

Z Series motors can produce substantial steady-state torques and rapid accelerations. A combination of these forces can shear shafts and mounting hardware if the mounting design is faulty. Rapid acceleration can produce shock and vibration loads that require heavier hardware than normally required. The motor itself, under certain load profiles, can generate low-frequency vibrations within the mounting structure as well. These vibrations can cause fasteners to loosen if they are not locked. Compumotor recommends that you use elastic nut type fasteners.

**CAUTION**

Vibrations produced by a cycling motor can induce metal fatigue within structural members. Have all plans reviewed by a mechanical engineer.

## Couplers

Shaft misalignments are unavoidable due to fabrication tolerances. Common shaft misalignment problems include parallel, angular, and end float misalignment. **Parallel misalignment** is the offset of two shaft center lines where the center lines remain parallel to each other. **Angular misalignment** occurs when the shaft center lines are not parallel, but intersecting at some angle not equal to 0°. **End float misalignment** is a variance in the relative distance between the ends of the two shafts.

Couplings can help you accommodate these misalignment problems while maintaining desired torque. Several coupling types are available.

- Single-flex
- Double-flex
- Rigid

A single-flex coupler will correct only for angular misalignment while a double-flex handles both angular and parallel problems. Depending upon their design both types may or may not accommodate end play problems.

When joining two shafts that are fixed in the radial and angular direction, you should use a double-flex coupling. Single-flex couplings are not recommended for this type application because uncompensated parallel misalignment will eventually bend shafts and place bearings under unacceptable loads.

If only one of the shafts is free to move radially, Compumotor recommends that you use single-flex couplings. A double-flex coupling may allow too much freedom of movement leading to destructive vibration generation.

Applications that require rigid couplings are extremely limited. Rigid couplings do not compensate for any misalignments and are therefore not recommended for most applications. You should use them only if the motor is on floating mounts that allow for alignment compensation.

Ensure that any coupling you select for your application is within the range of the couplings performance specifications.

# System Wiring

This section provides instructions for all Z Series system wiring.

- ❑ Motor Connections
- ❑ Resolver Connections
- ❑ Indexer Connections
- ❑ I/O[1] & I/O[2] Connections
  - Limit Inputs
  - Home Inputs
- ❑ Power Connections

### WARNING

All AC power must be disconnected prior to installation wiring. Failure to observe safety precautions may expose you to dangerous voltages.

## Connections

The Z Drive is shipped with a pre-assembled motor cable. The motor end of the cable has an MS-type connector.

Motor Type	Motor Cable Connector	Resolver Cable Connector
Z606 - Z606	851-Ø6EC14-5S5Ø	851-Ø6EC14-19S5Ø
Z610 - Z630	CIRØ65-18-1ØS	851-Ø6EC14-19S5Ø
Z640	CIRØ6F-22-22S	851-Ø6EC14-19S5Ø
Z806 - Z806	PTØ6A-14-5S	PTØ6E-14-12S
Z810 - Z840	97B-3106-24-22S MS-3057-6A 3420-12	PTØ6E-14-12S
Z910	CIRØ65-18-1ØS	851-Ø6EC14-19S5Ø
Z920 - Z940	CIRØ6F-22-22S	851-Ø6EC14-19S5Ø

*ZX Series Resolver and Motor Connectors*

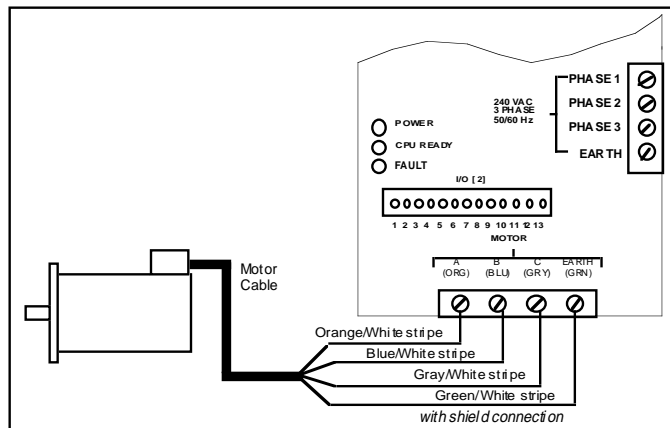
The drive end has four leads with spade terminals that should be attached prior to applying power. *The ground wire is connected at the spade terminal to an uninsulated, stranded wire that touches the motor cable shield.*

### WARNING

Be sure the motor is properly grounded to reduce the chance of electrical shock.

#### **Helpful Hint:**

Motor screw terminal connections to the Z Drive are marked Motor A, B, C, and EARTH. The motor connectors are the same for all Z Drives.



*Motor Wiring Pin Out and Color Codes*

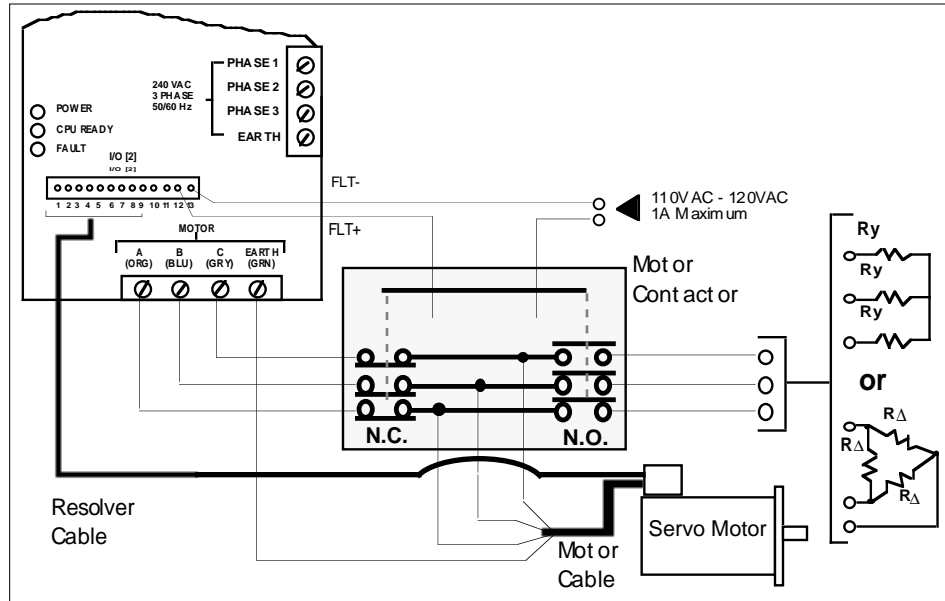
The standard Z600 Drive motor cable is a 4-conductor, 12 AWG, 25-foot cable. The standard Z900 cable is a 4-conductor, 8 AWG, 25-foot cable. If the motor and drive must be mounted further than 25 feet apart, Compumotor can provide cables with the MS connector installed for cable lengths of up to 100 feet. Standard cables are 25, 50, and 100 feet. *To order special cables, call Compumotor's Customer Service Department (800- 722-2282). These cables must be ordered separately.* Cable lengths in excess of 100 feet are not recommended. *Compumotor recommends installing the motor and resolver cables in separate conduits to minimize noise coupling as well as for safety.*

