

Z825B - November 22, 2023

Item # Z825B was discontinued on November 22, 2023. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

1" (25 mm) TRAVEL MOTORIZED ACTUATORS

- ▶ Piezo Inertia, DC Servo, or Stepper Actuators with 25 mm of Travel
- ▶ Load Capacities Up to 55 lbs (25 kg) Available
- ▶ Maximum Speeds Up to 50 mm/s Available
- ▶ Compatible with a Wide Range of Stages



[Hide Compact Stepper Motor Actuator with 25 mm Travel](#)

Compact Stepper Motor Actuator with 25 mm Travel

[Hide Overview](#)

OVERVIEW

Features

- ▶ Compact, Bi-Polar Stepper Motor Actuator: 88.5 mm (3.48") Long when Fully Retracted
- ▶ Manual Adjustment via Rear-Located Thumbscrew
- ▶ Non-Rotating Drive Tip
- ▶ Compatible with Stages and Mounts that Accept Ø3/8" (Ø9.525 mm) Barrels
- ▶ Also Available in 6 mm and 13 mm Travel Versions

Required Controller KST201

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



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Our ZFS25B Actuator provides smooth, precise linear motion control in a sleek, compact package measuring just 88.5 mm (3.48") 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 ZST225B actuator described above.

Powered by a small-diameter, dual-phase stepper motor, this actuator operates at speeds of up to 2.0 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 accomplished using the rear-located thumbscrew. The actuator motor can be damaged if this thumbscrew is rotated while power is being supplied. Mounting is accomplished via a standard Ø3/8" (Ø9.525 mm) barrel.

The ZFS25B Motorized Actuator uses a stepper motor that provides sufficient torque for loads up to 40 N (8.99 lb). The actuator allows 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 TST101 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 ZFS25B ships 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 KST201 stepper motor controller. A 1 m (3.3 ft) extension cable (PAA614) is available separately.

Specification	Value
Travel	25 mm (0.98")
Backlash ^a	<15 µm
Repeatability	<5.0 µm

The ZFS25B has a standard Ø3/8" (Ø9.525 mm) mounting barrel for fastening into any application compatible with our precision micrometer heads, like the PT1 Single-Axis Translation Stage or the PT3 Three-Axis Translation Stage. The manual adjuster of the LNR25 stage in the photo below was replaced with a ZFS25B motorized actuator.

Home Location Accuracy	<5.0 µm
Maximum Load Capacity	40 N (8.99 lb)
Speed	2.0 mm/s (Max)
Acceleration	10 mm/s ² (Max)
Gearbox Ratio	400:9 (Approx 44:1)
Limit Switches	Hall Effect Sensor
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
Mounting	Ø3/8" (9.525 mm) Barrel
Operating Temperature	5 to 40 °C (41 to 104 °F)
Dimensions (L x W x H)	88.5 mm x 35.0 mm x 19.0 mm (3.48" x 1.38" x 0.75")
Cable Length	0.6 m (2 ft)
Connector	HDDB15
Required Controller	KST201

^aThe user can correct for backlash errors by adjusting software settings.
^bMeasured using Thorlabs' previous generation TST101 T-Cube™ Stepper Motor Controller.
^cSee the *Calculations* tab for more information.



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The ZFS25B actuator is a component of the LNR25ZFS Translation Stage.

[Hide Calculations](#)

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 KST201 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

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

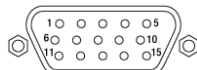
[Hide Pin Diagram](#)

PIN DIAGRAM

Connector Pin Out

Pin Diagram

Pin	Description	Pin	Description



High-Density D-Type Male 15 Pin Connector

1	Limit Ground	8	Reserved for Future Use
2	CCW Limit Switch	9	Reserved for Future Use
3	CW Limit Switch	10	Vcc (+5 VDC)
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
ZFS25B	Customer Inspired! 25 mm Travel, Compact Stepper Motorized Actuator, Ø3/8" Barrel	\$1,346.30	Today

[Hide Stepper Motor Actuator with 25 mm Travel](#)

Stepper Motor Actuator with 25 mm Travel

[Hide Overview](#)

