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# Low Cost, Small Package, 120VAC Microstepping Drive

Compumotor's new E-AC is a low-cost, high-performance, high-reliability microstepping drive in a small package. The design of the E-AC is based on the design of our proven Zeta and OEM750 microstepping drives. It provides up to 3.5 Amps of current to the motor and accepts 120VAC direct-online power only. All step motors are subject to mid-range instability or oscillations. The E-AC incorporates an anti-resonance circuitry that aggressively and effectively suppresses these oscillations, thus taking advantage of the full capabilities of the step motor.

## Features

### Performance

- Designed for use with motor inductance of 0.5 mH - 80 mH
- 3-state current control allows the drive and motor to run cooler and more efficiently than 2-state drives
- Selectable resolution up to 50,800 steps/rev
- Auto standby reduces motor current (and heating) at rest
- Provides 0.02 Amps to 3.5 Amps (peak)
- 95 - 132VAC power supply input
- Four predefined current waveforms to optimize smoothness

### Protection

- Optically isolated step and direction inputs
- Short circuit protection – phase-to-phase and phase-to-ground
- Auto-run feature to verify proper system operation
- Over temperature circuitry protects the drive from thermal damage

### Physical

- Status/fault LED indicators to confirm proper operation
- ASIC and surface-mount technologies minimize product footprint, overall package size and increase product reliability
- Optically isolated fault output for embedded applications
- Simplified, 2-screw mounting
- Overall dimensions: 5.35 x 4.3 x 1.9 in. (133 x 109 x 48 mm)
- Certified as UL-recognized component
- Approvals: CE (LVD), and CE (EMC)


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## E-AC Specifications

| | Parameter | Value |
|---|---|---|
| **Power Input** | | |
| | AC | 95 - 132 VAC @ single phase 50/60 Hz |
| **Performance** | | |
| | Accuracy | ±5 arc min (0.0833°) typical.<br>Unloaded-bidirectional with Compumotor supplied motors. Other motors may exhibit different absolute accuracy.<br>±1 arc min (0.0167°) typical/per each frictional load equal to 1% rated torque.<br>Loaded-in addition to unloaded accuracy. |
| | Repeatability | ±5 arc sec (0.0014°) typical.<br>Unloaded-one revolution returning to start point from same direction. |
| | Hysteresis | Less than 2 arc min (0.0334°) unloaded-bidirectional. |
| | Resolution | 16 selectable choices: 200, 400, 1000, 2000, 5000, 10000, 12800, 18000, 20000, 21600, 25000, 25400, 25600, 36000, 50000, 50800 |
| | Waveform | Selectable. Allows waveform shaping for optimum smoothness or relative accuracy. Pure sine; -4%, -6%, -8%, 3rd harmonic. |
| **Amplifier** | | |
| | Type | 20 kHz fixed frequency, variable duty cycle pulse width modulated (PWM )<br>Current Controlled, bipolar chopper |
| | Number of Phases | 2 |
| | Output Current | 0.02–3.5 Amps peaks of Sine |
| | Standby Current Reduction | 50% of selected motor current |
| | Nominal Chopping Frequency | 20 kHz |
| | Max Stepping Rate | 2 MHz max pulse rate; 50 rps max speed |
| | Step Input | High-going pulse, 200 nsec min width; max pulse rate is 2 MHz; User-supplied driver for the step and direction inputs should be capable of providing a minimum of 6.5 mA to maximum of 15 mA |
| | Direction Input | Logic High = positive (CW) rotation—3.5–5.0V<br>Logic Low = negative (CCW) rotation—0–0.4V<br>User-supplied driver for the step and direction inputs should be capable of providing a minimum of 6.5 mA to a maximum of 15 mA. The direction input must be stable for at least 200 µsec before the drive receives the first pulse |
| | Fault Output | Open-Collector/Emitter, Vce = 70 VDC, Vce sat = 0.3 VDC, Ic = 40 mA (max)<br>Maximum dissipation = 40 mW<br>Conducting = normal operation<br>Non conduction = drive fault |
| **Protective Circuts** | | |
| | Short Circuit* | Phase-to-phase, phase-to-ground<br>If AC supply drops below 85VAC |
| | Overtemperature* | The drive will fault if heat plate exceeds 55°C |
| **Environmental** | | |
| | Drive Temp | Max allowable ambient temperature is 122°F (50°C). Fan cooling may be required if airflow is restricted. |
| | Humidity | 0 to 95%, Non-condensing |
| **Physical** | | |
| | Drive Dimensions | 5.35 x 4.34 x 1.9in (133 x 109 x 48 mm) |
| | Weight | 1.2 lbs |
| **Motor** | | |
| | Type | Two-phase hybrid permanent magnet, 1.8° |
| | Number of Leads | 4, 6, or 8 |
| | Inductance Range | 0.5 minimum; 5 to 50 mH recommended range; 100 mH max |

* Drive shuts down in conditions listed. Power must be cycled or drive reset to resume operations.