## Motor Braking

If the Z Drive faults, for any reason, the amplifier will be disabled and the motor will freewheel. Refer to *Chapter 8 Maintenance & Troubleshooting*, for all fault conditions. If a freewheeling load is unacceptable, you must install auxiliary motor braking resistors.

In the scenario depicted in the figure below, the motor contactor is normally energized to provide a direct connection between the motor and drive. The motor contactor (*N.O.—normally open/N.C.—normally closed*) is controlled by the fault relay+ (**FLT+**)/fault relay- (**FLT-**) output on the Z Drive's I/O[2] connector. If the amplifier faults or if the line voltage is disconnected, the contactor connects the motor braking resistors across the motor. The braking resistors can be sized by analyzing specific applications.

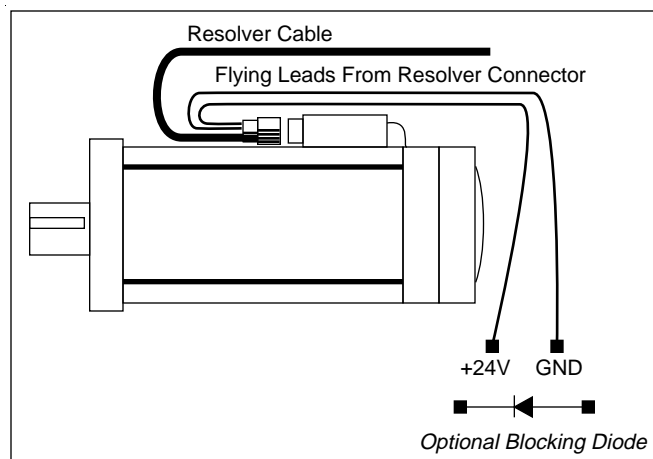
**Helpful Hint:**  
Braking resistors provide very little braking at zero velocity. If standstill braking or emergency stopping are required, you can order the spring-type motor brake option from Compumotor (800) 722-2282. The brake is activated from a separate 24VDC supply and operates in a fail-safe mode.



Motor Braking (Dynamic)

If the total load inertia is less than five times the rotor inertia, non-inductive 200 watt power resistors can be used as the braking resistors. For a wye configuration, use 5 ohms or more ( $R_Y = 5\Omega$ ). For a delta configuration, use 15Ω or more ( $R_{\Delta} = 15\Omega$ ). If quicker stopping is required, the braking resistors can be lowered, but you must increase their power ratings.

## Wiring the Motor Brake Option

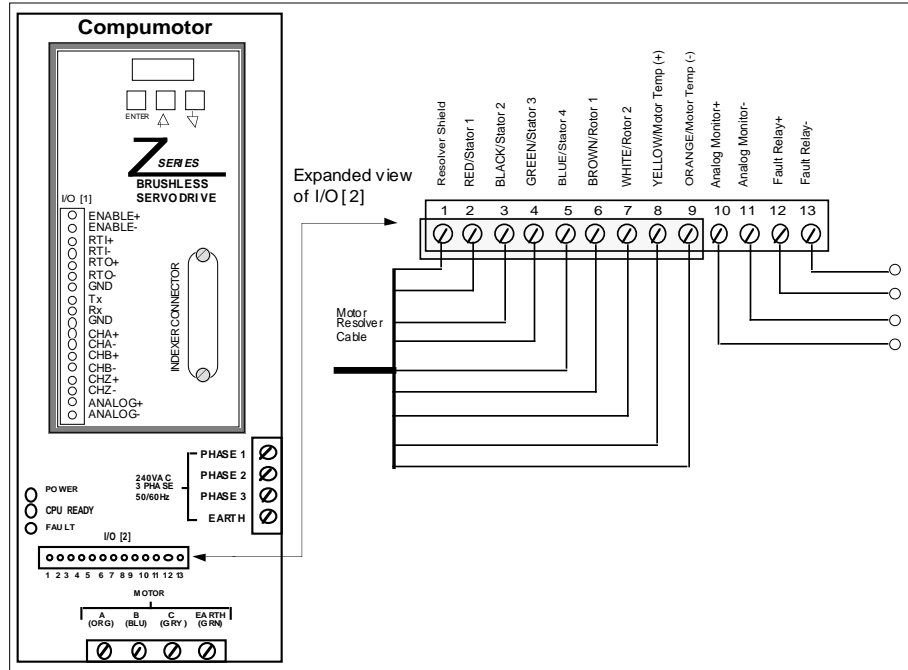


Wiring Z Series Motor Braking Option (-B)

Apply +24V to one of the flying leads from the resolver connector, and GND to the other lead (this energizes a coil that releases the brake). It may be necessary to place a blocking or flyback diode across the brake coil to prevent noise spike from falsely triggering other devices when the brake is engaged or disengaged (a 1N4936 should be sufficient). **Install the diode between the wires as shown in the figure above.**

## Resolver Connections

The Z Drive is equipped with a pre-assembled 25-foot resolver cable. The motor end of the cable includes an MS-type connector, Amphenol (part #PT06E-14-12S). The drive end of the cable is a screw terminal connector (I/O[2]). All Z Drives have the same resolver connector.

