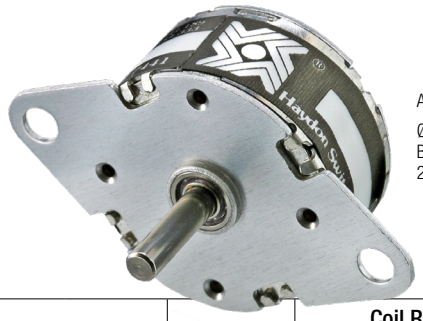
# AC Rotary Motors

Stepping motors can also be run on AC (Alternating Current). However, one phase must be energized through a properly selected capacitor. In this case the motor is limited to only one synchronous speed. For instance, if 60 hertz is being supplied, there are 120 reversals or alterations of the power source. The phase being energized by a capacitor is also producing the same number of alterations at an offset time sequence. The motor is really being energized at the equivalent of 240 steps per second.

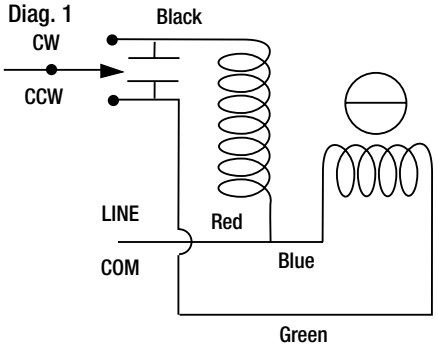


AC Synchronous
Ø 26 mm (1-in)
Ball Bearing
26000 Series

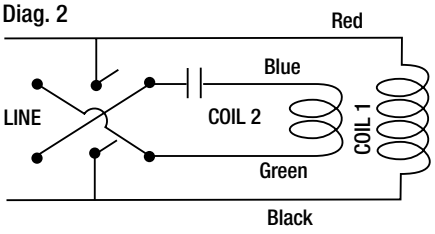
## Specifications

| Motor Part No. | Rotary Speed (RPMs) @ | | Torque | | Watts | Amps | Capacitor @ | | Connection Diagram | Coil Resistance (Ohms) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 60 Hz | 50 Hz | oz-in | N-cm | | | 60 Hz | 50 Hz | | Main Wind | Cap. Wind |
| Z20540-24-700 | 600 | 500 | 0.5 | 0.4 | 2.5 | .15 | 12.5 | 12.5 | 2 | 300 | 75 |
| A26440-24 | 300 | 250 | 0.9 | 0.6 | 3.4 | .20 | 15.0 | 15.0 | 2 | 214 | 54 |
| A265540-24 | 600 | 500 | 0.9 | 0.6 | 3.4 | .20 | 15.0 | 20.0 | 2 | 214 | 54 |
| Z26440-24-700 | 300 | 250 | 1.2 | 0.8 | 3.4 | .19 | 15.0 | 15.0 | 2 | 214 | 54 |
| Z26540-24-700 | 600 | 500 | 1.5 | 1.1 | 3.4 | .19 | 15.0 | 15.0 | 2 | 214 | 54 |
| A36240-24 | 150 | 125 | 2.5 | 1.8 | 4.6 | .23 | 20.0 | 20.0 | 2 | 160 | 40 |
| A36440-24 | 300 | 250 | 2.6 | 1.8 | 4.6 | .23 | 20.0 | 20.0 | 2 | 160 | 40 |
| A36540-24 | 600 | 500 | 1.3 | 0.9 | 4.6 | .23 | 20.0 | 20.0 | 2 | 160 | 40 |
| A46440-24 | 300 | 250 | 8.5 | 6.0 | 10.0 | .38 | 20.0 | 20.0 | 1 | 29 | 29 |
| A46540-24 | 600 | 500 | 6.5 | 4.6 | 10.0 | .38 | 20.0 | 25.0 | 1 | 58 | 58 |
| A36240-120 | 150 | 125 | 2.5 | 1.8 | 4.6 | .05 | 0.8 | 0.8 | 2 | 4000 | 1000 |
| A36440-120 | 300 | 250 | 2.6 | 1.8 | 4.6 | .05 | 0.8 | 0.8 | 2 | 4000 | 1000 |
| A36540-120 | 600 | 500 | 1.3 | 0.9 | 4.6 | .05 | 0.8 | 0.8 | 2 | 4000 | 1000 |
| A46440-120 | 300 | 250 | 8.5 | 6.0 | 10.0 | .08 | 0.8 | 0.8 | 1 | 725 | 725 |
| A46540-120 | 600 | 600 | 6.5 | 4.6 | 10.0 | .08 | 0.8 | 1.0 | 1 | 1450 | 1450 |

Diag. 1




Diag. 2




Capacitors not furnished (with production units).

