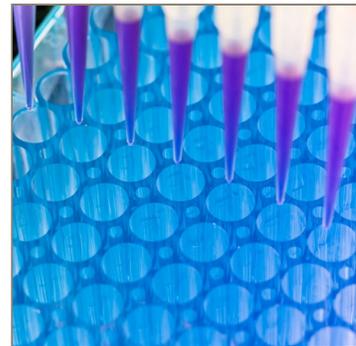


ZFA Series

Optomechanical Focusing Nano Positioner



ENGINEERING YOUR SUCCESS.

ZFA Series Nano Positioner

Achieve nanometer level stability in milliseconds

For instrument builders who require nanometer level stability and ultra low settling times, the Parker ZFA offers industry leading performance

The Parker ZFA is a precision machined, crossed roller guided, voice coil driven positioner utilizing the latest in linear encoder technology, with selectable integration features to match the application need.



Nanometer Level Performance

With industry leading natural frequencies, the ZFA provides stabilities on the nanometer scale. These, combined with single digit nanometer resolutions, allow for rapid step and settle moves, increasing image quality and throughput.

Precision Objective Bracket Alignment

Integral carriage datum features allow factory alignment of objective bracket to travel path. Base datum features allow for easy integration of the ZFA into instruments. Datum features are present with or without an included objective bracket for alignment in the field.

Features

- **95 x 90 x 36 form factor**
- **Up to 9 mm of usable travel**
- **Up to 1 kg objective mass with internal magnetic counterbalance**
- **Up to 2 kg objective mass with optional external counterbalance**
- **Included encoder reference mark**
- **Adjustable hard stops**
- **Non-moving cable design**
- **CE and RoHS Compliance**



ZFA Series Nano Positioner

Selectable Levels of Integration

Included Objective Mounting Bracket

- M25-M32, SM1, and RMS mounting
- Custom brackets available

Configurable Internal Magnetic Counterbalance

- Objective masses up to 1 kg
- Non-contact design
- Internal mounting

Optional Additional External Magnetic Counterbalance

- Objective masses from 1 to 2 kg
- External mounting
- Non-contact design



ZFA Series - Basic Specifications

	Units	ZFA
Travel Range	mm	9
Travel (Hard Stop to Hard Stop)	mm	9.5
Resolution (Digital Encoder)	nm	2.5
Positional Accuracy over full travel ^{(1),(2)}	µm	+/- 4
Positional Accuracy over 1mm travel ^{(1),(2)}	µm	1
Positional Repeatability over full travel ^{(1),(2)}	nm	+/- 250
Standstill Stability ^{(1),(2),(3),(4)}	nm (rms)	5
Step and Settle Capability ^{(1),(2),(3),(4)}	nm	100nm step and settle within +/- 15nm < 15ms
Max Velocity (2.5nm digital encoder) Requires minimum of 20 Mhz encoder input	mm/sec	32
Continuous Motor Force	N	4
Peak Motor Force	N	10
Stage Mass (No bracket)	kg	0.96
Overall Dimension (excluding bracket)	L x W x H (mm)	95 x 90 x 36 101 x 90 x 36 (Includes cable clearance)

⁽¹⁾ Stage mounted to granite surface, 2.5 micron optical encoder.

⁽²⁾ Measurements taken at 35 mm above the center of the carriage.

⁽³⁾ Please see tables on page 7-11 for more details.

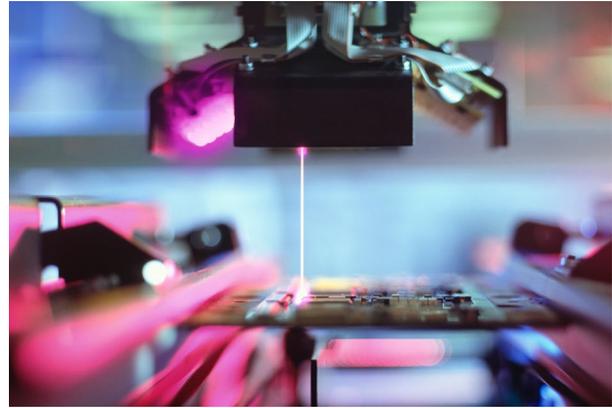
⁽⁴⁾ Possible performance highly dependent on other system design factors, including drive and control. Contact factory for details.

