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THORLABS

DRV001 - OCT 24, 2018

Item # DRV001 was discontinued on OCT 24, 2018. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

0.39" (10 MM) TRAVEL OR LESS MOTORIZED ACTUATORS

- ▶ High-Resolution Piezo Inertia, Stepper, and DC Servo Actuators
- ▶ Compatible with a Wide Range of Stages
- ▶ Velocities up to 4 mm/s



DRV001
 8 mm Travel,
 Stepper Motor Actuator



Z806
 6 mm Travel, DC Actuator



PIAK10
 10 mm Travel
 Piezo Inertia Actuator



ZFS06
 6 mm Travel, Compact
 Stepper Motor Actuator

Features

- ▶ Compact Design, 31.5 mm x 17.0 mm (W x H)
- ▶ Piezo Inertia Actuator Offers 20 nm Typical Step Size
- ▶ Manual Adjustment via Rear-Located Thumbscrew
- ▶ 125 V Maximum Operating Voltage
- ▶ Compatible with Mirror Mounts and Translation Stages using 1/4"-80 Thread or 3/8" Mounting Block
- ▶ Also Available in 13 mm, 25 mm, and 50 mm Travel Versions
- ▶ Ideal for Set-and-Hold Applications that Require Relative Positioning with High Resolution
- ▶ Control Cable can be Adjusted up to 110° for Space-Constrained Applications

Required Controller KIM101

- Four Output Channels, Single- or Dual-Channel Operation
- Standalone Control via Top Panel or PC-Control via USB Plug and Play
- Voltage Output from 85 V to 125 V



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The Control Cable Can be Adjusted up to 110° for Space-Constrained Applications

Thorlabs' PIAK10 Piezoelectric Inertia Actuator provides high-resolution linear motion control with a long piezo-controlled translation range in a compact package. It can support loads up to 2.5 kg (5.51 lbs) and preloads up to 30 N with typical movements of 20 nm and no backlash. The step size can be adjusted up to 30% to a maximum of approximately 30 nm using the KIM101 Controller and Kinesis[®] software. However, due to the open-loop design, hysteresis, and application conditions, the achieved step size of the system can vary over 20%. An external feedback system will need to be used to overcome this variance.

This actuator has a 1/4"-80 threaded barrel that can be mounted to any manual mirror mount or positioning stage equipped with 1/4"-80 threads. It also has a 3/8" (9.5 mm) mounting barrel for compatibility with our wide range of translation and rotation stages. The actuator is self-locking when at rest and when there is no power supplied to the piezo, making the actuator ideal for set-and-hold applications that require nanometer resolution and long-term alignment stability. Manual adjustments can be made at any time, as long as the piezo is not actively translating the screw, by using the rear-located thumbscrew or with a 5/64" (2 mm) hex key.

Powered by a 10 mm (0.39") long discrete piezo stack, the actuator can operate at speeds of up to 3.5 mm/min. The design of the piezo motor will rotate the tip of the lead screw during translation. As shown in the image to the right, the control cable for each actuator can be rotated up to 110° for space-constrained applications.

For information on the design of our piezo inertia "slip-stick" motor actuators, please see the complete presentation here.

Required Controller

The KIM101 Controller is required to operate our PIAK10 Piezo Inertia Actuator; the actuator cannot be operated using a standard piezo controller. The KIM101 has an internal sawtooth voltage signal generator capable of sending sub-millisecond pulses (steps) with controllable amplitudes from 85 V to 125 V. The driver features four channels and is capable of single- or dual-channel operation, making the controller ideal for applications involving multiple motorized actuators, such as beam steering.

For more information, please see the full web presentation.

