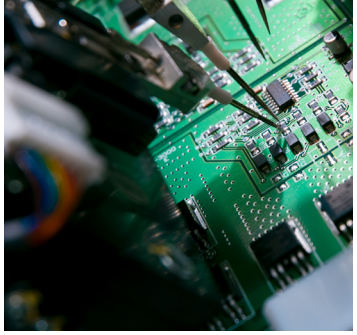
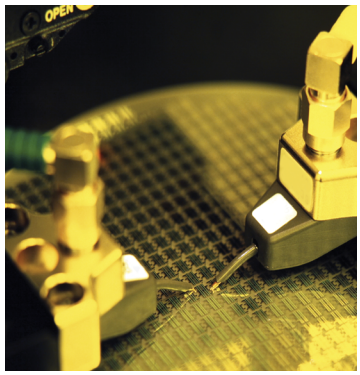
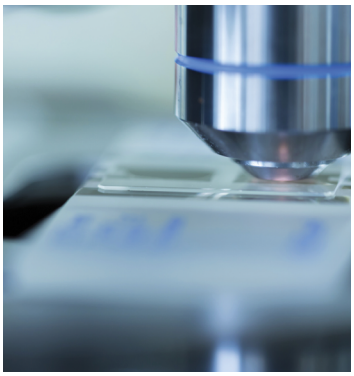
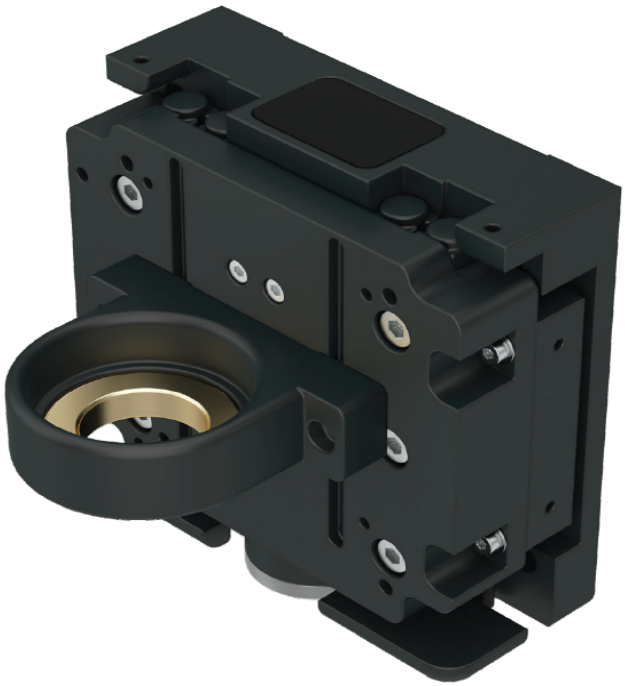


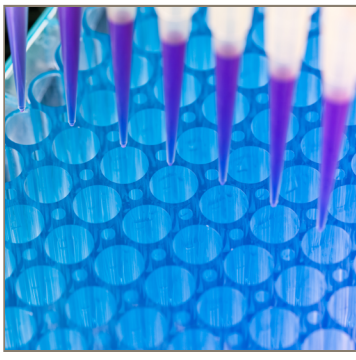






ZFA Series

Optomechanical Focusing Nano Positioner



Parker

ENGINEERING YOUR SUCCESS.

ZFA Series Nano Positioner

IMPORTANT USER INFORMATION: WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE

This document and other information from Parker Hannifin Corporation, its subsidiaries, and authorized distributors provide product and/or systems options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these product systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuming that all performance, safety, and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

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ZFA Series Nano Positioner

Release History

MANUAL NO. : 102-8631
REV: 002
EFFECTIVE: 11/15/2024
SUPERSEDES: 10/22/2024

REV 001: Initial Release
REV 002: Minor edits to the table on page 17. Added in a new cable specifcation page that is now on page 16.

ZFA Series Nano Positioner

Thank you for your interest in the products and systems offered by Parker Hannifin Electronic Motion and Controls Division.

Introduction

For builders of machinery and instruments seeking smooth motion, high stability, and rapid step and settle performance, Parker offers the ZFA series. ZFA is a voice coil driven positioner that provides nano meter level stability. Units are offered with internal or external non-contact magnetic counterbalance assemblies to support a wide range of objective masses in vertical orientations.

General Information

This guide is designed to offer general information about ZFA, which includes safety instructions, integration, basic maintenance tips and key features. As the ZFA is a configurable product, please note that not all information may be relevant to your specific product.
For general questions or challenges please contact your local Parker distributor, or our factory support team at 800-245-6903

It is the ultimate responsibility of the end user to ensure that Equipment is installed an operated in accordance with both local and federal safety codes and guidelines. The user must ensure that the attachment of work pieces/tools or other devices to the product does not endanger persons and/or property. The ZFA is intended for use in clean lab/instrument environments. It is the ultimate responsibility of the end user to ensure acceptable environmental conditions are maintained at all times.

If you have any questions or challenges please contact our factory support team at 800-245-6903.

Return Information

Parker offers warranty and non-warranty factory service. All returns must reference a "Return Material Authorization" (RMA) number that is obtained by your local Parker distributor.

Distribution channels request RMA's Online via Parker's sales portal (parkermotion.com/extranet) or contact Parker's customer service for additional support: emn.service@support.parker.com / 800-245-6903.