OVERVIEW

Features

- ▶ Non-Rotating Drive Tip
- ▶ Bi-Polar Stepper Motor Actuator: 150.5 mm (5.93") Long
- ▶ Compatible with Stages and Mounts that Accept Ø3/8" (Ø9.525 mm) Barrels
- ▶ Also Available in 6 mm and 13 mm Travel Versions

The ZST225B Actuator provides smooth, precise linear motion control in a package measuring 150.5 mm (5.93") in length. Powered by a small-diameter, dual-phase stepper motor, this actuator operates at speeds of up to 2.0 mm/s. The non-rotating drive tip reduces wear and friction and improves smoothness of motion by removing rotational contact at the tip. Mounting is via a standard Ø3/8" (Ø9.525 mm) barrel.

This actuator uses a stepper motor that provides sufficient torque for loads up to 40 N (8.99 lb). It allows 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 KST201 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. The ZST225B ships with 0.6 m (2 ft) of cable terminated in a 15-pin D-Type connector that is compatible with our KST201 stepper motor controller. A 1 m (3.3 ft) extension cable (PAA614) is available separately.

The ZST225B has a standard Ø3/8" (Ø9.525 mm) mounting barrel for fastening into any application compatible with our precision micrometer heads, like the PT1 Single-Axis Translation Stage or the PT3 Three-Axis Translation Stage.

Required Controller KST201

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

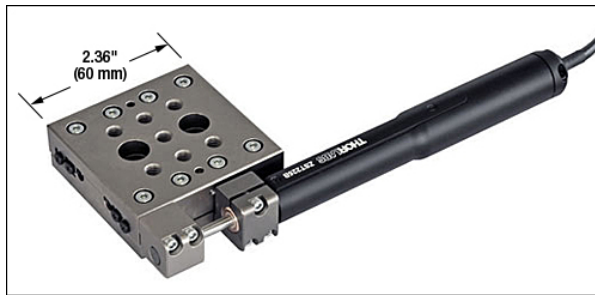


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Specification	Value
Travel	25 mm (0.98")
Backlash ^a	<15 µm
Repeatability	<5.0 µm
Home Location Accuracy	<5.0 µm
Maximum Load Capacity	40 N (8.99 lb)
Speed	2.0 mm/s (Max)
Acceleration	10 mm/s ² (Max)
Gearbox Ratio	29791:729 (Approx 41:1)
Limit Switches	Hall Effect Sensor
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
Mounting	Ø3/8" (9.525 mm) Barrel

Operating Temperature	5 to 40 °C (41 to 104 °F)
Cable Length	0.6 m (2 ft)
Connector	HDDB15
Required Controller	KST201

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



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An LNR25 1" travel stage shown with the manual adjuster replaced by a ZST225B actuator.

[Hide Calculations](#)

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 KST201 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:

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

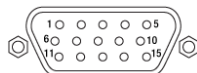
The linear displacement of the lead screw per microstep is

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

[Hide Pin Diagram](#)

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 VDC)
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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Part Number	Description	Price	Availability
ZST225B	25 mm Travel, Stepper Motorized Actuator, Ø3/8" Barrel	\$1,139.01	Today

[Hide High-Load Stepper Motor Actuator with 25 mm Travel](#)

High-Load Stepper Motor Actuator with 25 mm Travel

[Hide Overview](#)

OVERVIEW

Features

- ▶ Specifically Designed to be Used with LNR50 TravelMax™ Stages
- ▶ $\pm 1.6 \mu\text{m}$ Unidirectional Repeatability
- ▶ Maximum Pushing Force: 180 N
- ▶ Preload to Eliminate Backlash
- ▶ Non-Rotating Tip
- ▶ 50 mm Travel Version Also Available

The DRV225 Trapezoidal Stepper Motor Drive offers 25 mm (0.98") of travel and a unidirectional repeatability of $\pm 1.6 \mu\text{m}$. When used with one of our stepper motor controllers, this actuator can achieve a theoretical minimum step size of 2.4 nm and a maximum speed of 50 mm/s.

