APPENDIX C

120VAC Operation

IN THIS APPENDIX

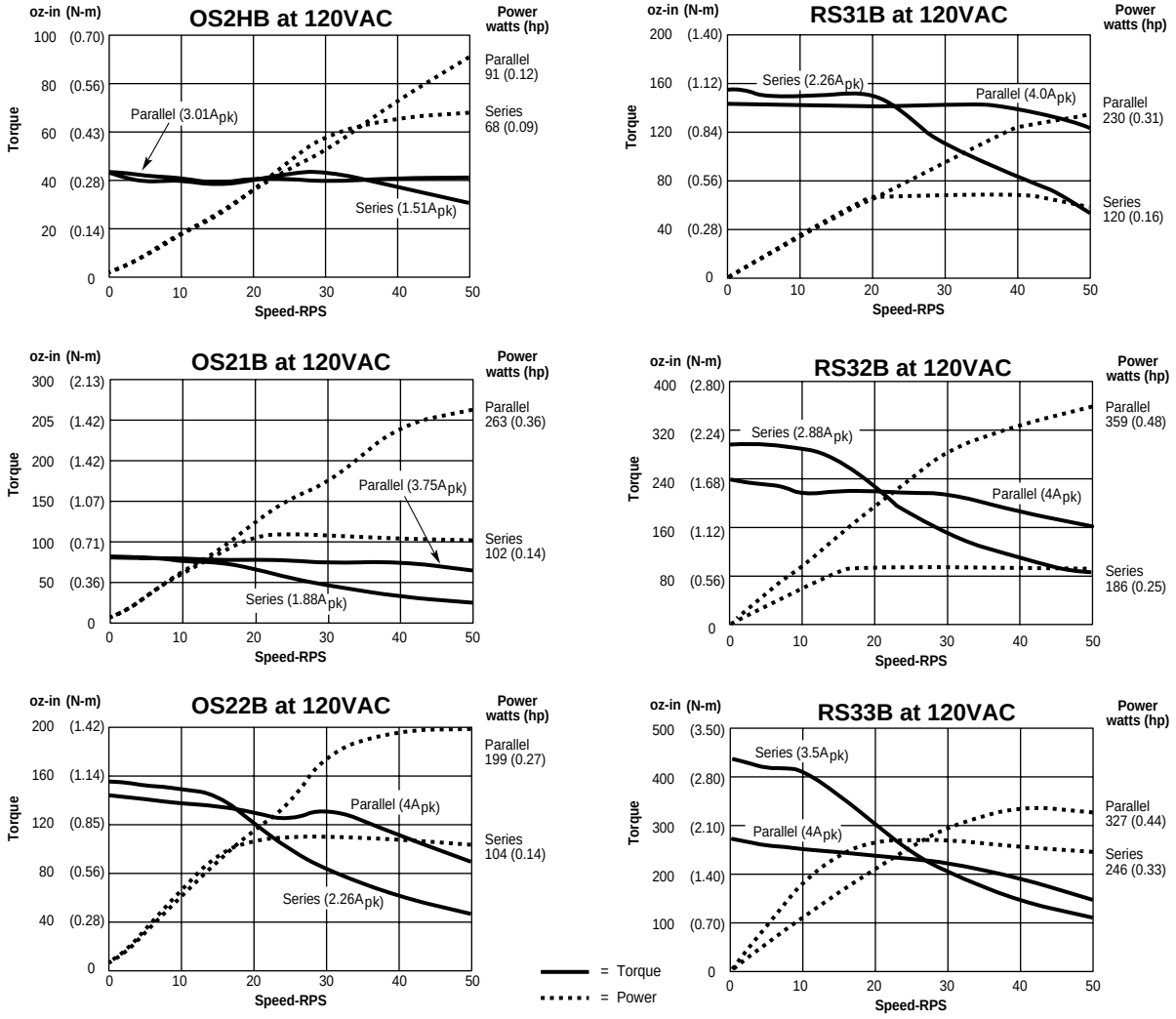
- Motor Information
- Drive Information
- EMC Considerations

IN THIS APPENDIX

In this appendix, we give information for using the ZETA4-240 Drive at 120VAC, with Compumotor's O and R Series motors with "B" (120V) windings.

Topics are presented in the same order in which they occur in the user guide.

SPEED/TORQUE CURVES FOR O AND R SERIES MOTORS AT 120VAC



Note 1: Parallel connected motors are limited to 50% duty cycle when operated above 5 rps. For greater than 50% duty cycle above 5 rps, you must connect the motor in series. Fan cooling the motor will increase duty cycles above 5 rps.

