Chapter 3. Installation

Chapter Objectives

The information in this chapter will enable you to:

- ❑ Mount all system components properly
- ❑ Connect all electrical system inputs and outputs properly
- ❑ Ensure that the complete system is installed properly
- ❑ Perform basic system operations

You must perform all the bench test procedures in Chapter 2, *Getting Started*, before you can proceed with the permanent installation process.

System Specifications

Refer to Table 3-1 for Model 500 system specifications and Table 3-2 for factory default settings.

Parameter	Value
Performance	
Stepping Accuracy	+0 steps from preset total
Velocity Accuracy	+0.02% of max rate above 1 rps
Velocity Repeatability	+0.02% of max rate
Motor Resolutions	200 steps/rev - 50,000 steps/rev
Position Range	+0 - 99,999,999 steps
Velocity Range	25,000 steps/rev: 0.00001 - 40 rps; 5000 steps/rev: 0.00001 - 100 rps
Acceleration Range	25,000 steps/rev: 0.01 - 999.99 rps^2; 5000 steps/rev: 0.01 - 999.99 rps^2
Power	
Voltage	90 - 240VAC, or 127 - 340VDC
Frequency	50 - 6Hz
Current	Less than 1.3A RMS max
Inputs	
Command Interface	
Type	RS-232C serial type, 3-wire (Rx, Tx & GND)
Parameters	Selectable baud rate (300, 600, 1200, 2400, 4800, 9600); 8 data bits, 1 stop bit, no parity
Configuration	Up to 16 indexers daisy-chained from a single host RS-232 port
Programmable Inputs (13 total)	Optically isolated 5 - 30VDC. May be used for BCD recall of motion programs and for interactive machine control.
CW & CCW Limits, Home Enable	TTL levels, optically isoltated, 0 - 30VDC
Outputs	
Step, Direction, & Shutdown	Differential drive +3.0VDC min., +60mA high, +1.0VDC max., -60mA signal low
Fault Output	Normal open or closed, 2A at 120VA
Programmable Outputs (8 total)	Open-collector, user must supply pull-up resistor with min. of 100Ω resistance
Encoder A, B and Z Channels	Differential or single-ended, active high, <0.5VDC = low, >3.0VDC = high, 4.5mA sink
Max Frequency (A & B channels)	80KHz (line rate)
Minimum Pulse (Z channel)	1MHz (40 rps) if using Step and Direction source at 25000 step/rev resolution (see **MR** command description for max. speed at other resolutions)
	500 nanoseconds
Motion Programming	
Memory Storage	8K battery-backed RAM
Number of Programs	99 sequences, dynamically allocated to 8K
RS-232C Execution	Program execution may be initiated from the RS-232C interface with Run (**XR**) command
BCD Input Execution	Sequence select BCD inputs using thumbwheels
Power-up Auto Run	Sequences may be automatically executed on power-up via power-up sequence (#100)
Front Panel Execution	Sequences may be executed using the front panel bushbuttons
Environmental	
Operating Temperature	32°F - 122°F (0°C - 50°C)
Storage Temperature	-22°F - 185°F (-30°C - 85°C)
Humidity	0 - 95%, non-condensing

Table 3-1. Model 500 System Specifications

Parameter	Value
Default Settings	
RS-232C Communication	9,600 Baud Rate; 8 Data Bits; 1 Stop Bit; No Parity; Full Duplex
Device Address	**01** (refer to Chapter 2 for procedures to display and change via front panel pushbuttons)
Hardwae Interfaces	Front panel pushbuttons enabled Sequence and Ratio Select disabled RS-232C enabled Inputs active low, configured as triggers, with dedicated CW, CCW and Home limits Outputs active low, configured as programmable outputs
Limits	Hardware limits enabled; Software limits disabled
Motion Parameters	Acceleration = 10 rps^2 Deceleration = 10 rps^2 Velocity = 1 rps Motor Resolution = 25,000 steps/rev Distance = 25,000 Encoder Resolution = 4,000 Use the **DR** command to display the present configuration of the Model 500

Table 3-2. Model 500 Factory Default Settings

Environmental Considerations

You must consider the environment in which your system will be operating. Proper mounting, wiring, and grounding will ensure trouble-free operation. The Model 500 is designed to operate in an industrial environment; however, severe atmospheric contamination, electrical noise, or temperature extremes can affect performance of the system. ***Operate the drive and motor within its designed specifications.***

Compumotor recommends that you operate and store the Model 500 in the conditions identified in Table 3-1 above.

Complete System Configuration

Safety is the primary concern when installing any motion control system. This chapter provides installation guidelines that are designed to preserve the safety of the operator and the equipment. **You should install all Compumotor hardware in conformity with local and national electrical and safety codes.**

This chapter provides detailed instructions on all aspects of the Model 500 's installation and configuration. Once the system has been properly installed and initial adjustments are made, there should be little or no adjustment required to maintain normal operation.

Indexer Mounting

The Model 500 should be installed in an enclosure that will protect it from atmospheric contaminants such as oil, metal flakes, moisture, and dirt. The National Electrical Manufacturers Association (NEMA) has established standards that define the degree of protection that electrical enclosures provide. Industrial application environments may contain airborne contaminants, so the enclosure used should conform to at least a *NEMA TYPE 12 standard*.

Refer to Figure 3-1 for the Model 500's dimensions.