## Identifying the AC Rotary Motor Number Codes when Ordering

| Z | 26 | 5 | 4 | 0 | — | 24 | — | 700 |
|---|---|---|---|---|---|---|---|---|
| **Prefix** | **Series Number Designation** | **Style** | **Coils** | **Code ID Resolution Travel/Step** | | **Voltage** | | **Suffix** |
| **A** = A Coil<br>**Z** = Economy<br>(For 20000 and 26000 Series, only use –700 suffix to identify AC motor) | **20 = 20000**<br>(Ø 20 mm .79-in)<br>**26 = 26000**<br>(Ø 26 mm 1-in)<br>**36 = 36000**<br>(Ø 36 mm 1.4-in)<br>**46 = 46000**<br>(Ø 46 mm 1.8-in) | **4** = 7.5°<br>**5** = 15° | **4** = Bipolar (4 wire) | **0** = Rotary Motor | | **24** = 24 VDC<br>**120** = 120VDC<br>Custom V for select 36000 and 46000 Series | | –700 = indicates AC for Z Series motors<br>–999 = Ball bearings<br>–001 = Ball bearings for Z Series motors<br>–000 = Sleeve bearings<br>–XXX = Proprietary suffix assigned to a specific customer application. Identifier can apply to either a standard or custom part. |

**NOTE:** Dashes must be included in Part Number (–) as shown above. For assistance call our Engineering Team at 203 756 7441.

# AMETEK Haydon Kerk Pittman **Stepper Motor Linear Actuator Customization**

Haydon Kerk Pittman takes great pride in designing and developing customized solutions for your application needs.

Our Design and Development Engineers begin with our standard catalog products and build ideal solutions for your motion needs. Our factories bring your solutions into production.

# Multi-axis Motion Systems

Haydon Kerk offers pre-engineered and customizable solutions for multi-axis positioning requirements, leveraging our core actuator and linear rail technologies to deliver optimized system performance. Our integrated solutions solve the motion application challenges for technology driven original equipment manufacturers (OEMs) around the globe.

# Z-Theta

Designed for easy integration in OEM assemblies, the Haydon Kerk Z-Theta™ offers linear + rotary point to point motion in an compact footprint.  Unlike in-house component-up designs requiring engineering, multiple vendors and complex assembly integration, Z-Theta is a modular “bolt-in” package.

# ZT04 Multi-Axis System

## Performance in an Ultra-Compact 2-Axis Design

Designed for easy integration in OEM assemblies, the Haydon Kerk Z-Theta™ offers linear + rotary point to point motion in a compact footprint. Unlike in-house component-up designs requiring engineering, multiple vendors and complex assembly integration, Z-Theta is a modular "bolt-in" package.

At the core of Z-Theta is the patented ScrewRail™, which combines guidance and linear transmission in a slender co-axial profile. Haydon Kerk's unique dual-motion integration with a pair of stepper motors adds rotary (theta) motion in manner that reduces motion system size by 50-80% as compared to alternative approaches, and less expensively than the equivalent components purchased separately.

The highly configurable Z-Theta provides flexibility, value, durability and performance suited for a host of lab automation, semiconductor and light factory automation applications. Performance is customized through a variety of leadscrew resolutions, available free-wheeling and anti-backlash nut selections, stepper motor configuration options, and optical encoder line counts.