Note 2: Viscous damper is not required to achieve speed torque curves.

Note 3: ±10% torque variance due to motor tolerance .

Speed/Torque Curves for O and R Motors with ZETA2-240 Drive at 120VAC

MOTOR SPECIFICATIONS – O AND R MOTORS

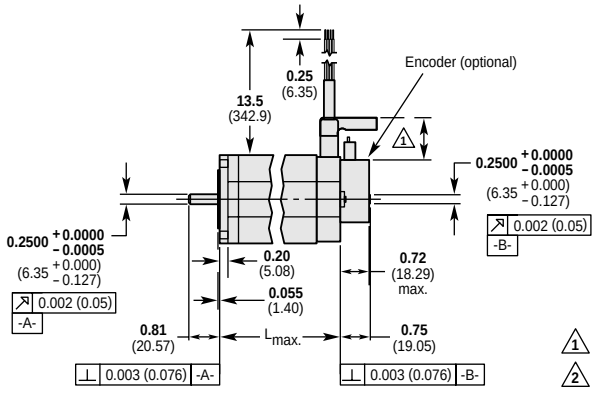
	Size 23 OS Motors			Size 34 RS Motors		
	OS2HB	OS21B	OS22B	R31B	RS32B	RS33B
Static torque						
oz-in	43	82	155	141	292	382
(N-m)	(0.30)	(0.58)	(1.09)	(1.00)	(2.06)	(2.70)
Rotor inertia						
oz-in^2	0.386	0.656	1.390	3.204	6.563	9.652
(kg-cm^2)	(0.070)	(0.119)	(0.253)	(0.583)	(1.195)	(1.757)
Bearings – Thrust load						
lb	13	13	13	180	180	180
(kg)	(5.9)	(5.9)	(5.9)	(81.6)	(81.6)	(81.6)
Bearings – Radial load						
lb	20	20	20	35	35	35
(kg)	(9.1)	(9.1)	(9.1)	(15.9)	(15.9)	(15.9)
Bearings – End play *(reversing load equal to 1 lb)*						
in	0.001	0.001	0.001	0.001	0.001	0.001
(mm)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Bearings – Radial play *(per 0.5 lb load)*						
in	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008
(mm)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Motor Weight *(motor + cable + connector)*						
lb	1.0	1.5	2.5	3.2	5.3	7.6
(kg)	(0.45)	(0.68)	(1.14)	(1.45)	(2.41)	(3.45)
Certifications						
UL recognized	no	no	no	yes	yes	yes
CE (LVD)	yes	yes	yes	yes	yes	yes
CE (EMC & LVD)	no	no	no	*	*	*

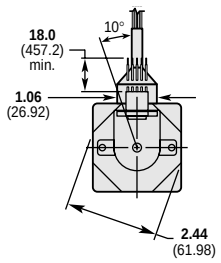
*EMC is achievable with C10 Cable Kit and EMC Kit

MOTOR DIMENSIONS

Model	Lmax
OS2HB	**1.60** (40.70)
OS21B	**2.06** (52.40)
OS22B	**3.10** (78.80)

Dimensions in inches (mm)

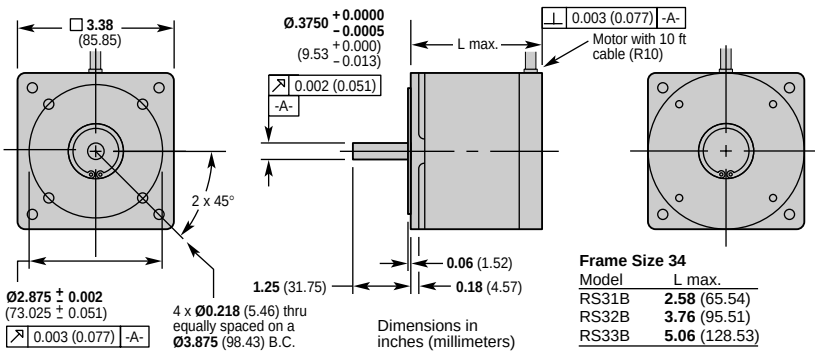




1 Flexible rubber boot may be bent as shown. Nominal height 1.0 (25.4)

2 Motor painted black

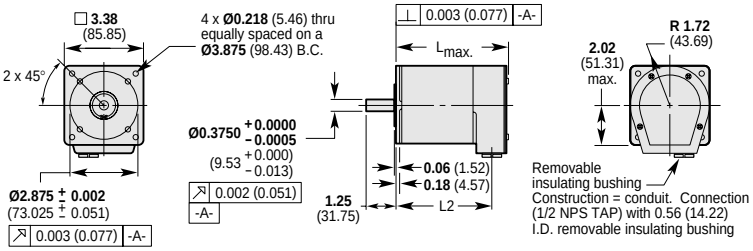
Dimensions – O Series Motors (with 120VAC windings)