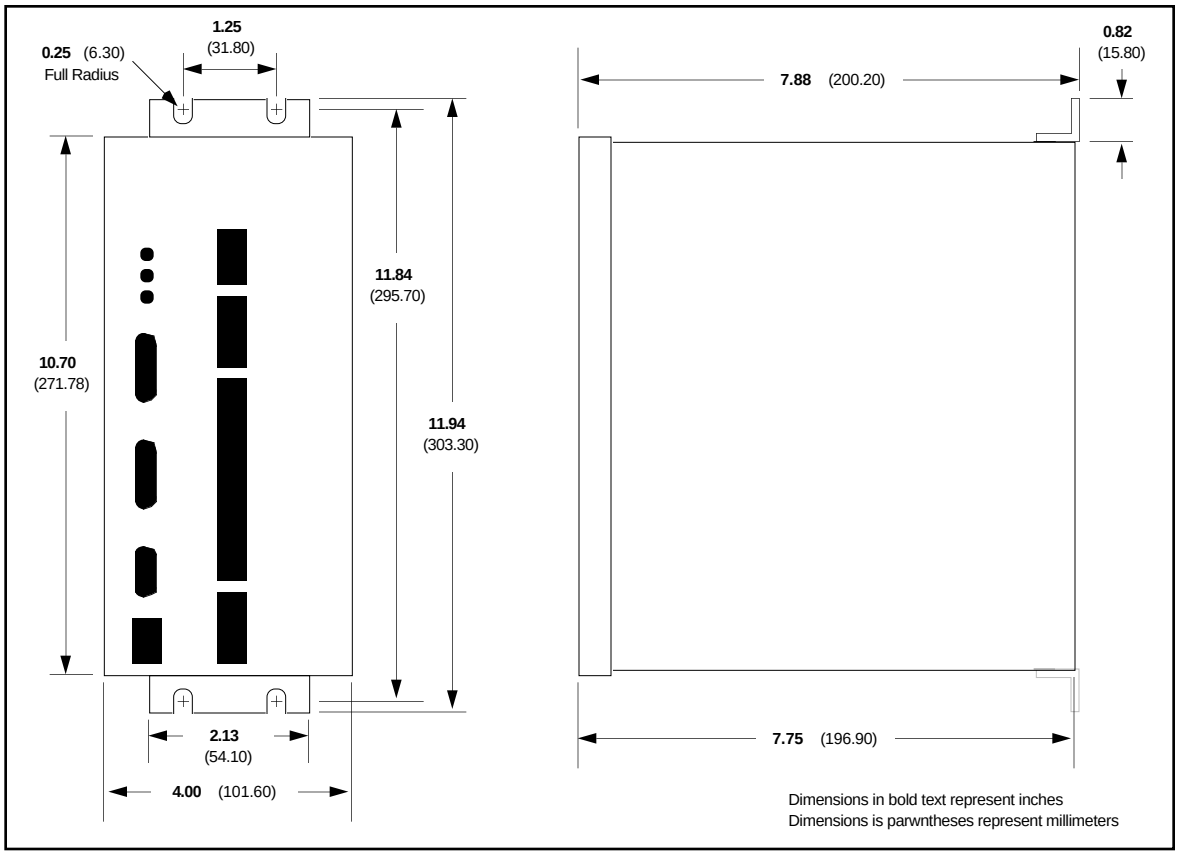


Figure 3-1. Model 500 Dimensions

Panel Layout

If you mount the Model 500 in an enclosure, observe the following guidelines:

- ❑ Make sure there is at least 4 inches of unrestricted air-flow space around the Model 500 to allow for efficient convection cooling (refer to Figure 3-2). Fan cooling may be necessary if adequate air flow is not provided.
- ❑ Do not mount large, heat-producing equipment (such as a drive) directly beneath the Model 500. The maximum allowable ambient temperature directly below the Model 500 is 40˚C.

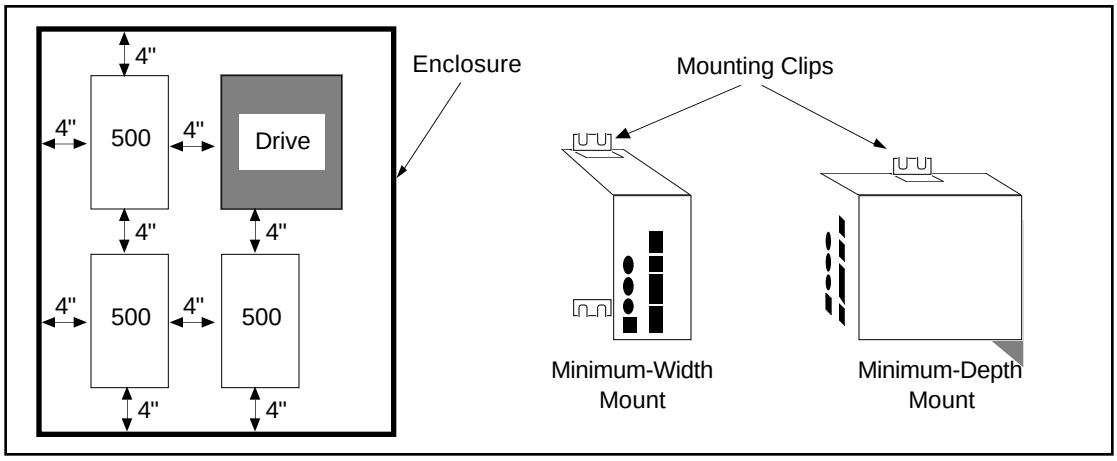


Figure 3-2. Panel Layout Guidelines and Mounting Options

Minimum Width or Depth

You can mount the Model 500 for minimum depth or width, depending on how you attach the mounting clips to the unit (see Figure 3-2 above).

The Model 500 is shipped with the two clips attached to the back of the indexer, opposite the power connectors. This allows the maximum amount of panel space possible.

For minimum depth, attach the two clips to the side of the indexer. This allows you to mount the drive in the shallowest possible enclosure.

System Wiring

This section provides information for system I/O and encoder connections and daisy-chaining. Refer to Chapter 2, *Getting Started*, for procedures to connect the following system components:

- ❑ Power
- ❑ RS-232C Communication
- ❑ Motor Driver

Test procedures are provided later in this chapter to verify that you have performed all the wiring correctly.

Wiring Guidelines

Proper grounding of electrical equipment is essential to ensure the safety of personnel. You can reduce the effects of electrical noise due to electromagnetic interference (EMI) by grounding. All Compumotor equipment should be properly grounded. A good source of information on grounding requirements is the National Electrical Code published by the National Fire Protection Association of Boston, Massachusetts.

In general, all components and enclosures must be connected to earth ground through a grounding electrode conductor to provide a low impedance path for ground fault or noise-induced currents. All earth ground connections must be continuous and permanent. Compumotor recommends a single-point grounding setup. Prepare components and mounting surfaces prior to installation so that good electrical contact is made between mounting surfaces of equipment and enclosure. Remove the paint from equipment surfaces where the ground contact will be bolted to a panel and use star washers to ensure solid bare metal contact.

For temporary installation, or when you cannot implement the grounding method described above, you must connect the **GND** terminal on the AC power connector to the earth ground.

WARNING

All AC power must be disconnected prior to installation wiring. Failure to observe safe working practices when installing or servicing this equipment can expose you to dangerous voltages.

PROG INPUTS Connections

The Model 500's **PROG INPUTS** connector has 16 inputs: 13 programmable inputs, 2 end-of-travel limit inputs, and 1 home limit input. These inputs have an internal 5V supply. **These inputs are <u>not</u> sinking inputs.** You can directly wire up to 30V to the inputs (no current-limiting resistor required). This allows you direct interface to a PLC. Figure 3-3 illustrates the Model 500's internal input circuit.