Z-Theta
Mutli-Axis System

### Benefits

- Compact co-axial design enables small footprint
- Easy integration into system design
- Pre-engineered modular design reduces supply chain and time to market
- Configuration options optimize performance for specific applications
- Compatible with a wide range of drive and controllers

## Identifying the Z-Theta Part Number Codes when Ordering

| ZT | 04 | A | K | — | B | A | J | A | A | — | E1 | — | FY06 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Prefix** | **Nominal Rail Size** | **Nut Style** | **Coating** | | **Motors Frame Size** | **Rotary Motor** | **Rotary Motor Encoder** | **Linear Motor** | **Linear Motor Encoder** | | **Nominal Leadscrew Thread** | | **Stroke / Unique Identifier** |
| **ZT** = Z-Theta | **04** = 1/2 in (13mm) | **A** = Free-wheeling<br>**B** = Anti-backlash | **S** = Uncoated<br>**K** = Kerkote® | | **B** = Steppers, Size 23 Rotary, Size 17 Linear | **A** = 1.8°, 3.25VDC, Bipolar coils (4 wire)<br>**B** = 1.8°, 5VDC, Bipolar coils (4 wire) | **J** = 12000 CPR<br>**X** = No Encoder | **A** = 1.8°, 2.33VDC, Bipolar coils (4 wire)<br>**B** = 1.8°, 5VDC, Bipolar coils (4 wire) | **A** = 500 CPR<br>**C** = 1000 CPR<br>**E** = 2000 CPR<br>**X** = No Encoder | | **E1** = .050-in (1.27mm<br>**E2** = .100-in (2.54mm)<br>**E4**= .250-in (6.35mm)<br>**E6**= .500-in (12.7mm)<br>**E7**= 1.00-in (25.4mm) | | **Xxx** = Unique identifier |

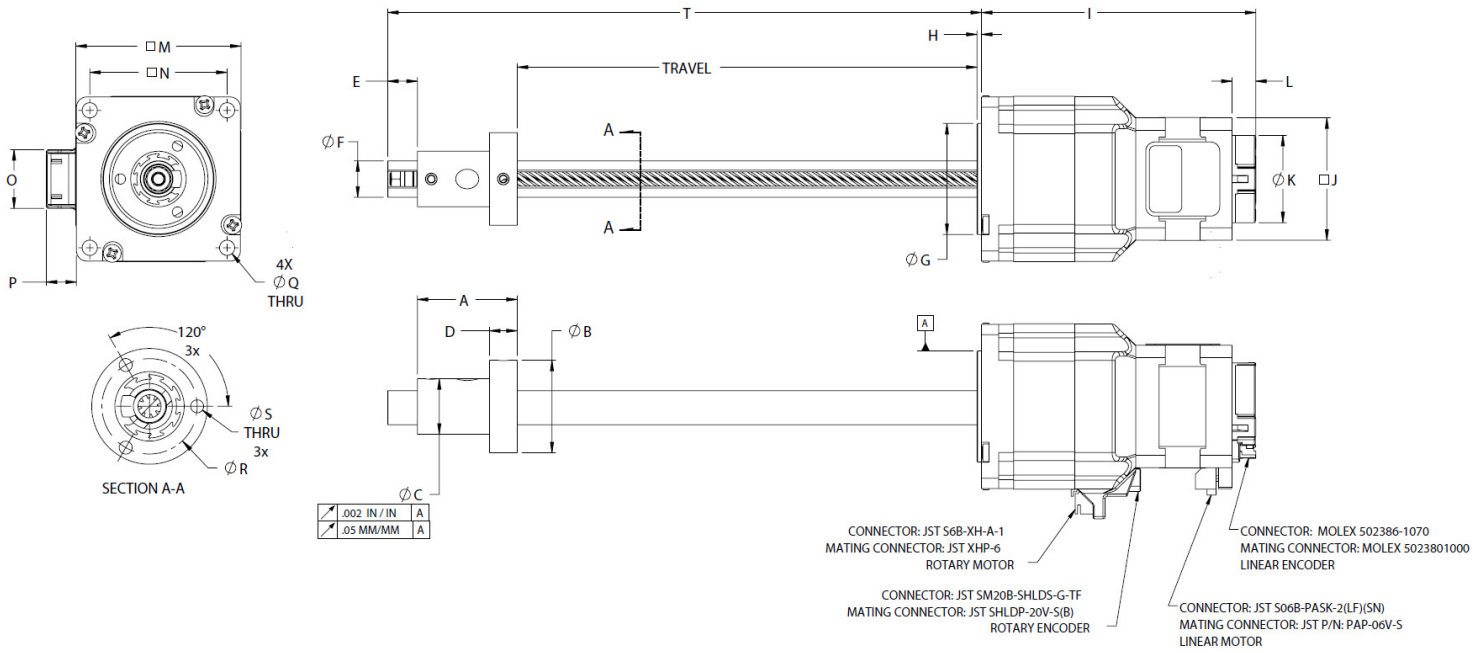
**NOTE:** Dashes must be included in Part Number (–) as shown above. For assistance call our Engineering Team at 203 756 7441.

