

CHAPTER ONE

Installation

IN THIS CHAPTER

- Product ship kit list
- Things to consider before you install the ZETA6xxx
- General specifications table
- Optional pre-installation alterations
 - DIP switch settings – motor current, device address, autobaud feature
 - Changing the COM 2 port from RS-232C to RS-485
- Mounting the ZETA6xxx
- Connecting all electrical components (includes specifications)
- Testing the installation
- Matching the motor to the ZETA6xxx
- Motor mounting and coupling guidelines
- Using the damping features to optimize performance
- Preparing for what to do next



To install the ZETA6xxx so that it is LVD compliant, refer to the supplemental instructions in Appendix C. Appendix D provides guidelines on how to install the ZETA6xxx in a manner most likely to minimize the ZETA6xxx's emissions and to maximize the ZETA6xxx's immunity to externally generated electromagnetic interference.

What You Should Have (ship kit)

Part	Part Number
ZETA6108 standard product (with ship kit).....	ZETA6108
OR	
ZETA6112 standard product (with ship kit).....	ZETA6112
OR	
ZETA6104-240 standard product (with ship kit).....	ZETA6104-240
Ship kit:	
This user guide (ZETA6xxx Indexer/Drive Installation Guide)	88-017277-01
6000 Series Software Reference	88-012966-01
6000 Series Programmer's Guide	88-014540-01
Motion Architect disks: Disk 1	95-013070-01
Disk 2.....	95-013070-02
Driver & Samples.....	95-016324-01
Wire jumpers: Qty 3.....	44-015142-01
Qty 1.....	44-015741-01
Quick-reference magnet (located on the side of the ZETA6xxx chassis).....	87-017473-01
Motor connector.....	43-008755-01
120VAC power cord.....	44-014768-01
(ZETA6108 and ZETA6112 versions only)	
240 VAC power connector.....	43-011905-01
(ZETA6104-240 version only)	

If an item is missing, call the factory (see phone numbers on inside front cover).

You may have also ordered some of the following accessories:

Part	Part Number
* O Series Motor (CE/LVD Marked) (170 VDC winding)	OS2HB- <i>nnnnn</i> OS21B- <i>nnnnn</i> OS22B- <i>nnnnn</i>
* R Series Motor (CE/LVD Marked) (170 VDC winding)	RS31B- <i>nnnnn</i> RS32B- <i>nnnnn</i> RS33B- <i>nnnnn</i> RS42B- <i>nnnnn</i> RE42B- <i>nnnnn</i>
* T Series Motor (CE/LVD Marked) (170 VDC winding)	TS31B- <i>nnnnn</i> TS32B- <i>nnnnn</i> TS33B- <i>nnnnn</i> TS41B- <i>nnnnn</i> TS42B- <i>nnnnn</i> TS43B- <i>nnnnn</i>
** R Series Motor (CE/LVD Marked) (340 VDC winding)	RS31C- <i>nnnnn</i> RS32C- <i>nnnnn</i> RS33C- <i>nnnnn</i> RS42C- <i>nnnnn</i> RE42C- <i>nnnnn</i> RS43C- <i>nnnnn</i>
Cable Kit for LVD/EMC Motor Installation (10') (compatible with R & T series motors)	C10 C10H***
EMC Kit for LVD/EMC Installation	ZETA EMC SHIPKIT
24V input/output module	VM24
50-pin header-to-screw terminal breakout board	VM50
Operator interface	RP240
Operator interface (NEMA 4 rated)	RP240-NEMA 4
DDE server for 6000 series	DDE 6000
LabVIEW library of VI's for Motion Control	Motion Toolbox
Graphical icon-based programming software	Motion Builder

* These motors are recommended for use with the ZETA6108, ZETA6112 and the ZETA6104-240 operating at 120 VAC.

** These motors are recommended for use with the ZETA6104-240 operating at 240 VAC.

***The C10H (to be released soon) is recommended for use with applications rated for more than 10 amps of current in the motor.

NOTE: See the Compumotor catalog for more information on accessories.

Before You Begin



WARNINGS



The ZETA6xxx is used to control your system's electrical and mechanical components. Therefore, you should test your system for safety under all potential conditions. Failure to do so can result in damage to equipment and/or serious injury to personnel.

Always remove power to the ZETA6xxx before:

- Connecting any electrical device (e.g., motor, encoder, inputs, outputs, etc.)
- Adjusting the DIP switches, jumpers, or other internal components

Recommended Installation Process

This chapter is organized sequentially to best approximate a typical installation process.

1. Review the general specifications
2. Perform configuration/adjustments (if necessary)
3. Mount the ZETA6xxx
4. Connect all electrical system components
5. Test the installation
6. Match the motor to the ZETA6xxx — *optional*
7. Mount the motor and couple the load
8. Optimize performance (using the ZETA6xxx's damping features) — *optional*
9. Record the system configuration (record on the information label and/or in a set-up program)
10. Program your motion control functions. Programming instructions are provided in the *6000 Series Programmer's Guide* and the *6000 Series Software Reference*. We recommend using the programming tools provided in Motion Architect for Windows (found in your ship kit). You can also benefit from an optional iconic programming interface called Motion Builder (sold separately).

Electrical Noise Guidelines

- Do not route high-voltage wires and low-level signals in the same conduit.
- Ensure that all components are properly grounded.
- Ensure that all wiring is properly shielded.
- Noise suppression guidelines for I/O cables are provided on page 26.
- Appendix D (page 63) provides guidelines on how to install the ZETA6xxx in a manner most likely to minimize the ZETA6xxx's emissions and to maximize the ZETA6xxx's immunity to externally generated electromagnetic interference.

General Specifications

Parameter	Specification
Power	
AC input.....	95-132VAC, 50/60Hz, single-phase (95-264VAC for ZETA6104-240) (refer to page 25 for peak power requirements, based on the motor you are using)
Status LEDs/fault detection.....	Refer to <i>Diagnostic LEDs</i> on page 46
Environmental	
Operating Temperature	32 to 113°F (0 to 45°C)
Storage Temperature.....	-22 to 185°F (-30 to 85°C)
Humidity.....	0 to 95% non-condensing
Performance	
Position Range & Stepping Accuracy.....	Position range: $\pm 2,147,483,648$ steps; Stepping accuracy: ± 0 steps from preset total
Velocity Range, Accuracy, & Repeatability	Range: 1-2,000,000 steps/sec; Accuracy: $\pm 0.02\%$ of maximum rate; Repeatability: $\pm 0.02\%$ of set rate
Acceleration Range.....	1-24,999,975 steps/sec ²
Motion Algorithm Update Rate	2 ms
Serial Communication	
	<i>RS-485 requires internal jumper and DIP switch configuration (see page 8).</i>
Connection Options	RS-232C, 3-wire; RS-485 (default is 4-wire; for 2-wire move JU7 to position 1); Change internal jumpers JU1-JU6 to position 1 to select RS-485 communication
Maximum units in daisy-chain or multi-drop	99 (use DIP switch or ADDR command to set individual addresses for each unit)
Communication Parameters	9600 baud (range is 19200-1200—see <i>AutoBaud</i> , page 7), 8 data bits, 1 stop bit, no parity; RS-232: Full duplex; RS-485: Half duplex (change jumper JU6 to position 1)
Inputs	
	<i>All inputs are optically isolated from the microprocessor (not from the other inputs).</i>
HOM, POS, NEG, TRG-A, TRG-B, P-CUT	Powered by voltage applied to V_I/O terminal (switching levels: $\leq 1/3$ of V_I/O voltage = low, $\geq 2/3$ of V_I/O voltage = high). V_I/O can handle 5-24V with max. current of 100mA. Internal 6.8 K Ω pull-ups to AUX-P terminal—connect AUX-P to power source (+5V terminal or an external 5-24V supply) to source current or connect AUX-P to GND to sink current; AUX-P can handle 0-24V with max. current of 50mA. Voltage range for these inputs is 0-24V.
Encoder	Differential comparator accepts two-phase quadrature incremental encoders with differential (recommended) or single-ended outputs. Maximum voltage = 5VDC. Switching levels (TTL-compatible): Low $\leq 0.4V$, High $\geq 2.4V$. Maximum frequency = 1.6 MHz. Minimum time between transitions = 625 ns.
16 General-Purpose Programmable	HCMOS compatible* with internal 6.8 K Ω pull-ups to IN-P terminal—connect IN-P to power source (+5V pin #49 or an external 5-24V supply) to source current or connect IN-P to GND to sink current; IN-P can handle 0-24V with max. current of 100 mA. Voltage range = 0-24V.
Outputs	
	<i>All outputs are optically isolated from the microprocessor (not from the other outputs).</i>
9 Programmable (includes OUT-A)	Open collector output with 4.7 K Ω pull-ups. Can be pulled up by connecting OUT-P to power source (+5V terminal or an external 5-24V supply); OUT-P can handle 0-24V with max. current of 50mA. Outputs will sink up to 300mA or source up to 5mA at 5-24VDC. 8 general-purpose outputs on the Programmable I/O connector, OUT-A on the I/O connector.
+5V Output	Internally supplied +5VDC. +5V terminals are available on the COM2, ENCODER and I/O connectors. Load limit (total load for all I/O connections) is 0.5A.

* HCMOS-compatible switching voltage levels: Low $\leq 1.00V$, High $\geq 3.25V$.
TTL-compatible switching voltage levels: Low $\leq 0.4V$, High $\geq 2.4V$.

Motor Specifications Parameters	Size 23 O Motors (170 VDC winding)			Size 34 R Motors (170 VDC winding)			Size 42 R Motors (170 VDC winding)	
	OS2HB	OS21B	OS22B	RS31B	RS32B	RS33B	RS42B	RE42B
Static Torque** oz-in (N-m)	43 (0.30)	82 (0.58)	155 (1.09)	133 (0.93)	267 (1.87)	392 (2.74)	985 (6.90)	1907 (13.35)
Rotor Inertia oz-in ² (kg-cm ²)	0.39 (0.07)	0.66 (0.12)	1.39 (0.25)	3.02 (0.55)	6.56 (1.20)	9.65 (1.77)	61.76 (11.30)	61.76 (11.30)
Drive Current (Apk)(Arms)**								
Series	1.5 (1.0)	1.8 (1.3)	2.2 (1.5)	2.3 (1.6)	2.8 (2.0)	3.4 (2.4)	6.1 (4.3)	3.4 (2.4)
Parallel	3.0 (2.1)	4.0 (2.8)	4.0 (2.8)	4.6 (3.3)	5.6 (4.0)	6.9 (4.9)	12.0 (8.5)	7.2 (5.1)
Phase Inductance (mH)***								
Series	8.6	12	16.6	9.4	11.6	9.6	8.2	42.6
Parallel	2.2	3	4.2	2.4	2.9	2.4	2.1	10.7
Drive Bus Voltage (VDC)	170	170	170	170	170	170	170	170
Detent Torque								
oz-in (Nm)	2.5 (0.02)	4.0 (0.03)	7.0 (0.05)	8.8 (0.06)	18.0 (0.13)	27.0 (0.19)	41.7 (0.35)	81.0 (0.57)
Bearings Information								
Thrust load lb (kg)	13 (5.9)	13 (5.9)	13 (5.9)	180 (81.6)	180 (81.6)	180 (81.6)	400 (182)	400 (182)
Radial load lb (kg)	20 (9.1)	20 (9.1)	20 (9.1)	35 (15.9)	35 (15.9)	35 (15.9)	140 (63.6)	140 (63.6)
End play <i>(Reversing load equal to 1 lb)</i> in (mm)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)
Radial play <i>(Per 0.5 lb load)</i> in (mm)	0.0008 (0.02)	0.0008 (0.02)	0.0008 (0.02)	0.0008 (0.02)	0.0008 (0.02)	0.0008 (0.02)	0.0008 (0.02)	0.0008 (0.02)
Motor Weight lb <i>(Motor+Cable+Connector)</i> (kg)	1 (0.5)	1.5 (0.7)	2.5 (1.1)	3.2 (1.5)	5.3 (2.4)	7.6 (3.5)	18.2 (8.3)	18.2 (8.3)
Certifications								
UL Rec.	Pending	Pending	Pending	Yes	Yes	Yes	Yes	Yes
CE (LVD)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CE (LVD & EMC)*	No	No	No	*	*	*	*	*
Speed/Torque Curves	----- Refer to page 15 -----			----- Refer to page 15 -----			-- Refer to page 15 -----	
Dimensions	----- Refer to page 33 -----			----- Refer to page 34 -----			-- Refer to page 34 -----	

*EMC is a system compliance. To comply with EMC and low-noise (C15PR22/EN55022 Class B or FCC Class B emissions) standards, the following items are required:

- ZETA4-240, ZETA8, or ZETA12 Drive
- CE(LVD) motor for LVD. Compumotor recommends a terminal board (NPS) motor construction for easier EMC installation
- C10 motor accessory (LVD/EMC cable kit)
- ZETA EMC Kit

**Values shown in speed-torque curves

***Small signal values

Motor Specifications Parameters	Size 34 T Series (170 VDC winding)			Size 42 T Series (170 VDC winding)			Size 34 R Series (340 VDC winding)			Size 42 R Series (340 VDC winding)		
	TS31B	TS32B	TS33B	TS41B	TS42B	TS43B	RS31C	RS32C	RS33C	RS42C	RE42C	RS43C
	Static Torque** oz-in (N-m)	455 (3.19)	647 (4.53)	1525 (10.68)	1332 (9.32)	2515 (17.61)	3479 (24.35)	171 (1.21)	292 (2.06)	532 (3.76)	1,266 (8.94)	1,959 (13.8)
Rotor Inertia oz-in ² (kg-cm ²)	7.80 (1.43)	14.67 (2.68)	21.89 (4.01)	30.22 (5.53)	59.68 (10.92)	88.51 (16.20)	3.20 (0.59)	6.56 (1.20)	9.65 (1.77)	61.76 (11.30)	61.76 (11.30)	92.64 (16.95)
Drive Current (Apk)(Arms)**												
Series	3.3 (2.3)	3.1 (2.2)	5.6 (4.0)	6.4 (4.5)	6.7 (4.7)	6.9 (4.9)	2.2 (1.6)	2.8 (2.0)	3.5 (2.5)	3.2 (2.3)	3.4 (2.4)	4.0 (2.8)
Parallel	6.7 (4.7)	6.2 (4.4)	12.0 (8.5)	12.0 (8.5)	12.0 (8.5)	12.0 (8.5)	4.0 (2.8)	4.0 (2.8)	4.0 (2.8)	4.0 (2.8)	4.0 (2.8)	4.0 (2.8)
Phase Inductance (mH)***												
Series	10.3	10.3	13.6	15.8	22.0	30.7	17.4	26.2	23.3	65.4	55.6	42.9
Parallel	2.6	2.6	3.4	3.9	5.5	7.7	4.4	6.6	5.8	16.4	13.9	10.7
Drive Bus Voltage (VDC)	170	170	170	170	170	170	340	340	340	340	340	340
Detent Torque												
oz-in (Nm)	18 (0.13)	36 (0.25)	54 (0.38)	42 (0.30)	84 (0.59)	106 (0.75)	8.8 0.062	18.0 0.130	27.0 0.190	50.0 (0.350)	81.0 (0.570)	71.0 (0.500)
Bearings Information												
Thrust load	305 (139)	305 (139)	305 (139)	404 (184)	404 (184)	404 (184)	180 (81.6)	180 (81.6)	180 (81.6)	400 (182)	400 (182)	400 (182)
Radial load	65 (30)	65 (30)	110 (50)	125 (57)	110 (50)	110 (50)	35 (15.9)	35 (15.9)	35 (15.9)	140 (63.6)	140 (63.6)	140 (63.6)
End play (Reversing load equal to 1 lb)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)	0.001 (0.025)
Radial play (Per 0.5 lb load)	0.0008 (0.020)	0.0008 (0.020)	0.0008 (0.020)	0.0008 (0.020)	0.0008 (0.020)	0.0008 (0.020)	0.0008 (0.02)	0.0008 (0.02)	0.0008 (0.02)	0.0008 (0.02)	0.0008 (0.02)	0.0008 (0.02)
Motor Weight (Motor+Cable+Connector)	5.0 (2.3)	8.4 (3.8)	11.9 (5.4)	11.0 (5.0)	18.4 (8.4)	25.7 (11.7)	3.2 (1.5)	5.3 (2.4)	7.6 (3.5)	18.2 (8.3)	18.2 (8.3)	25.7 (11.7)
Certifications												
UL Rec.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CE (LVD)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CE (LVD & EMC)*	*	*	*	*	*	*	*	*	*	*	*	*
Speed/Torque Curves	----- Refer to page 15 -----			----- Refer to page 15 -----			----- Refer to page 16 -----			----- Refer to page 16 -----		
Dimensions	----- Refer to page 34 -----			----- Refer to page 35 -----			----- Refer to page 34 -----			----- Refer to page 34 -----		

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- C10 motor accessory (LVD/EMC cable kit)
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**Values shown in speed-torque curves

***Small signal values

Pre-installation Adjustments

Factory Settings May Be Sufficient (if so, skip this section):

- Device address is set to zero (if daisy-chaining you can automatically establish with the ADDR command).
- Serial communication method is RS-232C.