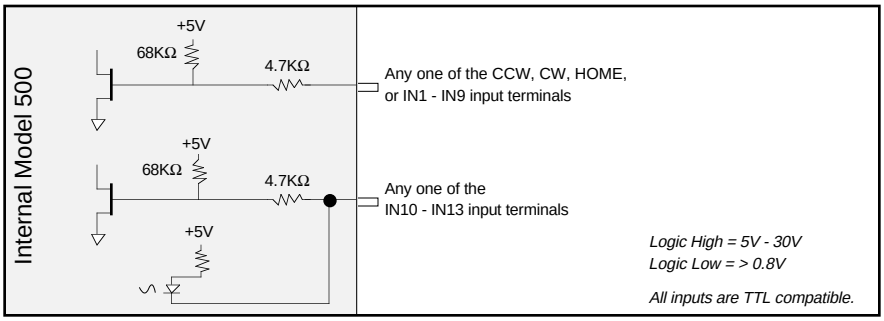


Figure 3-3. Model 500 Internal Input Circuit

You can change the active level of the inputs with the Configure Input Level (**INL**) command. The default setting for these inputs is **INLØ** (input active low). Figure 3-4 illustrates a typical wiring configuration (**INLØ** mode) for the inputs on the **PROG INPUTS** Connector.

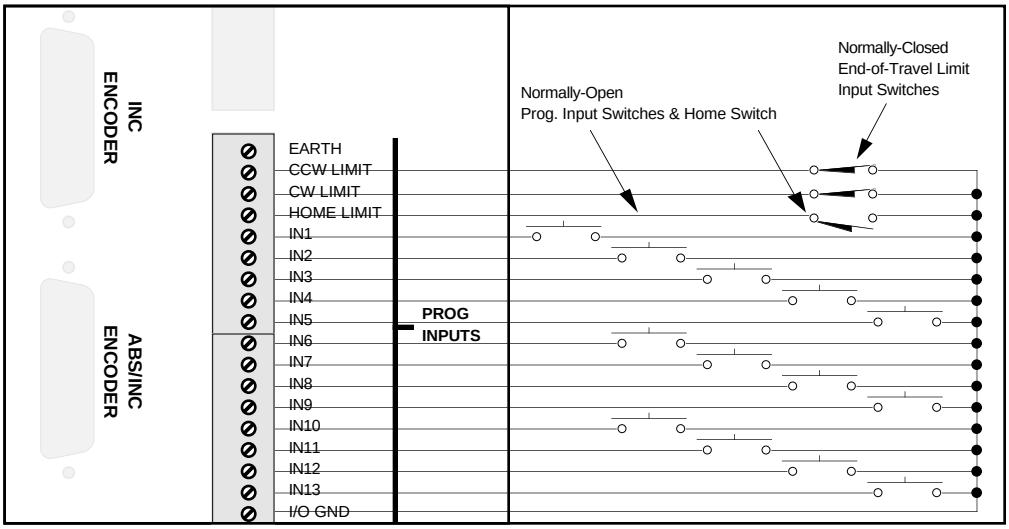


Figure 3-4. Typical Connections for **PROG INPUTS** Connector

End-of-Travel Limits

The Model 500 has two dedicated hardware end-of-travel limits (**CCW LIMIT** and **CW LIMIT** on the front panel). When you power up the Model 500 these limits are enabled. If you want to test the Model 500 without connecting the CW and CCW limit switches, you will have to disable the limit inputs with the Limit Disable (**LD3**) command. If you attempt to perform a move without disabling the inputs or using the **LD3** command, the **FAULT** LED will illuminate and error code **41** or **42** (depending on whether it was the CW or CCW limit) will flash on the display. These error codes indicate that the motor has reached the hardware limit.

The Model 500 also has software limit capabilities. The software limits are disabled when you power up the system. If you do not plan to use any hardware limit switches, you can provide added system safety by enabling software limits with the Software Limits (**SL**) command (refer to the **SL** command description in the **Model 500 Software Reference Guide**).

Figure 3-4 illustrates standard end-of-travel switch connections using normally-closed limit switches. This helps ensure a safer operating environment in which the motor will be stopped if the switch is opened or is faulty, or if the connection is broken somehow. You can, however, use normally-open switches by changing the active state of the end-of-travel limits to *active high* with the **OSA1** command.

Home Limit

The Model 500's dedicated **HOME LIMIT** input provides a reference position for your application's motion. The active state of the home limit input is determined by the **OSC** command. This input is useful if you want your machine to start its operation from a repeatable position. You can use this input in conjunction with the Go Home (**GH**) command or the Go Home input set-up using the Input (**IN**) command. When the Model 500 executes a **GH** command, it scans the Home Limit input until the switch activates the Home Limit input circuit. The Homing function is discussed in detail in Chapter 4, *Application Design*.

Figure 3-4 illustrates connections for a typical normally-open home input switch.

Programmable Inputs

The Model 500 has 13 programmable inputs. Each input can be programmed to serve any of up to 25 different functions with the **IN** command (refer to the **IN** command description in the **Model 500 Indexer Software Reference Guide**). The inputs can be used with PLCs and can be configured along with the outputs to interface with thumbwheel switches. As part of the set-up of your application, you may need to configure the inputs to have the functionality you require.

To activate the inputs when the input active level is low, connect the input pin to the **I/O GND**. If you are using a relay to activate the inputs, use solid state relays to prevent electrical noise from impairing the performance of your application.

Using the Input (**IN**) command, you can program the programmable inputs to perform various functions (i.e., stop input, sequence-select input, etc.).

Figure 3-4 illustrates typical normally-open switches connected to accommodate the default **INLØ** (input active-low) mode.

PROG OUTPUTS Connections

The Model 500's **PROG OUTPUTS** connector has 8 programmable open-collector outputs (**OUT1** - **OUT8**) that can be directly wired to 30VDC and can sink up to 300mA. Figure 3-5 is a diagram of the Model 500's output circuit.