ZFA Series Nano Positioner

ZFA Application Solutions



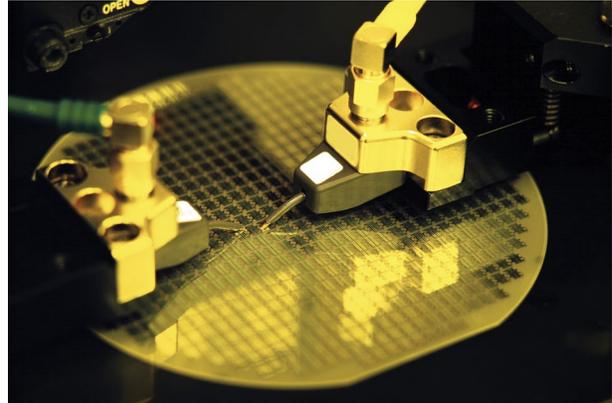
Electronics Manufacturing



Metrology



Life Sciences

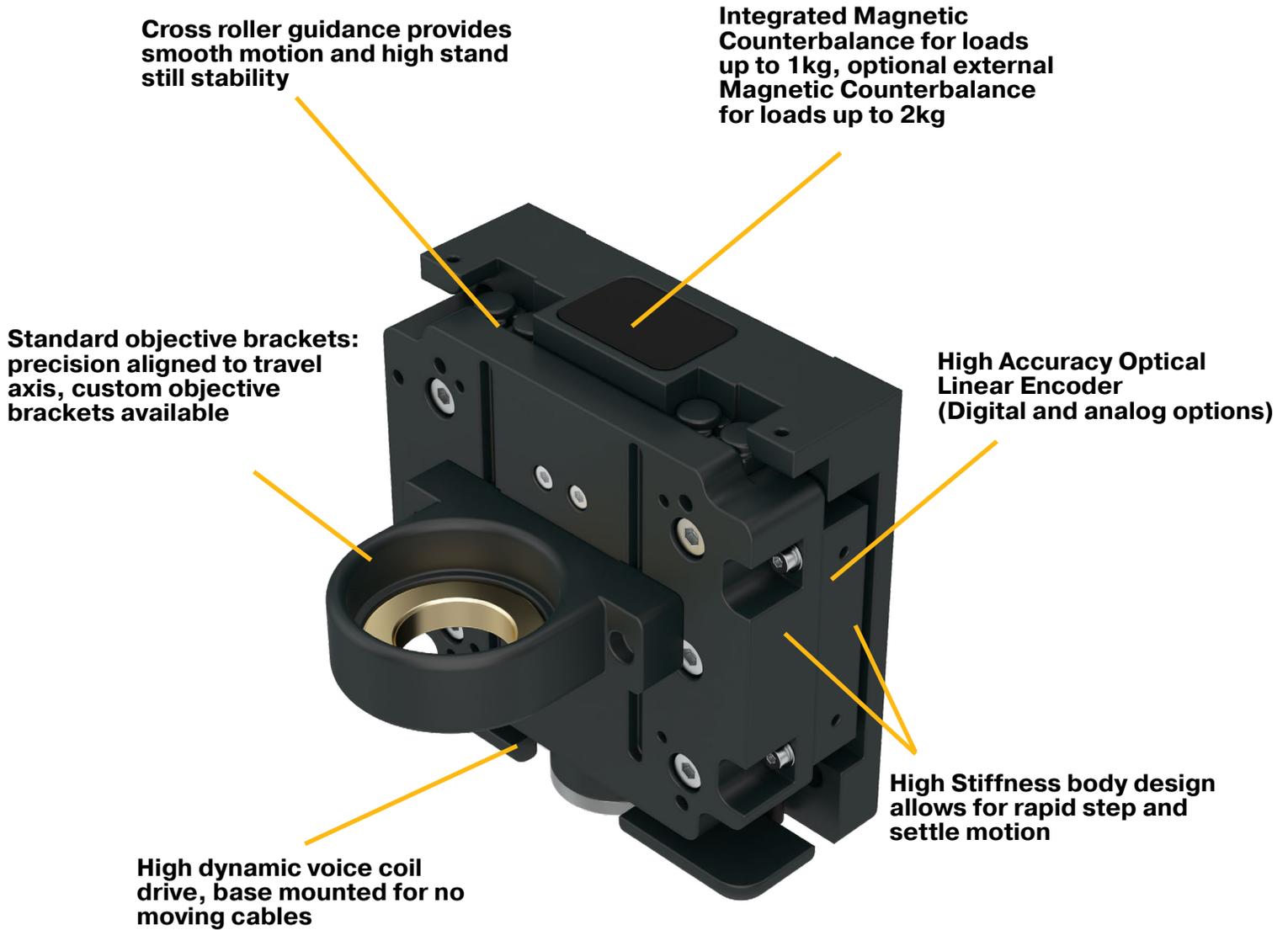


Semiconductor

For the fields of digital pathology, Next-Generation Sequencing dynamic metrology, and laser processing, the ZFA provides high bandwidth critical to in motion imaging applications. Rapid step and settle response reduces device cycle times contributing to reduced costs per run. The non-contact voice coil drivetrain provides consistent performance across instrument life, greatly increasing performance and reducing total cost of ownership. High degrees of stand still stability allow for never before seen image quality and resolution. Industry leading load capacities allow for larger than typical objective lenses, increasing field of view and reducing travel requirements on scan axes. In some cases, two axis scanning can be reduced to a single axis of motion, accelerating instrument design cycles, reducing footprint, and reducing cost.

ZFA Series Nano Positioner

ZFA Design Overview



CE and RoHS Compliance

The ZFA conforms to both CE and RoHS directives as standard.



ZFA Series Nano Positioner

Performance Specifications

Parameter	Units	Specification
Travel Range (Usable)	mm	9
Travel (Min. Hard Stop to Hard Stop)	mm	9.5
Max Travel (Hard Stop to Hard Stop)	mm	10.5
Top Hard Stop to Index Location	mm	4.9 to 5.1
Index to Bottom Hard Stop Location	mm	4.4 to 5.6
Resolution (Digital Encoder)	nm	2.5
Resolution (1 V p-p Sin/Cos Encoder) Divided by controllers A/D resolution	µm	20
Positional Accuracy over full travel ⁽¹⁾⁽²⁾	µm	+/-4
Positional Accuracy over 1 mm travel ⁽¹⁾⁽²⁾	µm	+/-1
Positional Repeatability over full travel ⁽¹⁾⁽²⁾⁽⁴⁾	µm	+/-0.25
Angular Pitch per mm ⁽¹⁾⁽³⁾	Arcsec	+/-2
Angular Roll per mm ⁽¹⁾⁽³⁾	Arcsec	+/-2
Angular Yaw per mm ⁽¹⁾⁽³⁾	Arcsec	+/-2
Index (Home) Repeatability ⁽¹⁾⁽²⁾⁽³⁾	µm	+/-0.2
Standstill Stability ⁽¹⁾⁽²⁾⁽³⁾⁽⁴⁾	nm (rms)	5 to 15
Max Velocity (2.5nm digital encoder, 20 Mhz clock frequency capability required)	mm/sec	32
Max Acceleration / Deceleration	g's	Load Dependent
Continuous Motor Force	N	4.19
Peak Motor Force	N	10
Moving Mass (No bracket)	Kg	0.39
Moving Mass (with std Objective bracket)	Kg	0.455
Stage Mass (no bracket)	Kg	1.15
Overall Dimension (excluding bracket)	L x W x H (mm)	95 x 90 x 36 101 x 90 x 36 (includes cable clearance)
Payload Capacity - With Internal Counterbalance ⁽⁵⁾	g	1,050
Payload Capacity - With Optional External Counterbalance ⁽⁵⁾	g	2,250

(1). Measured at optical center line.