DIP Switch Settings

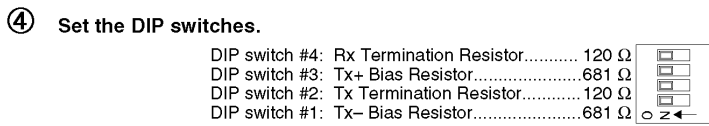
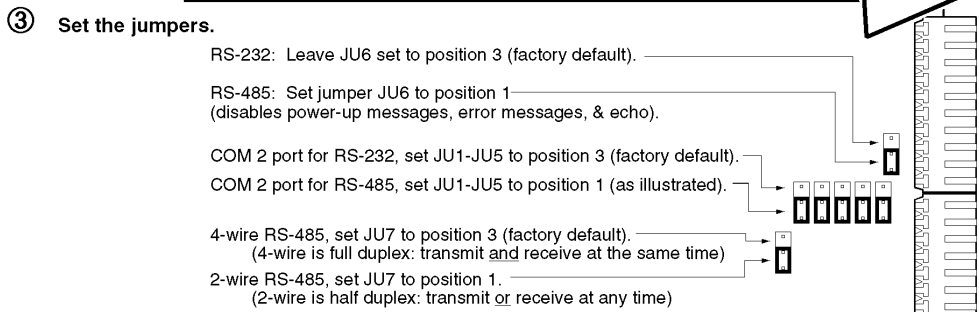
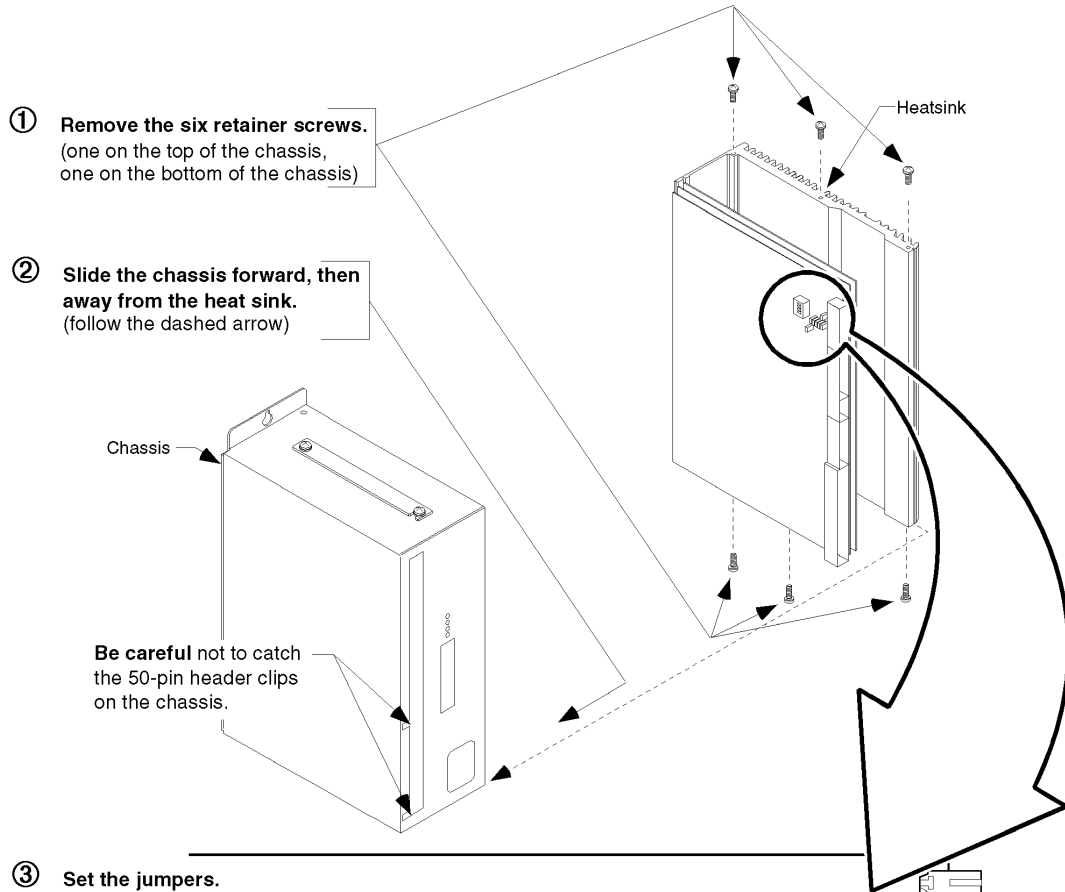
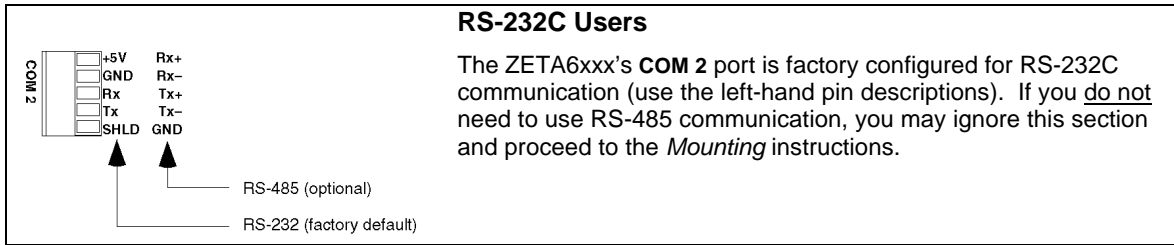
SW1 **SW2**

Phase Select Phase A Offset Phase B Offset Phase C Offset E-stop A.D.

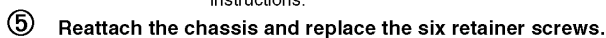
ZETA6000
Compumotor

Current (amps)	1	2	3	4	5
2.00	2.4	2.12			
3.11	3.12	3.12	off	off	off
3.30	3.32	3.32	off	off	off
3.50	3.52	3.52	off	off	off
3.71	3.71	3.71	off	off	off
3.94	3.94	3.94	off	off	off
4.19	4.19	4.19	off	off	off
4.45	4.45	4.45	off	off	off
4.73	4.73	4.73	off	off	off
5.02	5.02	5.02	off	off	off
5.33	5.33	5.33	off	off	off
5.65	5.65	5.65	off	off	off
6.00	6.00	6.00	off	off	off
6.37	6.37	6.37	off	off	off
6.76	6.76	6.76	off	off	off
7.18	7.18	7.18	off	off	off
7.62	7.62	7.62	off	off	off
8.09	8.09	8.09	off	off	off
8.58	8.58	8.58	off	off	off
9.10	9.10	9.10	off	off	off
9.64	9.64	9.64	off	off	off
10.21	10.21	10.21	off	off	off
10.81	10.81	10.81	off	off	off
11.44	11.44	11.44	off	off	off
12.10	12.10	12.10	off	off	off
12.79	12.79	12.79	off	off	off
13.51	13.51	13.51	off	off	off
14.26	14.26	14.26	off	off	off
15.04	15.04	15.04	off	off	off
15.85	15.85	15.85	off	off	off
16.69	16.69	16.69	off	off	off
17.56	17.56	17.56	off	off	off
18.46	18.46	18.46	off	off	off
19.39	19.39	19.39	off	off	off
20.35	20.35	20.35	off	off	off
21.34	21.34	21.34	off	off	off
22.36	22.36	22.36	off	off	off
23.41	23.41	23.41	off	off	off
24.49	24.49	24.49	off	off	off
25.60	25.60	25.60	off	off	off
26.74	26.74	26.74	off	off	off
27.91	27.91	27.91	off	off	off
29.11	29.11	29.11	off	off	off
30.34	30.34	30.34	off	off	off
31.60	31.60	31.60	off	off	off
32.89	32.89	32.89	off	off	off
34.21	34.21	34.21	off	off	off
35.56	35.56	35.56	off	off	off
36.94	36.94	36.94	off	off	off
38.35	38.35	38.35	off	off	off
39.79	39.79	39.79	off	off	off
41.26	41.26	41.26	off	off	off
42.76	42.76	42.76	off	off	off
44.29	44.29	44.29	off	off	off
45.84	45.84	45.84	off	off	off
47.42	47.42	47.42	off	off	off
49.03	49.03	49.03	off	off	off
50.67	50.67	50.67	off	off	off
52.34	52.34	52.34	off	off	off
54.04	54.04	54.04	off	off	off
55.77	55.77	55.77	off	off	off
57.53	57.53	57.53	off	off	off
59.32	59.32	59.32	off	off	off
61.14	61.14	61.14	off	off	off
63.00	63.00	63.00	off	off	off
64.89	64.89	64.89	off	off	off
66.81	66.81	66.81	off	off	off
68.76	68.76	68.76	off	off	off
70.74	70.74	70.74	off	off	off
72.75	72.75	72.75	off	off	off
74.79	74.79	74.79	off	off	off
76.86	76.86	76.86	off	off	off
78.96	78.96	78.96	off	off	off
81.09	81.09	81.09	off	off	off
83.25	83.25	83.25	off	off	off
85.44	85.44	85.44	off	off	off
87.66	87.66	87.66	off	off	off
89.91	89.91	89.91	off	off	off
92.19	92.19	92.19	off	off	off
94.50	94.50	94.50	off	off	off
96.84	96.84	96.84	off	off	off
99.21	99.21	99.21	off	off	off
101.61	101.61	101.61	off	off	off
104.04	104.04	104.04	off	off	off
106.50	106.50	106.50	off	off	off
109.00	109.00	109.00	off	off	off
111.53	111.53	111.53	off	off	off
114.09	114.09	114.09	off	off	off
116.68	116.68	116.68	off	off	off
119.30	119.30	119.30	off	off	off
121.95	121.95	121.95	off	off	off
124.63	124.63	124.63	off	off	off
127.34	127.34	127.34	off	off	off
130.08	130.08	130.08	off	off	off
132.85	132.85	132.85	off	off	off
135.65	135.65	135.65	off	off	off
138.48	138.48	138.48	off	off	off
141.34	141.34	141.34	off	off	off
144.23	144.23	144.23	off	off	off
147.15	147.15	147.15	off	off	off
150.10	150.10	150.10	off	off	off
153.08	153.08	153.08	off	off	off
156.09	156.09	156.09	off	off	off
159.13	159.13	159.13	off	off	off
162.20	162.20	162.20	off	off	off
165.30	165.30	165.30	off	off	off
168.43	168.43	168.43	off	off	off
171.59	171.59	171.59	off	off	off
174.78	174.78	174.78	off	off	off
178.00	178.00	178.00	off	off	off
181.25	181.25	181.25	off	off	off
184.53	184.53	184.53	off	off	off
187.84	187.84	187.84	off	off	off
191.18	191.18	191.18	off	off	off
194.55	194.55	194.55	off	off	off
197.95	197.95	197.95	off	off	off
201.38	201.38	201.38	off	off	off
204.84	204.84	204.84	off	off	off
208.33	208.33	208.33	off	off	off
211.85	211.85	211.85	off	off	off
215.40	215.40	215.40	off	off	off
218.98	218.98	218.98	off	off	off
222.59	222.59	222.59	off	off	off
226.23	226.23	226.23	off	off	off
229.90	229.90	229.90	off	off	off
233.60	233.60	233.60	off	off	off
237.33	237.33	237.33	off	off	off
241.09	241.09	241.09	off	off	off
244.88	244.88	244.88	off	off	off
248.70	248.70	248.70	off	off	off
252.55	252.55	252.55	off	off	off
256.43	256.43	256.43	off	off	off
260.34	260.34	260.34	off	off	off
264.28	264.28	264.28	off	off	off
268.25	268.25	268.25	off	off	off
272.25	272.25	272.25	off	off	off
276.28	276.28	276.28	off	off	off
280.34	280.34	280.34	off	off	off
284.43	284.43	284.43	off	off	off
288.55	288.55	288.55	off	off	off
292.70	292.70	292.70	off	off	off
296.88	296.88	296.88	off	off	off
301.09	301.09	301.09	off	off	off
305.33	305.33	305.33	off	off	off
309.60	309.60	309.60	off	off	off
313.90	313.90	313.90	off	off	off
318.23	318.23	318.23	off	off	off
322.59	322.59	322.59	off	off	off
326.98	326.98	326.98	off	off	off
331.40	331.40	331.40	off	off	off
335.85	335.85	335.85	off	off	off
340.33	340.33	340.33	off	off	off
344.84	344.84	344.84	off	off	off
349.38	349.38	349.38	off	off	off
353.95	353.95	353.95	off	off	off
358.55	358.55	358.55	off	off	off
363.18	363.18	363.18	off	off	off
367.84	367.84	367.84	off	off	off
372.53	372.53	372.53	off	off	off
377.25	377.25	377.25	off	off	off
382.00	382.00	382.00	off	off	off
386.78	386.78	386.78	off	off	off
391.59	391.59	391.59	off	off	off
396.43	396.43	396.43	off	off	off
401.30	401.30	401.30	off	off	off
406.20	406.20	406.20	off	off	off
411.13	411.13	411.13	off	off	off
416.09	416.09	416.09	off	off	off
421.08	421.08	421.08	off	off	off
426.10	426.10	426.10	off	off	off
431.15	431.15	431.15	off	off	off
436.23	436.23	436.23	off	off	off
441.34	441.34	441.34	off	off	off
446.48	446.48	446.48	off	off	off
451.65	451.65	451.65	off	off	off
456.85	456.85	456.85	off	off	off
462.08	462.08	462.08	off	off	off
467.34	467.34	467.34	off	off	off
472.63	472.63	472.63	off	off	off
477.95	477.95	477.95	off	off	off
483.30	483.30	483.30	off	off	off
488.68	488.68	488.68	off	off	off
494.09	494.09	494.09	off	off	off
499.53	499.53	499.53	off	off	off
505.00	505.00	505.00	off	off	off
510.50	510.50	510.50	off	off	off
516.03	516.03	516.03	off	off	off
521.59	521.59	521.59	off	off	off
527.18	527.18	527.18	off	off	off
532.80	532.80	532.80	off	off	off
538.45	538.45	538.45	off	off	off
544.13	544.13	544.13	off	off	off
549.84	549.84	549.84	off	off	off
555.58	555.58	555.58	off	off	off
561.35	561.35	561.35	off	off	off
567.15	567.15	567.15	off	off	off
572.98	572.98	572.98	off	off	off
578.84	578.84	578.84	off	off	off
584.73	584.73	584.73	off	off	off
590.65	590.65	590.65	off	off	off
596.60	596.60	596.60	off	off	off
602.58	602.58	602.58	off	off	off
608.59	608.59	608.59	off	off	off
614.63	614.63	614.63	off	off	off
620.70	620.70	620.70	off	off	off
626.80	626.80	626.80	off	off	off
632.93	632.93	632.93	off	off	off
639.09	639.09	639.09	off	off	off
645.28	645.28	645.28	off	off	off
651.50	651.50	651.50	off	off	off
657.75	657.75	657.75	off	off	off
664.03	664.03	664.03	off	off	off
670.34	670.34	670.34	off	off	off
676.68	676.68	676.68	off	off	off
683.05	683.05	683.05	off	off	off
689.45	689.45	689.45	off	off	off
695.88	695.88	695.88	off	off	off
702.34	702.34				

Changing the COM 2 Connector from RS-232 to RS-485



NOTE: Set the switches to ON (as illustrated) to use the internal resistors. Do this for a single unit or for the last unit in a multi-drop only. If these resistor values are not appropriate for your application, set the switches to OFF and connect your own external resistors. See page 12 for resistor calculations and wiring instructions.

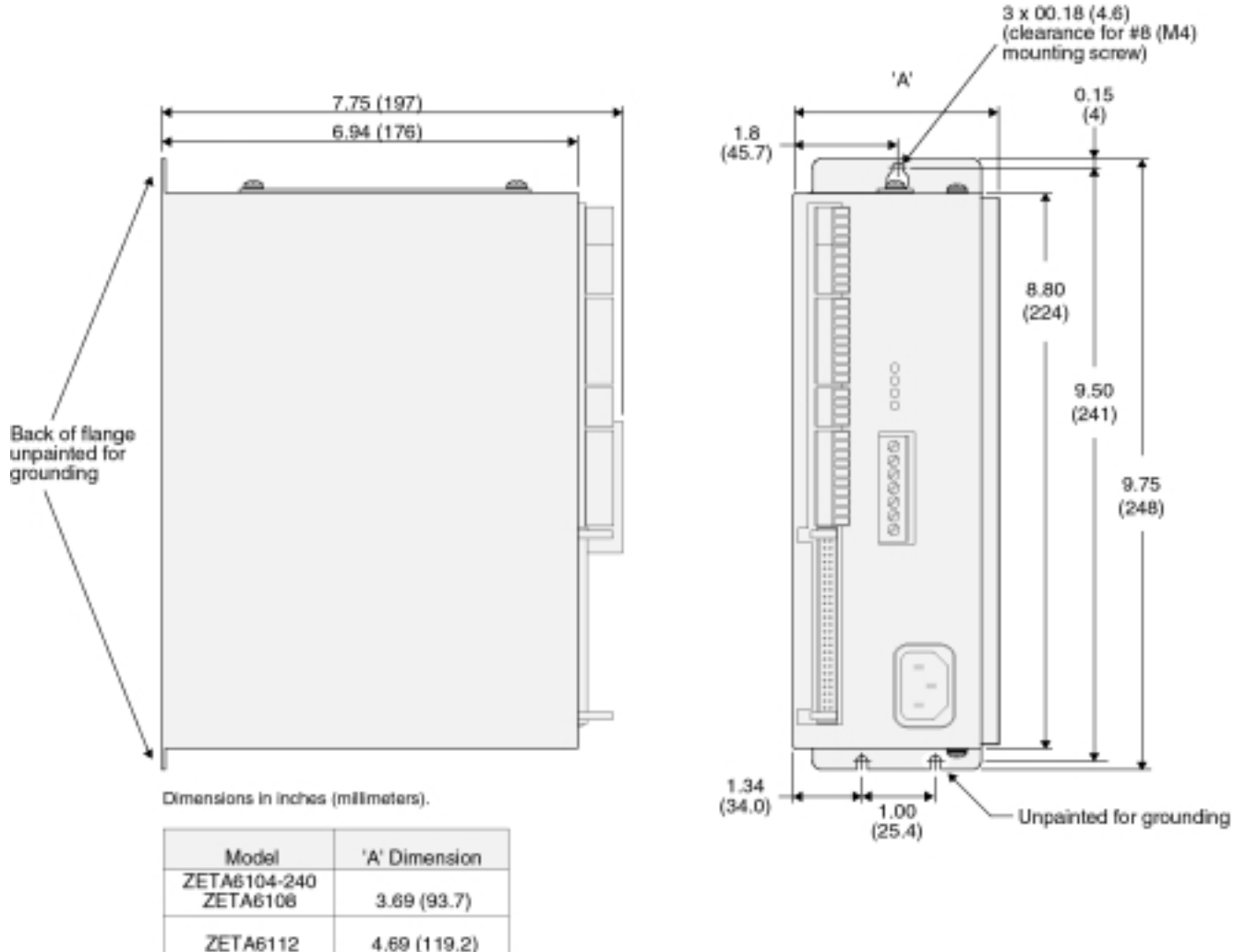


Mounting the ZETA6xxx

Before you mount the ZETA6xxx

Check the list below to make sure you have performed all the necessary configuration tasks that require accessing internal components (DIP switches, potentiometers, and jumpers). You may, however, be able to adjust DIP switches and pots after mounting, if you allow access to the top of the ZETA6xxx chassis.