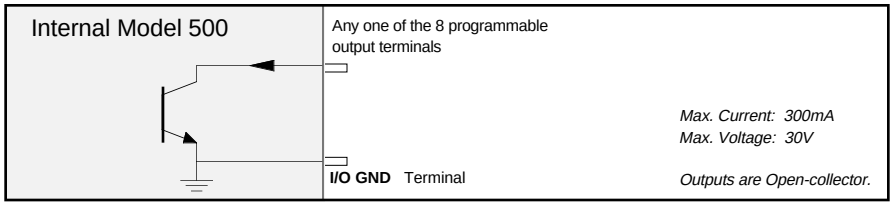


Figure 3-5. Model 500 Internal Output Circuit

You can directly interface these outputs with a PLC, *if the PLC can directly interface with an open-collector output*. If not, you must use a pull-up resistor (minimum of 100Ω) and an external 5 - 30VDC power supply to use these outputs (refer to Figure 3-6).

If you are using a relay to activate the outputs, use solid state relays to prevent electrical noise from impairing the performance of your application.

These outputs can be configured for different functions (i.e., moving/not moving) with the Configure Output (**OUT**) command. You can also configure the active level of the outputs with the Configure Output Level (**OUTL**) command. The default setting for these outputs is **OUTLØ** (Output Active Low).

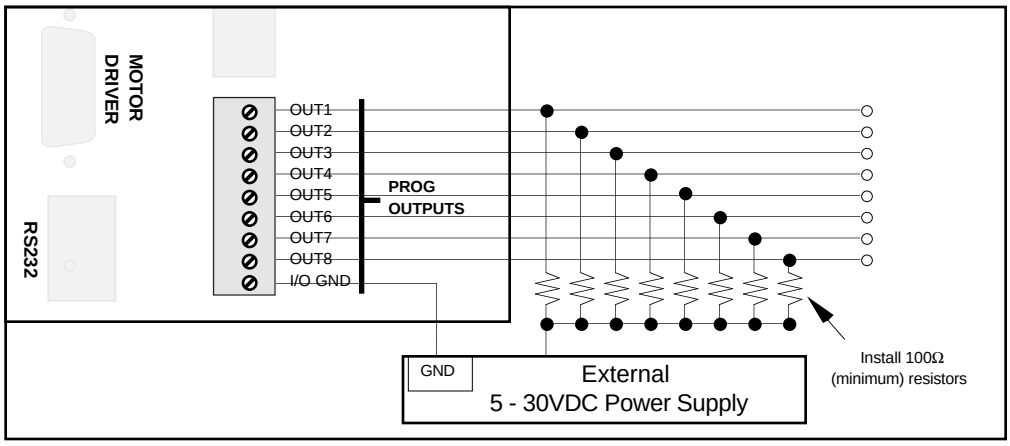


Figure 3-6. Programmable Output Wiring Diagram

Fault Output Connections

The Model 500 provides a programmable fault output that defaults to the same function as the other programmable outputs; referred to as **OUT9**, you can use the **OUT** command to program its function as you would the other eight outputs (refer to the **OUT** command description in the **Model 500 Indexer Software Reference Guide**.

It is also hard-wired so that if the microprocessor is reset, the **CPU READY** LED goes out, or if a fault occurs, the relay will change state.

The fault output is labeled **FAULT OUT** on the front panel. There are two types of outputs available: normally-open and normally-closed (see Figure 3-7 for connections). Normally-closed outputs will **open** if a fault occurs. Normally-open outputs will **close** if a fault occurs. The relay fault outputs are rated for up to 120VAC and 10A of current.

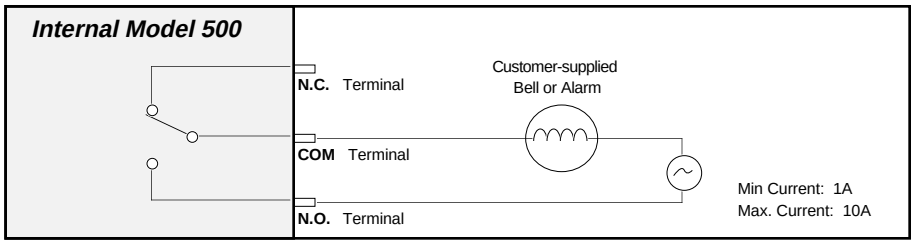


Figure 3-7. Fault Output Connections

Daisy-Chain Connections

If you are not daisy-chaining multiple Model 500 Indexers, you can skip this section.

You may daisy-chain up to 16 Model 500s to one serial port on a terminal. Figure 3-8 shows a three-indexer daisy-chain configuration from one controlling terminal or computer.

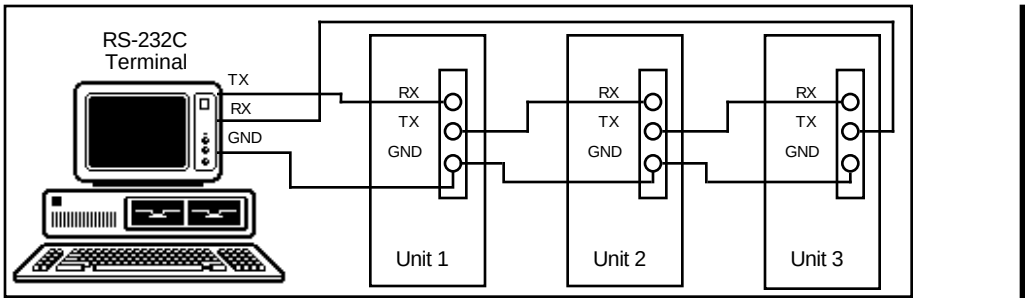


Figure 3-8. RS-232C Daisy-Chain Configuration

If you are daisy-chaining 500s, you should establish different addresses for each unit so you can distinguish them when you are programming. Refer to Chapter 2, *Getting Started*, for instructions on displaying and changing the 500's device address.

Commands prefixed with a device address affect only the unit specified. Commands without a device address affect all units on the daisy chain. For instance, entering the **1G** command instructs only unit #1 to go (move), but entering the **G** command instructs all units on the daisy-chain to go.

Any command that causes the drive to transmit information from the RS-232C port (such as a status or report command), must be prefixed with a device address. This prevents daisy-chained units from all transmitting at the same time.

No 500 executes a device-specific command unless the unit number specified with the command matches the 500's unit number. Device-specific commands include both buffered and immediate commands.

You must use status request commands in an orderly fashion. Commands should only be issued when the host is ready to read the response. You should not send new commands until you receive a response from the previous status request command. In particular, you should not issue an immediate-status command until the host receives a buffered command status response. If this is not followed, the command responses will be intertwined, rendering the data useless.

If you enable the Interactive mode (**SSI1**), only the 500 that is set to address 1 will respond with a prompt (>). This prevents all the 500s from sending out > in a daisy-chain. Typically, you should disable the Interactive mode when you use a host computer with the 500.