(2). With 2.5 nm resolution encoder.

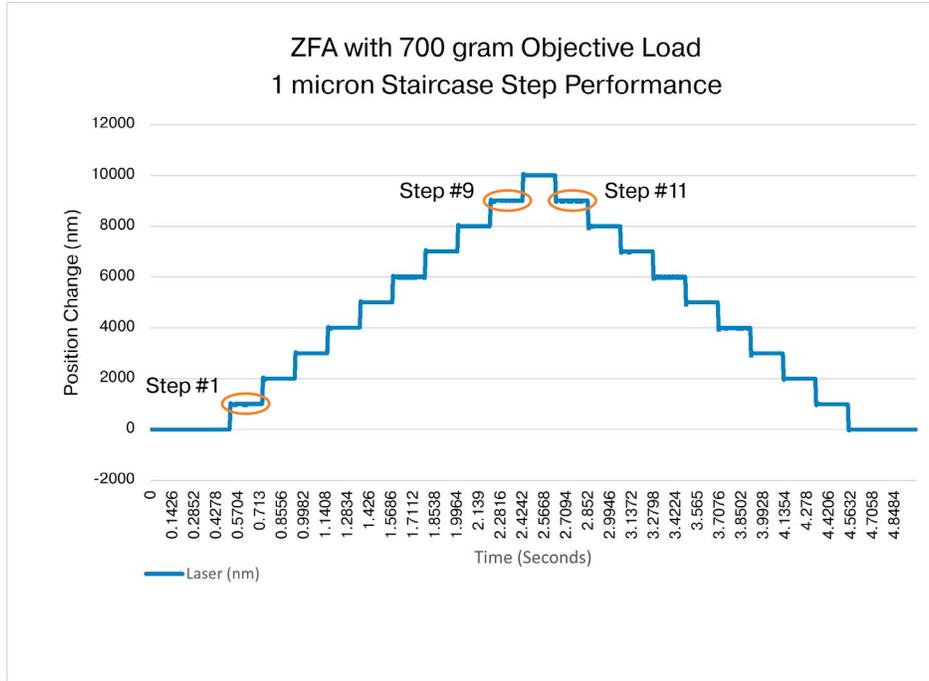
(3). Mounting to a frame with a Minimum Natural Frequency >1 KHz and mounting surface flatness of 8 microns or better.

(4). Possible performance highly dependent on other system design factors, including drive and control. Contact factory for details.

(5). Total payload mass including any mounting brackets.

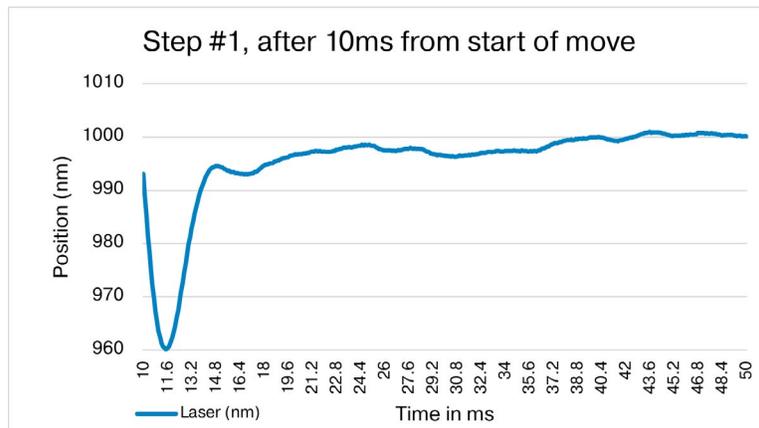
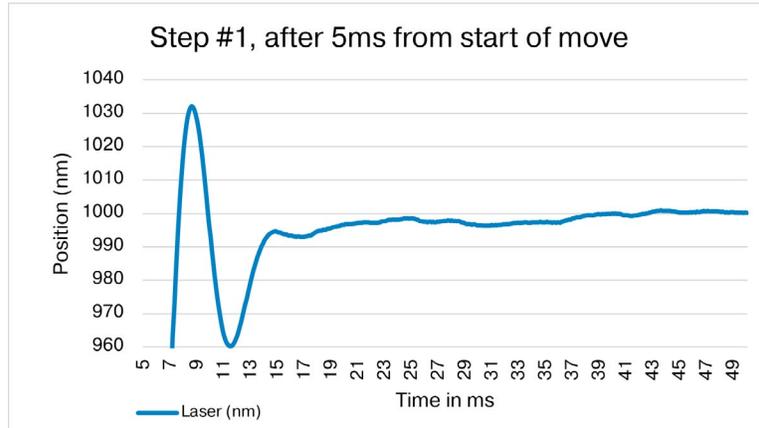
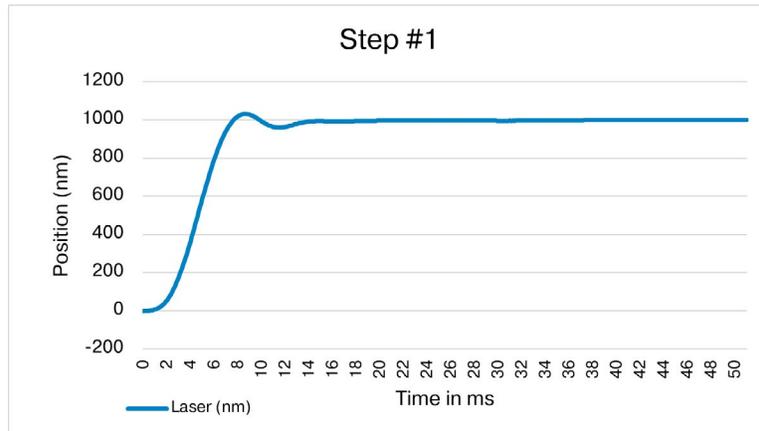
ZFA Series Nano Positioner