Item #	PIAK10
Travel	10 mm
Typical Step Size ^a	20 nm
Maximum Step Size ^b	<30 nm
Step Size Adjustability ^c	≤30%
Maximum Step Frequency ^d	2000 Hz
Backlash	None
Maximum Axial Preload ^e	30 N
Typical Angular Resolution ^f	Ø1" Mirror Mounts: 0.5 µrad Ø2" Mirror Mounts: 0.3 µrad
Recommended Maximum Axial Load Capacity ^g	2.5 kg (5.51 lbs)
Velocity	2 mm/min (Typical) <3.5 mm/min (Maximum)
Drive Screw	1/4"-80 Thread, Hard PVD Coated
Motor Type	Piezoelectric Inertia
Mounting Options	1/4"-80 Threaded Barrel
	Ø3/8" (Ø9.5 mm) Barrel
Operating Temperature	10 to 40 °C (50 to 104 °F)
Dimensions	2.87" x 1.24" x 0.67" (72.9 mm x 31.5 mm x 17.0 mm)
Cable Length	1.0 m (3.28')
Connector	SMC, Female
Compatible Controller	KIM101

- This value can vary over 20% due to component variance, change of direction, and application condition.

- This can be adjusted up to 30% in both directions using the KIM101 Controller and Kinesis Software.
- This can be Adjusted using the KIM101 Controller and Kinesis Software.
- Using the KIM101 Inertia Piezo Controller
- The axial force applied to the drive tip to achieve the specified step size. A minimum of 5 N is recommended to enhance stepping behavior.
- The typical angular resolution when a PIAK10 Actuator is fitted to a Ø1" or Ø2" mirror mount with a maximum active preload of 30 N.
- A higher maximum load is possible but it may adversely affect the typical step size.



Click to Enlarge
Two PIAK10 Inertia Actuators Being Used in Place of
the
1/4"-80 Adjustment Screws in our KM100 Mirror
Mount
(Mount Sold Separately)

Part Number	Description	Price	Availability
PIAK10	Piezo Inertia Actuator, 10 mm Travel, Mounting: 1/4"-80 Thread and 3/8" Barrel	\$519.18	Today

Features

- ▶ Non-Rotating Drive Tip
- ▶ Bi-Polar Stepper Motor Actuator: 111.0 mm (4.37") Long
- ▶ 1/4"-80 Threaded Barrel Mounting
- ▶ Compatible with Mirror Mounts and Translation Stages with 1/4"-80 Threads
- ▶ Also Available in 13 mm and 25 mm Travel Versions

Our ZST series actuators provide smooth, precise linear motion control in a package measuring 111.0 mm (4.37") in length. Powered by a small-diameter, two-phase, bi-polar stepper motor, this actuator operates at speeds of up to 3.0 mm/s. The non-rotating drive tip reduces wear and friction and improves smoothness of motion by removing rotational contact at the tip. This actuator has a 1/4"-80 threaded barrel that can be mounted to any manual mirror mount or positioning stage equipped with 1/4"-80 threads.

Our ZST200 line of actuators all incorporate a stepper motor that provides sufficient torque for loads up to 40 N (8.99 lb). The actuator allows for very small step sizes over the entire travel range, delivering greater flexibility with low (<15 μm) backlash and fine resolution. The design incorporates a 41:1 gear reduction head which, when combined with the 49,152 microsteps per revolution offered by the KST101 stepper motor driver, gives a theoretical travel per microstep of 0.5 nm (see the *Calculations* tab for details).

Hall effect limit switches prevent the unit from being overdriven and provide homing capability with an accuracy of <5.0 μm . This actuator comes with 0.6 m (2 ft) of cable terminated in a 15-pin D-Type connector that is compatible with our KST101 stepper motor controller.

The ZST206 has been designed specifically to replace the manual adjusters in stages and mirror mounts that have 1/4"-80 threaded fittings. Simply remove the existing manual adjuster from the mount and screw in the ZST206 actuator.

Required Controller KST101

- 49,152 Microsteps per Revolution
- 15 V Output at 12 W
- Trapezoidal and 'S-Curve' Velocity Profiles



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Specification	Value
Travel	6 mm (0.24")
Backlash^a	<15 μm
Bidirectional Repeatability	<5.0 μm
Home Location Accuracy	<5.0 μm
Maximum Load Capacity	40 N (8.99 lb)
Velocity	3.0 mm/s (Max)
Acceleration	10 mm/s ² (Max)
Gearbox Ratio	29791:729 (Approx 41:1)
Limit Switches	Hall Effect
Lead Screw Pitch	1.0 mm
Motor Type	2-Phase Stepper
Microsteps per Revolution of the Motor^b	24 Full Steps, 2048 μsteps per Full Step 49,152 μsteps per Revolution
Calculated Minimum Incremental Motion	0.5 nm
Operating Temperature	5 to 40 °C (41 to 104 °F)
Dimensions (L x W)	111.0 mm x 19.0 mm (4.37" x 0.75")
Cable Length	0.6 m (2 ft)
Connector	HDDB15
Required Controller	KST101

- The user can correct for backlash errors by adjusting software settings
- Measured using Thorlabs' previous generation TST101 T-Cube Stepper Motor Controller.