Encoder Connections

If you purchased the Model 500 Indexer and will not be using encoder feedback, you can skip this section.

The Model 500 has two encoder interfaces. One is labeled **INC ENCODER** on the front panel and the other is labeled **ABS/INC ENCODER**. The **INC ENCODER** interface accepts only incremental encoders (*does not accept Z Channel*), while the **ABS/INC ENCODER** interface accepts either an incremental (*accepts Z Channel*) or an absolute encoder.

The Model 500-FOL (*following*) option can follow from either the **ABS/INC** or the **INC ENCODER** interface, depending on the setting of the **FSJ** command. When using one encoder interface for following, you can use the other encoder interface to perform position maintenance while in the following mode. The encoders used for position feedback that are compatible with the Model 500 and the Model 500-FOL are listed below:

- ❑ Compumotor -E Series encoders (or any other incremental encoder with quadrature signals and a Z channel)
- ❑ Compumotor's AR-C and AL-C absolute encoders

Encoder Configurations

Depending on your application, you can use the encoder interfaces in one of the configurations listed in Table 3-3.

Model 500

Application	Configuration
Open-loop Indexing	1. **INC ENCODER**—Not used **ABS/INC ENCODER**—Not used
Indexing, Position Maintenance	1. **INC ENCODER**—Incremental encoder used for position information **ABS/INC ENCODER**—Not used
	2. **INC ENCODER**—Not used **ABS/INC ENCODER**—Incremental encoder used for position information
	3. **INC ENCODER**—Not used **ABS/INC ENCODER**—Absolute encoder used for position information

Model 500-FOL

Application	Configuration
Following, No Position Maintenance	1. **INC ENCODER**—Incr. encoder provides following info. from primary axis **ABS/INC ENCODER**—Not used
	2. **INC ENCODER**—Not used **ABS/INC ENCODER**—Incr. encoder provides following info. from primary axis
	3. **INC ENCODER**—Not used **ABS/INC ENCODER**—Abs. encoder provides following info. from primary axis
Following, Position Maintenance	1. **INC ENCODER**—Incremental encoder used for position information. **ABS/INC ENCODER**—Incr. encoder provides following info. from primary axis
	2. **INC ENCODER**—Incremental encoder used for position information. **ABS/INC ENCODER**—Abs. encoder provides following info. from primary axis
	3. **INC ENCODER**—Incr. encoder provides following info. from primary axis **ABS/INC ENCODER**—Incremental encoder used for position information
	4. **INC ENCODER**—Incr. encoder provides following info. from primary axis **ABS/INC ENCODER**—Absolute encoder used for position information

Table 3-3. Possible Encoder Configurations (Model 500 & Model 500-FOL)

Procedures to connect the encoder to the model 500 are provided in the sections below.

Position maintenance, encoder step mode, and *stall detect* functions are discussed in detail in Chapter 4, *Application Design*. *Following functions* are discussed in Chapter 5, *Following*.

Incremental Encoders

The Model 500 requires the standard phase A+, phase A-, phase B+, phase B-, phase Z+ and phase Z- inputs. You can use single-ended encoders by not connecting the encoder's A-, B-, and Z- outputs. The phase A and phase B inputs provide quadrature input signals. The Model 500 has an internal quadrature detection circuit. The phase Z inputs provide one pulse per revolution and are used to find the final home position when you execute a Go Home (**GH**) command (applies only if you use an incremental encoder connected to the **ABS/INC ENCODER** interface).

The resolution of the encoder is determined by the particular encoder that you choose. If the encoder that you choose provides 1,000 pulses per revolution (a 1,000-line encoder), it will have 4,000 distinct locations per revolution after going through the quadrature detection circuit in the Model 500. The 1,000 lines per revolution is known as the *pre-quadrature resolution*. This means that the phase A input provides 1,000 pulses in one revolution. The phase B input also provides 1,000 pulses per revolution. These pulses are offset from each other by 90° as shown in Figure 3-9.

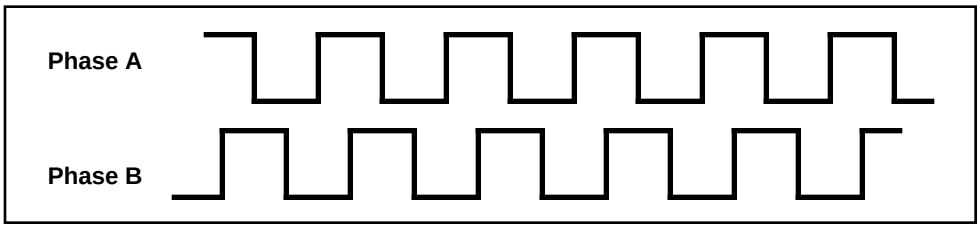


Figure 3-9. Quadrature Signals From an Incremental Encoder

The two phases go through a quadrature detection circuit. They provide four times the pre-quadrature resolution (1,000 pulses per revolution) or 4,000 counts per revolution. This is known as the *post-quadrature* resolution. The Z channel sends one pulse every time the encoder passes its zero point. Therefore, it provides one pulse per revolution.

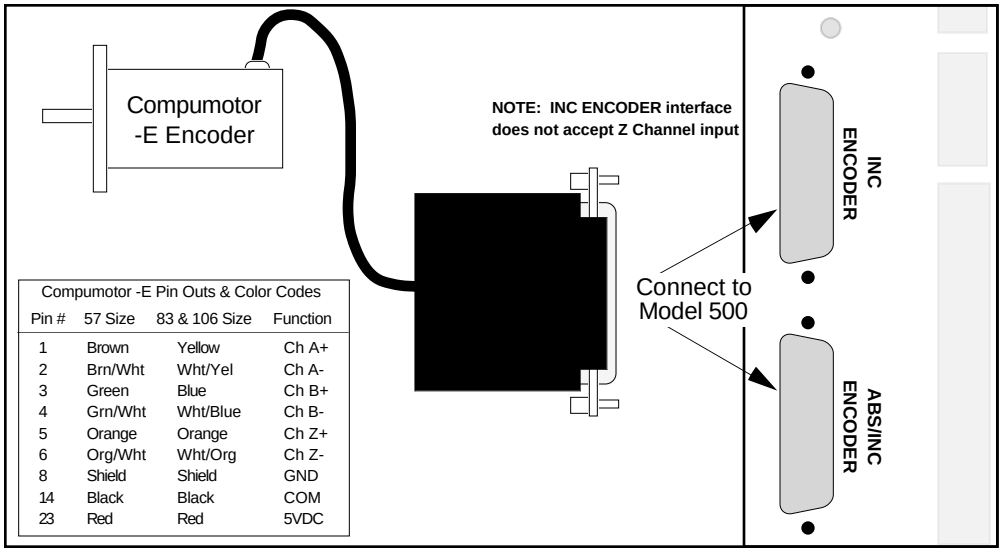
The maximum rate at which the phase A and phase B pulse can be detected determines the maximum speed that the motor can achieve. This is limited by the bandwidth of the encoder interface circuit. The Model 500 has a bandwidth of 80KHz pre-quadrature. With the incremental encoder in this example, 1,000 pulses per revolution are received. If the encoder is moving at 50 rps, the Model 500 will receive 1,000 • 50 pulses per revolution. This is less than the maximum bandwidth of the interface. A speed of 50 rps is adequate for most applications. If your application requires higher speeds, use a lower resolution encoder.

