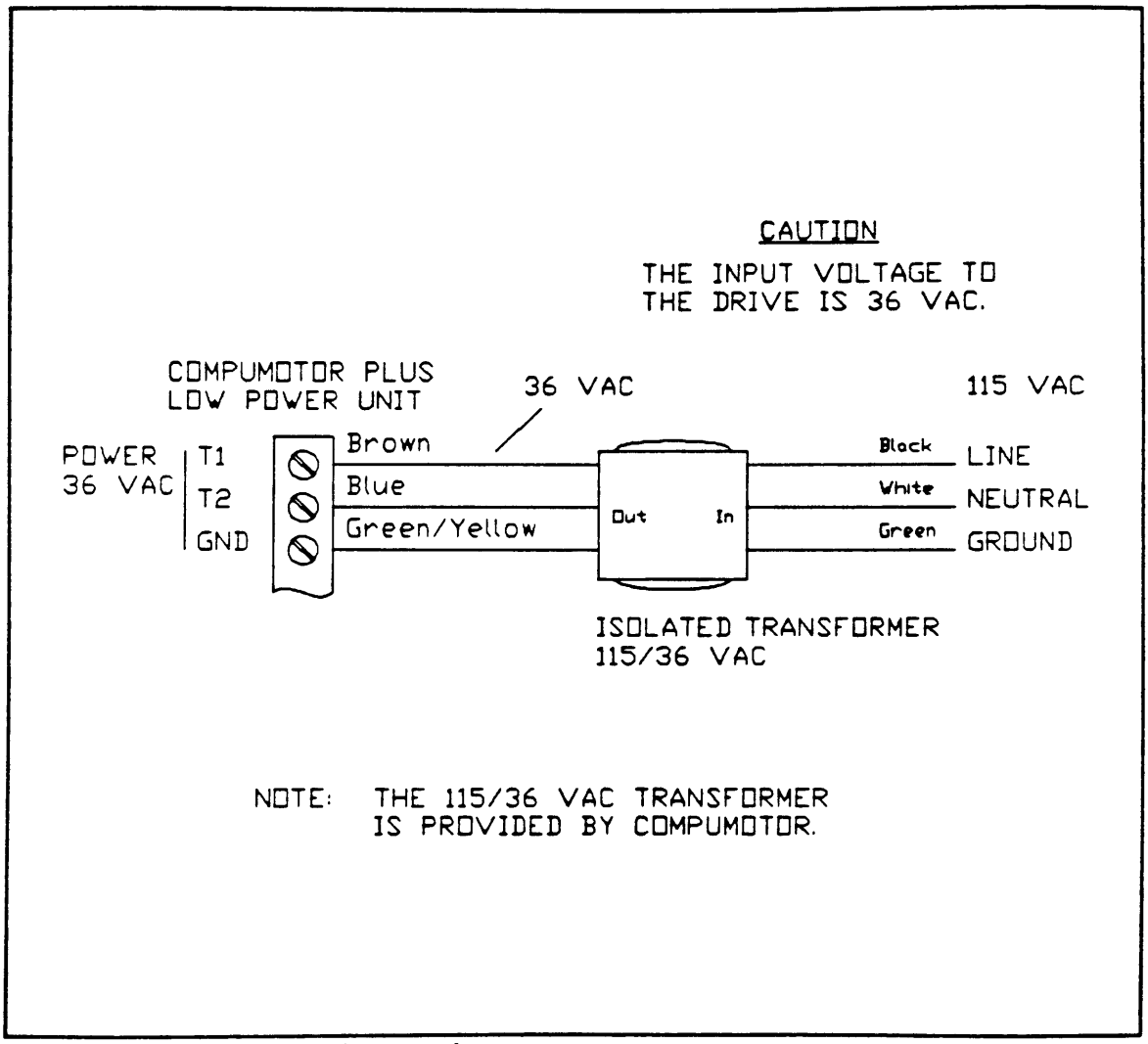

Figure 5: CPL Power Connections

2.3.6. Isolation Transformer

The Compumotor Plus high-power indexer/drive does not provide line isolation for the input power. If your installation requires line isolation, use a 1KVA transformer.

An isolation transformer with line filtering capabilities will also insulate sensitive equipment on the same power line from power line noise produces by the switch-mode amplifiers in the Compumotor Plus Drive.

> **NOTE**
>
> **The Compumotor Plus low-power drives (CPL57-120 and CPL83-150) are supplied with step-down, isolation transformers to step down 115VAC to 36VAC.**

2.3.7. Input/Output Connections

2.3.7.1. *Indexer Connections: Step & Direction Version*

If you are supplying indexer signals from your own equipment to the Step & Direction version of the Compumotor Plus, you must supply step and direction signals to the drive. COMMAND 1+ and COMMAND 1- must be connected to run the motor. COMMAND 2+ and COMMAND 2- need only be connected if the motor needs to be run bi-directionally. When left open, the motor runs counterclockwise.