A KM100 mirror mount with the screw adjusters replaced by two ZST206 actuators.

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CALCULATIONS

How to calculate the linear displacement per microstep

Each member of the ZST200 series of motors has 24 full steps per revolution, and when driven by the KST101 drivers, there are 2048 microsteps per full step. Hence, there are 49,152 microsteps per revolution of the motor. The output shaft of the motor goes into a 40.866:1 gear head. This requires the motor to rotate 40.866 times to rotate the 1.0 mm pitch lead screw one revolution. The end result is the lead screw advances by 1.0 mm. To calculate the linear displacement of the actuator per microstep, use the following:

Linear displacement of the lead screw per microstep:

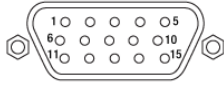
$$\text{Number of Microsteps} \times \text{Gearbox Ratio} = 49,152 \times 40.866 = 2,008,645.63$$

The linear displacement of the lead screw per microstep is

$$1.0 \text{ mm} / 2,008,645.63 = 0.49 \times 10^{-6} \text{ mm} = 0.5 \text{ nm}$$

PIN DIAGRAM

Pin Diagram



High-Density D-Type Male 15 Pin Connector

Connector Pin Out

Pin	Description	Pin	Description
1	Limit Ground	8	Reserved for Future Use
2	CCW Limit Switch	9	Reserved for Future Use
3	CW Limit Switch	10	Vcc (+5 V DC)
4	Motor Phase B-	11	Reserved for Future Use
5	Motor Phase B+	12	Reserved for Future Use
6	Motor Phase A-	13	Reserved for Future Use
7	Motor Phase A+	14	Reserved for Future Use
-	-	15	Ground



Click to Enlarge
High-Density D-Type Male 15 Pin Connector

Part Number	Description	Price	Availability
ZST206	6 mm Travel, Stepper Motorized Actuator, 1/4"-80 Thread	\$949.62	Today

Features

- ▶ Compact Package: 86.5 mm (3.40") Long, Fully Retracted
- ▶ Manual Adjustment via Rear-Located Thumbscrew
- ▶ Non-Rotating Drive Tip
- ▶ Compatible with Mirror Mounts and Translation Stages with 1/4"-80 Threads
- ▶ Also Available in 13 mm and 25 mm Travel Versions

Required Controller KST101

- 49,152 Microsteps per Revolution
- 15 V Output at 12 W
- Trapezoidal and 'S-Curve' Velocity Profiles



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Our ZFS06 Motorized Actuator provides smooth, precise linear motion control in a sleek, compact package measuring just 86.5 mm (3.40") in length when fully retracted.

This compact profile reduces the distance between the end of the actuator and optomechanical components, keeping the center of mass closer to the contact point than the ZST206 actuator featured above. This actuator has a 1/4"-80 threaded barrel that can be mounted to any manual mirror mount or positioning stage equipped with 1/4"-80 threads.

Powered by a small-diameter, two-phase, bi-polar stepper motor, this actuator operates at speeds of up to 3.0 mm/s. The non-rotating drive tip reduces wear and friction and improves smoothness of motion by removing rotational contact at the tip. If power is not supplied to the actuator, manual adjustment is achievable using the rear-located thumbscrew. The actuator motor can be damaged if this thumbscrew is rotated while power is being supplied to the motor.

Our ZFS06 actuator incorporates a stepper motor that provides sufficient torque for loads up to 40 N (8.99 lb). The actuator allows for very small step sizes over the entire travel range, delivering greater flexibility with low (<15 μm) backlash and fine resolution. The design incorporates a 400:9 gear reduction head which, when combined with the 49,152 microsteps per revolution offered by the KST101 stepper motor driver, gives a theoretical travel per microstep of 0.46 nm (see the *Calculations* tab for details).