See Servo Drive section for the full line of Gemini servo drives and drive/controllers.



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# Lower-Cost DC Power Input Microstepping Drive

Compumotor's new E-DC microstepping drive is designed for a 48VDC input power requirement and provides current up to 4.8 Amps peak of current to the motor.

## Features

### Performance

- Designed for use with motor inductance range of 0.2 mH–80 mH
- Three-state current control allows the drive and motor to run cooler and more efficiently than two-state drives
- Selectable resolution up to 50,800 steps/rev
- Auto standby reduces motor current (and heating) at rest
- Provides 0.2 Amps to 4.8 Amps (peak)
- Single 24-48 VDC power supply input
- Compatible with a variety of motors
- Six predefined current waveforms to optimize smoothness

### Protection

- Optically isolated step and direction inputs
- Short circuit protected—phase-to-phase, and phase-to-ground
- Power dump circuitry to protect drive from regeneration caused by large inertial loads
- Self-test feature to verify proper system operation
- Overtemperature circuitry protects the drive from thermal damage

### Physical

- Status/fault LED indicators to confirm proper operation
- ASIC and surface mount technologies minimize product footprint, overall package size, and increase product reliability
- Removable snap-on molded cover for convenient configuration and protection against contaminants
- Optically isolated fault output for embedded applications
- Heat plate design allows thermal dissipation through a suitable heat dissipating mounting surface
- Simplified, two-screw mounting
- Right-angle screw terminal allows side-to-side mounting or Eurorack compatibility
- Overall dimensions 5.0 x 3.6 x 1.6 in. (127 x 91 x 41 mm)
- Convenient configuration DIP switches
- Certified as UL-recognized component
- CE (LVD & EMC)


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## E-DC Drive Specifications

| | Parameter | Value |
|---|---|---|
| **Power Input** | | |
| | DC | 24–48 VDC @ 2.0 Arms (motor dependent) |
| **Performance** | | |
| | Accuracy | ±5 arc min (0.0833°) typical.<br>Unloaded-bidirectional with Compumotor supplied motors. Other motors may exhibit different absolute accuracy.<br>±1 arc min (0.0167°) typical/per each frictional load equal to 1% rated torque.<br>Loaded-in addition to unloaded accuracy. |
| | Repeatability | ±5 arc sec (0.0014°) typical.<br>Unloaded-one revolution returning to start point from same direction. |
| | Hysteresis | Less than 2 arc min (0.0334°) unloaded-bidirectional. |
| | Resolution | 16 selectable choices: 200, 400, 1000, 2000, 5000, 10000, 12800, 18000, 20000, 21600, 25000, 25400, 25600, 36000, 50000, 50800 |
| | Waveform | Selectable. Allows waveform shaping for optimum smoothness or relative accuracy. Pure sine;<br>-4%, -6%, -8%, -10% 3rd harmonic. |
| **Amplifier** | | |
| | Type | 20 kHz fixed frequency, variable duty cycle pulse width modulated (PWM )<br>Current Controlled, bipolar chopper |
| | Number of Phases | 2 |
| | Output Current | 0.2–4.8 amps current per phase peak (selectable) |
| | Drive Supply Voltage | 24–48 VDC (dependent on external power supply) |
| | Standby Current Reduction | 25%, 50%, or 75% of selected motor current |
| | Nominal Chopping Frequency | 20 kHz |
| | Max Stepping Rate | 2 MHz max pulse rate; 50 rps max speed |
| | Step Input | High-going pulse, 200 nsec min width; max pulse rate is 2 MHz; User-supplied driver for the step and direction inputs should be capable of providing a minimum of 6.5 mA to maximum of 15 mA |
| | Direction Input | Logic High = positive (CW) rotation—3.5–5.0V<br>Logic Low = negative (CCW) rotation—0–0.4V<br>User-supplied driver for the step and direction inputs should be capable of providing a minimum of 6.5 mA to a maximum of 15 mA. The direction input must be stable for at least 200 µsec before the drive receives the first pulse |
| | Fault Output | Open-Collector/Emitter, Vce = 70 VDC, Vce sat = 0.3 VDC, Ic = 10 mA (max)<br>Maximum dissipation = 55 mW<br>Conducting = normal operation<br>Non conduction = drive fault |
| **Protective Circuts** | | |
| | Short Circuit* | Phase-to-phase, phase-to-ground |
| | Undervoltage | If DC supply drops below 24 VDC |
| | Overtemperature* | The drive will fault if heat plate exceeds 55°C |
| **Environmental** | | |
| | Drive Temp | Max allowable ambient temperature is 122°F (50°C). Fan cooling may be required if airflow is restricted. Max allowable heatplate temperature is 55°C. |
| | Humidity | 0 to 95%, Non-condensing |
| **Physical** | | |
| | Drive Dimensions | 5.0 x 3.6 x 1.6 in (127 x 91 x 41 mm) |
| | Weight | 12 oz |
| **Motor** | | |
| | Type | Two-phase hybrid permanent magnet, 1.8° |
| | Number of Leads | 4, 6, or 8 |
| | Inductance Range | 0.2 mH–80 mH |