The hybrid stepper motor, with its rotor that consists of 50 individual magnetic teeth, is ideally suited for microstepping applications. Its 200 full steps per revolution are further broken down into 409 600 microsteps. In addition to the resulting increase in resolution, microstepping produces smoother low-speed motion by allowing the discrete 1.8° step size to be reduced to much smaller steps with inherently lower vibrational noise.

The DRV225 stepper motor drive is equipped with a trapezoidal screw thread for more efficient high-load operation than is available from standard threading.

This actuator is compatible with our 2" TravelMax manual stages. To use the DRV225 with these stages, mount the motor to the side of the stage using two 40 mm long M4 cap screws (included).

A 500 mm (19.7") cable with a 15-pin D-type connector is attached to the unit to connect the stepper motor to a controller. The unit also comes with a 3 m (9.8 ft) extension cable (item # PAA613). If a shorter cable is needed, the 1 m (3.3 ft) PAA612 cable is available separately.

Recommended Controllers BSC201, BSC202, or BSC203

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



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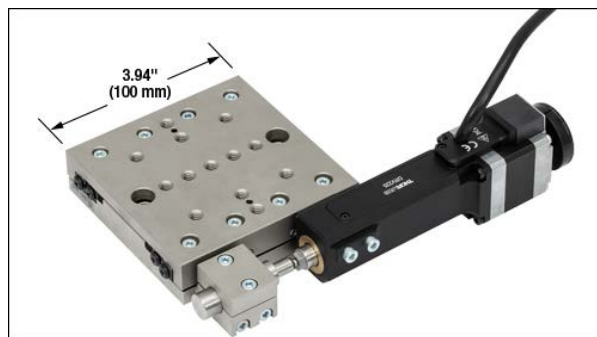
Key Specifications^a

Travel Range	25 mm (0.98")
Unidirectional Repeatability	$\pm 1.6 \mu\text{m}$
Bidirectional Repeatability	$\pm 3.9 \mu\text{m}$
Maximum Pushing Force ^b	180 N
Maximum Velocity	50 mm/s
Maximum Acceleration	50 mm/s^2
Limit Switches	Hall Effect
Homing Repeatability	$\pm 3.6 \mu\text{m}$
Feedback	None ^c
Motor Type	2-Phase Stepper Motor
Full Step Angle	1.8°
Lead Screw Pitch	1.0 mm
Microsteps per Revolution	409 600
Actuator Mass	0.58 kg
Compatible Controllers	BSC201, BSC202, BSC203, or MST602

^aFor complete specifications, see the manual.

^bThe unit requires a preload in order to function properly and should only be used for pushing loads. Do not use for pulling.

^cAlthough feedback is not provided within the actuator, closed-loop control can be achieved by using the LNR502E(/M) stage.



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An LNR50 Series 2" Travel Stage with the Manual Adjuster Replaced by a DRV225 Actuator

[Hide Calculations](#)

CALCULATIONS

How to Calculate Linear Displacement per Microstep

The stepper motor used in the DRV225 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 leadscrew has a pitch of 1.0 mm, meaning that it will produce 1.0 mm of linear motion per revolution. The linear displacement of one actuator microstep can be calculated as follows:

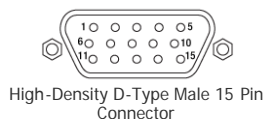
$$1.0 \text{ mm per Revolution} / 409,600 \text{ Microsteps per Revolution} = 2.4 \times 10^{-6} \text{ mm per Microstep}$$

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

[Hide Pin Diagram](#)

PIN DIAGRAM

Pin Diagram



15-Pin D-Sub Connector Pin Out

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

^aThe limit switch ground wire is connected to the motor body.



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

Part Number	Description	Price	Availability
DRV225	25 mm Trapezoidal Stepper Motor Drive	\$997.33	Today

[Hide DC Servo Motor Actuator with 25 mm Travel](#)

DC Servo Motor Actuator with 25 mm Travel

[Hide Overview](#)

OVERVIEW

Features

- ▶ 6 VDC Servo Actuator
- ▶ Sub-micron Resolution
- ▶ Maximum Velocity: 2.3 mm/s
- ▶ Drop-In Replacement for Most 25 mm Manual Actuators
- ▶ Compatible with Stages and Mounts that Accept Ø3/8" (Ø9.525 mm) Barrels
- ▶ Limit Switches for Zero Datum and Actuator Protection
- ▶ Also Available in 6 mm and 12 mm Travel Versions

Required Controller KDC101

- 34,555 Microsteps per Revolution
- 15 V Output at 2.5 W
- Trapezoidal Velocity Profile



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Our Z8 Series Motorized Actuators are engineered for use with optical positioning devices. They offer high resolution in a lightweight package, which makes these actuators ideally suited for demanding optical laboratory automation applications. The Z825B delivers 25 mm of travel and has been designed as a replacement for the Z725 motor.