- **Select motor current (DIP switches).** Set your motor current appropriately. See page 7 for current level DIP switch settings. If you ordered an O, R or T series motor, see pages 5 and 6 for the correct drive current rating for your particular motor.
- **Select device address (DIP switches).** If you are not connecting multiple ZETA6xxx units in an RS-232C daisy chain or an RS-485 multi-drop, use the factory setting. If you need to change this setting, refer to page 7 for instructions.
- **Select serial communication method (jumpers & DIP switches).** If you are using RS-232C to communicate with the ZETA6xxx, use the factory settings. If you need to change these settings (i.e., for RS-485), refer to page 8 for instructions.
- Be aware that if you exercise the motor matching procedures on page 30, you will need to access the potentiometers at the top of the ZETA6xxx chassis. (The motor matching procedures are placed after the Electrical Connections section of this manual because the process requires that you first understand how to connect the motor, serial communication, and AC power.)

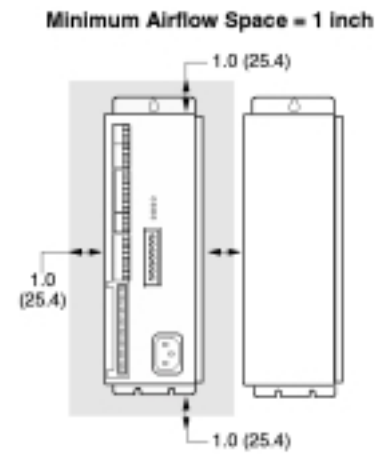


Environmental Considerations

Temperature. Operate the ZETA6xxx in ambient temperatures between 32°F (0°C) and 113°F (45°C). Provide a minimum of 1 inch (25.4 mm) of unrestricted air-flow space around the ZETA6xxx chassis (see illustration). The ZETA6xxx will shut itself down if its internal sensor reaches 122°F (50°C).

Humidity. Keep below 95%, non-condensing.

Airborne Contaminants, Liquids. Particulate contaminants, especially electrically conductive material, such as metal shavings and grinding dust, can damage the ZETA6xxx and the Zeta motor. Do not allow liquids or fluids to come in contact with the ZETA6xxx or its cables.

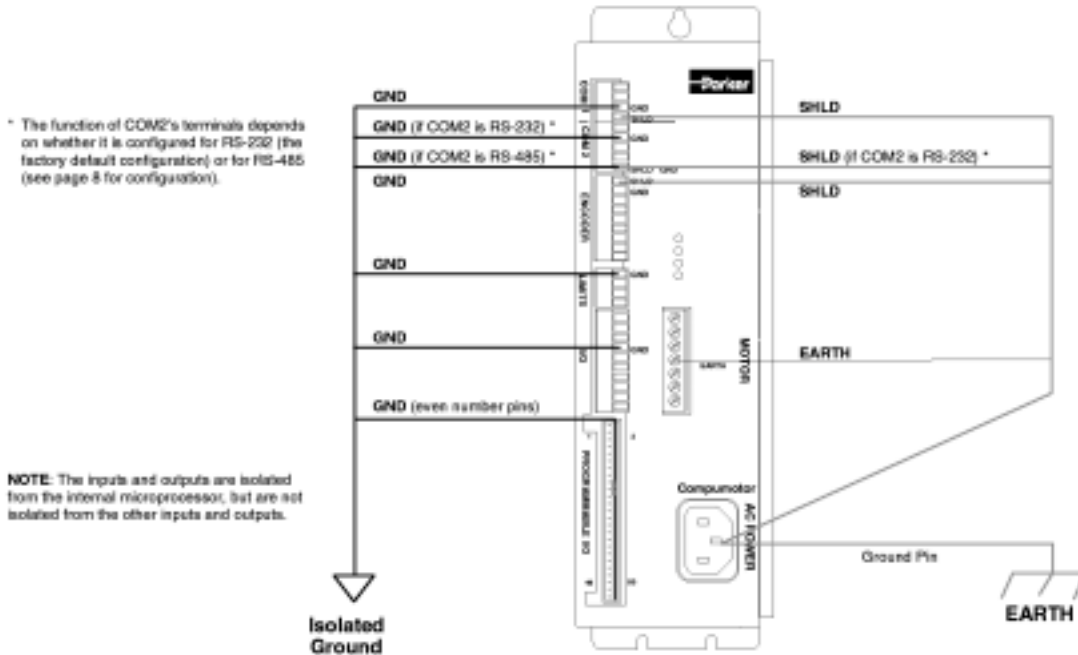


Electrical Connections



To install the ZETA6xxx so that it is LVD compliant, refer also to the supplemental instructions in Appendix C. Appendix D provides guidelines on how to install the ZETA6xxx in a manner most likely to minimize the ZETA6xxx's emissions and to maximize the ZETA6xxx's immunity to externally generated electromagnetic interference.

Grounding System



Pulse Cut-Off (P-CUT) Emergency Stop Switch

P-CUT connected to GND (normally-closed switch).
If this connection is opened, motion is killed and the program in progress is terminated.

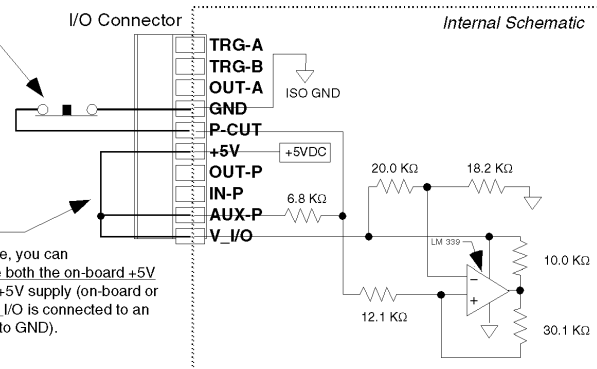
If the P-CUT input is not grounded when motion is commanded, motion will not occur and the error message "WARNING: PULSE CUTOFF ACTIVE" will be displayed in the terminal emulator.

+5V connected to AUX-P and V_I/O (sourcing current).
Provides +5V power to the P-CUT pull-up resistor. As an alternative, you can connect AUX-P to an external supply of up to +24V (but do not use both the on-board +5V terminal and an external 5-24V supply). If V_I/O is connected to a +5V supply (on-board or external), AUX-P can be connected to a supply of up to +24V. If V_I/O is connected to an external +24V supply, AUX-P must also be connected to +24V (or to GND).

Switching levels depend on the voltage applied to V_I/O:
LOW $\leq 1/3$ of V_I/O voltage; HIGH $\geq 2/3$ of V_I/O voltage

NOTE: AUX-P and V_I/O are also used by the HOM, NEG, POS & TRG inputs.

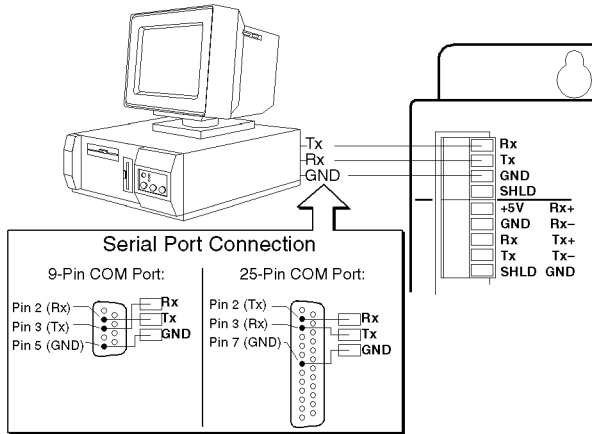
SINKING CURRENT: To make P-CUT (as well as HOM, NEG, POS & TRG) sink current, connect AUX-P to GND.



CAUTION: You must select either the on-board +5V terminal or an external power supply to power the **AUX-P** pull-up resistor (for the **P-CUT**, **HOM**, **NEG**, **POS**, **TRG-A**, and **TRG-B** inputs). Connecting **AUX-P** to the **+5V** terminal and an external supply will **damage the ZETA6xxx**. (The same rule applies to the **IN-P** and **OUT-P** terminals, see page 20.)

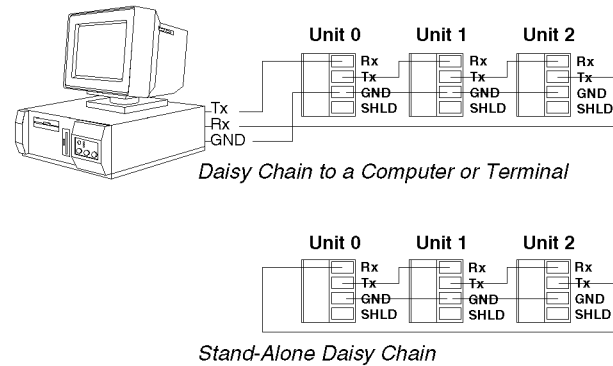
Serial Communications

RS-232C Connections



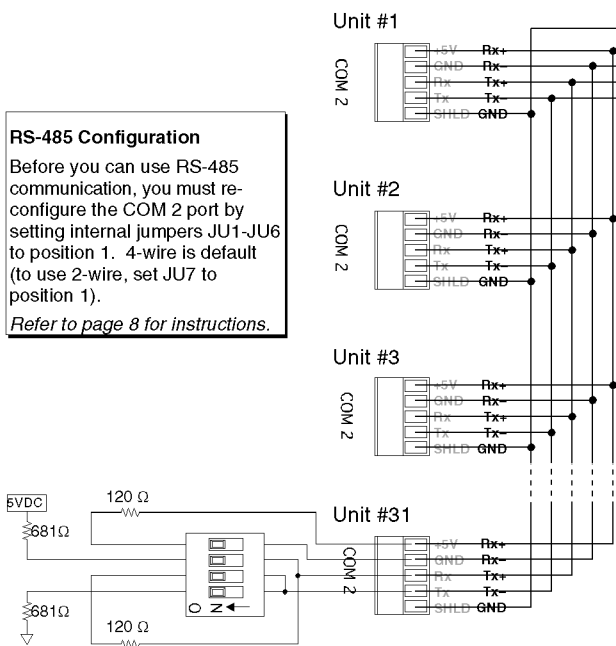
NOTE: Maximum RS-232C cable length is 50 feet (15.25 meters)

RS-232C Daisy-Chain Connections*



* Be sure to set unique device addresses for each unit. To set the address, use the DIP switch (see page 7), or use the ADDR command (see 6000 Series Programmer's Guide).

RS-485 Connections (4-wire interface, plus ground)



RS-485 Configuration
Before you can use RS-485 communication, you must reconfigure the COM 2 port by setting internal jumpers JU1-JU6 to position 1. 4-wire is default (to use 2-wire, set JU7 to position 1). Refer to page 8 for instructions.

DIP switch selects internal resistor values (ON selects the resistor). Use these resistors only for the last unit (or for a single unit). If your application requires terminating resistors other than 120Ω, and/or bias resistors other than 681Ω, then make sure the internal DIP switches are set to OFF and connect your own external resistors. To calculate resistor values:

NOTE: Maximum RS-485 cable length is 4000 feet (1220 meters)

Calculating Resistor Values

Example Assumptions: The cable's characteristic impedance (Z_0) = 120Ω. R_c and R_b are equal and are selected to match Z_0 ($R_c = R_b = Z_0 = 120\Omega$).

Step 1 Calculate the equivalent resistance (R_{eq})* of $R_c // R_b$:
 $R_c // R_b = 120\Omega // 120\Omega = 60\Omega$

Step 2 Calculate the pull-up and pull-down resistor values knowing that the FAILSAFE bias is 200mV and $V_{cc} = 5V$:
 $V_b = V_{cc} (R_{eq} / (R_a + R_{eq} + R_d))$
 solving for R' (defined as $R_a + R_d$)
 $R' = ((R_{eq} V_{cc} / V_b) - R_{eq})$
 $R' = ((60\Omega) 5V / 0.2V) - 60\Omega = 1440\Omega$
 Since R_a and R_d are equal, $R_a = R_d = 1440\Omega / 2 = 720\Omega$

Step 3 Recalculate the equivalent resistance of $R_c // (R_a + R_d)$:
 $R_c // (R_a + R_d) = 120\Omega // (720\Omega + 720\Omega) = 110.77\Omega$

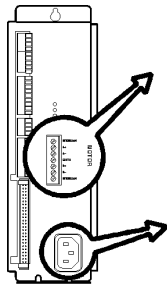
Since the equivalent resistance is close (within 10%) to the characteristic impedance of the cable (Z_0), no further adjustment of resistor values is required.

* Actual calculation for equivalent resistance (e.g., $R_1 // R_2$):

$$\frac{R_1 R_2}{(R_1 + R_2)}$$

For further information, consult a communications interface reference.

Motor (O, R and T motors only)

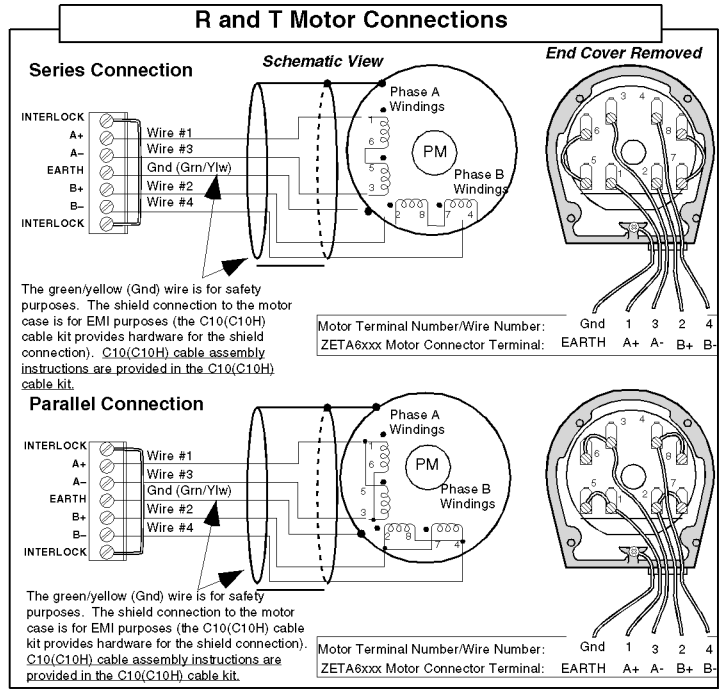
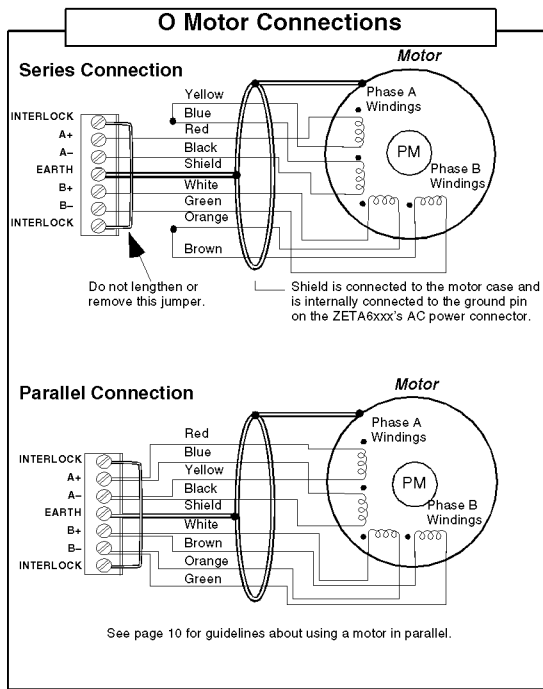


Motor Connector

WARNING: Remove AC power before connecting or disconnecting the motor. Lethal voltages are present on the screw terminals

OS, RS and TS Motors
 Specifications – see page 5.
 Speed/Torque curves – see pages 15-16.
 Considerations for series & parallel wiring – see pages 15-16.
 Current settings – see page 7. Dimensions – see pages 33-35.
 Cable extension – see table on following page.

Non-Compumotor Motors
 If you intend to use a non-Compumotor motor, refer to Appendix B for connection instructions and current selection.



Auto Current Standby Mode: Reduces motor current by 50% when step pulses from the ZETA6xxx have stopped for one second (**CAUTION:** torque is also reduced). Full current is restored upon the first step pulse. See page 11 for details.

Extending OS and RS Motor Cables

-L10, -S10 & -P10 motors are shipped with 10 ft (3 m) cables;

-FLY motor is shipped with 1 ft (0.3 m) flying leads.

-NPS motor does not include cable/leads; 10-foot: use 18 AWG (0.75 mm²) wire for current levels below 10 amps and 16 AWG (1.5 mm²) for up to 12 amps..

LVD COMPLIANCE: Maximum DC resistance between the ZETA6xxx's "EARTH" terminal ("protective conductor terminal") and motor body must not exceed 0.1Ω. (This criteria must be taken into consideration when sizing cross-section (gage) for extended cable lengths.) See Appendix C for more LVD information.

