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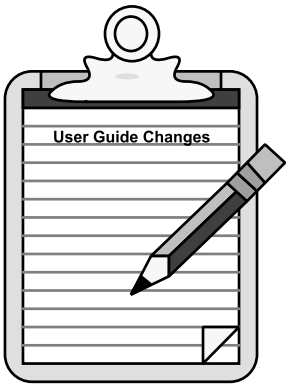
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USER GUIDE CHANGE SUMMARY



The following is a summary of the primary changes to this user guide since the last version was released. This user guide, version **88-010759-01H**, supersedes version 88-010759-01G.

The entire user guide has been changed according to the new Compumotor user guide styles, format, and illustration standards. Also, the chapters have been renumbered and reorganized. Technical changes to each chapter are summarized below.

Chapter ① Introduction

The Z635 motor was added to the "*What You Should Have*" section.

Chapter ② Getting Started

Chapter ② was unchanged.

Chapter ③ Installation

- ❏ Installation (wiring) directions were provided for the Brake (-B) Braking option.
- ❏ Maximum step rate was corrected (was 2.5 MHz, changed to 1 MHz). See STEP Input.
- ❏ The DIRECTION Input schematic was modified.

Chapter ④ Application Design

Chapter ④ was unchanged.

Chapter ⑤ Z Series Shunt Regulator

The capacitor energy absorption calculation was modified (refer to "*Selecting a Z Series Shunt Regulator.*")

Chapter ⑥ Software Reference

In the **CTC** command description, time increments were corrected from **ms** to µ**s**.

Chapter ⑦ Hardware Reference

An exception for Z600 and Z900 Series motors was added regarding the IP Classification. The shaft is IP30 rated (not IP65).

Chapter ⑧ Maintenance & Troubleshooting

Chapter ⑧ was unchanged.

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How To Use This User Guide

This user guide is designed to help you install, develop, and maintain your system. Each chapter begins with a list of specific objectives that should be met after you have read the chapter. This section should help you find and use the information in this user guide.

Assumptions

This user guide assumes that the user has a fundamental understanding of the following information.

- ❏ Basic electronic concepts (voltages, switches, current, etc.)
- ❏ Basic motion control concepts (torque, velocity, distance, force, etc.)

Installation Process Overview

To ensure trouble-free operation, you should pay special attention to the environment in which the Z Drive equipment will operate. Environmental conditions include the layout, mounting, and wiring and grounding practices used. These recommendations are intended to help you easily and safely integrate the Z Drive into your facility.

Installation Procedures

Before you attempt to install this product, you should complete the following steps:

① Review this user guide. Become familiar with the user guide's contents so that you can quickly find the information you need.

② Develop a basic understanding of all system components, their functions, and interrelationships.

③ After you have read Chapter ③ and clearly understand what must be done to properly install the system, begin the installation process. Do not deviate from the sequence or installation methods provided.

④ Before you customize your system, check all of the system functions and features to ensure that you have completed the installation process correctly.

The successful completion of these steps will prevent subsequent performance problems and allow you to isolate and resolve any potential system difficulties before they affect your system.

Contents of This User Guide

This user guide contains the following information.

Chapter ①: Introduction — This chapter provides a description of the product and a brief account of its features.

Chapter ②: Getting Started — This chapter contains a detailed list of items you should have received with your Z Drive shipment. It will help you become familiar with the system and ensure that each component functions properly.

Chapter ③: Installation — This chapter provided instructions for you to properly mount the system and make all electrical and non-electrical connections. Upon completion of this chapter, your system should be completely installed and ready to perform basic operations.

Chapter ④: Application Design — This chapter provides additional information that will help you customize the system to meet your application's needs. Important application considerations are discussed. Sample applications are provided.

Chapter ⑤: Software Reference — This chapter describes the Z Drive's set-up commands. These commands allow you to set system parameters, tune the drive, and display drive status.

Chapter ⑥: Z Series Shunt Regulator — This chapter contains information on the shunt regulator option for the Z Drive. Installation instructions, dimensions, and selection criteria (400W version vs. 800W version) are included.

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Chapter ⑦: Hardware Reference — This chapter contains information on system specifications (dimensions and performance). This chapter may be used as a quick-reference tool for proper I/O connections.

Chapter ⑧: Maintenance & Troubleshooting — This chapter describes Compumotor's recommended system maintenance procedures. It also provides methods for isolating and resolving hardware and software problems. Diagnostic error codes are listed.

Related Publications

The following publications may be helpful resources.

Seyer, Martin. *RS-232C Made Easy: Connecting Computers, Printers, Terminals and Modems*. Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1984

Current Parker Compumotor Motion Control Catalog

Manual for the IBM or IBM-compatible computer that you may use with the Z Drive

Schram, Peter (editor). *The National Electric Code Handbook (Third Edition)*. Quincy, MA: National Fire Protection Association

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C H A P T E R ①

Introduction

The information in this chapter will enable you to:

- ❏ Understand the product's basic functions, features, and theory of operation

Product Description

The Z Drive is a brushless servo system that includes a brushless servomotor, a brushless resolver (for feedback), and a Digital Signal Processor (DSP) based servo amplifier. Digital electronics simplify system operation and maintenance.

The Z Drive can accept either a digital (Step and Direction) input or an analog (±10V) input. You can configure the Z Drive to servo on commanded position, velocity, or torque. The series offers maximum speeds of 7000 rpm, maximum continuous torques of 9000 oz-in, and maximum peak torques of 18000 oz-in.

The Z Drive uses two processors to achieve high-performance servo control. The first processor (DSP) compares the commanded inputs (position, velocity, or torque) to the resolver feedback, and then determines the proper motor currents to apply. The second processor handles all user communication, error checking, and additional I/O. All servo performance parameters are stored in battery-backed RAM (random access memory).

Z Drive systems can be installed and operated easily with minimal training in servo systems. Z Series motor/drives are supplied as packaged systems that are factory compensated for typical load and performance requirements. In most applications, no adjustments will be required. When adjustments are required, changes to the drive can be made from two interfaces—push-button adjustments or an RS-232C interface. These interfaces provide access to all servo parameters simply and effectively.

The Z Drive's power amplifier uses a bipolar 7 kHz pulse-width modulation (PWM) sinusoidal current control scheme. This type of amplifier improves reliability, power regulation, and low-speed smoothness.

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Product Features

- ❏ Brushless servo motor
- ❏ Brushless resolver feedback
- ❏ Speeds to 7000 rpm
- ❏ Torques to 9000 oz-in continuous (18000 oz-in peak)
- ❏ User programmable resolutions (200 - 65536 steps/rev, 5000 steps/rev standard)
- ❏ Multi-processor control: no drift, no analog pots to adjust
- ❏ Fan-cooled compact drive enclosure
- ❏ 7 k*Hz* PWM switching frequency
- ❏ Accepts digital step and direction inputs
- ❏ Accepts analog (±10V) input for velocity or torque control
- ❏ Analog (±10V) output monitor for either velocity or torque
- ❏ Pseudo 4096 pulse per revolution (ppr) incremental encoder output for interfacing with servo controls
- ❏ Servo parameters factory-set and stored in battery-backed RAM (random access memory)
- ❏ *H*igh-noise immunity due to optical isolation and brushless resolver technology
- ❏ Simple push-button adjustment of servo gains
- ❏ Alphanumeric display for fault or user-defined messages
- ❏ RS-232C interface

Interface Options

In Step and Direction mode, the Z Drive is compatible with all Compumotor indexers. The Z Drive moves the motor one increment in the specified direction for each step pulse received. Both of the drive's Step and Direction inputs are optically isolated and can be driven by an external pulse generator. The Z Drive's resolution is programmable, so you can specify convenient motor increments. The optically isolated analog input accepts a ±10V signal that may be configured as either a velocity or torque command.

The ZX is the drive/indexer version of the Z Drive. It contains the servo controller and a complete RS-232C based indexer that executes Compumotor's X Series programming language. You can combine motion control parameters such as distance, velocity, and acceleration into sequences with time delays, loops, and programmable outputs. These sequences can be controlled via RS-232C or via external inputs that can be connected to a PLC or host computer. You can use trigger inputs to coordinate program execution with external events. Multiple motion control programs can be stored in nonvolatile memory and executed automatically from external sequence and trigger controls. The X Series language is based on simple commands, and uses decimal numbers.

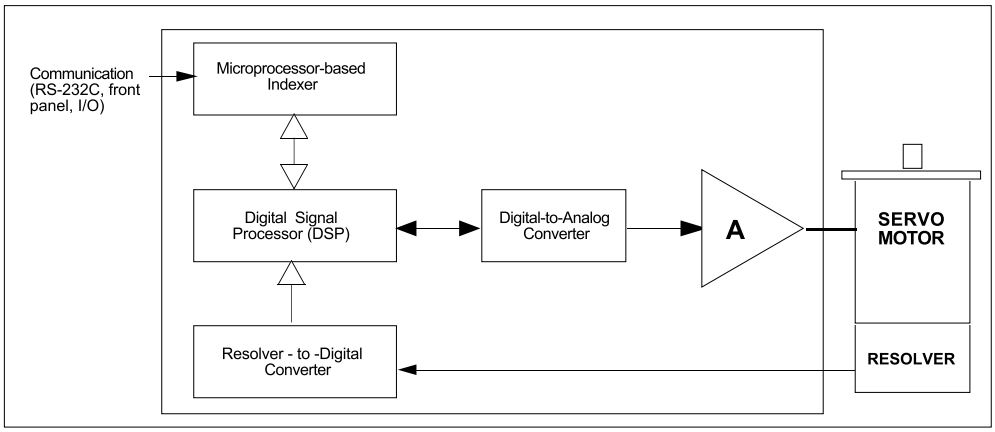
Theory of Operation

The Z Drive's primary function is to servo to either a digital position command from an indexer or to an analog voltage command (velocity or torque) from a servo controller.

In ***Position mode***, the indexer sends a position command to the drive and the resolver feeds back the actual position of the shaft. If the actual position of the shaft is different from the commanded position, a positional error is produced. The drive then commands torque to the motor to correct the positional error. In ***Velocity mode***, the servo controller sends a velocity command and the drive servos to it by comparing the commanded velocity to the actual velocity. In ***Torque mode***, the servo controller controls the actual shaft torque directly.

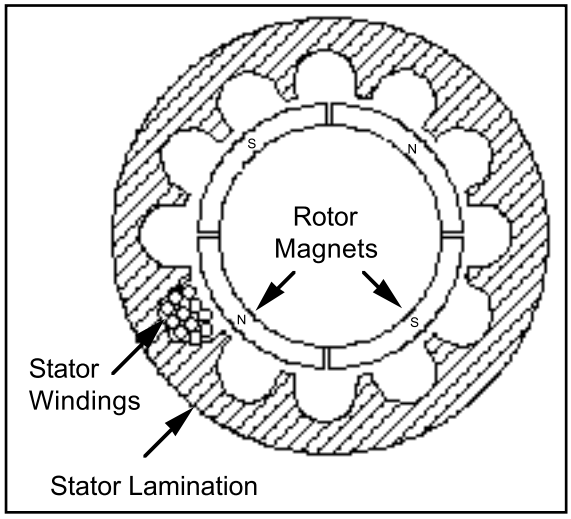
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The Z Drive digital servo system is composed of three major components: the servo motor, the drive, and the resolver.



Z Drive Digital Servo System

The Z motor family consists of brushless, 3-phase, AC motors. The figure below illustrates the basic construction of the Z servo motor. The permanent magnets are securely held in place by metal bands and composite fiber materials to allow high-speed performance. The rotors are precision-balanced, which provides low- and high-speed smoothness. The windings are located in the outer portion of the motor (stator). This *inside-out* construction allows better heat dissipation than conventional brush-type motors. As a result, higher continuous torque and horsepower ratings are achieved for a given motor size.



4-Pole Brushless Motor

Brushless DC refers to motors that produce a trapezoidal EMF (Electro-Motive Force) waveform. Z Drive motors are brushless AC motors that produce sinusoidal back EMF waveforms. These motors provide smoother low-speed operation than trapezoidal type motors.

The Z Drive is a 3-phase inverter that controls the amplitude, frequency, and phase of each of the three motor stator currents. Controlling the current amplitude relates directly to the magnitude of the torque being generated. Since the motor is *synchronous*, controlling the frequency of the stator currents controls the mechanical rotation of the shaft. The following equation describes this relationship.

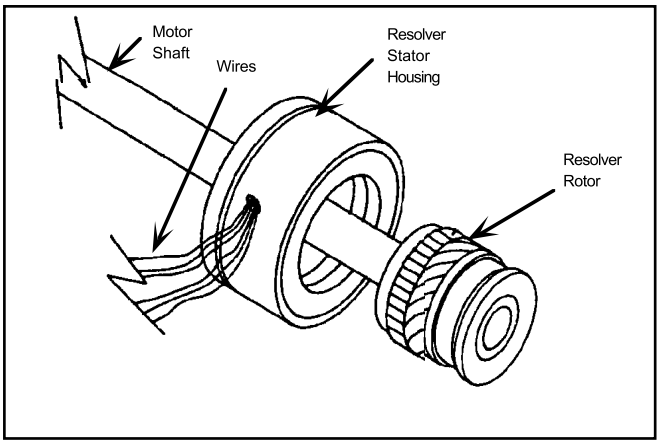
$$\omega_e = \omega_r * (P/2)$$

ω_e = Electrical frequency of the stator currents
ω_r = Mechanical frequency of the shaft
$(P/2)$ = Number of motor pole pairs

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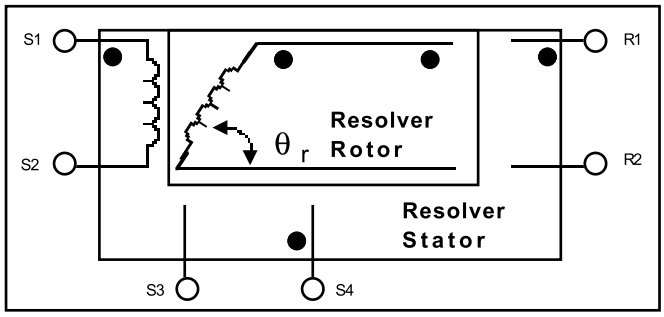
Controlling the phase of each of the motor's stator currents ensures balanced 3-phase operation and minimizes torque ripple. Actual motor currents are sensed, and the current is adjusted using pulse width modulation. Feedback is provided by a single-speed, brushless, pancake-type resolver.

The resolver is mounted directly to the motor shaft. This eliminates the need for internal coupling. The resolver stator windings are mounted to the motor housing.



Resolver Mechanical Drawing

The figure below shows the internal windings of the resolver. Stator windings are S1/S2 and S3/S4. R1 and R2 are the rotor windings. When a voltage is excited in the rotor winding, a voltage is induced in the stator windings. The phase voltages of the stator waveforms S1/S2 and S3/S4 are compared to obtain a digital value (**θr**) representing the physical position of the motor shaft.



Resolver Electrical Drawing

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C H A P T E R ②

Getting Started

The information in this chapter will enable you to:

- ❏ Verify that each component of your system has been delivered safely
- ❏ Properly configure and *check out* the system

What You Should Have

Inspect your Z Drive shipment upon receipt for obvious damage to its shipping container. Report any damage to the shipping company immediately. Parker Compumotor cannot be held responsible for damage incurred in shipment. Z Series systems include the items listed in the upper table. Z Drive-only orders include the items listed in the bottom Table.

Part/Quantity	Available Types
Z Drive	Z600 (120VAC or 240VAC) or Z900 (240VAC)
Motor	Z605, Z606, Z610, Z620, Z630, Z635, Z640, Z805, Z806, Z810, Z820, Z830, Z840, Z910, Z920, Z930, or Z940
Motor Cable	25 ft., 50 ft., or 100 ft.
Resolver Cable	25 ft., 50 ft., or 100 ft.
Z Drive User Guide	88-010759-01 F

Ship Kit (Z System)

Part/Quantity	Available Types
Z Drive (1)	Z600 (120VAC or 240VAC) or Z900 (240VAC)
Z Drive User Guide	88-010759-01 F

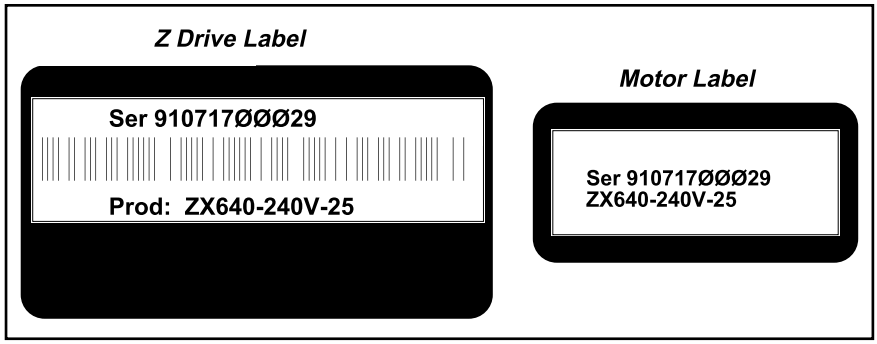
Ship Kit (Z Drive Only)

Drive/Motor Configuration

Compumotor configures Z Drive's according to the motor that you order. *If you purchased the Z Drive to run 600 Series motors (Z605, Z606, Z610, Z620, Z630, Z635, and Z640), it will not run 800 Series (Z805, Z806, Z810, Z820, Z830, and Z840) or Z900 series motors (Z910, Z920, Z930, and Z940). All Z Series drives* ***must*** *be run with the same Z Series motors.* You can determine which motor you have by checking the model numbers on the drive and motor labels.

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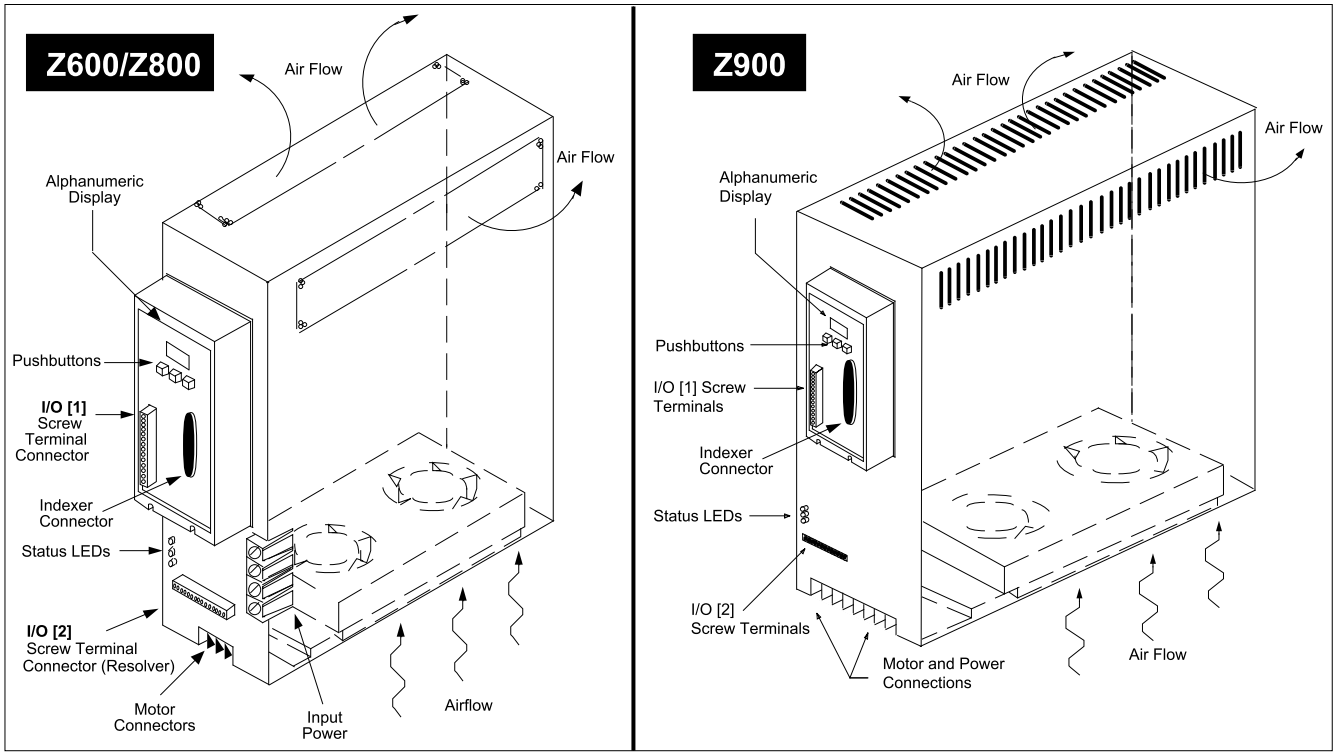
The Z*600* and Z*800* are available in a ***120VAC version*** and a ***240VAC version***. The Z*900* Drive is available in a **240VAC** version only. Be sure you have the drive version you ordered before you connect power to the drive. The model numbers on the drive and motor labels identify the 3-phase input power level (*120*V or *240*V). ***The model numbers must match***.



Product Labels

Check-Out Procedure

This section provides a basic ***bench test*** of the Z Drive. **You must complete the steps in this chapter before you permanently install the drive and connect the motor to its intended load.** The figures below illustrate the location of all the Z Series' connections.



Z600/Z800 and Z900 Drives

Tools

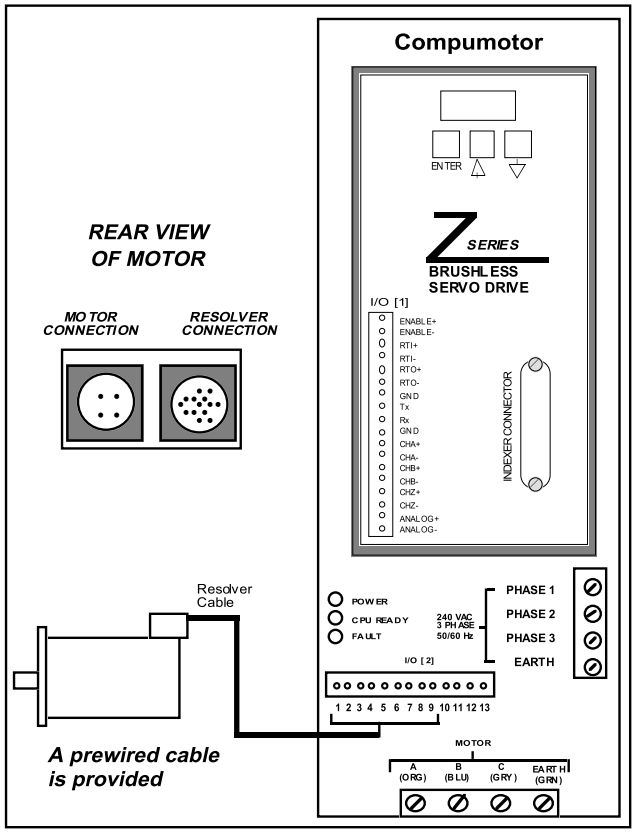
To complete the *Check-Out Procedure*, you must have the following tools:

- ❏ Phillips-head screwdriver
- ❏ Large flat blade screwdriver
- ❏ Small flat blade screwdriver
- ❏ Power cable

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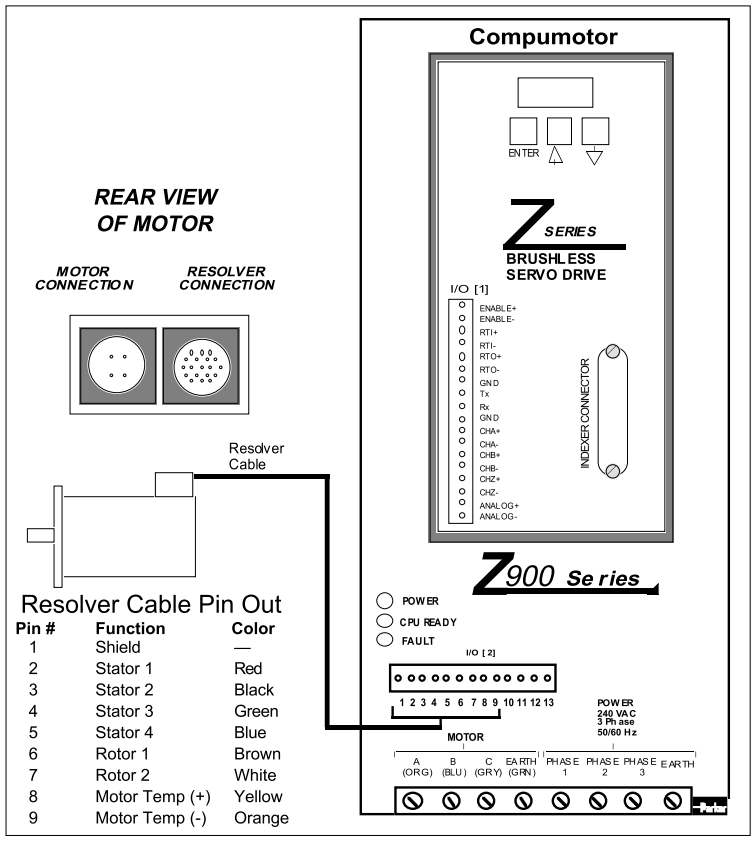
Step ①

Connect the resolver cable between the Z Drive `I/O[2]` connector and the servo motor as shown in the figures below (for Z*600*/Z*800* and Z*900*).



Z600/800 Resolver Cable Connection

☞ **Helpful Hint:** The table in the figure is a summary of the resolver cable pin out. All Z Drives (Z600, Z800, and Z900) have the same resolver connections.



Resolver Cable Pin Out

Pin #	Function	Color
1	Shield	—
2	Stator 1	Red
3	Stator 2	Black
4	Stator 3	Green
5	Stator 4	Blue
6	Rotor 1	Brown
7	Rotor 2	White
8	Motor Temp (+)	Yellow
9	Motor Temp (-)	Orange

Z900 Resolver Cable Connection

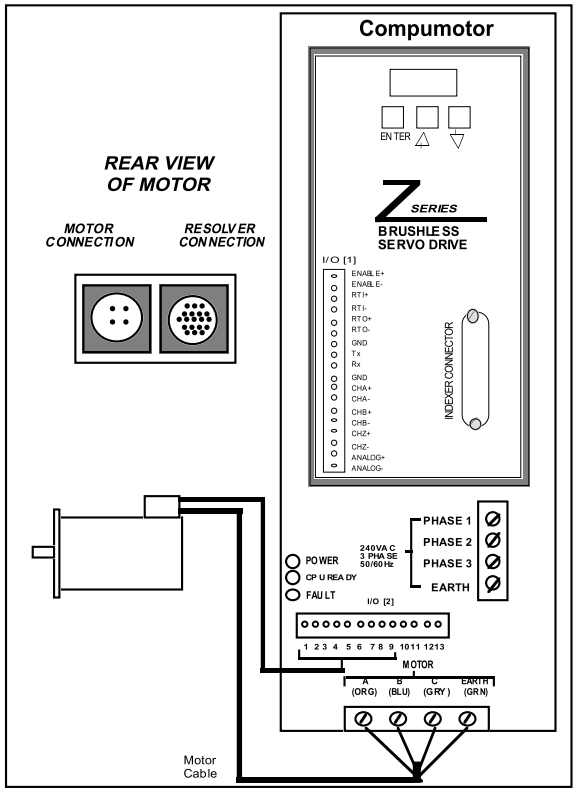
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Step ②

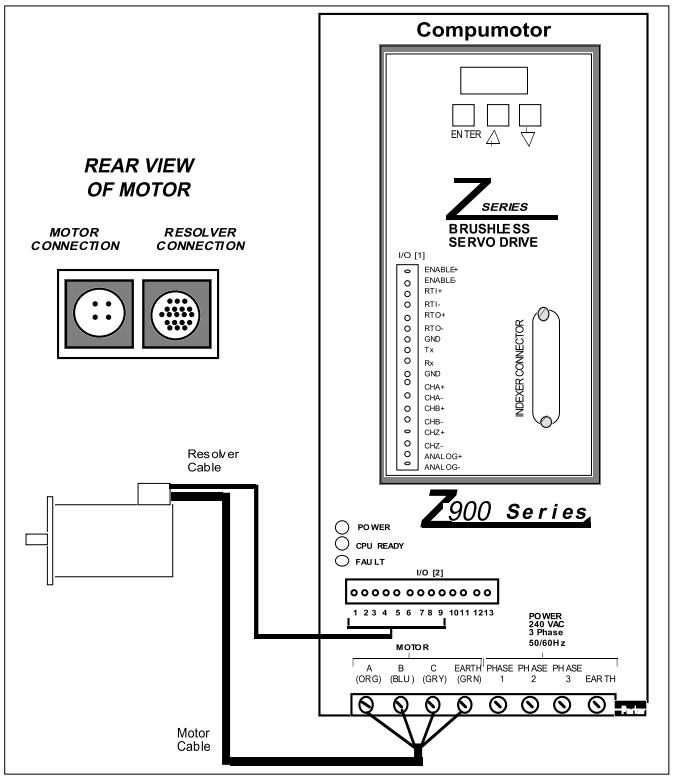
Connect the cable between the Z motor connector and the servo motor. ***Match the color of the wire with the proper terminal.***

WARNING

Never disconnect the motor cable with the power on. The motor produces lethal voltages. Be sure the motor is properly grounded to reduce the chance of electrical shock.



Z600/800 Motor Cable Connection



Z900 Motor Cable Connection

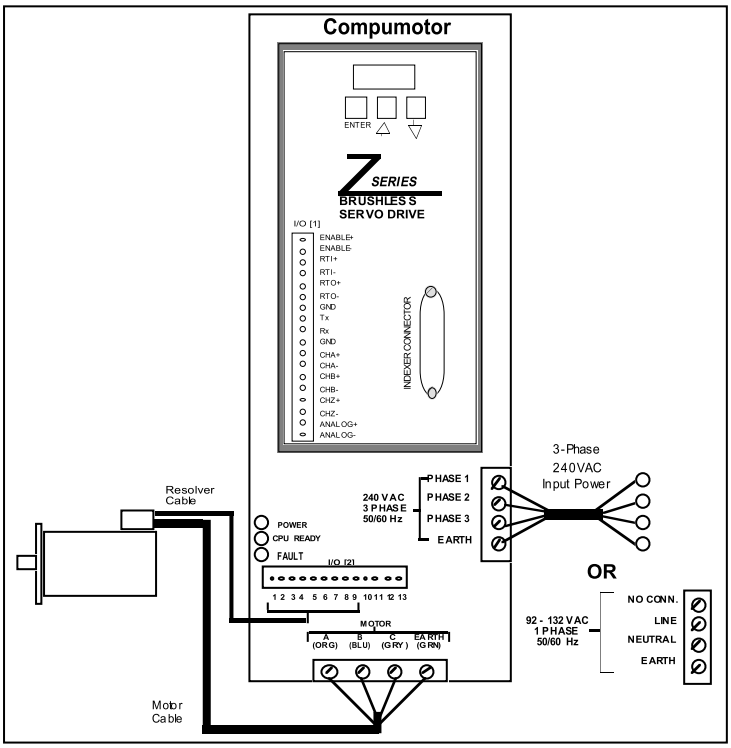
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Step ③

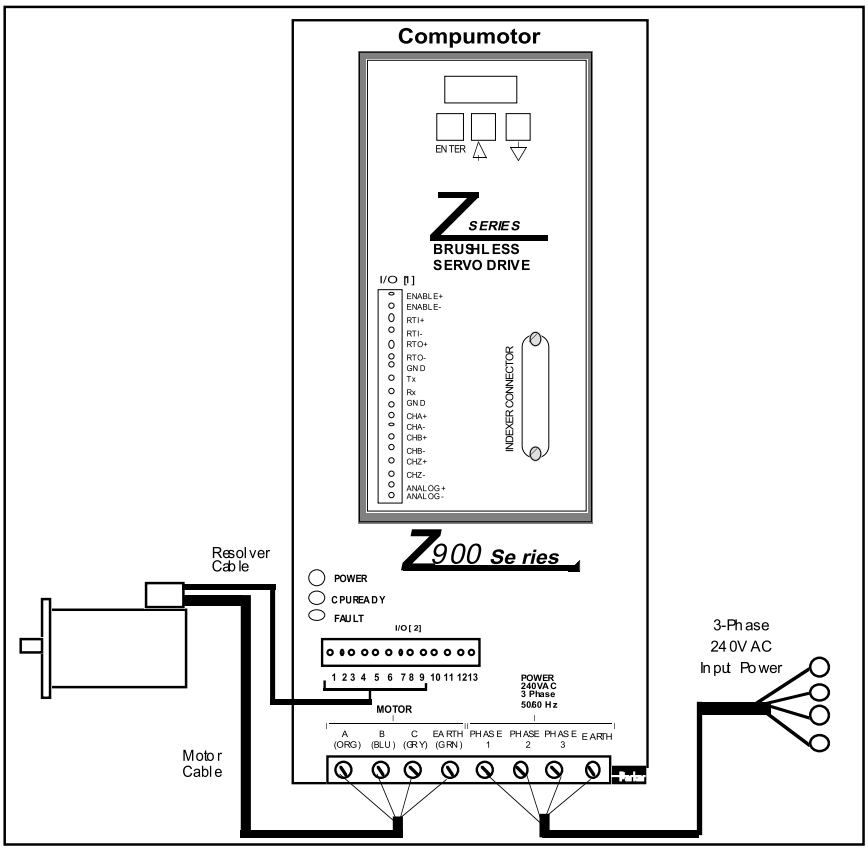
Measure and verify your incoming 3-phase *240VAC* (*or 120VAC*) line with a voltmeter. Connect, ***but do not energize***, the 3-phase power as shown in the figure below. The Z Drive is designed to operate best on a balanced 3-phase input. Additional wiring options for this connection are provided in *Chapter ③ Installation.*

WARNING

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



Z600/800 Power Cable Connection



Z900 Power Cable Connection

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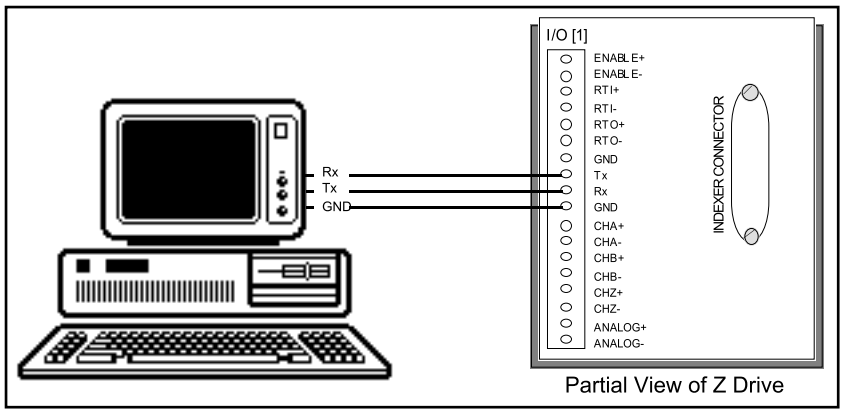
Step ④ (Optional)

The Z Drive is functional without a terminal; however, a terminal simplifies the setup of system parameters. Some features are not available without a terminal (e.g., report back of servo parameters). Connect a terminal to the RS-232C connector (`I/O[1]`) using the **`Rx`** (receive), **`Tx`** (transmit) and **`GND`** (ground) connections. All Z Series drives have the same RS-232C connections.

☞ ***Helpful Hint:*** These are the basic communications parameters.

- ❏ Baud Rate: *9600*
- ❏ Data Bits: *8*
- ❏ Stop Bits: *1*
- ❏ Parity: None
- ❏ Full Duplex mode

Refer to the operations manual that accompanied your terminal for instructions on setting the communication parameters listed above. ***Chapter ③ Installation*** *provides detailed RS-232C information for the Z Drive.*



RS-232C Connection

Be sure that the Z Drive's ***ENABLE*** *input (****I/O [1]****) is jumpered to ground. The Z Drive is shipped with the* ***ENABLE*** *input grounded.*

If you use a host computer to send characters to the Z Drive via RS-232C at a high rate, you may need to insert time delays (**pacing characters**) to ensure that the drive has enough time to process each character. The ability to set a variable time delay is available in most terminal emulator packages.

Step ⑤

In this step, you will select the operating mode that you want to use. **You must select one mode and complete only the test procedures that are applicable to the selected mode**. All Z drives have three operating modes:

- ❏ Position mode
- ❏ Velocity mode
- ❏ Torque mode

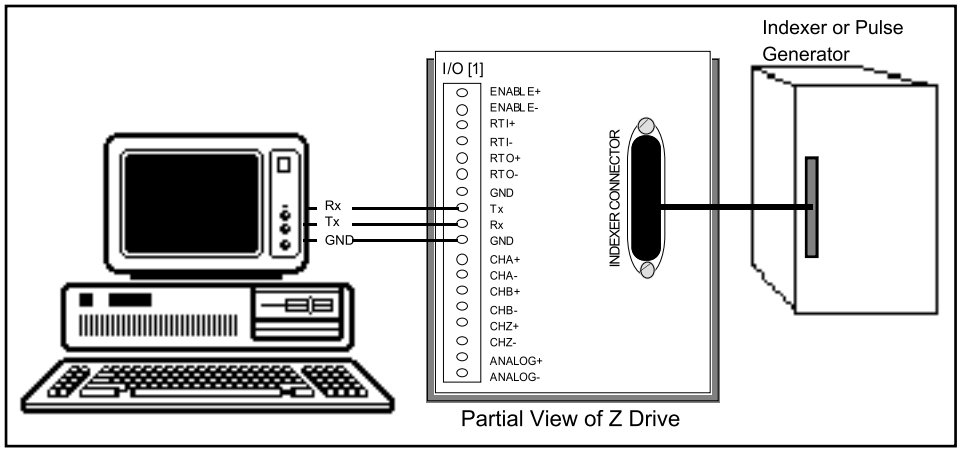
Position mode is the default operating mode*. Chapter ④ Application Design* provides detailed information about these operating modes.

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Position Mode

In this mode, the drive receives indexer pulses and a direction sign from any Compumotor indexer. The drive interprets these pulses as STEP pulses and moves accordingly. The default resolution is *5,000* steps per revolution. To test this mode, complete the following steps:

① Connect a Compumotor indexer or a pulse generator (TTL out) to the **INDEXER CONNECTOR** on the Z Drive.



Position Mode Bench Test

② Make certain that the motor shaft is clear of all objects. The motor should be firmly supported to prevent it from shifting while the drive is operating.

③ Energize the 3-phase *240*VAC (*or 120VAC*). The POWER LED and the CPU READY LED should both be on (green).

④ If you are using a terminal with the Z Drive, it should be connected to the Z Drive's **Rx** (receive), **Tx** (transmit), and **GND** (ground) connections on **I/O[1]**. You should also have set the RS-*232*C communication parameters. Be sure that you have completed this step properly before proceeding.

☞ ***Helpful Hint:*** This step is *optional*

To ensure that your RS-*232*C communication link is working properly (***if you are using a terminal***), send the Display Drive Information (**DDI**) command.

☞ ***Helpful Hint:*** Type DDI and press ENTER (*or the space bar*) on your terminal. The Z Drive will send the following message.

```
            PP     PI     PD     VP     VI     VF     TG
*PERCENT    50     10     00     20     00     50     60
*MAXIMUM 10000   400  32000   5000     00  32000  32000

*TIME_CONSTANT=00005(*100_microSeconds)
*AVE_CURRENT_LIMIT=020.00_AMPS
*PEAK_CURRENT_LIMIT=040.00_AMPS
*MOTOR_RESOLUTION=05000_STEPS
*RESOLVER_RESOLUTION=AUTO
*MOTOR_TYPE=Z640
*Z_MODE=1...[POSITION]
```

If you type one character, and ***two*** *characters are shown on your screen, your terminal is set for* ***Half Duplex mode*** *rather than* ***Full Duplex mode*** *(i.e., you type* ***D*** *and* ***DD*** *appears on the screen). Reset the terminal for* ***Full Duplex mode*** *and try the test again.*

⑤ Send a one-revolution move command from your indexer to the Z Drive. **Most Compumotor Indexers have a default resolution value of 25,000 steps per rev**. The default one-revolution move for the Z drive would only be *5,000* steps. At this point, the motor should turn 5 revolutions.

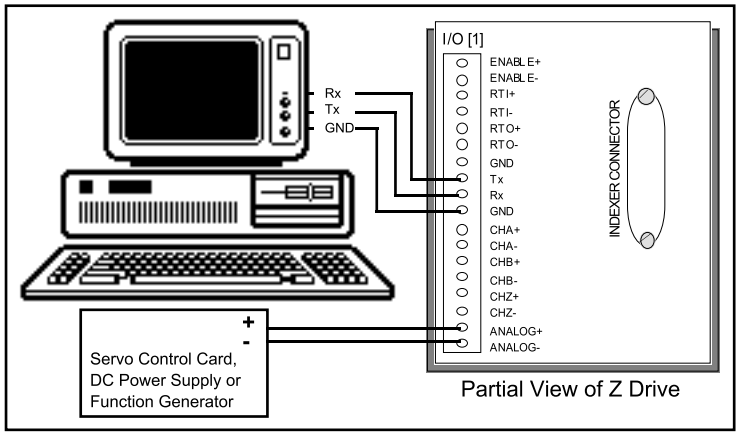
The successful completion of this test means that you wired the resolver, motor, terminal (optional), and power connections correctly. The components of your system are functioning properly. If the motor does not move as commanded, check your connections and try the test again. When you successfully complete this test, you may begin Chapter ③ Installation.

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Torque Mode

In Torque mode, the drive receives a ±10V signal that is proportional to commanded torque. Positive torque will accelerate the motor CW (as viewed from the front). The default torque-to-voltage relationship is 50% of the peak torque rating. You can modify the torque-to-voltage relationship with software commands (refer to the **ANV** command description in *Chapter ⑤ Software Reference*). ***The Z Drive will shut down automatically if the unit operates at peak torque for more than 3.3 seconds***. To test this mode, complete the following steps:

① Connect a DC power supply or a function generator to the **ANALOG+** and **ANALOG-** connections on the Z Drive's **I/O[1]** connector.
*If an analog ground point is available on your servo control card, function generator or DC power supply, connect it to either ground terminal on **I/O[1]**.*



Torque Mode Bench Test

② Make certain that the motor shaft is clear. The motor should be firmly supported to prevent it from shifting while the drive is operating.

③ Energize the 3-phase 240VAC (or 120VAC). The Power LED and the CPU READY LED should be on (green).

☞ **Helpful Hint:**
This step is *optional*

④ You can enter Torque mode via the Z Drive's front panel or via a software command (if you are using a terminal). You can follow either of the subsequent sets of instructions to enter Torque mode. *Once entered, Torque mode will be the default Power-Up mode (instead of Position mode) until you change modes again.*

Torque Mode Via Front Panel:

A. Press the down arrow button under the display until **MODE** appears.
B. Press the **ENTER** button once.
C. Press the down arrow button until **TOR** appears in the display.
D. Press the **ENTER** button again. An asterisk (*) should appear next to **TOR**.

Torque Mode Via Terminal (CZM2) Command:

A. If you are using a terminal with the Z Drive, it should be connected to the Z Drive's **Rx** (receive), **Tx** (transmit), and **GND** (ground) connections on **I/O[1]**. You should also have set the RS-232C communication parameters. Be sure that you have completed this step properly before proceeding.

B. Type **CZM2** (Configure Z Drive Mode 2) to set the drive to ***Torque mode***. The following modes are available:

- ❏ **CZM1** = Position mode
- ❏ **CZM2** = Torque mode
- ❏ **CZM3** = Velocity mode

*If you type one character, and **two** characters are shown on your screen, your terminal is set for **Half Duplex mode** rather than **Full Duplex mode**. (i.e., you type **C** and **CC** appears on the screen). Reset the terminal for **Full Duplex mode** and try the test again.*

C. To ensure that your RS-232C communication link is working properly (*if you are using a terminal*), send the Display Drive Information (**DDI**) command.