## Mechanical Specifications

| ZT04: Size 23 Rotary Motor, Size 17 Linear Motor | | |
|---|---|---|
| Stroke Length Limit | in [mm] | 12 [305] |
| Speed Limit | in/sec [mm/s] | 6 [152] |
| Axial Force Limit | lb-f [N] | 15 [67] |
| Load Limit (mass) | lb [kg] | 5 [2.3] |
| Moment Load | in-lb [NM] | 15 [1.7] |
| Torque, Theta Axis Motor | in-lb [NM] | 3 [0.34] |
| Nut Length | in [mm] | 1.4 [36] |
| Unit Height | in [mm] | Travel + 5.5 [140] |
| Width, Mounting Flange | in [mm] | 2.23 [57] |
| Rail Material | | Steel |
| Rail Runout | in/in [mm/25mm] | 0.002 [0.05] |
| Rotary Repeatability (Open Loop) | in [mm] | +/-0.005 [0.13] |
| Rotary Resolution (@6" Radius) | in [mm] | +/-0.0031 [0.08] |
| Duty Cycle | | 100% |

| ZT04 Linear Specifications | | | | | | |
|---|---|---|---|---|---|---|
| Lead Code | | E1 | E2 | E4 | E6 | E7 |
| Lead | in | 0.050 | 0.100 | 0.250 | 0.500 | 1.00 |
| | [mm] | [1.27] | [2.54] | [6.35] | [12.7] | [25.4] |
| Nominal Screw Diameter | in | 0.25 | | | | |
| | [mm] | [6] | | | | |
| Max Drag Torque | oz-in | 2.0 | TBD | 3.0 | 4.0 | 5.0 |
| | [NM] | [0.014] | | [0.021] | [0.028] | [0.035] |
| Torque to Move Load | oz-in/lb | 0.5 | TBD | 1.5 | 2.5 | 4.5 |
| | [NM/Kg] | [0.004] | | [0.011] | [0.018] | [0.32] |
| Resolution (Open Loop) | in | 0.00025 | 0.0005 | 0.00125 | 0.0025 | 0.005 |
| | [mm] | [0.00625] | [0.0127] | [0.03175] | [0.0635] | [0.127] |

## Dimensional Drawings



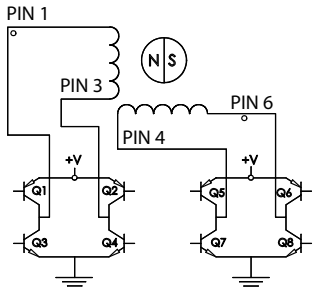

| Units | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| in | 1.35 ± .01 | 1.250 ± .005 | .750 ± .005 | .375 ± .005 | .40 ± .01 | .489 - .492 | 1.498 - 1.500 | .06 ± .01 | 3.7 ± .1 | 1.65 ± .01 |
| mm | 34.29 ± 0.25 | 31.75 ± 0.13 | 19.05 ± 0.13 | 9.53 ± 0.13 | 10.16 ± 0.25 | 12.42 - 12.50 | 38.05 - 38.1 | 1.52 ± 0.25 | 93.98 ± 2.54 | 41.91 ± 0.25 |