Hall effect limit switches prevent the unit from being overdriven and provide homing capability with an accuracy of <5.0 μm . The ZFS series actuators come with 0.6 m (2 ft) of cable terminated in a 15-pin D-Type connector (see the *Pin Diagrams* tab) that is compatible with our KST101 stepper motor controller.

The ZFS06 has been designed specifically to replace the manual adjusters in stages and mirror mounts that have 1/4"-80 threaded fittings, particularly in applications where space is tight. Simply remove the existing manual adjuster from the mount and screw in the ZFS06 actuator. Two ZFS06 motorized actuators replace the thumbscrews of the KM100 in the image below.

Specification	Value
Travel	6 mm (0.24")
Backlash ^a	<15 μm
Bidirectional Repeatability	<5.0 μm
Home Location Accuracy	<5.0 μm
Maximum Load Capacity	40 N (8.99 lb)
Velocity	3.0 mm/s (Max)
Acceleration	10 mm/s ² (Max)
Gearbox Ratio	400:9 (Approx 44:1)
Limit Switches	Hall Effect
Lead Screw Pitch	1.0 mm
Motor Type	2-Phase Stepper
Microsteps per Revolution of the Motor ^b	24 Full Steps, 2048 μsteps per Full Step 49,152 μsteps per Revolution
Calculated Minimum Incremental Motion ^c	0.46 nm
Operating Temperature	5 to 40 °C (41 to 104 °F)
Dimensions (L x W x H)	86.5 mm x 35.0 mm x 19.0 mm (3.40" x 1.38" x 0.75")
Cable Length	0.6 m (2 ft)
Connector	HDDB15
Required Controller	KST101

- The user can correct for backlash errors by adjusting software settings.
- Measured using Thorlabs' previous generation TST101 T-Cube Stepper Motor Controller.
- See the *Calculations* tab for more information.



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A KM100 mirror mount with the screw adjusters replaced by two ZFS06 actuators.

CALCULATIONS

How to calculate the linear displacement per microstep

The ZFS series of motors has 24 full steps per revolution, and when driven by the KST101 drivers, there are 2048 microsteps per full step, giving 49,152 microsteps per revolution of the motor. The output shaft of the motor goes into a 400:9 gear head. This requires the motor to rotate 44.445 times to rotate the 1.0 mm pitch lead screw one revolution. The end result is the lead screw advances by 1.0 mm.

Linear displacement of the lead screw per microstep:

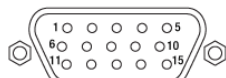
$$\text{Number of Microsteps} \times \text{Gearbox Ratio} = 49,152 \times 44.445 = 2184560.64$$

The linear displacement of the lead screw per microstep is

$$1.0 \text{ mm} / 2184560.64 = 0.46 \times 10^{-6} \text{ mm} = 0.46 \text{ nm}$$

PIN DIAGRAM

Pin Diagram



High-Density D-Type Male 15 Pin Connector

Connector Pin Out

Pin	Description	Pin	Description
1	Limit Ground	8	Reserved for Future Use
2	CCW Limit Switch	9	Reserved for Future Use
3	CW Limit Switch	10	Vcc (+5 V DC)
4	Motor Phase B-	11	Reserved for Future Use
5	Motor Phase B+	12	Reserved for Future Use
6	Motor Phase A-	13	Reserved for Future Use
7	Motor Phase A+	14	Reserved for Future Use
-	-	15	Ground



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High-Density D-Type Male 15 Pin Connector

10/18/2018

Thorlabs.com - 0.39" (10 mm) Travel or Less Motorized Actuators

Part Number	Description	Price	Availability
ZFS06	Customer Inspired! 6 mm Travel, Compact Stepper Motorized Actuator, 1/4"-80 Threaded	\$1,127.10	Today

8 mm Travel Stepper Motor Actuator

OVERVIEW

Features

- ▶ Ideal for 4 mm Travel Stages
- ▶ 8 mm Total Travel
- ▶ High Load Capacity of 48 lbs (21.8 kg)
- ▶ Non-Rotating Tip
- ▶ Manual Adjuster Knob Provided
- ▶ 3 m (9.8') Long Connection Cable Included
- ▶ Compatible with Modular Quick-Connect Adapter