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☞ **Helpful Hint:** Type `DDI` and press `ENTER` (*or the space bar*) on your terminal. The Z Drive will send the following message.

```
            PP    PI    PD    VP    VI    VF    TG
*PERCENT    00    00    00    00    00    00    00
*MAXIMUM 00000 00000 00000 00000 00000 00000 00000

*TIME_CONSTANT=00020(*100_microSeconds)
*AVE_CURRENT_LIMIT=020.00_AMPS
*PEAK_CURRENT_LIMIT=040.00_AMPS
*MOTOR_RESOLUTION=05000_STEPS
*RESOLVER_RESOLUTION=AUTO
*MOTOR_TYPE=Z640
*Z_MODE=2...[TORQUE]
```

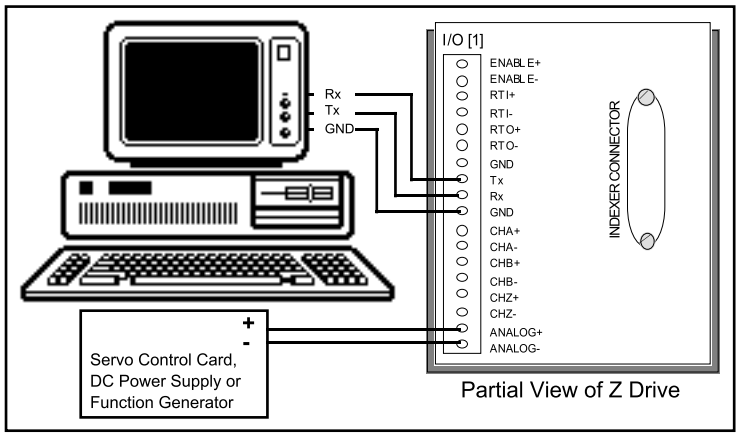
⑤ Increase the voltage to command the motor to accelerate. If the motor appears to be creeping at ***zero voltage*** (0V), you may have a slight offset in the supply. The Analog Zero (**ANZ**) command can compensate for this offset.

The successful completion of this test means that you wired the resolver, motor, terminal (optional), and power connections correctly. The components of your system are functioning properly. If the motor does not move as commanded, check your connections and try the test again. When you successfully complete this test, you may begin Chapter ③ Installation.

Velocity Mode

In Velocity mode, the drive receives a ±10V signal that is proportional to commanded velocity. Positive voltage turns the motor CW as viewed from the front. A default speed-to-voltage relationship of 10V = maximum rated speed is stored in the drive. You can change this value (refer to the **ANV** command description in *Chapter ⑤ Software Reference*). To test this mode, complete the following steps:

① Connect a DC power supply or a function generator to the **ANALOG+** and **ANALOG-** connections on the Z Drive's **I/O[1]** connector.
If an analog ground point is available on your servo control card, function generator, or DC power supply, connect it to either ground terminal on **I/O[1]**.



Velocity Mode Bench Test

② Make certain that the motor shaft is clear of all objects. The motor should be firmly supported to prevent it from shifting while the drive is operating.

③ Energize the 3-phase 240VAC (*or 120VAC*). The Power LED and the CPU READY LED should be on (green).

④ You can enter Velocity mode via the Z Drive's front panel or via a software command (if you are using a terminal). You can follow either of the subsequent sets of instructions to enter Velocity mode. *Once entered, Velocity mode will be the default Power-Up mode (instead of Position mode) until you change modes again.*

Velocity Mode Via Front Panel:

A. Press the down arrow button under the display until **MODE** appears.
B. Press the **ENTER** button once.
C. Press the down arrow button until **VEL** appears in the display.
D. Press the **ENTER** button again. An asterisk (*****) should appear next to **VEL**.

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Velocity Mode Via Terminal (CZM3 Command):

A. If you are using a terminal with the Z Drive, it should be connected to the Z Drive's **Rx** (receive), **Tx** (transmit), and **GND** (ground) connections on **I/O[1]**. You should also have set the RS-232C communication parameters. Be sure that you have completed this step properly before proceeding.

B. Type **CZM3** (Configure Z Drive Mode 3) to set the drive to ***Velocity mode***. The following modes are available:

- ❏ **CZM1** = Position mode
- ❏ **CZM2** = Torque mode
- ❏ **CZM3** = Velocity mode

*If you type one character, and **two** characters are shown on your screen, your terminal is set for **Half Duplex mode** rather than **Full Duplex mode**. (i.e., you type **C** and **CC** appears on the screen). Reset the terminal for **Full Duplex mode** and try the test again.*

C. To ensure that your RS-232C communication link is working properly (*if you are using a terminal*), send the Display Drive Information (**DDI**) command.

☞ **Helpful Hint:** Type DDI and press ENTER (*or the space bar*) on your terminal. The Z Drive will send the following message.

```
            PP    PI    PD    VP    VI    VF    TG
*PERCENT    00    00    00    50    20    00    00
*MAXIMUM 00000 00000 00000 15000 01000 00000 00000

*TIME_CONSTANT=00005(*100_microSeconds)
*AVE_CURRENT_LIMIT=020.00_AMPS
*PEAK_CURRENT_LIMIT=040.00_AMPS
*MOTOR_RESOLUTION=05000_STEPS
*RESOLVER_RESOLUTION=AUTO
*MOTOR_TYPE=Z640
*Z_MODE=3...[VELOCITY]
```

⑤ Increase the voltage to command the motor to turn. If the motor appears to be creeping at ***zero voltage*** (ØV), you may have a slight offset in the supply. The Analog Zero (**ANZ**) command can compensate for this offset (refer to *Chapter ⑥ Software Reference* for a detailed description of the **ANZ** command).

The successful completion of this test means that you wired the resolver, motor, terminal (optional), and power connections correctly. The components of your system are functioning properly. If the motor does not move as commanded, check the connections and try the test again. When you successfully complete this test, you may begin to Chapter ③ Installation.

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C H A P T E R ③

Installation

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

You must complete the Check-Out Procedure in *Chapter ② Getting Started* before proceeding with the permanent installation process.

Environmental Considerations

Consider the environment in which your system will be operating. Proper mounting, wiring, and grounding will ensure trouble-free operation. The Z Drive 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 Z Drive in the following conditions.

- ❑ Storage Temp.: -40°F to +185°F (-40°C to +85°C)
- ❑ Operating Temp.: 32°F to 122°F (0°C to 50°C) w/adequate air flow (10 cubic feet per minute)

Complete System Configurations

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. Install all Compumotor hardware in conformity with local and national electrical and safety codes.

This chapter provides detailed instructions on all aspects of the Z Drive'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.

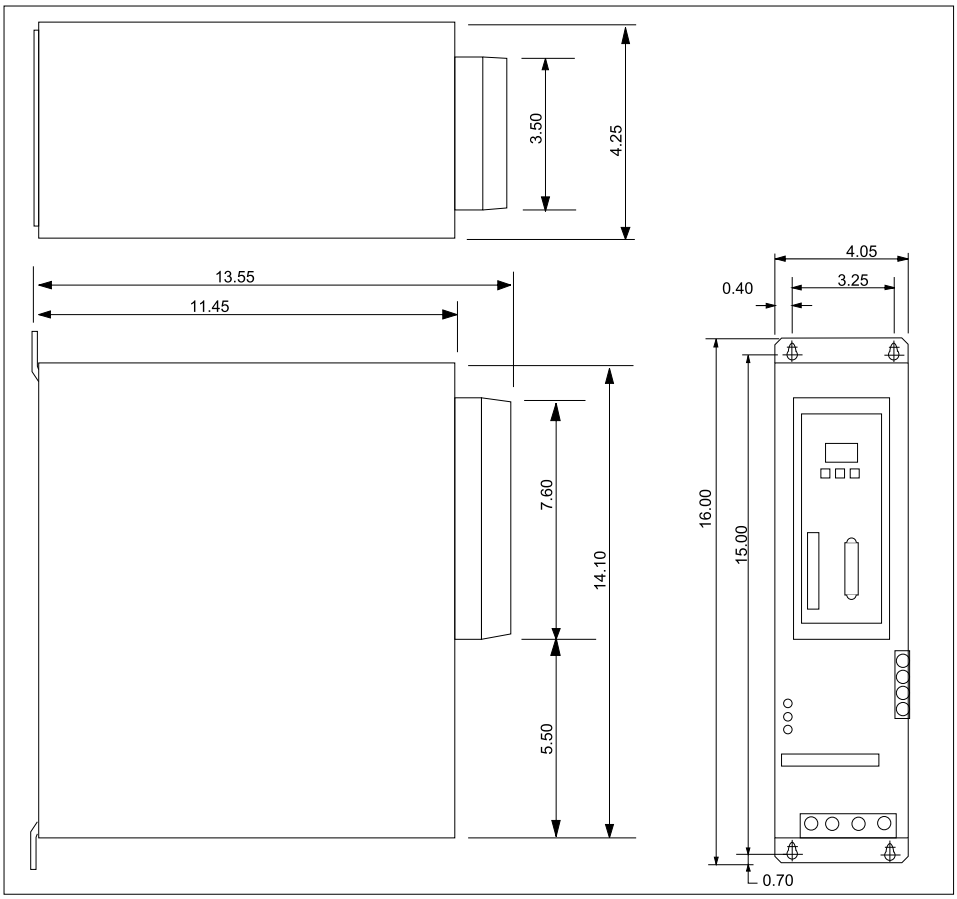
Drive Mounting

The Z Drive 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 provided. Industrial application environments may contain airborne contaminants, so the enclosure used should conform to at least a *NEMA TYPE 12 standard.*

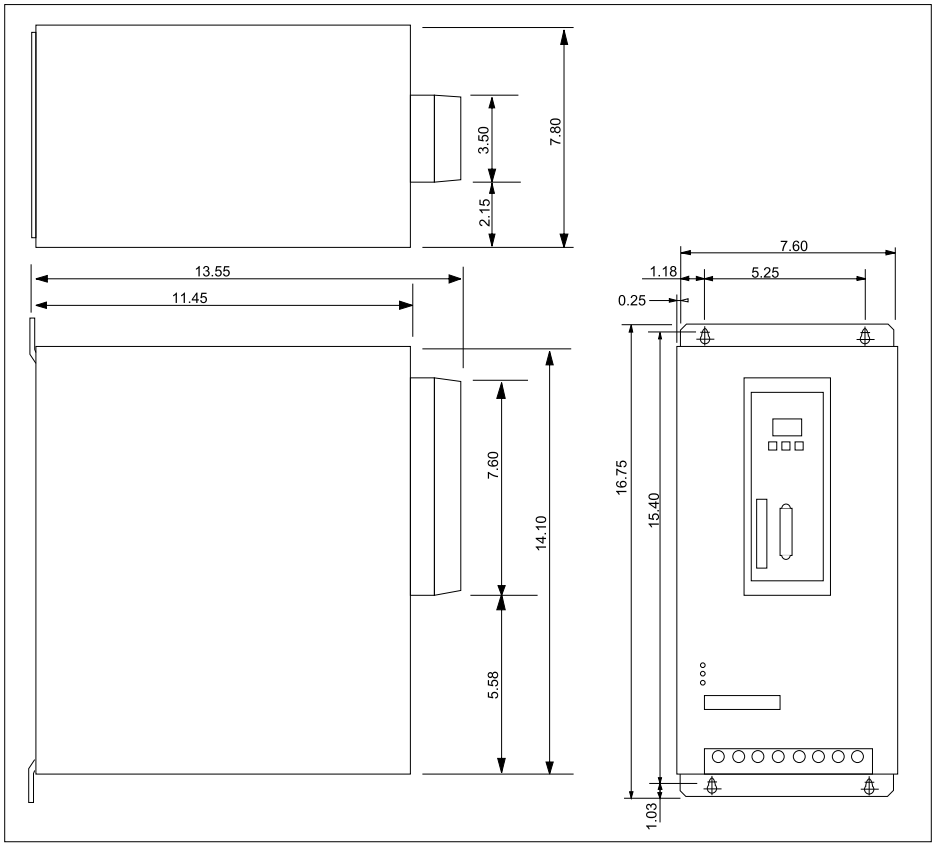
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The Z Drive mounting bracket is notched with keyhole type slots to accept screws on either end for flat panel surface mounting.

☞ ***Helpful Hint:*** You should use 10-32 or 1/4 x 20 screws into captured nuts to mount the Z Drive in a panel mount configuration. Use locking type fasteners to prevent the drive from coming loose due to vibration.



Z600/800 Drive Dimensions

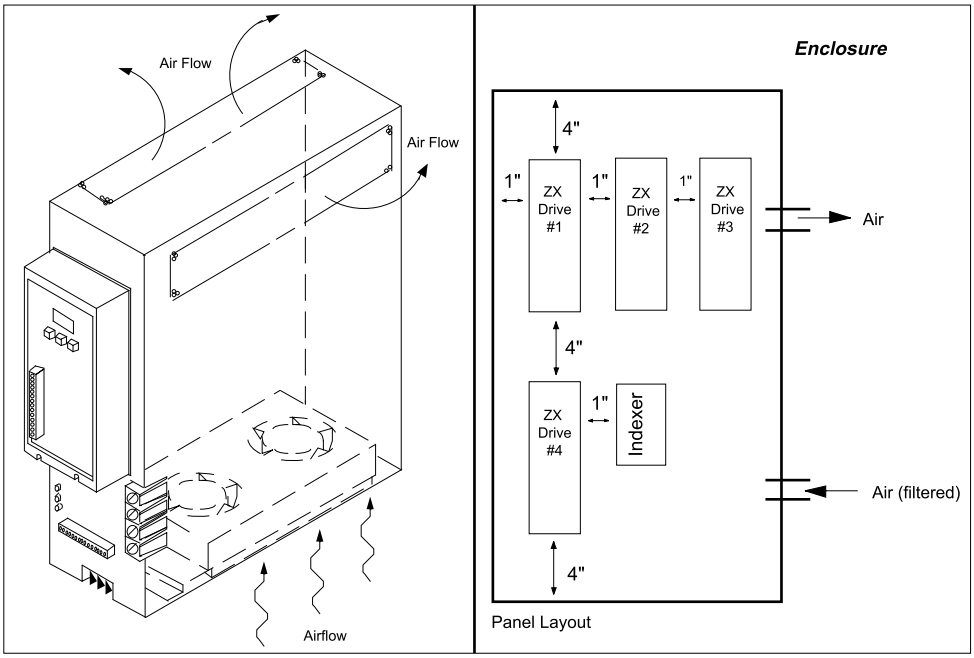


Z900 Drive Dimensions

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Panel Layout

Proper panel layout is essential to ensure sufficient cooling of equipment within the enclosure. The Z Drive is fan cooled. It is designed to operate at its rated speed and torque specifications in a 32°F to *122*°F (0°C to 50°C) ambient environment. When you design your panel layout, allow sufficient space for unrestricted airflow through each drive. Since the fan draws air upward over the heatsink, the air directly beneath the unit must not exceed *122*°F (50°C). The Z Drive has two temperature sensors. One sensor is mounted to the heatsink, and the other is mounted to the control board circuitry. If the drive overheats, the front-panel display will provide an error message. The figure below shows drive air flow.



Z Drive Air Flow and Panel Layout Guidelines

The Z Drive produces heat that must be dissipated. The heat generated when a Z600 Drive is operated in continuous duty at maximum current may be as high as 500 watts (the Z900 Drive can generate 750 watts). The actual dissipation will vary depending on the application duty cycle, motor size, and load inertia.

① The vertical distance between the Z Drive and other equipment, or the top and bottom of the enclosure, should be no less than 4 inches.

② The horizontal distance between the Z Drive and other equipment, or the side walls of the enclosure, should be no less than *1* inch.

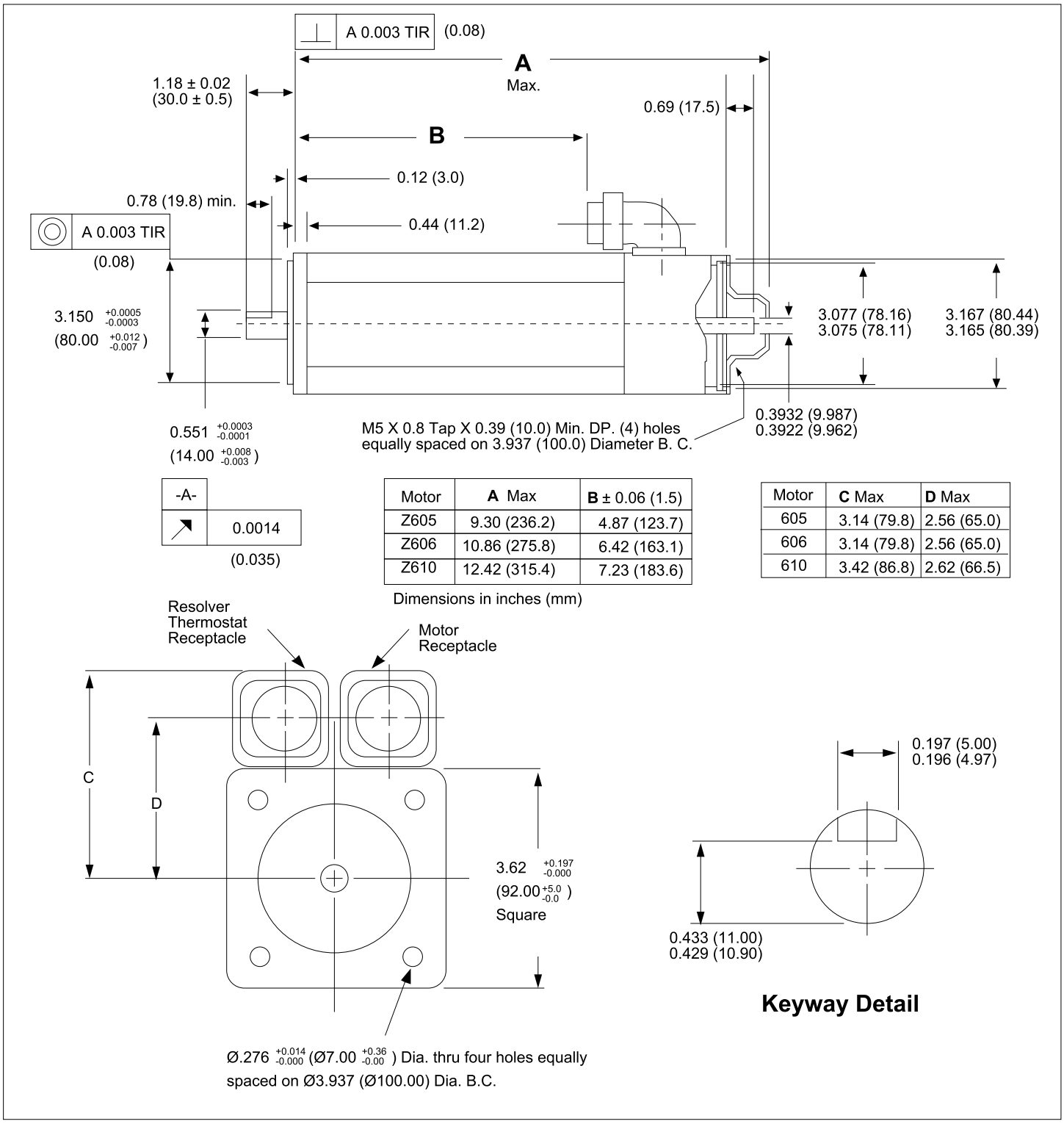
③ Do not mount the Z Drive directly below an indexer.

④ Large heat-producing equipment (such as transformers) should not be mounted directly beneath the Z Drive.

Motor Mounting

You should mount the motors with the four flange bolts that are on the front face plate. Center the motor with the pilot on the front face.

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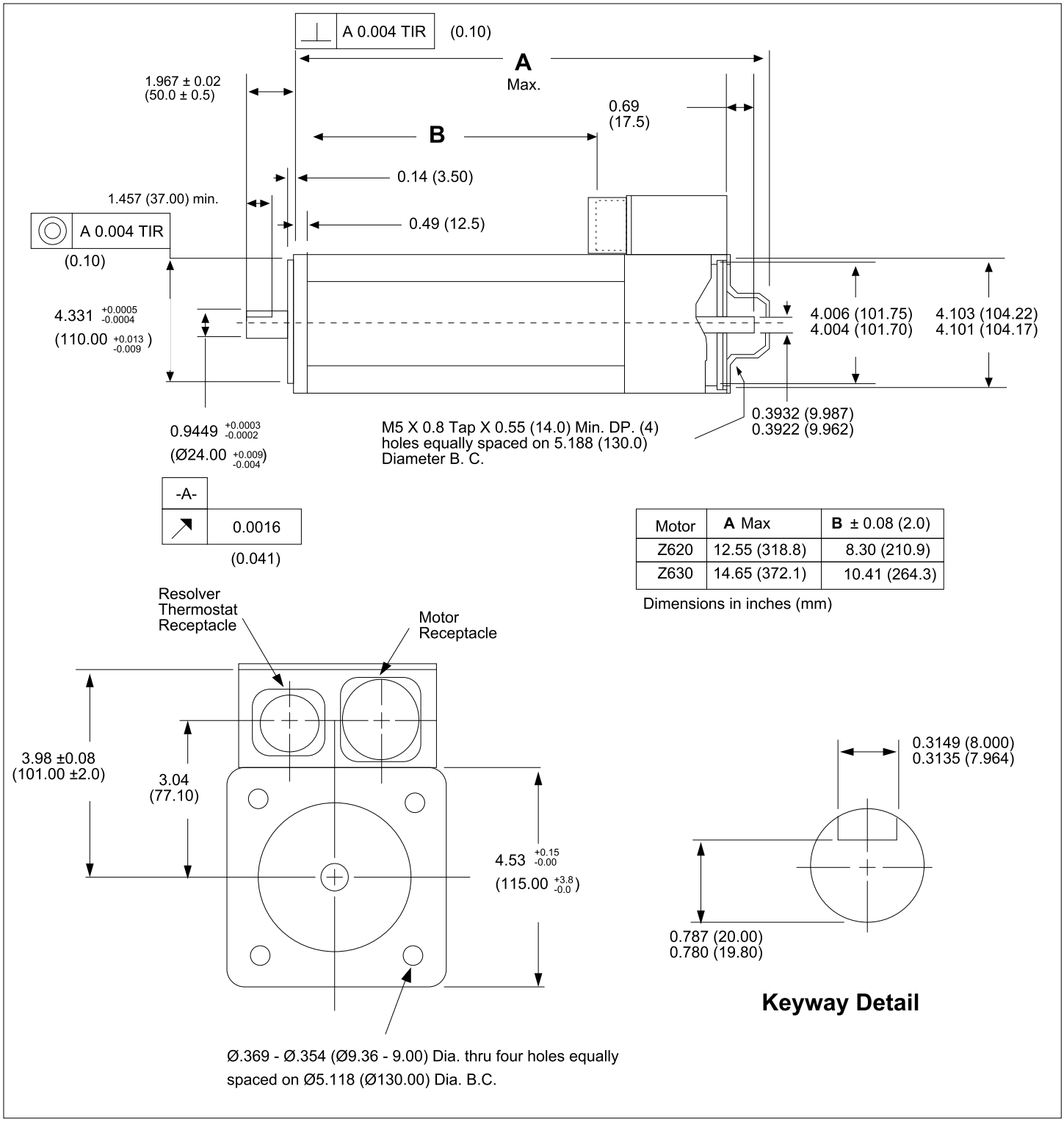


Motor	**A** Max	**B** ± 0.06 (1.5)
Z605	9.30 (236.2)	4.87 (123.7)
Z606	10.86 (275.8)	6.42 (163.1)
Z610	12.42 (315.4)	7.23 (183.6)

Motor	**C** Max	**D** Max
605	3.14 (79.8)	2.56 (65.0)
606	3.14 (79.8)	2.56 (65.0)
610	3.42 (86.8)	2.62 (66.5)

Z605—Z610 Motor Dimensions

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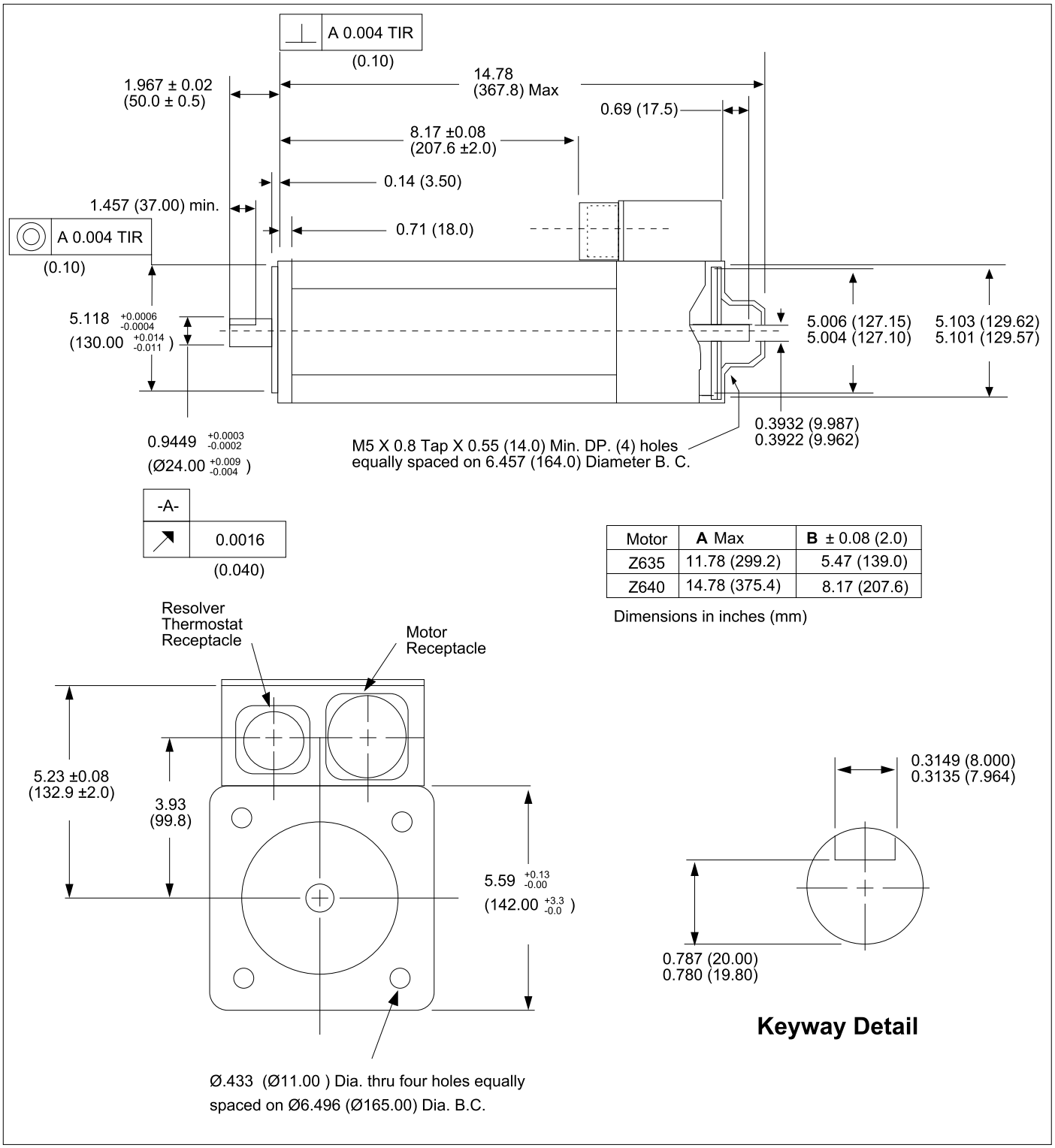


Motor	**A** Max	**B** ± 0.08 (2.0)
Z620	12.55 (318.8)	8.30 (210.9)
Z630	14.65 (372.1)	10.41 (264.3)

Dimensions in inches (mm)

Z620 & Z630 Motor Dimensions

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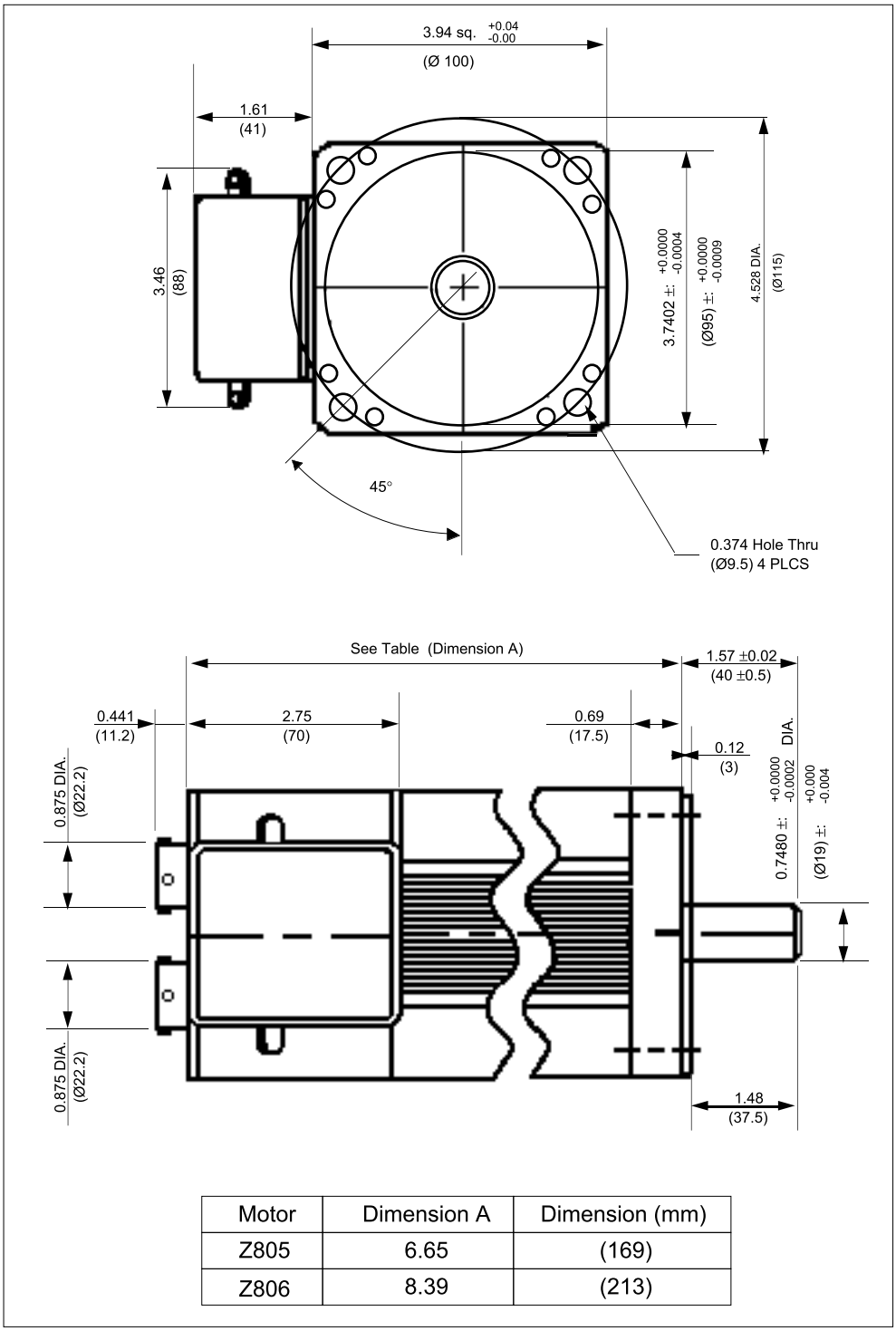


Motor	**A** Max	**B** ± 0.08 (2.0)
Z635	11.78 (299.2)	5.47 (139.0)
Z640	14.78 (375.4)	8.17 (207.6)

Dimensions in inches (mm)

Z635 & Z640 Motor Dimensions

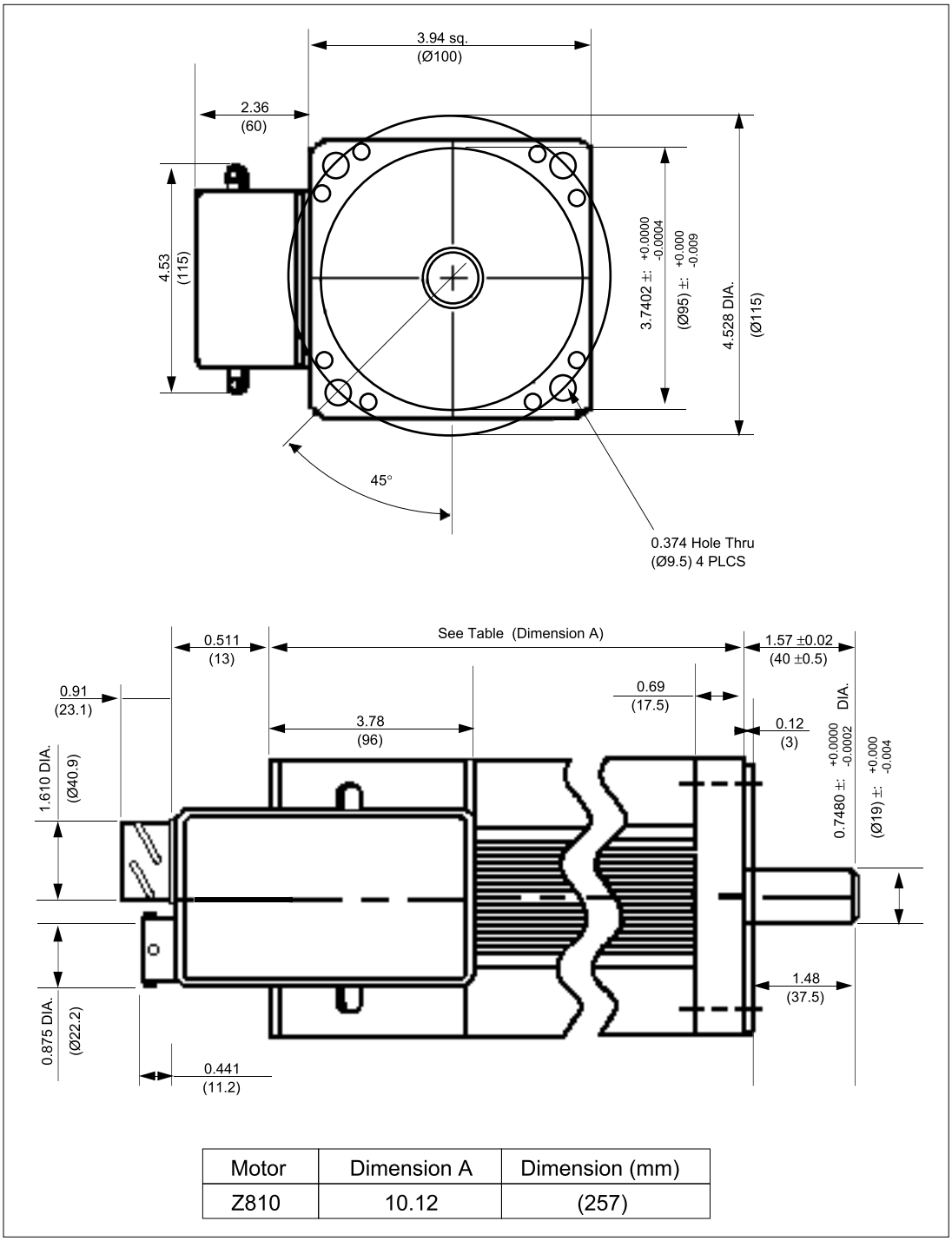
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Motor	Dimension A	Dimension (mm)
Z805	6.65	(169)
Z806	8.39	(213)

Z805 & 806 Motor Dimensions

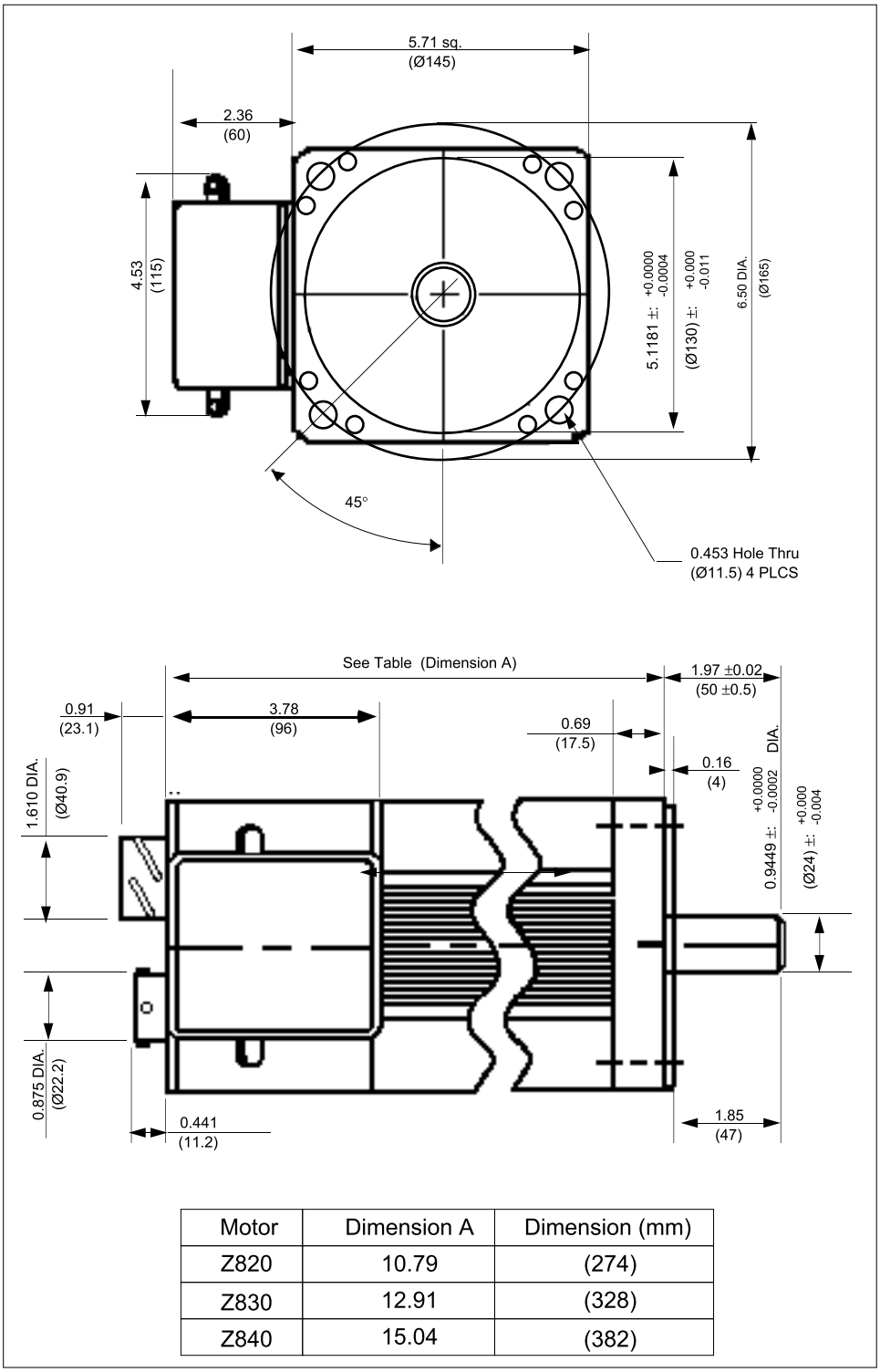
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Motor	Dimension A	Dimension (mm)
Z810	10.12	(257)

Z810 Motor Dimensions

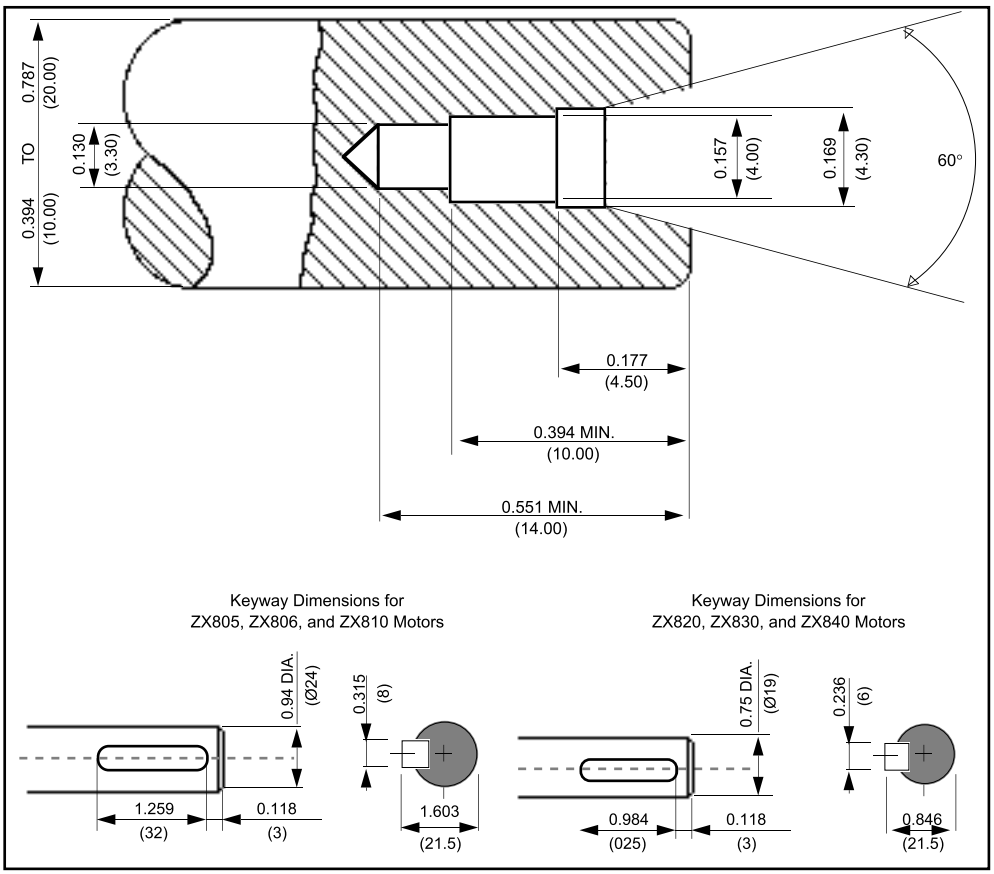
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Motor	Dimension A	Dimension (mm)
Z820	10.79	(274)
Z830	12.91	(328)
Z840	15.04	(382)