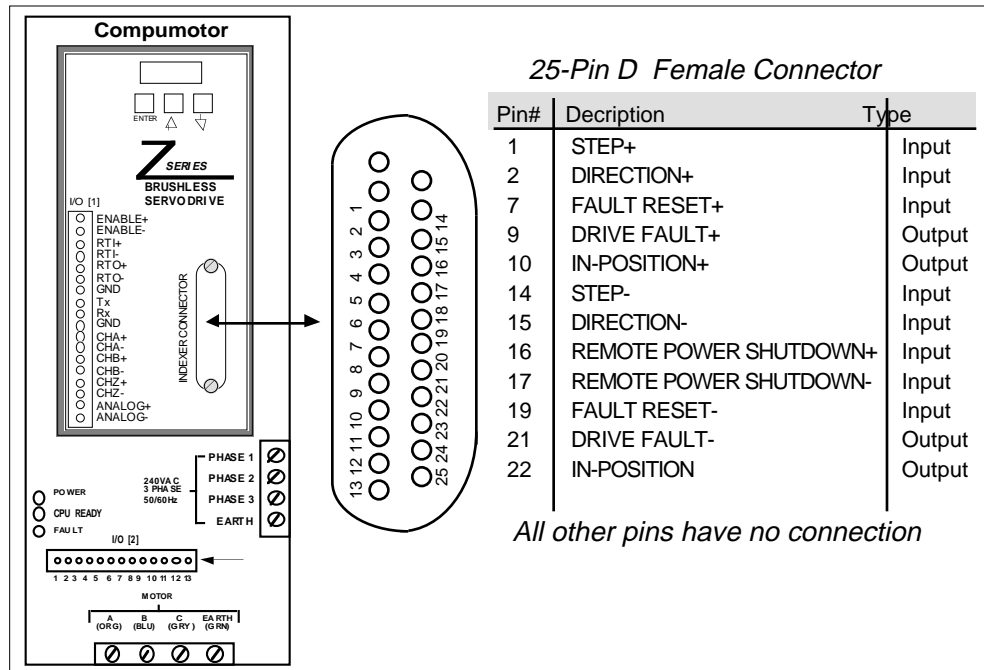


Resolver Pin-Out I/O[2]

## Indexer Connections

This section provides functional descriptions of the INDEXER CONNECTOR's inputs and outputs. All indexer connections are optically isolated. All Z Series Drives have the same indexer connector.

**Helpful Hint:**  
This figure shows the pin-out for the Z Drive's 25-pin D Indexer Connector.



Indexer Connector Pin-Out

## Indexer Connector Inputs

The Z Drive has the following Indexer Connector inputs.

- Step
- Direction
- Remote Power Shutdown
- Fault Reset

## STEP

The Step input controls the distance the motor will rotate.

- STEP+** (pin #1)
- STEP-** (pin #14)

The distance is commanded with respect to the motor resolution. For a motor resolution of 5000 steps/rev (factory default), it will take 5000 pulses to command 1 mechanical revolution. Optional resolutions of 200 to 65536 steps per revolution are chosen using the Configure Motor Resolution (**CMR**) command. By applying steps at various rates, the motor rotates at velocities proportional to the input frequencies. Increasing the frequency of the step pulses accelerates the motor. The Step input is a single-ended input, but it can be driven differentially. It is optically isolated. The minimum pulse width is 500ns. The maximum step rate is 1MHz. The Step input is triggered on the *falling edge* of the pulse.

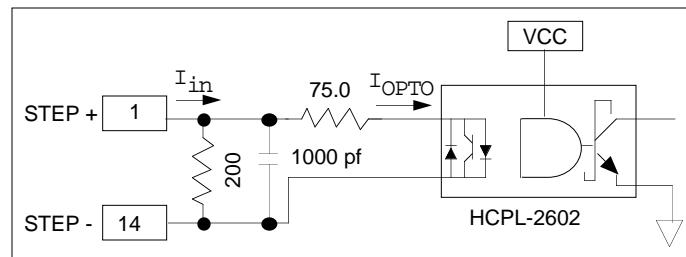
### Input Voltage

- Voltage Low = 0.4V maximum
- Voltage High = 2.5V - 5.0V

### Input Current

- Voltage = 2.5  $I_{in} \approx 18.5\text{mA}$   $I_{OPTO} \approx 6\text{mA}$
- Voltage = 5.0  $I_{in} \approx 51.1\text{mA}$   $I_{OPTO} \approx 12.5\text{mA}$

**Helpful Hint:**  
This figure is a schematic of the Step Input.



Step Input Schematic

Attempting to accelerate the motor too quickly can cause the motor to lag behind the commanded position. There is an adjustable, user-defined value for maximum following error that will shut down the drive if exceeded. Refer to the Configure Position Error (**CPE**) command description in *Chapter 5 Software Reference*.

## DIRECTION

The Direction input controls the direction of motor rotation.

- Direction+** (pin #2)
- Direction-** (pin #15)

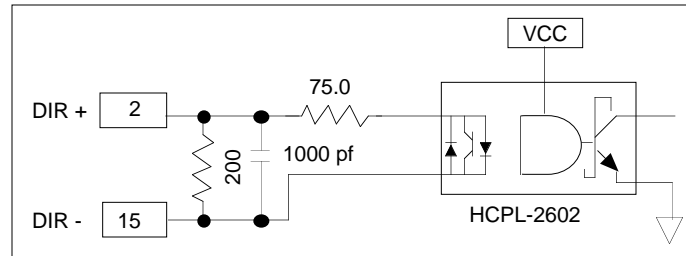
If the Direction input is not activated, the motor shaft rotates CCW as viewed from the flange end of the motor. If the Direction input is activated, the motor shaft rotates CW. *The Direction Input Polarity Control (SSM) command can reverse this polarity.* Refer to **Chapter 5 Software Reference**.