Step and Settle Response



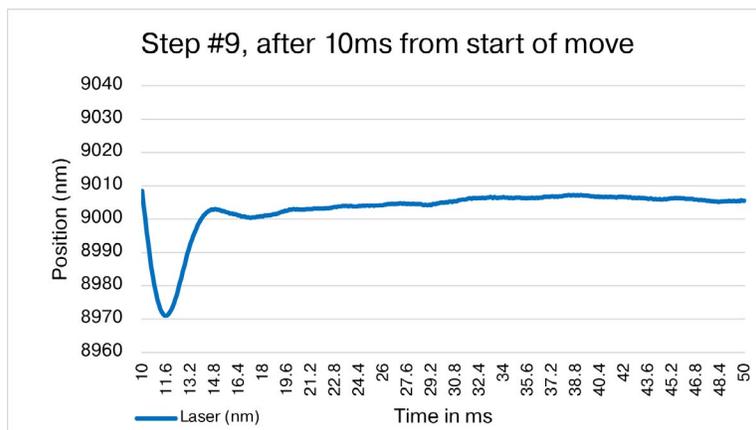
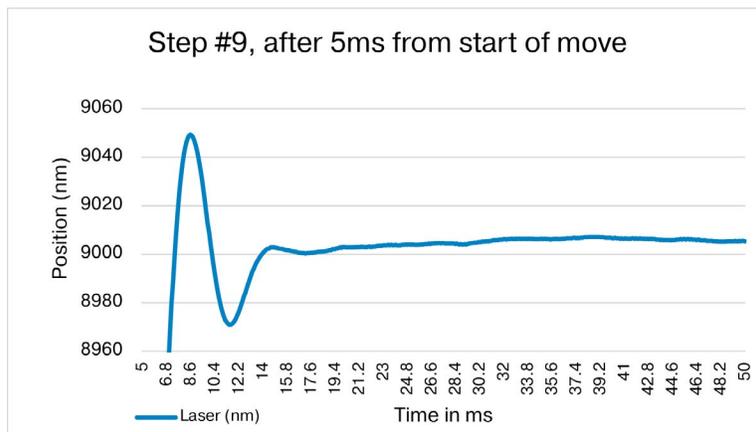
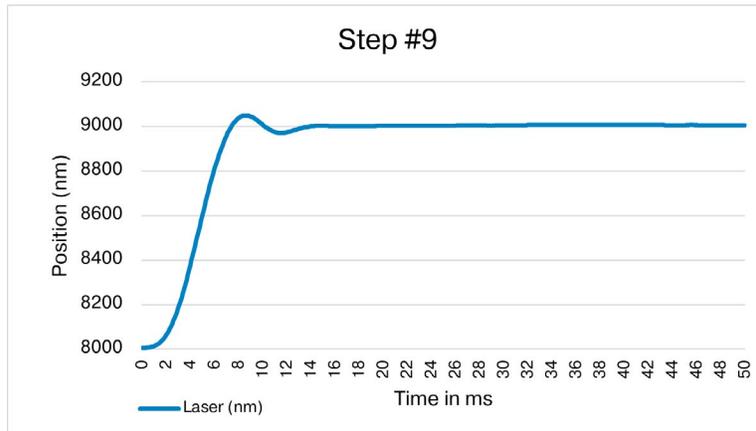
ZFA Series Nano Positioner