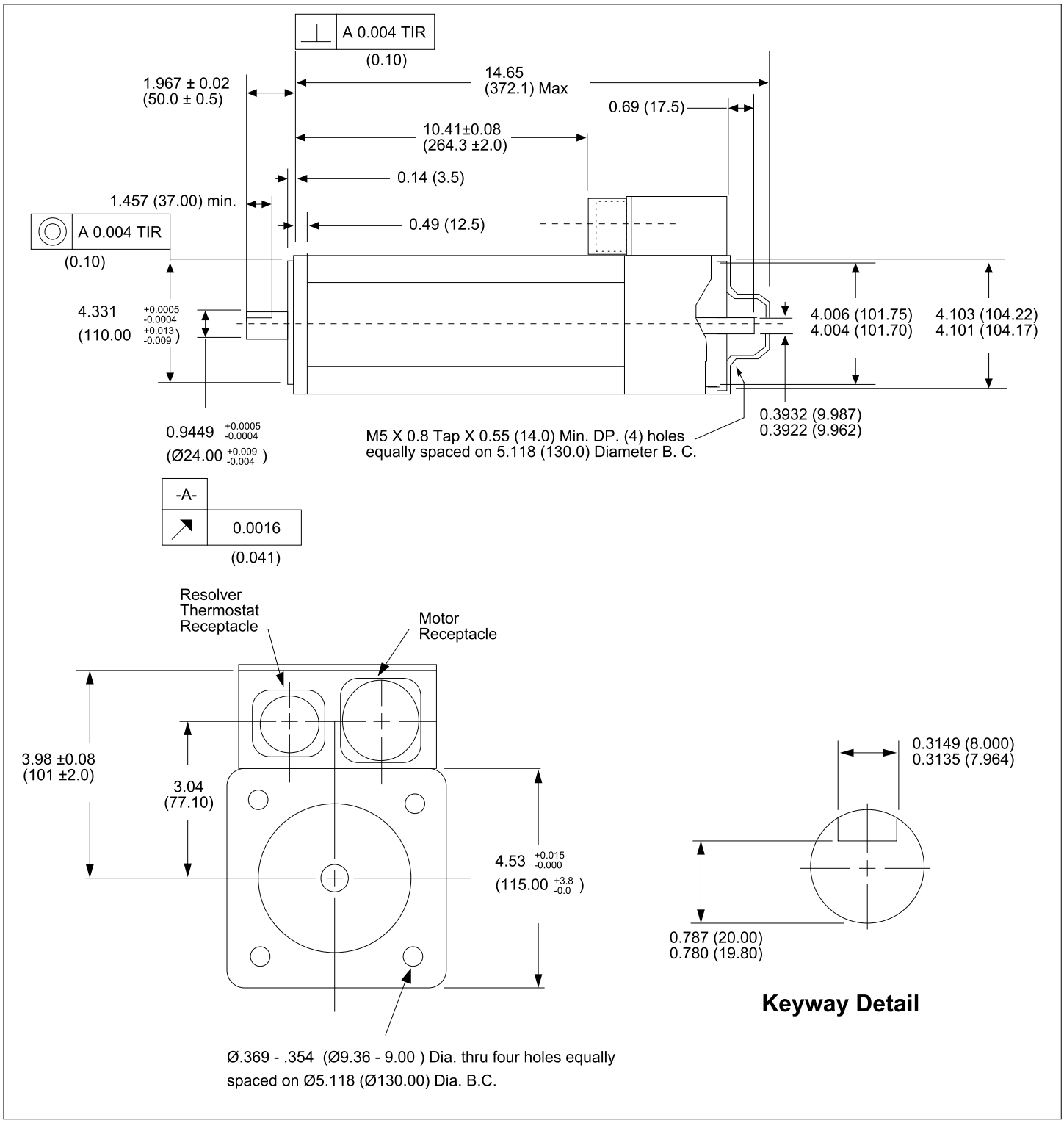
Z820, 830, & 840 Motor Dimensions

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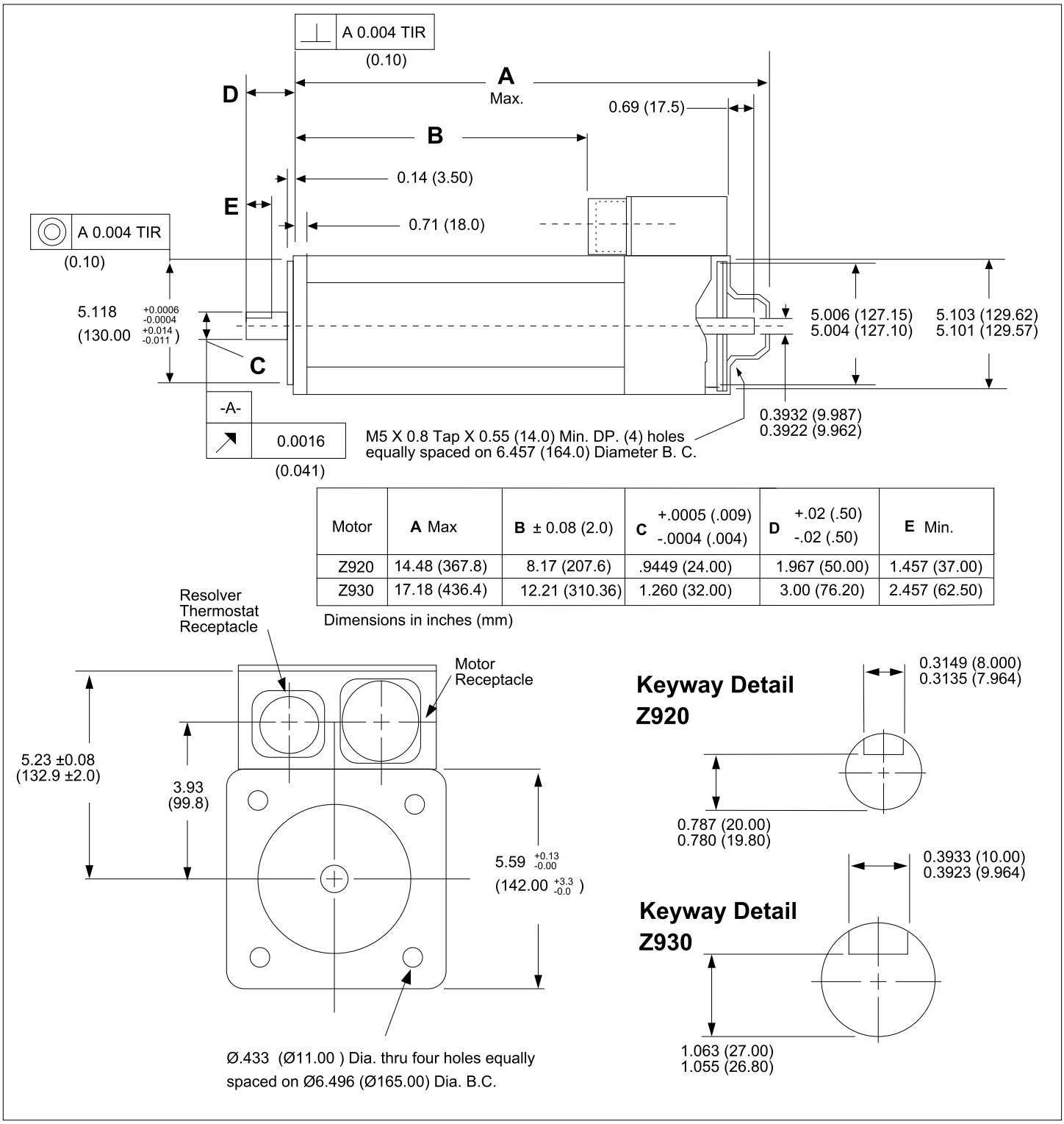
Z800 Motor Shaft Dimensions

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Z910 Motor Dimensions

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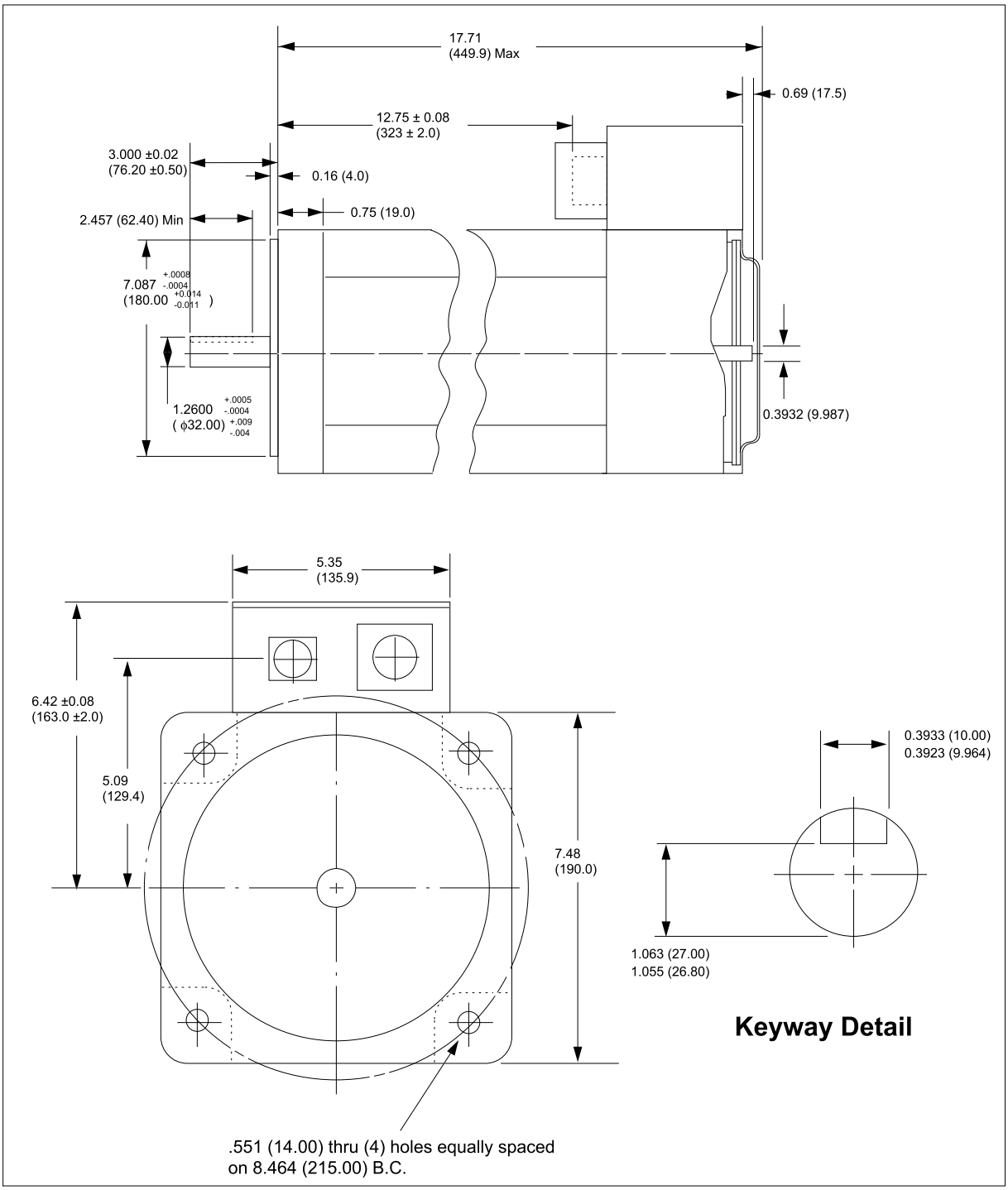


Motor	**A** Max	**B** ± 0.08 (2.0)	**C** +.0005 (.009) -.0004 (.004)	**D** +.02 (.50) -.02 (.50)	**E** Min.
Z920	14.48 (367.8)	8.17 (207.6)	.9449 (24.00)	1.967 (50.00)	1.457 (37.00)
Z930	17.18 (436.4)	12.21 (310.36)	1.260 (32.00)	3.00 (76.20)	2.457 (62.50)

Dimensions in inches (mm)

Z920 & Z930 Motor Dimensions

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Z940 Motor Dimensions

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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.

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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	PT06A-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-22-225	851-Ø6EC14-19S5Ø

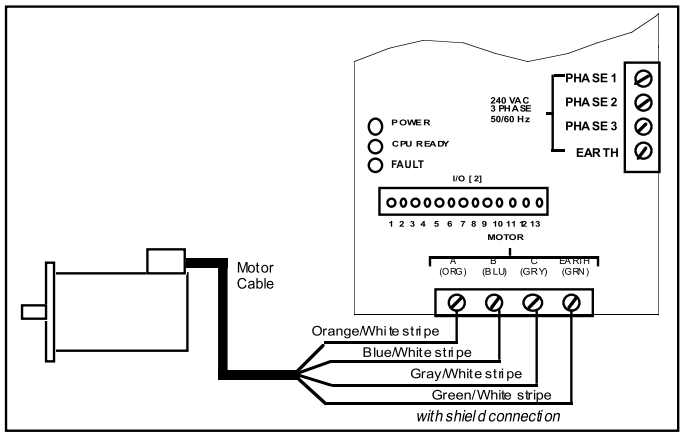
ZX Series Resolver and Motor Connectors

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.*

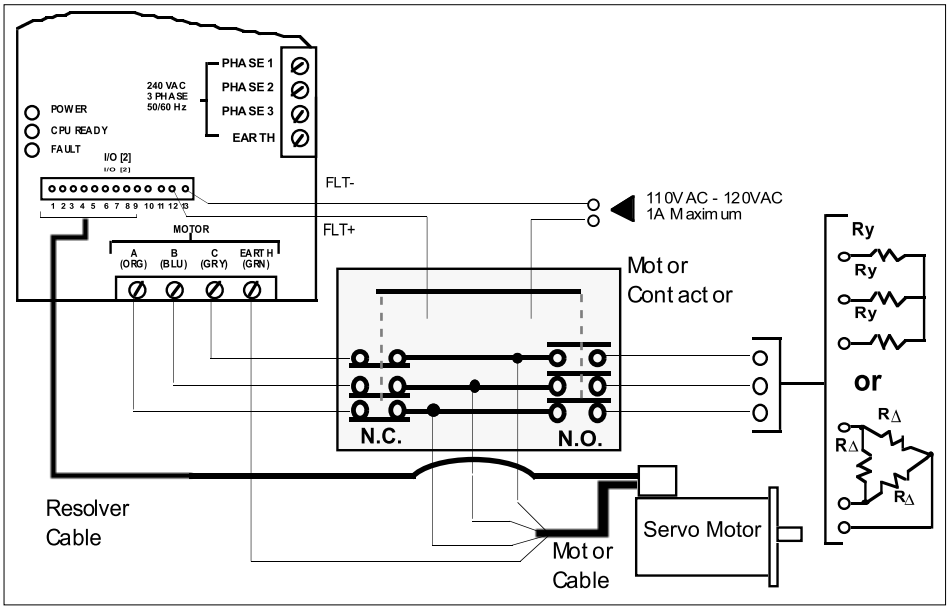
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Motor Braking

If the Z Drive faults, for any reason, the amplifier will be disabled and the motor will freewheel. Refer to *Chapter ® 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.

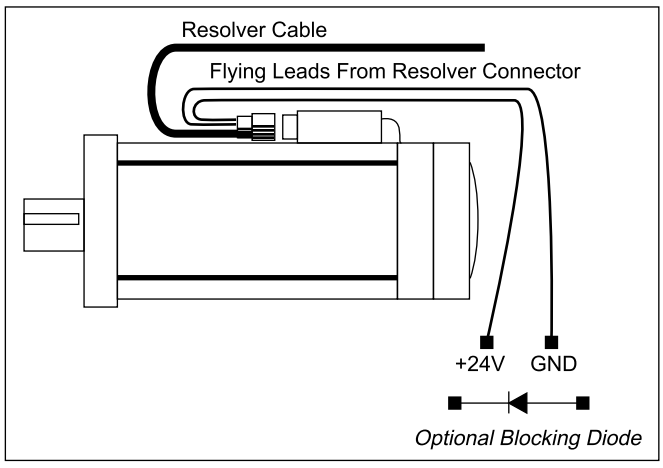
☞ ***Helpful Hint:*** *Braking resistors provide very little braking at zero velocity.* If standstill braking or emergency stopping are required, you can order the spring-type motor brake option from Compumotor (800) 722-2282. The brake is activated from a separate 24VDC supply and operates in a fail-safe 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 = 5Ω). For a *delta* configuration, use 15Ω or more (R_Δ = 15Ω). If quicker stopping is required, the braking resistors can be lowered, but you must increase their power ratings.

Wiring the Motor Brake Option



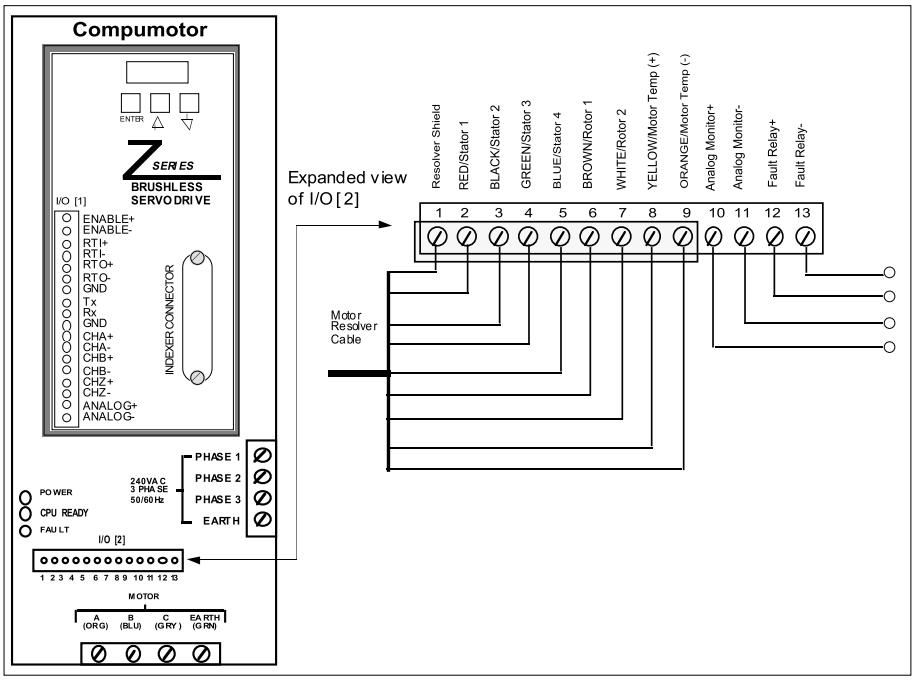
Wiring Z Series Motor Braking Option (-B)

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.***

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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.

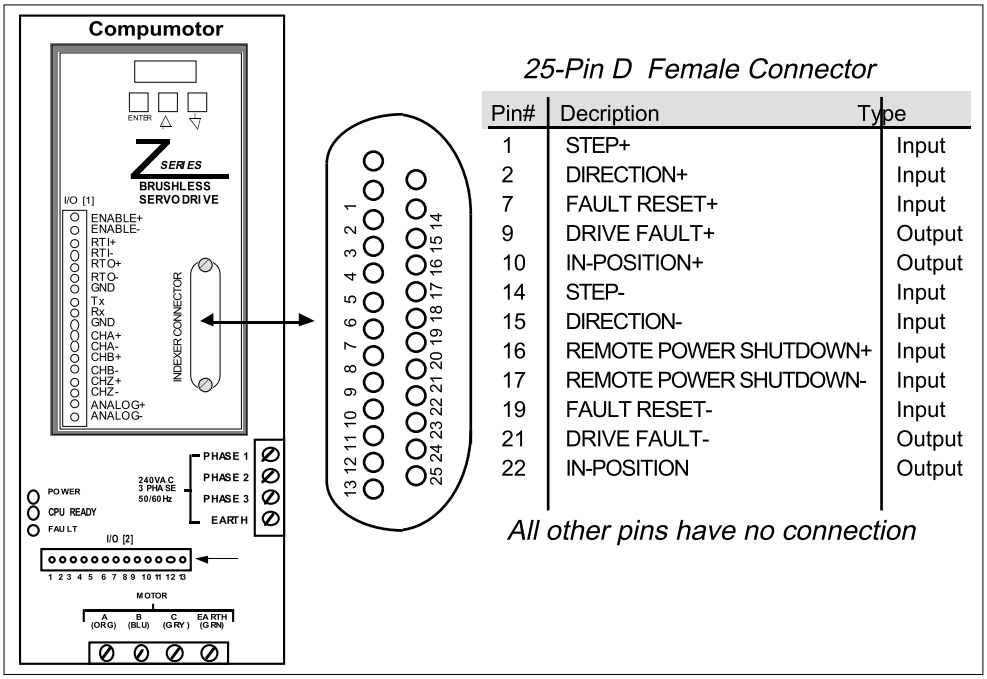


Resolver Pin-Out I/O[2]

Indexer Connections

This section provides functional descriptions of the INDEXER CONNECTOR's inputs and ouputs. 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.



25-Pin D Female Connector

Pin#	Decription	Type
1	STEP+	Input
2	DIRECTION+	Input
7	FAULT RESET+	Input
9	DRIVE FAULT+	Output
10	IN-POSITION+	Output
14	STEP-	Input
15	DIRECTION-	Input
16	REMOTE POWER SHUTDOWN+	Input
17	REMOTE POWER SHUTDOWN-	Input
19	FAULT RESET-	Input
21	DRIVE FAULT-	Output
22	IN-POSITION	Output

All other pins have no connection

Indexer Connector Pin-Out

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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.

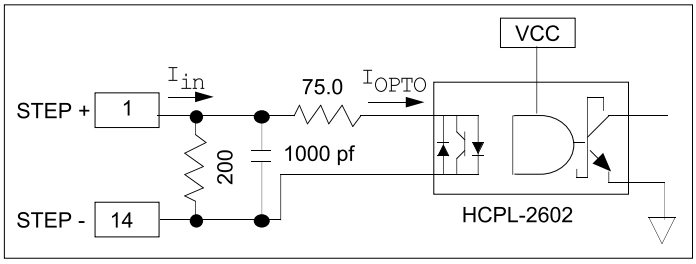
Input Voltage

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

Input Current

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

☞ ***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*.

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DIRECTION

The Direction input controls the direction of motor rotation.

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

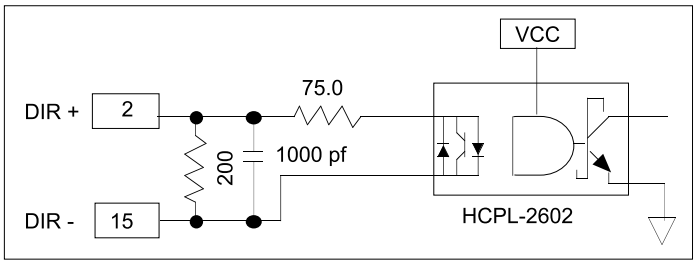
If the Direction input is not activated, the motor shaft rotates CCW as viewed from the flange end of the motor. If the Direction input is activated, the motor shaft rotates CW. *The Direction Input Polarity Control (**SSM**) command can reverse this polarity.* Refer to ***Chapter ⑤ Software Reference***.

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.

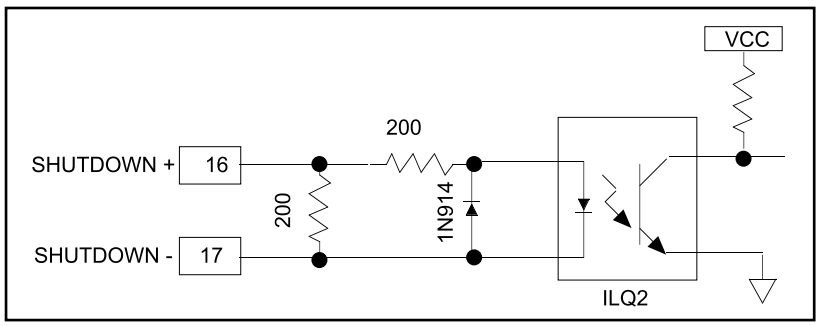
> ***WARNING***
>
> The remote power shutdown is not intended to act as an emergency stop for the motor. Refer to *Motor Braking* earlier in this chapter for information on installing braking resistors for emergency stops.

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

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FAULT RESET

The Fault Reset input resets the processors.

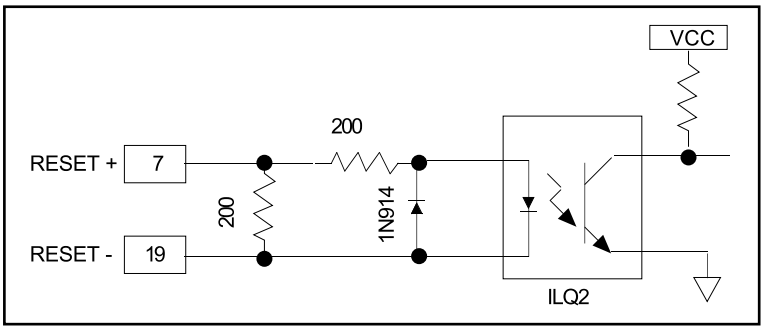
- **Fault Reset+** (pin #7)
- **Fault Reset-** (pin #19)

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 ($V_{OUT} \approx ØV$).

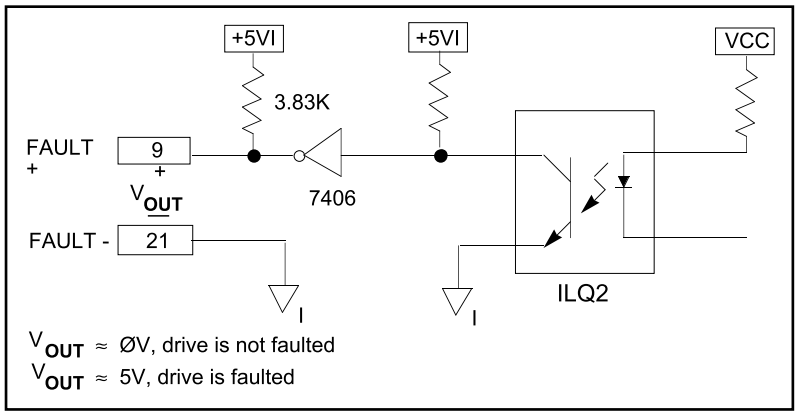
- **Fault+** (pin #9)
- **Fault-** (pin #21)

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

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IN-POSITION

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

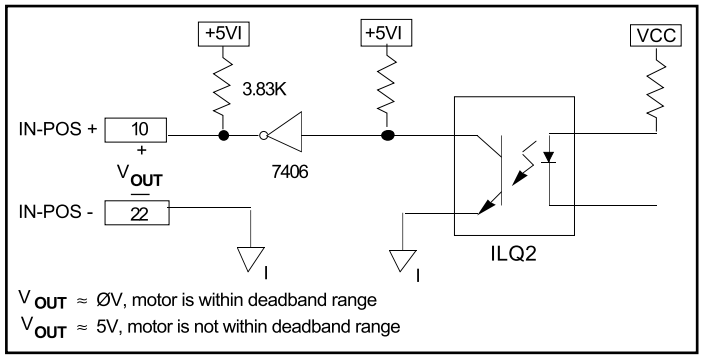
- **In-Position+** (pin #10)
- **In-Position-** (pin #22)

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 ($V_{OUT} \approx ØV$) 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.



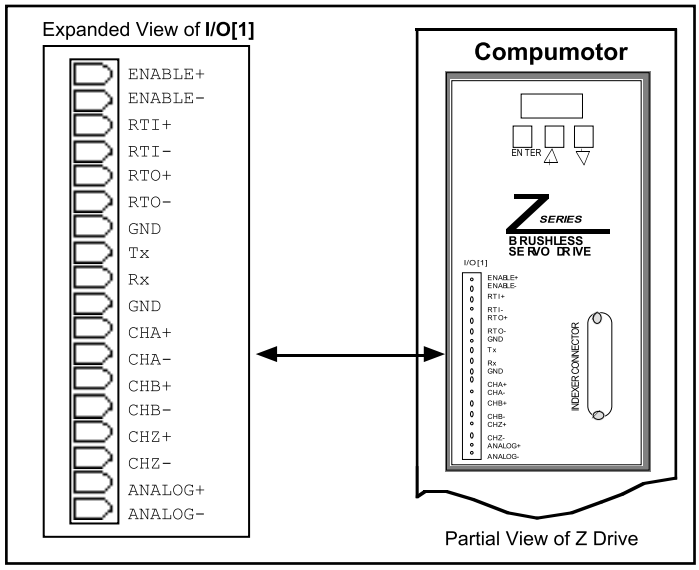
In-Position Output Schematic

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.



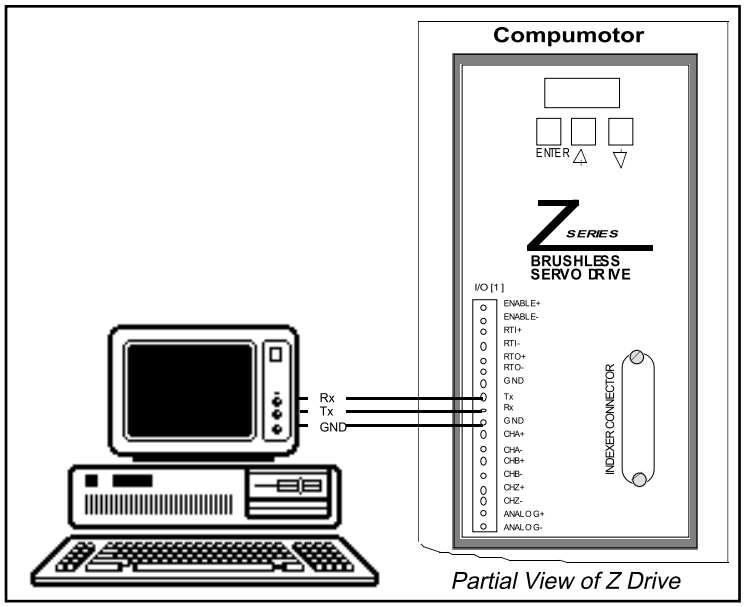
Screw Terminal I/O [1]

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RS-232C Connections I/O[1]

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.

☞ ***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.

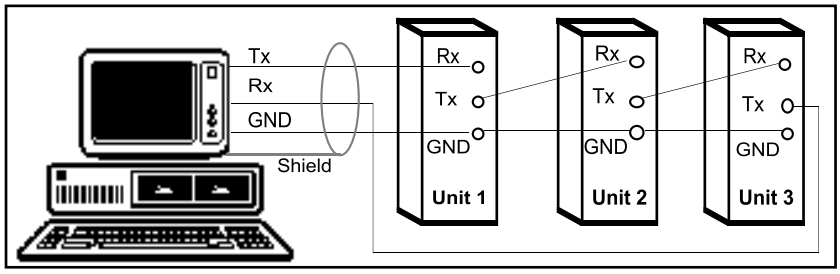


RS-232C Connections

Daisy Chain Wiring

You may daisy chain up to 99 Z Drives. Individual drive addresses are set with push-buttons. When daisy chained, drives may be addressed individually or simultaneously. Establish a unique device address for each drive.

☞ ***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.



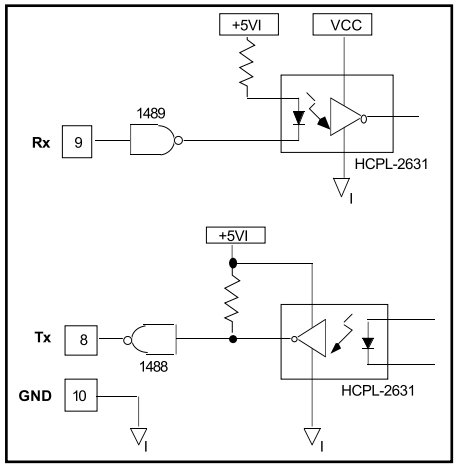
RS-232C Daisy Chain Configuration

☞ ***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.



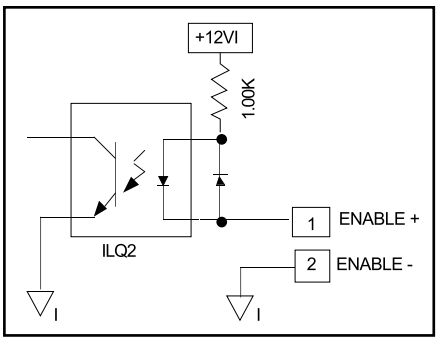
RS-232C Input Schematic

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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.

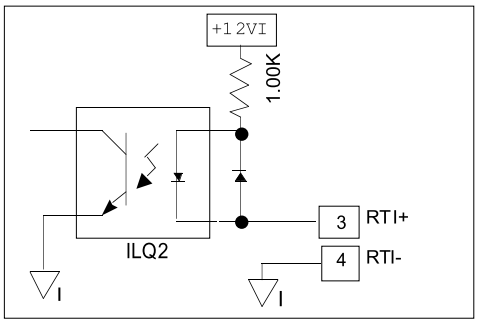


Enable Input Schematic

RTI Input I/O[1]

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

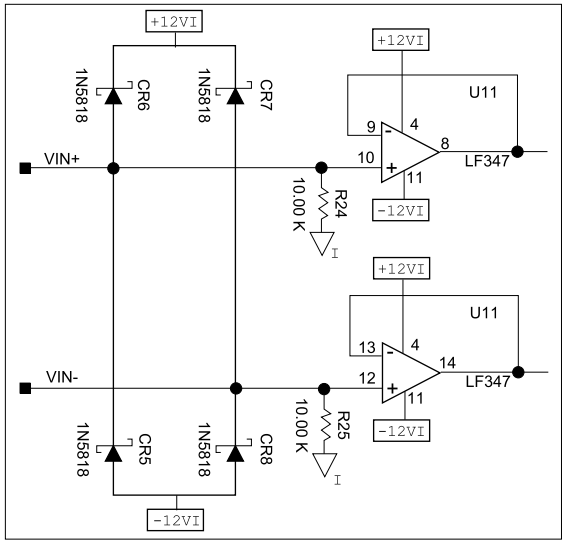
☞ ***Helpful Hint:*** Schematic of the `I/O[1]` Real-Time Input.



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 Applic29 ation Design*, for further instructions on using the Z Drive in various input modes.



Analog Velocity Input Schematic

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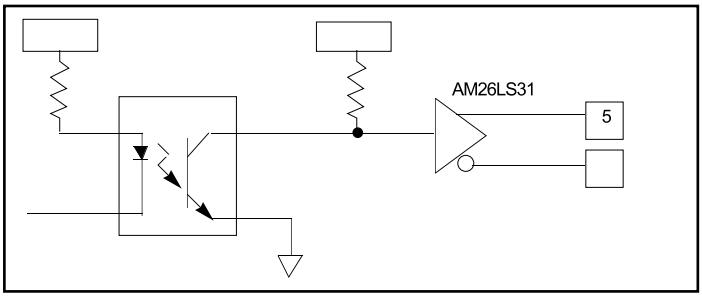
RTO Output I/O[1]

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

Output Voltage

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

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



Real-Time Output Schematic

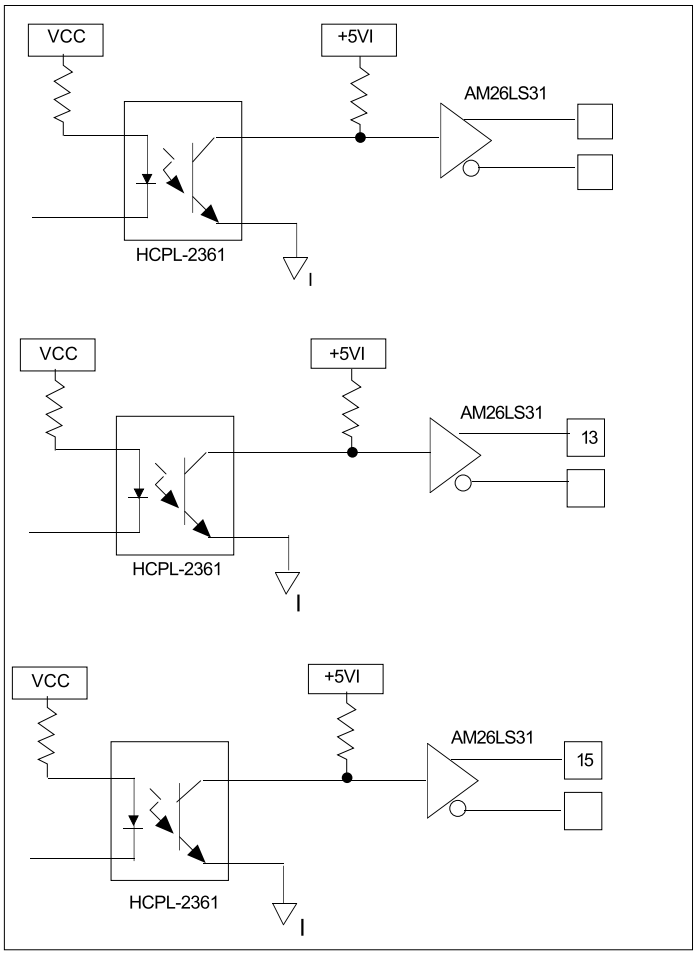
CHA, CHB, and CHZ Outputs I/O[1]

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.

Output Voltage

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

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



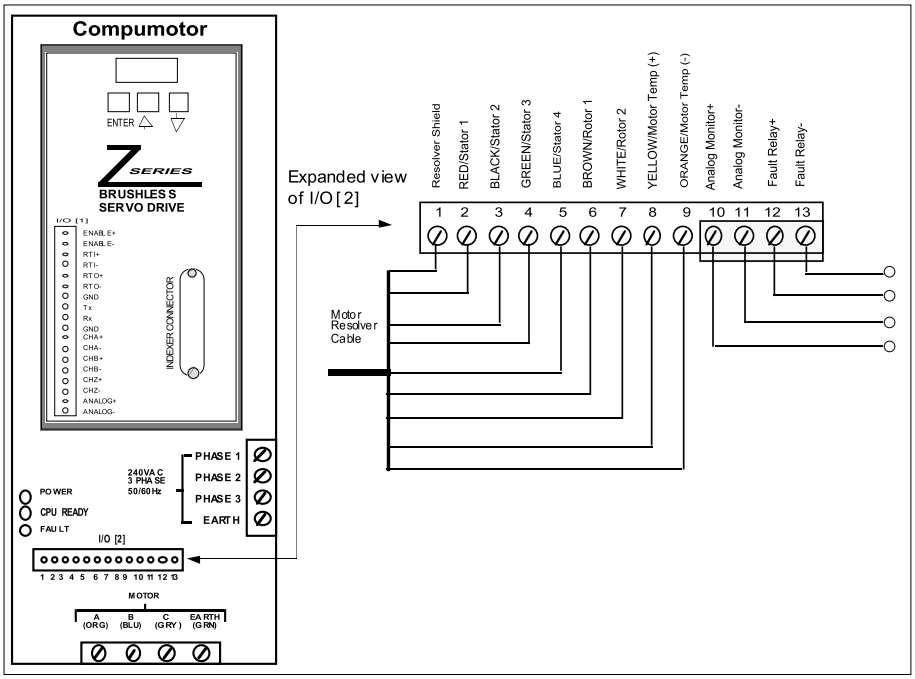
Pseudo-Quadrature Schematic

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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 (±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.

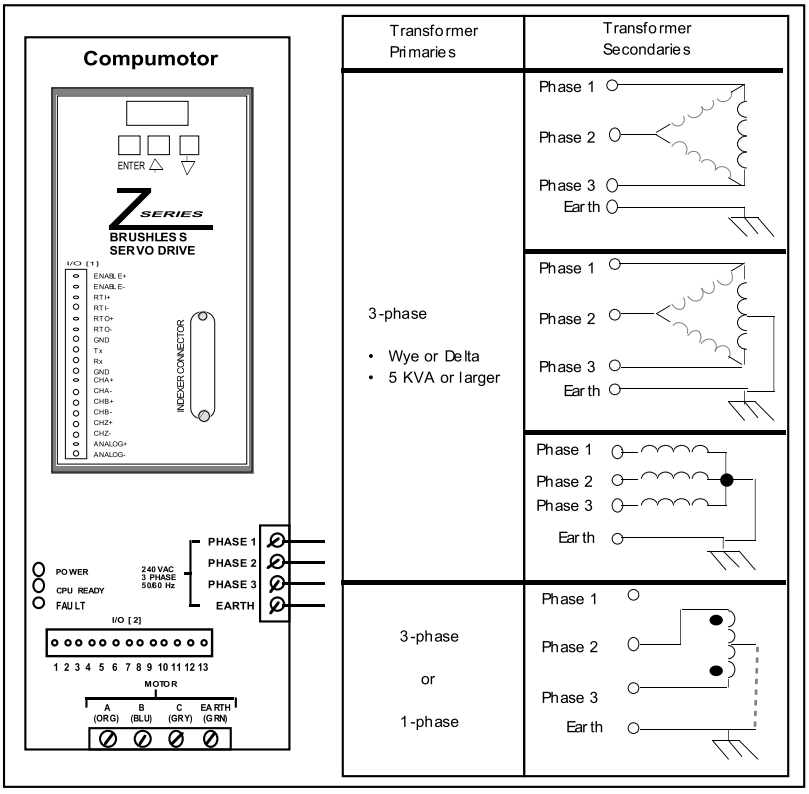
Line Power Connections

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.

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☞ ***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.*

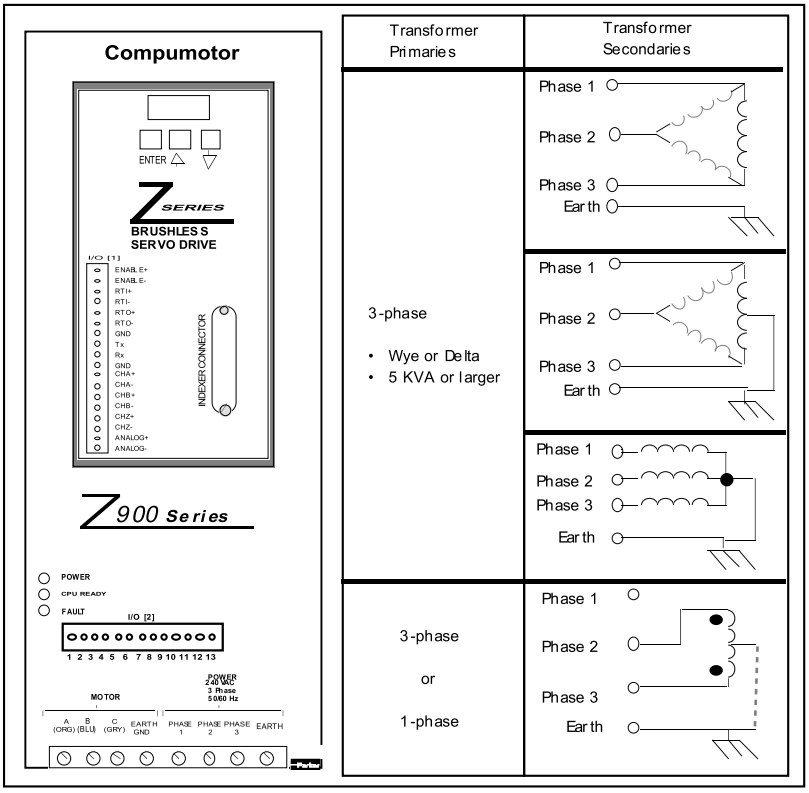


ZX600/800 Power Connections

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

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Check-Out Procedure

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.

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C H A P T E R ④

Application Design

The information in this chapter will enable you to:

- ❏ Become familiar with the front panel interface
- ❏ Customize the system to meet your requirements (operating modes and tuning)
- ❏ Understand the use of encoder output signals

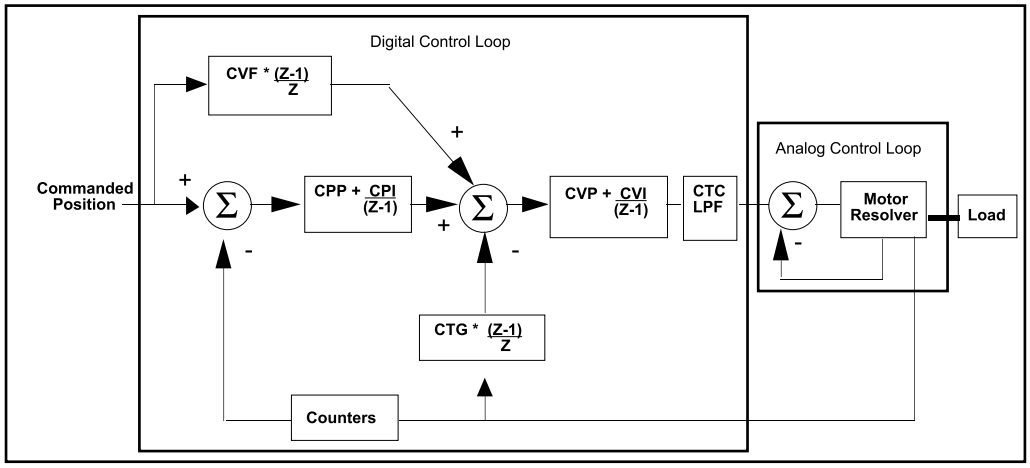
Basic Servo Tuning Theory

The Z Series Drive employs two basic control loops.

- ❏ Digital Control Loop
- ❏ Analog Control Loop

The *digital control loop* uses information from the resolver and user inputs to determine what the commanded motor currents should be.

The *analog control loop* takes current commands from the digital control loop and pulse width modulates the bus voltage to achieve these currents in the motor.



Digital and Analog Control Loops

The digital control loop has 15 parameters that you can adjust to obtain optimal shaft performance. You cannot adjust the analog control loop. It is configured to run all sixteen Z Series motors (605, 606, 610, 620, 630, 640, 805, 806, 810, 820, 830, 840, 910, 920, 930, and 940) at optimum performance without modification. To ensure that the system operates properly, you must select the correct motor size with the Configure Motor (**CMTR**) command (refer to *Chapter ⑥ Software Reference*).

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Tuning parameters can vary significantly in each operating mode (Position mode, Velocity mode, or Torque mode). To simplify the task of tuning, default tuning parameters are stored for each motor size in each mode. If the default parameters do not provide adequate performance, you can manually tune the drive with the front panel interface or the RS-232C interface. All tuning parameters are accessible via the RS-232C interface; however, only some are accessible via the front panel.