NON-LVD: Maximum extended length is 200 ft (61 m), but cables longer than 50 feet (15 m) may degrade performance. See table below for guidelines:

Motor Type	Max. Current (amps)	< 100 ft (30 m)		100-200 ft (30-60 m)	
		AWG	mm ²	AWG	mm ²
OS2HB(S)	1.51	22	0.34	20	0.50
OS2HB(P)	3.01	22	0.34	20	0.50
OS21B(S)	1.88	22	0.34	20	0.50
OS21B(P)	3.75	20	0.50	18	0.75
OS22B(S)	2.14	22	0.34	20	0.50
OS22B(P)	4.00	20	0.50	18	0.75
RS31B(S)	2.32	20	0.50	18	0.75
RS31B(P)	4.65	18	0.75	16	1.50
RS32B(S)	3.10	20	0.50	18	0.75
RS32B(P)	5.81	18	0.75	14	2.50
RS33B(S)	3.48	18	0.75	16	1.50
RS33B(P)	6.97	16	1.50	14	2.50
RS42B(S)	6.19	16	1.50	14	2.50
RS42B(P)	12.00	14	2.50	12	4.00
RE42B(S)	3.48	18	0.75	16	1.50
RE42B(P)	7.35	16	1.50	14	2.50
TS31B(S)	3.48	18	0.75	16	1.50
TS31B(P)	6.97	16	1.50	14	2.50
TS32B(S)	3.10	20	0.50	18	0.75
TS32B(P)	6.19	16	1.50	14	2.50
TS33B(S)	5.81	18	0.75	14	2.50
TS33B(P)	12.00	14	2.50	12	4.00
TS41B(S)	6.58	16	1.50	14	2.50
TS41B(P)	12.00	14	2.50	12	4.00
TS42B(S)	6.97	16	1.50	14	2.50
TS42B(P)	12.00	14	2.50	12	4.00
TS43B(S)	6.97	16	1.50	14	2.50
TS43B(P)	12.00	14	2.50	12	4.00
RS31C(S)	2.26	20	0.50	18	0.75
RS31C(P)	4.00	18	0.75	16	1.50
RS32C(S)	2.88	20	0.50	18	0.75
RS32C(P)	4.00	18	0.75	16	1.50
RS33C(S)	3.50	18	0.75	16	1.50
RS33C(P)	4.00	18	0.75	16	1.50
RS42C(S)	3.26	20	0.50	18	0.75
RS42C(P)	4.00	18	0.75	16	1.50
RE42C(S)	3.38	20	0.50	18	0.75
RE42C(P)	4.00	18	0.75	16	1.50
RS43C(S)	4.00	18	0.75	16	1.50
RS43C(P)	4.00	18	0.75	16	1.50

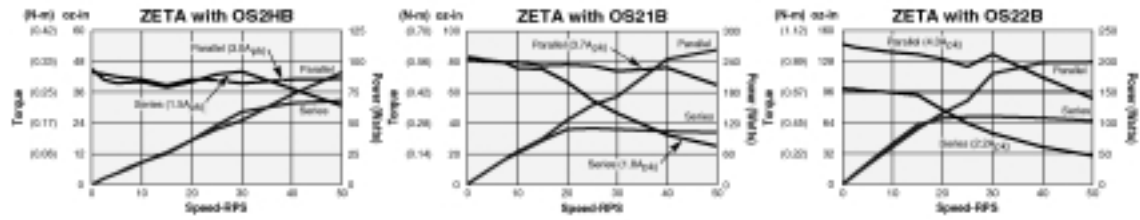
(S) = Series Configuration (P) = Parallel Configuration

NOTE: Rated current in wire sizes shown may result in a maximum temperature rise of 18°F (10°C) above ambient.

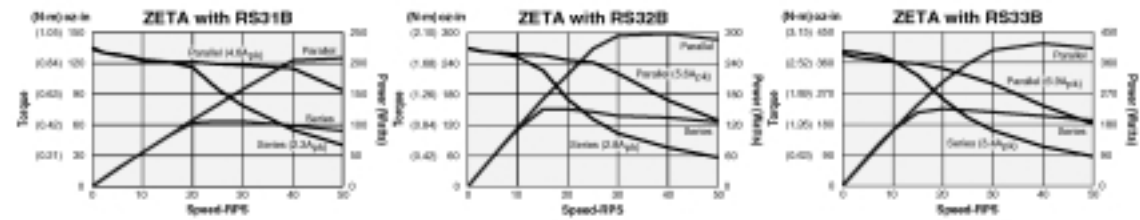
CAUTION: Cables longer than 50 feet (15m) may degrade performance.

Selecting Series or Parallel Motor Wiring

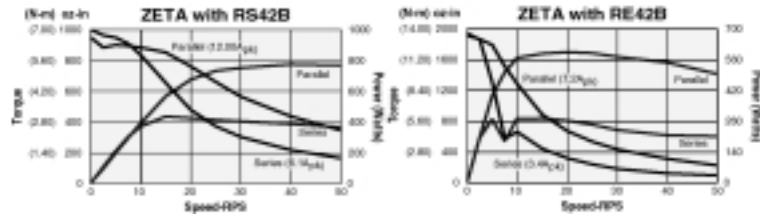
O Series Motors (170 VDC winding) Size 23 Frame



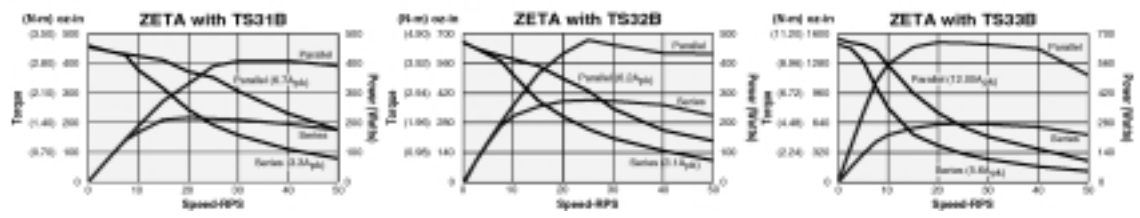
R Series Motors (170 VDC winding) Size 34 Frame



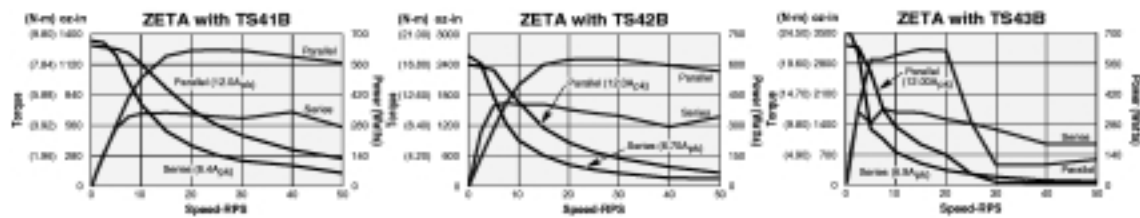
R Series Motors (170 VDC winding) Size 42 Frame



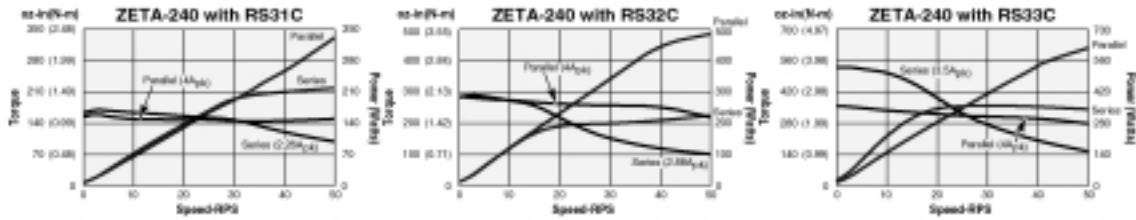
T Series Motors (170 VDC winding) Size 34 Frame



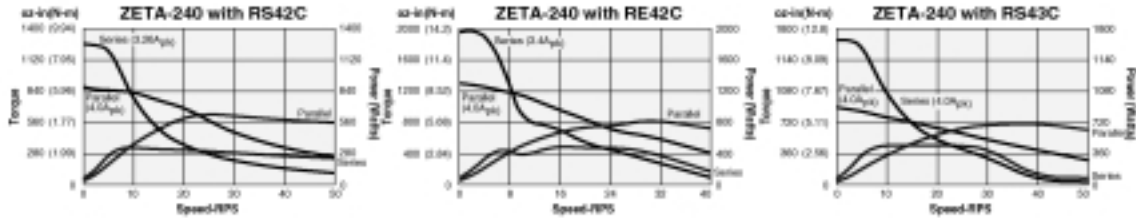
T Series Motors (170 VDC winding) Size 42 Frame



**R Series Motors (340 winding)
Size 34 Frame**



**R Series Motors (340 winding)
Size 42 Frame**



Drive's Peak Current Levels	
ZETA4, ZETA6104 ZETA4-240, ZETA6104-240	0-4A _{pk}
ZETA8, ZETA6108	0-8A _{pk}
ZETA12, ZETA6112	0-12A _{pk}

Parallel connected motors are limited to 50% duty cycle when operated above 5rpm. For greater than 50% duty cycle above 5rpm, you must connect the motor in series. Fan cooling the motor will increase duty cycles above 5rpm.

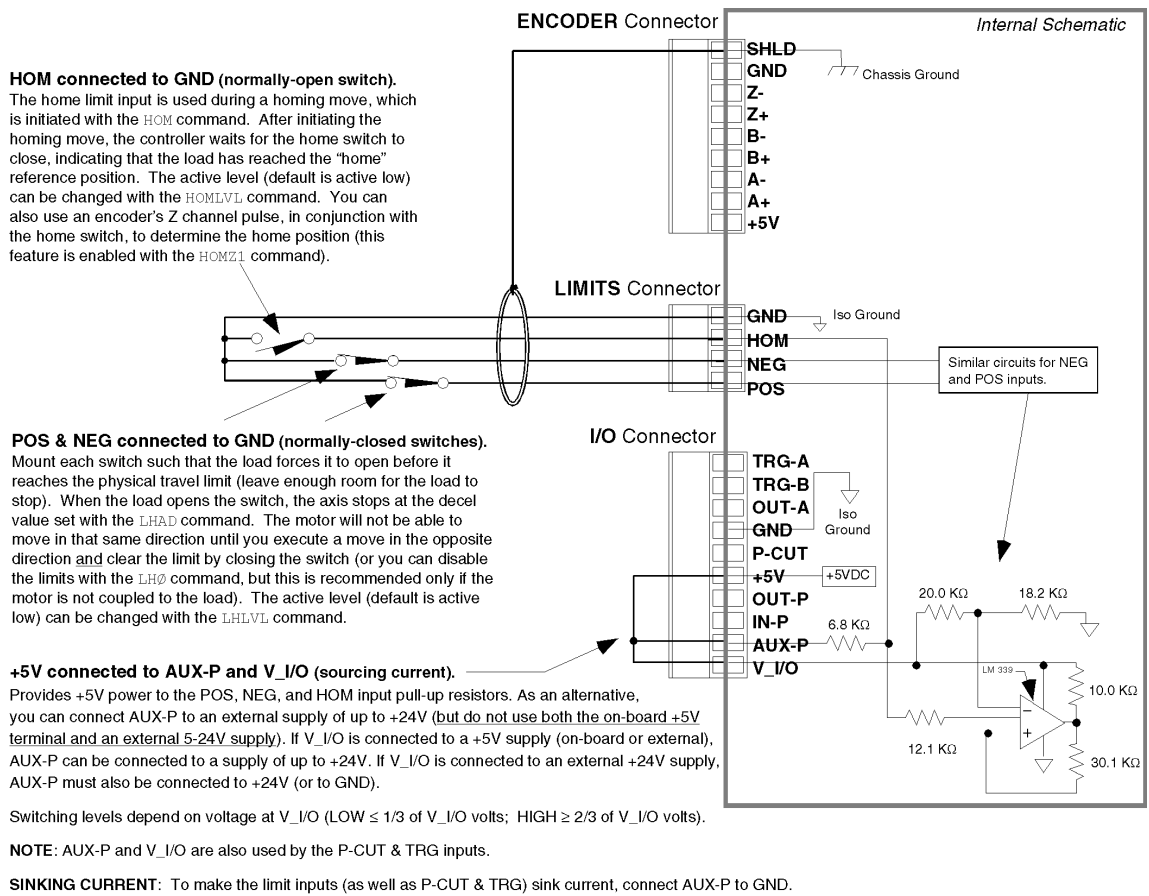
Viscous damper is not required to achieve speed-torque curves.

Note: ± 10% torque variance due to motor tolerance

End-of-Travel and Home Limit Inputs

- NOTES**
- **CAUTION:** Use either the on-board +5V terminal or an external power supply to power the AUX-P pull-up resistor (using both will damage the ZETA6xxx).
 - Motion will not occur until you do one of the following:
 - Install end-of-travel (POS & NEG) limit switches.
 - Disable the limits with the LHØ command (recommended only if load is not coupled).
 - Change the active level of the limits with the LHLVL command.
 - Refer to the *Basic Operation Setup* chapter in the *6000 Series Programmer's Guide* for in-depth discussions about using end-of-travel limits and homing.

CONNECTIONS & INTERNAL SCHEMATICS



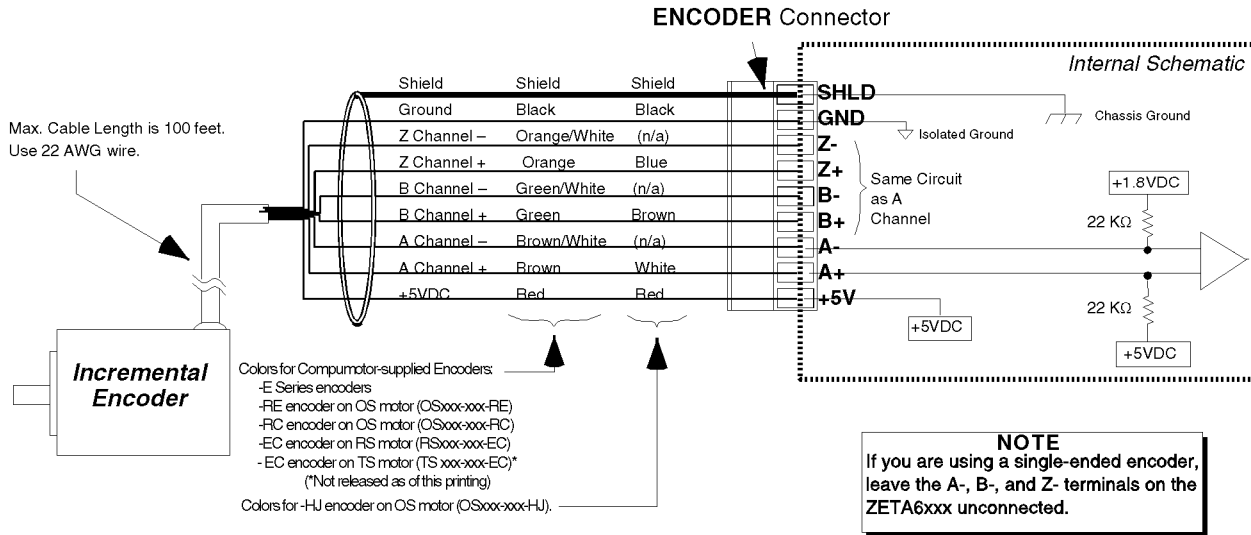
PIN OUTS & SPECIFICATIONS (4-pin LIMITS Connector)

Name	In/Out	Description
GND	—	Isolated ground.
HOM	IN	Home limit input.
NEG	IN	Negative-direction end-of-travel limit input.
POS	IN	Positive-direction end-of-travel limit input.

- Specification for all limit inputs**
- Powered by voltage applied to V_I/O terminal (switching levels: Low ≤ 1/3 of V_I/O voltage, High ≥ 2/3 of V_I/O voltage). V_I/O can handle 5-24V with max. current of 100mA. Internal 6.8 KΩ pull-ups to AUX-P terminal—connect AUX-P to power source (+5V terminal or an external 5-24V supply) to source current, or connect AUX-P to GND to sink current; AUX-P can handle 0-24V with max. current of 50mA. Voltage range for these inputs is 0-24V.
 - Active level for HOM is set with HOMLVL (default is active low, requires n.o. switch).
 - Active level for POS & NEG is set with LHLVL (default is active low, requires n.c. switch).

Encoder

CONNECTIONS & INTERNAL SCHEMATICS



PIN OUTS & SPECIFICATIONS (9-pin ENCODER Connector)

Pin Name	In/Out	Description
SHLD	----	Shield—Internally connected to chassis ground (earth).
GND	----	Isolated logic ground.
Z-	IN	Z- Channel signal input.
Z+	IN	Z+ Channel signal input.
B-	IN	B- Channel quadrature signal input.
B+	IN	B+ Channel quadrature signal input.
A-	IN	A- Channel quadrature signal input.
A+	IN	A+ Channel quadrature signal input.
+5V	OUT	+5VDC output to power the encoder.