The Direction input is a single-ended input, but it can be driven differentially. It is optically isolated. The input must be held for 600ns minimum after falling edge of the Step input.

### Input Voltage

- Voltage Low = 0.4V maximum
- Voltage High = 2.5V - 5.0V

**Helpful Hint:**  
This figure is a schematic of the Direction Input.



Direction Input Schematic

## REMOTE POWER SHUTDOWN

The Remote Power Shutdown input disables the drive.

- Remote Power Shutdown+** (pin #16)
- Remote Power Shutdown-** (pin #17)

Activation of this input will disable the drive and allow the motor to freewheel. Negating this input will re-enable the amplifier.

### WARNING

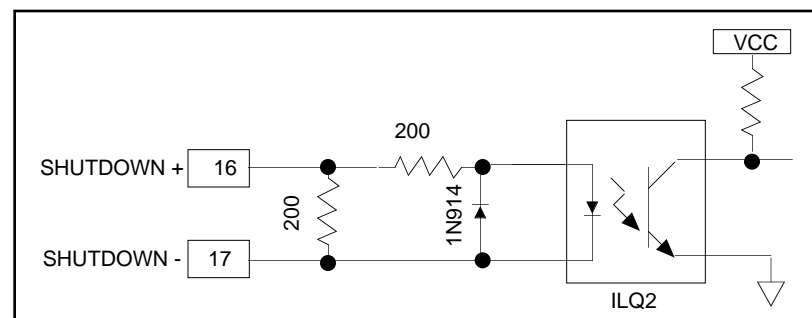
The remote power shutdown is not intended to act as an emergency stop for the motor. Refer to *Motor Braking* earlier in this chapter for information on installing braking resistors for emergency stops.

The Remote Power Shutdown input is a single-ended input, but it can be driven differentially. It is optically isolated.

### Input Voltage

- Voltage Low = 0.4V maximum
- Voltage High = 3.0V - 5.0V

**Helpful Hint:**  
This figure is a schematic of the Remote Power Shutdown Input.



Remote Power Shutdown Schematic

## FAULT RESET

The Fault Reset input resets the processors.

- Fault Reset+** (pin #7)
- Fault Reset-** (pin #19)

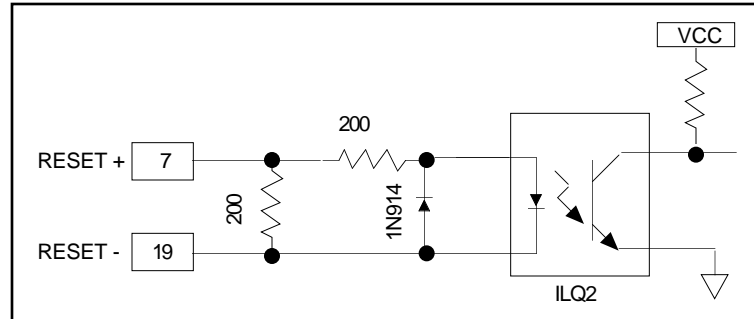
Activating, then releasing the fault will re-initialize the drive. When the input is deactivated, the drive will re-initialize. An error or drive fault will be cleared if the condition that causes the fault is been removed. Error #19, Short Circuit Fault is the only exception. It can only be removed by cycling power to the drive. The Fault Reset input is single-ended, but it can be driven differentially. If the Fault Reset is held active for more than 140 ms, the processor will lock up and power must be cycled to the drive. It is optically isolated.

### Input Voltage

- Voltage Low = 0.4V maximum
- Voltage High = 3.0V - 5.0V

#### **Helpful Hint:**

This figure is a schematic of the Fault Reset Input.



*Fault Reset Input Schematic*

## Indexer Connector Outputs

The Z Drive has the following Indexer Connector outputs.

- Drive Fault
- In-Position

## DRIVE FAULT

The Drive Fault output is normally active ( $V_{OUT} \approx \emptyset$ ).

- Fault+** (pin #9)
- Fault-** (pin #21)

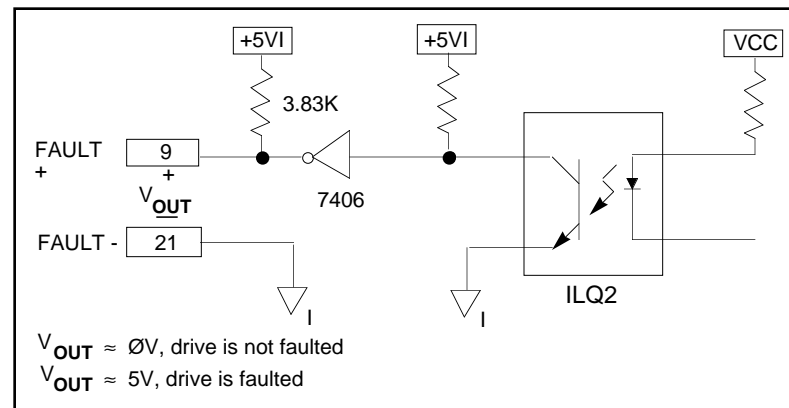
The output is off ( $V_{OUT} \approx 5V$ ) when the drive is shut down for any reason, including absence of power to the drive. The Drive Fault output is a single-ended, open collector output with a pull-up to 5V (provided). If desired, you can pull this output up to 24V (max.). The output can sink up to 30 mA (max.). It is optically isolated.

### Output Voltage

- Voltage Low = 0.4V maximum
- Voltage High = 4.0V minimum

#### **Helpful Hint:**

This figure is a schematic of the Drive Fault Output.



*Drive Fault Schematic*

## IN-POSITION

The In-Position output denotes the motor's In-Position status.