Command	RS-232C	Front Panel	Tuning Commands
CPD	Yes	Yes	Configure Position Derivative
CPDM	Yes	No	Configure Position Derivative Maximum
CPI	Yes	Yes	Configure Position Integral
CPIM	Yes	No	Configure Position Integral Maximum
CPP	Yes	Yes	Configure Position Proportional
CPPM	Yes	No	Configure Position Proportional Maximum
CTC	Yes	No	Configure Time Constant
CTG	Yes	Yes	Configure Tach Gain
CTGM	Yes	No	Configure Tach Gain Maximum
CVF	Yes	No	Configure Velocity Feed-Forward
CVFM	Yes	No	Configure Velocity Feed-Forward Maximum
CVI	Yes	No	Configure Velocity Integral
CVIM	Yes	No	Configure Velocity Integral Maximum
CVP	Yes	Yes	Configure Velocity Proportional
CVPM	Yes	No	Configure Velocity Proportional Maximum

Tuning Parameter Commands

Tuning Procedure

If you are using the Z Drive for the first time, Compumotor recommends that you use the RS-232C interface. This interface provides access to all of the tuning parameters and gives you real-time access to some of the control variables. Two basic commands—**DDI** (Display Drive Information) and **DSP** (Display Servo Picture)—are designed to help you tune the drive. The **DDI** command lists all the tuning parameters as well as motor's resolution, drive configuration, etc. You can use this command to verify the drive's current operating mode. A sample **DDI** command response is shown below.

```
          PP    PI    PD    VP    VI    VF    TG
*PERCENT  50    Ø5    ØØ    1Ø    ØØ    6Ø    6Ø
*MAXIMUM  1ØØØØ ØØ4ØØ 32ØØØ 1ØØØØ ØØØØØ 32ØØØ 32ØØØ

*TIME_CONSTANT=ØØØØ5 (*1ØØ_MICROSECONDS)
*AVE_CURRENT_LIMIT=2Ø.ØØ_AMPS
*PEAK_CURRENT_LIMIT=4Ø.ØØ_AMPS
*MOTOR_RESOLUTION=Ø5Ø9Ø
*RESOLVER_RESOLUTION=AUTO
*MOTOR_TYPE=Z62Ø
```

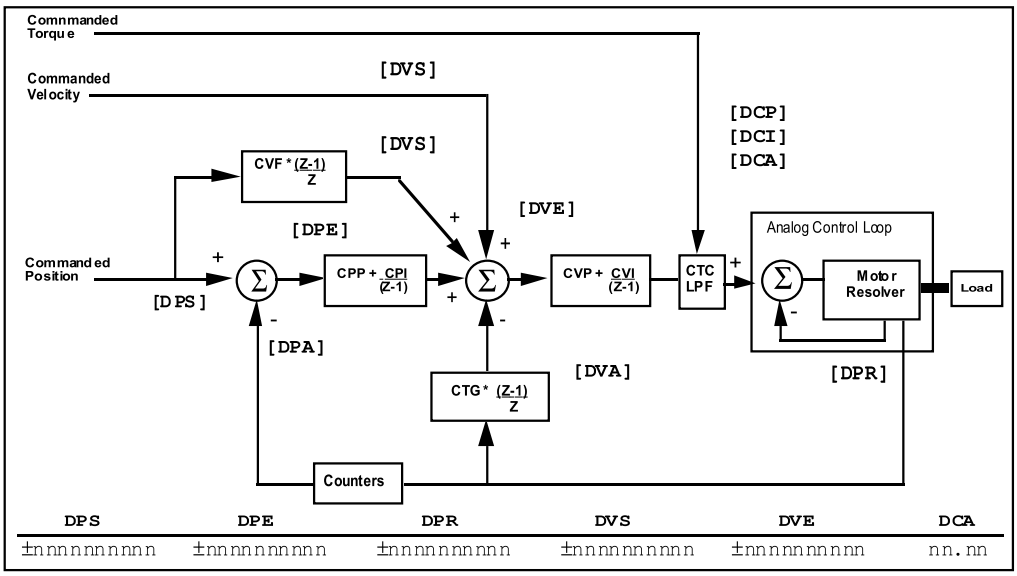
*All the gain commands have a maximum limit. This is done to provide a wide dynamic range. For example, the gain term **PP** (Position Proportional) can vary from 0-99% using the **CPP** command. The maximum **CPPM** value can vary from 0 - 32,767. The equation below illustrates the number that is actually used in the control loop assuming that **CPP** = 50 and **CPPM** = 10000.*

```
Position Proportional gain = (CPP/100) * CPPM
                           = 50% * 10000
                           = 5000
```

The **DSP** command gives you near real-time servo parameters. Use this command to get an approximate real-time preview of what the control loop is doing and how changing the parameters will affect the system. The software commands in brackets **[ ]** are the actual data in the loop. These variables are continuously updated. These commands are defined below.

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☞ ***Helpful Hint:***
A **DSP** command and the different parameters that you can display while the drive is operating.



Display Servo Picture Command (DSP) Response

The following display commands will help you tune the Z Drive.

DCA: Display Current Average — This command displays the Z Drive's average current.

DCP: Display Current Peak — This command displays the Z Drive's peak current.

DPS: Display Position Setpoint — This command displays the actual number of steps received from an indexer or pulse generator. This display is inactive in velocity and torque mode operation.

DPA: Display Position Actual — This command displays the motor shaft's actual position.

DPE: Display Position Error — This command displays the difference between the commanded and actual position in user-defined resolution.

DPR: Display Position Resolver — This command displays the position of the resolver. It *rolls over* numerically every mechanical revolution.

DVS: Display Velocity Setpoint — This command displays the desired velocity. In Position mode, this would correspond to the rate of change in steps.

DVA: Display Velocity Actual — This command displays the actual motor shaft velocity in rpm.

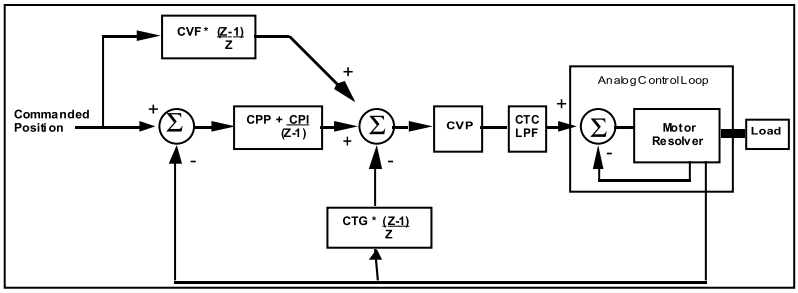
DVE: Display Velocity Error — This command displays the difference in the commanded velocity and the actual velocity in rpm.

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Servo Tuning

The Z Drive's microprocessor-based indexer internally generates position setpoint commands while the Z Drive's **DSP** closes the position loop.

☞ ***Helpful Hint:*** This figure illustrates the active part of the control loop.



Z Drive Tuning

The following table contains the Z Drive's tuning commands.

Command	Tuning Commands
CPD	Configure Position Derivative
CPDM	Configure Position Derivative Maximum
CPI	Configure Position Integral
CPIM	Configure Position Integral Maximum
CPP	Configure Position Proportional
CPPM	Configure Position Proportional Maximum
CTC	Configure Time Constant
CTG	Configure Tach Gain
CTGM	Configure Tach Gain Maximum
CVF	Configure Velocity Feed-Forward
CVFM	Configure Velocity Feed-Forward Maximum
CVP	Configure Velocity Proportional
CVPM	Configure Velocity Proportional Maximum

Tuning Commands

CPP: Configure Position loop Proportional Gain

This command directly reflects the *stiffness* of the system. Generally, you want this gain as high as possible without causing the system to oscillate.

CPI: Configure Position Loop Integral Gain

This command directly influences the final position accuracy. In the default mode, it is turned on, but only slightly. It is error-limited to prevent integral windup.

CPD: Configure Position Loop Derivative Gain

This command sets both the digital tach gain and the velocity feed-forward gain to the same value. It has the effect of *damping* the system response. This gain is increased if the motor oscillates at zero commanded position.

CVP: Configure Velocity Loop Proportional Gain

This command directly reflects the *stiffness* of the system similar to the **CPP** command. Generally, you want this gain as high as possible without causing the system to oscillate. The only difference with this command relative to **CPP** is that it takes into account the velocity tach gain.

CVF: Configure Velocity Feed-forward Gain

This term reduces the position loop following error only when the shaft is turning. It does not affect the system's dynamics.

CTG: Configure Tach Gain

This term allows additional damping. If you increase this term, the system will become sluggish, but you will be able to stabilize large inertias.

CTC: Configure Torque Time Constant

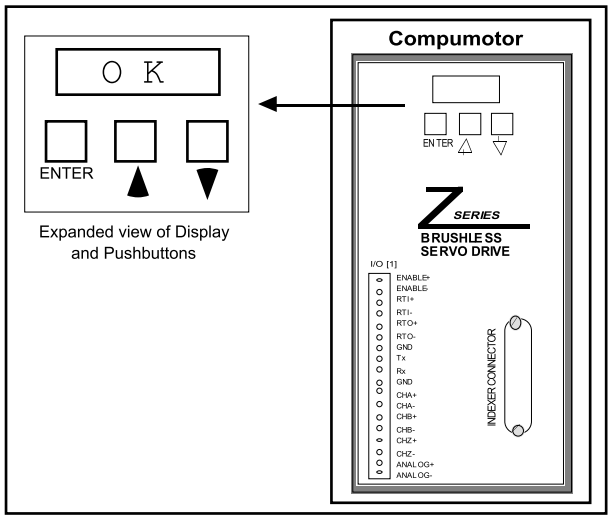
This command filters the output response of the digital controller. The motor is *commutated* every 100 µs and the servo loop is updated every 500 µs. In between each servo update, the commutation can use an average torque commanded value. The default is to 500 µs (**CTC5**). This effectively low-pass filters the torque command signal with a -3dB frequency of 2000 Hz. You can change this value to decrease the low-pass filter frequency. This will lower the drive's bandwidth.

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Alphanumeric Display and Pushbuttons

The Z Drive has a four-character, dot-matrix, alphanumeric display. All error messages are scrolled across the display when a fault occurs.

☞ ***Helpful Hint:***
You can modify many drive parameters with the three pushbuttons.



Z Drive Display and Pushbuttons

Fault Messages

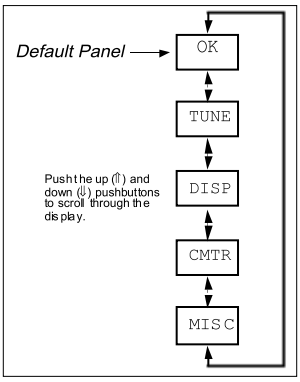
When a fault occurs, the corresponding fault message will appear. A fault code followed by a description of the fault scroll across the display.

Example: **ERROR #04 > OVER_VOLTAGE**

Fault messages are displayed continually until the fault is removed and the drive is turned on again. Refer to *Chapter ⑧ Maintenance & Troubleshooting* for a complete list of error messages and troubleshooting methods.

Pushbutton Operation

You can use the Z Drive's pushbuttons to modify drive parameters and to display several drive variables. The figure (left column) is an overview of the Main menu panels and sub-panels. Although only one panel is shown on the display at a time, the Z Drive's display operates in a menu-driven format.



Main Menu Panel (Overview)

*The default value for the drive's Configure Pushbuttons (**CPB**) command is **CPB1**. This fully enables the front panel. **CPBØ** provides you with access to all front panel displays. **CPBØ**, however, will not let you activate any of the menus.*

***OK** is the default message. It indicates that you are in the main menu. Use the up and down pushbuttons to view the menu items in the following order:*

- **OK** Default user message, the home panel
- **TUNE** Tune Menu
- **DISP** Display Menu
- **CMTR** Configure Motor Menu
- **MISC** Miscellaneous Menu

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To choose a menu, press the up and down pushbuttons to display the menu you want. Press **ENTER** to access the sub-panel menu. Each menu is discussed in detail below.

O K	T U N E	D I S P	C M T R	M I S C
Home Panel	P P n n	D V E L	6 0 5	S A V E
	P I n n	D E R R	6 0 6	R F S
	P D n n	D C A	6 1 0	B R m m
	T G n n		6 2 0	A D p p
	V P n n		6 3 0	FOLL/NTFL
	V I n n		6 3 5	SEQU
	V F n n		6 4 0	REV#
			8 0 5	JOG
			8 0 6	
			8 1 0	
			8 2 0	
			8 3 0	
			8 4 0	
			9 1 0	
			9 2 0	
			9 3 0	
			9 4 0	
			F M C A	

Main Menu Panel for a Z Series System (Overview)

Pressing the **UP** and **DOWN** pushbuttons at the same time will return the display to the Home panel, regardless of the sub-menu that you are currently using. If you do not press any pushbuttons for several seconds, the display will also return to the home panel.

If an error message is scrolling when the front panel is accessed, the scrolling will be interrupted. When no pushbutton is pressed for several seconds, the scrolling message will return.

If you hold a pushbutton, the selected feature will repeat automatically. If you hold a pushbutton for several seconds, the selected feature will repeat automatically at an accelerated pace. To reset the drive, press the **UP**, **DOWN**, and **ENTER** pushbuttons together (works like the Reset [**Z**] command).

TUNE Menu

Select the **TUNE** menu to adjust the system gains for optimum performance. ***The drive is factory-configured for typical user loads. Hence, many applications do not require tuning***. The following gains are available.

- ❏ **PPnn** Position Proportional Gain
- ❏ **PInn** Position Integral Gain
- ❏ **PDnn** Position Derivative Gain
- ❏ **TGnn** Tachometer Gain
- ❏ **VPnn** Velocity Proportional Gain
- ❏ **VInn** Velocity Integral Gain
- ❏ **VFnn** Velocity Feed-forward Gain

The variable **nn** represents a percentage ranging from **00** to **99**. Use the **UP** and **DOWN** pushbuttons to locate the desired gain parameter on the display panel. To change the gain value, press and hold the **ENTER** pushbutton while using the **UP** or **DOWN** pushbuttons to increase or decrease the gain. When the desired value is reached, release the **UP** or **DOWN** pushbutton and the **ENTER** pushbutton. After you modify the gain, you can now change another gain or press the **UP** and **DOWN** pushbuttons together to return to the main menu. *To change the maximum gain values, you must use a terminal and communicate via RS-232C.*

DISP Menu

Select the **DISP** menu to display drive parameters on the front panel. To review the respective numerical values, press the **ENTER** pushbutton. The following parameters are may be displayed:

- ❏ **DVEL** Display Actual Shaft Velocity in rpm
- ❏ **DERR** Display Position error in steps (-999 to +999)
- ❏ **DCA** Display Average Current X 100 (0234=2.34 amps)

☞ ***Helpful Hint:*** To return to the Main menu, press **UP** and **DOWN** simultaneously.

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CMTR Menu

Select the **CMTR** menu to configure the motor type (**CMTR** command). The following choices are available:

❑ 605	❑ 805	❑ 910
❑ 606	❑ 806	❑ 920
❑ 610	❑ 810	❑ 930
❑ 620	❑ 820	❑ 940
❑ 630	❑ 830	❑ FMCA: Find Motor Commutation Angle
❑ 635	❑ 840	
❑ 640		

To select a motor size, locating the desired motor size with the up and down pushbuttons and press the **ENTER** pushbutton. The preset motor size is designated by an asterisk. Changing motor sizes also changes some of the tuning parameters. The drive has been configured at the factory for the motor type that you ordered. *If you change motor sizes, be sure to enter the proper **CMTR** value.*

> ***WARNING***
> Disconnect the load prior to re-commutating the motor. System damage and/or personal injury can occur during re-commutation if the load is attached.

This command recalculates the mechanical offset between the rotor poles and the stator poles. The offset is factory-set to zero, but you can recalibrate the offset if you select the **FMCA** panel and press the **ENTER** pushbutton to select the **FMCA** command. This command locates the rotor magnets relative to the stator windings and allows you to properly commutate the motor. *All of Compumotor's resolvers are pre-aligned to the rotors at the factory, so this procedure is not usually necessary.*

MISC Menu

Selecting the **MISC** menu allows you to perform a variety of functions. The following section explains the submenu choices and their functions.

SAVE Saves the servo tuning parameters to battery-backed RAM. To use, press the **ENTER** pushbutton. ***SV*** will be displayed when this function is executed.

RFS This option returns all servo parameters to factory settings. To use this command, press the **ENTER** pushbutton. **FSET** will be displayed after the command is executed.

BRnn This option allows you to change the baud rate (**mm** = 03, 06, 12, 24, 48, and 96—these values represent baud rates 300, 600, 1200, 2400, 4800, and 9600 respectively). To change the baud rate, press the **ENTER** and **UP** or **DOWN** pushbuttons simultaneously (as appropriate).

ADpp This option allows you to change the device address (**pp** represents a device address from 01 to 99). To change the device address, press the **ENTER** and **UP** or **DOWN** pushbuttons simultaneously (as appropriate).

REV# When you press the **ENTER** pushbutton, this menu displays the current microprocessor and DSP software revision levels (respectively).

Tuning in Different Modes of Operation

The Z Drive has three modes of operation.

- ❑ Position Mode
- ❑ Velocity Mode
- ❑ Torque Mode

Each mode of operation has a unique tuning procedure.

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Position Mode

Position mode (**CZM1**) is the default operating mode of the Z Drive. The Z Drive interprets incoming Step/Direction pulses as position commands. A constant step rate represents constant velocity, and an increasing (decreasing) step rate represents acceleration (deceleration).

☞ ***Helpful Hint:*** Position Mode Tuning Procedure

Use the following steps to tune the Z Drive in Position mode.

Step ① Set motor resolution to the proper number of steps/rev you desire (refer to **CMR** command in *Chapter ⑥ Software Reference*). The default is 5000 steps/rev.

Step ② Check to make sure the **CMTR** command reports back the actual motor you are using. If it is wrong, change it with the **CMTR** command (refer to *Chapter ⑥ Software Reference*).

Step ③ Attach the load and make your desired move with the default settings. Pay careful attention to the response time, end-of-position overshoot, following error, etc.

Step ④ Vary parameters to improve your performance if needed. Some common performance problems and suggested tuning procedures on how to improve performance are listed below.

Shaft Seems Spongy

Solution Procedure:
① Increase **CPP**
② Increase **CVP**
③ Decrease **CTG**
④ Increase **CPI**

Shaft Oscillates

Solution Procedure:
① Increase **CTG**
② Decrease **CVP**
③ Decrease **CPP**
④ Decrease **CPI**

Shaft Overshoots at End of Move

Solution Procedure:
① Decrease **CPI**
② Increase **CTG**

Shaft Has Too Much Following Error During Move

Solution Procedure:
① Increase **CVF**
② Decrease **CTG**
③ Increase allowable **CPE**

Step ⑤ When performance is acceptable, you can save your gain parameters with a Save (**SV**) command over RS-232C or with the front panel display (press the **ENTER** pushbutton in the SAVE display).

Torque Mode

You can control motor torque directly by running the Z Drive in Torque mode (**CZM2**). The analog voltage input is located on the **I/O[1]** connector. When the terminals are shorted, the Analog+/Analog- input represents no commanded torque. A positive voltage at Analog+ with respect to Analog- represents torque in the CW direction. A negative voltage represents torque in the CCW direction.

☞ ***Helpful Hint:*** If you run the Z Drive in Torque mode, consider the following Torque mode characteristics.

- ❑ All position and velocity control parameters are set to zero when Torque mode is activated.
- ❑ The default setting for analog voltage is 10V it equals the maximum rated continuous current. This parameter can be adjusted to a larger value.

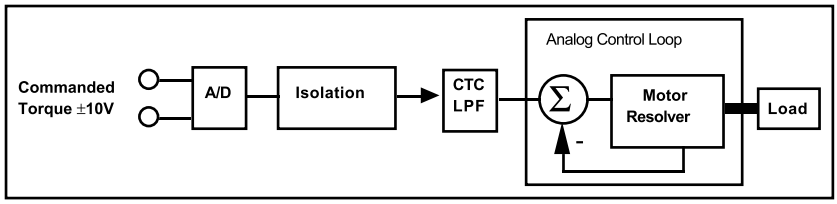
  For example, a Z610 motor has a continuous rated current of 20A. The default value for the Analog Voltage Range (**ANV**) command is 10V = 20A for the Z610 motor. You can enter **ANV40** to change the value to 10V = 40A. However, if you request 40A for more than 3.3 seconds, the drive will shutdown due to excessive average current.

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- ❏ The torque angle is set to 90° for CW torque and -90° for CCW torque. There is some automatic phase advancing done to maintain maximum shaft torque as a function of shaft speed.
- ❏ If the motor creeps at zero commanded torque, use the Analog Voltage Zero (**ANZ**) command to recalibrate the zero commanded torque.

Torque mode operation uses even a smaller part of the servo controller. *There is virtually no tuning in Torque mode.* Only the **CTC** command, which adds additional filtering, can be used.

☞ ***Helpful Hint:***
Active control loop



Torque Mode Tuning

There are three additional commands that facilitate Torque mode.

- ❏ The Analog Voltage Range (**ANV**) command
- ❏ The Analog Zero (**ANZ**) command
- ❏ The Analog Deadband (**ANDB**) command

ANV: Analog Voltage Range

This command sets the relationship between the analog voltage and the commanded torque. The default **ANV** setting is such that +1ØV is equivalent to the maximum continuous CW torque and -1ØV is equivalent to the maximum continuous CCW torque. This scaling factor can be changed such that +1ØV equates to the maximum peak CW torque, however, be aware that you can only command peak torque for 4.Ø seconds before the drive faults.

ANZ: Analog Zero

You can use **ANZ** command to subtract any offset voltage that may be causing the motor to creep at zero commanded torque (ØV). This command can also be used to operate the drive from ØV - 1ØV. You can set the the input voltage to 5V, issue the **ANZ** command, and 5V - 1ØV will correspond to CW torque and Ø - 5V as CCW torque (-1ØV to ØV will also be interpreted as CCW torque).

ANDB: Analog Deadband

The **ANDB**command sets the deadband window around zero commanded torque. If the motor oscillates, significant noise may be coupled on the analog input lines. Follow recommended noise immunity practices (proper grounding, twisted pair of control wires, etc.). If the motor still creeps, you can set the deadband window in units of tens of mV. An **ANDB.1** command will require a signal of at least 100mV to be interpreted as a torque command. Normally, this deadband window is centered around 0V; however, in the case above where **ANZ** positioned the zero torque command at 5V, **ANDB** will center around 5V.

Velocity Mode

You can control motor velocity by running the Z Drive in Velocity mode (**CZM3**). In Velocity mode, the drive accepts a ±10V analog signal that represents commanded motor velocity. The analog voltage input is located on the **I/O[1]** connector. When the terminals are shorted, the Analog+/Analog- input represents no commanded velocity. A positive voltage at Analog+ with respect to Analog- represents velocity in the CW direction. A negative voltage represents velocity in the CCW direction.

In Velocity mode, you command an analog voltage between ±10V representing velocity. This signal is digitized and compared to the actual velocity of the shaft. The resolution of the signal is ±1.7 rpm. There are three additional commands that facilitate the use of Velocity mode.

- ❏ The Analog Voltage Range (**ANV**) command
- ❏ The Analog Zero (**ANZ**) command
- ❏ The Analog Deadband (**ANDB**) command

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ANV: Analog Voltage Range

ANV sets the relationship between the analog voltage and the commanded velocity. The default setting of this command is such that +10V is equivalent to the maximum continuous CW velocity and -10V is equivalent to the maximum continuous CCW velocity. This scaling factor can be changed such that +10V equates to values greater than the maximum continuous velocity.

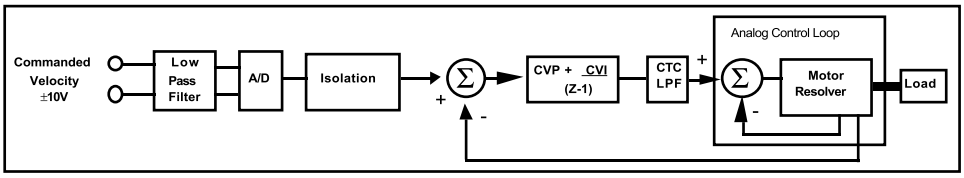
ANZ: Analog Zero

ANZ subtracts any offset voltage that may be causing the motor to creep at zero commanded velocity (0V). This command can also be used to operate the drive from 0 - 10V. You can set the the input voltage to 5V, issue the **ANZ** command, and 5V - 10V will correspond to CW velocity and 0 - 5V as CCW velocity (-10V to 0V will also be interpreted as CCW velocity).

ANDB: Analog Deadband

ANDB sets the deadband window around zero commanded velocity. If the motor oscillates, significant noise may be coupled on the analog input lines. Follow recommended noise immunity practices (proper grounding, twisted pair of control wires, etc.). If the motor still creeps, you can set the deadband window in units of 10's of mV. An **ANDB.1** command will require a signal of at least 100 mV to be interpreted as a velocity command. Normally, this deadband window is centered around 0V; however, in the case above where **ANZ** positioned the zero velocity command at 5V, **ANDB** will center around 5V.

☞ ***Helpful Hint:***
Velocity mode uses a smaller part of the servo controller.



Velocity Mode Tuning

The following gains affect shaft performance in Velocity mode:

CVP: Configure Velocity Loop Proportional Gain

This command directly reflects the *stiffness* of the system. Generally, you want this gain as high as possible without causing the system to oscillate.

CVI: Configure Velocity Loop Integral Gain

This command will tend to zero out any velocity error. It will also increase the shaft stiffness.

CTG: Configure Tach Gain

This term is automatically set to 1 in the controller.

CTC: Configure Torque Time Constant

CTC filters the output response of the digital controller. The motor current is *commutated* every 100 µs and the velocity servo loop is updated every 500 µs. In between each servo update, the current commands use an average torque value. The default is set to 500 µs (**CTC5**). This effectively low-pass filters the torque command signal with a -3dB frequency of 2000 Hz. You can change this value so that the low-pass filter frequency can be made lower. This will lower the drive's bandwidth. ***This command is most applicable when used with Velocity and Torque modes***.

☞ ***Helpful Hint:***
Velocity Mode Tuning Procedure

Use the following steps to tune the Z Drive in Velocity mode.

Step ①

Set motor resolution to proper number of steps/rev. The default is 5,000 steps/rev.

Step ②

Check to make sure the **CMTR** command reports back the actual motor you are using. If it is wrong, change it with the **CMTR** command (Refer to *Chapter ⑥ Software Reference*).

Step ③

Attach load and make your desired move with the default settings. Pay attention to the response time, velocity overshoot, following error etc.

Step ④

Issue a **DSP** command and repeat your move.

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Step ⑤ Connect an oscilloscope to the Analog Monitor output. Be sure that the **SSR** command is set to **Ø** so that the motor velocity will be sent to the motor Analog Monitor terminals.

Step ⑥ Vary parameters to improve performance if needed. Sample performance problems and suggested tuning procedures to resolve them are listed below.

System Seems Too Spongy

Solution Procedure:
① Increase **CVP**
② Increase **CVI**

Shaft Oscillates

Shaft Oscillates

Solution Procedure:
① Decrease **CVP**
② Decrease **CVI**
③ Increase **CTC**

Motor Creeps with Zero Voltage (ØV)

Solution Procedure:
① Issue an **ANZ** command
② Increase **ANDB**

Slow-Speed Performance Rough

Solution Procedure:
① Decrease **ANV**
② Increase **CVP**

Step ⑦ When performance is acceptable, you can save your gain parameters with a Save (**SV**) command or with the front panel display (press the **ENTER** pushbutton in the SAVE display).

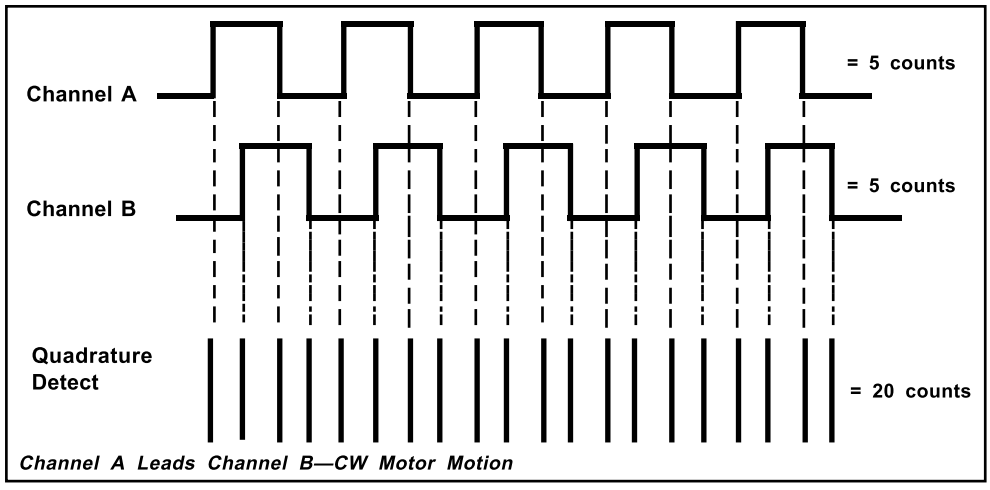
Pseudo-Quadrature Outputs

The Z Drive's pseudo-quadrature outputs are located on screw terminal **I/O[1]**. These quadrature outputs are called ***pseudo*** because they are hardware-derived from resolver information and not from an actual encoder. The resolution is 1024 counts per revolution—pre-quadrature or 4096 counts per revolution—post-quadrature. Three signals constitute the pseudo-quadrature outputs:

- ❏ Channel A (CHA)
- ❏ Channel B (CHB)
- ❏ Channel Z (CHZ)

Channels A and B produce two square waves that are 90 electrical degrees apart. The position of the motor shaft can be determined by counting pulses. Direction can determined by comparing the phase shift of Channel A relative to Channel B (e.g., if Channel A leads Channel B, the motor shaft is moving CW).

☞ ***Helpful Hint:*** Many Compumotor indexers and controllers have a quadrature detect circuit that can enhance motor resolution. By monitoring the rising and falling edges of CHA and CHB, each pulse is equivalent to four counts. In this way, the 1024 counts are translated into 4096 counts.



Quadrature Detection

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The Z Channel, or marker, provides a reference pulse once per revolution. The Z marker will appear at the same time as the **DPR** (Display Position Resolver) command shows the resolver information changing from ØØØØØ to 65535 or vice versa.

The quadrature outputs are true differential or complementary outputs. The use of complementary outputs increases the system's noise immunity. When Channel A+ (CHA+) goes high, Channel A- (CHA-) goes low, and vice versa.

With all servo drives, the motor shaft position may be changing ±1 or more resolver counts, even when the shaft appears still. If the drive is servoing around the roll-over point of the resolver data, the Z pulse will appear each time the data goes from ØØØØØ to 65535 or from 65535 to ØØØØØ.

*The pseudo-quadrature outputs are derived from the resolver's digital information. Using automatic resolver resolution switching (refer to the Configure Resolver Resolution (**CRR**) command in Chapter ⑥ Software Reference) will cause errors in the quadrature outputs when the resolver's resolution is changed.*

*If you will be accelerating through any resolver switching points, use a fixed resolver resolution (e.g., **CRR12**) to get correct quadrature outputs.*

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C H A P T E R ⑤

Z Series Shunt Regulator

The information in this chapter will enable you to:

- ❏ Understand the shunt regulator's purpose
- ❏ Install the shunt regulator
- ❏ Use this chapter as a quick reference for shunt regulator specifications

What Is A Shunt Regulator?

The Z Shunt Regulator is an option for the Z600, Z800, and Z900 series motor/drives. Two versions of the Z Shunt Regulator are available.

- ❏ The ZSR-400W version dissipates 400 watts
- ❏ The ZSR-800W version dissipates 800 watts

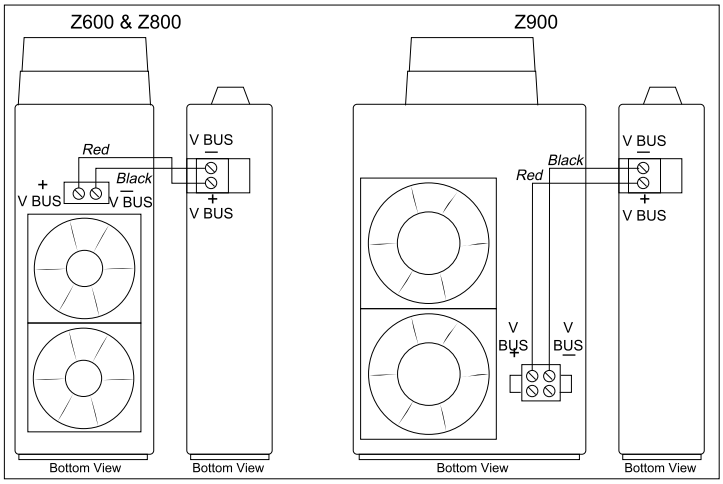
☞ ***Helpful Hint:***
The Z Shunt Regulator is designed to operate from 0°C - 50°C and dump power at a voltage level of 365VDC

Compumotor recommends that you use this option if your load reflects more energy than the Z Drive can absorb. This typically happens when the drive is decelerating a large inertial load with little or no friction. In this situation, the Z Drive will fault with error code **Ø4** (Drive Overvoltage). The shunt regulator dissipates the reflected energy (heat).

Shunt Regulator Installation

① Make sure that power is off before proceeding with this procedure.
② Connect V BUS(+) on the Z Drive to V BUS(+) on the shunt regulator.
③ Connect V BUS(-) on the Z Drive to V BUS(-) on the shunt regulator.

☞ ***Helpful Hint:***
For best performance, the shunt regulator should be as close to the Z Drive as possible. Use 12 AWG, twisted pair wires (20A - 30A @ 350VDC pulsed) to connect the terminals. The wire should be no longer than 2'.

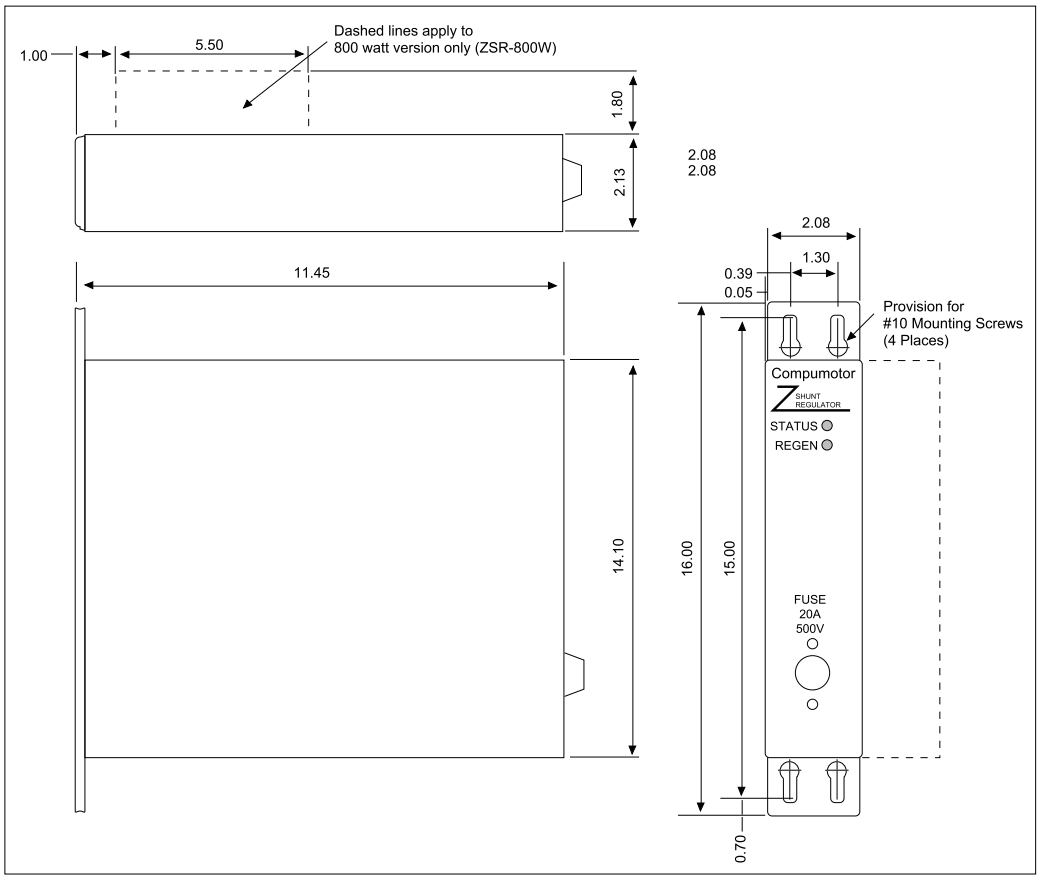


Shunt Regulator Installation

④ Mount the shunt regulator so air flows from the bottom to the top of the unit.
⑤ Apply power to the Z Drive.

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☞ ***Helpful Hint:***
If the shunt regulator is properly configured, the unit's status LED will be illuminated. When the units is power dumping, the yellow **REGEN** LED will be illuminated. When power is removed from the Z Drive, the **STATUS** LED will remain on until the bus voltage drops to approximately 60V.



Z Series Shunt Regulator Dimensions

As the motor decelerates the load, the voltage on the DC bus inside the Z Drive increases as the energy is reflected to the drive from the load. The capacitors inside the drive store energy; however, the capacitors' storage capacity is limited. If the energy in the system exceeds the capacitors' storage capacity, the excess energy must be dumped into a shunt regulator. Shunt regulators dump excess energy into resistors. If the bus voltage in the Z Drive rises above 365VDC, **Overvoltage Warning #03** occurs. At a bus voltage of 405VDC the drive faults with an **Overvoltage Fault #04**. A shunt regulator can eliminate these conditions.

Selecting a Z Series Shunt Regulator

To determine which shunt regulator is appropriate for your system, complete the following steps.

① Determine how much energy is in the mechanical system. Use the following equation:

$Mech_{energy}$ (Joules) $= \frac{1}{2} J\ \omega^2$: Where J is the *system* inertia in Kg-m^2 and ω is the maximum motor velocity in radians/sec.

② Determine if the Z Drive capacitors can absorb the mechanical system's energy. Use the following equation depending on the Z Drive type:

$Elec_{energy}$ (Joules) $= \frac{1}{2} C\ V^2$: where C is the capacitance of the Z Drive in Farads. In the Z600s and Z800s, C = 4200µF and in the Z900s, C = 8400µF. The V that you use to calculate the energy the drive can absorb is the maximum Z Drive voltage (405VDC) for ELEC/ENERGY1 and the AC line voltage • $\sqrt{2}$ for ELEC/ENERGY2. The absorption capability = ELEC/ENERGY1 — ELEC/ENERGY2

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☞ ***Helpful Hint:***
Capacitor Energy Absorption Calculation

Line voltage is 208VAC applied to a Z620

$$\Delta \text{ ELEC/ENERGY1} = \text{ELEC/ENERGY1} - \text{ELEC/ENERGY2}$$

$$= \frac{1}{2} C (405)^2 - \frac{1}{2} C (208 \cdot \sqrt{2})^2$$

$$= \frac{1}{2} (0.0042) [405^2 - (208 \cdot \sqrt{2})^2]$$

$$= 0.0021 (164{,}025\text{-}86{,}528)$$

$$= 162.7 \text{ Joules}$$

If the amount of mechanical energy in the system is less than the amount of electrical energy that the Z Drive can store, you do not need a shunt regulator. You may run your load at any velocity and decelerate at any rate to a stop without causing an overvoltage fault.

☞ ***Helpful Hint:***
Fast decelerations require more power to be dumped than slow decelerations.

If the system's mechanical energy exceeds the amount that can be absorbed, a shunt regulator may be required. There are several losses in the system that help lower the amount of energy the drive needs to absorb. Friction, drive inefficiencies and I^2R losses in the motor are some examples. These losses can skew your ability to determine whether or not a shunt regulator is needed (if your calculations indicate that there is more mechanical energy than electrical energy in the system). If, however, the mechanical energy exceeds the electrical energy that can be absorbed and you want to decelerate the load quickly, you will need a regulator. To select the proper regulator (400W or 800W), additional calculations must be made. Determine the amount of power (not energy) that must be dumped. The power that must be dissipated increases as deceleration time decreases (assuming the same load and peak velocity for the move). Since the average power is the change in energy over time, and the energy in this example is fixed, the only variable is time.

☞ ***Helpful Hint:***
To calculate the time required to decelerate, use the following equation:

$$\text{Time}_{\text{decel}} \text{ (Seconds)} = \frac{(V_{\text{init}} - V_{\text{final}})}{\text{Decel rate}}$$

Where V is in revs/sec and decel rate is in revs/sec^2

The shunt regulator for a 240V Z Drive is only active when the bus voltage exceeds 365VDC. The Z Drive absorbs some energy before the shunt becomes active and continues to absorb energy if the bus voltage continues to climb while the regulator is active. Therefore, the amount of electrical energy that the drive can absorb from the mechanical system should be subtracted before calculating the power that must be dumped. For a Z600 or Z800 operating at 240VAC input, subtract 102 joules. For a Z900 at 240VAC, subtract 204 joules. The calculation for a Z600 is shown below:

$$\text{Elec}_{\text{energy}} = \frac{1}{2} (0.0042)[405^2 - (240 * \sqrt{2})^2] = 102 \text{ Joules}$$

Now divide the mechanical energy by the decel time to get the average power in joules that will dissipate over the linear deceleration portion of the move.

$$\text{Power}_{\text{avg}} = \frac{\text{Mech}_{\text{energy}}}{\text{Time}_{\text{decel}}}$$

$$\text{Power}_{\text{peak}} = \text{Power}_{\text{avg}} \cdot 2$$

☞ ***Helpful Hint:***
For moves with a *linear deceleration ramp*, peak power is twice the average power.

The shunt regulator chosen must be able to dump the **peak** power of the move. If the peak power is too high, lower the deceleration rate or the move velocity. A lower velocity will reduce the stored mechanical energy in the system.

The table below indicates the maximum load-to-rotor inertia ratio for the various motor sizes that you can have without requiring a shunt regulator. These calculations are based on the motors being operated at rated speed and an input power of 240V to the Z Drive. The assumption is that there are no losses in the drive or motor. These numbers are conservative.

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Motor	Rated Speed	Load:Rotor Inertia Ratio
605	103.33	3.9:1
606	60.00	7.3:1
610	116.67	0.52:1
620	61.67	1.1:1
630	41.67	2.2:1
635	50.00	1.0:1.0

Motor	Rated Speed	Load:Rotor Inertia Ratio
640	26.67	2.6:1
910	83.33	0.61:1
920	52.5	0.86:1
930	38.33	1.34:1
940	25.00	0.98:1

As long as the load to rotor inertia ratio is equal to or less than what is in the table, you may run at any velocity and use any deceleration rate ($0<decel<\infty$) to stop the load without getting an over voltage **fault** on the drive. If your inertia ratio is greater than the listing, you will have to limit either your deceleration rate or lower the rotor speed. The greater the inertial mismatch, the lower the allowable deceleration rate or velocity.

The table below gives the maximum load-to-rotor-inertia ratio you can use having an infinite deceleration rate without a shunt regulator at various percentages of the rated motor velocity. Again, these numbers are based on 240VAC input power to the Z Drive. Losses are not accounted for, so the numbers are conservative.

Motor	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
605	3.91	5.06	6.68	9.02	12.64	18.65	29.70	53.58	121.80	490.21
606	7.39	9.36	12.11	16.13	22.31	32.57	51.46	92.25	208.82	838.28
610	0.53	0.89	1.39	2.12	3.24	5.11	8.55	15.98	37.20	151.79
620	1.09	1.59	2.27	3.27	4.82	7.38	12.09	22.27	51.35	208.41
630	2.24	3.00	4.06	5.61	8.00	11.96	19.24	34.99	79.98	322.90
635	1.0	2.48	3.10	4.10	5.60	8.00	12.58	22.4	50.3	201.3
640	2.61	3.46	4.64	6.37	9.03	13.45	21.57	39.13	89.29	360.18
910	0.62	1.00	1.53	2.31	3.50	5.48	9.12	16.99	39.49	160.95
920	0.86	1.30	1.91	2.80	4.18	6.45	10.65	19.71	45.59	185.37
930	1.34	1.89	2.65	3.77	5.50	8.36	13.62	24.99	57.47	232.89
940	0.99	1.46	2.11	3.06	4.53	6.96	11.43	21.10	48.73	197.92

The table is calculating theoretical maximums. It would be difficult, if not impossible, to tune a servo with inertia mismatches greater than 25:1. If your application is not within the ranges in the table, you may need a shunt regulator.

The tables below show the maximum allowable deceleration rates using different wattage shunt regulators at various speeds and with variable inertia ratios. The calculations do not include any losses in the system (the results are conservative).

The load-to-rotor inertia ratios are on the top row of each table. Each table uses a different wattage shunt regulator. These tables can help determine the right shunt regulator for your application (400W or 800W version).