Required Controller BSC201

- 409,600 Microsteps per Revolution
- 48 V Output at 25 W
- Trapezoidal and 'S-Curve' Velocity Profile



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The DRV001 Modular Stepper Motor Actuator is ideal for short travel stages equipped with the Modular Quick-Connect Adapter such as the MAX300 and MAX600 series flexure stages. This actuator is capable of speeds up to 4 mm/s over an 8 mm travel range with a minimum incremental movement of 60 nm and a bidirectional repeatability of 0.5 μm . The powerful stepper motor has a load capacity of 48 lbs (21.8 kg).

Using the MCA series quick-connect adapters, these actuators can also be fitted to stages with standard $\text{\O}3/8''$ or $\text{\O}10$ mm mounting clamps.

A 3 m (9.8') PAA613 cable is included for connecting the stepper motor to the controller. If a shorter cable is required, a 1 m (3.3') PAA612 cable is also available separately.



[Click to Enlarge](#)

Three DRV001 actuators are included with our MAX341 3-Axis Nano-Max Stage.

Specification	Value
Travel	8 mm (0.315")
Bidirectional Repeatability	0.5 μm
Maximum Load Capacity	48 lbs (21.8 kg)
Velocity Range	40.0 $\mu\text{m/s}$ to 4 mm/s
Full Step Angle	1.8°
Step Angle Accuracy	5%
Rated Phase Current	1 A
Phase Resistance	3.6 Ω
Phase Inductance	4.6 mH
Holding Torque	23.1 N•cm
Detent Torque	1.7 N•cm
Rotor Inertia	32 g•cm ²
Insulation Class	B
Feedback	None
Limit Switches	Ceramic-Tipped Mechanical
Lead Screw Pitch	0.5 mm
Microsteps per Revolution of Leadscrew	409,600
Motor Type	2-Phase Stepper
Minimum Incremental Movement	60 nm
Compatible Controllers	BSC201 MST602

CALCULATIONS

How to calculate the linear displacement per microstep

The stepper motor used in the DRV001 actuator has 200 full steps per revolution of the motor. Each full step is broken down into 2048 microsteps. There are 409,600 microsteps per revolution of the motor when using the BSC201 controller. The end result is the leadscrew advances by 0.5 mm. To calculate the linear displacement of the actuator microstep, use the following:

$$409,600 \text{ microsteps per revolution of the lead screw}$$

The linear displacement of the lead screw per microstep is:

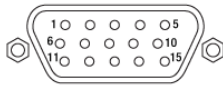
$$0.5 \text{ mm} / 409,600 = 1.2 \times 10^{-6} \text{ mm}$$

To calculate the linear displacement for a full step, substitute 409,600 with 200.

PIN DIAGRAM

Connector Pin Out

Pin Diagram



High-Density D-Type Male 15 Pin Connector

Pin	Description
1	Limit Switch Ground
2	Not Connected
3	CW Limit Switch
4	Motor Phase B-
5	Motor Phase B+
6	Motor Phase A-
7	Motor Phase A+
8 to 12	Reserved for Future Use
13	Not Connected
14	Reserved for Future Use
15	Earth GND



Click to Enlarge
High-Density D-Type Male 15 Pin
Connector

Part Number	Description	Price	Availability
DRV001	8 mm Travel Modular NanoMax Stepper Motor Drive	\$628.32	3-5 Days
MCA1	Modular Quick-Connect Adapter, Ø3/8" (9.5 mm) Mounting	\$19.69	Today
MCA2	Modular Quick-Connect Adapter, 10 mm (Ø0.39") Mounting	\$19.69	Today

Features

- ▶ 6 VDC Servo Actuator
- ▶ Sub-Micron Resolution
- ▶ Maximum Velocity: 2.3 mm/s
- ▶ Drop In Replacement for Most 6 mm Manual Actuators
- ▶ Compatible with 1/4"-80 Thread-Fitting Stages and Mounts
- ▶ Limit Switches for Zero Datum and Actuator Protection
- ▶ Also Available in 12 mm and 25 mm Travel Versions

Required Controller KDC101

- 34,304 Microsteps per Revolution
- 15 V Output at 2.5 W
- Trapezoidal Velocity Profile



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The Z8 Series of Motorized Actuators are engineered for use with optical positioning devices such as mirror mounts and stages. They offer high resolution in a lightweight package, which makes these actuators ideally suited for demanding optical laboratory automation applications.