Step and Settle Response: Step One



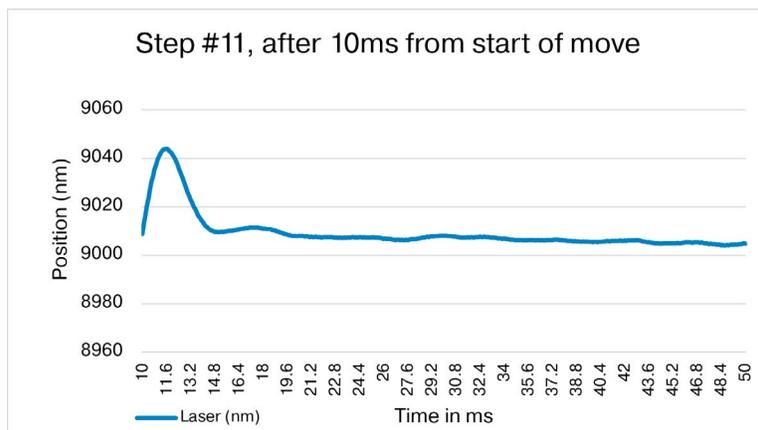
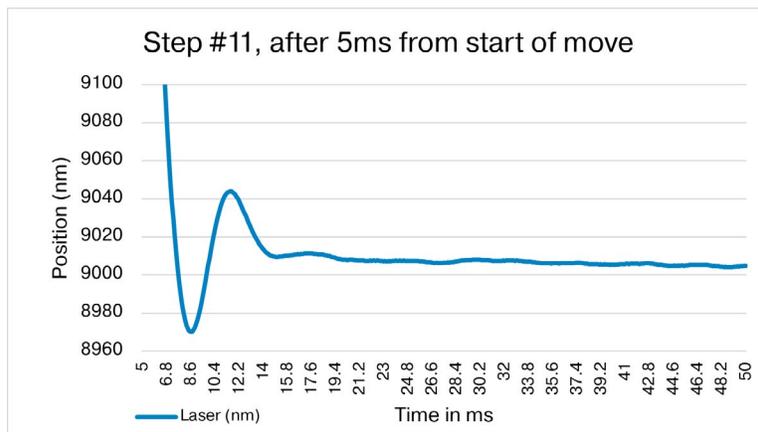
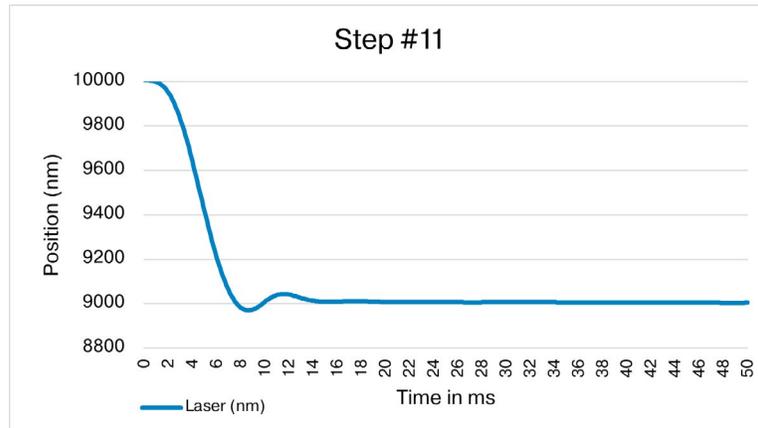
ZFA Series Nano Positioner

Step and Settle Response: Step Nine



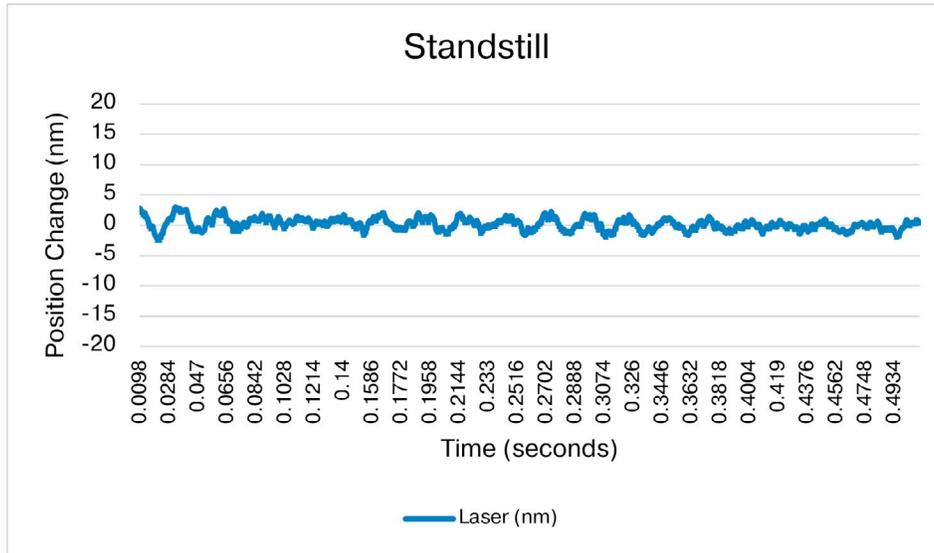
ZFA Series Nano Positioner

Step and Settle Response: Step Eleven



ZFA Series Nano Positioner

Standstill Stability



Note: Possible performance highly dependent on other system design factors, including drive and control. Contact factory for details.

ZFA Series Nano Positioner

Motor Specifications

	Units	
Stall Force Continuous ¹	N	4.19
Stall Current Continuous ¹	Amps	1.35
Peak Force ⁴	N	10.00
Peak Current ⁴	Amps	3.23
Voltage Constant ²	Volts/m/s	3.10
Force Constant ²	N/ Amps	3.10
Resistance ⁸	Ohms	3.50
Inductance ³	mH	1.05
Maximum Bus Voltage	Volts DC	50
Thermal Resistance Winding-Ambient	°C/watt	9.43
Thermal Resistance Winding-Case	°C/watt	3.30
Thermal Resistance Case-Ambient	°C/watt	6.13
Motor Thermal Time Constant ⁶	Minutes	1.80
Winding Thermal Time Constant ⁷	Minutes	1.20
Electrical Time Constant ⁵	Millisecs	0.30
Rated Winding Temperature	°C	100
Rated Ambient Temperature	°C	25