The inputs to the drive are optically isolated and require a drive current of 20 mA at 2.3V to 5V to activate the opto's LED. The command input requires a pulse of at least 600 nanoseconds to create a single step on the servo. Pulse rates slower than 800 KHz can use a 50% duty cycle since the circuit is edge-triggered.

STEP+ = COMMAND 1 +
STEP- = COMMAND 1 -
DIR+ = COMMAND 2 +
DIR- = COMMAND 2 -

2.3.7.2. *Controller Connections: Analog Version*

In the analog version, the analog voltage input controls motor velocity. The velocity is proportional to the magnitude of a voltage applied between COMMAND 1+ and COMMAND 1-. The polarity of the velocity (whether a positive voltage produces a positive or negative velocity) depends on the state of COMMAND 2. If COMMAND 2 is not connected or if a logic "low" (less than 2V) is present between COMMAND 2+ and COMMAND 2-, the motor rotates Clockwise for a positive velocity command. If logic "high" (more than 3V) is present between COMMAND 2+ and COMMAND 2-, the motor rotates CCW for a positive velocity command.

COMMAND 2 *Low*	COMMAND 2 *High*
+10V = +50 revs/sec	+10V = -50 revs/sec
0V = 0 revs/sec	0V = 0 revs/sec
-10V = -50 revs/sec	-10V = 50 revs/sec

> **NOTE**
>
> These are approximate values and vary +/- 10%. This input is designed to be used in conjunction with an external position loop (which you provide).

The analog drive is shipped without a jumper between the Enable input and ground. Normally, an external controller will close the Enable-to-Ground connection when it is ready to move the motor. When the Enable line is not grounded and the drive is powered up, a flashing 23 will appear on the front-panel display. When the Enable line is grounded, the display will show 00, and the drive will immediately respond to the voltage command across the COMMAND1- inputs.

NOTE

When the Enable input is grounded, the Compumotor Plus Analog Drive will move the motor in response to any voltage signal across the COMMAND1 inputs.

Without an external controller, and the Enable line grounded, the analog drive will drive a motor at about 0.25 rps in response to 0V across the COMMAND1 inputs.

2.3.7.3. *RS-232C Connector*

The RS-232C connector allows the user to interface to a standard terminal or computer. This interface is electrically compatible with the EIA specifications for RS-232C communications. The Compumotor Plus Drive has a three wire implementation of this interface and provides RECEIVE DATA, TRANSMIT DATA, and GROUND signals on the command connector.

The communication format is 8 data bits, 1 stop bit, and no parity. The baud rates available are shown below:

BAUD	
300	Selectable through front-panel push buttons, 9,600 baud is the default setting.
600	
1,200	
2,400	
4,800	
9,600	
19,200	

2.3.7.4. Enable Input

The enable input must be connected to isolated GND (the pin directly above it) for the unit to operate. This input is designed to be used with normally closed ESTOP (Emergency Stop) type switches. The amplifier will remain shut off unless Enable is grounded.

> **NOTE**
>
> The Enable input is grounded with a jumper wire at the factory on the Step & Direction version and not grounded on the Analog Input version. This *ground* refers to the unit's isolated ground (on the long connector block) and not to the safety or earth ground.