Commercial limit switches have been added to provide overdrive protection and accurate home positioning. The incorporated motor is capable of speeds up to 2.3 mm/s. The precision of the encoder (512 counts/rev) results in a minimum resolution of about 29 nm.

The Z806 has been designed specifically to replace the manual adjusters in stages and mirror mounts that have 1/4"-80 threaded fittings. Simply remove the existing manual adjuster from the mount, and screw in our Z8 Actuator. The photo below shows a KM100 mirror mount with one of the screw adjusters replaced by a Z806 actuator.

The KDC101 DC Servo Controller is the required driver for the Z8 series actuators. Please note that previous generation TDC001 units will require a firmware upgrade to V1.0.10 or later, before they can be used with the Z8 series motors. An upgrade is included with the latest APT Server software, which can be downloaded here.

For applications with longer travel requirements, see our 12 mm travel Z812 and 25 mm travel Z825 actuators. We also offer the Z806V vacuum-compatible version, which is rated for use down to 10^{-6} torr and is shipped with a 1.6' flat ribbon cable, IDC connector, and converter cable for use with the KDC101 controller. See below for more details.



The units are shipped with 1.6' (0.5 m) of cable. A 2.5

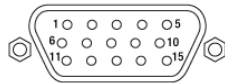
Specification	Value
Motor Type ^a	6 V DC Servo
Travel	6.0 mm
Backlash	<8 μ m
Bidirectional Repeatability	<1.5 μ m
Home Location Accuracy	<2 μ m
Homing Repeatability	\pm 1.0 μ m
Vertical Load Capacity	4.5 kg (Max)
Horizontal Load Capacity	9 kg (Max)
Vertical Load Capacity ^b	<4.0 kg
Horizontal Load Capacity ^b	<7.5 kg
Velocity ^c	2.6 mm/s (Max)
Velocity Stability	\pm 0.125 mm/s
Acceleration	4 mm/s ² (Max)
Absolute On-Axis Accuracy	42 μ m
Maximum Percentage Accuracy	0.75%
Motor Coil Temperature	85 °C (Max)
Phase to Phase Resistance	33.0 Ω (Max)
Phase to Phase Inductance	0.6 mH (Max)
Limit Switch Life Time	>100,000 Cycles
Minimum Achievable Incremental Movement	0.05 μ m
Minimum Repeatable Incremental Movement	0.2 μ m
Operating Temperature Range	41° to 104° F (5° to 40° C)
Weight	0.134 kg

- The nominal motor drive voltage is 6 V. Voltages up to 12 V can be used with pulse width modulation (PWM) controlled outputs.
- Recommended
- At 2.6 mm/s velocity ripple and distortion of the acceleration/deceleration profile may occur. For improved control, the max velocity should be limited to 2.3 mm/s.

m (8 ft) extension cable (PAA632) is available separately.

PIN DIAGRAM

Pin Diagram



High-Density D-Type Male 15 Pin Connector

Connector Pin Out

Pin	Description	Pin	Description
1	Ground (Limit and Vcc)	8	Reserved for Future Use
2	Forward Limit	9	Ident Resistor
3	Reverse Limit	10	Vcc (+5 V DC)
4	Reserved for Future Use	11	Encoder Channel A
5	Motor (-)	12	Reserved for Future Use
6	Reserved for Future Use	13	Encoder Channel B
7	Motor (+)	14, 15	Reserved for Future Use



Click to Enlarge
High-Density D-Type Male 15 Pin Connector

CALCULATIONS

How to Calculate the Linear Displacement per Encoder Count

For the Z806, there are 512 encoder counts per revolution of the motor. The output shaft of the motor goes into a 67:1 planetary gear head. This requires the motor to rotate 67 times to rotate the 1.0 mm pitch lead screw one revolution. The end result is the lead screw advances by 1.0 mm.