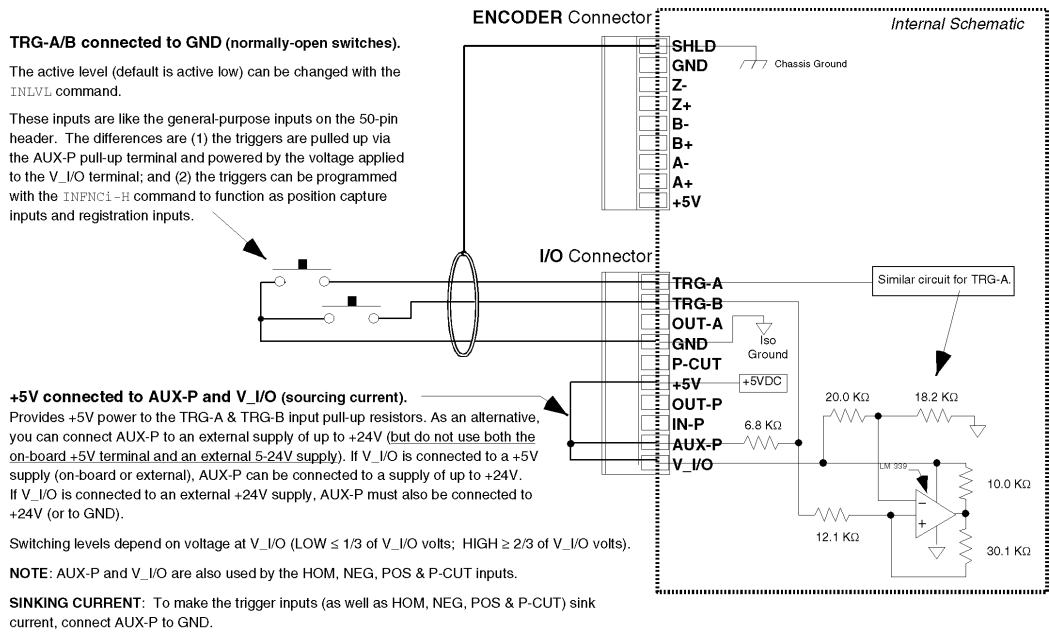
Specification for all encoder inputs

Differential comparator accepts two-phase quadrature incremental encoders with differential (recommended) or single-ended outputs. Max. frequency is 1.6 MHz. Minimum time between transitions is 625 ns. TTL-compatible voltage levels: Low $\leq 0.4V$, High $\geq 2.4V$. Maximum input voltage is 5VDC.

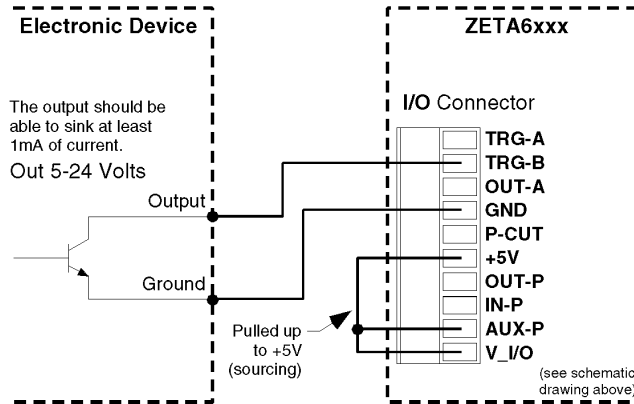
Requirements for Non-Compumotor Encoders

- Use incremental encoders with two-phase quadrature output. An index or Z channel output is optional. **Differential outputs are recommended.**
- It must be a 5V (< 200mA) encoder to use the ZETA6xxx's +5V output. Otherwise, it must be separately powered with TTL-compatible (low $\leq 0.4V$, high $\geq 2.4V$) or open-collector outputs.
- The decoded quadrature resolution should be less than the motor resolution by a factor of four to take advantage of the ZETA6xxx's position maintenance capability.

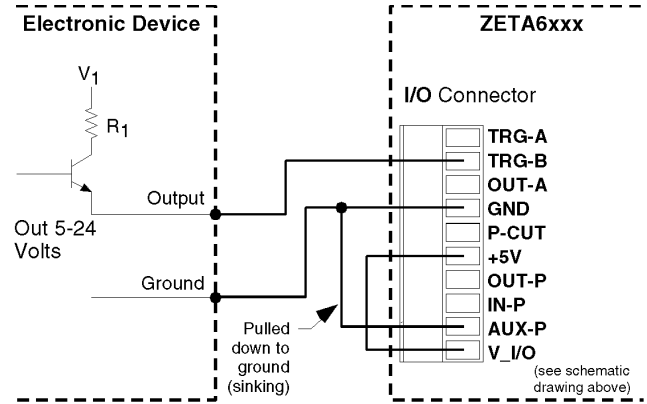
Trigger Inputs



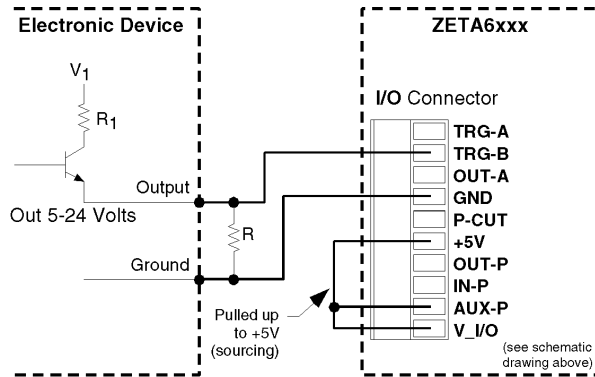
Connection to a Sinking Output Device



Connection to a Sourcing Output Device



Connection to a Combination of Sinking & Sourcing Outputs



Typical value for R = 450Ω (assuming R₁ = 0)
 Note: The value of R may vary depending on the value of R₁ and V₁.

If you will be connecting to a combination of sourcing and sinking outputs, connect AUX-P to +5-24V to accommodate sinking output devices. Then for each individual input connected to a sourcing output, wire an external resistor between the ZETA6xxx's trigger input terminal and ground (see illustration). The resistor provides a path for current to flow from the device when the output is active.

PROGRAMMING TIP

Connecting to a sinking output? Set the trigger input's active level to low with the `INLVL` command (0 = active low, *default setting*).

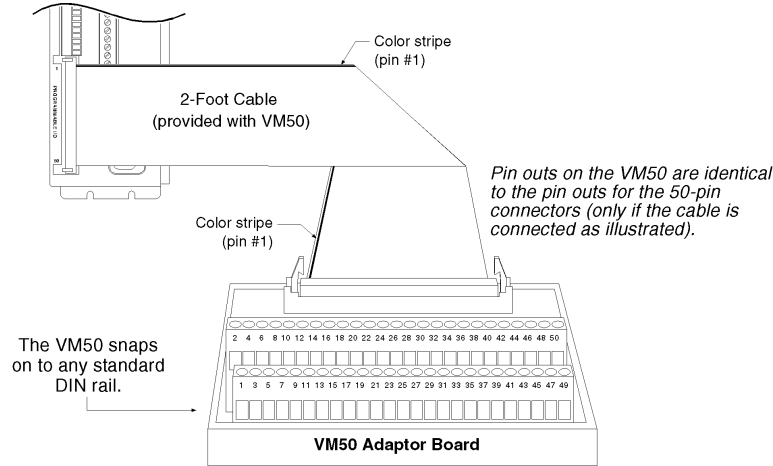
Connecting to a sourcing output? Set the trigger input's active level to high with the `INLVL` command (1 = active high).

Thus, when the output is active, the `TIN` status command will report a "1" (indicates that the input is active), regardless of the type of output that is connected.

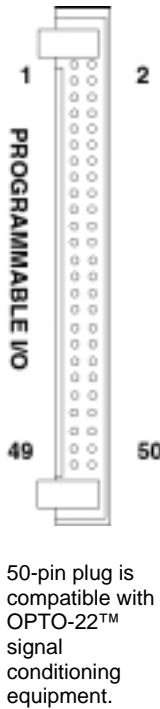
For details on setting the active level and checking the input status refer to the `INLVL` and `TIN` command descriptions in the *6000 Series Software Reference*.

General-Purpose Programmable Inputs & Outputs

VM50 ADAPTOR — for screw-terminal connections



PIN OUTS & SPECIFICATIONS



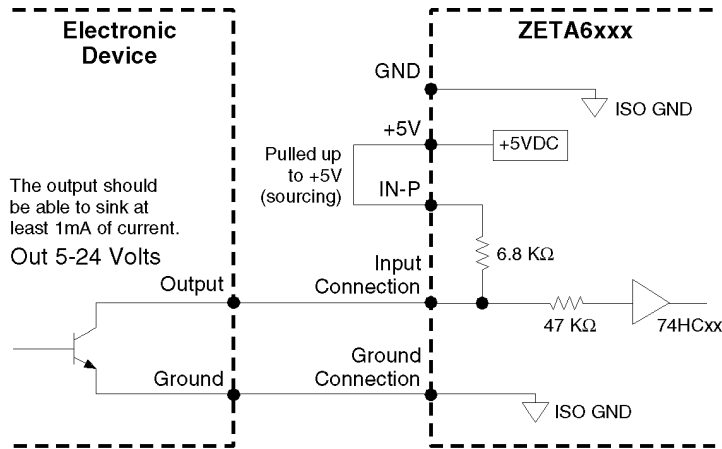
Pin	Function	Internal Schematics	Specifications		
1	Input #16 (MSB of inputs)	Inputs External 5-24VDC Supply (an alternative to using the on-board +5V terminal) When connecting to a sinking output device, connect IN-P to the +5V terminal OR to a user-supplied external supply of up to 24VDC (but not to both). 	Inputs HCMOS-compatible voltage levels (low ≤ 1.00V, high ≥ 3.25V). Voltage range = 0-24V. Sourcing Current: On the I/O connector, connect IN-P to +5V <u>or</u> connect IN-P to an external 5-24VDC power supply (<u>but not to both</u>). Sinking Current: On the I/O connector, connect IN-P to GND. STATUS: Check with TIN or INFNC. Active level: Default is active low, but can be changed to active high with the INLVL command.		
3	Input #15				
5	Input #14				
7	Input #13				
9	Input #12				
11	Input #11				
13	Input #10				
15	Input #9				
17	Output #8 (MSB of outputs)			Outputs (including OUT-A) External 5-24VDC Supply (an alternative to using the on-board +5V terminal) Pull-up: Connect OUT-P to the +5V terminal OR to a user-supplied external supply of up to 24VDC (but not to both). 	Outputs (including OUT-A) Open collector output. Pull-up connection on I/O connector: Connect OUT-P to +5V, <u>or</u> to an external 5-24VDC power supply (<u>but not to both</u>). Outputs will sink up to 300mA or source up to 5mA at 5-24VDC. STATUS: Check with TOUT or OUTFNC. Active level: Default is active low, but can be changed to active high with the OUTLVL command.
19	Output #7				
21	Output #6				
23	Output #5				
25	Input #8				
27	Input #7				
29	Input #6				
31	Input #5				
33	Output #4				
35	Output #3				
37	Output #2				
39	Output #1 (LSB of outputs)				
41	Input #4				
43	Input #3				
45	Input #2				
47	Input #1 (LSB of inputs)				
49	+5VDC				

NOTE: All even-numbered pins are connected to a common logic ground (DC ground) — see drawing on page 11.
 LSB = least significant bit; MSB = most significant bit

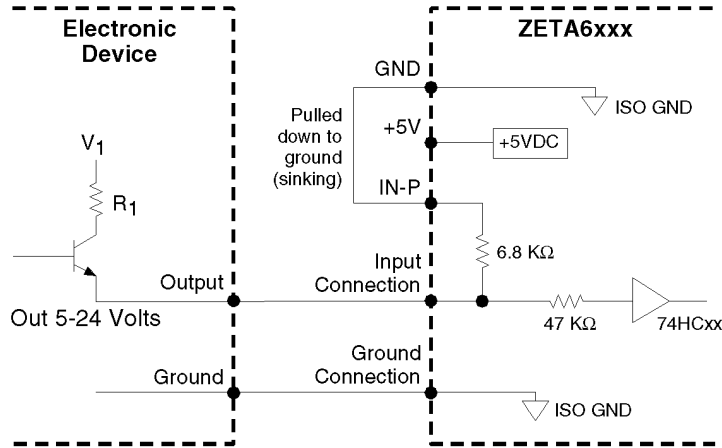
CAUTION: You must select either the on-board +5V terminal or an external power supply to power the IN-P and OUT-P pull-up resistors. Connecting IN-P or OUT-P to the +5V terminal and an external supply will **damage the ZETA6xxx**. (The same rule applies to the AUX-P terminal.)

INPUT CONNECTIONS — Connecting to electronic devices such as PLCs

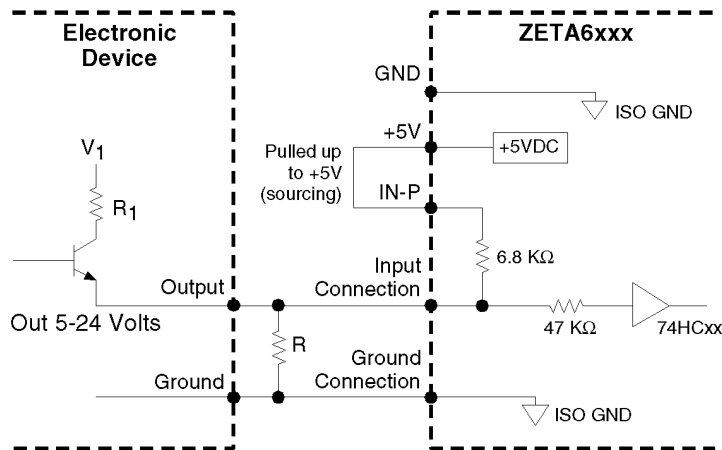
Connection to a Sinking Output Device



Connection to a Sourcing Output Device



Connection to a Combination of Sinking & Sourcing Outputs



Typical value for R = 450Ω (assuming R₁ = 0)
Note: The value of R may vary depending on the value of R₁ and V₁.

PROGRAMMING TIP

Connecting to a sinking output? Set the input's active level to low with the INLVL command (∅ = active low).

Connecting to a sourcing output? Set the input's active level to high with the INLVL command (1 = active high).

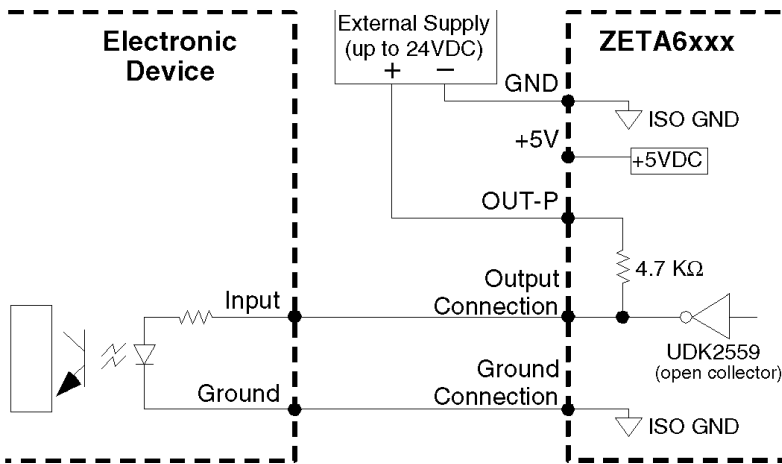
Thus, when the output is active, the TIN status command will report a "1" (indicates that the input is active), regardless of the type of output that is connected.

Details on setting the active level and checking the input status are provided in the *6000 Series Programmer's Guide*. Refer also to the INLVL and TIN command descriptions in the *6000 Series Software Reference*.

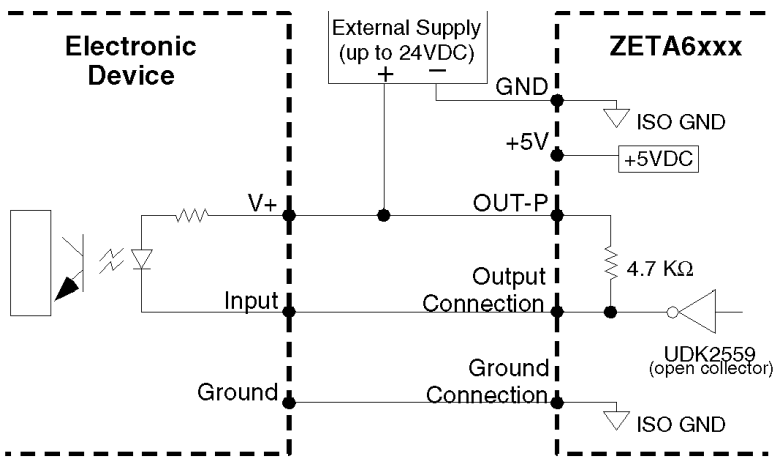
NOTE: If you will be connecting to a combination of sourcing and sinking outputs, connect IN-P to +5V (or to an external 5-24VDC supply) to accommodate sinking output devices. Then for each individual input connected to a sourcing output, wire an external resistor between the ZETA6xxx's programmable input terminal and ground (see "R" in above drawing). The resistor provides a path for current to flow from the device when the output is active.

OUTPUT CONNECTIONS (includes OUT-A) — for electronic devices such as PLCs

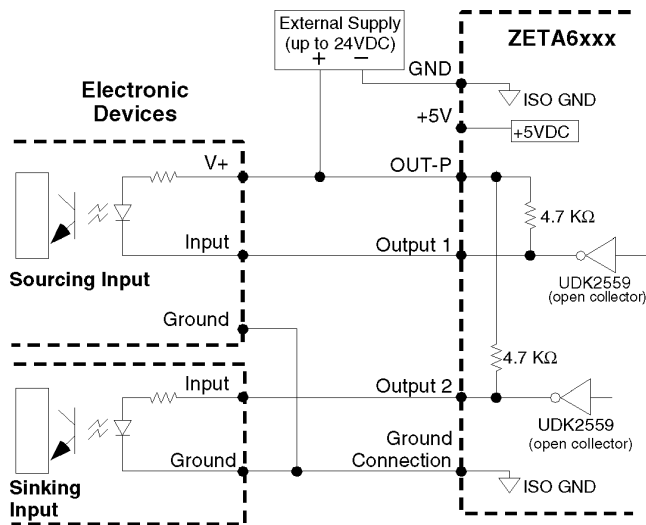
Connection to a Sinking Input (active high)



Connection to a Sourcing Input (active low)



Connection to a Combination of Sinking & Sourcing Inputs



Combinations of sourcing and sinking inputs can be accommodated at the same voltage level. Be aware of the input impedance of the sourcing input module, and make sure that there is enough current flowing through the input module while in parallel with the OUT-P pull-up resistor.