* Drive shuts down in conditions listed. Power must be cycled or drive reset to resume operations.

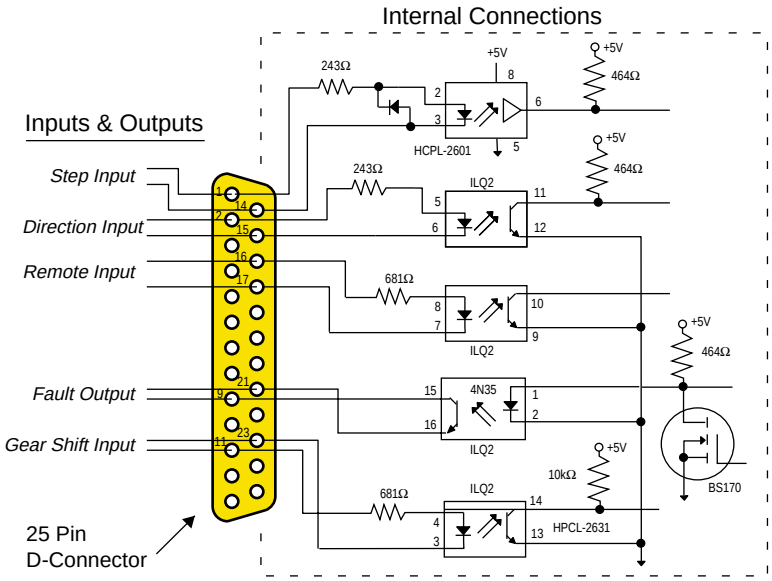
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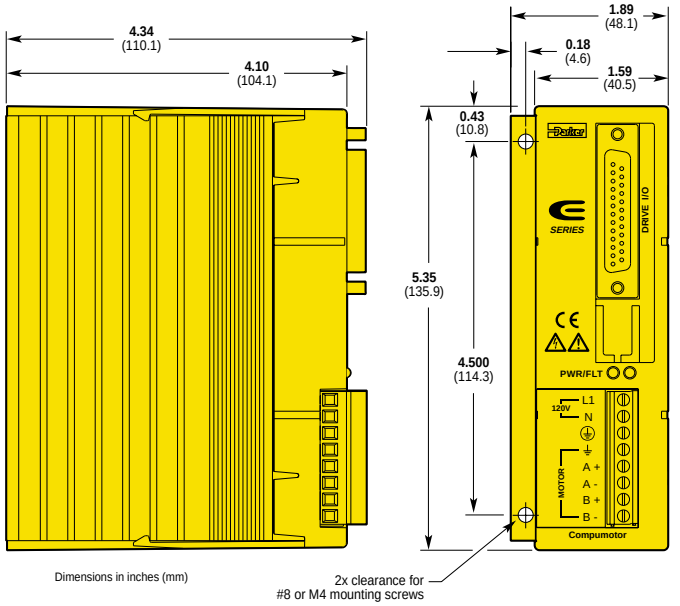
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# E Series Connections