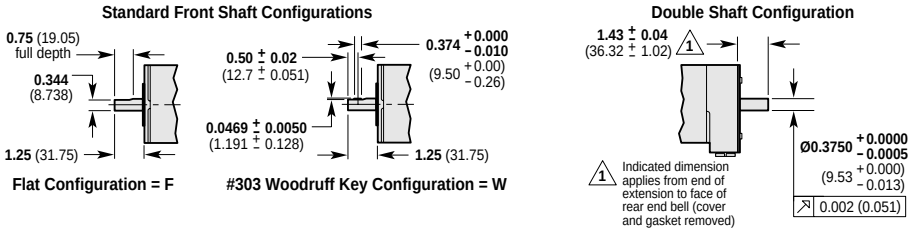


Dimensions – R Series Motors, Regular Construction (with 120VAC windings)

Model	Lmax	L2
RS31B-□□NPS	**3.62** (91.95)	**2.87** (72.90)
RS32B-□□NPS	**4.77** (121.16)	**4.02** (102.11)
RS33B-□□NPS	**6.05** (153.67)	**5.30** (134.62)

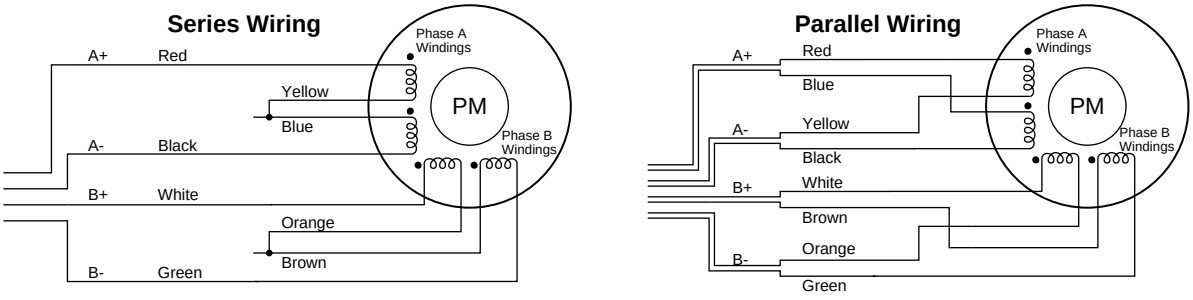
Dimensions in inches (mm)





Dimensions – R Series Motors, End Bell Construction (NPS) (with 120VAC windings)

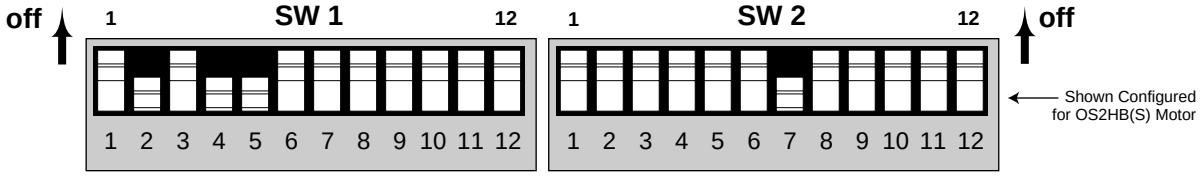
COLOR CODE – O AND R MOTORS



Color Code – O and R Motors

Settings for current, inductance, and static torque are shown below for the ZETA4-240 Drive with Compumotor O and R Series Motors.