Commercial limit switches have been added to provide overdrive

Item #	Z825B
Travel Range	25 mm (0.98")
Encoder Resolution ^a	34,555 counts/mm (Linear Displacement)
Maximum Pushing Force	45 N
Homing Repeatability	±9 µm

protection and accurate home positioning. The incorporated motor is capable of speeds up to 2.6 mm/s, but a maximum speed of 2.3 mm/s is recommended in order to maintain the specified control. The precision of the encoder (512 counts/rev) results in a minimum resolution of about 29 nm (see the *Calculations* tab for more information).

The Z825B has been designed specifically to replace the manual adjusters in stages and mirror mounts that have a Ø3/8" (Ø9.525 mm) barrel clamp, like the PT1 Single-Axis Translation Stage or the PT3 Three-Axis Translation Stage.

To install, remove the existing manual adjuster from the mount, and fit the replacement Z8 Actuator. The image below shows a PT3 three-axis stage with a Z825B fitted to one of the axes.

The units are shipped with one 457.2 mm (18.0") cable. A 2.5 m (8') extension cable (Item # PAA632) is available separately.

For applications with different travel requirements, please see our 6 mm Z906 and 12 mm Z912 actuators. We also offer the Z825BV vacuum-compatible version (sold below), which is rated for use down to 10⁻⁶ Torr and is shipped with a 457.4 mm flat ribbon cable, IDC connector, and a converter cable for use with our KDC101 controller.

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.



A PT3 1" XYZ translation stage with a Z825B motorized actuator replacing the manual adjuster.

Uncompensated Backlash	13 µm
Uncompensated Bidirectional Repeatability	±7 µm
Residual Backlash After Compensation ^b	0.7 µm
Compensated Bidirectional Repeatability	±0.8 µm
Travel Accuracy ^c	40 µm
Minimum Repeatable Incremental Movement	0.2 µm
Maximum Speed ^d	2.6 mm/s
Maximum Acceleration	4 mm/s ²
Maximum Phase to Phase Resistance	33.0 Ω
Maximum Phase to Phase Inductance	0.6 mH
Tested Lifetime ^e	>100,000 Cycles
Operating Temperature Range	41° to 104° F (5° to 40° C)
Weight	0.13 kg
Motor Type ^f	DC Servo
Cable Length	457.2 mm (18.0")
Required Controller	KDC101

^aSee *Calculations* tab for details.

^bFor an inward move, the system moves 300 µm beyond the target location to compensate for known backlash.

^cDefault backlash compensation is present against a constant force.

^dAt 2.6 mm/s, velocity ripple and distortion of the acceleration/deceleration profile may occur. For improved control, the maximum speed should be limited to 2.3 mm/s.

^eTested with a load of 9 N on the lead screw.

^fVariable voltage under pulse width modulation (PWM) from a 15 V supply.

[Hide Calculations](#)

CALCULATIONS

How to Calculate the Linear Displacement per Encoder Count

For the Z825B, there are 512 encoder counts per revolution of the motor. The output shaft of the motor goes into a 67.49:1 planetary gear head. This requires the motor to rotate 67.49 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

$$512 \times 67.49 = 34,555 \text{ encoder counts per revolution of the lead screw,}$$

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

$$1.0 \text{ mm} / 34,555 \text{ counts} = 2.9 \times 10^{-5} \text{ mm (29 nm).}$$

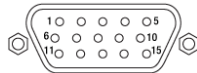
[Hide Pin Diagram](#)

PIN DIAGRAM

Connector Pin Out

Pin Diagram

Pin	Description	Pin	Description
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High-Density D-Type Male 15 Pin Connector