PROGRAMMING TIP

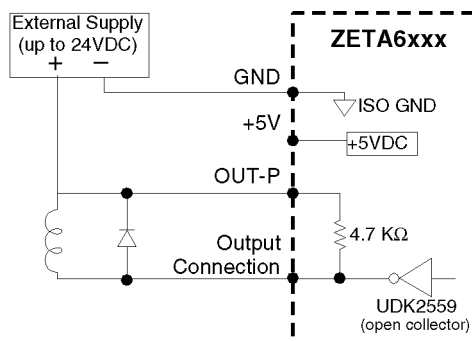
Connecting to an active-high sinking input? Set the output's active level to high with the OUTLVL command (1 = active high).

Connecting to an active-low sourcing input? Set the output's active level to low with the OUTLVL command (0 = active low).

Thus, when the ZETA6xxx's output is activated, current will flow through the attached input and the TOUT status command will report a "1" (indicates that the output is active), regardless of the type of input that is connected.

Details on setting the active level and checking the output status are provided in the 6000 Series Programmer's Guide. Refer also to the OUTLVL and TOUT command descriptions in the 6000 Series Software Reference.

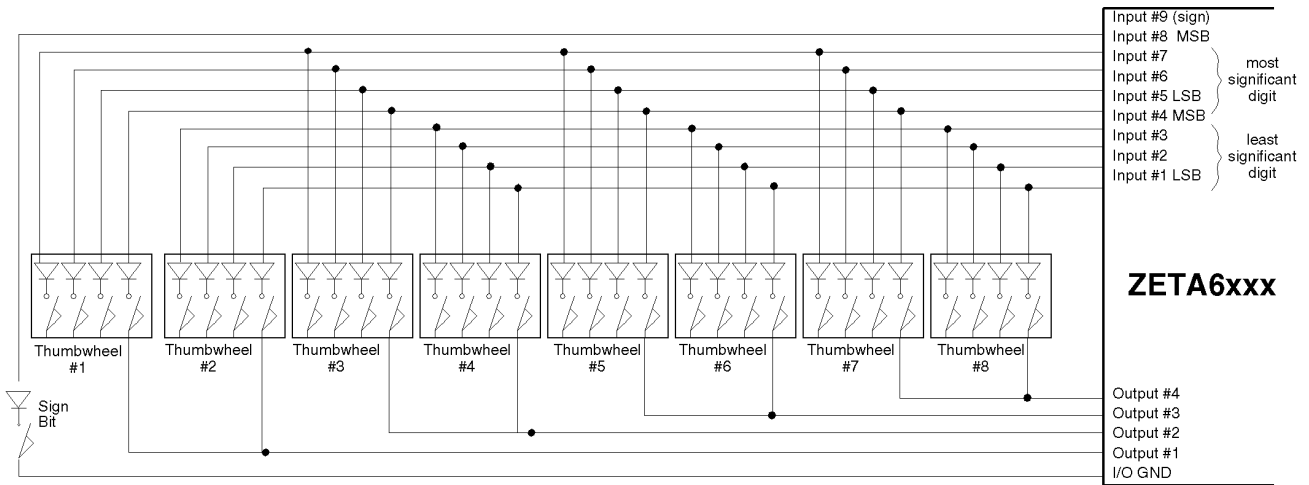
Connection to an Inductive Load (active low)



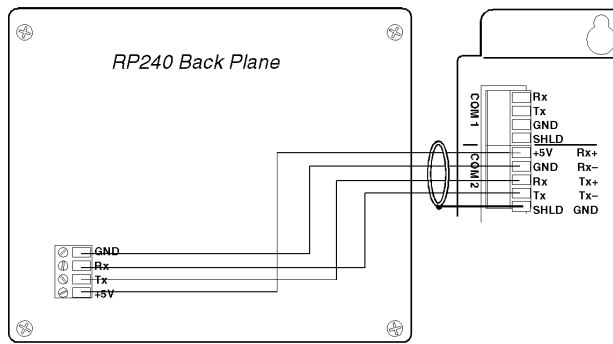
Use an external diode when driving inductive loads. Connect the diode in parallel to the inductive load, attaching the anode to the ZETA6xxx output and the cathode to the supply voltage of the inductive load.

THUMBWHEEL CONNECTIONS — for entering BCD data

Connection to your own Thumbwheel Module



RP240 Remote Operator Panel



RP240 Connections when using RS-485

If you will use RS-485 serial communication, you must connect the RP240 to the **COM 1** connector (and connect the RP240's +5V lead to the +5V terminal on the I/O connector).

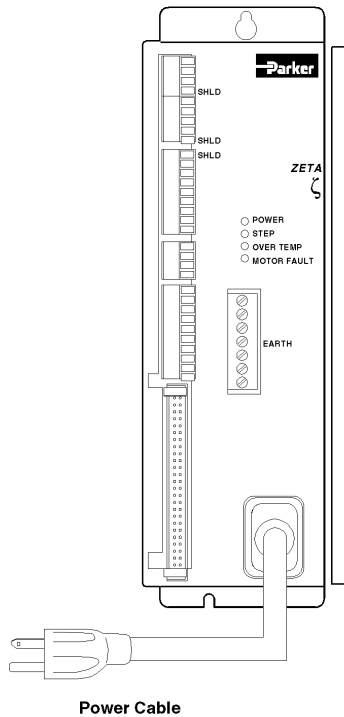
In addition, you will have to issue these commands to configure the ZETA6xxx to communicate successfully with the RP240 connected to **COM 1** and with RS-485 connected to **COM 2**.

PORT1 Select COM 1 as the affected port.
 DRPCHK1 . . . On powerup, check for RP240 on COM 1.
 PORT2 Select COM 2 as the affected port.
 DRPCHK0 . . . On powerup, do not check for RP240 on COM 2.

Input Power

Peak Power Ratings

The amount of power the ZETA Drive requires from your AC power source depends upon the motor you use, whether it is wired in series or parallel, and upon your specific application. The next table shows *peak* power requirements. Power required for your application may be less.



WARNING: The motor case (via the EARTH terminal) and the ZETA6xxx's SHLD terminals are grounded through the AC power connector ground pin. You must provide a proper AC power ground for safety purposes.

Power Input Specification			Power Input Specification		
95-132VAC, 50/60Hz, single-phase			95-264VAC, 50/60Hz, single-phase		
(ZETA6108, ZETA6112, ZETA6104-240(@ 120 VAC))			(ZETA6104-240)		
Peak Power requirements depend on the motor you use:					
Motor Type	Current (Amps)	Volt-Amp (Rating (VA))	Motor Type	Current (Amps)	Volt-Amp (Rating (VA))
OS2HB(S)	1.51	199	RS31C(S)	2.26	611
OS2HB(P)	3.01	466	RS31C(P)	4.00	1337
OS21B(S)	1.88	240	RS32C(S)	2.88	649
OS21B(P)	3.75	509	RS32C(P)	4.00	1312
OS22B(S)	2.14	262	RS33C(S)	3.50	822
OS22B(P)	4.00	542	RS33C(P)	4.00	1401
RS31B(S)	2.32	440	RS42C(S)	3.26	758
RS31B(P)	4.65	830	RS42C(P)	4.00	1258
RS32B(S)	3.10	570	RE42C(S)	3.38	962
RS32B(P)	5.81	1030	RE42C(P)	4.00	1384
RS33B(S)	3.48	630	RS43C(S)	4.00	1016
RS33B(P)	6.97	1220	RS43C(P)	4.00	1526
RS42B(S)	6.19	1090			
RS42B(P)	12.00	2080			
RE42B(S)	3.48	630			
RE42B(P)	7.35	1290			
TS31B(S)	3.48	630			
TS31B(P)	6.97	1220			
TS32B(S)	3.10	570			
TS32B(P)	6.19	1090			
TS33B(S)	5.81	1030			
TS33B(P)	12.00	2080			
TS41B(S)	6.58	1160			
TS41B(P)	12.00	2080			
TS42B(S)	6.97	1220			
TS42B(P)	12.00	2080			
TS43B(S)	6.97	1220			
TS43B(P)	12.00	2080			

(S): Series Configuration (P): Parallel Configuration

LEDs (after power is applied):

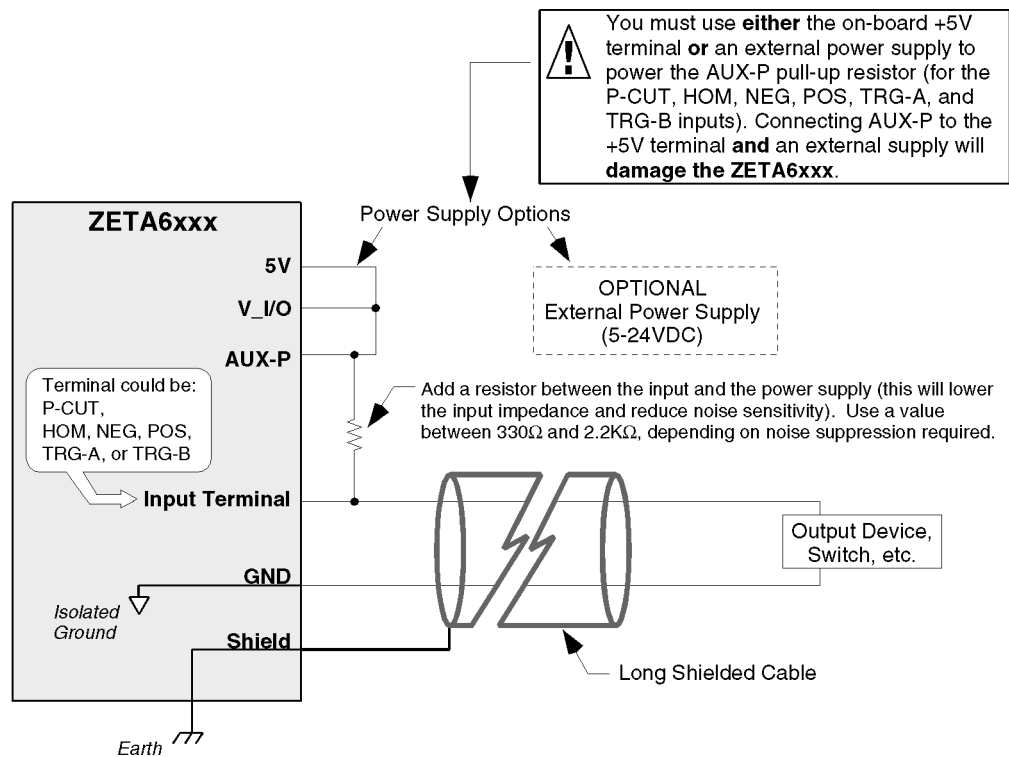
- POWER On (green).
- STEP Off. Or green if motion is commanded.
- OVER TEMP Off. Or red if the internal sensor reaches 122°F (50°C).
- MOTOR FAULT Off. Or red if there is a short in the motor windings or motor cable, or if the INTERLOCK jumper on the motor connector is removed or extended.

Lengthening I/O Cables

Bear in mind that lengthening cables increases noise sensitivity. (The maximum length of cables is ultimately determined by the environment in which the equipment will be used.) If you lengthen the cables, follow the precautions below to minimize noise problems.

- Use a minimum wire size of 22 AWG.
- Use twisted pair shielded cables and connect the shield to a **SHLD** terminal on the ZETA6xxx. Leave the other end of the shield disconnected.
- Do not route I/O signals in the same conduit or wiring trays as high-voltage AC wiring or motor cables.

Reducing noise on limit, trigger, and P-CUT inputs. If you are experiencing noise problems, try adding resistors to reduce noise sensitivity (see illustration below).



Testing the Installation

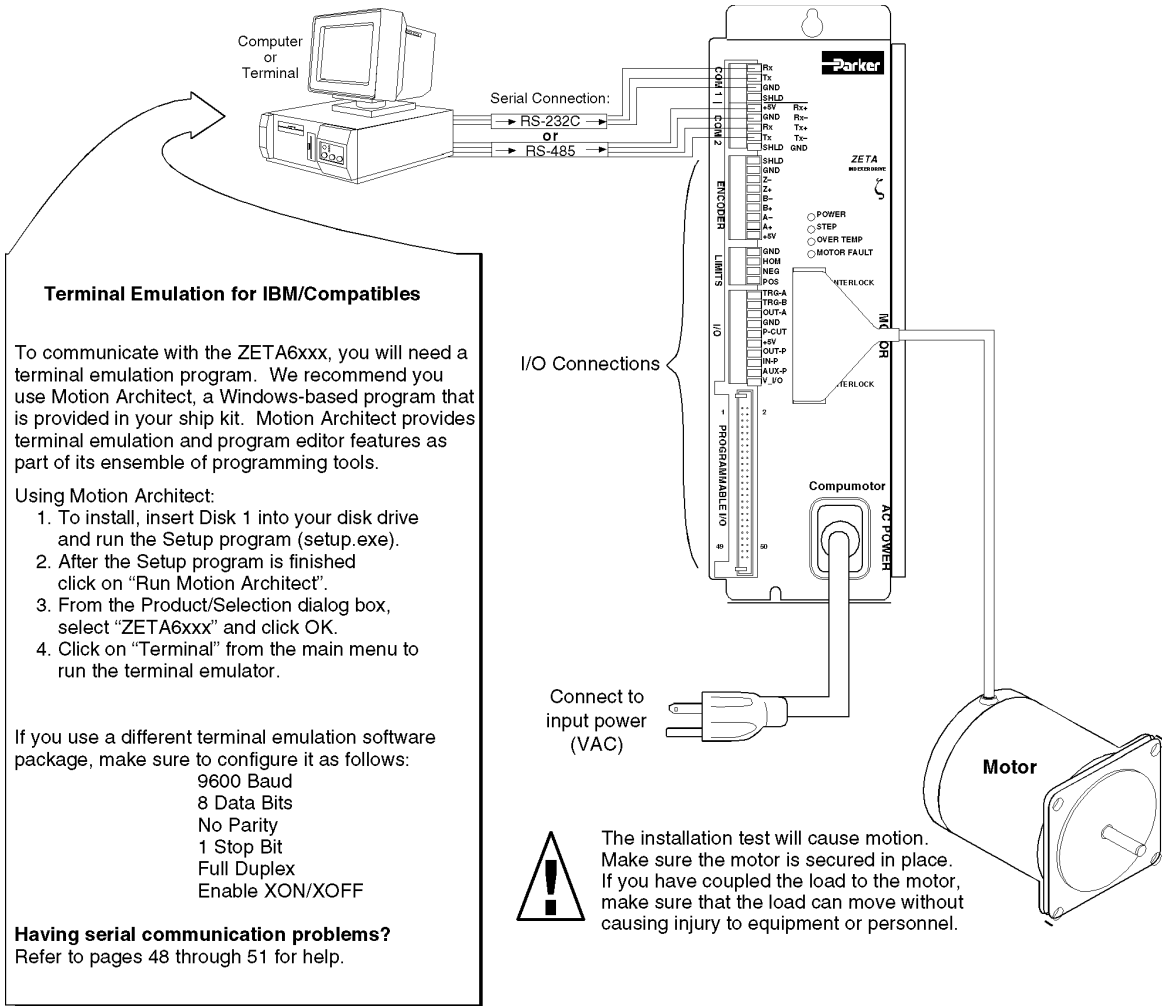
⚠

WARNING

⚠

This test procedure allows you to control I/O and produce motion. Make sure that exercising the I/O will not damage equipment or injure personnel. We recommend that you leave the motor uncoupled from the load, but if you have coupled the load to the motor, make sure that you can move the load without damaging equipment or injuring personnel.