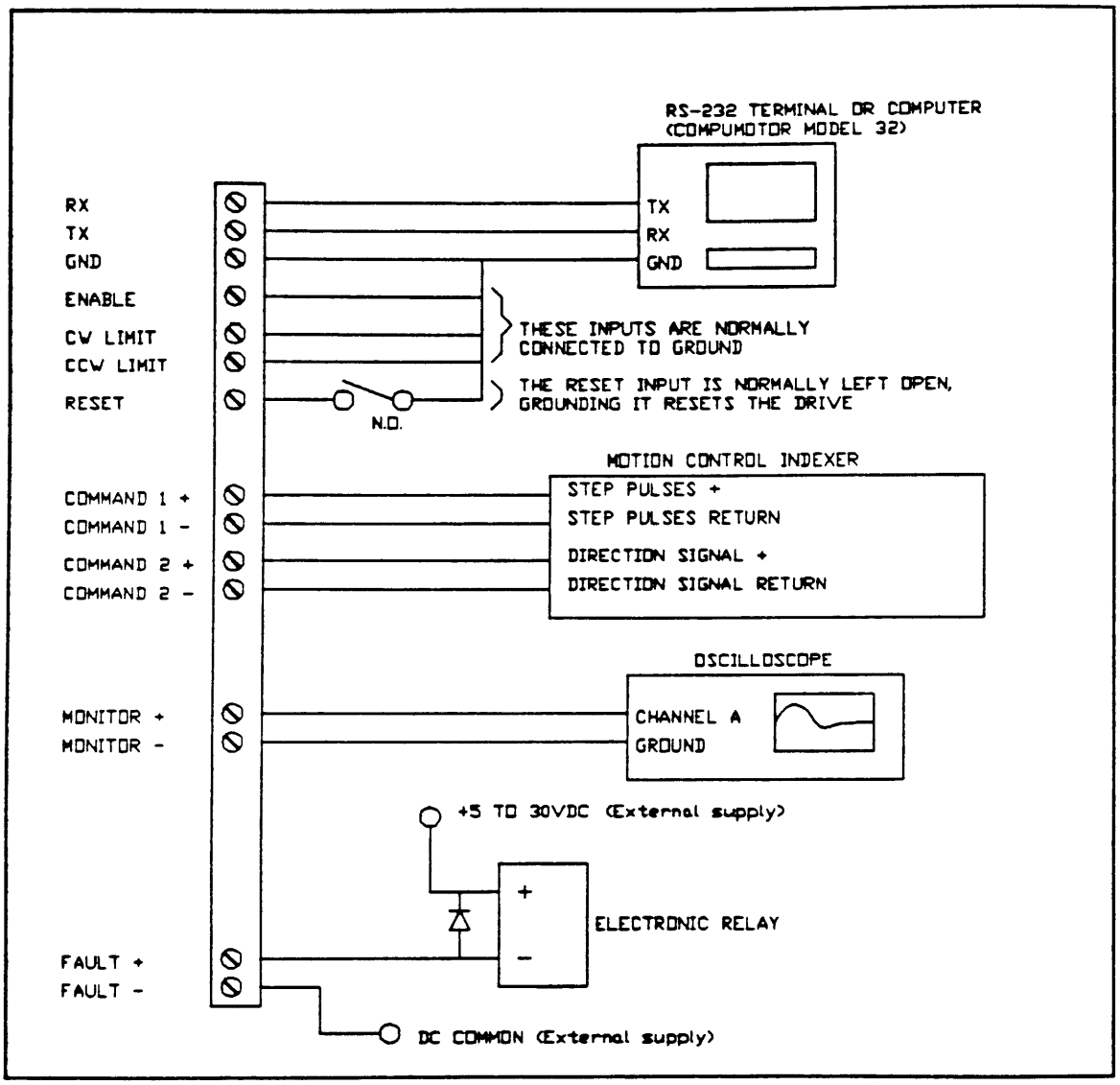

Figure 6. Command Connections (Step & Direction Version)