The linear displacement of the actuator per encoder count is given by

$$512 \times 67 = 34,304 \text{ encoder counts per revolution of the lead screw,}$$

whereas the linear displacement of the lead screw per encoder count is given by

$$1.0 \text{ mm} / 34,304 \text{ counts} = 2.9 \times 10^{-5} \text{ mm (29 nm).}$$

Part Number	Description	Price	Availability
Z806	6 mm Motorized DC Actuator, 1/4"-80 Thread Fitting, 0.5 m Cable	\$616.08	Today
PAA632	APT DC Servo Motor Cable for Z8 Motors, DE15 Male to DE15 Female, 2.5 m	\$56.61	Today

6 mm Travel Vacuum-Compatible DC Servo Motor Actuators

OVERVIEW

Features

- ▶ 6 VDC Servo Actuator
- ▶ Sub-Micron Resolution
- ▶ Maximum Velocity: 2.3 mm/s
- ▶ Drop In Replacement for Most 6 mm Manual Actuators
- ▶ Compatible with 1/4"-80 Thread-Fitting Stages and Mounts
- ▶ Limit Switches for Zero Datum and Actuator Protection
- ▶ Rated Down To 10^{-6} Torr
- ▶ Also Available in 12 mm and 25 mm Travel Versions

The Z806V offers all the features and specifications of the Z806 described above with the added benefit of being vacuum compatible down to 10^{-6} Torr. It incorporates vacuum-rated servo motors, phosphorus bronze internal coupling mechanism and mounting bush, and high-vacuum grease.

The Z806V actuator is shipped with a 1.6' (0.5 m) vacuum compatible flat ribbon cable with IDC connector. This cable has a 0.05" (1.27 mm) pitch, 28 AWG stranded conductors and Fluorinated Ethylene Propylene (FEP) insulation. A converter cable for use with the KDC101 controller is also supplied, but it is not vacuum compatible and should only be used outside the chamber.

For applications with longer travel requirements, see our 12 mm travel Z812V and 25 mm travel Z825BV actuators. For vacuum compatible versions of our stages and mirror mounts, please contact Tech Support.

The KDC101 DC Servo Controller is the required driver for the Z8 series actuators. Please note that previous generation TDC001 units will require a firmware upgrade to V1.0.10 or later, before they can be used with the Z8 series motors. An upgrade is included with the latest APT Server software, which can be downloaded [here](#).

Specification	Value
Motor Type ^a	6 VDC Servo
Travel	6.0 mm
Backlash	<8 μm
Bidirectional Repeatability	<1.5 μm
Home Location Accuracy	<2 μm
Homing Repeatability	$\pm 1.0 \mu\text{m}$
Vertical Load Capacity	4.5 kg (Max)
Horizontal Load Capacity	9 kg (Max)
Vertical Load Capacity ^b	<4.0 kg
Horizontal Load Capacity ^b	<7.5 kg
Velocity ^c	2.6 mm/s (Max)
Velocity Stability	$\pm 0.125 \text{ mm/s}$
Acceleration	4 mm/s^2 (Max)
Absolute On-Axis Accuracy	42 μm
Percentage Accuracy	0.82% (Max)
Motor Coil Temperature	85 °C (Max)
Limit Switch Life Time	>100,000 Cycles
Minimum Achievable Incremental Movement	0.05 μm
Minimum Repeatable Incremental Movement	0.2 μm
Operating Temperature Range	41 to 104 °F (5 to 40 °C)
Vacuum Rating	10^{-6} Torr
Weight	0.134 kg

- The nominal motor drive voltage is 6 V. Voltages up to 12 V can be used with pulse width modulation (PWM) controlled outputs.
- Recommended
- At 2.6 mm/s velocity ripple and distortion of the acceleration/deceleration profile may occur. For improved control, the max velocity should be limited to 2.3 mm/s.

Required Controller KDC101

- 34,304 Microsteps per Revolution
- 15 V Output at 2.5 W
- Trapezoidal Velocity Profile



[Click to Enlarge](#)

CALCULATIONS

How to Calculate the Linear Displacement per Encoder Count

For the Z806V, there are 512 encoder counts per revolution of the motor. The output shaft of the motor goes into a 67:1 planetary gear head. This requires the motor to rotate 67 times to rotate the 1.0 mm pitch lead screw one revolution. The end result is the lead screw advances by 1.0 mm.