Test Setup



NOTE

The test procedures below are based on the factory-default active levels for the ZETA6xxx's inputs and outputs. Verify these settings with the following *status* commands:

Command Entered	Response Should Be
INLVL	*INLVL0000_0000_0000_0000_00
HOMLVL	*HOMLVL0
LHLVL	*LHLVL00
OUTLVL	*OUTLVL0000_0000_0

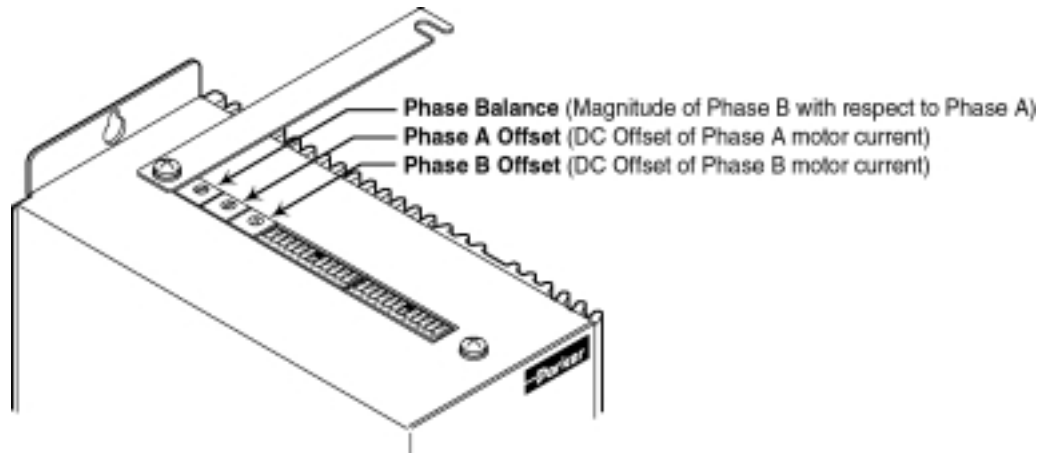
Connections	Test Procedure	Response Format (left to right)
End-of-travel and Home Limits	<p>NOTE: If you are not using end-of-travel limits, issue the Disable Limits (LH0) command and ignore the first two bits in each response field.</p> <ol style="list-style-type: none"> 1. Enable the hardware end-of-travel limits with the LH3 command. 2. Close the end-of-travel switches and open the home switch. 3. Enter the TLIM command. The response should be *TLIM110. 4. Open the end-of-travel switches and close the home switch. 5. Enter the TLIM command. The response should be *TLIM001. 6. Close the end-of-travel switches and open the home switch (return to original config.). 7. Enter the TLIM command. The response should be *TLIM110. 	<p>TLIM response:</p> <p>bit 1= POS (positive travel) limit bit 2= NEG (negative travel) limit bit 3 = HOM (home) limit</p>
Motor and Encoder (motion)	<ol style="list-style-type: none"> 1. Enter the ENC0 command to enable the motor step mode. Enter the PSET0 command to set the motor position to zero. Enter the TPM command to determine the motor position. The response should be *TPM+0 (motor is at position zero). Enter the D25000 command, followed by the GO command. The motor will move one revolution (25000 steps) in the clockwise direction (viewed from the flange end). Enter the TPM command to determine the motor position. The response should be *TPM+25000 (motor is at position 25000). 2. NOTE: Ignore this step if you are <u>not</u> using encoder feedback. This test assumes you are using a 1000-line encoder yielding a 4000 count/rev resolution. Enter the ENC1 command to enable the encoder step mode. Enter the PSET0 command to set the encoder position to zero. Enter the TPE command to determine the encoder position. The response should be *TPE+0 (encoder is at position zero). If the encoder is coupled to the motor shaft: Enter the D4000 command, followed by the GO command. The encoder (and motor) will move one revolution (4000 counts) in the clockwise direction (viewed from the flange end). If the encoder is <u>not</u> coupled to the motor shaft: Manually rotate the encoder shaft one revolution in the clockwise direction (viewed from the flange end). Enter the TPE command to determine the encoder position. The response should be *TPE+4000 (encoder is at position 4000). Enter the ENC0 command to return the ZETA6xxx to the default motor step mode. 	<p>TPM response = motor counts</p> <p>TPE response = encoder counts</p> <p>Direction of rotation:</p> 
Programmable Inputs (incl. triggers)	<ol style="list-style-type: none"> 1. Open the input switches or turn off the device driving the inputs. 2. Enter the TIN command. The response should be *TIN0000_0000_0000_0000_00. 3. Close the input switches or turn on the device driving the inputs. 4. Enter the TIN command. The response should be *TIN1111_1111_1111_1111_11. 	<p>TIN response:</p> <p>bits 1-16 = prog. inputs 1-16 bits 17 & 18 = TRG-A & TRG-B</p>
Programmable Outputs	<ol style="list-style-type: none"> 1. Enter the OUTALL1,9,1 command to turn on (sink current on) all programmable outputs. Verify that the device(s) connected to the outputs activated properly. 2. Enter the TOUT command. The response should be *TOUT1111_1111_1. 3. Enter the OUTALL1,9,0 command to turn off all programmable outputs. Verify that the device(s) connected to the outputs de-activated properly. 4. Enter the TOUT command. The response should be *TOUT0000_0000_0. 	<p>TOUT response:</p> <p>bits 1-8 = prog. outputs 1-8 bit 9 = OUT-A</p>

<p>RP240</p>	<ol style="list-style-type: none"> 1. Cycle power to the ZETA6xxx. 2. If the RP240 is connected properly, the RP240's status LED should be green and one of the lines on the computer or terminal display should read *RP240 CONNECTED. If the RP240's status LED is off, check to make sure the +5V connection is secure. If the RP240's status LED is green, but the message on the terminal reads *NO REMOTE PANEL, the RP240 Rx and Tx lines are probably switched. Remove power and correct. 3. Assuming you have not written a program to manipulate the RP240 display, the RP240 screen should display the following: <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <p style="text-align: center;">COMPUMOTOR 6XXX INDEXER/DRIVE RUN JOG STATUS DRIVE DISPLAY ETC</p> </div> 	<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">ASSUMPTIONS</p> <ul style="list-style-type: none"> • RP240 connected to COM 2 • COM 2 (PORT2) configured for RP240. To verify, type these commands: PORT2 <cr> DRPCHK<cr> <p>The system response should report "*DRPCHK3".</p> </div>
<p>Pulse Cut</p>	<ol style="list-style-type: none"> 1. Open the P-CUT switch or turn off the device driving the P-CUT input. 2. Enter the TINO command (note the condition of the 6th bit from the left). The response should be *TINO0000_0000. 3. Close the P-CUT switch or turn on the device driving the P-CUT input. 4. Enter the TINO command. The response should be *TINO0000_0100. 	<p>TINO response: bit 6 = pulse cut input bits 1-5, 7 & 8 are not used</p>

Matching the Motor to the ZETA6xxx (OPTIONAL)

Due to slight manufacturing variations, each motor has its own particular characteristics. In the procedure below, you will adjust three potentiometers (*pots*), to match your ZETA6xxx to your specific motor. You will also select the best current waveform to use with your motor.

The ZETA6xxx's pots are located behind the removable metal cover on top of the chassis.



Before You Start

- Note that if you replace the ZETA6xxx unit or the motor, you will have to redo this procedure.
- Set up a serial communication link and terminal emulator (see installation test on page 27).
- Connect the motor to the ZETA6xxx.
- Secure the motor in a location such that you can turn the pots and feel or hear the motor at the same time. (You should perform this procedure with the motor not coupled to the load, because the characteristics you are matching are those only of the drive/motor combination.)
- Apply AC power when necessary to perform the steps below.

- Step 1 Apply power to the ZETA6xxx, and allow it to reach a stable operating temperature. This may take up to 30 minutes. For optimum results, perform the matching procedure at the same ambient temperature at which your application will operate.
- Step 2 For the adjustments that follow, consult the table below to find the speed at which to run the motor. These are speeds that cause *resonance* in the unloaded motor. When the motor is running at a resonant speed, you will notice increased noise and vibration. To make resonance the most noticeable, you may need to vary the speed around the value given below for your motor. You can find the resonant speed by touching the motor lightly with your fingertips as you vary the speed. When you feel the strongest vibrations, the motor is running at resonant speed.

These values are for use with ZETA6108, ZETA6112 or ZETA6104-240 at 120 VAC.

Motor	Offset Adjust (rps)	Balance Adjust (rps)	Waveform Adjust (rps)
OS2HB(S)	4.52	2.26	1.13
OS2HB(P)	4.52	2.26	1.13
OS21B(S)	4.49	2.24	1.12
OS21B(P)	4.49	2.24	1.12
OS22B(S)	4.51	2.26	1.13
OS22B(P)	4.51	2.26	1.13
RS31B(S)	2.58	1.29	0.65
RS31B(P)	2.58	1.29	0.65
RS32B(S)	2.48	1.24	0.62
RS32B(P)	2.48	1.24	0.62
RS33B(S)	2.63	1.32	0.66
RS33B(P)	2.63	1.32	0.66
RS42B(S)	1.72	0.86	0.43
RS42B(P)*	1.68 / 1.46	0.84 / 0.73	0.42 / 0.37
RE42B(S)	2.58	1.29	0.65
RE42B(P)	2.58	1.29	0.65
TS31B(S)	3.11	1.56	0.78
TS31B(P)	3.11	1.56	0.78
TS32B(S)	2.72	1.36	0.68
TS32B(P)	2.72	1.36	0.68
TS33B(S)	3.36	1.68	0.84
TS33B(P)*	3.40 / 2.92	1.70 / 1.46	0.85 / 0.73
TS41B(S)	2.82	1.41	0.71
TS41B(P)*	2.78 / 2.50	1.39 / 1.25	0.70 / 0.63
TS42B(S)	2.94	1.47	0.74
TS42B(P)*	2.57 / 2.35	1.29 / 1.18	0.64 / 0.59
TS43B(S)	2.74	1.37	0.69
TS43B(P)*	2.56 / 2.21	1.28 / 1.11	0.64 / 0.55

*Note: Use secondary value (after slash when being run with ZETA8 (only 8 amps)).

These values are for use with ZETA6104-240 at 240 VAC

Motor	Offset Adjust (rps)	Balance Adjust (rps)	Waveform Adjust (rps)
RS31C(S)	2.93	1.47	0.73
RS31C(P)	2.78	1.39	0.70
RS32C(S)	3.08	1.54	0.77
RS32C(P)	2.76	1.38	0.69
RS33C(S)	3.07	1.53	0.77
RS33C(P)	2.49	1.24	0.62
RS42C(S)	1.78	0.89	0.45
RS42C(P)	1.55	0.77	0.39
RE42C(S)	2.99	1.50	0.75
RE42C(P)	2.04	1.02	0.51
RS43C(S)	1.80	0.90	0.45
RS43C(P)	1.40	0.70	0.35

Note: Resonant speeds are shown for motors at full rated current. Operation of the motors at lower currents will shift the resonant speeds slightly.

Step 3 Run your motor at the resonant speed listed in the *Offset Adjust* column. Vary the speed slightly until you find the resonance point.

To initiate motion, type these commands (followed by a carriage return) to the ZETA6xxx from the terminal emulator:

MC1 (This command makes the motion run continuously until you issue a !S command.)
 vn (This command sets the velocity to *n*. For example, v4.66 sets the velocity to 4.66 rps.)
 GO (This command initiate motion.)

To vary the speed while the motor is moving, type these *immediate* commands:

!vn (This command selects the new velocity of *n*.)
 !GO (This command changes the motor's velocity to the new velocity value of *n*.)

NOTE: To stop the motor during this procedure, issue the !S command.
 Re-issue the GO command to resume motion.

Step 4 Adjust the Phase A Offset and Phase B Offset pots for minimum motor vibration and smoothest operation. Alternate between Phase A and Phase B to find the minimum vibration point.

Step 5 Run your motor at the resonant speed listed in the *Balance Adjust* column. Vary the speed slightly until you find the resonance point.

Step 6 Adjust the balance pot until you find the setting that provides minimum motor vibration and smoothest operation.

Step 7 Repeat steps 3–6.

Step 8 Run the motor at the resonant speed listed in the *Waveform Adjust* column. Vary the speed slightly until you find the resonance point.

Step 9 Choose the current waveform that provides minimum motor vibrations and smoothest operation at the speed you selected in step 8. To find the best waveform, compare motor performance as you select different waveforms using the !DWAVEF command.

Waveform	DWAVEF Setting	
-4% 3rd harmonic	!DWAVEF1	← Factory default
-10% 3rd harmonic	!DWAVEF2	
-6% 3rd harmonic	!DWAVEF3	
Pure sine	!DWAVEF4	← Do not use if drive resolution (DRES) is set to 200 steps/rev

NOTE: The DWAVEF command setting is NOT automatically saved in non-volatile memory; therefore, if DWAVEF1 is not adequate, you have to place an alternative DWAVEF setting in a set-up (STARTP) program. Refer to page 31 for an example.

Step 10 Disconnect AC power to turn off the ZETA6xxx. Replace the cover over the pots. This completes the matching procedure.

Step 11 Proceed to the next section to mount and couple the motor.

Mounting & Coupling the Motor



WARNINGS



- Improper motor mounting and coupling can jeopardize personal safety, and compromise system performance.
- Never disassemble the motor; doing so will cause contamination, significant reduction in magnetization, and loss of torque.
- Improper shaft machining will destroy the motor's bearings, and void the warranty. Consult a factory Applications Engineer (see phone number on inside of front cover) before you machine the motor shaft.

Mounting the Motor

Use flange bolts to mount rotary step motors. The *pilot*, or centering flange on the motor's front face, can help you position the motor.

Do not use a foot-mount or cradle configuration, because the motor's torque is not evenly distributed around the motor case. When a foot mount is used, for example, any radial load on the motor shaft is multiplied by a much longer lever arm.

The motors can produce very high torque and acceleration. If the mounting is inadequate, this combination of high torque/high acceleration can shear shafts and mounting hardware. Because of shock and vibration that high accelerations can produce, you may need heavier hardware than for static loads of the same magnitude.

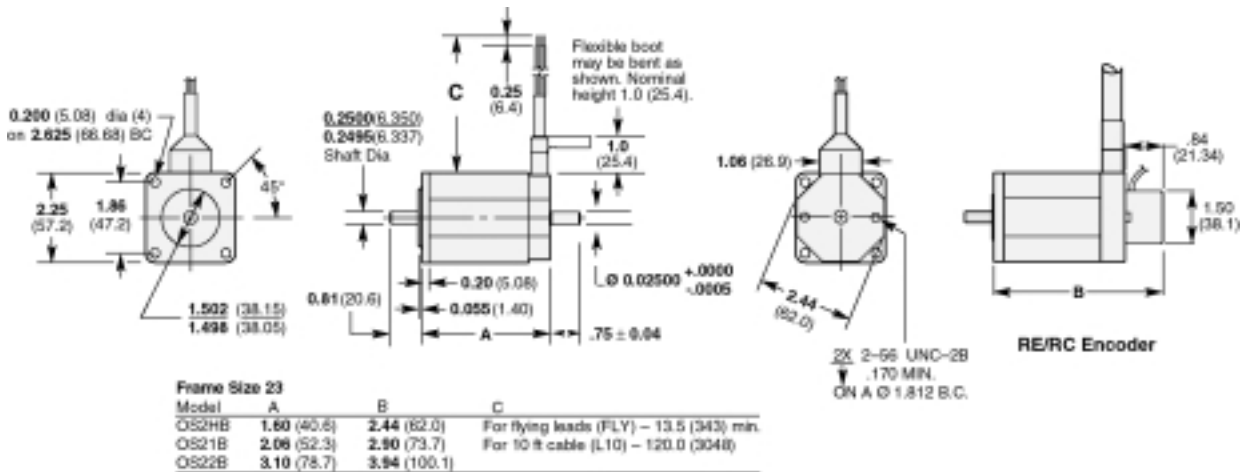
Under certain move profiles, the motor can produce low-frequency vibrations in the mounting structure that can cause fatigue in structural members. A mechanical engineer should check the machine design to ensure that the mounting structure is adequate.

Zeta Series CE

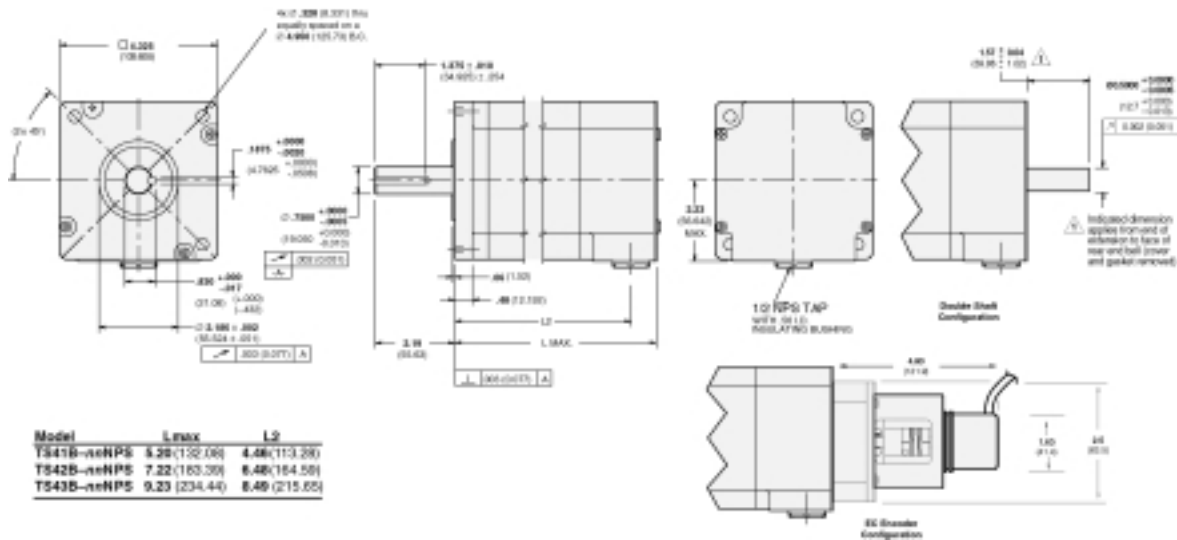
Motor Dimensions

Dimensions in inches (mm)

Size 23 Frame, 0 Series



Size 42 Frame, T Series



Motor Temperature & Cooling

The motor's face flange is used not only for mounting; it is also a *heatsink*. Mount the face flange to a large thermal mass, such as a thick steel plate. This is the best way to cool the motor. Heat will be conducted from inside the motor, through the face flange, and dissipated in the thermal mass. You can also use a fan to blow air across the motor for increased cooling, if you do not get enough cooling by conduction through the face flange.

In addition, the ZETA6xxx has an automatic standby current feature that reduces motor current by 50% if no step pulses have been commanded for a period of 1 second or more. (**WARNING:** torque is also reduced.) Full current is restored upon the first step pulse. To enable this feature, change DIP switch SW2-1 (see page 8) to the ON position (enabled) (default is disabled, OFF).

Coupling the Motor

To ensure maximum performance, align the motor shaft and load as accurately as possible (although some misalignment may be unavoidable). The type of misalignment will affect your choice of coupler.

Single-Flex Coupling: Use for angular misalignment only. One (only) one of the shafts must be free to move in the radial direction without constraint. Do not use a single-flex coupling with parallel misalignment—this will bend the shafts, causing excessive bearing loads and premature failure.

Double-Flex Coupling: Use whenever two shafts are joined with parallel misalignment, or a combination of angular and parallel misalignment. Single-flex and double-flex couplings may or may not accept end pla, depending on their design.