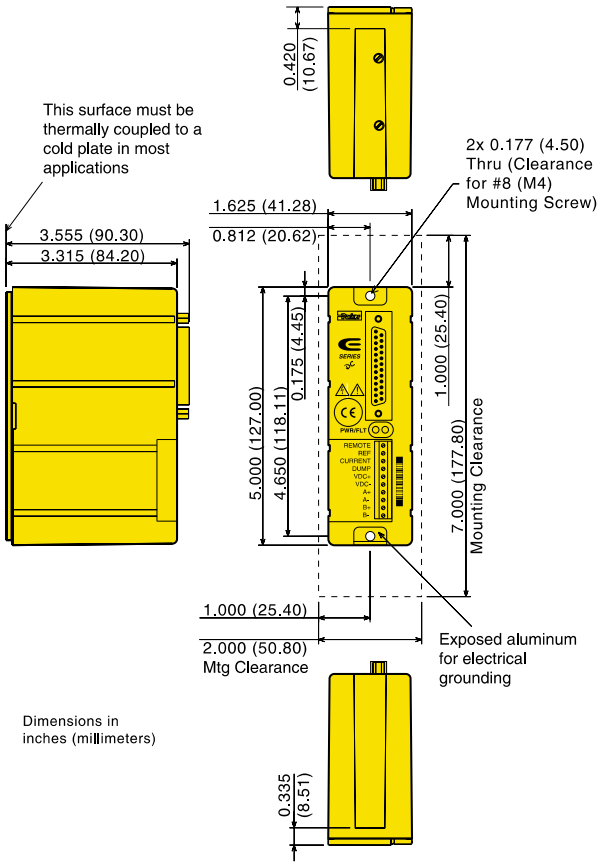



| E Series Screw-Terminal | |
|---|---|
| **Pin No** | **Signal** |
| 1 (Top) | LINE |
| 2 | NEUTRAL |
| 3 | GND |
| 4 | MOTOR GND |
| 5 | A+ |
| 6 | A- |
| 7 | B+ |
| 8 (Bottom) | B- |

## E-AC Dimensions




## E-DC Drive Dimensions






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## OS Series Motor Specifications Size 23 Frame

| Parameters | | E-DC OS2HA | E-DC OS21A | E-DC OS22A | E-AC OS2HB | E-AC OS21B | E-AC OS22B |
|---|---|---|---|---|---|---|---|
| **Static torque** | oz-in<br>(Nm) | 49.1<br>(0.35) | 114<br>(0.81) | 186<br>(1.31) | 61.35<br>(0.43) | 126.5<br>(0.84) | 238<br>(1.68) |
| **Rotor inertia** | oz-in$^2$<br>(kg-cm$^2$) | 0.39<br>(0.07) | 0.66<br>(0.12) | 1.39<br>(0.25) | 0.39<br>(0.07) | 0.66<br>(0.12) | 1.39<br>(0.25) |
| **Drive Current Apk (Arms)** | Series<br>Parallel | 3.0 (2.12)<br>NA | 4.8 (3.39)<br>NA | 4.8 (3.39)<br>NA | 1.76 (1.24)<br>3.25 (2.30) | 1.88 (1.33)<br>3.5 (2.47) | 2.38 (1.68)<br>3.5 (2.47) |
| **Phase Inductance (mH)** | Series<br>Parallel | 1.7<br>NA | 1.8<br>NA | 2.8<br>NA | 8.6<br>2.2 | 12<br>3 | 16.6<br>4.2 |
| **Detent Torque** | oz-in<br>(N-m) | 2.5<br>(0.02) | 4.0<br>(0.03) | 7.0<br>(0.05) | 2.5<br>(0.02) | 4.0<br>(0.03) | 7.0<br>(0.05) |
| **Bearings Information** | | | | | | | |
| **Thrust Load** | lb<br>(kg) | 13<br>(5.9) | 13<br>(5.9) | 13<br>(5.9) | 13<br>(5.9) | 13<br>(5.9) | 13<br>(5.9) |
| **Radial Load** | lb<br>(kg) | 20<br>(9.1) | 20<br>(9.1) | 20<br>(9.1) | 20<br>(9.1) | 20<br>(9.1) | 20<br>(9.1) |
| **End Play (Reversing load equal to 1 lb)** | in<br>(mm) | 0.001<br>(0.025) | 0.001<br>(0.025) | 0.001<br>(0.025) | 0.001<br>(0.025) | 0.001<br>(0.025) | 0.001<br>(0.025) |
| **Radial Play (Per 0.5 lb load)** | in<br>(mm) | 0.0008<br>(0.02) | 0.0008<br>(0.02) | 0.0008<br>(0.02) | 0.0008<br>(0.02) | 0.0008<br>(0.02) | 0.0008<br>(0.02) |
| **Motor Weight** | lb<br>(kg) | 1<br>(0.5) | 1.5<br>(0.7) | 2.5<br>(1.1) | 1<br>(0.5) | 1.5<br>(0.7) | 2.5<br>(1.1) |
| **Certifications** | UL recognized<br>CE (LVD)<br>CE (EMC & LVD) | Pending<br>Yes<br>No | Pending<br>Yes<br>No | Pending<br>Yes<br>No | Pending<br>Yes<br>No | Pending<br>Yes<br>No | Pending<br>Yes<br>No |

See Servo Drive section for the full line of Gemini servo drives and drive/controllers.