The linear displacement of the actuator per encoder count is given by

$$512 \times 67 = 34,304 \text{ encoder counts per revolution of the lead screw,}$$

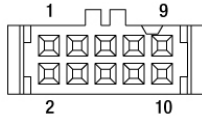
whereas the linear displacement of the lead screw per encoder count is given by

$$1.0 \text{ mm} / 34,304 \text{ counts} = 2.9 \times 10^{-5} \text{ mm (29 nm).}$$

PIN DIAGRAM

The vacuum-compatible cable integrated with the Z806V is terminated in a Female IDC 10-Pin socket connector. A short converter cable, which adapts this female IDC socket connector to a D-Type male HD15 pin connector, is included with the Z806V to facilitate connecting the actuator to the recommended KDC101 controller. This converter cable, whose terminating connectors are shown at right, is not vacuum compatible. Information describing the pin assignments for both the female IDC socket and Male D-Type HD connector (when it is connected to the female IDC socket connector) follows.

Pin Diagram



10 Pin Female IDC Socket Connector
(Amphenol T812 Series, 2.54 mm Pitch)



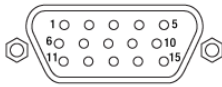
Click to Enlarge
10 Pin Female IDC Socket Connector
(Amphenol T812 Series, 2.54 mm Pitch)

Female IDC 10-Pin Connector Pin Out

Pin	Description	Pin	Description
1	Motor (+ve) (6 V) ^a	6	Motor (-ve) (6 V) ^a
2	Vcc (+5 V)	7	Limit Ground
3	Encoder Channel A	8	Reverse Limit
4	Encoder Channel B	9	Forward Limit
5	Ground	10	Reserved for Future Use

- The nominal motor drive voltage is 6 V. Voltages up to 12 V can be used with pulse width modulation (PWM) controlled outputs.

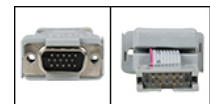
Pin Diagram



High-Density D-Type Male 15 Pin Connector

Male HDDB15 Connector Pin Out

Pin	Description	Pin	Description
1	Ground (Limit and Vcc)	8	Reserved For Future Use
2	Forward Limit	9	Ident Resistor
3	Reverse Limit	10	Vcc (+5 VDC)
4	Reserved For Future Use	11	Encoder Channel A
5	Motor (-)	12	Reserved for Future Use
6	Reserved for Future Use	13	Encoder Channel B
7	Motor (+)	14, 15	Reserved For Future Use



Click to Enlarge
Connectors terminating the converter cable. The image on the left shows the high-density D-Type male 15-pin connector, and the image on the right shows the 10-pin male IDC socket connector.

Part Number	Description	Price	Availability
Z806V	Vacuum-Compatible 6 mm Motorized DC Actuator, 1/4"-80 Thread Fitting	\$873.12	Today
Z806V	Vacuum-Compatible 6 mm Motorized DC Actuator, 1/4"-80 Thread Fitting	\$873.12	Today

Re-greasing Kit

OVERVIEW

Features

- ▶ 1.5 cc Syringe of Apiezon 100 Grease
- ▶ Convenient, Inexpensive Package that Reduces Waste
- ▶ Prolongs Lifetime of Actuator
- ▶ Ready to Dispense
- ▶ Vacuum Compatible to 10^{-9} Torr

This Apiezon grease has excellent anti-seize properties. It contains PTFE for maximum lubricity and is ideal for re-lubricating the lead screw threads of our ZST, ZFS, and Z8 series actuators described above. It is supplied in a syringe for easy application and is recommended both for general use and for vacuum applications down to 10^{-9} Torr. It has an optimal working range of 10 to 30 °C (50 to 86 °F).

Note: It is recommended that the lead screws of the Z8, ZFS, and ZST motors are lubricated every 50,000 cycles or 6 months, whichever comes first.

Part Number	Description	Price	Availability
GKZ8	Grease Kit for Z8, ZFS, and ZST Actuators	\$14.59	Today

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