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 High-Density D-Type Male 15 Pin Connector

Part Number	Description	Price	Availability
Z825B	25 mm Motorized Actuator with Ø3/8" Barrel (0.5 m Cable)	\$729.07	Lead Time

[Hide Vacuum-Compatible DC Motor Actuator, 25 mm Travel](#)

Vacuum-Compatible DC Motor Actuator, 25 mm Travel

[Hide Overview](#)

OVERVIEW

Features

- ▶ Servo Actuator
- ▶ Sub-micron Resolution
- ▶ Maximum Operating Speed 2.6 mm/s
- ▶ Drop-In Replacement for Most 25 mm Manual Actuators
- ▶ Compatible with Ø3/8" Barrel-Fitting Stages and Mounts
- ▶ Limit Switches for Zero Datum and Actuator Protection
- ▶ Rated Down To 10⁻⁶ Torr
- ▶ Also Available in 6 mm and 12 mm Travel Versions

Required Controller KDC101

- 34,555 Microsteps per Revolution
- 15 V Output at 2.5 W
- Trapezoidal Velocity Profile



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The Z825BV actuator offers features and specifications similar to the Z825B actuator described above with the added benefit of being vacuum compatible down to 10⁻⁶ Torr. They incorporate vacuum-rated servo motors, a phosphorus bronze internal coupling mechanism and mounting bush, and high-vacuum grease.

These actuators are shipped with a 457.4 mm (18.0") vacuum-compatible flat ribbon cable with an IDC connector. The cable has 1.27 mm (0.05") 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.

The Z825BV has been designed specifically to replace the manual adjusters in stages and mirror mounts that have a Ø3/8" barrel clamp, such as the PT1 Single-Axis Translation Stage or the PT3 Three-Axis Translation Stage.

To install, remove the existing manual adjuster from the mount, and fit the replacement Z8 Actuator. The photo below shows a Z825BV fitted to a custom vacuum compatible PT1 stage. For custom vacuum-compatible stages, please contact Tech Support. For applications with different travel requirements, please see our 6 mm Z906V and 12 mm Z912V and Z912BV actuators.

Item #	Z825BV
Travel Range	25 mm (0.98")
Encoder Resolution^a	34,555 counts/mm (Linear Displacement)
Maximum Pushing Force	45 N
Homing Repeatability	±9 µm
Uncompensated Backlash	13 µm
Uncompensated Bidirectional Repeatability	±7 µm
Residual Backlash After Compensation^b	0.7 µm
Compensated Bidirectional Repeatability	±0.8 µm
Travel Accuracy^c	40 µm
Minimum Repeatable Incremental Movement	0.2 µm
Maximum Speed^d	2.6 mm/s
Maximum Acceleration	4 mm/s ²
Maximum Phase to Phase Resistance	33.0 Ω
Maximum Phase to Phase Inductance	0.6 mH
Tested Lifetime^e	>100,000 Cycles
Operating Temperature Range	41° to 104° F (5° to 40° C)
Vacuum Rating	10 ⁻⁶ Torr
Weight	0.13 kg
Motor Type^f	DC Servo
Cable Length	457.4 mm (18.0")

Required Controller	KDC101
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- See *Calculations* tab for details.
- For an inward move, the system moves 300 μm beyond the target location to compensate for known backlash.
- Default backlash compensation is present against a constant force.
- At 2.6 mm/s, velocity ripple and distortion of the acceleration/deceleration profile may occur. For improved control, the maximum speed should be limited to 2.3 mm/s.
- Tested with a load of 9 N on the lead screw.
- Variable voltage under pulse width modulation (PWM) from a 15 V supply.



A Z825BV motorized actuator fitted to a custom vacuum-compatible PT1 stage.

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](#).