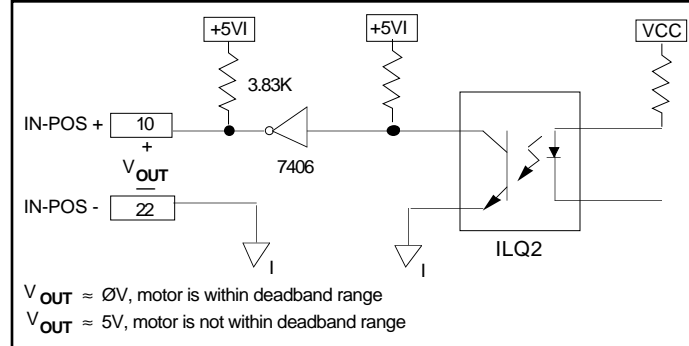
- ❑ In-Position+ (pin #10)
- ❑ In-Position- (pin #22)

The output is off ( $V_{OUT} \approx 5V$ ) whenever the actual position of the motor is outside the user-defined deadband range. This output is active ( $V_{OUT} \approx 0V$ ) when the absolute value of the position following error is less than the deadband. This deadband is defined by the Configure Deadband (CDB) command. Refer to *Chapter 6 Software Reference*. The In-Position output is a single-ended, open collector output with a pull-up to 5V (provided). If desired, you can pull this output up to 24V (max.). The output can sink up to 30mA maximum. It is optically isolated.

### Output Voltage

- ❑ Voltage Low = 0.4V maximum
- ❑ Voltage High = 4.0V minimum

**Helpful Hint:**  
This figure is a schematic of the In-Position Output.



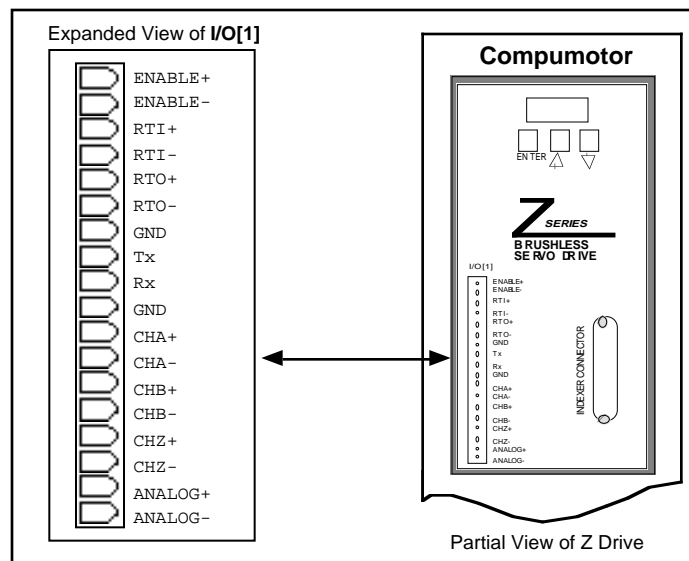
*In-Position Output Schematic*

## I/O[1] Connections

The Z Drive's I/O[1] connector provides the following communication, input, and output connections.

- ❑ Communication
  - RS-232C
- ❑ Inputs
  - Enable
  - RTI
  - Analog Velocity or Torque
- ❑ Outputs
  - RTO
  - CHA
  - CHB
  - CHZ

**Helpful Hint:**  
This figure highlights the I/O[1] Connector.



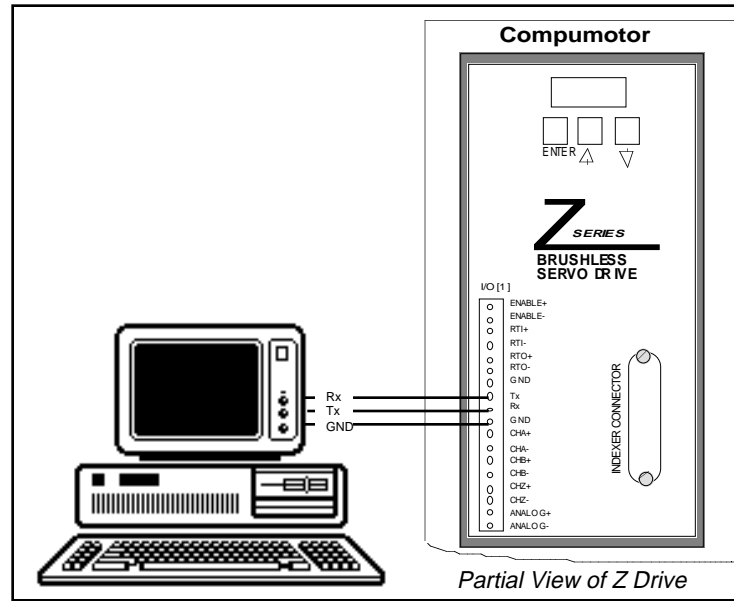
*Screw Terminal I/O [1]*

## RS-232C Connections I/O[1]

### Helpful Hint:

The Z Drive has a three-wire, optically isolated I/O[1] RS-232C interface that is compatible with RS-232C specifications. Receive Data (Rx), Transmit Data (Tx), and ground (GND) signals are connected on the screw terminal I/O[1]. Proper shielding of the RS-232C signal wires is required. The shield should be connected to an earth ground point on the terminal.

The Z Drive can communicate to any RS-232C-configured terminal or host computer. The Z Drive has a set of commands that set up the drive, program the drive, and report back drive information.

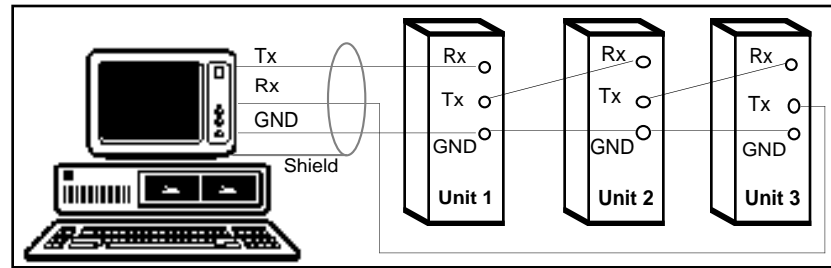


RS-232C Connections

## Daisy Chain Wiring

### Helpful Hint:

A multiple-drive configuration (daisy-chain) of RS-232C ports from one controlling terminal or computer. If more than 10 units are daisy chained, the baud rate should not exceed 2400.