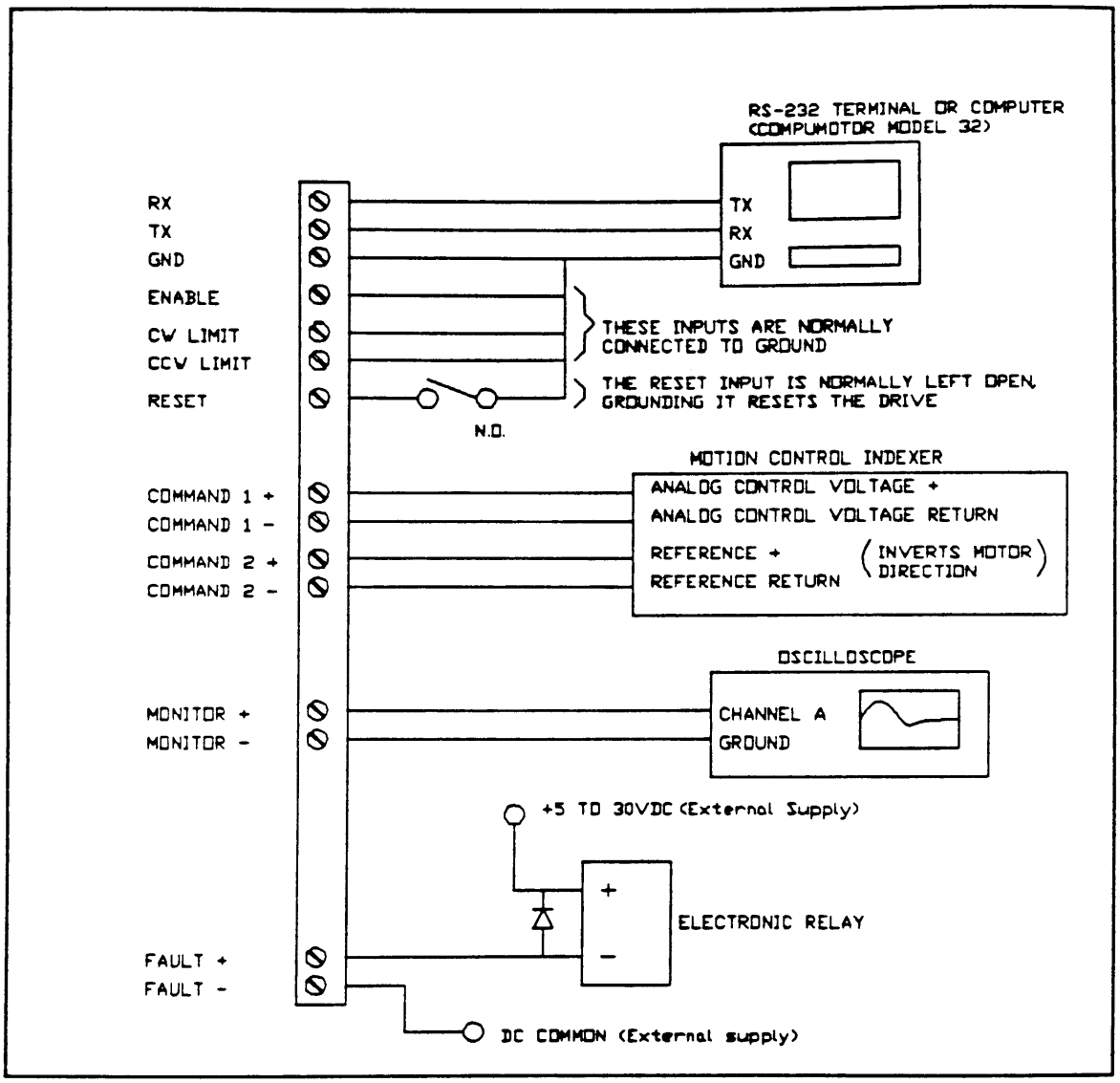

Figure 7. Command Connections (Analog Input Version)