[Hide Calculations](#)

CALCULATIONS

How to Calculate the Linear Displacement per Encoder Count

For the Z825BV, there are 512 encoder counts per revolution of the motor. The output shaft of the motor goes into a 67.49:1 planetary gear head. This requires the motor to rotate 67.49 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

$$512 \times 67.49 = 34,555 \text{ encoder counts per revolution of the lead screw,}$$

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

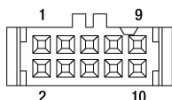
$$1.0 \text{ mm} / 34,555 \text{ counts} = 2.9 \times 10^{-5} \text{ mm (29 nm).}$$

[Hide Pin Diagram](#)

PIN DIAGRAM

The vacuum-compatible cable integrated with the Z825BV actuator 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 Z825BV actuator to facilitate connecting it to the recommended KDC101 controller. This converter cable, whose terminating connectors are shown below, 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)



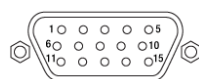
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10 Pin Female IDC Socket Connector
(Amphenol T812 Series, 2.54 mm Pitch)

Female IDC 10-Pin Connector Pin Out

Pin	Description	Pin	Description
1	Motor (+)	6	Motor (-)
2	Vcc	7	Limit Ground
3	Channel A	8	Reverse Limit

4	Channel B	9	Forward Limit
5	Ground	10	Not Connected

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



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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
Z825BV	Vacuum-Compatible 25 mm Motorized Actuator with Ø3/8" Barrel Fitting	\$1,009.74	Today

[Hide Piezo Inertia Actuator with 25 mm Travel](#)

Piezo Inertia Actuator with 25 mm Travel

[Hide Overview](#)

OVERVIEW

Features

- ▶ Compact Design: 31.5 mm x 17.0 mm (W x H)
- ▶ 20 nm Typical Step Size
- ▶ Manual Adjustment via Knob on Adjuster Screw
- ▶ 125 V Maximum Operating Voltage
- ▶ Ø3/8" Mounting Barrel for Compatibility with Translation Stages
- ▶ Also Available in 10 mm, 13 mm, and 50 mm Travel Versions
- ▶ Ideal for Set-and-Hold Applications that Require High-Resolution Relative Positioning
- ▶ Control Cable can be Adjusted up to 110° for Space-Constrained Applications

**Required Controller:
KIM001 or KIM101**

- KIM001: Single-Channel Output
- KIM101: Four Output Channels, Capable of Multi-Channel Operation
- Standalone Control via Top Panel or PC-Control via USB
- Voltage Output from 85 V to 125 V



Click to Enlarge

Thorlabs' PIA25 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 25 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, piezo hysteresis, and application conditions such as the direction of travel, the achieved step size of the system can vary by up to 20% and is not normally repeatable. An external feedback system will need to be used to overcome this variance.

This actuator has a Ø3/8" (Ø9.525 mm) barrel that can be mounted in a manual stage that has a Ø3/8" mounting clamp. For compatibility with 1/4"-80 threaded mirror mounts see our 10 mm travel piezo inertia actuator. 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 using the knob on the adjuster

Item #	PIA25
Travel	25 mm (0.98")
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 Active Preload^e	25 N
Recommended Maximum Axial Load Capacity^f	2.5 kg (5.51 lbs)
Speed (Continuous Stepping)	2 mm/minute (Typical) <3.5 mm/minute (Maximum)
Drive Screw	1/4"-80 Thread, Hard PVD Coated
Motor Type	Piezoelectric Inertia
Mounting Feature (Auxiliary)	Ø3/8" (Ø9.525 mm) Barrel (3/8"-40 Thread with Lock Nut)
Operating Temperature	10 to 40 °C (50 to 104 °F)
Dimensions	2.81" x 1.24" x 0.67"

screw, as long as the piezo is not actively translating the screw; the knob is also compatible with 5/64" (2.0 mm) hex keys.

Powered by a 10 mm 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. For information on the design of our piezo inertia "slip-stick" motor actuators, please see the complete presentation here.



Click for Details
The control cable can be adjusted up to 110° for space-constrained applications.

Required Controller

A KIM001 or KIM101 controller is required to operate our PIA25 Piezo Inertia Actuator; the actuator cannot be operated using a standard piezo controller. These drivers have an internal sawtooth voltage signal generator capable of sending sub-millisecond pulses (steps) with controllable amplitudes from 85 V to 125 V. The KIM001 and KIM101 controllers offer one and four output channels, respectively.

For more information, please see the full web presentation.