RS-232C Daisy Chain Configuration

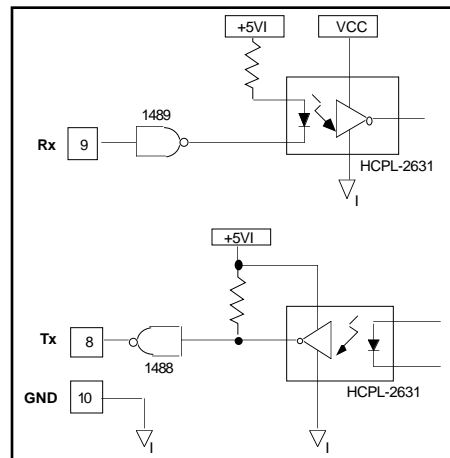
### Helpful Hint:

The default communication parameters. Baud rates of 300, 600, 1200, 2400, and 4800 are also available.

- Baud Rate: 9600
- Data Bits: 8
- Stop Bit: 1
- Parity: None

**Handshaking is not supported. The terminal should be set for Full Duplex mode. You can change the baud rate with the front-panel pushbuttons (see Chapter 4 Application Design).**

**Helpful Hint:** The RS-232C communication interface is optically isolated—schematic of the RS-232C communication interface.

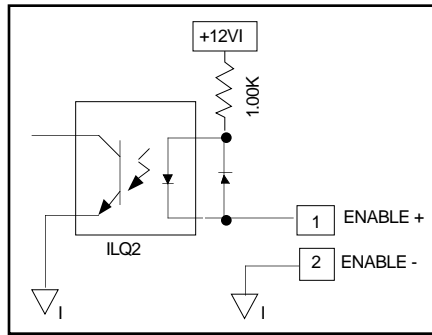


RS-232C Input Schematic

## ENABLE Input I/O[1]

The Z Drive's Enable differential input [ENABLE+/ENABLE-] enables and disables the drive. This input requires a normally closed connection from ENABLE+ to ENABLE-. A jumper is included with the drive. If the jumper is removed, the drive will shutdown. After the jumper is replaced, the drive will remain disabled until you enable the drive with the ON command or the Reset (Z).

**Helpful Hint:**  
Refer to the Enable Input Control (SST) command for exceptions—schematic of the I/O[1] Enable Input.

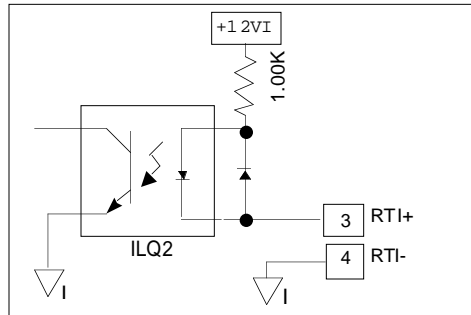


Enable Input Schematic

## RTI Input I/O[1]

The RTI (Real-Time input) differential input [RTI+/RTI-] is reserved.

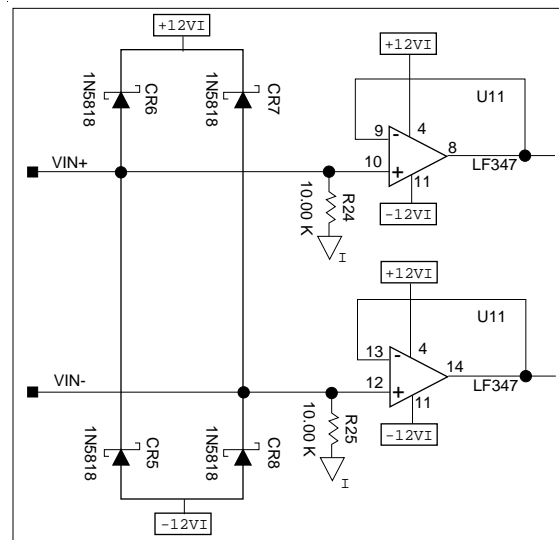
**Helpful Hint:**  
Schematic of the I/O[1] Real-Time Input.



Real-Time Input Schematic

## ANALOG Input I/O[1]

The I/O[1] Analog Velocity differential input [ANALOG+/ANALOG-] can be used for velocity or torque control of the Z Drive instead of position control (Step and Direction inputs). This input must be used in conjunction with the Configure Z Drive Mode (CZM) command. Refer to Chapter 4 Application Design, for further instructions on using the Z Drive in various input modes.



Analog Velocity Input Schematic

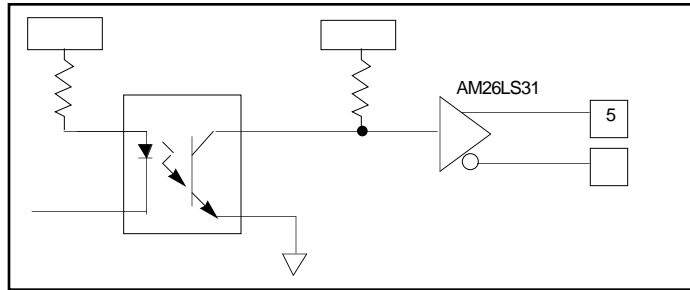
## RTO Output I/O[1]

### Output Voltage

**Helpful Hint:**  
This figure is a schematic of the I/O[1] Real-Time Output.

The RTO (I/O[1] Real-Time Output) differential output [RTO+/RTO-] is a programmable output (refer to the Out [OUT] command).