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Deceleration rates using a 400W Shunt Regulator
Deceleration rates at 100% of rated speed

Motor	RPS	1:1	2:1	3:1	4:1	5:1	6:1	8:1	10:1	15:1	20:1	25:1
605	103.33	∞	∞	∞	6972.4	862.7	459.8	237.7	160.3	88.4	61.0	46.6
606	60.00	∞	∞	∞	∞	∞	∞	1398.9	362.0	126.9	76.9	55.2
610	116.67	707.5	232.2	138.9	99.1	77.0	63.0	46.2	36.4	23.9	17.7	14.1
620	61.67	∞	269.7	129.9	85.5	63.8	50.8	36.1	28.1	18.0	13.2	10.5
630	41.67	∞	∞	328.8	145.7	93.6	69.0	45.2	33.6	20.5	14.7	11.5
635	50	∞	199.2	99.1	65.9	49.4	39.5	28.2	21.9	14.1	10.38	8.21
640	26.67	∞	∞	437.0	130.9	77.0	54.5	34.4	25.2	15.0	10.7	8.3
910	83.33	328.8	93.6	54.6	38.5	29.8	24.2	17.7	13.9	9.1	6.7	5.4
920	52.50	606.1	82.0	44.0	30.1	22.8	18.4	13.3	10.4	6.7	5.0	3.9
930	38.33	∞	126.7	51.6	32.4	23.6	18.6	13.0	10.0	6.4	4.7	3.7
940	25.00	1487.8	46.7	23.7	15.9	12.0	9.6	6.9	5.3	3.4	2.5	2.0

Deceleration rates at 75% of rated speed

Motor	RPS	1:1	2:1	3:1	4:1	5:1	6:1	8:1	10:1	15:1	20:1	25:1
605	77.50	∞	∞	∞	∞	∞	∞	3624.8	555.7	178.3	106.2	75.6
606	45.00	∞	∞	∞	∞	∞	∞	∞	∞	1049.1	208.7	115.8
610	87.50	∞	1471.8	351.0	199.3	139.1	106.9	73.0	55.5	34.6	25.2	19.8
620	46.25	∞	∞	1051.8	253.5	144.1	100.7	62.8	45.6	27.1	19.3	15.0
630	31.25	∞	∞	∞	∞	1147.3	267.6	105.6	65.8	33.9	22.8	17.2
635	37.5	∞	∞	618.0	184.4	108.4	76.7	48.4	35.4	21.2	15.1	11.7
640	20.00	∞	∞	∞	∞	∞	383.9	94.0	53.6	25.8	17.0	12.7
910	62.50	∞	1147.3	151.5	81.1	55.4	42.0	28.4	21.4	13.3	9.6	7.5
920	39.38	∞	∞	175.0	73.4	46.5	34.0	22.1	16.4	9.9	7.1	5.6
930	28.75	∞	∞	∞	130.7	61.4	40.2	23.7	16.8	9.8	6.9	5.3
940	18.75	∞	∞	128.1	42.8	25.7	18.4	11.7	8.6	5.1	3.7	2.9

Deceleration rates at 50% of rated speed

Motor	RPS	1:1	2:1	3:1	4:1	5:1	6:1	8:1	10:1	15:1	20:1	25:1
605	51.67	∞	∞	∞	∞	∞	∞	∞	∞	∞	1258.3	299.9
606	30.00	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
610	58.33	∞	∞	∞	∞	∞	724.2	234.0	139.6	69.5	46.2	34.7
620	30.83	∞	∞	∞	∞	∞	∞	701.2	184.5	64.9	39.4	28.3
630	20.83	∞	∞	∞	∞	∞	∞	∞	∞	164.4	64.0	39.7
635	25.0	∞	∞	∞	∞	∞	∞	412.0	133.3	49.5	30.4	21.9
640	13.33	∞	∞	∞	∞	∞	∞	∞	∞	218.5	55.7	31.9
910	41.67	∞	∞	∞	∞	∞	442.0	101.0	57.0	27.3	17.9	13.4
920	26.25	∞	∞	∞	∞	∞	∞	116.7	52.3	22.0	13.9	10.2
930	19.17	∞	∞	∞	∞	∞	∞	∞	99.6	25.8	14.8	10.4
940	12.50	∞	∞	∞	∞	∞	∞	85.4	30.8	11.9	7.3	5.3

Deceleration rates at 25% of rated speed

Motor	RPS	1:1	2:1	3:1	4:1	5:1	6:1	8:1	10:1	15:1	20:1	25:1
605	25.83	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
606	15.00	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
610	29.17	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	760.3
620	15.42	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
630	10.42	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
635	12.5	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
640	6.67	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
910	20.83	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	1419.0
920	13.13	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
930	9.58	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
940	6.25	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞

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Deceleration rates using an 800W Shunt Regulator
Deceleration rates at 100% of rated speed

Motor	RPS	1:1	2:1	3:1	4:1	5:1	6:1	8:1	10:1	15:1	20:1	25:1
605	103.33	∞	∞	∞	∞	1725.3	919.5	475.4	320.6	176.7	122.0	93.1
606	60.00	∞	∞	∞	∞	∞	∞	2797.7	724.0	253.7	153.8	110.4
610	116.67	1414.9	464.5	277.8	198.2	154.0	126.0	92.3	72.9	47.7	35.5	28.2
620	61.67	∞	539.4	259.7	171.0	127.5	101.6	72.3	56.1	36.0	26.5	20.9
630	41.67	∞	∞	657.6	291.5	187.2	137.9	90.3	67.2	40.9	29.4	23.0
635	50.0	∞	398.6	198.2	131.8	98.8	79.0	56.4	43.9	28.2	20.7	16.4
640	26.67	∞	∞	874.1	261.7	153.9	109.0	68.8	50.3	30.1	21.4	16.7
910	83.33	657.6	187.2	109.2	77.0	59.5	48.5	35.4	27.9	18.2	13.5	10.7
920	52.50	1212.1	164.1	88.0	60.1	45.7	36.8	26.5	20.7	13.4	9.9	7.9
930	38.33	∞	253.3	103.1	64.7	47.2	37.1	26.0	20.0	12.7	9.3	7.3
940	25.00	2975.6	93.4	47.5	31.8	23.9	19.2	13.7	10.7	6.9	5.1	4.0

Deceleration rates at 75% of rated speed

Motor	RPS	1:1	2:1	3:1	4:1	5:1	6:1	8:1	10:1	15:1	20:1	25:1
605	77.50	∞	∞	∞	∞	∞	∞	7249.6	1111.4	356.6	212.4	151.2
606	45.00	∞	∞	∞	∞	∞	∞	∞	∞	2098.3	417.3	231.7
610	87.50	∞	2943.5	702.1	398.6	278.3	213.7	146.0	110.9	69.2	50.3	39.5
620	46.25	∞	∞	2103.6	506.9	288.2	201.3	125.6	91.3	54.2	38.6	29.9
630	31.25	∞	∞	∞	∞	2294.5	535.2	211.2	131.6	67.7	45.6	34.4
635	37.5	∞	∞	1236.0	368.8	216.7	153.5	96.9	70.8	42.3	30.1	23.4
640	20.00	∞	∞	∞	∞	∞	767.8	188.1	107.2	51.6	34.0	25.4
910	62.50	∞	2294.5	302.9	162.2	110.7	84.1	56.7	42.8	26.5	19.2	15.1
920	39.38	∞	∞	350.1	146.9	92.9	68.0	44.2	32.8	19.9	14.3	11.1
930	28.75	∞	∞	∞	261.4	122.9	80.3	47.4	33.7	19.5	13.7	10.6
940	18.75	∞	∞	256.1	85.6	51.4	36.7	23.4	17.1	10.3	7.3	5.7

Deceleration rates at 50% of rated speed

Motor	RPS	1:1	2:1	3:1	4:1	5:1	6:1	8:1	10:1	15:1	20:1	25:1
605	51.67	∞	∞	∞	∞	∞	∞	∞	∞	∞	2516.6	599.8
606	30.00	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
610	58.33	∞	∞	∞	∞	∞	1448.5	468.0	279.1	138.9	92.5	69.3
620	30.83	∞	∞	∞	∞	∞	∞	1402.4	369.1	129.9	78.8	56.6
630	20.83	∞	∞	∞	∞	∞	∞	∞	∞	328.8	127.9	79.4
635	25.0	∞	∞	∞	∞	∞	∞	824.0	266.7	99.1	60.9	43.9
640	13.33	∞	∞	∞	∞	∞	∞	∞	∞	437.0	111.4	63.8
910	41.67	∞	∞	∞	∞	∞	884.0	202.0	114.0	54.6	35.9	26.7
920	26.25	∞	∞	∞	∞	∞	∞	233.4	104.7	44.0	27.9	20.4
930	19.17	∞	∞	∞	∞	∞	∞	∞	199.2	51.6	29.6	20.8
940	12.50	∞	∞	∞	∞	∞	∞	170.8	61.6	23.7	14.7	10.6

Deceleration rates at 25% of rated speed

Motor	RPS	1:1	2:1	3:1	4:1	5:1	6:1	8:1	10:1	15:1	20:1	25:1
605	25.83	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
606	15.00	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
610	29.17	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	1520.6
620	15.42	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
630	10.42	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
635	12.5	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
640	6.67	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
910	20.83	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	2837.9
920	13.13	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
930	9.58	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞
940	6.25	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞	∞

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C H A P T E R ⑥

Software Reference

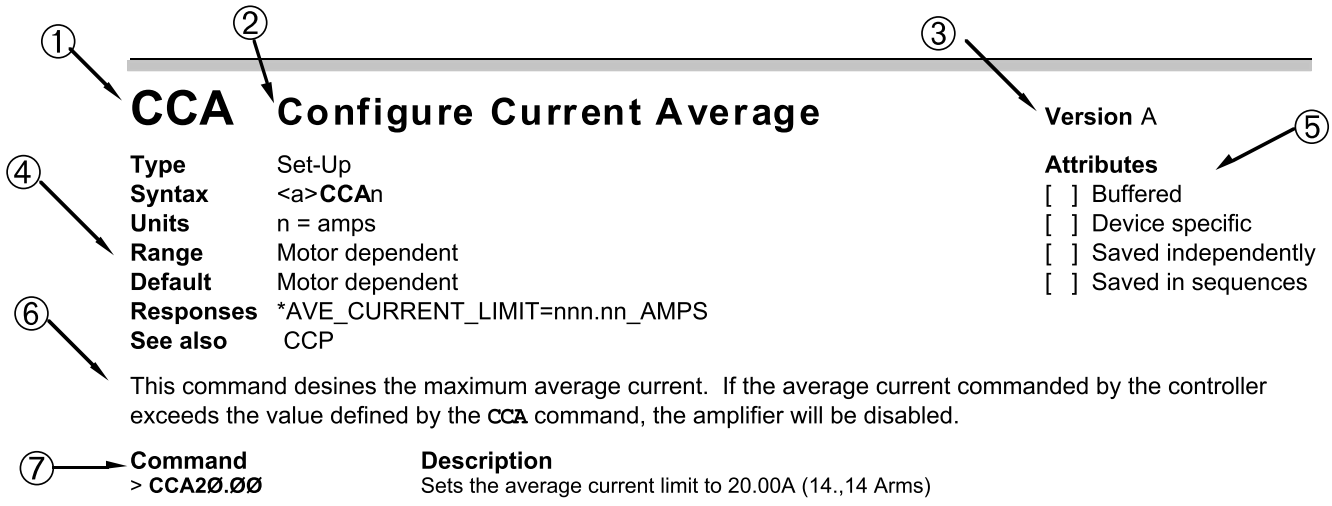
The information in this chapter will enable you to:

- ❏ Understand the Z Drive's command language
- ❏ Use this chapter as a reference for the function, range, default, and sample use of each command

The Z Drive has more than 40 software commands that you can use to tune the drive, define various parameters, and display drive variables. All commands are sent to the drive over the RS-232C serial interface. Any terminal or computer that has an RS-232C port can communicate with the Z Drive. *Chapter ③ Installation* explains the configuration of the RS-232C port. *Chapter ⑧ Maintenance & Troubleshooting*, offers guidelines to help you resolve communications problems.

Command Format Description

The following section describes the format of the command descriptions used in this chapter. The numbered arrows refer to the numbered sections below the drawing.



① Command Identifier

The letter or letters used to represent the command.

② Command Name

This name used to refer to the command. For example, Acceleration for the `A` command.

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③ Version

The revision of software in the Z Drive when the described command was first introduced or last modified. If the revision level of the software you are using is equal to or greater than the revision level listed here, the command is available in your unit. You can determine the level of software in your Z Drive by issuing the Revision Level (**RV**) command.

④ Characteristics

The following sections describe the main characteristics of the command.

Type

This portion of the box contains the command's type. The four command types are listed below.

Set-Up These commands define Set-Up conditions for the application. Set-Up commands include the following types of commands:

- ❏ Homing (go home acceleration and velocity, etc.)
- ❏ Input/Output (limits, scan time, in-position time, etc.)
- ❏ Tuning (servo or position tracking)
- ❏ General (set switches, return to factory settings, etc.)

Programming Programming commands affect programming and program flow. For example, trigger, output, all sequence commands, quote, time delays, pause and continue, enable and front-panel, loop and end loop, line feed, carriage return, and backspace.

Status Status commands respond (report back) information.

Motion Motion commands affect motor motion (for example, acceleration, velocity, distance, go home, stop, direction, mode, etc.)

Syntax

This field shows the syntax for the command. Z Drive commands use the following generic syntax: **acspd**.

Variable **a**	This variable is the device address. If the address is optional it is shown in angle brackets: **<d>**. Only commands which require the Z Drive to send a response require a device address. All commands may use a device address to designate which unit on a daisy chain the command is intended for.
Variable **c**	This variable is the command identifier, which is one or more letters.
Variable **s**	This variable represents a sign. A sign is not allowed for all commands. The **s** is not shown in the syntax if not allowed.
Variable **p**	This variable represents the parameters the command requires. There may be zero or more parameters. If the number of parameters is zero **n** is not shown in the syntax
Variable **d**	This variable is the end of command delimiter. This is always required and is not shown in the following descriptions for clarity. The delimiter may be a space character or a carriage return.

Units

This field describes what unit of measurement the parameter in the command syntax represents.

Range

This is the range of valid values that you can specify for **n** (or any other parameter specified).

Default

The default setting for the command is shown in this box. A command will perform its function with the default setting if you do not provide a value.

Response

The response to the command is shown in this box. Status commands report a condition in the indexer. Status commands do not affect the status they read.

Commands that set parameters report the parameters when the command is issued without a parameter. For example, **A1ØØ** sets the acceleration to 100 rps, but **1A** returns the current setting. ***Note**: To receive a response, a device address is required.*

See Also

Commands that are related or similar to the command described are listed here.

⑤ Attributes

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Each command has attributes as shown below.

Attributes
[X] Buffered
[ ] Device specific
[X] Independently saved
[ ] Saved in sequences

Buffered

If the Buffered box is checked the command is buffered. If it is not checked the command is acted on immediately. Buffered commands are executed in the order they are received. An internal buffer, or storage area, holds the commands in a queue until the previous command has been executed.

Immediate commands are executed as they are received. Immediate commands are executed even if the command buffer has commands in it. For example, the Stop (**S**) command is immediate. When a Stop command is received the motor is stopped as soon as the command is received. The Z Drive does not process the commands in its command buffer before stopping the motor.

Device Specific

If the Device specific box is checked the command requires a device identifier. If it is not checked the command may be used with or without a device identifier. Commands which are device specific are normally Status commands. Device specific commands have a syntax description with a `d` by itself before the command. If it is not device specific the command syntax description has a **<d>** in angle brackets before the command.

Saved Always

If the Independently saved box is checked the parameter controlled by the command is always saved. This differs from commands which may only be saved in sequences and those which are never saved. If neither the Saved always nor the Saved in sequences box is checked the command is never saved.

Saved In Sequences

If the Saved in sequences box is checked the command will be saved only if it is in a sequence and you issue the Save command (**SV**). If neither the Saved always nor the Saved in sequences box is checked the command is never saved.

⑥ Description

A description of the command appears in this area along with any special considerations you should know about.

⑦ Example

An example of how to use the command appears in this area. The left column contains the commands you would issue to the Z Drive. The right column contains descriptions of what the commands do in the program.

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Command List

Command	*Tuning Commands*
CPD	Configure Position Derivative
CPDM	Configure Position Derivative Maximum
CPI	Configure Position Integral
CPIM	Configure Position Integral Maximum
CPP	Configure Position Proportional
CPPM	Configure Position Proportional Maximum
CTC	Configure Time Constant
CTG	Configure Tach Gain
CTGM	Configure Tach Gain Maximum
CVF	Configure Velocity Feed-Forward
CVFM	Configure Velocity Feed-Forward Maximum
CVI	Configure Velocity Integral
CVIM	Configure Velocity Integral Maximum
CVP	Configure Velocity Proportional
CVPM	Configure Velocity Proportional Maximum

Command	*Drive Commands*
CCA	Configure Current Average
CCP	Configure Current Peak
CDB	Configure Deadband
CIP	Configure In Position
CMR	Configure Motor Resolution
CMV	Configure Max. Velocity (Torque Mode)
CMTR	Configure Motor Type
CPE	Configure Position Error
CRR	Configure Resolver Resolution
CVE	Configure Velocity Error

Command	*Display Commands*
DCA	Display Current Average
DCI	Display Current Instantaneous
DCP	Display Current Peak
DDI	Display Drive Information
DPA	Display Position Actual
DPE	Display Position Error
DPR	Display Position Resolver
DPS	Display Position Setpoint
DSP	Display Servo Picture
DVA	Display Velocity Actual
DVE	Display Velocity Error
DVS	Display Velocity Setpoint

Command	*Miscellaneous Commands*
CPB	Configure Pushbuttons
CZM	Configure Z Drive Mode
DISP'	Front Panel Display
E	Enable Communications Interface
F	Disable Communications Interface
FMCA	Find Motor Commutation Angle
^H	Backspace
HELP	Help
OFF	Amplifier Off
ON	Amplifier On
OUT	Real Time Output Control
RFS	Return to Factory Settings
RSE	Report Servo Errors
RV	Revision Level
SS	Set-up Status Report
SSA	RS-232C Echo Control
SSI	Interactive Mode Control
SSM	Direction Input Polarity Control
SSR	Analog Output Control
SSU	Set Warning Display Mode
SV	Save
Z	Reset

Command	*Analog Voltage Commands*
ANDB	Analog Voltage Deadband
ANG	Analog Voltage Gain
ANV	Analog Voltage Range
ANZ	Analog Voltage Zero

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ANDB Analog Voltage Deadband

Version A

Type Set-Up
Syntax <a>**ANDB**n
Units n = volts
Range 0.00 - 1.00
Default 0.00
Response *ANALOG_DEADBAND=nnn.nn_VOLTS
See also ANV, ANZ

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

ANDB defines the maximum analog voltage deadband that the Z Drive will allow without commanding torque to the motor. This voltage should normally be zero to allow for the greatest command accuracy. If your application requires zero velocity drift, a deadband may be required.

Command	Description
> **ANDBØ.1Ø**	Sets the analog deadband to 100 mV

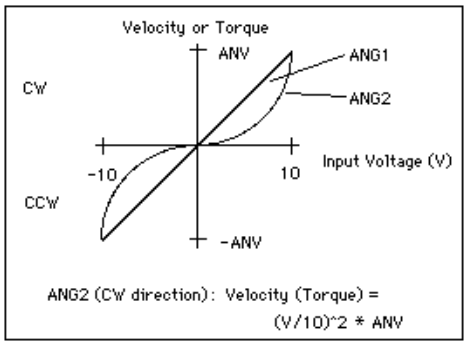
ANG Analog Voltage Gain

Version C

Type Set-Up
Syntax <a>**ANG**n
Units n = mode
Range 1 or 2
Default 1
1
Response *ANALOG_GAIN=1
See also ANV

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command offers two different analog input voltage to desired velocity (or torque) relationships. **ANG1** use a linear function (see **ANV** command). **ANG2** uses a parabolic function (refer to the following figure).



ANG Graphical Relationship

ANV Analog Voltage Range

Version A

Type Set-Up
Syntax <a>**ANV**n
Units n = rpm or amp
Range Motor dependent
Default Motor dependent
Response *10V_ANALOG=nnnnn_RPM
*10V_ANALOG=nn.nn_AMPS
See also ANDB, ANZ, CZM, ANG

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the ratio between the input voltage range and the commanded velocity or torque. Once the **ANV** value is specified, the desired speed or torque is calculated as follows (assuming **ANG** = 1):

$$\text{Desired speed or torque} = \left(\frac{\text{Input voltage}}{10\text{V}}\right) * \textbf{ANV Setting}$$

First, verify the drive's the operational mode. Use the Configure Z Drive Mode (**CZM**) command before using **ANV**. While in Velocity mode (**CZM3**) the **ANV** default is set so that 10V equals the rated speed of the motor. While in Torque mode (**CZM2**), the **ANV** default is set so that 10V equals the rated continuous torque of the motor. The value can be set as high as the peak allowable torque. If an application requires greater analog input resolution for low speeds or low torques, use **ANV** to set 10V equal to a lower speed or torque value.

Command	Description
> **CZM3**	Sets the Z Drive to velocity mode
> **ANV1ØØØ**	Sets 10V analog input equal to 1,000 rpm

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ANZ Analog Voltage Zero

Version A

Type Set-Up
Syntax <a>**ANZ**
Units None
Range None
Default None
Response None
See also ANV, ANDB

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command executes the Analog Auto Zero feature. Execute this command to set the current voltage level to represent 0V. This command is used to remove the DC offset out of the commanded velocity (or torque). If this command is not used, a small offset in the servo controller will cause the motor to creep.

Command	Description
> **ANZ**	Defines the analog input value as 0V

CCA Configure Current Average

Version A

Type Set-Up
Syntax <a>**CCA**n
Units n = amperes
Range Motor and Drive dependent
Default Motor dependent
Response *AVE_CURRENT_LIMIT=nnn.nn_AMPS
See also CCP

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the maximum average current. If the average current commanded by the controller exceeds the value defined by **CCA** command, the amplifier will be disabled.

Command	Description
> **CCA2Ø.ØØ**	Sets the average current limit to 20.00A (14.14 Arms)

CCP Configure Current Peak

Version A

Type Set-Up
Syntax <a>**CCP**n
Units n = amperes
Range Motor and Drive dependent
Default Motor dependent
Response *PEAK_CURRENT_LIMIT=nnn.nn_AMPS
See also CCA

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the maximum peak current that will be sent to the motor. The commanded current will never exceed the value defined by the **CCP** command.

Command	Description
> **CCP4Ø.ØØ**	Sets the peak current limit to 40.00A (28.28 Arms)

CDB Configure Deadband

Version A

Type Set-Up
Syntax <a>**CDB**n
Units n = steps
Range 0 - (1048575)
Default 0
Response *SLIP_FAULT_DEADBAND=nnnnnnn_STEPS
See also CIP, CMR, CPE

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

The **CDB** command defines the deadband in steps. The deadband is the range of input signals for which there is no system response. If the absolute value of the position error exceeds the deadband, the in-position output on the Indexer Connector will be active. When the In-Position line is off, the absolute value of the position error is within the deadband region (for the minimum time specified by the Configure In-Position (**CIP**) command. This command is scaled by the Configure Motor Resolution (**CMR**) command (steps are in the user's resolution). Set the desired **CMR** value before setting the **CDB** value.

CDB differs from the Configure Position Error (**CPE**) command. When the deadband is exceeded, the In-Position signal on the indexer connector will be activated, but the drive will continue to strive for zero position error. When the position error limit is exceeded, the drive will fault.

Command	Description
> **CDB5Ø**	Sets the deadband to 50 steps

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CIP Configure In-Position

Version A

Type Set-Up
Syntax <a>**CIP**n
Units n = 5 ms increments
Range 0 - 255
Default 0
Response *IN_POSITION_TIME=nnn_(*5_milliSeconds)
See also CDB

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

The **CIP** command defines the minimum time for the motor to be declared *in-position*. This command is used in conjunction with the Configure Deadband (**CDB**) command. The deadband is the range of input signals for which there is no system response. The **CIP** command specifies the amount of time required within the deadband to activate the in-position output. When the in-position line is off, the absolute value of the position error has been within the deadband region for the minimum time specified by the **CIP** command.

Command	Description
> **CIP1Ø**	Sets the in-position time to 10*5ms = 50 ms

CMR Configure Motor Resolution

Version A

Type Set-Up
Syntax <a>**CMR**n
Units n = steps
Range 200-32768 (Any #), 32768-65536 (even #'s only)
Default 5000
Response *MOTOR_RESOLUTION_(STEPS)=nnnn
See also OFF, ON

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

The **CMR** command defines the resolution of the motor in steps per revolution. This resolution will be used when interpreting the step input from the indexer.

This command changes the values and responses of the **CPE**, **CDB**, **DPA**, and **DPE** commands. You should configure motor resolution before you use any of these commands. Before you define the resolution, you must issue the **OFF** command to shut down the drive. After the **CMR** command is executed, you must issue the **ON** command to re-enable the drive.

Changing motor resolution does not affect the system's performance. The controller converts the commanded position to the proper absolute resolver position.

Command	Description
> **OFF**	Turns amplifier off
> **CMR4Ø96**	Defines motor resolution of 4,096 steps/rev
> **ON**	Turns amplifier on

CMTR Configure Motor

Version A

Type Set-Up
Syntax <a>**CMTR**n
Units n = motor type
Range 605, 606, 610, 620, 630, 635, 640, 805, 806, 810, 820, 830, 840,910, 920, 930, 940
Default 605
Response *MOTOR_TYPE=Znnn
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

Use this command to configure the drive to the motor size that is being used. The drive is configured at the factory, but if you change motor size, you must reconfigure the motor type.

This command selects the proper current values and factory defaults for the various motor sizes that may be use with the drive. Issuing the **CMTR** command will return the following set-up parameters to their default values: **ANV**, **CCA**, **CCP**, **CMV**, **CPD**, **CPDM**, **CPI**, **CPIM**, **CPP**, **CPPM**, **CRR**, **CTC**, **CTG**, **CTGM**, **CVE**, **CVF**, **CVFM**, **CVI**, **CVIM**, **CVP**, **CVPM**, and motor commutation data. **CMTR** automatically saves these parameters.

Command	Description
> **CMTR62Ø**	Configures drive for default settings for the Z620 motor

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CMV Configure Maximum Velocity

Version A

Type Set-Up
Syntax <a>**CMV**n
Units n = rpm
Range 0 - 7000
Default Motor dependent
Response *MAX_VELOCITY_(TORQUE_MODE_ONLY)=nnnn_RPM
See also CZM

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

Use **CMV** only when operating in Torque mode (**CZM2**). **CMV** limits maximum motor speed in Torque mode.

Command	Description
> **CMV32**	Configures drive for maximum velocity of 32 rpm when in Torque mode

CPB Configure Pushbuttons

Version A

Type Set-=Up
Syntax <a>**CPB**n
Units n = pushbuttons
Range 0 = disabled, 1 = enabled, 2 = chgs disabled
Default 1
Response *CPB=2...BUTTON_CHANGES_DISABLED
*CPB=1...BUTTONS_ENABLED
*CPB=0...BUTTONS_DISABLED
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command controls user access to the front panel pushbuttons. Since many drive parameters can be modified via the front panel, it may be desirable to disable this interface.

- ❑ **CPBØ** = All pushbutton functionality is disabled.
- ❑ **CPB1** = Pushbuttons are enabled.
- ❑ **CPB2** = Pushbuttons are partially enabled—display features are enabled. Parameter/drive modifications are disabled.

Command	Description
> **CPBØ**	Pushbuttons are disabled

CPD Configure Position Derivative

Version A

Type Set-Up
Syntax <a>**CPD**n
Units n = % of maximum derivative gain
Range 0 - 99
Default Motor dependent
Response *POSITION_DERIVATIVE_PERCENT=nn
See also CPDM (Refer to *Chapter ④ Application Design* for tuning information.)

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

CPD defines the derivative gain for the position control loop. When you tune the drive using **CPD**, a percentage of the Configure Position Derivative Maximum (**CPDM**) is set. **CPD** overrides the Configure Velocity Feed-Forward (**CVF**) and Configure Tach Gain (**CTG**) commands.

Command	Description
> **CPD15**	Sets position derivative gain to 15% of the maximum value

CPDM Configure Position Derivative Maximum

Version A

Type Set-Up
Syntax <a>**CPDM**n
Units n = maximum derivative gain
Range 0 - 32767
Default Motor dependent
Response *POSITION_DERIVATIVE_MAXIMUM=nnnn
See also CPD

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

CPDM defines the maximum derivative gain for the position control loop. When tuning the drive, set **CPDM** and adjust the overall derivative gain parameter by increasing or decreasing the **CPD** value. **CPDM** is configured at the factory and typically does not need to be adjusted. (Refer to Display Drive Information [**DDI**] example.)

Command	Description
> **CPDM1ØØØ**	Sets maximum derivative gain to 1,000
> **CPD15**	Sets position derivative gain to 15% of 1,000

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CPE Configure Position Error

Version A

Type Set-Up
Syntax <a>**CPE**n
Units n = steps
Range 0 - 1048575
Default 5000
Response *POSITION_ERROR_LIMIT=nnnnnn_STEPS
See also CMR

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command specifies a value for the maximum position error. If the position error exceeds the **CPE** value, the controller will disable the amplifier. **CPE** is scaled by the Configure Motor Resolution (**CMR**) command (steps are in the user's resolution). Set the desired **CMR** value before setting the **CPE** value. **CPEØ** will disable the position error fault.

CPE differs from the Configure Deadband (**CDB**) command. When the deadband is exceeded, the in-position signal on the indexer connector will be activated, but the drive will continue to strive for zero position error. When the position error limit is exceeded, the drive will fault.

Command	Description
> **CPE1ØØØ**	Sets the maximum position error to 1,000 motor steps

CPI Configure Position Integral

Version A

Type Set-Up
Syntax <a>**CPI**n
Units n = % of maximum integral gain
Range 0 - 99
Default Motor dependent
Response *POSITION_INTEGRAL_PERCENT=nn
See also CPIM

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the integral gain for the position control loop. When you tune the drive using the **CPI** command, you are setting a percentage of the Configure Position Integral Maximum (**CPIM**).

Command	Description
> **CPI5**	Sets position integral gain to 5% of the maximum value

CPIM Configure Position Integral Maximum

Version A

Type Set-Up
Syntax <a>**CPIM**n
Units n = maximum integral gain
Range 0 - 32767
Default Motor dependent
Response *POSITION_INTEGRAL_PERCENT=nn
See also CPI

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the maximum integral gain for the position control loop. When tuning the drive, first set **CPIM** and then adjust the overall derivative gain parameter by increasing or decreasing **CPI**. **CPIM** is configured at the factory and typically does not need to be adjusted. Refer to the Display Drive Information (**DDI**) command example.

Command	Description
> **CPIM5ØØ**	Sets maximum integral gain to 500
> **CPI5**	Sets position derivative gain to 5% of 500

CPP Configure Position Proportional

Version A

Type Set-Up
Syntax <a>**CPP**n
Units n = % of maximum proportional gain
Range 0 - 99
Default Motor dependent
Response *POSITION_PROPORTIONAL_PERCENT=nn
See also CPPM

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the proportional gain for the position control loop. When you tune the drive using the **CPP** command, you are setting a percentage of the Configure Position Proportional Maximum (**CPPM**).

Command	Description
> **CPP35**	Sets position proportional gain to 35% of the maximum value

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CPPM Configure Position Proportional Maximum

Version A

Type	Set-Up
Syntax	<a>**CPPM**n
Units	n = maximum proportional gain
Range	0 - 32767
Default	Motor dependent
Response	*POSITION_PROPORTIONAL MAXIMUM=nnnn
See also	CPP

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the maximum proportional gain for the position control loop. When you tune the drive, you must first set **CPPM** and then adjust the overall derivative gain parameter by increasing or decreasing the **CPP**. **CPPM** is configured at the factory and typically does not need to be adjusted. Refer to the Display Drive Information (**DDI**) command example.

Command	Description
> **CPPM25ØØ**	Sets maximum to 2,500
> **CPP35**	Sets position proportional gain to 35% of 2,500

CRR Configure Resolver Resolution

Version A

Type	Set-Up
Syntax	<a>**CRR**n
Units	n = bits or auto (A)
Range	12, 14, 16, A
Default	A for position or torque mode, n for Velocity mode
Response	*RESOLVER_RESOLUTION=AUTO *RESOLVER_RESOLUTION=nn_BITS...[nnnn_RPM_MAX]
See also	DPR

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

The **CRR** command defines the resolution of the resolver. The resolver provides information required by the controller to commutate the motor and perform its servo loop. This number is expressed in bits. Higher resolutions are desirable, but limit the speed at which the resolver to digital converter can operate. The following is the maximum speed for each resolution setting:

- ❏ 12-bits = 4,096 counts/rev 7000 rpm max
- ❏ 14-bits = 16,384 counts/rev 3800 rpm max
- ❏ 16-bits = 65,536 counts/rev 900 rpm max

If the velocity commanded by the indexer exceeds these maximum values, the amplifier will be disabled.

The **CRRA** command selects automatic resolution switching. In this mode, the Z Drive chooses the highest resolution, based on the present motor speed. This is desirable for most applications. Do not use the **CRRA** command if you are using the pseudo-quadrature outputs (refer to *Chapter ④ Application Design*).

Command	Description
> **CRR12**	Sets resolver resolution to 4,096 counts/rev

CTC Configure Time Constant

Version A

Type	Set-Up
Syntax	<a>**CTC**n
Units	n = µSec
Range	0 - 30000
Default	Position mode = 5, Velocity mode = 5 Torque mode = 20
Response	*TIME_CONSTANT_=nnnn_(*100_microSeconds)
See also	None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the filter time constant of the servo loop in increments of 100 µs periods, where 100 µs is the servo update rate. The **CTC** command controls the -3dB frequency of the torque command's low-pass filter.

Command	Description
> **CTC2**	Sets time constant to 200 µs (0.2 ms).

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CTG Configure Tach Gain

Version A

Type Set-Up
Syntax <a>**CTG**n
Units % of torque gain
Range 0 - 99
Default Motor dependent
Response *TACH_GAIN_PERCENT=nn
See also CTGM

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the tach gain of the servo loop. When you tune the drive using the **CTG** command, you are setting a percentage of the Configure Tach Gain Maximum (**CTGM**).

Command	Description
> **CTG33**	Sets tach gain to 33% of the maximum value

CTGM Configure Tach Gain Maximum

Version A

Type Set-Up
Syntax <a>**CTGM**n
Units n = maximum torque gain
Range 0 - 32767
Default Motor dependent
Response *TACH_GAIN_MAXIMUM=nnnnn
See also CTG

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the maximum tach gain for the servo loop. When you tune the drive, you must first set **CTGM** and then adjust the overall derivative gain parameter by increasing or decreasing the **CTG** value. **CTGM** is configured at the factory and typically does not need to be adjusted. Refer to Display Drive Information (**DDI**) command example.

Command	Description
> **CTGM2ØØØ**	Sets maximum tach gain to 2,000
> **CTG33**	Sets tach gain to 33% of 2,000

CVE Configure Velocity Error

Version A

Type Set-Up
Syntax <a>**CVE**n
Units n = rpm
Range 0 - 7000
Default Motor dependent
Response *VELOCITY_ERROR_LIMIT=nnnn_RPM
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command specifies a value for the maximum velocity error. If the absolute value of velocity error exceeds the **CVE** value, the amplifier will be disabled. This value represents the absolute value of velocity error. **CVEØ** will disable the velocity error fault.

Command	Description
> **CVE1ØØ**	Sets the maximum velocity error to +/- 100 rpm

CVF Configure Velocity Feed-Forward

Version A

Type Set-Up
Syntax <a>**CVF**n
Units % of maximum velocity feed-forward
Range 0 - 99
Default Motor dependent
Response *VELOCITY_FEED-FORWARD_PERCENT=nn
See also CVFM

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the velocity gain for the velocity control loop. When you tune the drive using the **CVF** command, you are setting a percentage of the Configure Velocity Feed-Forward Maximum (**CVFM**).

Command	Description
> **CVF15**	Sets velocity feed-forward gain to 15% of the maximum value

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CVFM Configure Velocity Feed-Forward Maximum

Version A

Type	Set-Up
Syntax	<a>**CVFM**n
Units	n = maximum velocity feed-forward
Range	0 - 32767
Default	Motor dependent
Response	*VELOCITY_FEED-FORWARD_MAXIMUM=nnnn
See also	CVF

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the maximum velocity gain for the velocity control loop. When you tune the drive, you must first set **CVFM** and then adjust the overall derivative gain parameter by increasing or decreasing the **CVF**. **CVFM** is configured at the factory and typically does not need to be adjusted. Refer to the Display Drive Information (**DDI**) command example.

Command	Description
> **CVFM1ØØØ**	Sets the maximum velocity feed-forward gain to 1,000
> **CVF15**	Sets velocity feed-forward gain to 15% of 1,000

CVI Configure Velocity Integral

Version A

Type	Set-Up
Syntax	<a>**CVI**n
Units	% of maximum velocity integral gain
Range	0 - 99
Default	Motor dependent
Response	*POSITION_INTEGRAL_PERCENT=nn
See also	CVIM

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the integral gain for the velocity control loop. When you tune the drive using the **CVI** command, you are setting a percentage of the Configure Velocity Integral Maximum (**CVIM**).

Command	Description
> **CVI5**	Set velocity integral gain to 5% of the maximum value

CIM Configure Velocity Integral Maximum

Version A

Type	Set-Up
Syntax	<a>**CVIM**n
Units	n = maximum integral gain
Range	0 - 32767
Default	Motor Dependent
Response	*POSITION_INTEGRAL_MAXIMUM=nnnn
See also	CVI

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the maximum integral gain for the velocity control loop. When you tune the drive, you must first set **CVIM** and then adjust the overall derivative gain parameter by increasing or decreasing the **CVI**. **CVIM** is configured at the factory and typically does not need to be adjusted. Refer to the Display Drive Information (**DDI**) command example.

Command	Description
> **CVIM5ØØ**	Sets maximum integral gain to 500
> **CVI5**	Sets velocity integral gain to 5% of 500

CVP Configure Velocity Proportional

Version A

Type	Set-Up
Syntax	<a>**CVP**n
Units	n = % of maximum velocity proportional gain
Range	0 - 99
Default	Motor dependent
Response	*POSITION_PROPORTIONAL_PERCENT=nn
See also	CVPM

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the proportional gain for the velocity control loop. When you tune the drive using the **CVP** command, you are setting a percentage of the Configure Velocity Proportional Maximum (**CVPM**).

Command	Description
> **CVP35**	Sets velocity proportional gain to 35% of the maximum value

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CVPM Configure Velocity Proportional Maximum

Version A

Type Set-Up
Syntax <a>**CVPM**n
Units n = maximum velocity proportional gain
Range 0 - 32767
Default Motor dependent
Response *POSITION_PROPORTIONAL_MAXIMUM=nnnnn
See also CVP

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command defines the maximum proportional gain for the velocity control loop. When you tune the drive, you must first set **CVPM** and then adjust the overall derivative gain parameter by increasing or decreasing the **CVP**. **CVPM** is configured at the factory and typically does not need to be adjusted. Refer to the Display Drive Information (**DDI**) command example.

Command	Description
> **CVPM25ØØ**	Sets maximum to 2,500
> **CVP35**	Sets velocity proportional gain to 35% of 2,500

CZM Configure Z Drive Mode

Version A

Type Set-Up
Syntax <a>**CZM**n
Units n = mode
Range 1 - 3
Default 1
Response *Z_MODE=1...POSITION
*Z_MODE=2...TORQUE
*Z_MODE=3...VELOCITY
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

The **CZM** command defines the mode of the Z Drive controller:

1 = Position servo mode

2 = Torque mode (from analog input)

3 = Velocity mode (from analog input)

Changing the operating mode of the Z Drive with the **CZM** command will reload all of the default tuning parameters for that particular mode. These new parameters are automatically saved. Refer to ***Modes of Operation*** in *Chapter ④ Application Design* for a detailed description of these parameters.

Command	Description
> **CZM1**	Defines the controller as a position servo

DCA Display Current Average

Version A

Type Status
Syntax a**DCA**<n>
Units n = amps
Range Motor Dependent
Default None
Response *AVERAGE_CURRENT_(AMPS)=nnn.nn
See also DCP, DCI

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command reports the average current commanded to the motor in amperes. This number is calculated by averaging 256 samples of instantaneous current.

- ❏ a**DCA1** Reports the average current only once.
- ❏ a**DCA** Reports the average current continuously until a character is sent.

Command	Response
> **1DCA**	*AVERAGE_CURRENT_(AMPS)=012.45

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DCI Display Current Instantaneous

Version A

Type Status
Syntax a**DCI**<a>
Units n = Amps
Range Motor Dependent
Default None
Response *INSTANTANEOUS_CURRENT_(AMPS)=nnn.nn
See also DCA, DCP

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command reports the instantaneous current commanded to the motor in amperes.

- ❏ a**DCI1** Reports the instantaneous current only once.
- ❏ a**DCI** Reports the instantaneous current continuously until a character is sent.

Command	Response
> 1DCI	*INSTANTANEOUS_CURRENT_(AMPS)=032.88

DCP Display Current Peak

Version A

Type Status
Syntax a**DCP**<a>
Units n = Amps
Range Motor Dependent
Default None
Response *PEAK_CURRENT_(AMPS)=nnn.nn
See also DCA, DCI

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command reports the largest instantaneous current commanded by the controller since the **DCP** command was issued.

- ❏ a**DCP1** Reports the peak current only once.
- ❏ a**DCP** Reports the peak current continuously until a character is sent.
- ❏ a**DCPØ** Resets peak current hold then, reports the peak current continuously until a character is sent.

Command	Response
> 1DCP	*PEAK_CURRENT_(AMPS)=36.42

DDI Display Drive Information

Version A

Type Status
Syntax a**DDI**
Units None
Range None
Default None
Response See Below
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command displays all tuning parameters and other drive parameters at one time. A sample response is provided below.

```
           PP    PI    PD    VP    VI    VF    TG
*PERCENT   50    10    00    20    00    50    60
*MAXIMUM 10000  400  32000  5000   00  32000 32000

*TIME_CONSTANT=00005(*100_microSeconds)
*AVE_CURRENT_LIMIT=020.00_AMPS
*PEAK_CURRENT_LIMIT=040.00_AMPS
*MOTOR_RESOLUTION=05000_STEPS
*RESOLVER_RESOLUTION=AUTO
*MOTOR_TYPE=Z640
*Z_MODE=1...[POSITION]
```


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DISP' Front Panel Display

Version A

Type Status
Syntax <a>**DISP'**x
Units x = characters
Range up to 126 characters
Default OK
Response None
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

The **DISP'** command is used to change the *home* front-panel display message. The default message is **OK** (fixed, non-scrolling). The display message can either be a fixed message of 4 characters or less, or a scrolling message of up to 126 characters.

A four character display message can be entered by typing **> DISP'xxxx** where **xxxx** will be the message. If a blank space is desired in the message, an underscore must be entered (a space is interpreted as an end of command delimiter).

A scrolling display message can be entered by typing **> DISP'xxx....xxx** where **xxx....xxx** will be the scrolling message. Four blank spaces will be appended to the message. The message will repeatedly scrolled when no error messages are present.

Command	Description
> DISP'_#1	Home panel display is set to **#1**
> DISP'TOOL_SLIDE	Display will scroll **TOOL SLIDE**

DPA Display Position Actual

Version A

Type Status
Syntax a**DPA**<n>
Units n = steps
Range +2,147,483,647 -2,147,483,689
Default None
Response *ACTUAL_POSITION_(STEPS)=±nnnnnnnnnn
See also DPE, DPS, CMR

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command displays the actual cumulative resolver position in motor steps. The value is a cumulative count based on the shaft position when the drive was enabled. This command is scaled by the Configure Motor Resolution (**CMR**) command (steps are in the user's resolution).

- ❑ a**DPA1** Reports the actual position only once.
- ❑ a**DPA** Reports the actual position continuously until a character is sent.

Command	Response
> 1DPA	*ACTUAL_POSITION_(STEPS)=+0000345092

DPE Display Position Error

Version A

Type Status
Syntax a**DPE**<n>
Units n = steps
Range +2,147,483,647 -2,147,483,689
Default None
Response *POSITION_ERROR_(STEPS)=±nnnnnnnnnn
See also DPA, DPS, CMR

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command reports the difference between the position setpoint and the actual position. This command is scaled by the Configure Motor Resolution (**CMR**) command (steps are in the user's resolution).

- ❑ a**DPE1** Reports the actual position once without descriptive text.
- ❑ a**DPE** Reports the actual position continuously until a character is sent to the Z Drive.