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## VS Series Motor Specifications Size 17, 23 and 34 Frame

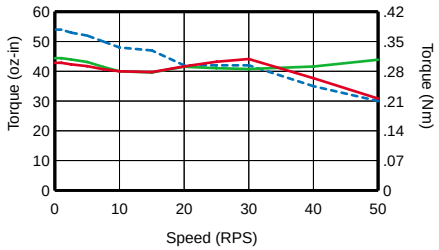
| Parameters | | Size 17 Frame VS12B | Size 17 Frame VS13B | Size 23 Frame VS21B | Size 23 Frame VS22B | Size 23 Frame VS23B | Size 34 Frame VS31B | Size 34 Frame VS32B |
|---|---|---|---|---|---|---|---|---|
| **Static torque - E-AC** | oz-in<br>(Nm) | 55.27<br>(0.39) | 72.8<br>(0.51) | 115.5<br>(0.82) | 194.5<br>(1.37) | 334.5<br>(2.36) | 551.8<br>(3.90) | 1269.67<br>(8.97) |
| **Static torque - E-DC** | oz-in<br>(Nm) | 58<br>(0.41) | 81<br>(0.57) | 115<br>(0.81) | 156<br>(1.10) | 330<br>(2.33) | 442<br>(3.12) | 664<br>(4.69) |
| **Rotor inertia** | $oz\text{-}in^2$<br>$(kg\text{-}cm^2)$ | 0.3<br>(0.054) | 0.37<br>(0.068) | 0.66<br>(0.12) | 1.64<br>(0.3) | 2.62<br>(0.48) | 7.65<br>(1.4) | 14.8<br>(2.7) |
| **Drive Current Apk (Arms) - E-AC** | Series<br>Parallel | 1.0 (0.71)<br>2.0 (1.42) | 1.01(0.71)<br>2.02 (1.43) | 2.26 (1.6)<br>3.5 (2.47) | 2.01 (1.42)<br>3.5 (2.47) | 2.01 (1.42)<br>3.5 (2.47) | 3.0 (2.12)<br>3.5 (2.47) | 3.13 (2.21)<br>3.5 (2.47) |
| **Drive Current Apk (Arms) - E-DC** | Series<br>Parallel | NA<br>3.0 (2.12) | NA<br>3.0 (2.12) | NA<br>4.8 (3.39) | NA<br>4.0 (2.83) | NA<br>4.8 (3.39) | NA<br>4.8 (3.39) | NA<br>4.8 (3.39) |
| **Phase Inductance (mH)** | Series<br>Parallel | 12.8<br>(3.2) | 11.2<br>(2.8) | 5<br>(1.25) | 12<br>(3.0) | 15.4<br>(3.85) | 15.8<br>(3.95) | 25.0<br>(6.25) |
| **Detent Torque** | oz-in<br>(N-m) | 2.5<br>(0.02) | 4.0<br>(0.03) | 7.0<br>(0.05) | 8.8<br>(0.06) | 18.0<br>(0.13) | 27.0<br>(0.19) | 50<br>(0.35) |
| **Bearings Information** | | | | | | | | |
| **Thrust Load** | lb<br>(kg) | 11.0<br>(5) | 11.0<br>(5) | 17.6<br>(8) | 17.6<br>(8) | 17.6<br>(8) | 35.3<br>(16) | 35.3<br>(16) |
| **Radial Load** | lb<br>(kg) | 7.7<br>(3.5) | 7.7<br>(3.5) | 15.0<br>(6.8) | 15.0<br>(6.8) | 15.0<br>(6.8) | 30.9<br>(14) | 30.9<br>(14) |
| **End Play (with 2.2 lbs axial load)** | in<br>(mm) | 0.003<br>(0.075) | 0.003<br>(0.075) | 0.003<br>(0.075) | 0.003<br>(0.075) | 0.003<br>(0.075) | 0.0032<br>(0.080) | 0.0032<br>(0.080) |
| **Radial Play (with 1.1 lb radial load)** | in<br>(mm) | 0.001<br>(0.025) | 0.001<br>(0.025) | 0.001<br>(0.025) | 0.001<br>(0.025) | 0.001<br>(0.025) | 0.0008<br>(0.020) | 0.0008<br>(0.020) |
| **Motor Weight** | lb<br>(kg) | 0.55<br>(0.25) | 0.77<br>(0.35) | 1.03<br>(0.47) | 1.54<br>(0.7) | 2.2<br>(1.0) | 3.86<br>(1.75) | 6.18<br>(2.8) |
| **Certifications** | UL recognized | No | No | No | No | No | No | No |