Incremental Encoder Connections

The **INC ENCODER** and **ABS/INC ENCODER** connectors accept two-phase quadrature incremental encoders with differential or single-ended outputs (+5V TTL-compatible). The Model 500 provides the 5VDC at 500mA supply for the encoder. The maximum frequency per channel is 80KHz.

The* INC ENCODER *does not accept Z channel inputs. If you need to home to a Z channel, use the* ABS/INC ENCODER *connector configured for incremental operation (refer to the Absolute Encoders section discussed later in this chapter).

If you use a Compumotor -E incremental encoder, it will be provided with a cable that has a 25-pin D connector compatible with the Model 500's 25-pin encoder input. Connect the encoder cable to the Model 500 as shown in Figure 3-10. Figure 3-10 also lists the encoder cable color codes and pin outs.



Compumotor -E Pin Outs & Color Codes

Pin #	57 Size	83 & 106 Size	Function
1	Brown	Yellow	Ch A+
2	Brn/Wht	Wht/Yel	Ch A-
3	Green	Blue	Ch B+
4	Grn/Wht	Wht/Blue	Ch B-
5	Orange	Orange	Ch Z+
6	Org/Wht	Wht/Org	Ch Z-
8	Shield	Shield	GND
14	Black	Black	COM
23	Red	Red	5VDC

Figure 3-10. Compumotor -E Encoder Connections (Differential)

If you do not use a Compumotor encoder, you must make your own cable. Two 25-pin D shells are included in the Model 500 ship kit for making a connector. You must solder the connections to make the cable.

The incremental encoder inputs can be used either differentially or single-ended. Refer to Figure 3-11 for differential and single-ended solder connections to the 25-pin D connector. Figure 3-12 shows the typical incremental encoder interface circuit.

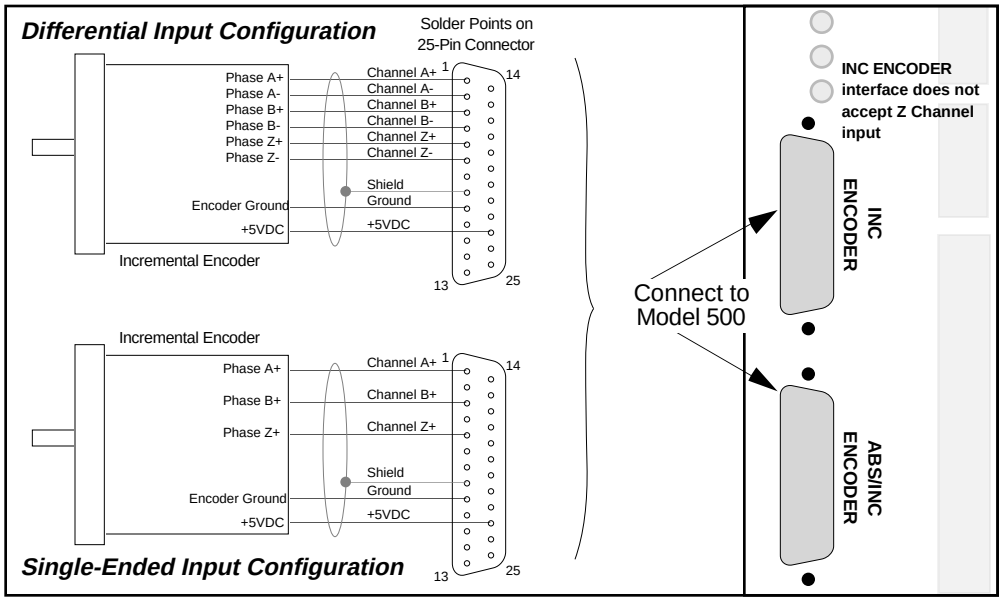


Figure 3-11. Differential and Single-Ended Incremental Encoder Connections

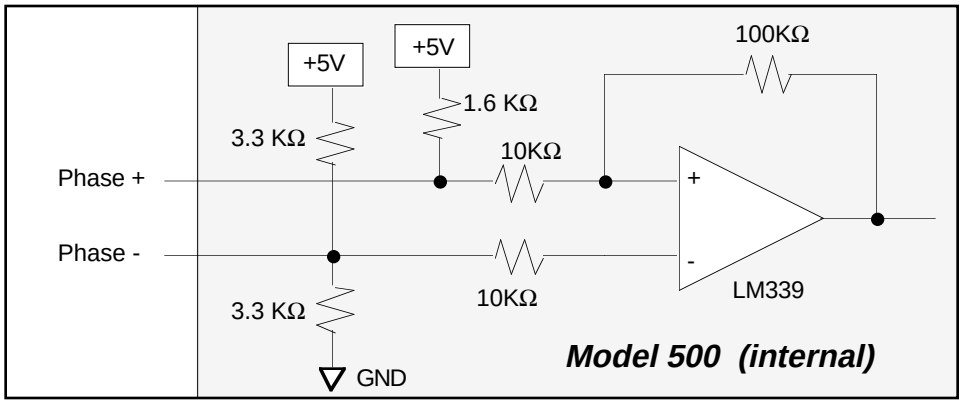


Figure 3-12. Typical Model 500 Encoder Input Circuit

For procedures to verify that your encoder interface is correctly wired, refer to the *Verifying Installation* section later in this chapter.

Absolute Encoders

The Model 500 allows you to use absolute encoders as position sensors. Compumotor offers three absolute encoders compatible with the Model 500 — one rotary (AR-C) and one linear (AL-C). Each absolute encoder uses a decoder box to translate the encoder input for the indexer. The decoder box has a cable with a 25-Pin D connector that plugs directly into the **ABS/INC ENCODER** interface.