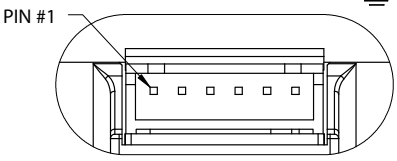
| Units | K | L | M | N | O | P | Q** | R | S** | T |
|---|---|---|---|---|---|---|---|---|---|---|
| in | 1.18 ± .02 | .32 ± .02 | 2.23 ± .02 | 1.856 ± .005 | .79 - .81 | .41 - .43 | .205 ± .005 | 1.030 ± .005 | .140 ± .005 | = Travel + E +A+H (± .040) |
| mm | 29.97 ± 0.51 | 8.13 ± 0.51 | 56.64 ± 0.51 | 47.14 ± 0.13 | 20.07 - 20.57 | 10.41 - 10.92 | 5.21 ± 0.13 | 26.16 ± 0.13 | 3.56 ± 0.13 | = Travel + E +A+H (± 1) |

** Tapped holes also available

## Connector Pinouts: Rotary

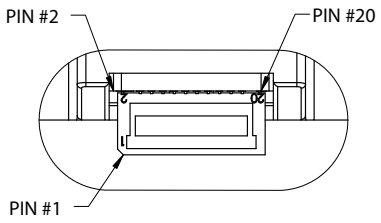
| Pin # | Rotary Motor Connector Pinout |
|---|---|
| 1 | Phase 1 Start |
| 2 | |
| 3 | Phase 1 Finish |
| 4 | Phase 2 Finish |
| 5 | |
| 6 | Phase 2 Start |




ROTARY MOTOR CONNECTOR
DETAIL VIEW

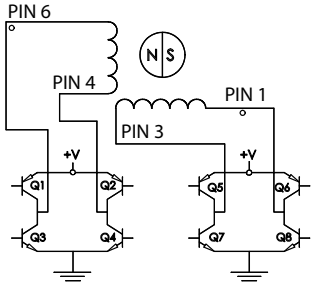
| Pin # | Rotary Encoder Connector Pinout |
|---|---|
| 1 - 8 | Not used |
| 9 | DCOM** |
| 10 | Not used |
| 11 | VDD** |
| 12 | Chan. A+ |
| 13 | Not used |
| 14 | Chan. B- |
| 15 | DGND |
| 16 | Chan. B+ |
| 17 | +5V |
| 18 | Index- |
| 19 | Chan. A- |
| 20 | Index+ |

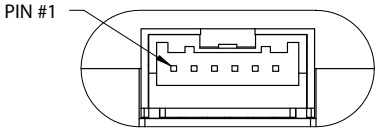



**Connects to EMI Filter Circuit

## Connector Pinouts: Linear

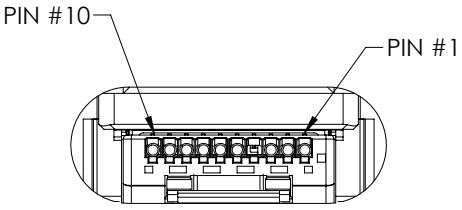
| Pin # | Linear Motor Connector Pinout |
|---|---|
| 1 | Phase 2 Start |
| 2 | |
| 3 | Phase 2 Finish |
| 4 | Phase 1 Finish |
| 5 | |
| 6 | Phase 1 Start |




LINEAR MOTOR CONNECTOR
DETAIL VIEW

| Pin # | Linear Encoder Connector Pinout |
|---|---|
| 1 | GND |
| 2 | Vcc +5VDC |
| 3 | Index- |
| 4 | Not used |
| 5 | Chan. A- |
| 6 | Chan. A+ |
| 7 | Chan. B+ |
| 8 | Chan. B- |
| 9 | Index+ |
| 10 | Motor Ground |




## Motor Specifications: Rotary

| Size 23: 57 mm (2.3 inch) Hybrid Rotary Stepper Motor (1.8° Step Angle) | | | |
|---|---|---|---|
| **Motor Ordering Code** | **A** | **B** | **C** |
| **Stack Length** | Single | | |
| **Wiring** | Bipolar | | |
| **Winding Voltage** | 3.25 VDC | 5 VDC | 12 VDC |
| **Current/phase** | 2.0 Arms | 1.3 Arms | 540 mArms |
| **Resistance/phase** | 1.63 Ω | 3.85 Ω | 22.2 Ω |
| **Inductance/phase** | 3.5 mH | 10.5 mH | 58 mH |
| **Holding Torque** | 8.5 kg-cm | | |
| **Power Consumption** | 13 W Total | | |
| **Insulation Class** | Class B | | |
| **Insulation Resistance** | 20 MΩ | | |