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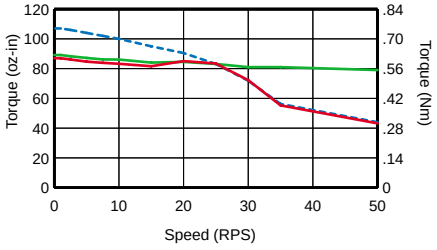
# Motor Speed-Torque Performance Curves

## E-AC with OS and VS Series motors, 17, 23 and 34 frame

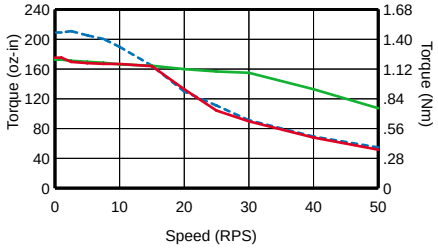
### OS2HB/E-AC




### OS21B/E-AC



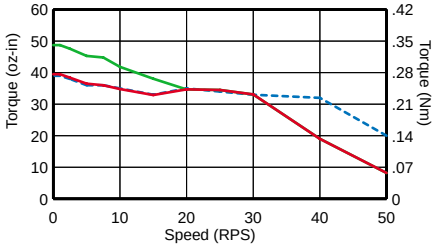

### OS22B/E-AC



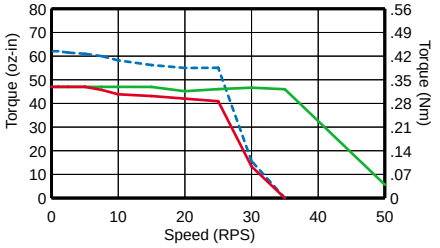




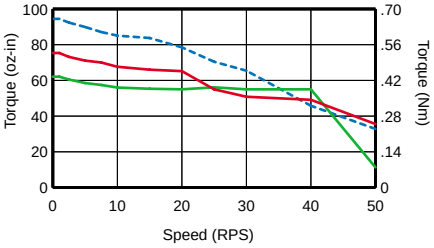
### VS12B/E-AC



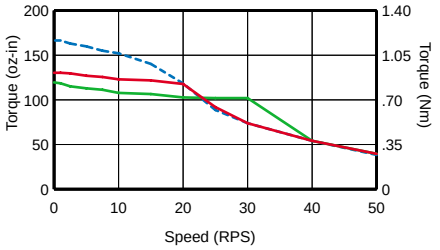

### VS13B/E-AC



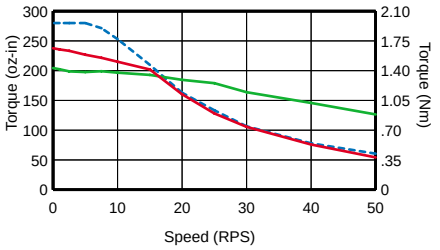

### VS21B/E-AC



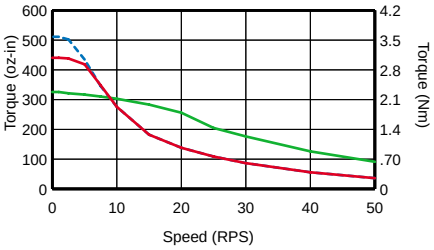

### VS22B/E-AC



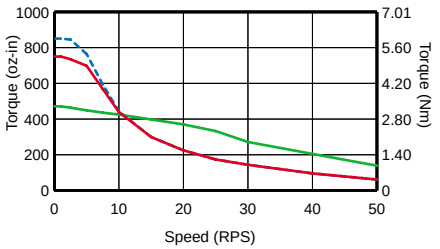

### VS23B/E-AC




### VS31B/E-AC




### VS32B/E-AC







See Servo Drive section for the full line of Gemini servo drives and drive/controllers.