Rigid Coupling: Not recommended, because they cannot compensate for *any* misalignment. Use only if the motor or load is on some form of floating mounts that allow for alignment compensation. Rigid couplings can also be used when the load is supported entirely by the motor's bearings. A small mirror connected to a motor shaft is an example of such an application.

Coupling Manufacturers: HUCO, 70 Mitchell Blvd, Suite 201, San Rafael, CA 94903, (415) 492-0278
ROCOM CORP., 5957 Engineer Drive, Huntington Beach, CA 92649, (714) 891-9922



Optimizing System Performance (OPTIONAL)

The ZETA6xxx is equipped with three damping circuits that minimize resonance and ringing, and thus enhance stepper performance:

The ZETA6xxx automatically switches between the damping circuits, based upon the motor's speed.

- **Anti-Resonance** – General-purpose damping circuit. The ZETA6xxx ships from the factory with anti-resonance enabled (see page 7). No configuration is necessary. Anti-resonance provides aggressive and effective damping at speeds greater than 3 revolutions per second (rps). If you are using a high-inductance motor (not applicable to O, R or T motors), you should disable anti-resonance with the DIP switch SW2-2.
- **Active Damping** – Extremely powerful damping circuit at speeds greater than 3 rps. The ZETA6xxx ships from the factory with active damping disabled. To enable active damping and optimize it for a specific motor size and load, refer to the *Configuring Active Damping* procedure below.
- **Electronic Viscosity** – Provides passive damping at lower speeds (from rest to 3 rps). The ZETA6xxx ships with electronic viscosity disabled. To enable electronic viscosity and optimize it for a specific application, refer to the *Configuring Electronic Viscosity* procedure below.

For a theoretical discussion about these three circuits and how they minimize resonance and ringing, refer to Appendix A.

NOTE: You need to "match the motor to the ZETA6xxx" before you can configure active damping or electronic viscosity. Refer to the matching procedure on page 30.

Configuring Active Damping

Before You Start

- **Couple the motor to the load** (see pages 33-35 for details). Active damping must be configured under the normal mechanical operating conditions for your application.

Follow these steps to configure the active damping circuit.

1. Verify Correct Drive/Motor Matching

See *Matching the Motor to the ZETA6xxx* earlier in this chapter. To be fully effective, the active damping circuit requires proper matching. If you are replacing a component (new drive or motor in an existing application), you must rematch your system.

2. Verify Correct DIP Switch Settings

Anti-Resonance	SW2-#2	switch in <i>OFF</i> position
Inductance	SW2-#7 - #8	set for your motor
Static Torque	SW2-#9 - #12	set for your motor

3. Verify that the Active Damping Rotary Switch is at Zero

4. Calculate the Maximum Rotary Switch Setting

To do this, first calculate your system inertia. Be sure to include the motor's rotor inertia. Then consult the table of inertia ranges below. Find the switch setting that corresponds to your system inertia.

DIP SW2-#6 in OFF Position (Low Inertia Range)

Switch Position	Total Inertia (kg-cm ²)	Total Inertia (kg-m ² x 10 ⁻⁶)	Total Inertia (oz-in ²)
15	0.088 - 0.205	8.8 - 20.5	0.481 - 1.121
14	0.205 - 0.572	20.5 - 57.2	1.121 - 3.127
13	0.572 - 1.069	57.2 - 106.9	3.127 - 5.845
12	1.069 - 1.754	106.9 - 175.4	5.845 - 9.590
11	1.754 - 2.727	175.4 - 272.7	9.590 - 14.910
10	2.727 - 3.715	272.7 - 371.5	14.910 - 20.312
9	3.715 - 5.020	371.5 - 502.0	20.312 - 27.447
8	5.020 - 6.275	502.0 - 627.5	27.447 - 34.308
7	6.275 - 8.045	627.5 - 804.5	34.308 - 43.986
6	8.045 - 9.595	804.5 - 959.5	43.986 - 52.460
5	9.595 - 11.760	959.5 - 1176.0	52.460 - 64.297
4	11.760 - 14.245	1176.0 - 1424.5	64.297 - 77.884
3	14.245 - 15.895	1424.5 - 1589.5	77.884 - 86.905
2	15.895 - 17.765	1589.5 - 1776.5	86.905 - 97.130
1	17.765 - 20.570	1776.5 - 2057.0	97.130 - 112.466
0	Active Damping Disabled		

DIP SW2-#6 in ON Position (High Inertia Range)

Switch Position	Total Inertia (kg-cm ²)	Total Inertia (kg-m ² x 10 ⁻⁶)	Total Inertia (oz-in ²)
15	13 - 31	1324 - 3084	75 - 169
14	31 - 86	3084 - 8606	169 - 471
13	86 - 161	8606 - 16084	471 - 879
12	161 - 264	16084 - 26390	879 - 1443
11	264 - 410	26390 - 41029	1443 - 2243
10	410 - 559	41029 - 55894	2243 - 3056
9	559 - 755	55894 - 75528	3056 - 4129
8	755 - 944	75528 - 94411	4129 - 5162
7	944 - 1210	94411 - 121041	5162 - 6618
6	1210 - 1444	121041 - 144362	6618 - 7893
5	1444 - 1769	144362 - 176935	7893 - 9674
4	1769 - 2143	176935 - 214323	9674 - 11718
3	2143 - 2391	214323 - 239148	11718 - 13075
2	2391 - 2673	239148 - 267283	13075 - 14614
1	2673 - 3095	267283 - 309486	14614 - 16921
0	Active Damping Disabled		

Active Damping Rotary Switch Settings & Corresponding Inertia Ranges

This is your *Maximum* switch setting. If you are on the boundary between two switch settings, pick the lower of the two numbers. In the rest of this procedure **never set the switch higher than this maximum setting.**

5. Make a Move With Active Damping Turned Off

(Rotary switch should be in the zero position.) This is your baseline move. Notice the sound, amount of motor vibration, etc. This move shows how your system operates with anti-resonance enabled, and active damping disables. Each time you adjust this switch, you will compare results with this baseline move.

The move should be representative of your application, with similar velocity and acceleration. The speed must be faster than 3 rps, in order for the drive to activate anti-resonance or active damping.

6. Turn On Active Damping

Turn the active damping rotary switch to position 1. This turns on active damping at its lowest setting, and disables anti-resonance.

You can change the rotary switch setting "on the fly." You do not have to cycle power each time you change the switch setting. During a repetitive move, you can change the switch setting while the move is in progress. This allows you to immediately compare two different switch settings.

7. Make a Move With Active Damping Turned On

Compare the sound and vibration to the baseline move.

8. Increase the Switch Setting

Turn the rotary switch to position 2 (unless position 1 is your calculated maximum). Make the move again. Compare the sound and vibration to the levels obtained at the lower setting.

9. Find the Ideal Switch Setting

Continue to increase the switch setting by single increments. Each time you increase the setting, compare the results with the lower setting. Increase the setting until you obtain optimum results for your move. This will be the setting that yields the lowest audible noise and smoothest motor operation.

Never exceed your maximum switch setting. For many applications, you will not need to go as high as the maximum setting. If you do not see perceptible improvement from one switch setting to the next, use the lower switch setting.

Higher switch settings will result in higher dynamic motor current during transients, which can cause increased motor heating. Higher current also increases motor torque, resulting in sharper accelerations than can jerk or stress the mechanics in your system. If you ramp up through each intermediate switch position, you can evaluate the effects on your mechanics as you gradually increase damping.

Configuring Electronic Viscosity (EV)

Before You Start

- If you configured active damping (see procedure above), leave the setting set at the value you chose. You do not need to disable active damping while you configure EV.
- **Couple the motor to the load** (see pages 33-35 for details). EV must be configured under the normal mechanical operating conditions for your application.
- **Record the DELVIS command setting.** The procedure below helps you identify the appropriate set-up command (DELVIS) that will prepare your system for optimized performance. DELVIS is not saved in non-volatile memory. Therefore, you should write down this command as you qualify it in this procedure, then place it in a program. Page 41 shows an example of how to place DELVIS in a set-up (STARTP) program (a set-up program executes user-specified commands that establish power-up operational defaults for your application).

- Step 1 **Verify correct motor-to-ZETA6xxx matching.** See *Matching the Motor to the ZETA6xxx* on page 30. To be fully effective, the active damping circuit requires proper matching. If you are replacing a component (new ZETA6xxx or motor) in an existing application, you must rematch your system.

Step 2 **Make a *baseline* move with EV disabled.** This is your baseline move. Notice the sound, amount of motor vibration, perceptible ringing, etc. This move shows how your system operates with EV disabled. Each time you adjust the DELVIS setting (in steps 3 & 4), you will compare results against this baseline move.

1. Issue the DELVIS0 command to disable active damping.
2. Make a move that is representative of your application, with similar velocity and acceleration. The velocity must 3 rps or less, in order for the ZETA6xxx to activate EV.

WARNING
 Make sure that causing motion will not damage equipment or injure personnel.

The following six commands illustrate a simple incremental point-to-point move:

```
MC0      ; select the preset positioning mode
MA0      ; select the incremental preset positioning mode
A10      ; set the acceleration to 10 revs/sec/sec
V2       ; set the velocity to 2 revs/sec/sec
D250000  ; set the distance to 250,000 steps, equal to 10 revs
GO       ; initiate the move
;*****
;* NOTE: To stop a move in progress, issue the !S command.      *
;* To repeat the move, issue the GO command. To reverse       *
;* direction, issue the D~ command and the GO command.        *
;*****
```

Step 3 **Make a move with EV enabled.** Compare the results with the baseline move.

1. Issue the DELVIS1 command to enable EV.
2. Make a move that is representative of your application. Use the same motion parameters that you set up in step 1. If you have not changed these settings, simply issue the GO command.

Step 4 **Find the ideal EV setting.** Continue to increase the DELVIS setting by single increments (the maximum setting is DELVIS7), and executing a move. Repeat this step until you find the setting that gives the best performance. You can try all seven settings. Incorrect settings will not cause damage.

During a repetitive move, you can change the setting “on the fly” (while the move is in progress) if you precede the DELVIS command with a “!” (e.g., !DELVIS2). This allows you to immediately compare two different settings.

Record Your Systems Configuration

You may wish to record your configuration information in the chart

Axis Name Motor Size S P

DIP Switch Settings

OFF	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ON	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

1 2 3 4 5 6 7 8 9 10 11 12

WF Setting (DWAVEF)

EV Setting (DELVIS)

AD Setting

COM 1 Serial Port Function RS-232 RP240

COM 2 Serial Port Function RS-232 RP240 RS-485

RS-485 Resistor Values Terminate Bias

- ← COM port functions set with internal jumpers and the PORT and DRPCHK commands.
- ← RS-485 resistors are selected with internal DIP switches, or connected externally.

Much of this chart is repeated, along with other facts, on the *magnetic* information label located on the side of the ZETA6xxx chassis. You can leave the label on the ZETA6xxx, or you can remove it and place it in a convenient location near the ZETA6xxx (e.g., on an equipment cabinet door).

Use a marker or pen to write configuration information in the spaces at the bottom of the label. If you have multiple ZETA6xxxs, you can remove the labels and stack them on top of each other, with the bottom edge of each visible. This shows information about all axes at a glance.

Recommended Set-up Elements (software & hardware)

NOTE
In most applications, the factory default settings are adequate.

Most of the software configuration commands (see table below) are not saved in non-volatile memory and therefore must be executed every time the ZETA6xxx is powered up or reset. Therefore, you may wish to include the software configuration commands in the *set-up* program.

The set-up program is automatically executed when the ZETA6xxx is powered up or reset; in it, you place the configuration commands that establish the operational readiness you require for your particular application. A sample set-up program is provided below. For more detailed information on creating a set-up program, refer to the *6000 Series Programmer's Guide*.

Command	Function	Factory Default Setting
DELVIS	Enable/disable electronic viscosity. Electronic viscosity is automatically inhibited above 3 rps. (See set-up procedure on page 38.)	DELVIS0 (disabled)
DRPCHK*	Establish the type of check for an RP240. In general, this command is necessary only if you are using RS-485, which forces the RP240 to be connected to the COM 1 connector, instead of being connected to the COM 2 connector.	DRPCHK3
DWAVEF	Match the motor waveform (required for matching the motor to the ZETA6xxx).	DWAVEF1 (-4% 3rd harmonic)
ECHO	Enable/disable echoing of characters. If communicating over RS-232 to the master ZETA6xxx in an RS-485 multi-drop, see setup requirements on page 50.	ECHO1 (enabled; but if using RS-485, COM 2 is changed to ECHO0 by default)
PORT	Identify the COM port to be affected by subsequent serial communication set-up commands (DRPCHK, E, ECHO, EOT, BOT, EOL, ERROK, ERBAD, ERRDEF, XONOFF, and ERRLVL).	PORT1 (COM 1 is affected)
DACTDP**	Enable/disable active damping. Active damping is automatically inhibited at or below 3 rps. If active damping is enabled, anti-resonance is automatically inhibited. (See set-up procedure on page 36.)	

- DAREN** Enable/disable anti-resonance. Anti-resonance is automatically inhibited at or below 3 rps, and it is inhibited if active damping is enabled.
- DAUTOS** Enable/disable automatic current standby mode in which current to the motor is reduced to 50% if no pulses are commanded for 1 second. Full current is restored upon the next pulse command.
- DMTIND** Match the inductance of your motor (used only for active damping).
- DMTSTT** Match the motor's static torque (used only for active damping).

* These commands are automatically saved in non-volatile memory.

** These commands do exist, but are non-functional in the higher power ZETA6xxx (ZETA6104-240, ZETA6108 and ZETA6112). Settings for these functions are made via DIP switch SW2 (see page 36) for the higher power ZETA versions.

Set-up Program Example

Assumptions: The ZETA6108 is used with a an RS32B-DKS10 motor (wired in series).
 RS-232C is connected to the **COM 1** serial port.
 An RP240 is connected to the **COM 2** serial port.

```

DEF SETUP      ; Begin definition of the program called setup
DWAVEF1       ; Select -4% 3rd harmonic waveform
              ; Active damping value set to 9 for a total system inertia of 4
              ; SW2-6 set to OFF for lower inertia range
              ; Motor inductance set for 11.6 (SW2-7 = OFF, SW2-8 = ON)
              ; Motor static torque set for 267 (SW2-9 = OFF, SW2-10 = OFF,
              ; SW2-11 = ON, SW2-12 = OFF)
              ; Anti-resonance enabled (SW-2 = OFF)
DELVIS2       ; Enable electronic viscosity with value of 2
PORT1         ; Subsequent serial communication setup affects COM1 port
DRPCHK0       ; COM1 to be used for 6000 language commands
PORT2         ; Subsequent serial communication setup affects COM2 port
DRPCHK1       ; Check COM2 for RP240 -- If no RP240, use for 6000 commands
PORT1         ; Subsequent serial-related commands will affect COM1 port
; *****
; * Insert other appropriate commands in the setup program (e.g., custom *
; * power-up message, scaling factors, input function assignments, output *
; * function assignments, etc.). *
; * See Programmer's Guide, chapter 3, for more information. *
; *****
END           ; End definition of program called setup
STARTP SETUP  ; Assign the program named setup as the program to be executed
              ; on power up or reset

```

Whats Next?

By now, you should have completed the following tasks, as instructed earlier in this chapter:

1. Review the general specifications — see page 4
2. Perform configuration/adjustments, as necessary — see pages 7-8
3. Mount the ZETA6xxx — see page 9
4. Connect all electrical system components — see pages 11-26
Supplemental installation instructions for LVD-compliance are provided in Appendix C.
5. Test the installation — see pages 27-29
6. Match the motor to the ZETA6xxx (OPTIONAL) — see pages 30-32
7. Mount the motor and couple the load — see pages 33-35
8. Optimize system performance (OPTIONAL)
by implementing Active Damping and Electronic Viscosity — see pages 36-39
9. Record your system configuration information — see pages 40-41

Program Your Motion Control Functions

You should now be ready to program your ZETA6xxx for your application. Knowing your system's motion control requirements, refer now to the *6000 Series Programmer's Guide* for descriptions of the ZETA6xxx's software features and instructions on how to implement them in your application. Be sure to keep the *6000 Series Software Reference* at hand as a reference for the 6000 Series command descriptions.

For assistance with your programming effort, we recommend that you use the programming tools provided in Motion Architect for Windows (found in your ship kit). Additional powerful programming and product interface tools are available (see below).

Motion Architect

Motion Architect® is a Microsoft® Windows™ based 6000 product programming tool (included in your ship kit). Motion Architect provides these features (refer to the *Motion Architect User Guide* for detailed information):

- **System configurator and code generator:** Automatically generate controller code for basic system set-up parameters (I/O definitions, feedback device operations, etc.).
- **Program editor:** Create blocks or lines of 6000 controller code, or copy portions of code from previous files. You can save program editor files for later use in BASIC, C, etc., or in the terminal emulator or test panel.
- **Terminal emulator:** Communicating directly with the ZETA6xxx, you can type in and execute controller code, transfer code files to and from the ZETA6xxx.
- **Test panel and program tester:** You can create your own test panel to run your programs and check the activity of I/O, motion, system status, etc. This can be invaluable during start-ups and when fine tuning machine performance.
- **On-line context-sensitive help and technical references:** These on-line resources provide help information about Motion Architect, as well as access to hypertext versions of the *6000 Series Software Reference* and the *6000 Series Programmer's Guide*.

Other Software
Tools Available

To Order these software packages, contact your local Automation Technology Center (ATC) or distributor.

Motion Builder™. A Windows-based iconic programming interface that removes the requirement to learn the 6000 programming language.

DDE6000™. Facilitates data exchange between the ZETA6xxx and Windows™ applications that support the dynamic data exchange (DDE) protocol. NetDDE™ compatible.

Motion Toolbox™. A library of LabVIEW® virtual instruments (VIs) for programming and monitoring the ZETA6xxx. Available for the Windows environment.