- Voltage Low = 0.5V maximum referenced to isolated ground
- Voltage High = 2.5V - 5.0V referenced to isolated ground



Real-Time Output Schematic

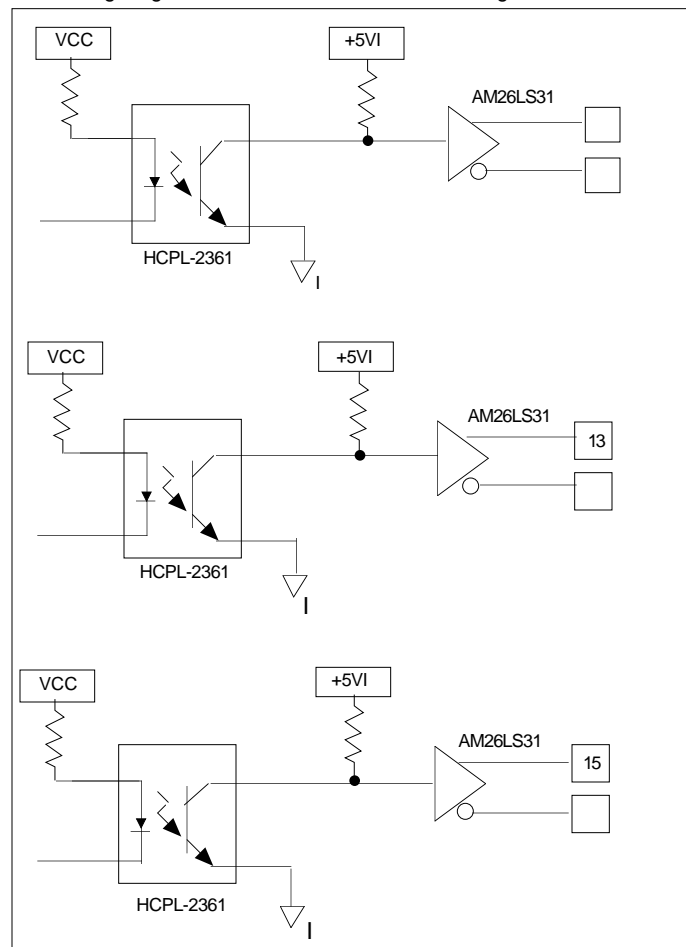
## CHA, CHB, and CHZ Outputs I/O[1]

### Output Voltage

**Helpful Hint:**  
Schematic of the psuedo-quadrature outputs.

Differential I/O[1] psuedo-quadrature outputs (CHA+/CHA-, CHB+/CHB-, CHZ+/CHZ-) are generated by the drive to simulate an optical encoder output. They can be used by an external encoder interface to determine incremental position of the motor shaft. The resolution is 1024 lines pre-quadrature, 4096 post-quadrature. The Z marker pulse (CHZ) occurs once per revolution.

- Voltage Low = 0.5V max. referenced to isolated ground
- Voltage High = 2.5V - 5.0V referenced to isolated ground

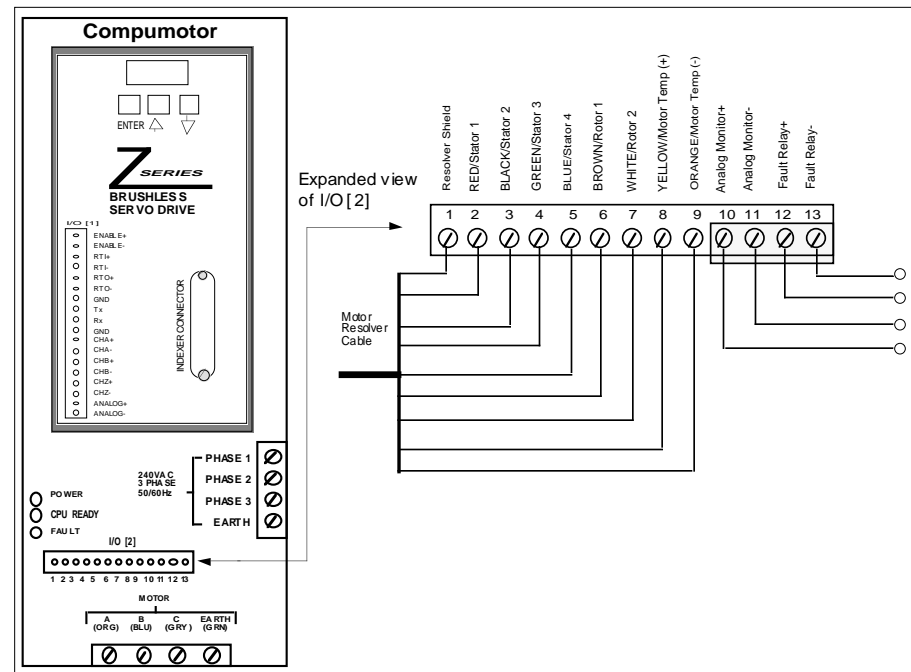


Pseudo-Quadrature Schematic

## I/O[2] Connections

In addition to resolver and motor thermal signals, the I/O[2] connector also has two outputs.

**Helpful Hint:**  
Resolver cables on all Z Series Drives are the same.



Screw Terminal I/O (2) Outputs

### Analog Monitor Output I/O[2]

This output provides an analog voltage ( $\pm 10V$ ) proportional to either the velocity of the motor shaft or the commanded torque (refer to the Analog Output Control [SSR] command in *Chapter 5 Software Reference*).

- Monitor+ (pin #10) labeled MON+
- Monitor- (pin #11) labeled MON-

**You can connect these pins to an oscilloscope to facilitate tuning.**

### Drive Fault Relay Output I/O[2]

This isolated output is active during normal operation.

- Fault Relay+ (pin #12) labeled FTL+
- Fault Relay- (pin #13) labeled FTL-

The relay opens during a fault condition or power loss. This output is specified at 1A at 24VDC or 120VAC, resistive. A minimum current of 100mA at 12VDC is required to ensure contacts will not become contaminated.