The encoder inputs are optically isolated. With absolute encoders, the maximum speed achievable is 4,800 rpm. The absolute encoder differs from the incremental encoder in that each location in the travel of the absolute encoder is a physically distinct location giving the same position reading every time the encoder reaches that location. With an absolute encoder, a home limit is not needed if you specify a specific location as the *home reference position*.

Absolute Encoder Connections

If you are using the AR-C or AL-C, refer first to the encoder's user guide to configure the decoder box for operation with the Model 500 and familiarize yourself with its operation. After you have done this, you can connect the decoder box cable to the **ABS/INC ENCODER** interface as shown in Figure 3-13.

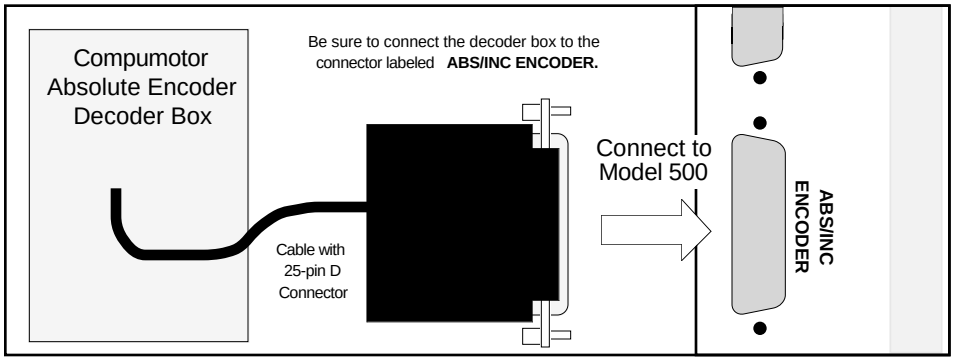


Figure 3-13. Compumotor Absolute Encoder (Decoder Box) Connections

Table 3-4 lists the **ABS/INC ENCODER** interface pin functions. To create a custom cable for use with the absolute encoder, you can solder the wires to one of the two 25-pin D-connectors provided in the Model 500 ship kit.

Pin #	INput or OUTput	Description
1	IN	A+
2	IN	A-
3	IN	B+
4	IN	B-
5	IN	Z+
6	IN	Z-
7	—	No Connection
8	IN	Shield
9	OUT	Ground
10	OUT	Strobe
11	OUT	Select Ø
12	OUT	Select 1

Pin #	INput or OUTput	Description
13	IN	Data Valid
14	OUT	Ground
15	IN	DØ (LSB)
16	IN	D1
17	IN	D2
18	IN	D3
19	IN	D4
20	IN	D5
21	IN	D6
22	IN	D7 (MSB)
23	OUT	+5VDC
24 & 25	—	No Connection

Table 3-4. **ABS/INC ENCODER** Interface Pin Outs

Installation Verification

This section provides procedures to verify that you successfully connected the system components and I/O. Procedures for testing the Model 500-FOL's following functions and associated encoder(s) are provided in Chapter 5, *Following*.

CAUTION

For safety purposes, the procedures in this section are written under the assumption that you have <u>not</u> coupled the motor to the load or machine. Couple the load <u>after</u> you perform these procedures.

This section provides instructions to test proper installation of a single-axis Model 500 system. If you have a multi-axis (daisy-chained) system, you should test every axis. To test every axis, you must repeat every device-specific command for each axis. All universal commands will be performed by every Model 500 unit in the chain. Status reports for each axis should yield the same response. For example, the following is a series of universal commands which will be performed by every axis in a daisy-chain:

Command	Description
> MN	Sets mode to normal (all axes)
> A1Ø	Sets acceleration to 10 rps^2
> V2	Sets velocity to 2 rps
> PZ	Sets absolute position counter to zero
> D25ØØØ	Sets distance to 25000 steps
> G	Executes the move (Go)

Each motor on every axis will perform a 25,000-step move simultaneously.

To report the absolute position on all axes, you will have to issue a **PR** command (a device-specific command) with the appropriate device address as follows:

Command	Description
> 1PR	Reports absolute position for unit 1 (response is ***ØØØØØ25ØØØ**)
> 2PR	Reports absolute position for unit 2 (response is ***ØØØØØ25ØØØ**)
> 3PR	Reports absolute position for unit 3 (response is ***ØØØØØ25ØØØ**)

Verify CW & CCW Limit Switches

Before you test the limit switches, check the following:

- ❑ Ensure that the CW and CCW limit switches are wired properly.
- ❑ **Make sure that the load is not attached to the motor.**
- ❑ Make sure that you can manually open and close the limit switches.

To test the CW and CCW Limit switches with the Model 500 controller, complete the following test procedure:

① Close the CW and CCW limit switches.

② Type **1IS** [cr]. Assuming that you have not grounded any other inputs or issued an **INL1** command, you should receive the following response: ***1100_0000_0000_0000**. This means that the CCW and CW limits (represented by the 1st and 2nd digits, respectively) are closed.

③ To test the CW limit switch, enter the following commands:

Command	Description
> LDØ	Enables the CW and CCW Limits
> INLØ	Normally-closed limit inputs
> MC	Sets controller to Continuous mode
> A1ØØ	Sets acceleration to 100 rps^2
> AD1ØØ	Sets deceleration to 100 rps^2
> V3	Sets velocity to 3 rps
> H+	Changes the direction of the motor (CW)
> G	Executes the move (Go)

The motor should move in the CW direction at a constant velocity.

④ While the motor is moving, open the CW limit switch. The motor should stop moving and error code **41** should be flashing in the two-digit LED. This verifies that the CW limit switch is working properly.

⑤ Close the CW limit switch. (Error code **41** will continue to flash until the motor is commanded to move in the opposite direction, or until you issue the **ON** command.)

⑥ To test the CCW limit, enter the following commands:

Command	Description
> H-	Changes the motor's direction (CCW)
> G	Executes the move (Go)

The motor should move in the CCW direction at a constant velocity.

⑦ While the motor is moving, open the CCW limit switch. The motor should stop moving and error code **42** should be flashing in the two-digit LED. This verifies that the CCW limit switch is working properly.

⑧ Close the CW limit switch. (Error code **42** will continue to flash until the motor is commanded to move in the opposite direction, or until you issue the **ON** command.)

If you are not able to stop the motor with the limit switches, issue the Stop (**S**) command, reverse the wiring of the CW and CCW limit inputs, and start over at step 1 above. If you are still unsuccessful, refer to Chapter 6, *Maintenance and Troubleshooting*.