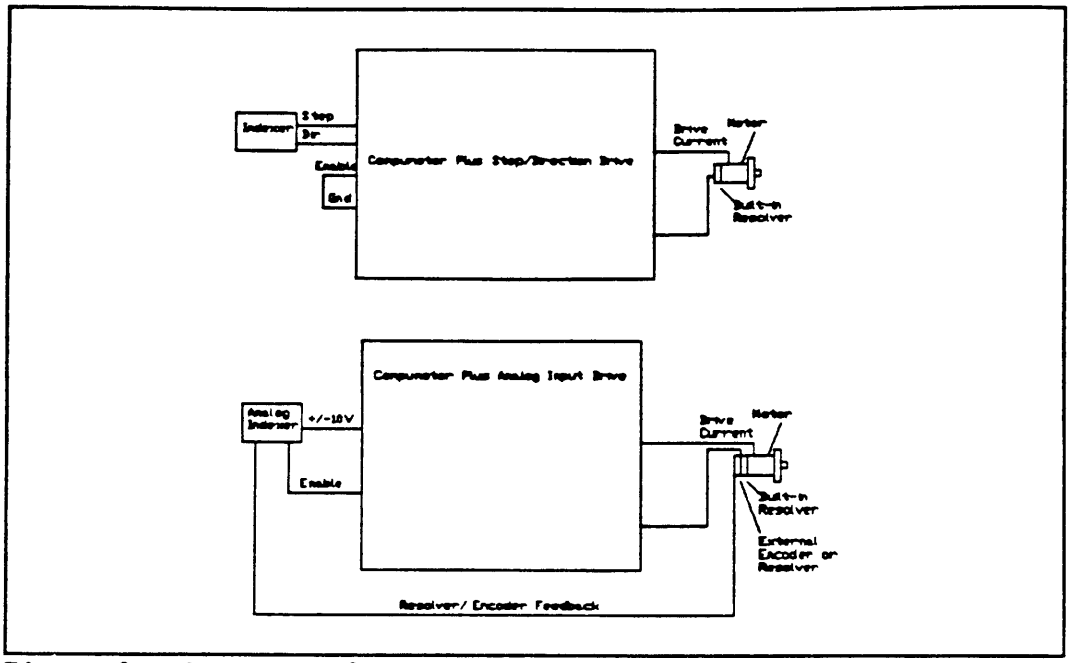

Figure 8. System Configuration

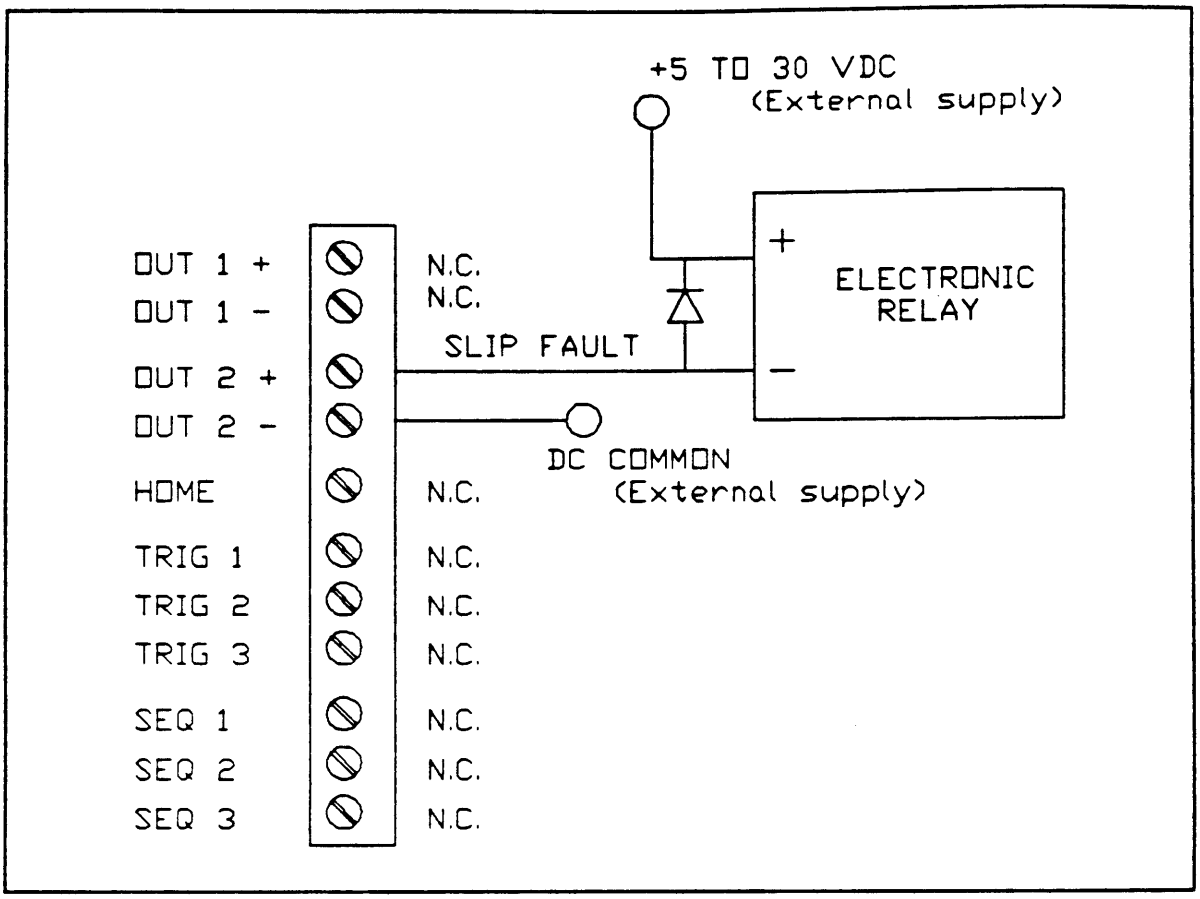

Figure 9. I/O Connections

NOTE

Refer to the Hardware Reference Section for hardware specifications.

2.3.7.5. *Fault Output*

The system provides fault output that lets users know when the amplifier has been shutdown because of a fault (i.e., excessive following error). Fault+ is the collector of a 60 mA, optically isolated transistor. Fault- is the emitter of that same transistor. If a mechanical relay is to be used, an external DC supply and a blocking diode (VERY IMPORTANT) must be used. Connect the anode of this diode to the FAULT+ output and the cathode to your positive DC supply terminal. This assumes that FAULT- is connected to the negative DC supply terminal (see Figure 8).

2.3.7.6. *End-of-Travel Limits*

End-of-travel limits must be connected to ground to allow motor movement (limits may be bypassed using the LD3 command). Normally closed switches, preferably electronic, must be used. This input draws 12 mA through the internal 12VDC supply. If a Compumotor indexer is used with the Step/Direction system, the limit may be installed through the indexer. This may be a drawback, however, since any large following error, overshoot, or servo motor instability will not be limited by the indexer.