	(71.4 mm x 31.5 mm x 17.0 mm)
Cable Length	1.0 m (3.28')
Connector	SMC, Female
Required Controller^g	KIM001 or KIM101 ^h

^aThis value can vary by up to 20% and is not normally repeatable due to component variance, change of direction, and application conditions.
^bThis can be adjusted up to 30% in both directions using the controller and Kinesis Software.
^cThis can be adjusted using the controller and Kinesis Software.
^dUsing the KIM101 Inertia Piezo Controller
^eThe axial force applied to the drive tip to achieve the specified step size. A minimum of 5 N is recommended to enhance stepping behavior.
^fA higher maximum load is possible but it may decrease the typical step size.
^gControllers Sold Separately
^hThese actuators can also be controlled using the legacy TIM101 T-Cube™ controller.

Part Number	Description	Price	Availability
PIA25	Piezo Inertia Actuator, 25 mm Travel, Ø3/8" Mounting Barrel	\$592.80	Today

[Hide Re-Greasing Kit](#)

Re-Greasing Kit

[Hide Overview](#)

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, Z8, and Z9 series actuators. 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 screw and end ball of the Z8, Z9, ZFS, and ZST actuators are lubricated every 10,000 cycles or whenever a squeaking noise is heard during motion.

Part Number	Description	Price	Availability
GKZ8	Grease Kit for Z8, Z9, ZFS, and ZST Actuators	\$21.05	Today

[Hide Stepper and DC Servo Drive Cables](#)

Stepper and DC Servo Drive Cables

[Hide Overview](#)

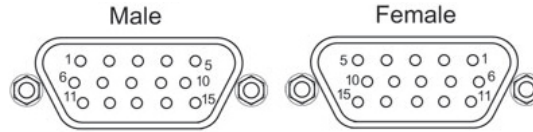
OVERVIEW

Thorlabs' DRV, ZST, and ZFS Stepper Motor Actuators, as well as our Z8 and Z9 DC Servo Motor Actuators, come with cables for connecting to the required controllers. Thorlabs also offers separate cables that may be used as extension cables.

Stepper Motor Cables

Thorlabs offers a variety of cables to support several stepper motor actuator and controller combinations. Supported stepper motors include our ZST, ZFS, and DRV actuators; supported controllers include our BSC benchtop controllers, our KST201 K-Cube™ Controller, and our MST602 Rack Control Module. In order to see which cable is compatible with a given combination of stepper motor and controller, please see the table below. The pin assignment for each cable is given in the *Pin Diagrams* tab. Please note that these cables cannot be used with motors and controllers that do not match their pin assignment, even if the connectors are the same.

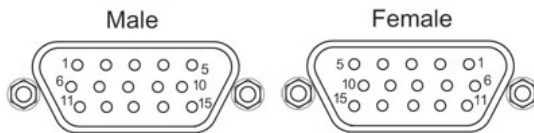
DE15 Male D-Type to DE15 Female D-Type



DE15 Male Pin	DE15 Female Pin	Description
1	1	Ground
2	2	Forward Limit Switch
3	3	Reverse Limit Switch
5	5	Motor -
7	7	Motor +
10	10	5 V Encoder Supply
11	11	Encoder Channel A
13	13	Encoder Channel B

PAA614 Stepper Motor Cable

DE15 Male D-Type to DE15 Female D-Type



DE15 Male Pin	DE15 Female Pin	Description
1	1	Ground
2	2	CCW Limit Switch
3	3	CW Limit Switch
4	4	Motor Phase B -
5	5	Motor Phase B +
6	6	Motor Phase A -
7	7	Motor Phase A +
10	10	+5 VDC
15	15	Ground

Part Number	Description	Price	Availability
PAA612	APT Stepper Motor Cable, DA15 Male to DE15 Female, 1 m	\$67.85	Today
PAA613	APT Stepper Motor Cable, DA15 Male to DE15 Female, 3 m	\$81.24	Today
PAA614	Customer Inspired! APT Stepper Motor Cable, DE15 Male to DE15 Female, 1 m	\$65.51	Today
PAA632	APT DC Servo Motor Cable for Z8 and Z9 Motors, DE15 Male to DE15 Female, 2.5 m	\$64.64	Today