Command	Response
> 1DPE	*POSITION_ERROR_(STEPS)=+0000000012

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DPR Display Position Resolver

Version A

Type Status
Syntax a**DPR**<n>
Units n = resolver steps
Range 0 - 65,535
Default None
Response *RESOLVER_POSITION=nnnnn
See also CMR

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

DPR reports the resolver position. The resolver is a single-speed resolver; for one complete CW rotation of the motor shaft the resolver position will go from 0 to 65535 counts. CCW rotation will cause the resolver position to count backwards. This information is not scaled by the **CMR** command. Use this command to verify proper resolver connection.

- ❑ a**DPR** Continually reports the resolver position value until any key is pressed
- ❑ a**DPR1** Report resolver position value 1 time only without descriptive text.

Command	Response
> 1DPR	*RESOLVER_POSITION=63281

DPS

Version A

Type Status
Syntax a**DPS**<n>
Units n = steps
Range +2,147,483,647 -2,147,483,689
Default None
Response *POSITION_SETPOINT_(STEPS)=±nnnnnnnnnn
See also DPA, DPE

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command reports the absolute position setpoint. The position setpoint indicates the Z Drive's commanded position. This position setpoint is the total number of steps that the drive has received since the amplifier was enabled.

- ❑ a**DPS** Continually reports the setpoint position value until any key is pressed
- ❑ a**DPS1** Reports position setpoint value 1 time only without descriptive text.

Command	Response
> 1DPS	*POSITION_SETPOINT_(STEPS)=+0000538112

DSP Display Servo Picture

Version A

Type Status
Syntax a**DSP**
Units None
Range None
Default None
Response None
See also SPA, DPE, DPS, DPR, DVA, DVE, DVS

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command draws a simple picture of the Z Drive servo loop, labeling various nodes, and then repeatedly displays most servo variables. This command can be used to display **DPA**, **DPE**, **DPS**, **DPR**, **DVA**, **DVE**, and **DVS** information. The servo variables are sampled at different points in time, the numbers shown will not necessarily correlate exactly.

DVA Display Velocity Actual

Version A

Type Status
Syntax a**DVA**<n>
Units n = rpm
Range 0 - 8,000
Default None
Response *ACTUAL_VELOCITY_(rpm)=±nnnnn
See also DVS, DVE

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command reports the shaft velocity in rpm (revolutions per minute).

- ❑ a**DVA** Continuously reports the actual velocity until any key is pressed
- ❑ a**DVA1** Report the actual velocity once, without descriptive text.

Command	Response
> 1DVA	*ACTUAL_VELOCITY_(rpm)=+05732

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DVE

Version A

Type Status
Syntax a**DVE**<n>
Units n = rpm
Range 0 - 8,000
Default None
Response *VELOCITY_ERROR_(rpm)-±nnnnn
See also DVS, DVA

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command reports the difference between the velocity setpoint and the actual velocity.

- ❏ a**DVE1** Reports the velocity error only once.
- ❏ a**DVE** Reports the velocity error continuously until a character is sent.

Command	Response
> **1DVE**	*VELOCITY_ERROR_(rpm)=+00003

DVS Display Velocity Setpoint

Version A

Type Status
Syntax a**DVS**<n>
Units n = rpm
Range 0 - 8,000
Default None
Response *VELOCITY_SETPOINT_(rpm)-±nnnnn
See also DVA, DVE

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command continuously reports the commanded shaft velocity setpoint in rpm (revolutions per minute).

- ❏ a**DVS** Continuously reports the velocity setpoint until any key is pressed.
- ❏ a**DVS1** Report the velocity setpoint once, without descriptive text.

Command	Response
> **1DVS**	*VELOCITY_SETPOINT_(rpm)=+03712

E Enable Communications Interface

Version A

Type Communication
Syntax <a>**E**
Units None
Range None
Default None
Response None
See also F

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

The Enable Communications Interface (**E**) command allows the drive to accept commands over the RS-232C interface. You can re-enable the communications interface with this command if you had previously disabled the interface with the **F** command. If several units are using the same communications interface, the **E** and **F** commands can help streamline programming.

Command	Description
> **F**	Disables all units on the RS-232C interface
> **1E**	Enables Device 1
> **4E**	Enables Device 4
> **CPP35**	Sets CPP value to 35% for device 1 and 4 only

F Disable Communications Interface

Version A

Type Communication
Syntax <a>**F**
Units None
Range None
Default None
Response None
See also E

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

Use the Disable Communications Interface (**F**) command to program multiple units on a single interface. Units that are not intended to process global commands should receive device specific **F** commands. This allows you to program other units without specifying a device identifier on every command.

Command	Description
> **1F**	Disables communications on Device 1
> **3F**	Disables communications on Device 3
> **CCA15**	Sets CCA value to 15 on all units except devices #1 and #3

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FMCA Find Motor Commutation Angle

Version A

Type Set-Up
Syntax a**FMCA**
Units None
Range None
Default 0
Response See Below
See also CMTR

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

All Z Drive motors have aligned resolvers so no calculation of the commutation angle is required. However, the **FMCA** command will recalculate this commutation angle if necessary. **FMCA** may be used to guarantee that the stored commutation angle is correct.

FMCA rotates the motor under program control in the drive. *While it is rotating, the user has no control over the motor. Once you start this sequence of events, you will have to cut off AC power to stop the motor before the commutation procedure is completed.* The motor must be disconnected from the load when **FMCA** is executed to ensure proper commutation angle.

Once commutation is completed, this angle is automatically saved in non-volatile memory. For any given motor, this commutation procedure does not have to be repeated.

Command	Description / Response
> **1OFF**	Turns amplifier off
> **1FMCA**	*COMMUTATION_OFFSET=00006...[000_DEGRESS]

^H Backspace

Version A

Type Communication
Syntax **^H**
Units None
Range None
Default None
Response None
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

^H allows you to delete the last character that you entered. (**^H** indicates that the Ctrl key is held down when the **H** key is pressed.) **^H** will not prevent execution of a command after the command delimiter has been entered. The drive will backspace one character in the command buffer, regardless of what appears on the terminal. On some terminals, the Ctrl and the left arrow keys produce the same character.

Command	Description
> **CCX^HP35**	CCP setting is 35A

HELP Help

Version A

Type Status
Syntax a**HELP**
Units None
Range None
Default None
Response None
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command lists all of the Z Drive commands and their descriptions.

OFF Off

Version A

Type Programming
Syntax <a>**OFF**
Units None
Range None
Default None
Response None
See also ON

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command disables the amplifier, no current is commanded to the motor. When you issue an **OFF** command, the fault LED will be on to indicate that the drive is shut down. You must issue an **ON** command to re-energize the motor and clear the fault. **OFF** removes motor torque, allowing you to move the motor manually. *If **OFF** is issued during motor motion, the motor will freewheel.*

Command	Description
> **OFF**	Powers down the motor (no torque)

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ON — On

Version A

Type Programming
Syntax <a>**ON**
Units None
Range None
Default None
Response None
See also OFF

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command turns the amplifier back on from the off state. If you issue the **OFF** command to shut the drive down, issuing the **ON** command re-enables the current to the motor, restoring motor torque.

Command	Description
> **ON**	Turns the amplifier on

OUT — Real Time Output Control

Version A

Type Set-Up
Syntax <a>**OUT**n
Units None
Range 0 - 3
Default 0
Response *OUT=Ø...RTO_LOW
*OUT=1...RTO_HIGH
*OUT=2...TEMPERATURE_PRE-FAULT
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command can activate (**OUT1**) or negate (**OUTØ**) the differential RTO (real time output) line or indicate a temperature fault (**OUT2**).

- ❏ **OUTØ** = RTO Low, never saved
- ❏ **OUT1** = RTO High, never saved
- ❏ **OUT2** = Temperature pre-fault, automatically saved
- ❏ **OUT3** = Over-voltage warning, automatically saved

*The **OUTØ**, **OUT1** commands are not savable.* The RTO line can be used to get an advance notice, or a pre-fault, of a temperature fault by entering **OUT2**. The RTO line will be activated one minute (fixed) prior to the amplifier shutdown when a PCB or motor temperature fault occurs. The system does not provide a pre-fault indication for a heatsink temperature fault. OUT3 will activate the RTO line whenever the over-voltage warning is active.

Command	Description
> **OUT1**	Activates the RTO line

RFS — Return to Factory Settings

Version A

Type Communication
Syntax <a>**RFS**
Units None
Range None
Default None
Response None
See also SV

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

RFS returns the following setup parameters to their default values: **ANDB**, **ANV**, **CCA**, **CCP**, **CDB**, **CIP**, **CMV**, **CPD**, **CPDM**, **CPE**, **CPI**, **CPIM**, **CPP**, **CPPM**, **CRR**, **CTC**, **CTG**, **CTGM**, **CVE**, **CVF**, **CVFM**, **CVI**, **CVIM**, **CVP**, **CVPM**, **DISP'**, and motor commutation information.

You cannot execute the **RFS** command if the drive is enabled. Use the **OFF** command to turn the drive off. The tuning parameters that are returned to factory defaults *are not* automatically saved. Issue a Save (**SV**) command to save the tuning parameters in non-volatile memory. Non-tuning parameters are automatically saved.

Command	Description
> **OFF**	Turns amplifier off
> **RFS**	Set-up parameters are returned to default values
> **ON**	Turns amplifier on

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RSE Report Servo Errors

Version A

Type Status
Syntax a**RSE**<n>
Units None
Range None
Default None
Response See Below
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

In addition to the front panel display, you can report error or warning conditions over RS-232C by using this command. Use **RSE** to troubleshoot the unit when a fault occurs. *Chapter ® Troubleshooting & Maintenance* discusses all of these errors and offers troubleshooting help. The possible messages are:

```
*NO_ERRORS/WARNINGS
*DRIVE_WARNINGS:
        *Ø3_OVER_VOLTAGE
*DRIVE_ERRORS:
        *Ø4_OVER_VOLTAGE
        *17_INDEXER_SHUTDOWN
        *18_LOW_VOLTAGE
        *19_SHORT_CIRCUIT:_CYCLE_POWER
        *2Ø_POSITION_ERROR_EXCEEDED
        *21_ROLLING_AVE_CURRENT_FAULT
        *22_AVERAGE_CURRENT_LIMIT_EXCEEDED
        *23_DRIVE_ENABLE_NOT_ACTIVE
        *27_VELOCITY_ERROR_EXCEEDED
        *3Ø_ZRAM_FAILURE
        *55_POWER_SUPPLY_FAILURE
        *6Ø_COMMANDED_SHUTDOWN
        *61_INCOMING_INDEXER_PULSES
        *7Ø_RESOLVER_DISCONNECTED
        *77_RESOLVER_RESOLUTION_FAULT
        *91_HEATSINK_OVER_TEMPERATURE
        *92_MOTOR_OVER_TEMPERATURE
        *93_PCB_OVER_TEMPERATURE
```

RSEØ displays old errors; errors that have been cleared by turning the drive on (**ON** command or a reset). The microprocessor saves errors that disable the amplifier. Additional errors that occur after the amplifier is off will not be saved. Errors are saved prior to the microprocessor canceling the drive fault output on the Indexer Connector. If you want to remove power from the Z Drive when a drive fault occurs, use the drive fault output to ensure that the microprocessor has enough time to save the errors before power is lost. The fault output on the screw terminal I/O[2] connector is a hardware fault signal (hardware generated fault) that will be activated before the microprocessor saves errors.

Command	Response
> 1RSE	*DRIVE_ERRORS: *2Ø_POSITION_ERROR_EXCEEDED
> ON	
> 1RSE	*NO_ERRORS/WARNINGS
> 1RSEØ	*OLD_ERRORS: *2Ø_POSITION_ERROR_EXCEEDED

RV Revision Level

Version A

Type Status
Syntax a**RV**
Units None
Range None
Default None
Response *92-010672-01xx *92-010799-01xx
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

The Revision (**RV**) command reports the software part numbers of both Z Drive processors and their revision levels. The part numbers (92-010672-01 and 92-010799-01) identify the installed software. The suffixes (xx) identify the revision levels. Record this information, it is required if you consult Compumotor's Applications Department.

Command	Response
> 1RV	*92-010672-01A *92-010799-01A

The software is identified by 92-010672-01 revision level A, and 92-010799-01 revision level A.

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SS Set-Up Status Report

Version A

Type Status
Syntax a**SS**
Units None
Range None
Default None
Response See Below
See also SSA, SSI, SSM, SSR, SST, SSU

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

Reports the status of the **SS** commands (**SSA**, **SSI**, **SSM**, **SSR**, and **SST**) settings.

Command	Response
> 1SS	*SSA=Ø...RS232_ECHO=ON *SSI=Ø...INTERACTIVE_MODE=ON *SSM=Ø...ACTIVE_DIR_INPUT=CW *SSR=Ø...ANALOG_OUT=VELOCITY *SST=Ø...ENABLE_INPUT=NORMAL *SSU=1...WARNING_DISPLAY=OFF

SSA RS-232C Echo Control

Version A

Type Set-Up
Syntax <a>**SSA**n
Units n = mode
Range 0, 1
Default 0
Response None
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command turns the RS-232C echo (transmission by the drive of characters received from the remote device) on and off.

- **SSAØ** = Echo on
- **SSA1** = Echo off

In the Echo On (**SSAØ**) mode, characters that are received by the drive are echoed automatically. In the Echo Off (**SSA1**) mode, characters are not echoed from the drive. Use **SSA1** if you do not want the drive to echo. In a daisy chain, you must have the echo turned on to allow drives further down the chain to receive commands.

Command	Description
> SSA1	Turns echo off

SSI Interactive Mode Control

Version A

Type Set-Up
Syntax <a>**SSI**n
Units n = mode
Range 0, 1
Default 0
Response None
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command turns the RS-232C interactive mode on and off.

- **SSIØ** = Interactive mode on
- **SSI1** = Interactive mode off

If the interactive mode is on (**SSIØ**), the drive transmits a command prompt after each RS-232C command has been executed. The command prompt consists of a carriage return, line feed, a '**>**', and a space. If the last command was rejected, then a '**?**' character would be sent (instead of a '**>**'). '***READY**' will be sent each time the Z Drive is reset.

If the interactive mode is off (**SSI1**), then no prompt is sent. Use **SSI1** if you do not want to transmit a carriage return or line feed. Only device address 1 is capable of sending command prompts.

Command	Description
> SSI1	Turns the command prompt off

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SSM Direction Input Polarity Control

Version A

Type Set-Up
Syntax <a>**SSM**n
Units n = mode
Range 0, 1
Default 0
Response None
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

This command can be used to reverse the polarity of the direction input.

- ❏ **SSMØ** = Active Direction input is CW
- ❏ **SSM1** = Active Direction input is CCW

Compumotor's standard interpretation is an active DIR input (DIR+ = 5V, DIR- = 0V) equals CW. With **SSM1**, you can reverse the polarity if desired.

Command	Description
> SSMØ	An active DIR input will cause incoming steps to be interpreted as a CW commanded position

SSR Analog Output Control

Version A

Type Set-Up
Syntax <a>**SSR**n
Units n = mode
Range 0, 1
Default 0
Response None
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

You can use **SSR** to monitor either velocity or torque at the monitor output on the Z Drive.

- ❏ **SSRØ** = Analog monitor output is velocity
- ❏ **SSR1** = Analog monitor output is the absolute torque value

Command	Description
> SSRØ	The motor shaft velocity will be in an analog format at the monitor output

SST Enable Input Control

Version A

Type Set-Up
Syntax <a>**SST**n
Units n = mode
Range 0, 1
Default 0
Response None
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

- ❏ **SSTØ** Enable input is in *normal* mode, once disabled from this input the drive remains disabled until an **ON** command or a drive reset.
- ❏ **SST1** Enable input is in *Shutdown* mode, once disabled from this input the drive can be re-enabled by replacing the jumper (see *Chapter ③ Installation* for detailed description of the Enable input). In this *shutdown* mode the Enable input behaves just like the Remote Power Shutdown input.

Command	Description
> SST1	Enable input is in Shutdown mode

SSU Set Warning Display Mode

Version A

Type Set-Up
Syntax <a>**SSU**n
Units n = mode
Range 0, 1
Default 0
Response None
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

SSUØ = Enables Warning Display mode
SSU1 = Disables Warning Display mode

When **SSU1** is entered the Z will not display warning messages. When **SSUØ** is entered, the Z will display all pending warning messages.

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SV Save Tuning Parameters

Version A

Type Set-Up
Syntax <a>**SV**
Units None
Range None
Default None
Response None
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

SV will save all current tuning parameters that have been defined (into battery backed RAM). The following parameters are saved in response to a **SV** command. Commands not listed here may be automatically saved when that command is entered. See the description of those individual commands: **CPD**, **CPDM**, **CPI**, **CPIM**, **CPP**, **CPPM**, **CTC**, **CVD**, **CVDM**, **CVI**, **CVIM**, **CVP**, **CVPM**.

Command	Description
> SV	Response after successful save is:*

Z Reset

Version A

Type Programming
Syntax <a>**Z**
Units None
Range None
Default None
Response None
See also None

Attributes
[ ] Buffered
[ ] Device specific
[ ] Saved independently
[ ] Saved in sequences

The Reset (**Z**) command is equivalent to cycling AC power to the Z Drive. This command returns all internal settings to their power-up values. *When the Z Drive is reset, the drive is busy for approximately 25 ms for system initialization (all commands are ignored).*

Command	Description
> Z	Software reset of drive

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C H A P T E R ⑦

Hardware Reference

The information in this chapter will enable you to:

- ❏ Use this chapter as a quick-reference for system performance specifications

Z600 Electrical Specifications

Electrical specifications for the Z Drive's input and output power are provided in this section.

Input Power

❏ Voltage (Nominal)	120VAC (1 or 3-phase) **or** 240VAC (1 or 3-phase)
❏ Voltage (Range)	92-130VAC (1 or 3-phase) **or** 205-252VAC (1 or 3-phase)
❏ Frequency (Range)	47-66 Hz
❏ Current (Max. cont.)	15A (rms) 3-phase **or** 26A (rms) 1-phase
❏ Power (Max. cont.)	6.2 KVA
❏ Fuses	20A slow blow—Not user accessible
❏ Isolation transformer	Not required

The actual input power and current is a function of the motor's operating point (speed and torque) and the duty cycle. You can de-rate the fuses and isolation transformer by scaling the above numbers by your actual requirements. The numbers above reflect the servo motor and drive operating at rated speed and rated torque at 100% duty.

Output Power

❏ Voltage	405 VDC (maximum)
❏ Frequency	0 - 400Hz fundamental (7 kHz PWM)
❏ Current	20A continuous per phase sinusoidal (14.14Arms) 40A peak per phase sinusoidal (28.3Arms)
❏ Regen/power dump	Optional accessory

Z600 Motor/Drive Configuration

The Z600's hardware is pre-configured to control Z600 motors. The Z600 series drives only Z600 motors, the Z800 series drives only Z800 motors, and the Z900 series drives only Z900 motors. *Be sure that your drive type matches your motor type* (Z600, Z800, or Z900). If you have questions about the Z motor/drive configuration, call your local Automation Technology Center (ATC) or distributor.

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Z600 Technical Data

	Units	Z-605	Z-606	Z-610	Z-620	Z-630	Z-635	Z-640
Continuous Stall Torque*	oz-in	346	633	867	1743	2475	2458	4114
	lb-in	22	40	54	109	155	154	257
	lb-ft	1.8	3.3	4.5	9.1	12.9	12.8	21.4
	Nm	2.4	4.5	6.1	12.3	17.5	17.4	29.1
Peak Torque (±10%)	oz-in	1083	1954	1733	3486	4951	7008	8228
	lb-in	68	122	108	218	309	438	514
	lb-ft	5.6	10.2	9.0	18.2	25.8	36.5	42.9
	Nm	7.7	13.8	12.2	24.6	35.0	49.5	58.1
Rated Torque (±10%)	oz-in	321	576	616	1538	2172	2054	3729
	lb-in	20	36	39	96	136	128	233
	lb-ft	1.7	3.0	3.2	8.0	11.3	10.7	19.4
	Nm	2.3	4.1	4.4	10.9	15.3	14.5	26.3
Rated Power	hp	2.0	2.1	4.3	5.6	5.4	6.1	5.9
	kWatts	1.5	1.5	3.2	4.2	4.0	4.5	4.4
Rated Speed	rpm	6200	3600	7000	3700	2500	3000	1600
	rps	103	60	117	62	42	50	27
Rated Current (line)	A (rms)	5.0	5.3	14.1	14.1	14.1	14.1	14.1
Peak Current (3.3 seconds max)	A (rms)	16.6	17.2	28.2	28.2	28.2	28.2	28.2
Max. Cont. AC Input Current (3 phase 240VAC)	A (rms)	6	6	15	15	15	15	15
Rotor Inertia	$oz\text{-}in^2$ (mass)	5.45	9.45	13.73	35.87	50.79	56.21	111.21
	oz-in-sec^2	0.01	0.02	0.04	0.09	0.13	0.146	0.29
	Kg-m^2 x 1E-6	99.6	172.9	251.2	656.0	929.0	1028.0	2034.0
Motor Weight	lbs	10	13	16	29	32	37	51
	kg(f)	5	6	7	13	15	16	23
Shipping Weight	lbs	51	55	58	70	73	78	92
	kg(f)	23	25	26	32	33	35	42

Z600 Series Indexer/Drive Performance Specifications

Positional Repeatability

Repeatability: ±0.088 degrees, unloaded

Positional Accuracy

Resolver Accuracy: ±7 arc minutes

Resolver-to-Digital Converter Accuracy: ±8 arc minutes *(For finer accuracies, contact Compumotor—800-722-2282.)*

Motor/Drive Compatibility

Different motors can take different amounts of current and require different tuning parameters for typical loads. The **CMTR** (Configure Motor Type) command sets up a drive for a particular motor. By issuing **CMTR**, motor current levels and default parameters are recalled from memory. Do not exceed the current level specified for the motor, excessive current levels will damage the motor. *The following information is provided in case you must modify the motor/drive configuration.*

> ***WARNING***
>
> The following commutation procedure causes violent motor motion. All loads should be removed from the motor shaft before you begin this procedure.

☞ ***Helpful Hint:***
This command sequence sets up a drive for a particular motor size and performs the commutation.

Command	Description
> **1OFF**	Turns drive off
> **1CMTRxxx**	Sets drive for the motor; xxx = 605, 606, 610, 620, 630, 635, or 640
> **1ON**	Enables the drive

Motor Brakes

Motor brakes are mounted directly behind the motor and are pre- assembled at the factory. When ordering the brake option, specify the motor type.

Brake Characteristics	Z605/606/610	Z620/630	Z640	Units
Supply voltage	24	24	24	VDC
Supply current	0.57	0.93	1.27	A
Static braking torque	960	1152	6720	oz-in

Z600 Motor Brake Characteristics

Motor Data

The data reflecting motor torque does not assume operation from a Z600 drive. The torque specifications reflect the motor's capabilities. In most cases, the motor windings match the drive's output power with an additional safety margin.

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	Motor Size:	**Z605**	Value	Units	Tolerance
1	Constant (s):	Torque	68.7	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	29.4	V rms/Krpm	± 10%
3		Electrical Time	10.68	milliseconds	nominal
4		Mechanical Time	1.46	milliseconds	nominal
5		Thermal	32	minutes	nominal
6	Torque (s):	Continuous, Stall	367	oz-in	min. [1]
7		Continuous, Stall	346	oz-in	min. [2]
8		Continuous, Rated	321	oz-in	min. [2]
9		Peak, Max w/o Saturation	1085	oz-in	min. [1]
10		Static Friction	0.96	oz-in	max.
11		Ripple (of Rated Torque)	5	percent	max. [3]
12	Speed:	Rated	6200	rpm	reference
13		Maximum	6200	rpm	reference
14	Frequency	Rated	207	Hz	max.
15	Current:	Rated	5	A rms	max. [1]
16		Peak	16.6	A rms	nominal
17	Voltage:	Rated	240	V rms	reference
18		Max	250	V rms	maximum
19	Output Power	Rated	1.5 (2.0)	kWatts (hp)	min. [1]
20	Inductance	Terminal (line-line)	25	mH	± 30%
21	D.C. Resistance	Terminal (line-line)	2.3	ohms	± 10 % [1]
22	Acceleration at Rated Torque		76870	rads/sec^2	Theoretical
23	Rotor Inertia		99.6	kgm^2 * 1E-6	nominal
24	Damping		0.96	oz-in / krpm	nominal
25	Weight		10	lbs.	max.
26	Winding Temperature		170 [4]	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		145	°C (Celsius)	reference
28	Insulation Class		H	—	reference
29	Thermostat TRIP Temperature		170	°C (Celsius)	± 5° C
30	Thermostat RESET Temperature		135	°C (Celsius)	± 10° C
31	Dielectric Strength, (Winding-to-Frame)		1750	VAC	min.
32	Winding Capacitance-to-Frame		0.00122	µF	max.
33	IP Classification		65 [8]	rated	standard
34	Shaft:	Radial-Play (Front to Back)	1.4E-5/8E-6	in/lb	reference
35		Material [5]	RC-#30	—	reference
36		Magnet Type	NdFeB	—	—
37		Loading [6] 1000 rpm	85.4	lbs.	max. [7]
		2000 rpm	67.8	lbs.	max. [7]
		3000 rpm	59.1	lbs.	max. [7]
		4000 rpm	53.8	lbs.	max. [7]
		5000 rpm	50	lbs.	max. [7]
38	Bearing Class, Internal/External		1/Class 3	ABEC/AFBMA	reference
39	Bearing Grease		SRI #2	Manufacturer	reference
40	Shaft Seal Pressure		0.21 (3)	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 2(P/2)		
42	Stator Phase Sequence		A-C-B (viewed from front face plate)		
43	Vendor/Supplier		Industrial Drives B-202-C		
44	Resolver Type/Accuracy		Single-Speed; Rotor-Excited; ± 7 arc min.		
45	Resolver Manufacturer/Model #		Fasco # 21-BRCX-335-J39		
46	Standard Resolver Cable Part Number		71-011777-xx		
47	Standard Motor Cable Part Number		71-011774-xx		
48	Options:	Brake—24VDC (0.57A)—960 oz-in Holding Torque IP67 Classification Incremental Encoder Tachometer No Keyway			

[1] 25°C Ambient
[2] 40°C Ambient
[3] Measured at 60 rpm (1 rps) in Velocity Mode
[4] Rated for 20,000 Hours or 40,000 Hours @ 155° C
[5] Rotor steel is rated as *fatigue proof*
[6] Loads centered 1 inch from mounting flange
[7] Loads may be radial and axial such that the sum of the radial and two times the axial does not exceed this figure.
[8] Motor shaft is IP30 rated.

Z605 Motor Specifications

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	Motor Size:	**Z606**	Value	Units	Tolerance
1	Constant (s):	Torque	120	oz-in/A rms	± 10%
2		Voltage (sinusodial)	51.2	V rms/Krpm	± 10%
3		Electrical Time	15.32	milliseconds	nominal
4		Mechanical Time	0.896	milliseconds	nominal
5		Thermal	34	minutes	nominal
6	Torque (s):	Continuous, Stall	672	oz-in	min. [1]
7		Continuous, Stall	634	oz-in	min. [2]
8		Continuous, Rated	576	oz-in	min. [2]
9		Peak, Max w/o Saturation	1957	oz-in	min. [1]
10		Static Friction	0.96	oz-in	max
11		Ripple (of Rated Torque)	5	percent	max. [3]
12	Speed:	Rated	3600	rpm	reference
13		Maximum	3600	rpm	reference
14	Frequency	Rated	120	Hz	max.
15	Current:	Rated	5.3	A rms	max. [1]
16		Peak	17.2	A rms	nominal
17	Voltage:	Rated	240	V rms	reference
18		Max	250	V rms	maximum
19	Output Power:	Rated	1.6 (2.1)	kWatts (hp)	min. [1]
20	Inductance:	Terminal (line-line)	38	mH	± 30%
21	D.C. Resistance	Terminal (line-line)	2.48	ohms	± 10 % [1]
22	Acceleration at Rated Torque		80000	rads/sec^2	Theoretical
23	Rotor Inertia		172.9	kgm^2 * 1E-6	nominal
24	Damping		1.344	oz-in / krpm	nominal
25	Weight		13.4	lbs.	max.
26	Winding Temperature		170 [4]	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		145	°C (Celsius)	reference
28	Insulation Class		H	—	reference
29	Thermostat TRIP Temperature		170	°C (Celsius)	± 5 °C
30	Thermostat RESET Temperature		135	°C (Celsius)	± 10 °C
31	Dielectric Strength, (Winding-to-Frame)		1750	VAC	min.
32	Winding Capacitance to Frame		0.00201	µF	max.
33	IP Classification		65 [8]	rated	standard
34	Shaft:	Radial-Play (front to back)	1.4E-5/8E-6	in/lb	reference
35		Material [5]	RC-#30	—	reference
36		Magnet Type	NdFeB	—	—
37		Loading [6] 1000 rpm	90.1	lbs.	max. [7]
		2000 rpm	71.6	lbs.	max. [7]
		3000 rpm	62.4	lbs.	max. [7]
		4000 rpm	N/A	lbs.	max. [7]
		5000 rpm	N/A	lbs.	max. [7]
38	Bearing Class, Internal/External		1/Class 3	ABEC/AFBMA	reference
39	Bearing Grease		SRI #2	Manufacturer	reference
40	Shaft Seal Pressure		0.21 (3)	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 2(P/2)		
42	Stator Phase Sequence		A-C-B (viewed from front face plate)		
43	Vendor/Supplier		Industrial Drives B-204-B		
44	Resolver Type/Accuracy		Single-Speed; Rotor-Excited; ± 7 arc min.		
45	Resolver Manufacturer/Model #		Fasco # 21-BRCX-335-J39		
46	Standard Resolver Cable Part Number		71-011777-xx		
47	Standard Motor Cable Part Number		71-011774-xx		
48	Options:	Brake—24VDC (0.57A)—960 oz-in Holding Torque			
		IP67 Classification			
		Incremental Encoder			
		Tachometer			
		No Keyway			

[1] 25°C Ambient
[2] 40°C Ambient
[3] Measured at 60 rpm (1 rps) in Velocity Mode
[4] Rated for 20,000 Hours or 40,000 Hours @ 155° C
[5] Rotor steel is rated as *fatigue proof*
[6] Loads centered 1 inch from mounting flange
[7] Loads may be radial and axial such that the sum of the radial and two times the axial does not exceed this figure.
[8] Motor shaft is IP30 rated.

Z606 Motor Specifications

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	Motor Size:	**Z610**	Value	Units	Tolerance
1	Constant (s):	Torque	61.4	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	26.2	V rms/Krpm	±10%
3		Electrical Time	13.16	milliseconds	nominal
4		Mechanical Time	0.762	milliseconds	nominal
5		Thermal	36	minutes	nominal
6	Torque (s):	Continuous, Stall	977	oz-in	min. [1]
7		Continuous, Stall	921.6	oz-in	min. [2]
8		Continuous, Rated	653	oz-in	min. [2]
9		Peak, Max w/o Saturation	2630	oz-in	min. [1]
10		Static Friction	0.96	oz-in	max
11		Ripple (of Rated Torque)	5	percent	min. [3]
12	Speed:	Rated	7000	rpm	reference
13		Maximum	7000	rpm	reference
14	Frequency	Rated	233	Hz	max.
15	Current:	Rated	15	A rms	max. [1]
16		Peak	45	A rms	nominal
17	Voltage:	Rated	230	V rms	reference
18		Max	250	V rms	maximum
19	Output Power:	Rated	3.3 (4.5)	kWatts (hp)	min. [1]
20	Inductance:	Terminal (line-line)	5	mH	± 30%
21	D.C. Resistance	Terminal (line-line)	0.38	Ohms	± 10 % [1]
22	Acceleration at Rated Torque		73934	rads/sec^2	Theoretical
23	Rotor Inertia		251.2	kgm^2 * 1E-6	nominal
24	Damping		1.728	oz-in / krpm	nominal
25	Weight		16.35	lbs.	max.
26	Winding Temperature		170 [4]	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		145	°C (Celsius)	reference
28	Insulation Class		H	—	reference
29	Thermostat TRIP Temperature		170	°C (Celsius)	± 5 °C
30	Thermostat RESET Temperature		135	°C (Celsius)	± 10 °C
31	Dielectric Strength, (Winding-to-Frame)		1750	VAC	min.
32	Winding Capacitance-to-Frame		0.00205	µF	max.
33	IP Classification		65 [8]	rated	standard
34	Shaft:	Radial-Play (front to back)	1.4E-5/8E-6	in/lb	reference
35		Material [5]	RC-#30	—	—
36		Magnet Type	NdFeB	—	max. [7]
37		Loading [6] 1000 rpm	93.5	lbs.	max. [7]
		2000 rpm	74.2	lbs.	max. [7]
		3000 rpm	64.8	lbs.	max. [7]
		4000 rpm	59	lbs.	max. [7]
		5000 rpm	54.7	lbs.	max. [7]
38	Bearing Class, Internal/External		1/Class 3	ABEC/AFBMA	reference
39	Bearing Grease		SRI #2	Manufacturer	reference
40	Shaft Seal Pressure		0.21 (3)	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 2(P/2)		
42	Stator Phase Sequence		A-C-B (viewed from front face plate)		
43	Vendor/Supplier		Industrial Drives B-206-D		
44	Resolver Type/Accuracy		Single-Speed; Rotor-Excited; ± 7 arc min.		
45	Resolver Manufacturer/Model #		Fasco # 21-BRCX-335-J39		
46	Standard Resolver Cable Part Number		71-011777-01		
47	Standard Motor Cable Part Number		71-011775-01		
48	Options:	Brake—24VDC (0.57A)—960 oz-in Holding Torque			
		IP67 Classification			
		Incremental Encoder			
		Tachometer			
		No Keyway			

[1] 25°C Ambient
[2] 40°C Ambient
[3] Measured at 60 rpm (1 rps) in Velocity Mode
[4] Rated for 20,000 Hours or 40,000 Hours @ 155° C
[5] Rotor steel is rated as *fatigue proof*
[6] Loads centered 1 inch from mounting flange
[7] Loads may be radial and axial such that the sum of the radial and two times the axial does not exceed this figure.
[8] Motor shaft is IP30 rated.

Z610 Motor Specifications

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	Motor Size:	**Z620**	Value	Units	Tolerance
1	Constant (s):	Torque	124.2	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	53	V rms/Krpm	± 10%
3		Electrical Time	23.4	milliseconds	nominal
4		Mechanical Time	0.82	milliseconds	nominal
5		Thermal	40	minutes	nominal
6	Torque (s):	Continuous, Stall	1974	oz-in	min. [1]
7		Continuous, Stall	1862	oz-in	min. [2]
8		Continuous, Rated	1632	oz-in	min. [2]
9		Peak, Max w/o Saturation	5299	oz-in	min. [1]
10		Static Friction	25	oz-in	max.
11		Ripple (of Rated Torque)	4.5	percent	min. [3]
12	Speed:	Rated	3700	rpm	reference
13		Maximum	3700	rpm	reference
14	Frequency	Rated	123	Hz	max.
15	Current:	Rated	15	A rms	max. [1]
16		Peak	45	A rms	nominal
17	Voltage:	Rated	230	V rms	reference
18		Max	250	V rms	maximum
19	Output Power:	Rated	4.5 (6)	kWatts (hp)	min. [1]
20	Inductance:	Terminal (line-line)	15	mH	± 30%
21	D.C. Resistance	Terminal (line-line)	0.64	Ohms	± 10 % [1]
22	Acceleration at Rated Torque		57025	rads/sec^2	Theoretical
23	Rotor Inertia		656	kgm^2 * 1E-6	nominal
24	Damping		2.496	oz-in / krpm	nominal
25	Weight		29	lbs.	max.
26	Winding Temperature		170 [4]	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		145	°C (Celsius)	reference
28	Insulation Class		H	—	reference
29	Thermostat TRIP Temperature		170	°C (Celsius)	± 5 °C
30	Thermostat RESET Temperature		135	°C (Celsius)	± 10 °C
31	Dielectric Strength, (Winding-to-Frame)		1750	VAC	min.
32	Winding Capacitance-to-Frame		0.0034	µF	max.
33	IP Classification		65 [8]	rated	standard
34	Shaft:	Radial-Play	2E-5/7E-6	in/lb	reference
35		Material [5]	RC-#30		reference
36		Magnet Type	NdFeB	—	—
37		Loading [6] 1000 rpm	154.7	lbs.	max. [7]
		2000 rpm	122.8	lbs.	max. [7]
		3000 rpm	107.2	lbs.	max. [7]
		4000 rpm	N/A	lbs.	max. [7]
		5000 rpm	N/A	lbs.	max. [7]
38	Bearing Class, Internal/External		1/Class 3	ABEC/AFBMA	reference
39	Bearing Grease		SRI #2	Manufacturer	reference
40	Shaft Seal Pressure		0.21 (3)	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 2(P/2)		
42	Stator Phase Sequence		A-C-B (viewed from front face plate)		
43	Vendor/Supplier		Industrial Drives B-404-D		
44	Resolver Type/Accuracy		Single-Speed; Rotor-Excited; ± 7 arc min.		
45	Resolver Manufacturer/Model #		Fasco # 21-BRCX-335-J39		
46	Standard Resolver Cable Part Number		71-011777-xx		
47	Standard Motor Cable Part Number		71-011775-xx		
48	Options:	Brake—24VDC (0.93A)—1140 oz-in Holding Torque			
		IP67 Classification			
		Incremental Encoder			
		Tachometer			
		No Keyway			

[1] 25°C Ambient
[2] 40°C Ambient
[3] Measured at 60 rpm (1 rps) in Velocity Mode
[4] Rated for 20,000 Hours or 40,000 Hours @ 155° C
[5] Rotor steel is rated as *fatigue proof*
[6] Loads centered 1 inch from mounting flange
[7] Loads may be radial and axial such that the sum of the radial and two times the axial does not exceed this figure.
[8] Motor shaft is IP30 rated.

Z620 Motor Specifications

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	Motor Size:	**Z630**	Value	Units	Tolerance
1	Constant (s):	Torque	175.3	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	74.9	V rms/Krpm	± 10%
3		Electrical Time	26.7	milliseconds	nominal
4		Mechanical Time	0.68	milliseconds	nominal
5		Thermal	43	minutes	nominal
6	Torque (s):	Continuous, Stall	2788	oz-in	min. [1]
7		Continuous, Stall	2630	oz-in	min. [2]
8		Continuous, Rated	2304	oz-in	min. [2]
9		Peak, Max w/o Saturation	7488	oz-in	min. [1]
10		Static Friction	40.7	oz-in	max.
11		Ripple (of Rated Torque)	4.5	percent	min. [3]
12	Speed:	Rated	2500	rpm	reference
13		Maximum	2500	rpm	reference
14	Frequency	Rated	83	Hz	max.
15	Current:	Rated	15	A rms	max. [1]
16		Peak	45	A rms	nominal
17	Voltage:	Rated	230	V rms	reference
18		Max	250	V rms	maximum
19	Output Power:	Rated	4.3 (5.7)	kWatts (hp)	min. [1]
20	Inductance:	Terminal (line-line)	20	mH	± 30%
21	D.C. Resistance	Terminal (line-line)	0.75	Ohms	± 10 % [1]
22	Acceleration at Rated Torque		56934	rads/sec^2	Theoretical
23	Rotor Inertia		929	kgm^2 * 1E-6	nominal
24	Damping		2.88	oz-in / krpm	nominal
25	Weight		32	lbs.	max.
26	Winding Temperature		170 [4]	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		145	°C (Celsius)	reference
28	Insulation Class		H	—	reference
29	Thermostat TRIP Temperature		170	°C (Celsius)	± 5 °C
30	Thermostat RESET Temperature		132	°C (Celsius)	± 5 °C
31	Dielectric Strength, (Winding-to-Frame)		1750	VAC	min.
32	Winding Capacitance to Frame		0.0038	µF	max.
33	IP Classification		65 [8]	rated	standard
34	Shaft:	Radial-Play	2E-5/7E-6	in/lb	reference
35		Material [5]	RC-#30	—	reference
36		Magnet Type	NdFeB	—	—
37		Loading [6] 1000 rpm	160	lbs.	max. [7]
		2000 rpm	127.1	lbs.	max. [7]
		3000 rpm	N/A	lbs.	max. [7]
		4000 rpm	N/A	lbs.	max. [7]
		5000 rpm	N/A	lbs.	max. [7]
38	Bearing Class, Internal/External		1/Class 3	ABEC/AFBMA	reference
39	Bearing Grease		SRI #2	Manufacturer	reference
40	Shaft Seal Pressure		0.21 (3)	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 2(P/2)		
42	Stator Phase Sequence—CW rotor rotation		A-C-B (viewed from front face plate)		
43	Vendor/Supplier		Industrial Drives B-406-D		
44	Resolver Type/Accuracy		Single-Speed; Rotor-Excited; ± 7 arc min.		
45	Resolver Manufacturer/Model #		Fasco # 21-BRCX-335-J39		
46	Standard Resolver Cable Part Number		71-011777-xx		
47	Standard Motor Cable Part Number		71-011775-xx		
48	Options:	Brake—24VDC (0.93A)—8.0 Nm Holding Torque			
		IP67 Classification			
		Incremental Encoder			
		Tachometer			
		No Keyway			

[1] 25°C (Celsius) ambient
[2] 40°C (Celsius) ambient
[3] Measured at 60 rpm (1 rps) in velocity mode
[4] Rated for 20,000 hours or 40,000 hours @ 155° C
[5] Rotor steel is rated as *fatigue proof*
[6] Loads centered 1 inch from mounting flange
[7] Loads may be radial and axial such that the sum of the radial and two times the axial does not exceed this figure.
[8] Motor shaft is IP30 rated.

Z630 Motor Specifications

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	Motor Size:	**Z635**	Value	Units	Tolerance
1	Constant (s):	Torque	175.3	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	70	V rms/Krpm	± 10%
3		Electrical Time	0.77	milliseconds	nominal
4		Mechanical Time	20.8	milliseconds	nominal
5		Thermal	28	minutes	nominal
6	Torque (s):	Continuous, Stall	2605	oz-in	min. [1]
7		Continuous, Stall	2458	oz-in	min. [2]
8		Continuous, Rated	2054	oz-in	min. [2]
9		Peak, Max w/o Saturation	7008	oz-in	min. [1]
10		Static Friction	69	oz-in	max.
11		Ripple (of Rated Torque)	4.5	percent	min. [3]
12	Speed:	Rated	3000	rpm	reference
13		Maximum	3000	rpm	reference
14	Frequency	Rated	150	Hz	max.
15	Current:	Rated	15	A rms	max. [1]
16		Peak	45	A rms	nominal
17	Voltage:	Rated	230	V rms	reference
18		Max	250	V rms	maximum
19	Output Power:	Rated	4.5 (6.1)	kWatts (hp)	min. [1]
20	Inductance:	Terminal (line-line)	14	mH	± 30%
21	D.C. Resistance	Terminal (line-line)	0.647	Ohms	± 10 % [1]
22	Acceleration at Rated Torque		48945	rads/sec^2	Theoretical
23	Rotor Inertia		1028	kgm^2 * 1E-6	nominal
24	Damping		2.88	oz-in / krpm	nominal
25	Weight		37	lbs.	max.
26	Winding Temperature		170 [4]	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		145	°C (Celsius)	reference
28	Insulation Class		H	—	reference
29	Thermostat TRIP Temperature		170	°C (Celsius)	± 5 °C
30	Thermostat RESET Temperature		135	°C (Celsius)	± 5 °C
31	Dielectric Strength, (Winding-to-Frame)		1750	VAC	min.
32	Winding Capacitance to Frame		0.0038	µF	max.
33	IP Classification		65	rated	standard
34	Shaft:	Radial-Play	2E-5/7E-6	in/lb	reference
35		Material [5]	RC-#30	—	reference
36		Magnet Type	NdFeB	—	—
37		Loading [6] 1000 rpm	243.5	lbs.	max. [7]
		2000 rpm	193.3	lbs.	max. [7]
		3000 rpm	168.8	lbs.	max. [7]
		4000 rpm	N/A	lbs.	max. [7]
		5000 rpm	N/A	lbs.	max. [7]
38	Bearing Class, Internal/External		1/Class 3	ABEC/AFBMA	reference
39	Bearing Grease		SRI #2	Manufacturer	reference
40	Shaft Seal Pressure		0.21 (3)	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 2(P/2)		
42	Stator Phase Sequence—CW rotor rotation		A-C-B (viewed from front face plate)		
43	Vendor/Supplier		Industrial Drives B-406-D		
44	Resolver Type/Accuracy		Single-Speed; Rotor-Excited; ± 7 arc min.		
45	Resolver Manufacturer/Model #		Fasco # 21-BRCX-335-J39		
46	Standard Resolver Cable Part Number		71-011777-xx		
47	Standard Motor Cable Part Number		71-011775-xx		
48	Options:	Brake—24VDC (0.93A)—8.0 Nm holding torque			
		IP67 Classification			
		Incremental Encoder			
		Tachometer			
		No Keyway			

[1] 25°C Ambient
[2] 40°C Ambient
[3] Measured at 60 rpm (1 rps) in Velocity Mode
[4] Rated for 20,000 hours or 40,000 hours @ 155° C
[5] Rotor steel is rated as *fatigue proof*
[6] Loads centered 1 inch from mounting flange
[7] Loads may be radial and axial such that the sum of the radial and two times the axial does not exceed this figure.