1. @ 25°C ambient, 100°C winding temperature

2. Measured Line to Line, +/- 10%

3. Inductance measurement @1Khz (Coil fully inside magnet stator housing)

4. Initial winding temperature must be 60°C or less before Peak Current is Applied

5. Time for motor value to reach 63% of its final current after a step change in voltage

6. Time the motor takes to reach 63% of its final temperature, given constant power

7. Time for the winding to reach 63% of its final temperature rise above the rest of the motor, given constant power

8. Measured between motor leads at 25°C. At 100°C, multiply resistance by 1.295 (75°C rise * 0.393%/°C)



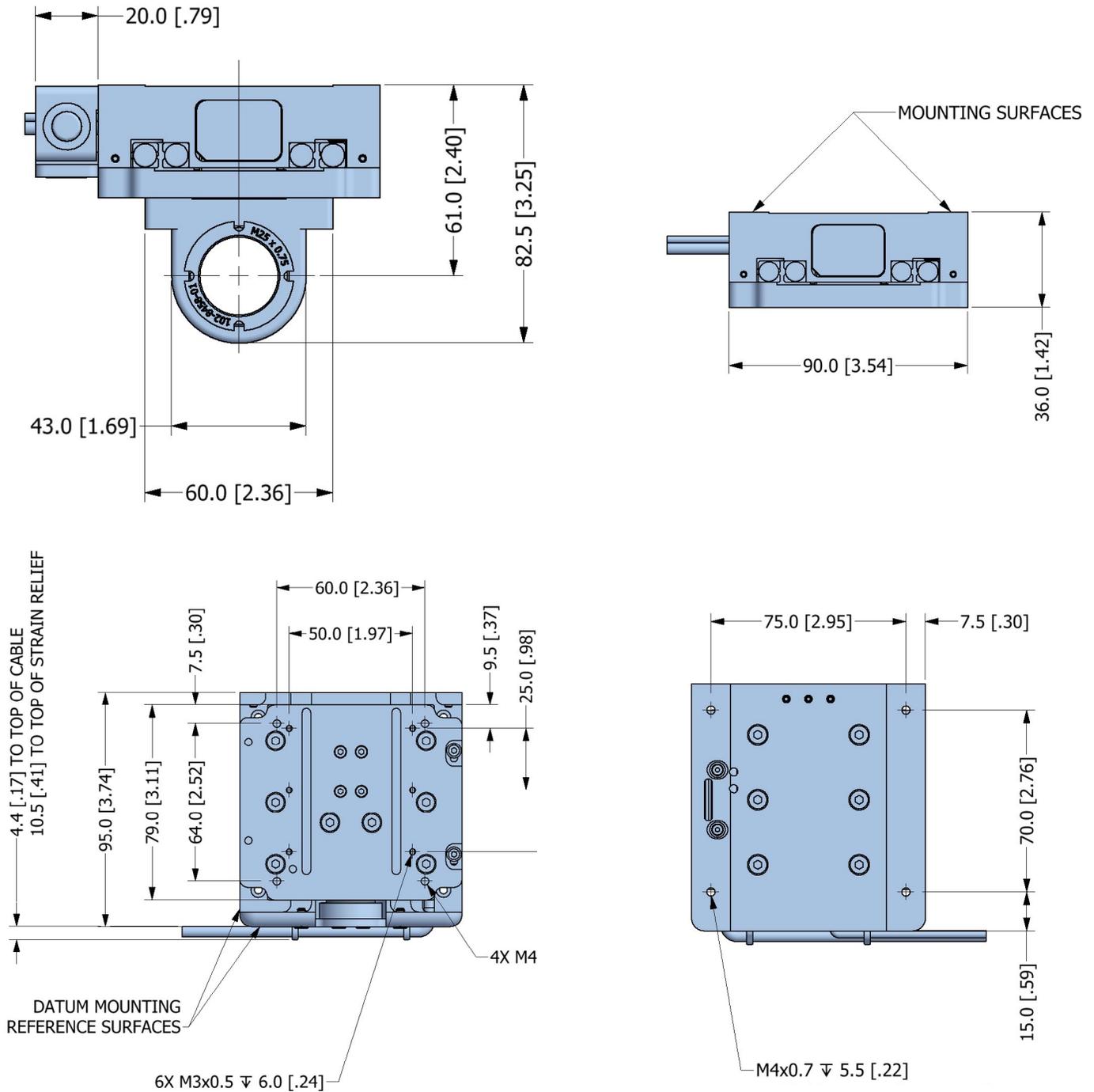
ZFA Series Nano Positioner

Encoder Specifications

Encoder	Type	Resolution	Scale Accuracy, un-mapped (+/- $\mu\text{m}/\text{m}$)	Clock Speed (MHz)	Supply Voltage (V)	Current (mA)	Scale Thermal Expansion ($\mu\text{m}/\text{m}/^\circ\text{C}$)
E5	Digital Incremental (Differential)	2.5 nm	5	20	5 -5%/+10%	200	10.1
SC	1V P-P Sin/Cos Incremental (Differential)	20 μm / Controller DAC	5	n/a	5 +/-10%	100	10.1