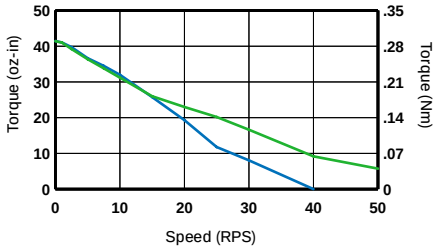


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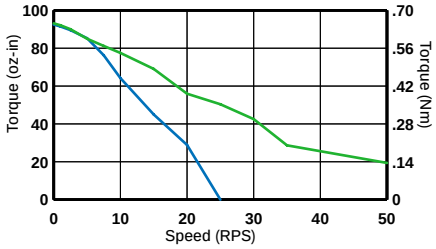
# Motor Speed-Torque Performance Curves

## E-DC Drive with OS and VS Series motors, 17, 23 and 34 frame

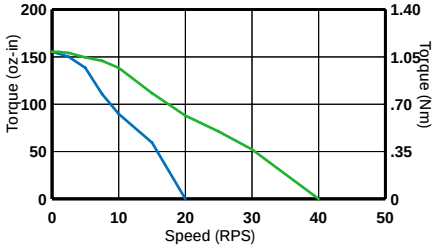
### OS2HA/E-DC




### OS21A/E-DC



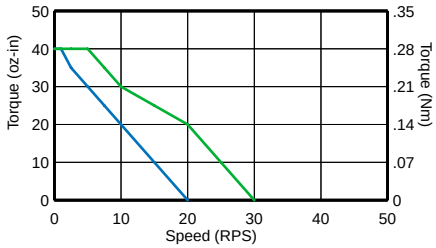

### OS22A/E-DC



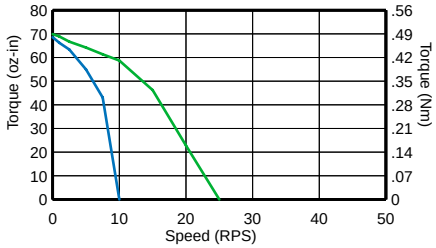




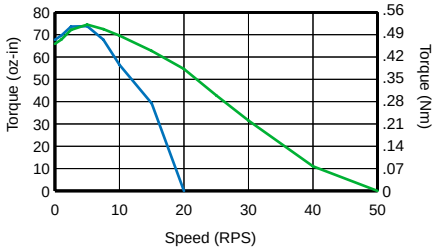
### VS12B/E-DC



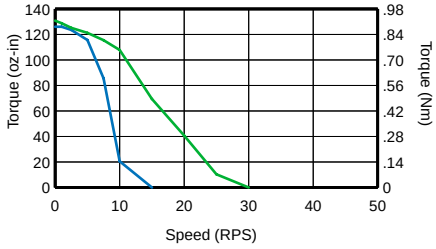

### VS13B/E-DC



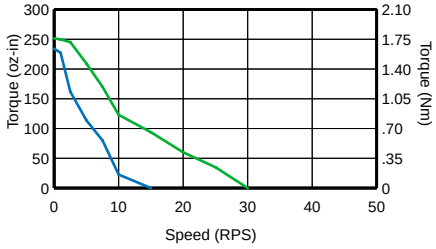

### VS21B/E-DC



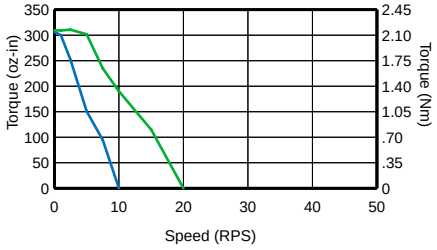

### VS22B/E-DC



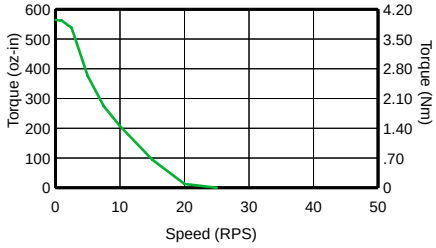