Z635 Motor Specifications

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	Motor Size:	**Z640**	Value	Units	Tolerance
1	Constant (s):	Torque	291.5	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	124.5	V rms/Krpm	± 10%
3		Electrical Time	26.2	milliseconds	nominal
4		Mechanical Time	0.55	milliseconds	nominal
5		Thermal	33	minutes	nominal
6	Torque (s):	Continuous, Stall	4640	oz-in	min. [1]
7		Continuous, Stall	4378	oz-in	min. [2]
8		Continuous, Rated	3955	oz-in	min. [2]
9		Peak, Max w/o Saturation	12461	oz-in	min. [1]
10		Static Friction	73	oz-in	max.
11		Ripple (of Rated Torque)	4.5	percent	max. [3]
12	Speed:	Rated	1600	rpm	reference
13		Maximum	1600	rpm	reference
14	Frequency	Rated	80	Hz	max.
15	Current:	Rated	15	A rms	max. [1]
16		Peak	45	A rms	nominal
17	Voltage:	Rated	230	V rms	reference
18		Max	250	V rms	maximum
19	Output Power:	Rated	4.7 (6.3)	kWatts (hp)	min. [1]
20	Inductance:	Terminal (line-line)	20	mH	± 30%
21	D.C. Resistance	Terminal (line-line)	0.763	Ohms	± 10 % [1]
22	Acceleration at Rated Torque		43667	rads/sec^2	Theoretical
23	Rotor Inertia		2034	kgm^2 * 1E-6	nominal
24	Damping		15.36	oz-in / krpm	nominal
25	Weight		51	lbs.	max.
26	Winding Temperature		170 [4]	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		145	°C (Celsius)	reference
28	Insulation Class		H	—	reference
29	Thermostat TRIP Temperature		170	°C (Celsius)	± 5 °C
30	Thermostat RESET Temperature		135	°C (Celsius)	± 10 °C
31	Dielectric Strength, (Winding-to-Frame)		1750	VAC	min.
32	Winding Capacitance to Frame		0.0082	µF	max.
33	IP Classification		65 [8]	rated	standard
34	Shaft:	Radial-Play	1E-5/4E-6	in/lb	reference
35		Material [5]	RC-#30	—	reference
36		Magnet Type	NdFeB	—	—
37		Loading [6] 1000 rpm	255.6	lbs.	max. [7]
		2000 rpm	N/A	lbs.	max. [7]
		3000 rpm	N/A	lbs.	max. [7]
		4000 rpm	N/A	lbs.	max. [7]
		5000 rpm	N/A	lbs.	max. [7]
38	Bearing Class, Internal/External		1/Class 3	ABEC/AFBMA	reference
39	Bearing Grease		SRI #2	Manufacturer	reference
40	Shaft Seal Pressure		0.21 (3)	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 3(P/2)		
42	Stator Phase Sequence—CW rotor rotation		A-C-B (viewed from front face plate)		
43	Vendor/Supplier		Industrial Drives B-604-D		
44	Resolver Type/Accuracy		Single-Speed; Rotor-Excited; ± 7 arc min.		
45	Resolver Manufacturer/Model #		Fasco # 21-BRCX-335-J39		
46	Standard Resolver Cable Part Number		71-011777-xx		
47	Standard Motor Cable Part Number		71-011776-xx		
48	Options:	Brake—24VDC (1.27A)—6816 oz-in Holding Torque			
		IP67 Classification			
		Incremental Encoder			
		Tachometer No Keyway			

[1] 25°C (Celsius) ambient
[2] 40°C (Celsius) ambient
[3] Measured at 60 rpm (1 rps) in velocity mode
[4] Rated for 20,000 hours or 40,000 hours @ 155° C
[5] Rotor steel is rated as *fatigue proof*
[6] Loads centered 1 inch from mounting flange
[7] Loads may be radial and axial such that the sum of the radial and two times the axial does not exceed this figure.
[8] Motor shaft is IP30 rated.

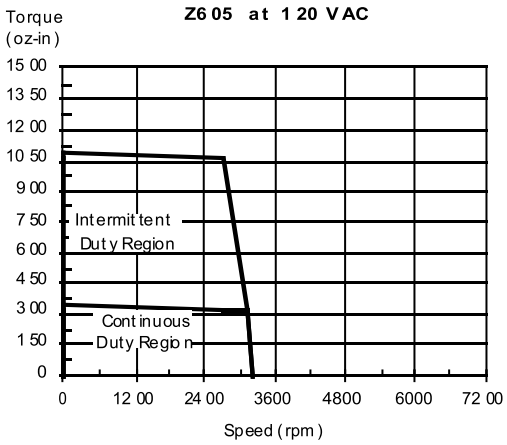
Z640 Motor Specifications

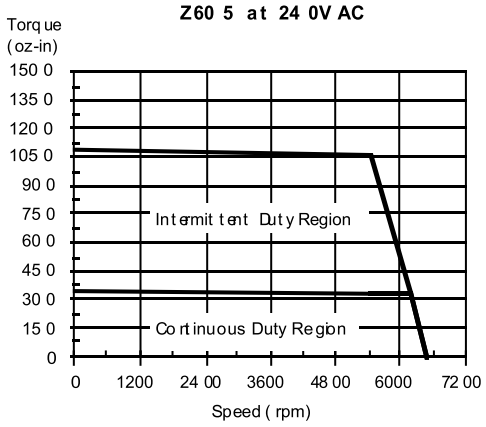
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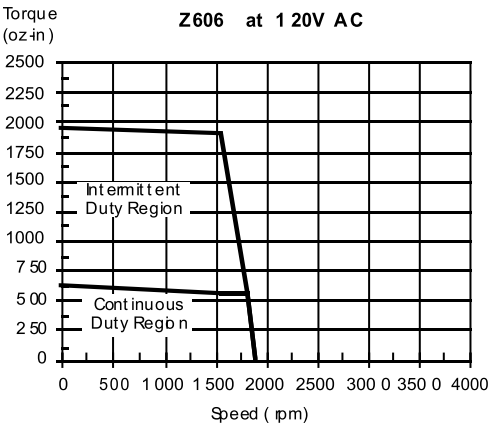
Speed/Torque Curves

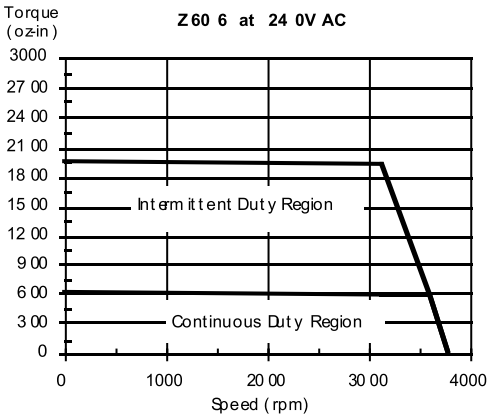
The following speed/torque curves represent the available shaft torque at different operating speeds. Operation at 120VAC and 240VAC is shown for each motor size. Actual motor torque may vary ±10% due to motor manufacturing variances. For operation from a 1-phase 120VAC, the output torque stays relatively constant and the top-end speed falls off at the ratio of the input voltage (i.e., A Z610 operating at 240VAC has a rated speed of 7000 rpm; operating at 120VAC, it will have a rated speed of 3500 rpm).

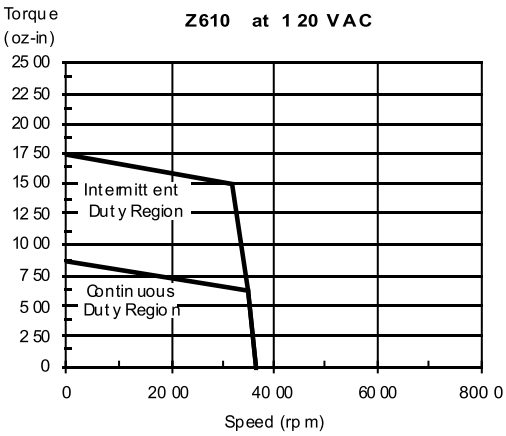
☞ ***Helpful Hint:*** **Continuous Duty** means steady state operation for drive ambient temperatures of 0°C to 50°C. **Intermittent Duty** means operation for 3.3 seconds or less.

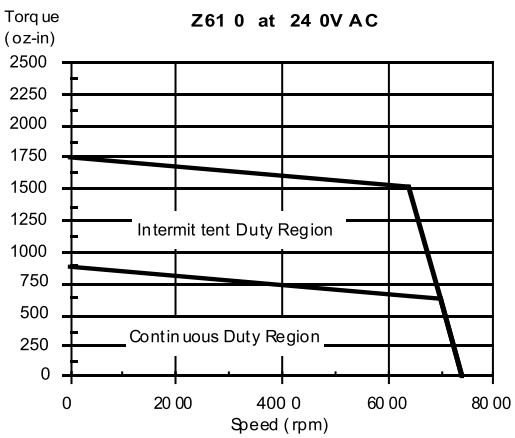




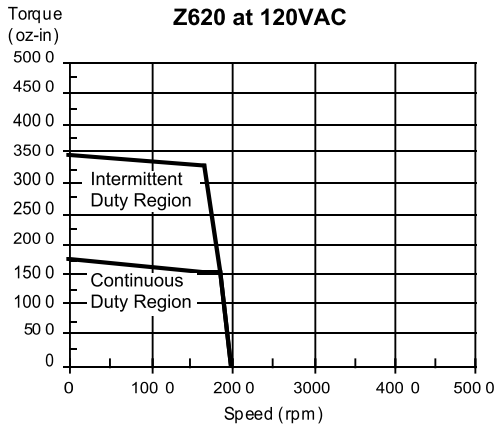


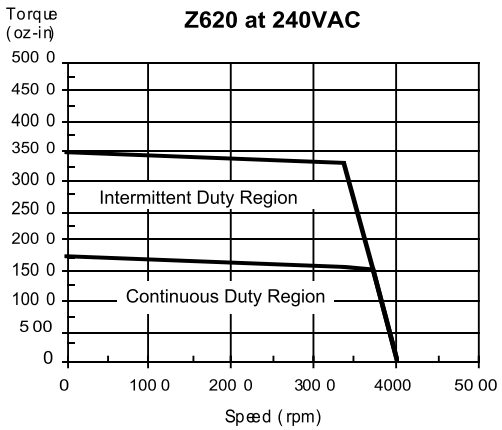


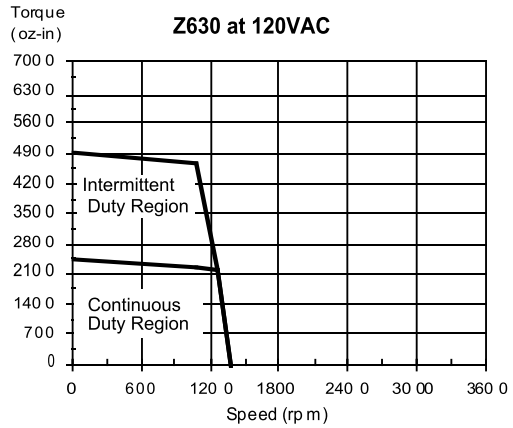


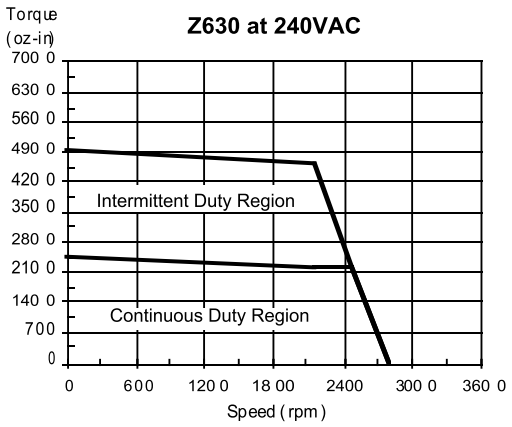


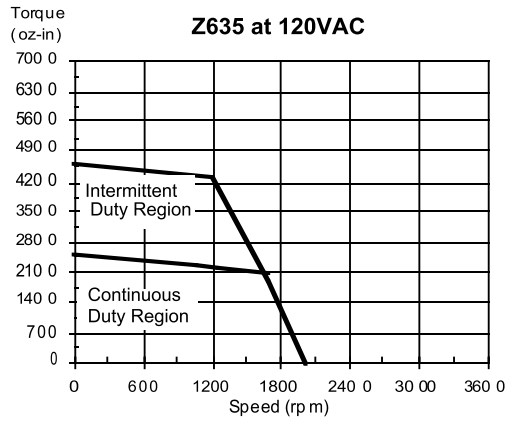
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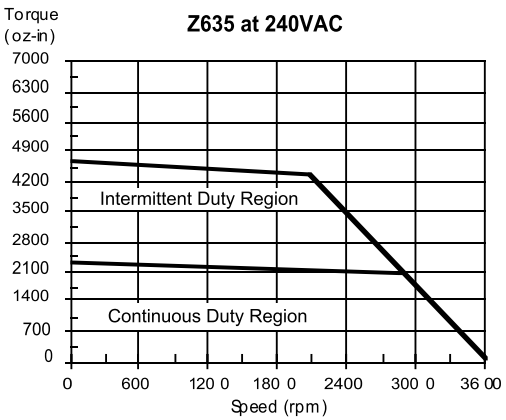


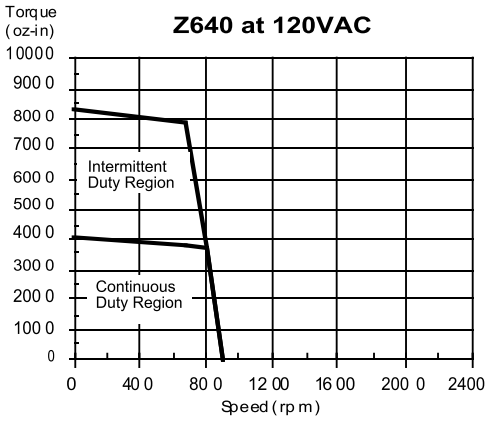


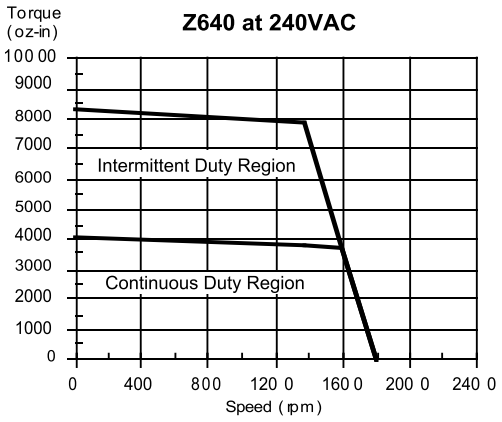












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Z800 Electrical Specifications

Electrical specifications for the Z800 Series drive's input and output power are provided in this section.

Input Power

❑ Voltage (Nominal)	120VAC (1 or 3-phase) **or** 120VAC (1 or 3-phase)
❑ Voltage (Range)	92-130VAC (1 or 3-phase) **or** 205-252VAC (1 or 3-phase)
❑ Frequency (Range)	47-66 Hz
❑ Current (Max. cont.)	15A (rms) 3-phase **or** 26A (rms) 1-phase
❑ Power (Max. cont.)	6.2 KVA
❑ Fuses	20A slow blow—Not user accessible
❑ Isolation transformer	Not required

The actual input power and current is a function of the operating point of the motor (speed and torque) and the duty cycle. You can de-rate the fuse and the isolation transformer by scaling the above numbers by your actual requirements. The data above reflects the servo motor and drive operating at rated speed and at rated torque at 100% duty.

Output Power

❑ Voltage	405VDC (maximum)
❑ Frequency	0 - 400Hz fundamental (7 kHz PWM)
❑ Current	20A continuous per phase sinusoidal (14.1Arms) 40A peak per phase sinusoidal (28.3Arms)
❑ Regen/power dump	Optional accessory

Z800 Motor/Drive Configuration

The Z800's hardware is pre-configured to control Z800 series motors. The Z800 drives only Z800 series motors, the Z600 drives only Z600 motors, and the Z900 drives only Z900 series motors. *Be sure that your drive type matches your motor type (Z600, Z800, or Z900).* If you have questions about the Z Series motor/drive configuration, contact your local Automation Technology Center (ATC) or distributor.

Z800 Technical Data

	Units	Z-805	Z-806	Z-810	Z-820	Z-830	Z-840
Continuous Stall Torque (*±10%)	oz-in lb-in lb-ft Nm	346 22 1.8	680 42 3.5 4.8	991 62 5.2 7.0	1997 125| 10.4 14.1	3101 194 16.2 21.9	4093 256 21.3 28.9
Peak Torque (*±10%)	oz-in lb-in lb-ft Nm	1005 63 5.2 7.1	1997 125 10.4 14.1	1983 124 10.3 14.1	3993 250 20.8 28.2	6203 388 32.3 43.8	8185 512 42.6 57.8
Rated Torque (*±10%)	oz-in lb-in lb-ft Nm	340 21 1.8 2.4	680 42 3.5 4.8	769 48 4.0 5.4	1651 103 8.6 11.7	2553 160 13.3 18.0	3554 222 18.5 25.1
Rated Power	hp kWatts	1.8 1.3	1.8 1.3	4.6 3.4	4.4 3.3	4.6 3.4	4.6 3.4
Rated Speed	rpm rps	5200 87	2600 43	6000 100	2700 45	1800 30	1300 22
Rated Current (line)	A (rms)	4.4	4.4	14.1	14.1	14.1	14.1
Peak Current (3.3 seconds max)	A (rms)	13.2	13.2	28.2	28.2	28.2	28.2
Max. Cont. AC input Current (3 phase 240VAC)	A (rms)	7	7	15	15	15	15
Rotor Inertia	oz-in^2 (mass) oz-in-sec^2 kg-m^2 x 1E-6	12.03 0.03 220	19.14 0.05 350	26.24 0.07 480	114.82 0.30 2100	166.76 0.43 3050	210.50 0.55 3850
Motor Weight	lbs kg(f)	11 5	15 7	20 9	37 17	48 22	59 27
Shipping Weight	lbs kg(f)	52 24	56 26	61 28	78 36	89 41	100 45

Z800 Indexer/Drive Performance Specifications

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Positional Repeatability

Repeatability: ±0.088 degrees, unloaded

Positional Accuracy

Resolver Accuracy: ±15 arc minutes

Resolver-to-Digital Converter Accuracy: ±8 arc minutes *(For finer accuracies, contact Compumotor—800-722-2282.)*

Motor/Drive Compatibility

Different motors can take different amounts of current and require different tuning parameters for typical loads. The **CMTR** (Configure Motor Type) command sets up a drive for a particular motor. By issuing **CMTR**, motor current levels and default parameters are recalled from memory. Do not exceed the current level specified for the motor, excessive current levels will damage the motor.

The following information is provided in case you must modify the motor/drive configuration. This command sequence will set up a drive for a particular motor size and perform the commutation (refer to the *Chapter ⑥ Software Reference* for more on these commands).

> ***WARNING***
>
> This commutation procedure causes violent motor motion. All loads should be removed from the motor shaft before you begin this procedure.

Command	Description
> 1OFF	Turns drive off
>1CMTRxxx	Sets drive for the motor; xxx = 805, 806, 810, 820, 830, or 840
> 1ON	Enables the drive

Motor Brakes

These brakes are mounted directly behind the motor and come completely assembled from the factory. When ordering the brake option, please specify the motor type.

Brake Characteristics	Z805/806/810	Z820/830/840	Units
Supply voltage	24	24	VDC
Supply current	1	1	A
Static braking torque	1345	4956	oz-in
Dynamic braking torque	1133	3965	oz-in
Inertia	0.007	0.063	$oz\text{-}in/sec^2$
Build-up time	90	140	ms
Release time	60	80	ms
Mass	3.9	11	lbs

Z800 Motor Brake Characteristics

Motor Data

The following pages provide data on each of the motor frame sizes of Z800 series systems (Z805, Z806, Z810, Z820, Z830, Z840). The data reflecting motor torque does not assume operation from a Z800 drive. The torque specifications reflect what the motor is capable of. In most cases the motor windings are match to the drive's output power with an additional safety margin.

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	Motor Size	**Z805**	Value	Units	Tolerance
1	Constant (s):	Torque	82.0	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	35.2	V rms/Krpm	± 10%
3		Electrical Time	2.8	milliseconds	nominal
4		Mechanical Time	2.3	milliseconds	nominal
5		Thermal	41	minutes	nominal
6	Torque (s):	Continuous, Stall	357	oz-in	min. [1]
7		Continuous, Stall	340	oz-in	min. [2]
8		Continuous, Rated	340	oz-in	min. [1]
9		Peak, Max w/o Saturation	1020	oz-in	min. [1]
10		Static Friction	—	oz-in	max
11		Ripple (of Rated Torque)	6	percent	max
12	Speed:	Rated	5300	rpm	reference
13		Maximum	5300	rpm	reference
14	Frequency:	Rated	353	Hz	max.
15	Current:	Rated	4.4	A rms	max. [1]
16		Peak	13.2	A rms	nominal
17	Voltage:	Rated	220	V rms	reference
18		Max	240	V rms	maximum
19	Output Power:	Rated	1.4 (1.9)	kWatts (hp)	min. [1]
20	Inductance:	Terminal (line-line)	5.6	mH	± 10%
21	DC Resistance	Terminal (line-line)	2.0	Ohms	± 10 % [1]
22	Acceleration at Rated Torque		10900	rads/sec^2	Theoretical
23	Rotor Inertia		220	kgm^2 * 1E-6	nominal
24	Damping		--	oz-in / krpm	nominal
25	Weight		11.0	lbs.	max.
26	Winding Temperature		150	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		125	°C (Celsius)	reference
28	Insulation Class		F	—	reference
29	Thermostat TRIP Temperature		145	°C (Celsius)	±5°C
30	Thermostat RESET Temperature		130	°C (Celsius)	±10°C
31	Dielectric Strength, (Winding-to-Frame)		1000	VAC	min.
32	Winding Capacitance to Frame		--	µF	max.
33	IP Classification		54	rated	standard
34	Shaft: Radial-Play (front to back)		0.001	in/lb	reference
35	Material [3]		UNI 5332	—	reference
36	Magnet Type		SmCo	—	—
37	Loading [4]	1000 rpm	123	lbs.	max.
		2000 rpm	101	lbs.	max.
		3000 rpm	81	lbs.	max.
		4000 rpm	74	lbs.	max.
		5000 rpm	67	lbs.	max.
38	Bearing Class, Internal/External		3/1	ABEC/AFBMA	reference
39	Bearing Grease		—	Manufacturer	reference
40	Shaft Seal Pressure		—	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 4 (P/2)		
42	Stator Phase Sequence		A-B-C (CW viewed from front face plate)		
43	Vendor/Supplier		Polymotor FAS 1 020 053 00 00 01		
44	Resolver Type/Accuracy		Single-Speed; Rotor-Excited; ± 15 arc min.		
45	Resolver Manufacturer/Model #		Clifton Precision JSMBH-21-K-3		
46	Standard Resolver Cable Part Number		71-011449-xx		
47	Standard Motor Cable Part Number		71-007200-xx		
48	Options:	Brake—24VDC (1A)—1345 oz-in Holding Torque IP65 Classification Incremental Encoder Tachometer No Keyway			

[1] 25°C ambient
[2] 40°C ambient
[3] Material 38 Ni Cr Mo 4
[4] Loads centered 1 inch from mounting flange
Life expectancy = 20000 hours

Z805 Motor Specifications

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	Motor Size	**Z806**	Value	Units	Tolerance
1	Constant (s):	Torque	164.0	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	70.4	V rms/Krpm	± 10%
3		Electrical Time	3.8	milliseconds	nominal
4		Mechanical Time	1.3	milliseconds	nominal
5		Thermal	40	minutes	nominal
6	Torque (s):	Continuous, Stall	714	oz-in	min. [1]
7		Continuous, Stall	680	oz-in	min. [2]
8		Continuous, Rated	680	oz-in	min. [1]
9		Peak, Max w/o Saturation	2040	oz-in	min. [1]
10		Static Friction	—	oz-in	max.
11		Ripple (of Rated Torque)	5	percent	max.
12	Speed:	Rated	2600	rpm	reference
		Maximum	2600	rpm	reference
14	Frequency	Rated	173	Hz	max.
15	Current:	Rated	4.4	A rms	max. [1]
16		Peak	13.2	A rms	nominal
17	Voltage:	Rated	220	V rms	reference
18		Max.	240	V rms	maximum
19	Output Power:	Rated	1.3 (1.7)	kWatts (hp)	min. [1]
20	Inductance:	Terminal (line-line)	11.3	mH	± 10%
21	D.C. Resistance	Terminal (line-line)	3.0	Ohms	± 10 % [1]
22	Acceleration at Rated Torque		13700	rads/sec^2	Theoretical
23	Rotor Inertia		350	kgm^2 * 1E-6	nominal
24	Damping		—	oz-in / krpm	nominal
25	Weight		15.5	lbs.	max.
26	Winding Temperature		150	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		125	°C (Celsius)	reference
28	Insulation Class		F	—	reference
29	Thermostat TRIP Temperature		145	°C (Celsius)	± 5 °C
30	Thermostat RESET Temperature		130	°C (Celsius)	± 10 °C
31	Dielectric Strength, (Winding-to-Frame)		1000	VAC	min.
32	Winding Capacitance to Frame		—	µF	max.
33	IP Classification		54	rated	standard
34	Shaft: Radial-Play (front to back)		0.001	in/lb	reference
35	Material [3]		UNI 5332	—	reference
36	Magnet Type		SmCo	—	—
37	Loading [4]	1000 rpm	135	lbs.	max.
		2000 rpm	105	lbs.	max.
		3000 rpm	90	lbs.	max.
		4000 rpm	—	lbs.	max.
		5000 rpm	—		max.
38	Bearing Class, Internal/External		3/1	ABEC/AFBMA	reference
39	Bearing Grease		--	Manufacturer	reference
40	Shaft Seal Pressure		--	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 4 (P/2)		
42	Stator Phase Sequence		A-B-C (CW viewed from front face plate)		
43	Vendor/Supplier		Polymotor FAS 1 040 026 00 00 01		
44	Resolver Type/Accuracy		Single-Speed; Rotor-Excited; ± 15 arc min.		
45	Resolver Manufacturer/Model #		Clifton Precision JSMBH-21-K-3		
46	Standard Resolver Cable Part Number		71-011449-xx		
47	Standard Motor Cable Part Number		71-007200-xx		
48	Options:	Brake—24VDC (1A)—1345 oz-in Holding Torque IP65 Classification Incremental Encoder Tachometer No Keyway			

[1] 25 °C ambient
[2] 40 °C ambient
[3] Material 38 Ni Cr Mo 4

[4] Loads centered 1 inch from mounting flange
Life expectancy = 20000 hours

Z806 Motor Specifications

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	Motor Size	**Z810**	Value	Units	Tolerance
1	Constant (s):	Torque	74.0	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	31.7	V rms/Krpm	± 10%
3		Electrical Time	8.5	milliseconds	nominal
4		Mechanical Time	1.8	milliseconds	nominal
5		Thermal	36	minutes	nominal
6	Torque (s):	Continuous, Stall	1086	oz-in	min. [1]
7		Continuous, Stall	1034	oz-in	min. [2]
8		Continuous, Rated	770	oz-in	min. [1]
9		Peak, Max w/o Saturation	3100	oz-in	min. [1]
10		Static Friction	—	oz-in	max.
11		Ripple (of Rated Torque)	15	percent	max.
12	Speed:	Rated	6000	rpm	reference
13		Maximum	6000	rpm	reference
14	Frequency	Rated	400	Hz	max.
15	Current:	Rated	14.0	A rms	max. [1]
16		Peak	42.0	A rms	nominal
17	Voltage:	Rated	220	V rms	reference
18		Max	240	V rms	maximum
19	Output Power:	Rated	3.4 (4.5)	kWatts (hp)	min. [1]
20	Inductance:	Terminal (line-line)	1.4	mH	± 10%
21	D.C. Resistance	Terminal (line-line)	0.6	Ohms	± 10 % [1]
22	Acceleration at Rated Torque		15200	rads/sec^2	Theoretical
23	Rotor Inertia		480	kgm^2 * 1E-6	nominal
24	Damping		—	oz-in/krpm	nominal
25	Weight		19.5	lbs.	max.
26	Winding Temperature		150	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		125	°C (Celsius)	reference
28	Insulation Class		F	—	reference
29	Thermostat TRIP Temperature		145	°C (Celsius)	± 5 °C
30	Thermostat RESET Temperature		130	°C (Celsius)	± 10 °C
31	Dielectric Strength, (Winding-to-Frame)		1000	VAC	min.
32	Winding Capacitance to Frame		—	µF	max.
33	IP Classification		54	rated	standard
34	Shaft: Radial-Play (front to back)		0.001	in/lb	reference
35		Material [3]	UNI 5332	—	reference
36		Magnet Type	SmCo	—	—
37		Loading [4] 1000 rpm	146	lbs.	max.
		2000 rpm	112	lbs.	max.
		3000 rpm	92	lbs.	max.
		4000 rpm	85	lbs.	max.
		5000 rpm	81	percent	max.
38	Bearing Class, Internal/External		3/1	ABEC/AFBMA	reference
39	Bearing Grease		—	Manufacturer	reference
40	Shaft Seal Pressure		—	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 4 (P/2)		
42	Stator Phase Sequence		A-B-C (CW viewed from front face plate)		
43	Vendor/Supplier		Polymotor FAS 1 060 060 00 00 01		
44	Resolver Type/Accuracy		Single-Speed; Rotor-Excited; ± 15 arc min.		
45	Resolver Manufacturer/Model #		Clifton Precision JSMBH-21-K-3		
46	Standard Resolver Cable Part Number		71-011449-xx		
47	Standard Motor Cable Part Number		71-007130-xx		
48	Options:	Brake—24VDC (1A)—1345 oz-in Holding Torque IP65 Classification Incremental Encoder Tachometer No Keyway			

[1] 25°C ambient
[2] 40°C ambient
[3] Material 38 Ni Cr Mo 4
[4] Loads centered 1 inch from mounting flange
Life expectancy = 20000 hours

Z810 Motor Specifications

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	Motor Size	**Z820**	Value	Units	Tolerance
1	Constant (s):	Torque	156.0	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	66.5	V rms/Krpm	± 10%
3		Electrical Time	8.5	milliseconds	nominal
4		Mechanical Time	1.8	milliseconds	nominal
5		Thermal	63	minutes	nominal
6	Torque (s):	Continuous, Stall	2171	oz-in	min. [1]
7		Continuous, Stall	2068	oz-in	min. [2]
8		Continuous, Rated	1652	oz-in	min. [1]
9		Peak, Max w/o Saturation	6200	oz-in	min. [1]
10		Static Friction	—	oz-in	max.
11		Ripple (of Rated Torque)	3	percent	max.
12	Speed:	Rated	2700	rpm	reference
13		Maximum	2700	rpm	reference
14	Frequency	Rated	180	Hz	max.
15	Current:	Rated	14.0	A rms	max. [1]
16		Peak	42.0	A rms	nominal
17	Voltage:	Rated	220	V rms	reference
18		Max	240	V rms	maximum
19	Output Power:	Rated	3.3 (4.4)	kWatts (hp)	min. [1]
20	Inductance:	Terminal (line-line)	5.1	mH	± 10%
21	D.C. Resistance	Terminal (line-line)	0.6	Ohms	± 10 % [1]
22	Acceleration at Rated Torque		7000	rads/sec^2	Theoretical
23	Rotor Inertia		2100	kgm^2 * 1E-6	nominal
24	Damping		—	oz-in / krpm	nominal
25	Weight		37.8	lbs.	max.
26	Winding Temperature		150	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		125	°C (Celsius)	reference
28	Insulation Class		F	—	reference
29	Thermostat TRIP Temperature		145	°C (Celsius)	± 5 °C
30	Thermostat RESET Temperature		130	°C (Celsius)	± 10 °C
31	Dielectric Strength, (Winding-to-Frame)		1000	VAC	min.
32	Winding Capacitance to Frame		—	µF	max.
33	IP Classification		54	rated	standard
34	Shaft: Radial-Play (front to back)		0.001	in/lb	reference
35	Material [3]		UNI 5332	—	reference
36	Magnet Type		SmCo	—	—
37	Loading [4]	1000 rpm	360	lbs.	max.
		2000 rpm	281	lbs.	max.
		3000 rpm	236	lbs.	max.
		4000 rpm	—	lbs.	max.
		5000 rpm	—	lbs.	max.
38	Bearing Class, Internal/External		3/1	ABEC/AFBMA	reference
39	Bearing Grease		—	Manufacturer	reference
40	Shaft Seal Pressure		—	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 4 (P/2)		
42	Stator Phase Sequence		A-B-C (CW viewed from front face plate)		
43	Vendor/Supplier		Polymotor FAS 2 120 120 00 00 01		
44	Resolver Type/Accuracy		Single-Speed; Rotor-Excited; ± 15 arc min.		
45	Resolver Manufacturer/Model #		Clifton Precision JSMBH-21-K-3		
46	Standard Resolver Cable Part Number		71-011449-xx		
47	Standard Motor Cable Part Number		71-007130-xx		
48	Options:	Brake—24VDC (1.7A)—4956 oz-in Holding Torque IP65 Classification Incremental Encoder Tachometer No Keyway			

[1] 25°C ambient
[2] 40°C ambient
[3] Material 38 Ni Cr Mo 4
[4] Loads centered 1 inch from mounting flange
Life expectancy = 20000 hours

Z820 Motor Specifications

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	Motor Size	**Z830**	Value	Units	Tolerance
1	Constant (s):	Torque	234.0	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	99.8	V rms/Krpm	± 10%
3		Electrical Time	9.6	milliseconds	nominal
4		Mechanical Time	1.6	milliseconds	nominal
5		Thermal	67	minutes	nominal
6	Torque (s):	Continuous, Stall	3271	oz-in	min. [1]
7		Continuous, Stall	3115	oz-in	min. [2]
8		Continuous, Rated	2554	oz-in	min. [1]
9		Peak, Max w/o Saturation	9345	oz-in	min. [1]
10		Static Friction	—	oz-in	max.
11		Ripple (of Rated Torque)	6	percent	max.
12	Speed:	Rated	1800	rpm	reference
13		Maximum	1800	rpm	reference
14	Frequency	Rated	120	Hz	max.
15	Current:	Rated	14.0	A rms	max. [1]
16		Peak	42.0	A rms	nominal
17	Voltage:	Rated	220	V rms	reference
18		Max	240	V rms	maximum
19	Output Power:	Rated	3.4 (4.6)	kWatts (hp)	min. [1]
20	Inductance:	Terminal (line-line)	7.7	mH	± 10%
21	D.C. Resistance	Terminal (line-line)	0.8	Ohms	± 10 % [1]
22	Acceleration at Rated Torque		7200	rads/sec^2	Theoretical
23	Rotor Inertia		3050	kgm^2 * 1E-6	nominal
24	Damping		—	oz-in / krpm	nominal
25	Weight		48.0	lbs.	max.
26	Winding Temperature		150	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		125	°C (Celsius)	reference
28	Insulation Class		F	—	reference
29	Thermostat TRIP Temperature		145	°C (Celsius)	± 5 °C
30	Thermostat RESET Temperature		130	°C (Celsius)	± 10 °C
31	Dielectric Strength, (Winding-to-Frame)		1000	VAC	min.
32	Winding Capacitance to Frame		—	µF	max.
33	IP Classification		54	rated	standard
34	Shaft: Radial-Play (front to back)		0.001	in/lb	reference
35	Material [3]		UNI 5332	—	reference
36	Magnet Type		SmCo	—	max
37	Loading [4]	1000 rpm	370	lbs.	max
		2000 rpm	281	lbs.	max
		3000 rpm	—	lbs.	max
		4000 rpm	—	lbs.	max
		5000 rpm	—	lbs.	max
38	Bearing Class, Internal/External		3/1	ABEC/AFBMA	reference
39	Bearing Grease		—	Manufacturer	reference
40	Shaft Seal Pressure		—	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 4 (P/2)		
42	Stator Phase Sequence		A-B-C (CW viewed from front face plate)		
43	Vendor/Supplier		Polymotor FAS 2 180 018 00 00 01		
44	Resolver Type/Accuracy		Single-Speed; Rotor-Excited; ± 15 arc min.		
45	Resolver Manufacturer/Model #		Clifton Precision JSMBH-21-K-3		
46	Standard Resolver Cable Part Number		71-011449-xx		
47	Standard Motor Cable Part Number		71-007130-xx		
48	Options:	Brake—24VDC (1.7A)—4956 oz-in Holding Torque IP65 Classification Incremental Encoder Tachometer No Keyway			

[1] 25°C ambient
[2] 40°C ambient
[3] Material 38 Ni Cr Mo 4
[4] Loads centered 1 inch from mounting flange
Life expectancy = 20000 hours

Z830 Motor Specifications

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	Motor Size	**Z840**	Value	Units	Tolerance
1	Constant (s):	Torque	312.0	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	133.0	V rms/Krpm	± 10%
3		Electrical Time	10.2	milliseconds	nominal
4		Mechanical Time	1.4	milliseconds	nominal
5		Thermal	68	minutes	nominal
6	Torque (s):	Continuous, Stall	4311	oz-in	min. [1]
7		Continuous, Stall	4106	oz-in	min. [2]
8		Continuous, Rated	3554	oz-in	min. [1]
9		Peak, Max w/o Saturation	12318	oz-in	min. [1]
10		Static Friction	—	oz-in	max.
11		Ripple (of Rated Torque)	8	percent	max.
12	Speed:	Rated	1300	rpm	reference
13		Maximum	1300	rpm	reference
14	Frequency	Rated	86.7	Hz	max.
15	Current:	Rated	14.0	A rms	max. [1]
16		Peak	42.0	A rms	nominal
17	Voltage:	Rated	220	V rms	reference
18		Maximum	240	V rms	maximum
19	Output Power:	Rated	3.5 (4.7)	kWatts (hp)	min. [1]
20	Inductance:	Terminal (line-line)	10.2	mH	± 10%
21	D.C. Resistance	Terminal (line-line)	1.0	Ohms	± 10 % [1]
22	Acceleration at Rated Torque		7500	rads/sec^2	Theoretical
23	Rotor Inertia		3850	kgm^2 * 1E-6	nominal
24	Damping		--	oz-in / krpm	nominal
25	Weight		59.0	lbs.	max.
26	Winding Temperature		150	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		125	°C (Celsius)	reference
28	Insulation Class		F	—	reference
29	Thermostat TRIP Temperature		145	°C (Celsius)	± 5 °C
30	Thermostat RESET Temperature		130	°C (Celsius)	± 10 °C
31	Dielectric Strength, (Winding-to-Frame)		1000	VAC	min.
32	Winding Capacitance to Frame		—	µF	max.
33	IP Classification		54	rated	standard
34	Shaft: Radial-Play (front to back)		0.001	in/lb	reference
35		Material [3]	UNI 5332	lbs.	maximum
36		Magnet Type	SmCo	lbs.	maximum
37		Loading [4] 1000 rpm	393	lbs.	maximum
		2000 rpm	—	lbs.	maximum
		3000 rpm	—	lbs.	maximum
		4000 rpm	—	lbs.	maximum
		5000 rpm	—	lbs.	maximum
38	Bearing Class, Internal/External		3/1	ABEC/AFBMA	reference
39	Bearing Grease		—	Manufacturer	reference
40	Shaft Seal Pressure		—	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 4 (P/2)		
42	Stator Phase Sequence		A-B-C (CW viewed from front face plate)		
43	Vendor/Supplier		Polymotor FAS 2 240 013 00 00 01		
44	Resolver Type/Accuracy		Single-Speed; Rotor-Excited; ± 15 arc min.		
45	Resolver Manufacturer/Model #		Clifton Precision JSMBH-21-K-3		
46	Standard Resolver Cable Part Number		71-011449-xx		
47	Standard Motor Cable Part Number		71-007130-xx		
48	Options:	Brake—24VDC (1.7A)—4956 oz-in Holding Torque IP65 Classification Incremental Encoder Tachometer No Keyway			

① 25°C ambient
② 40°C ambient
③ Material 38 Ni Cr Mo 4
④ Loads centered 1 inch from mounting flange
Life Expectancy = 20000 hours

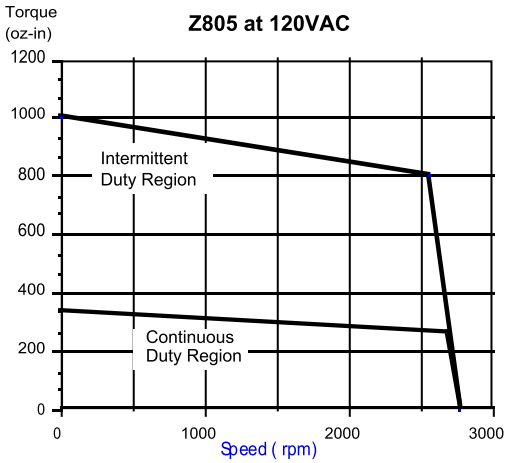
Z840 Motor Specifications

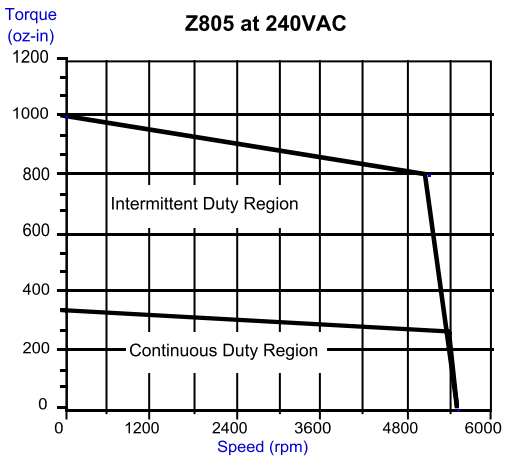
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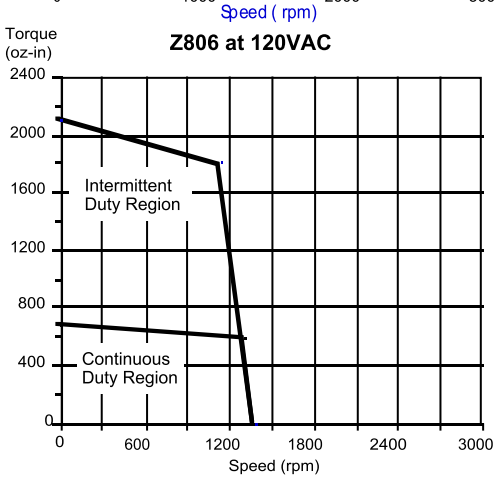
Speed/Torque Curves

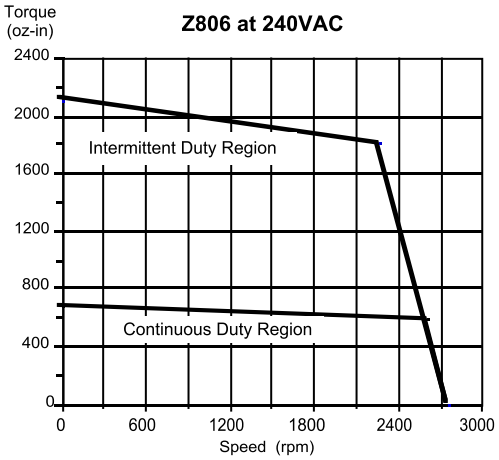
The following speed/torque curves represent the available shaft torque at different operating speeds. Operation at 120VAC and 240VAC is shown for each motor size. Actual motor torque may vary ±10% due to motor manufacturing variances. For operation from a 1-phase 120VAC, the output torque stays relatively constant and the top-end speed falls off at the ratio of the input voltage (i.e., A Z810 operating at 240VAC has a rated speed of 6000 rpm; at 120VAC, it has a rated speed of 3000 rpm).