Verify Homing Function

In this section you will test your home limit switch and home the motor. You can initiate the Go Home function by entering the Go Home (**GH**) command over the RS-232C interface or by enabling a Go Home input using the Configure Input (**IN**) command. You must also define the Go Home Velocity (**GHV**), Go Home Acceleration (**GHA**), Go Home Deceleration (**GHAD**) and Final Go Home Velocity (**GHF**) to properly initiate the Go Home function. You can define the initial direction of the homing function with the Go Home Velocity (**GHV**) command. The **OS** commands are used to set up the final go home approach and the edge of the switch to stop on.

When you command the motor to go home, it begins to move in the direction and at the velocity you specified. It performs this move at the acceleration rate specified with the **GHA** command, and looks for the Home limit input to open if in the **INLØ** mode (close if in the **INL1** mode). If the motor encounters an end-of-travel limit while it searches for home, it will reverse direction and look for the Home limit input to go active in the opposite direction. If the motor encounters the other limit before it detects the home signal, the Go Home move will be aborted and the motor will stop.

Use the following procedure to test the functionality of the Home limit switch (this is a *back up to home switch* homing example):

① Manually open the Home limit switch and type **1IS.** Assuming your end-of-limits are closed and all other inputs are open, the system should respond with ***1100_0000_0000_0000**.

② Close the Home limit switch and type **1IS.** The system should respond with ***1110_0000_0000_0000**. This verifies that the home limit switch (represented by the 3rd digit) is functioning properly.

③ Open the Home limit switch.

④ To test the Model 500's homing function, enter the following string of commands:

Command	Description
> 1GHA100	Sets go home acceleration to 100 rps^2
> 1GHAD100	Sets go home deceleration to 100 rps^2
> 1GHF.5	Sets final go home speed to 0.5 rps
> GHV+1	Sets the go home velocity to 1 rps in the clockwise (CW) direction
> 1OSB1	Enables the back up to home switch function
> 1OSGØ	The final approach direction is CW
> 1OSHØ	The CW edge is the edge the move stops on
> GH	Executes the Go Home function

The motor moves in the CW direction at constant velocity of 1 rps.

⑤ Close the Home limit switch. The motor decelerates to a stop. It then reverses direction and moves off the switch at the final approach speed so that it can make its final approach to the home switch in the CW direction.

⑥ Open the switch to simulate moving back off the home switch. Once it is off the switch it begins its final approach in the CW direction.

⑦ Close the Home limit switch again. The Model 500 will continue moving because it has encountered only the CCW edge of the limit switch.

⑧ Open the Home limit switch again. This will be the CW edge and the motor will stop. The Model 500 automatically considers this position as the zero position.

Chapter 4, *Application Design*, explains the back-up to home limit function in detail. You will use the **OS** commands to set up the exact homing sequence that your application needs.

Verify Incremental Encoder Interface

Follow the steps below to test the incremental encoder interface.

① Using the 25-pin D connector that you wired, or the one that came with your Compumotor incremental encoder, connect the encoder to the **ABS/INC ENCODER** input on the front panel of the Model 500.

② Set the **ABS/INC ENCODER** interface to function as a incremental position feedback interface (as opposed to a *following* interface).

Command	Description
> 1FSMØ	Sets the **ABS/INC ENCODER** interface for incremental feedback
> 1FSJØ	Sets the **ABS/INC ENCODER** interface for position feedback

③ Turn the encoder shaft CW and display the encoder position using the **1DPA** command. The **1DPA** command transmits the actual encoder position to the screen every 10 ms. **If your terminal or computer can not display the position at this rate, use the 1DPA1 command; this transmits the response only once.**

Command	Description
> 1DPA	Periodically display encoder position

As you turn the encoder CW, the position count displayed by the command will increase. Turning the encoder CCW decreases the count. If it decreases while turning CW, it is possible that you have the phase A and phase B channels of the encoder reversed in their connection to the Model 500. Reverse the phase A and phase B channels and repeat steps 1-3. To discontinue the position display press the space bar or the carriage return.

④ Remove the 25-pin D connector from the **ABS/INC ENCODER** interface. Attach it to the **INC ENCODER** interface.

⑤ Set the **INC ENCODER** interface to function as a position feedback interface.

Command	Description
> 1FSJ1	Sets the **INC ENCODER** interface for position feedback

⑥ Repeat step number ③.

This test verifies that both the **INC ENCODER** and the **ABS/INC ENCODER** interfaces are working properly and that your 25-pin D incremental encoder connector is wired properly.

Verifying Absolute Encoder Interface

Perform the following steps to verify the functionality of your absolute encoder interface. It is assumed at this point that you have read the absolute encoder user guide and are familiar with it's operation.

① Remove power from the motor/drive, Model 500, and absolute encoder/decoder.

② Attach the encoder cable to the decoder box and to the Model 500. Ensure that the encoder is plugged into the decoder box as well. Apply power to the decoder box.

③ Type in the following commands to select the absolute encoder and the **ABS/INC ENCODER** interface.

Command	Description
> 1FSM1	Selects the absolute encoder
> 1FSJØ	Selects the **ABS/INC ENCODER** interface for positioning

④ Turn (move) the encoder and display the encoder position using the **1DPA** command. The **1DPA** command transmits the actual encoder position to the screen every 10 ms. **If your terminal or computer can not display the position at this rate, use the 1DPA1 command; this transmits the response only once.**

Command	Description
> 1DPA	Periodically display encoder position

As you turn the encoder, the position count displayed by the command will increase CW and decrease CCW (with rotary encoders).

This test verifies that the **ABS/INC ENCODER** interface is working properly and that your 25-pin D encoder connector is wired properly.

Verify Input Wiring

Perform the following steps to verify proper wiring of your inputs.

① Place the inputs in the active low state and display their current state with the **IS** command.

Command	Description
> INLØ	Active level low
> 1IS	Response is ***ØØØØ_ØØØØ_ØØØØ_ØØØØ**

② Activate input number 1 (**IN1**) by shorting the input to ground, and enter the status request (**IS**) command again.

Command	Description
> 1IS	Response is ***ØØØ1_ØØØØ_ØØØØ_ØØØØ**

This indicates that the Model 500 has recognized that input number 1 has changed state. In this manner you can verify that each input is changing state correctly.

Verify Output Wiring

You can directly control each output by using the **O** command. Use the **O** command to turn on outputs 1 and 2 and turn off output 3. Use a voltmeter to verify that the output has changed state.

Command	Description
> O11Ø	Directly controls the outputs