DIP SWITCH SETTINGS for 120VAC



Current

(amps pk)	1	2	3	4	5
0.14	**off**	**off**	**off**	**off**	**off**
0.26	off	off	off	off	on
0.39	off	off	off	on	off
0.51	off	off	off	on	on
0.64	off	off	on	off	off
0.76	off	off	on	off	on
0.89	off	off	on	on	off
1.01	off	off	on	on	on
1.14	off	on	off	off	off
1.26	off	on	off	off	on
1.38	off	on	off	on	off
1.51	off	on	off	on	on
1.63	off	on	on	off	off
1.76	off	on	on	off	on
1.88	off	on	on	on	off
2.01	off	on	on	on	on
2.14	on	off	off	off	off
2.26	on	off	off	off	on
2.38	on	off	off	on	off
2.51	on	off	off	on	on
2.63	on	off	on	off	off
2.76	on	off	on	off	on
2.88	on	off	on	on	off
3.01	on	off	on	on	on
3.13	on	on	off	off	off
3.26	on	on	off	off	on
3.38	on	on	off	on	off
3.50	on	on	off	on	on
3.63	on	on	on	off	off
3.75	on	on	on	off	on
3.88	on	on	on	on	off
4.00	on	on	on	on	on

O & R Motors[4]:
(S) = Series
(P) = Parallel

OS2HB(S)
OS21B(S)
OS22B(S)
RS31B(S)
RS32B(S)
OS2HB(P)
OS21B(P)
OS22B(P) / RS3xB(P)[1]

Resolution[2]
(steps per revolution)

	6	7	8	9
50,800 steps	off	off	off	on
50,000 steps	off	off	on	off
36,000 steps	off	off	on	on
25,600 steps	off	on	off	off
25,400 steps	off	on	off	on
Default Setting **25,000 steps**	**off**	**off**	**off**	**off**
21,600 steps	off	on	on	off
20,000 steps	off	on	on	on
18,000 steps	on	off	off	off
12,800 steps	on	off	off	on
10,000 steps	on	off	on	off
5,000 steps	on	off	on	on
2,000 steps	on	on	off	off
1,000 steps	on	on	off	on
400 steps	on	on	on	off
200 steps	on	on	on	on

Waveform[2]

Default Setting	10	11
-4% 3rd harmonic	**off**	**off**
-10% 3rd harmonic	off	on
-6% 3rd harmonic	on	off
Pure sine	on	on

Automatic Test[2]

6	7	8	9	10	11
on	on	on	on	on	on

S&D/CW&CCW[2]

	12
Step & Direction Indexer	**off**
Clockwise & Counterclockwise Indexer	on

Static Torque[3, 4]

9	10	11	12	Torque Range N-m	Torque Range oz-in	Motor
off	**off**	**off**	**off**	0.26 – 0.72	36–100	OS2HB OS21B
off	off	off	on	0.73 – 1.41	101–200	OS22B RS31B
off	off	on	off	1.42 – 2.33	201–330	RS32B
off	off	on	on	2.34 – 3.47	331–492	RS33B
off	on	off	off	1.48 – 2.12	210–300	
off	on	off	on	2.13 – 3.60	301–510	
off	on	on	off	3.61 – 7.06	511–1000	
off	on	on	on	7.07 – 14.83	1001–2100	
on	off	off	off	3.18 – 4.94	450–700	
on	off	off	on	4.95 – 7.77	700–1100	
on	off	on	off	7.78 – 16.24	1101–2300	
on	off	on	on	16.25 – 35.31	2301–5000	
on	on	off	off	5.65 – 8.12	800–1150	
on	on	off	on	8.13 – 14.12	1151–2000	
on	on	on	off	14.13 – 28.95	2001–4100	
on	on	on	on	28.96 – 60.02	4101–8500	

Inductance[3, 4]

7	8	Inductance Range (mH)	Motor:
off	**off**	20.08 & greater	
off	on	10.31 – 20.07	OS21B(S), OS22B(S) RS31B(S), RS32B(S)
on	off	5.03 – 10.30	OS2HB(S), RS33B(S)
on	on	less than 5.02	OS2HB(P), OS21B(P), OS22B(P) RS31B(P), RS32B(P), RS33B(P)

System Inertia

6	
off	Less than 20kg-cm^2
on	Greater than 20kg-cm^2

Current-Loop Gain

5	
off	Standard
on	Reduced

Anti-Resonance Gain

4	
off	Standard (system inertia < 20kg-cm^2)
on	Reduced (system inertia > 20kg-cm^2)

Anti-Resonance Phase

3	
off	Resonant Freq. < 200 Hz
on	Resonant Freq. > 200 Hz

Anti-Resonance Disable

2	
off	Anti-res. Enabled
on	Anti-res. Disabled

Automatic Standby

1	
off	Full Current
on	50% Current Standby

NOTES:
1. RS3xB(P) can be RS31B(P), RS32B(P), RS33B(P).
2. The drive reads these switches only upon power up. It reads all other switches continuously.
3. These switches are read only by active damping circuit; they are ignored if active damping is off.
4. Motor Part Number Suffix: (S) = Series Configuration (P) = Parallel Configuration No Suffix = Series or Parallel Configuration

RESONANCE SPEEDS FOR MATCHING MOTOR TO DRIVE

Consult the table below to find the speed at which to run the motor during the *Matching Procedure* described in *Chapter 2, Installation*. 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.