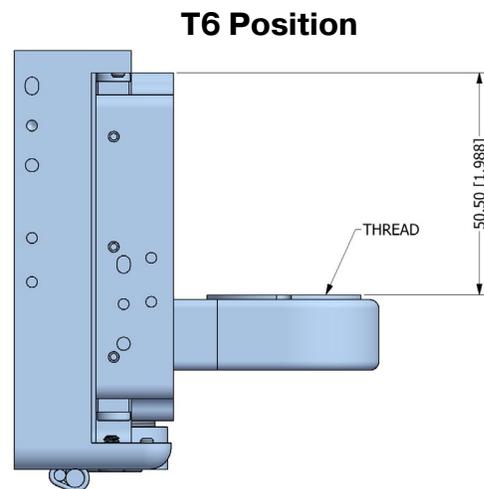
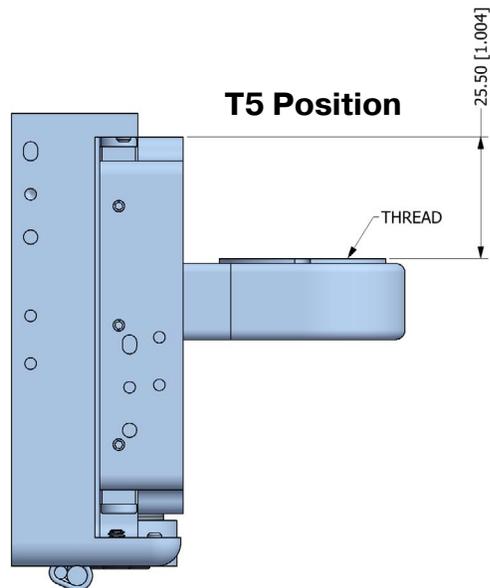
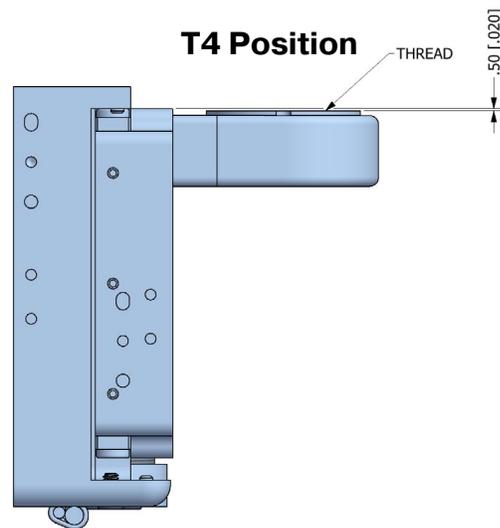
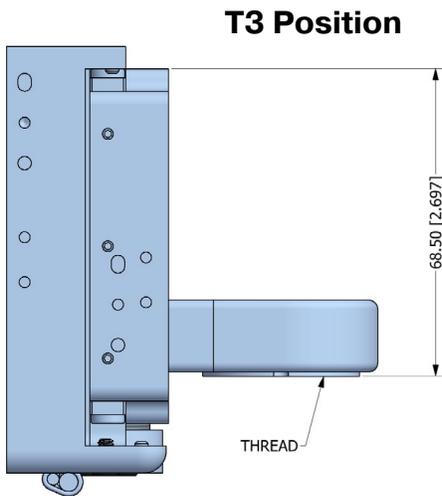
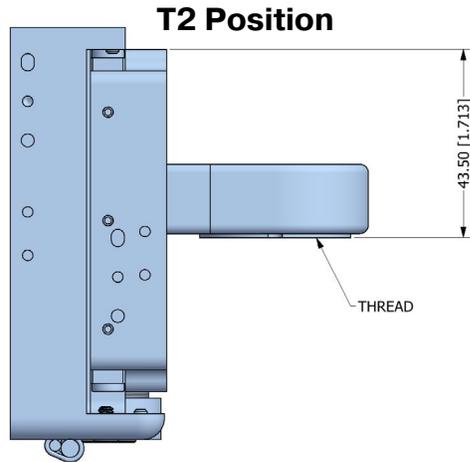
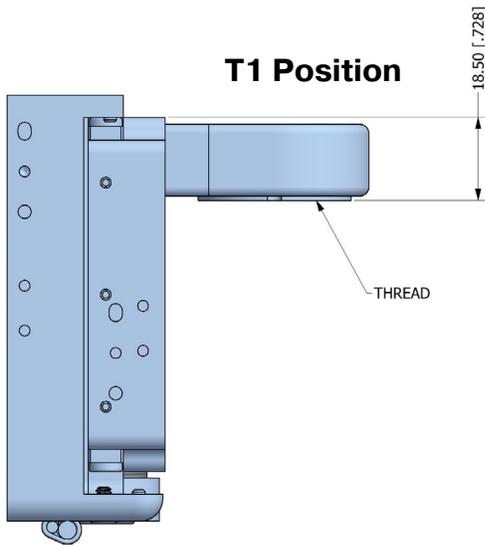
ZFA Series Nano Positioner

Dimensions – mm [in]



ZFA Series Nano Positioner

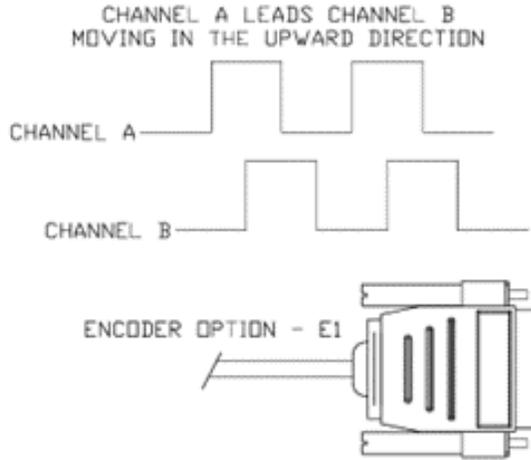
Objective Positions Dimensions – mm [in]



ZFA Series Nano Positioner

ZFA Feedback Cable Specifications

ZFA E1 Encoder Option - Digital Encoder Connector Pinout

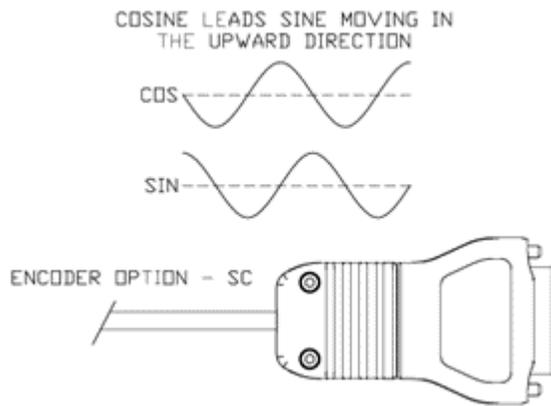


Digital Encoder With 15 Pin Male D-SUB			
Color	AWG	PIN #	Function
BRN	32	7, 8	5V
WHT	32	2, 9	0V
RED	32	14	A+
BLU	32	6	A-
YEL	32	13	B+
GRN	32	5	B-
VLT	32	12	Z+
GRY	32	4	Z-
PNK	32	11	NO CONNECT
BLK	32	10	NO CONNECT
ORG	32	3	E
CLR	32	1	CAL
SHLD		CASE	SHLD