†Part numbering information on page 192

## Motor Specifications: Linear

| Size 17: 43 mm (1.7 inch) Hybrid Rotary Stepper Motor (1.8° Step Angle) | | | |
|---|---|---|---|
| **Motor Ordering Code** | **A** | **B** | **C** |
| **Stack Length** | Single | | |
| **Wiring** | Bipolar | | |
| **Winding Voltage** | 2.33 VDC | 5 VDC | 12 VDC |
| **Current/phase** | 1.5 A | 700 mA | 290 mA |
| **Resistance/phase** | 1.56 Ω | 7.2 Ω | 41.5 Ω |
| **Inductance/phase** | 1.9 mH | 8.7 mH | 54.0 mH |
| **Power Consumption** | 7 W | | |
| **Rotor Inertia** | 37 gcm2 | | |
| **Insulation Class** | Class B (Class F available) | | |
| **Insulation Resistance** | 20 MΩ | | |

†Part numbering information on page 192

## Performance Curves

### SPEED vs. LINEAR FORCE (LINEAR MOTION)

– Chopper

– Bipolar

– 100% Duty Cycle

*Care should be taken when utilizing these screw pitches to ensure that the physical load limits of the motor are not exceeded. Please consult the factory for advice in selecting the proper pitch for your application.

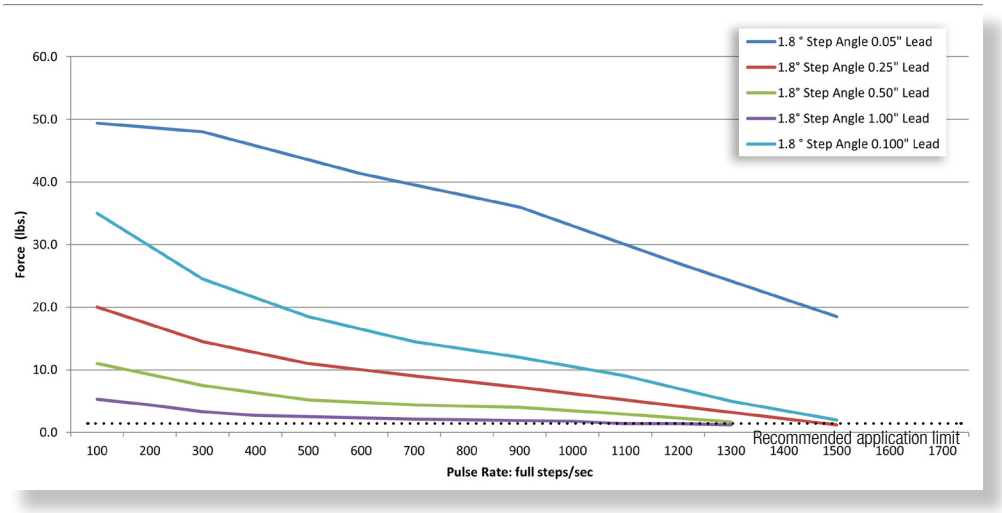
NOTE: 5 volt motor and 40 Vdc power supply (8:1 voltage ratio), X axis is Speed (Full-steps/sec), Y axis is Force (lbs)

The maximum step rate shown for each type of motor is the highest no-load start speed.

Ramping can increase the performance of a motor either by increasing the top speed or getting a heavier load accelerated up to speed faster. Also, deceleration can be used to stop the motor without overshoot.

With L/R drives peak force and speeds are reduced, using a unipolar drive will yield a further 30% force reduction.

Loading is on axis with nut.




### SPEED vs. PULL-OUT TORQUE (ROTARY MOTION)

– Chopper

– Bipolar

– 100% Duty Cycle

NOTE: 5 volt motor and 40 Vdc power supply (8:1 voltage ratio), X axis is Speed (Full-steps/sec), Y axis is Torque (oz-in).

Ramping can increase the performance f a motor by either increasing the top speed or getting a heavier load up to speed faster. Also, deceleration can be used to stop the motor without overshoot.