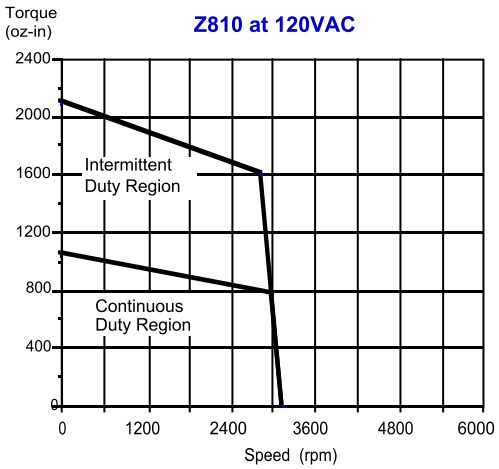
☞ ***Helpful Hint:*** **Continuous Duty** is steady state operation for drive ambient temperatures of 0°C - 50°C. **Intermittent Duty** is operation for 3.3 seconds or less.

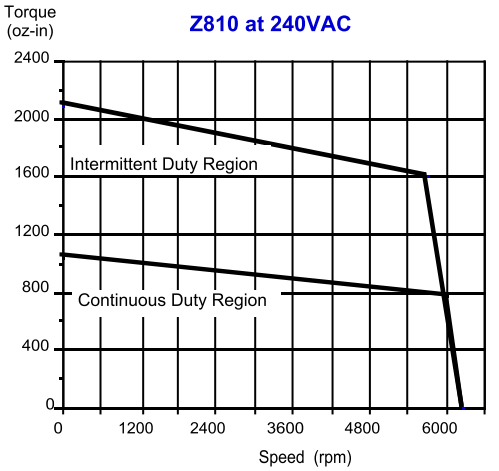




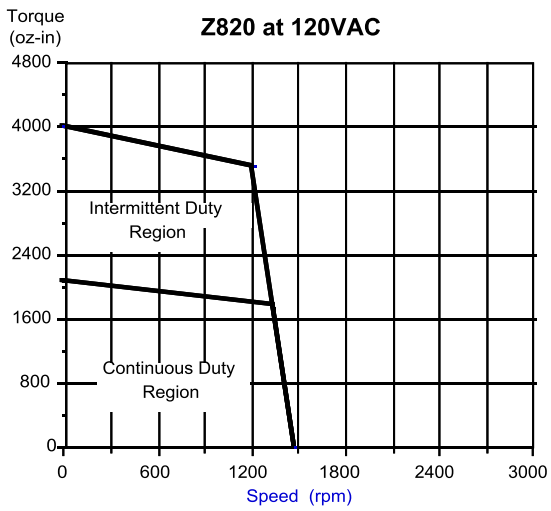


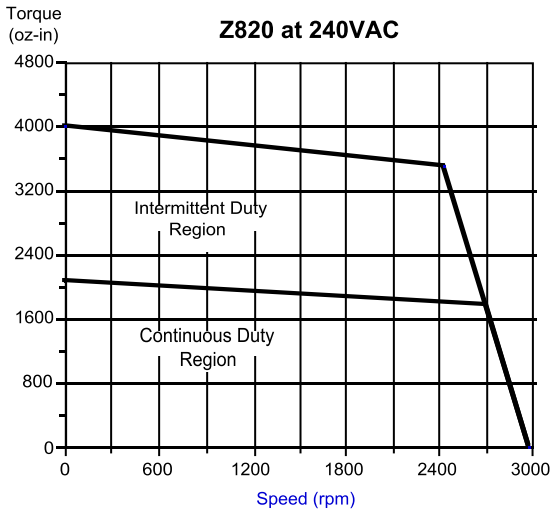


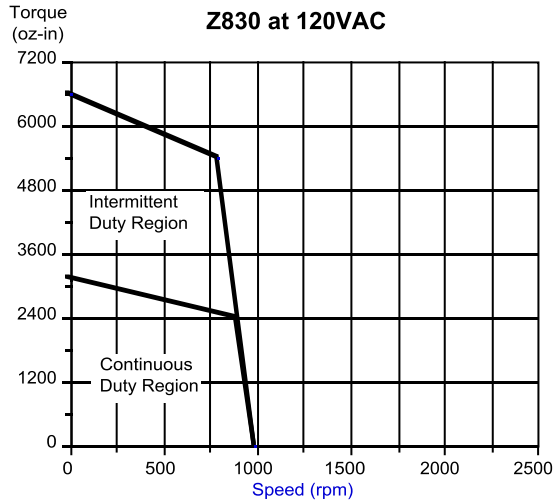


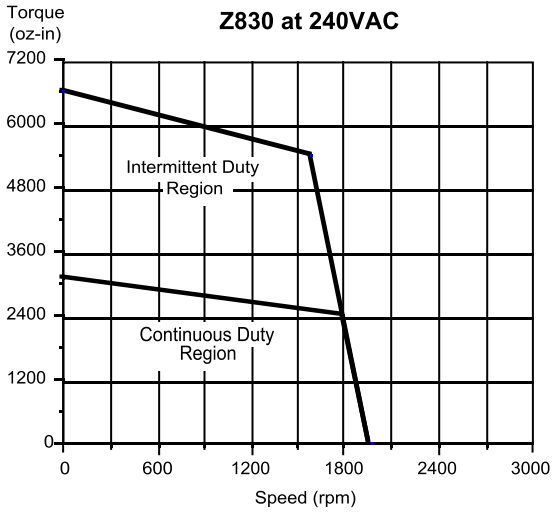


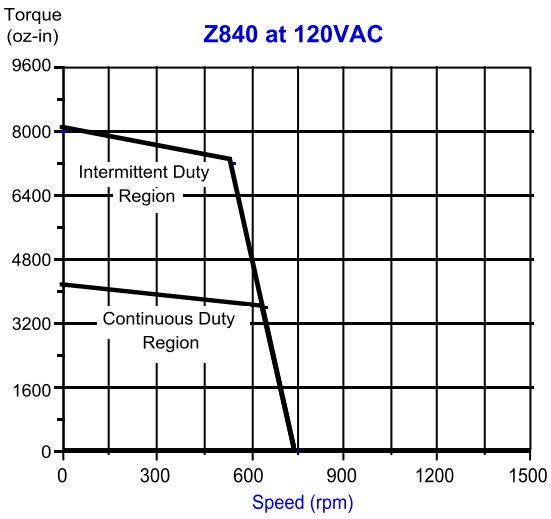
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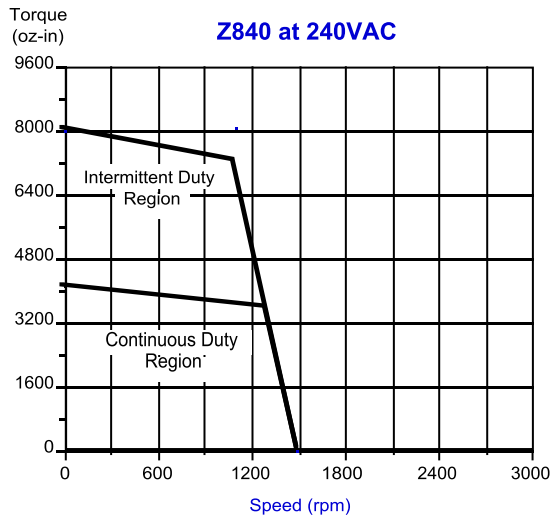












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Z900 Electrical Specifications

Electrical specifications for the Z900 series drive's input and output power are provided in this section.

Input Power

- ❏ Voltage (Nominal) — 240VAC (1-phase or 3-phase)
- ❏ Voltage (Range) — 205-252VAC (1-phase or 3-phase)
- ❏ Frequency (Range) — 47-66 Hz
- ❏ Current (Max. cont.) — 30A (rms) 3-phase **or** 52A (rms) 1-phase
- ❏ Power (Max. cont.) — 12.4 KVA
- ❏ Fuses — 40A slow blow—User accessible
- ❏ Isolation transformer — Not required

The actual input power and current is a function of the motor's operating point (speed and torque) and the duty cycle. You can de-rate the fuses and isolation transformer by scaling the above numbers by your actual requirements. The numbers above reflect the servo motor and drive operating at rated speed and at rated torque at 100% duty.

Output Power

- ❏ Voltage — 405VDC (maximum)
- ❏ Frequency — 0 - 400Hz fundamental (7 kHz PWM)
- ❏ Current — 40A continuous per phase sinusoidal (28.28 Arms)
80A per phase peak (56.56 Arms)
- ❏ Regen/power dump — Optional accessory

Z900 Motor/Drive Configuration

The Z900's hardware is pre-configured to control Z900 series motors. The Z9X00 series drives only Z900 motors, the Z800 series drives only Z800 motors, and the Z600 series drives only Z600 motors. *Be sure that your drive type matches your motor type (Z600, Z800, or Z900).* If you have questions regarding the Z motor/drive configuration, contact your local Automation Technology Center (ATC) or distributor.

Z900 Technical Data

	Units	Z910	Z920	Z930	Z940
Continuous Stall Torque (±10%)	oz-in	2407	4263	5990	9021
	lb-in	150	266	374	564
	lb-ft	12.5	22.2	31.2	47.0
	Nm	17.0	30.1	42.3	63.7
Peak Torque (±10%)	oz-in	5205	8525	11980	18041
	lb-in	325	533	749	1128
	lb-ft	27	44	62	94
	Nm	37	60	85	127
Rated Torque (±10%)	oz-in	1939	3341	4830	7480
	lb-in	121	209	302	467
	lb-ft	10.1	17.4	25.2	39.0
	Nm	13.7	23.6	34.1	52.8
Rated Power	hp	9.6	10.4	11.0	11.1
	Watts	7.2	7.8	8.2	8.3
Rated Speed	rpm	5000	3150	2300	1500
	rps	83.3	52.5	38.3	25.0
Rated Current (line)	A (rms)	27.2	27.7	28.3	28.3
Peak Current (3.3 seconds max)	A (rms)	56.6	56.6	56.6	56.6
Max. Cont. AC input current (3 phase 240VAC)	A (rms)	30	30	30	30
Rotor Inertia	oz-in^2 (mass) oz-in-sec^2 Kg m^2 x 1E-6	50.79 0.132 92.9	111.21 0.288 2034	166.21 0.431 3040	459.48 1.190 8404
Motor Weight	lbs	32	57	65	112
	kg(f)	15	26	29	51
Shipping Weight	lbs	89	114	122	169
	kg(f)	40	52	55	77

Z900 Series Performance Specifications

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Positional Repeatability

Repeatability: ±0.088 degrees, unloaded

Positional Accuracy

Resolver Accuracy: ±7 arc minutes

Resolver-to-Digital Converter Accuracy: ±8 arc minutes *(For finer accuracies, contact Compumotor—800-722-2282.)*

Motor Drive Compatibility

Different motors can take different amounts of current and require different tuning parameters for typical loads. The **CMTR** (Configure Motor Type) command sets up a drive for a particular motor. By issuing **CMTR**, motor current levels and default parameters are recalled from memory. Do not exceed the current level specified for the motor, excessive current levels will damage the motor.

The following information is provided in case you must modify the motor/drive configuration. This command sequence will set up a drive for a particular motor size and perform the commutation (refer to *Chapter ⑥ Software Reference* for more on these commands).

> ***WARNING***
>
> This commutation procedure causes violent motor motion. All loads should be removed from the motor shaft before you begin this procedure.

Command	Description
`> 1OFF`	Turns drive off
`> 1CMTRxxx`	Sets drive for the motor; xxx = 910, 920, 930, or 940
`> 1ON`	Enables the drive

Motor Brakes

These brakes are mounted directly behind the motor and come completely assembled from the factory. When ordering the brake option, please specify the motor type.

Brake Characteristics	Z910	Z920/930	Z940	Units
Supply Voltage	24	24	24	VDC
Supply Current	0.93	1.27	*	A
Static Braking Torque	1152	6720	*	oz-in

* Same as Z920/930 Characteristics

Z900 Motor Brake Characteristics

Motor Data

The following pages provide detailed information on each of the four motor frame sizes of Z900 series systems (Z910, Z920, Z930, Z940). The data reflecting motor torque does not assume operation from a Z900 drive. The torque specifications reflect the motor's capabilities. In most cases, the motor windings match the drive's output power with an additional safety margin.

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	Motor Size:	**Z910**	Value	Units	Tolerance
1	Constant (s):	Torque	88.32	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	26.7	V rms/Krpm	± 10%
3		Electrical Time	24	milliseconds	nominal
4		Mechanical Time	0.672	milliseconds	nominal
5		Thermal	43	minutes	nominal
6	Torque (s):	Continuous, Stall	2544	oz-in	min. [1]
7		Continuous, Stall	2400	oz-in	min. [2]
8		Continuous, Stall	1939	oz-in	min. [2]
9		Peak, Max w/o Saturation	6835	oz-in	min. [1]
10		Static Friction	40.7	oz-in	max.
11		Ripple (of Rated Torque)	4.5	percent	max. [3]
12	Speed:	Rated	5000	rpm	reference
13		Maximum	5000	rpm	reference
14	Frequency	Rated	166.6	Hz	max.
15	Current:	Rated	27.2	A rms	max. [1]
16		Peak	81.4	A rms	nominal
17	Voltage:	Rated	230	V rms	reference
18		Max	250	V rms	maximum
19	Output Power	Rated	7.2 (9.6)	kWatts (hp)	min. [1]
20	Inductance	Terminal (line-line)	4.8	mH	± 30%
21	D.C. Resistance	Terminal (line-line)	0.2	ohms	± 10 % [1]
22	Acceleration at Rated Torque		51971	rads/sec^2	Theoretical
23	Rotor Inertia		929	kgm^2 * 1E-6	nominal
24	Damping		1.728	oz-in / krpm	nominal
25	Weight		32	lbs.	max.
26	Winding Temperature		170 [4]	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		145	°C (Celsius)	reference
28	Insulation Class		H	—	reference
29	Thermostat TRIP Temperature		170	°C (Celsius)	± 5° C
30	Thermostat RESET Temperature		135	°C (Celsius)	± 10° C
31	Dielectric Strength, (Winding-to-Frame)		1750	VAC	min.
32	Winding Capacitance to Frame		0.00205	µF	max.
33	IP Classification		65 [8]	rated	standard
34	Shaft: Radial-Play (front to back)		2E-5/7E-6	in/lb	reference
35	Material [5]		RC#30	—	reference
36	Magnet type		NbFeB	—	—
37	Loading [6]	1000 rp m	160	lbs.	max. [7]
		2000 rpm	127.1	lbs.	max. [7]
		3000 rpm	110.9	lbs.	max. [7]
		4000 rpm	100.8	lbs.	max. [7]
		5000 rpm	93.6	lbs.	max. [7]
38	Bearing Class, Internal/External		1/Class 3	ABEC/AFBMA	reference
39	Bearing Grease		SRI#2	manufacturer	reference
40	Shaft Seal Pressure		0.21(3)	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 2(P/2)		
42	Stator Phase Sequence		A-C-B (viewed from front face plate)		
43	Vendor / Supplier		Industrial Drives B-406-C		
44	Resolver Type / Accuracy		oz-in/A rms ± 7 arc min.		
45	Resolver Manufacturer/Model #		Fasco # 21-BRCX-335-J39		
46	Standard Resolver Cable Part Number		71-011776-xx		
47	Standard Motor Cable Part Number		71-011776-xx		
48	Options:	Brake—24VDC (0.93A)—1152 oz-in Holding Torque IP67 classification Incremental Encoder Tachometer No keyway			

[1] 25°C Ambient
[2] 40°C Ambient
[3] Measured at 60 rpm (1 rps) in velocity mode
[4] Rated for 20,000 hours or 40,000 hours @ 155° C
[5] Rotor steel is rated as *fatigue proof*
[6] Loads centered 1 inch from mounting flange
[7] Loads may be radial and axial such that the sum of the radial and two times the axial does not exceed this figure.
[8] Motor shaft is IP30 rated.

Z910 Motor Specifications

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	Motor Size:	**Z920**	Value	Units	Tolerance
1	Constant (s):	Torque	154.2	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	46.6	V rms/Krpm	± 10%
3		Electrical Time	26.9	milliseconds	nominal
4		Mechanical Time	0.6	milliseconds	nominal
5		Thermal	46	minutes	nominal
6	Torque (s):	Continuous, Stall	4518	oz-in	min. [1]
7		Continuous, Stall	4262	oz-in	min. [2]
8		Continuous, Stall	3341	oz-in	min. [2]
9		Peak, Max w/o Saturation	12422	oz-in	min. [1]
10		Static Friction	65	oz-in	max
11		Ripple (of Rated Torque)	4.5	percent	max. [3]
12	Speed:	Rated	3150	rpm	reference
13		Maximum	3150	rpm	reference
14	Frequency	Rated	157.5	Hz	max.
15	Current:	Rated	27.7	A rms	max. [1]
16		Peak	84.8	A rms	nominal
17	Voltage:	Rated	230	V rms	reference
18		Max	250	V rms	maximum
19	Output Power	Rated	7.7 (10.4)	kWatts (hp)	min. [1]
20	Inductance	Terminal (line-line)	6.3	mH	± 30%
21	D.C. Resistance	Terminal (line-line)	0.234	ohms	± 10 % [1]
22	Acceleration at Rated Torque		43133	rads/sec^2	Theoretical
23	Rotor Inertia		2034	kgm^2 * 1E-6	nominal
24	Damping		15.36	oz-in / krpm	nominal
25	Weight		51	lbs.	max.
26	Winding Temperature		170 [4]	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		145	°C (Celsius)	reference
28	Insulation Class		H	—	reference
29	Thermostat TRIP Temperature		170	°C (Celsius)	± 5 °C
30	Thermostat RESET Temperature		135	°C (Celsius)	± 10 °C
31	Dielectric Strength, (Winding-to-Frame)		1750	VAC	min.
32	Winding Capacitance to Frame		0.0034	µF	max.
33	IP Classification		65 [8]	rated	standard
34	Shaft: Radial-Play (front to back)		2E-5/7E-6	in/lb	reference
35		Material [5]	RC#30	—	reference
36		Magnet type	NbFeB	—	—
37		Loading [6] 1000 rp m	255.6	lbs.	max. [7]
		2000 rpm	202.9	lbs.	max. [7]
		3000 rpm	177.2	lbs.	max. [7]
		4000 rpm	N/A	lbs.	max. [7]
		5000 rpm	N/A	lbs.	max. [7]
38	Bearing Class, Internal/External		1/Class 3	ABEC/AFBMA	reference
39	Bearing Grease		SRI#2	manufacturer	reference
40	Shaft Seal Pressure		0.21(3)	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 3(P/2)		
42	Stator Phase Sequence		A-C-B (viewed from front face plate)		
43	Vendor / Supplier		Industrial Drives B-604-B		
44	Resolver Type / Accuracy		Single-Speed; Rotor-Excited; ± 7 arc min.		
45	Resolver Manufacturer/Model #		Fasco # 21-BRCX-335-J39		
46	Standard Resolver Cable Part Number		71-011777-xx		
47	Standard Motor Cable Part Number		71-012979-xx		
48	Options:	Brake—24VDC (1.27A)—6720 oz-in Holding Torque IP67 Classification Incremental Encoder Tachometer No Keyway			

[1] 25°C ambient
[2] 40°C ambient
[3] Measured at 60 rpm (1 rps) in velocity mode
[4] Rated for 20,000 hours or 40,000 hours @ 155°C
[5] Rotor steel is rated as *fatigue proof*
[6] Loads centered 1 inch from mounting flange
[7] Loads may be radial and axial such that the sum of the radial and two times the axial does not exceed this figure.
[8] Motor shaft is IP30 rated.

Z920 Motor Specifications

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	Motor Size:	**Z930**	Value	Units	Tolerance
1	Constant (s):	Torque	212	oz-in	± 10%
2		Voltage (Sinusodial)	64	V rms/Krpm	±10%
3		Electrical Time	31.1	milliseconds	nominal
4		Mechanical Time	0.53	milliseconds	nominal
5		Thermal	50	minutes	nominal
6	Torque (s):	Continuous, Stall	6513	oz-in	min. [1]
7		Continuous, Stall	6144	oz-in	min. [2]
8		Continuous, Rated	4954	oz-in	min. [2]
9		Peak, Max w/o Saturation	17357	oz-in	min. [1]
10		Static Friction	133.2	oz-in	max
11		Ripple (of Rated Torque)	4.5	percent	min. [3]
12	Speed:	Rated	2300	rpm	reference
13		Maximum	2300	rpm	reference
14	Frequency	Rated	115	Hz	max.
15	Current:	Rated	29	A rms	max. [1]
16		Peak	86.2	A rms	nominal
17	Voltage:	Rated	230	V rms	reference
18		Max	250	V rms	maximum
19	Output Power:	Rated	8.4 (11.3)	kWatts (hp)	min. [1]
20	Inductance:	Terminal (line-line)	8.1	mH	± 30%
21	D.C. Resistance	Terminal (line-line)	0.26	ohms	± 10 % [1]
22	Acceleration at Rated Torque		40357	rads/sec^2	Theoretical
23	Rotor Inertia		3040	kgm^2 * 1E-6	nominal
24	Damping		2.88	oz-in / krpm	nominal
25	Weight		65	lbs.	max.
26	Winding Temperature		170 [4]	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		145	°C (Celsius)	reference
28	Insulation Class		H	—	reference
29	Thermostat TRIP Temperature		170	°C (Celsius)	± 5 °C
30	Thermostat RESET Temperature		135	°C (Celsius)	± 10 °C
31	Dielectric Strength, (Winding-to-Frame)		1750	VAC	min.
32	Winding Capacitance to Frame		0.0038	µF	max.
33	IP Classification		65 [8]	rated	standard
34	Shaft: Radial-Play (front to back)		2E-5/7E-6	in/lb	reference
35		Material [5]	RC#30	—	—
36		Magnet type	NbFeB	—	max. [7]
37		Loading [6] 1000 rpm	263	lbs.	max. [7]
		2000 rpm	208.8	lbs.	max. [7]
		3000 rpm	N/A	lbs.	max. [7]
		4000 rpm	N/A	lbs.	max. [7]
		5000 rpm	N/A	lbs.	max. [7]
38	Bearing Class, Internal/External		1/Class 3	ABEC/AFBMA	reference
39	Bearing Grease		SRI#2	manufacture	reference
40	Shaft Seal Pressure		0.21(3)	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 2(P/2)		
42	Stator Phase Sequence		A-C-B (viewed from front face plate)		
43	Vendor / Supplier		Industrial Drives B-606-D		
44	Resolver Type / Accuracy		Single-Speed; Rotor-Excited; ± 7 arc min.		
45	Resolver Manufacturer/Model #		Fasco # 21-BRCX-335-J39		
46	Standard Resolver Cable Part Number		71-011777-01		
47	Standard Motor Cable Part Number		71-012979-01		
48	Options:	Brake—24VDC (1.27A)—6720 oz-in Holding Torque IP67 Classification Incremental Encoder Tachometer No keyway			

[1] 25°C Ambient
[2] 40°C Ambient
[3] Measured at 60 rpm (1 rps) in velocity mode
[4] Rated for 20,000 hours or 40,000 hours @ 155° C
[5] Rotor steel is rated as *fatigue proof*
[6] Loads centered 1 inch from mounting flange
[7] Loads may be radial and axial such that the sum of the radial and two times the axial does not exceed this figure.
[8] Motor shaft is IP30 rated.

Z930 Motor Specifications

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	Motor Size:	**Z940**	Value	Units	Tolerance
1	Constant (s):	Torque	319	oz-in/A rms	± 10%
2		Voltage (Sinusodial)	96.3	V rms/Krpm	± 10%
3		Electrical Time	56.5	milliseconds	nominal
4		Mechanical Time	0.57	milliseconds	nominal
5		Thermal	56	minutes	nominal
6	Torque (s):	Continuous, Stall	12007	oz-in	min. [1]
7		Continuous, Stall	11328	oz-in	min. [2]
8		Continuous, Rated	9388	oz-in	min. [2]
9		Peak, Max w/o Saturation	32870	oz-in	min. [1]
10		Static Friction	128.6	oz-in	max.
11		Ripple (of Rated Torque)	4.5	percent	min. [3]
12	Speed:	Rated	1500	rpm	reference
13		Maximum	1500	rpm	reference
14	Frequency	Rated	75	Hz	max.
15	Current:	Rated	35.5	A rms	max. [1]
16		Peak	108.5	A rms	nominal
17	Voltage:	Rated	230	V rms	reference
18		Max	250	V rms	maximum
19	Output Power:	Rated	10.4 (14.0)	kWatts (hp)	min. [1]
20	Inductance:	Terminal (line-line)	13	mH	± 30%
21	D.C. Resistance	Terminal (line-line)	0.23	ohms	± 10 % [1]
22	Acceleration at Rated Torque		27613	rads/sec^2	Theoretical
23	Rotor Inertia		8400	kgm^2 * 1E-6	nominal
24	Damping		15.36	oz-in / krpm	nominal
25	Weight		112	lbs.	max.
26	Winding Temperature		170 [4]	°C (Celsius)	max.
27	Winding Temperature Rise (Above Ambient) [1]		145	°C (Celsius)	reference
28	Insulation Class		H	—	reference
29	Thermostat TRIP Temperature		170	°C (Celsius)	± 5 °C
30	Thermostat RESET Temperature		135	°C (Celsius)	± 10 °C
31	Dielectric Strength, (Winding-to-Frame)		1750	VAC	min.
32	Winding Capacitance to Frame		0.0082	µF	max.
33	IP Classification		65 [8]	rated	standard
34	Shaft: Radial-Play (front to back)		1E-5/4E-6	in/lb	reference
35		Material [5]	RC#30	—	reference
36		Magnet type	NbFeB	—	—
37		Loading [6] 1000 rpm	365.9	lbs.	max. [7]
		2000 rpm	N/A	lbs.	max. [7]
		3000 rpm	N/A	lbs.	max. [7]
		4000 rpm	N/A	lbs.	max. [7]
		5000 rpm	N/A	lbs.	max. [7]
38	Bearing Class, Internal/External		1/Class 3	ABEC/AFBMA	reference
39	Bearing Grease		SRI#2	manufacture	reference
40	Shaft Seal Pressure		0.21(3)	kg/cm^2 (psi)	max.
41	Basic Motor Design		3 phase *wye* connected 3(P/2)		
42	Stator Phase Sequence		A-C-B (viewed from front face plate)		
43	Vendor / Supplier		Industrial Drives B-804-A		
44	Resolver Type / Accuracy		Single-Speed; Rotor-Excited; ± 7 arc min.		
45	Resolver Manufacturer/Model #		Fasco # 21-BRCX-335-J39		
46	Standard Resolver Cable Part Number		71-011777-01		
47	Standard Motor Cable Part Number		71-012979-01		
48	Options:	Brake -- 24VDC (1.27A) -- 6816 oz-in Holding Torque IP67 Classification Incremental Encoder Tachometer No Keyway			

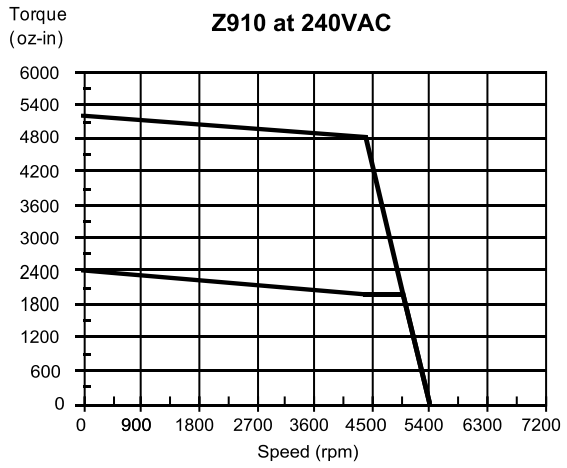
[1] 25°C Ambient
[2] 40°C Ambient
[3] Measured at 60 rpm (1 rps) in velocity mode
[4] Rated for 20,000 hours or 40,000 hours @ 155°C
[5] Rotor steel is rated as *fatigue proof*
[6] Loads centered 1 inch from mounting flange
[7] Loads may be radial and axial such that the sum of the radial and two times the axial does not exceed this figure.
[8] Motor shaft is IP30 rated.

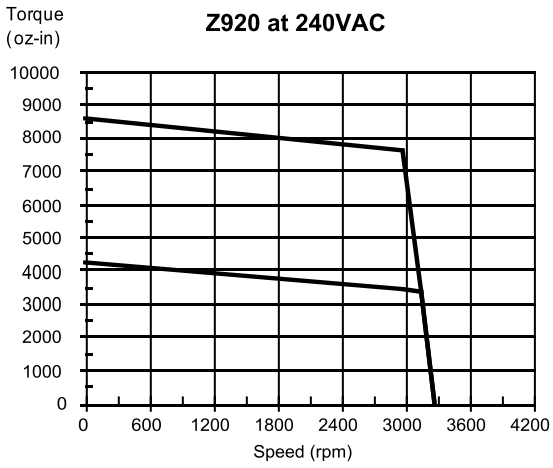
Z940 Motor Specifications

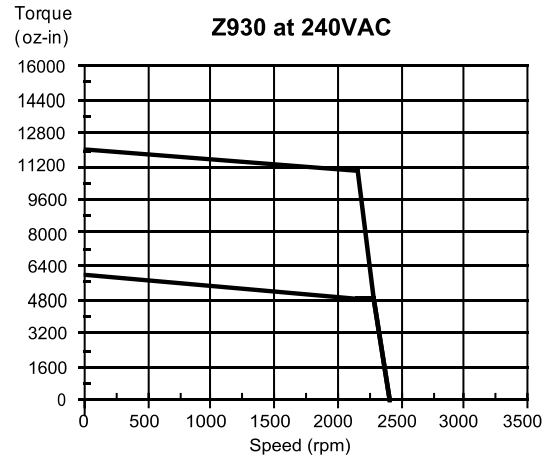
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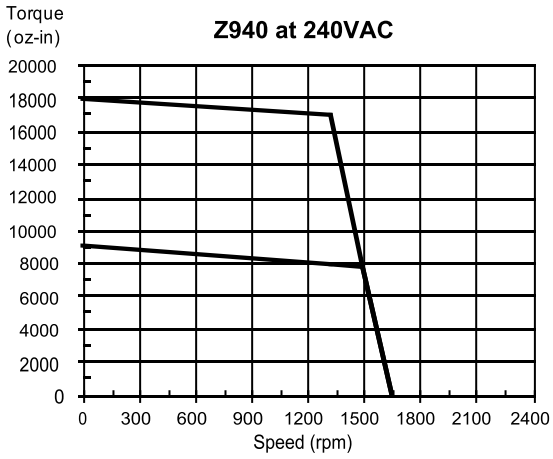
Speed/Torque Curves

The following speed/torque curves represent the available shaft torque at different operating speeds. Operation at 240VAC is shown for each motor size. Actual motor torque may vary ±10% due to motor manufacturing variances.









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C H A P T E R ⑧

Maintenance & Troubleshooting

The information in this chapter will enable you to:

- ❏ Maintain the system's components to ensure smooth, efficient operation
- ❏ Isolate and resolve system hardware and software problems
- ❏ Quick-reference for system warning & fault codes

Motor Maintenance

The motor should be inspected regularly to ensure that no bolts or couplings have worked loose during normal operation. This could prevent minor problems from developing into major problems.

The motor is brushless and the bearings are sealed. ***No maintenance, other than regular visual inspection, is necessary***.

Drive Maintenance

The Z Drive requires very little maintenance, but the NEMA cabinet should be regularly inspected to make sure that the air filters are kept clean. The Z Drive requires good air flow for proper cooling.

Troubleshooting

If your system malfunctions, you must identify and isolate the problem. The first step is to isolate each system component and ensure that each component functions properly when it is run independently. If you have additional units available, you may want to use them to replace existing components in your system to help identify the source of the problem.

Determine if the problem is mechanical, electrical, or software-related. Can you repeat or re-create the problem? Do not make quick rationalizations about problems. Random events may appear to be related, but they are not necessarily contributing factors to your problem. You must carefully investigate and decipher the events that occurred before the subsequent system problem.

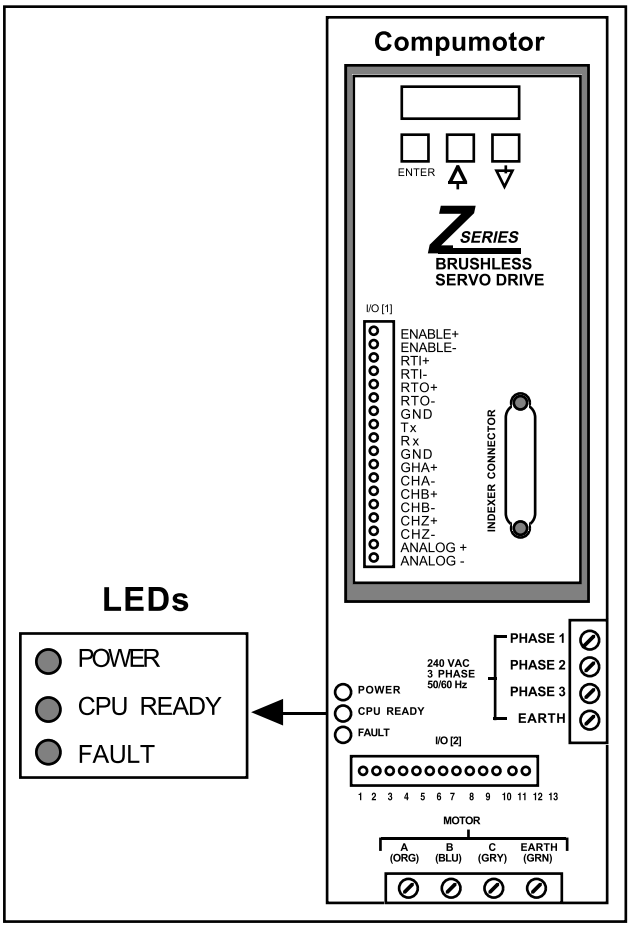
You may be experiencing more than one problem. You must solve one problem at a time. Log (document) all testing and problem isolation procedures. You may need to review and consult these notes later. This will also prevent you from duplicating your testing efforts.

Once you isolate the problem, take the necessary steps to resolve it. Refer to the problem solutions contained in this chapter. If your system's problem persists, contact Compumotor's Applications Engineering Department (800-358-9070).

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Diagnostic LEDs

The Z Drive has three diagnostic LEDs on its front panel. Figure 8-1 shows the location of the LEDs.



Z Drive LEDs

POWER Indicates that the drive is powered-up (normally green).

CPU READY Indicates that the processor is properly functioning (normally green).

FAULT Indicates a drive fault or error (red when a fault exists; normally off).

In addition to these LED indicators, the Z Drive has a front panel display that scrolls fault messages when a fault occurs. *Chapter ④ Application Design* describes all operations and capabilities of the front panel display.

Drive Warning

The following warning code will be displayed on the alphanumeric display before an overvoltage fault occurs.

Code	Warning	Description
03	**OVER VOLTAGE**	The internal bus voltage has passed the warning threshold. This warning will not fault the drive; the error threshold (Error 04) **will** fault the drive. The warning message will remain present until an ON command or a system reset is executed.

Z Drive Warning Code

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Drive Faults

The following Fault Codes and messages will be displayed on the alphanumeric display when the respective faults occur. The Report Servo Errors (**RSE**) command also reports faults and warnings.

All of the possible faults are described below, along with some troubleshooting information. Except where noted, the drive can be re-enabled after a fault has occurred by correcting the fault (if applicable) and typing a **ON** command.

Code	Fault	Description
04	OVER VOLTAGE	The internal bus voltage has exceeded its limit. Verify the input power voltage. This error may also be caused by rapid decelerations. You may need to use the Shunt Regulator option to dissipate the stored mechanical energy as heat. This error overrides the over voltage warning.
17	INDEXER SHUTDOWN	The Remote Power Shutdown input on the indexer connector has been activated, causing the drive to shutdown. Removing this input will re-enable the drive.
18	LOW VOLTAGE	The input power to the drive is either not present, or at a lower voltage than 92V. Verify the input power voltage and make sure that the power is correctly connected.
19	OVER-CURRENT (SHORT CIRCUIT)	A short circuit between motor phases, or between any phase and ground will cause the drive to fault. This may be due to improper motor wiring to the drive or due to a bad motor. In some cases an extremely high acceleration may cause this error. Power down the complete Z Drive, correct the wiring, and power-up the system. This fault cannot be removed by typing the **ON** command.
20	POSITION ERROR EXCEEDED	The user defined position error limit has been exceeded. The **CPE** (Configure Position Error) command can alter the error limit. The factory default is one revolution (5,000 motor steps). A position error may be caused by a rapid acceleration rate or possibly bad servo tuning. The user must decide whether to increase the position error limit or to change his motion profile so that the drive no longer faults out.
21	ROLLING AVERAGE CURRENT FAULT	The user specified average current limit has been exceeded. The **CCA** (Configure Current Average) command alters the average current limit. If the drive continues to fault out, you may have to reduce the acceleration rate of your move. The average current of the drive is calculated over a rolling 4-second time period.
22	AVERAGE CURRENT LIMIT EXCEEDED	The drive's average current limit has been exceed. A hardware detect circuit has turned the drive off due to too much current.
23	DRIVE ENABLE INPUT NOT ACTIVE	The drive enable input on the screw terminal connector I/O[1] has been deactivated. For drive operation, a normally closed switch or wire jumper is necessary from ENABLE+ to ENABLE- input. The Z Drive is shipped with a jumper installed.
27	VELOCITY ERROR EXCEEDED	The user-defined velocity error limit has been exceeded. The **CVE** (Configure Velocity Error) command can alter the error limit. A velocity error may be caused by a rapid acceleration rate or bad servo tuning.
30	Z RAM FAILURE	This error should occur only during factory initialization of the Z Drive.
55	POWER SUPPLY FAILURE	This error indicates that the isolated power supply for the Z Drive's amplifier has failed. Call Compumotor (800-358-9070).
60	COMMANDED SHUTDOWN	The Z Drive has been commanded off by the **OFF** command.
61	INCOMING INDEXER PULSES	When the Z Drive is reset or commanded **ON**, no step pulses are accepted when the amplifier is first enabled (this would constitute infinite acceleration). Make sure that the indexer connected to the Z Drive is not sending out any pulses before commanding the drive **ON**.
62	CURRENT INTEGRATION FAULT	Currently this fault is not enabled.
70	RESOLVER DISCONNECTED	The resolver feedback signal from the motor to the drive is missing. This feedback is required to operate the drive. Make sure the resolver connection is secure.
77	RESOLVER RESOLUTION FAULT	For a given resolver resolution there is a maximum velocity at which the resolver-digital converter can operate. If the drive faults due to this error, the maximum velocity commanded to the drive exceeds the capabilities of the resolver-digital converter. See the **CRR** command.
91	HEATSINK OVER TEMPERATURE	The internal heatsink of the Z Drive has reached its temperature limit. Make sure the ambient temperature for the drive is within specifications.
92	MOTOR OVER TEMPERATURE	The motor has reached its temperature limit. Make sure the ambient temperature for the motor is within specifications. Also make sure the drive is configured correctly for the motor you are using. See the **CMTR** command.
93	PCB OVER TEMPERATURE	The Printed Circuit Board temperature limit has been reached. Make sure the ambient temperature for the drive is within specifications.

Drive Fault Codes

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RS-232C Problems

Use the following procedure to resolve Z Drive communication problems.

① Be sure the host computer's transmit (**Tx**) wire is wired to the peripheral's receive (**Rx**) connection, and the host computer's receive (**Rx**) wire is wired to the peripheral's transmit (**Tx**) connection. Switch the receive and transmit wires on either the host or peripheral if the problem persists.

② Confirm that the host and peripheral are configured for the same baud rate, 8 data bits, 1 stop bit, and no parity.

③ If you receive double characters, for instance typing **A** and receiving **AA**, the the computer is set for half duplex mode. Change the setup to Full Duplex mode.

④ Use DC common or signal ground as a reference, not earth ground.

⑤ Cable lengths should not exceed 50 ft. unless you are using some form of line driver, optical coupler, or shield. As with any control signal, be sure to shield the cable-to-earth ground at one end only.

⑥ To test the terminal or terminal emulation software and the RS-232C cable for proper three-wire communication, unhook the Z Drive and enter a character. You should not receive an echoed character. If you do, you are in half duplex mode. Connect the host's transmit and receive lines together and send another character. You should receive the echoed character. If not, consult the manufacturer of the host's serial interface for proper pin outs.

Returning The System

If your Z Drive system is faulty, you must return the drive and motor for replacement or repair. A failed drive can damage motors, and a faulty motor can damage subsequent drives. If you must return your Z Drive to effect repairs or upgrades, use the following steps:

Step ① Get the serial number and the model number of the defective unit(s), and a purchase order number to cover repair costs in the event the unit is determined by Parker Compumotor to be out of warranty.

Step ② Before you ship the drive to Parker Compumotor, have someone from your organization with a technical understanding of the Z Drive and its application include answers to the following questions:

- ❏ What is the extent of the failure/reason for return?
- ❏ How long did it operate?
- ❏ How many units are still working?
- ❏ How many units failed?
- ❏ What was happening when the unit failed (i.e., installing the unit, cycling power, starting other equipment, etc)?
- ❏ How was the product configured (in detail)?
- ❏ What, if any, cables were modified and how?
- ❏ With what equipment is the unit interfaced?
- ❏ What was the application?
- ❏ What was the system sizing (speed, acceleration, duty cycle, inertia, torque, friction, etc.)?
- ❏ What was the system environment (temperature, enclosure, spacing, unit orientation, contaminants, etc.)?
- ❏ What upgrades, if any, are required (hardware, software, user guide)?

Step ③ Call Parker Compumotor [(800) 358-9070] for a Return Material Authorization (RMA) number. Returned products cannot be accepted without an RMA number.

Step ④ Ship the unit to:

Parker Compumotor Corporation
5500 Business Park Drive
Suite D
Rohnert Park, CA 94928
Attn: RMA # xxxxxxx

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A P P E N D I X

Alphabetical Command List

ANDB	Analog Voltage Deadband
ANV	Analog Voltage Range
ANZ	Analog Voltage Zero
CCA	Configure Current Average
CCP	Configure Current Peak
CDB	Configure Deadband
CIP	Configure In-Position
CMR	Configure Motor Resolution
CMTR	Configure Motor Type
CMV	Configure Maximum Velocity
CPB	Configure Pushbuttons
CPD	Configure Position Derivative
CPDM	Configure Position Derivative Maximum
CPE	Configure Position Error
CPI	Configure Position Integral
CPIM	Configure Position Integral Maximum
CPP	Configure Position Proportional
CPPM	Configure Position Proportional Maximum
CRR	Configure Resolver Resolution
CTC	Configure Time Constant
CTG	Configure Tach Gain
CTGM	Configure Tach Gain Maximum
CVD	Configure Velocity Derivative
CVDM	Configure Velocity Derivative Maximum
CVE	Configure Velocity Error
CVF	Configure Velocity Feed-Forward
CVFM	Configure Velocity Feed-Forward Maximum
CVI	Configure Velocity Integral
CVIM	Configure Velocity Integral Maximum
CVP	Configure Velocity Proportional
CVPM	Configure Velocity Proportional Maximum
CZM	Configure Z Drive Mode
DCA	Display Current Average
DCI	Display Current Instantaneous
DCP	Display Current Peak
DDI	Display Drive Information
DISP'	Front Panel Display
DPA	Display Position Actual
DPE	Display Position Error
DPR	Display Position Resolver
DPS	Display Position Setpoint
DSP	Display Servo Picture
DVA	Display Velocity Actual
DVE	Display Velocity Error
DVS	Display Velocity Setpoint
E	Enable Communications Interface
F	Disable Communications Interface
FMCA	Find Motor Commutation Angle
^H	Backspace
HELP	Help
OFF	Amplifier Off
ON	Amplifier On
OUT	Real Time Output Control
RFS	Return to Factory Settings
RSE	Report Servo Errors
RV	Revision Level
SS	Set-Up Status Report
SSA	RS-232C Echo Control
SSI	Interactive Mode Control
SSM	Direction Input Polarity Control
SSR	Analog Output Control
SST	Enable Input Control
SSU	Set Warning Display Mode
SV	Save
Z	Reset

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