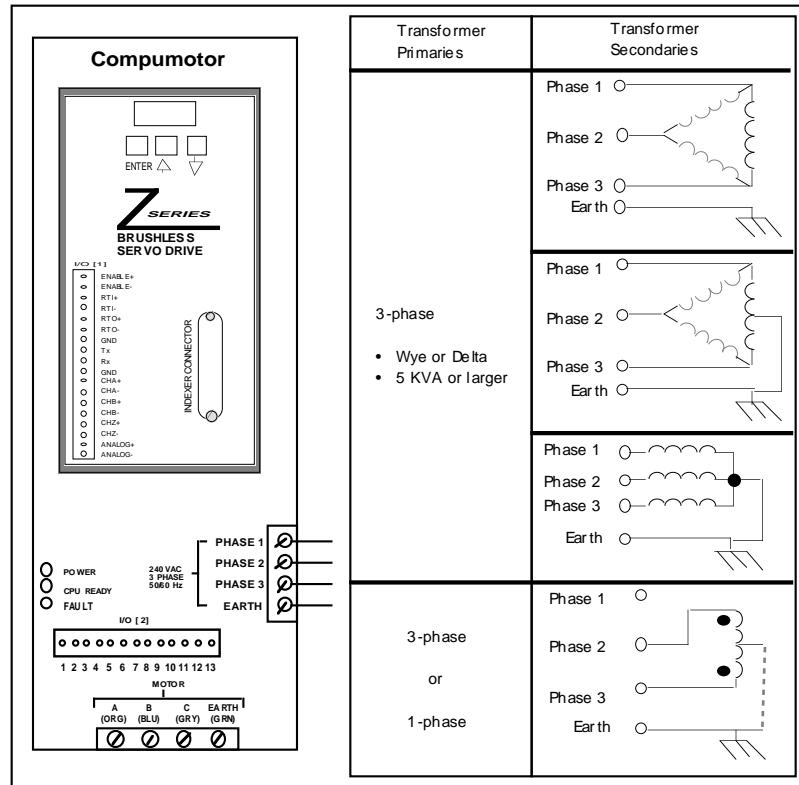
## Line Power Connections

The Z600 and Z800 are designed to be operated from a single or 3-phase 240VAC or single phase 120VAC power source. The Z900 drive is designed for single or 3-phase 240VAC operation. **Only qualified personnel should install and service the equipment. Serious injury or death could result from miswiring.** The three input phase terminals feed a 3-phase rectifier that has current in-rush protection (each leg of the 3-phase input is fused separately). A 5KVA isolation transformer may be used for the Z600 and Z800 series, and a 10KVA isolation transformer may be used with the Z900 series, but transformers are generally not necessary if proper grounding procedures are followed and the proper line voltage is available.

### WARNING

Never disconnect the motor cable with the power on. The motor cable produces lethal voltages. This may cause a fatal injury. Be sure the drive is properly grounded to reduce the chance of electrical shock.

**Helpful Hint:**  
 Fuses: The Z600 and Z800 are fused for 240VAC 3-phase power (20A). If you suspect that a fuse has blown, call Compumotor (800-358-9070). Do not remove the outer chassis to access these fuses. Removing the chassis will void your warranty.

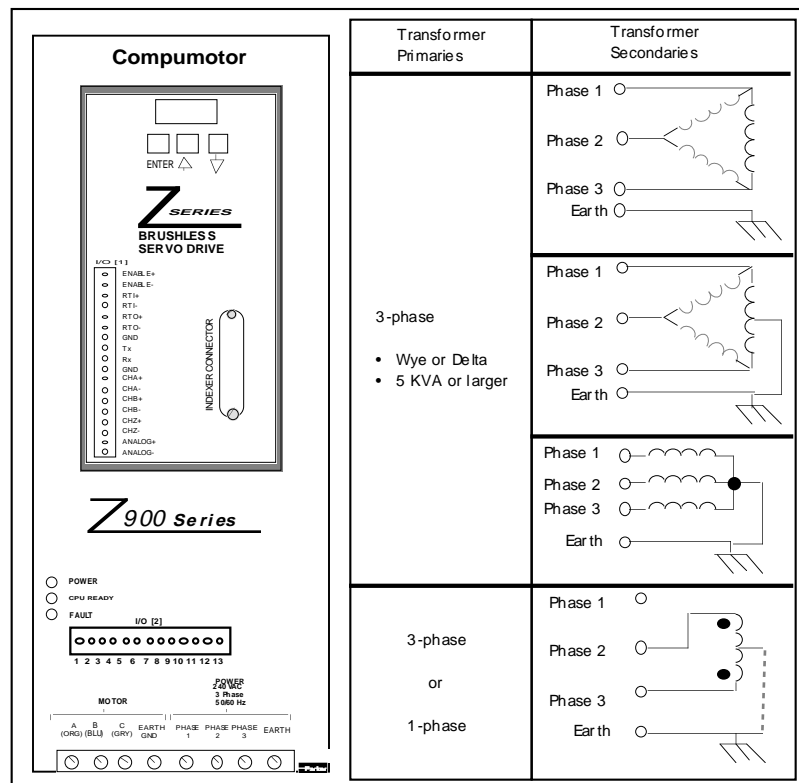


ZX600/800 Power Connections

### Safety Interlock Switch

Put a 3-phase safety interlock switch between the drive and the power source to conveniently de-energize the drive in an emergency and/or service situation. A re-settable circuit breaker can also be used.

**Helpful Hint:**  
 Fuses: The Z900 drives are fused for 240VAC 3-phase power (45A). The fuse block is located on the bottom of the drive beside the fan. These fuses may be replaced with Buss type SC45 fuses.



ZX900 Power Connections

## Check-Out Procedure

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After you complete the permanent installation of the Z Drive system, Compumotor recommends that you complete the Check-Out Procedure that you used in *Chapter ② Getting Started* to bench test your system.

***The successful completion of this test means that you wired the resolver, motor, terminal (optional), I/O, and power connections correctly. If the motor does not move as commanded, check your connections and try the test again. When you successfully complete this test, you can begin to customize your system using Chapter ④ Application Design.***