Motor	Offset Adjust (rps)	Balance Adjust (rps)	Waveform Adjust (rps)
OS2HB	4.52	2.26	1.13
OS21B	4.49	2.24	1.12
OS22B	4.51	2.26	1.13
RS31B	2.79	1.40	0.70
RS32B	2.72	1.36	0.68
RS33B	2.65	1.32	0.66

EXTENDING MOTOR CABLES

Compumotor O and R Series motors ship with various cable options, based upon the motor part number suffix, as follows:

- **-L10, -R10** and **-C10** motors ship with 10 ft (3 m) cables
- **-FLY** motor ships with 1 ft (0.3 m) flying leads
- **-NPS** motor does not include cable/leads; for 10 ft (3 m), use 18 AWG (0.75 mm^2) wire.

LVD COMPLIANCE

Maximum DC resistance between the ZETA4-240's "earth" terminal (protective conductor terminal) and motor body must not exceed 0.1 ohm. Consider this requirement when sizing wire cross section (gauge) for extended cable lengths.

NON-LVD COMPLIANCE

Maximum extended cable 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)	Less than 100 ft. (30 m) Size: AWG	Less than 100 ft. (30 m) mm^2	100 – 200 ft. (30 – 60 m) AWG	100 – 200 ft. (30 – 60 m) 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)	2.26	22	0.34	20	0.50
RS31B (P)	4.00	20	0.50	18	0.75

(S) = Series Configuration (P) = Parallel Configuration Rated current in wire sizes shown may result in a maximum temperature rise of 10°C (18°F) above ambient.

PEAK POWER RATINGS

PEAK POWER RATINGS

The amount of power the ZETA4-240 Drive requires from your AC power source depends upon the motor you use, whether the motor is wired in series or parallel, and upon your specific application. The next table shows *peak* power requirements at 120VAC. Power required for your application may be less.

Motor Type	Current (Amps)	Cabinet Loss (W)	Peak Motor Loss (W)	Peak Shaft Power (W)	Peak Total Power (W)	Volt-Amp Rating (VA)
OS2HB (S)	1.51	21.1	67	34	122	199
OS2HB (P)	3.01	39.1	187	79	305	466
OS21B (S)	1.88	22.6	61	67	150	240
OS21B (P)	3.75	48.8	180	114	343	509
OS22B (S)	2.14	20.4	55	89	165	262
OS22B (P)	4.00	44.5	147	165	357	542
RS31B (S)	2.26	20.0	50	120	200	300
RS31B (P)	4.00	40.0	110	240	400	600
RE32B (S)	2.88	30.4	61	149	241	372
RE32B (P)	4.00	48.8	170	226	445	668
RS33B (S)	3.50	33.3	73	210	316	493
RS33B (P)	4.00	56.6	164	299	519	769

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

EMC CONSIDERATIONS – MOTORS WITH NON-REMOVABLE CABLES

Except for the C10 cabling option used with R Series motors, Compumotor motors do not incorporate braided screen cables. This is true of O and R Series motors with the L10 option. To improve *electromagnetic compatibility* (EMC) performance, follow the suggestions below. In addition, review *Appendix B, LVD and EMC Installation Guide*.

If motor cabling is not confined within earthed conduit, shield the exposed length of cable and properly bond it to earth. In installations where the motor cable is within earthed conduit for the entire length of travel, the standard motor cable can be used.

To extend motor cables, cut off cable in excess of approximately 4 inches (10 cm). Configure the motor for series or parallel operation and attach braided screen cable to the motor. We recommend using a terminal block or other hardware, as in-line splicing on high power cables is not allowed.

Terminate the braided shield at the motor by using a clamp that provides a 360° bond to the motor body. R-clamp the braid to the rear end bell of the motor housing; this not only provides a good high frequency bond, but strain relief as well.

At the drive end of the motor cable, fit a ferrite absorber over the cable before wiring to the motor connector. Locate the absorber as close as possible to the connector using heat-shrink sleeving. Expose a short length of braiding and anchor to the panel with an R-clamp. The motor cable should be kept away from I/O cables carrying control signals.