ZFA E1 Encoder Option - Specification

Description	Specification
+5VDC Supply Voltage	-5%/+10% with a maximum current of 200mA

ZFA SC Encoder Option - Analog Encoder Connector Pinout



Digital Encoder With 15 Pin Male D-SUB			
Color	AWG	PIN #	Function
BRN	32	4, 5	5V
WHT	32	12, 13	0V
RED	32	9	COS+
BLU	32	1	COS-
YEL	32	10	SIN+
GRN	32	2	SIN-
VLT	32	3	Z+
GRY	32	11	Z-
PNK	32	7	NO CONNECT
BLK	32	8	NO CONNECT
ORG	32	14	CAL
CLR	32	6	SETUP
SHLD			INNER SHLD
SHLD		CASE	OUTER SHLD

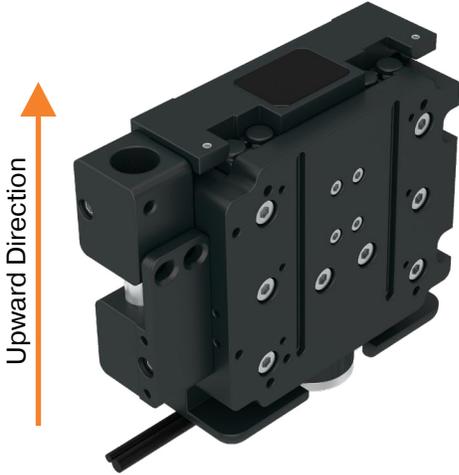
ZFA SC Encoder Option - Specification

Description	Specification
+5VDC Supply Voltage	+/- 10% with a maximum current of 100mA

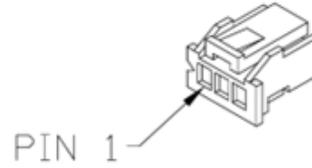
ZFA Series Nano Positioner

ZFA Power Cable Specifications

Stage Direction



Motor Connector Input

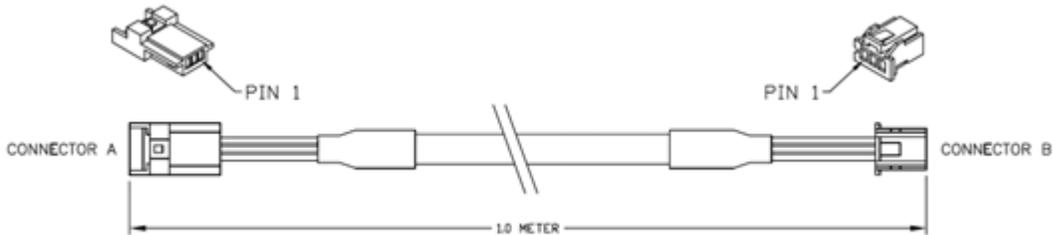


Motor Power Connector			
Color	AWG	PIN #	Function
BLK	24	3	PHASE N
RED	24	2	PHASE P
DRAIN	24	1	DRAIN

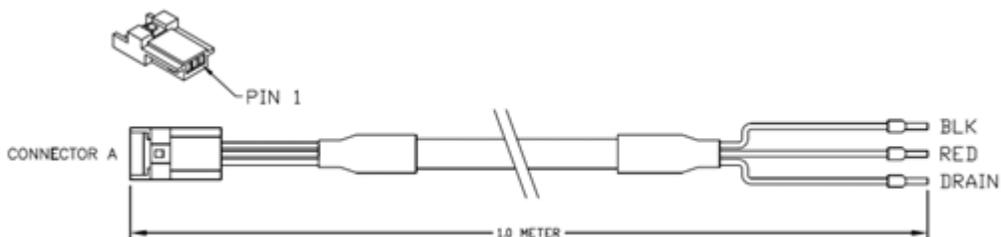
Feedback Extension Cable - 15 Pin D-Sub Male to Female

Parker Part Number	L-Com Part Number	Description
003-5430-1	CSM15MF-1	Cable, DB15M/F Molded, 1.0Ft
003-5430-2.5	CSM15MF-2.5	Cable, DB15M/F Molded, 2.5Ft
003-5430-5	CSM15MF-5	Cable, DB15M/F Molded, 5.0Ft

Motor Extension Cable Male to Female - 006-2983-01.00



Motor Extension Cable Flying Leads - 006-2982-01.00



ZFA Series Nano Positioner

Ordering Information

Fill in an order code from each of the numbered fields to create a complete part number

Order Example: ① ② ③ ④ ⑤ ⑥ ⑦ ⑧
ZFA 090 - 09 E1 - V - P3 T5 - 1000

① **Series**

ZFA Series

② **Base Size (width in mm)**

090 90 mm Base

③ **Travel**

09 9 mm Travel

④ **Encoder Option**

E1 Digital 2.5 nm resolution

SC Sine / Cosine

⑤ **Travel Orientation**

H Horizontal

V Vertical

⑥ **Objective Bracket Position**

P0 None

P1 Bracket Top/ Objective Down

P2 Bracket Middle/ Objective
Down

P3 Bracket Bottom/ Objective
Down

P4 Bracket Top/ Objective Up

P5 Bracket Middle/ Objective Up

P6 Bracket Bottom/ Objective
Up

⑦ **Objective Thread**

T0 M32 X 0.75 - No Adapter

T1 M25 X 0.75

T2 M26 X 0.706

T3 M27 X 0.75

T4 M27 X 1

T5 SM1 (1.035 - 40 / UNS 2B)

T6 RMS (0.800" - 36 / UNS 2B)

⑧ **Objective Mass**

XXXX Objective Mass in Grams

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