### VS23B/E-DC




### VS31B/E-DC




### VS32B/E-DC





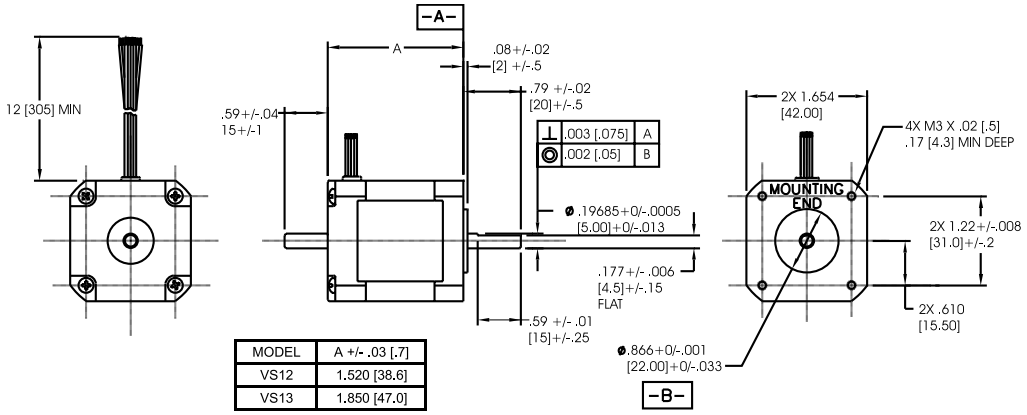




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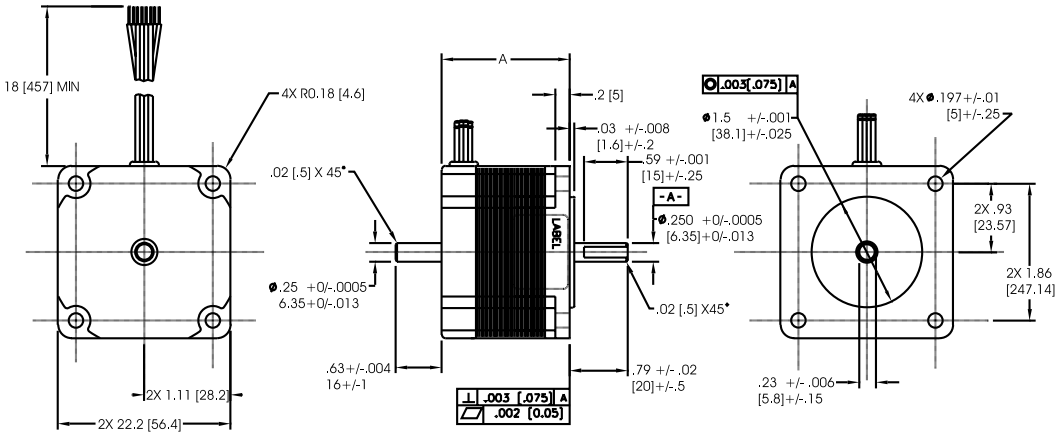
# Dimensional Drawings

## VS Series Motors, Size 17 Frame



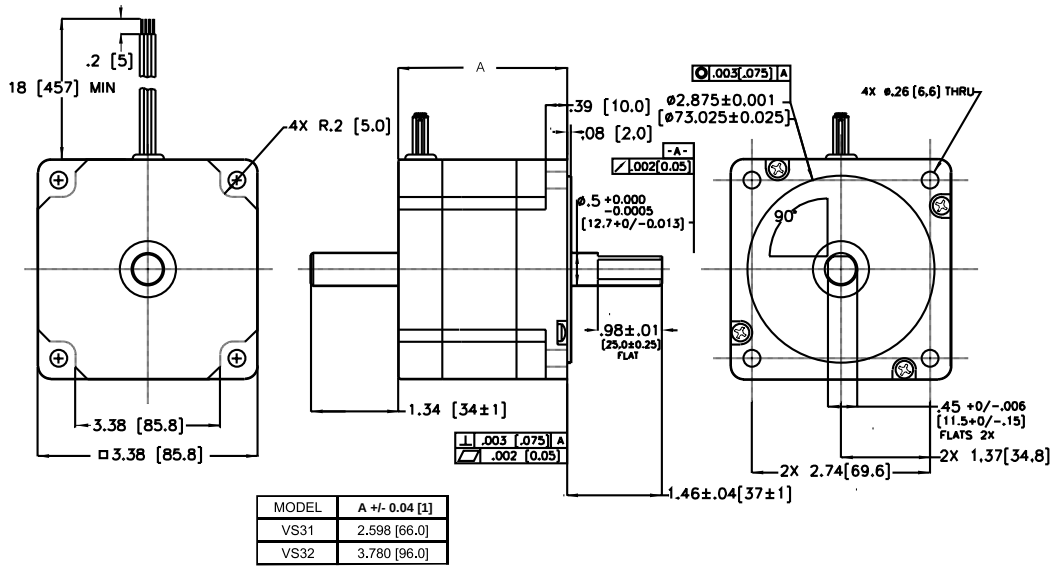

| MODEL | A +/- .03 [.7] |
|---|---|
| VS12 | 1.520 [38.6] |
| VS13 | 1.850 [47.0] |

## Size 23 Frame




| MODEL | A +/- .03 [.7] |
|---|---|
| VS21 | 1.732 [44.0] |
| VS22 | 2.165 [55.0] |
| VS23 | 3.051 [77.5] |

## Size 34 Frame




| MODEL | A +/- 0.04 [1] |
|---|---|
| VS31 | 2.598 [66.0] |
| VS32 | 3.780 [96.0] |

See Servo Drive section for the full line of Gemini servo drives and drive/controllers.



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