ZFA Series Nano Positioner

Unpacking and General Installation

Carefully remove the positioner from the shipping container and inspect the unit for any evidence of shipping damage. On heavier units (>40lb), 4 lifting lugs will be assembled on the unit. Use these to remove the positioner from the shipping container. Once removed the 4 lifting lugs must be disassembled from the positioner. Report any damage immediately to your local authorized distributor. Please save the shipping container for damage inspection or future transportation.

Incorrect handling of the positioner may adversely affect the performance of the unit in its application.

Please observe the following guidelines regarding your new positioner:

Proper mounting of the actuator is required to reduce risk of injury and provide optimal performance.

Positioner's should be mounted to a flat, stable surface.

DO NOT allow the positioner to drop onto the mounting surface. Dropping the positioner can generate impact loads that may result in flat spots on bearing surfaces or misalignment of drive components.

DO NOT drill holes into the positioner. Drilling holes into the positioner can generate particles and machining forces that may effect the operation of the positioner.

DO NOT subject the unit to impact loads such as hammering, riveting, etc. Impacts loads generated by hammering or riveting may result in flat spots on bearing surfaces or misalignment of drive components.

DO NOT expose positioner to mist, spray or submersion in liquids.

DO NOT disassemble positioner. Unauthorized adjustments may alter the positioner's specifications and void the product warranty.

DO NOT lift the positioner by cables. The unit should be lifted by the body structure only.

ZFA Series Nano Positioner

Warnings and Precautions

Hot Surfaces
DO NOT touch motor coils located in the positioner after high duty operation. Motor temperature may approach 60 degrees Celsius. The unit itself may become warm or hot to the touch.

Electrical Shock
DO NOT take apart or touch any internal components of the positioner while unit is under power. SHUT OFF power before replacing components to avoid electrical shock.

High Magnetic Field
Unit may be HAZARDOUS to people with Pace Makers or any other magnetically sensitive medical devices. Unit may have an effect on 'magnetically sensitive applications.

Ferrous Materials
The positioner will NOT keep out small ferrous materials in applications with air born metallic particles. The customer must take additional precautions in these applications to prevent intrusion of these ferrous particles.

Strain Relieve Electrical Components
All electrical components such as motor and encoders must be strain relieved. Failure to strain relieve electrical wires or cables may result in component failure.

Pinch Points
Unit has pinch point between moving elements relative to stationary elements. Proper care should be exercised.

Dismantling and Disposal
Properly dispose of product and components in accordance with national and international regulations and laws.

ZFA Series Nano Positioner

EMC Directive 2014/30/EU

A Highly-Immune, Low-Emission Installation – Meeting the Requirements of the Electromagnetic Compatibility (EMC) Directive

Refer to drive and control manufacturers EMC Installation requirements. Some of the requirements are listed below but are not all inclusive.

To reduce the risk of electrical noise entering your system you must properly earth ground the enclosure, and remove all paint and other non-conductive surface coatings from the panel mounting surface and RF earth bonding locations. If you mount a drive in an equipment cabinet, terminate cable braids (screens) at the entrance of the enclosure. The only exception is for the motor braid, which must return to the drive's R-Clamp.

Do not return the motor braid to any other location as its function is to return high frequency chopping current back to the drive. This may require mounting an auxiliary connector on a sub-panel insulated from the main cabinet, or using a connector having an insulated internal screen from the connector housing. The shields of all other cables that enter or exit the enclosure must be RF bonded to the enclosure entrance point using an R-Clamp, bulkhead clamshell clamp, or other 360° bonding technique. This ensures that no stray noise will enter or exit the enclosure. Refer to the amplifier and motion control electronics installation instructions for specific requirements on meeting EMC compatibility.

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 25ºC. At 100ºC, multiply resistance by 1.295 (75ºC rise * 0.393%/ºC)

ZFA Series Nano Positioner

Environmental Specifications	
Storage and Transport Humidity Range	10-95% Non Condensing 45
Operation Temperature to Achieve Product Specifications	20 Degrees C +/-1 Degrees C
Operation Temperature Range for Basic Motion[1]	5 to 40 Degrees C
Operational Humidity Range	10-95% Non Condensing
Cleanliness	Operating area is to be clean and free of particulation.

[1] Minimum to maximum continuous operating temperature range with NO guarantee of any specification except motion. Higher temperature will reduce continuous force capability.

Mounting Surface Requirements
Proper mounting of the ZFA is essential to optimize product performance. All specifications are based on the following conditions:
• The positioner must be bolted down to a flat surface which supports the entire length of the base using all mounting holes provided. • To meet catalog specifications the surface must have a flatness error less than or equal to 0.005mm over base mounting surface.

ZFA Series Nano Positioner

Performance Specifications

General Specifications	Units:	Parker ZFA
Travel Range:	mm	**9**
Travel (Min. Hard Stop to Hard Stop)	mm	9.5
Max Travel (Hard Stop to Hard Stop)		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)
Objective payload capacity Range (with internal Counterbalance)	Please note that this is for upward bias units and no objective bracket/adapter	
Objective payload capacity Range (with optional external Counterbalance)		

(1). Measured at optical center line.
(2). With 2.5nm resolution encoder.
(3). Mounting to a frame with Minimum Natural Frequency >1KHz and mounting surface flatness of 8 microns or better.
(4). Possible performance highly dependent on other system design factors, contact factory for details.

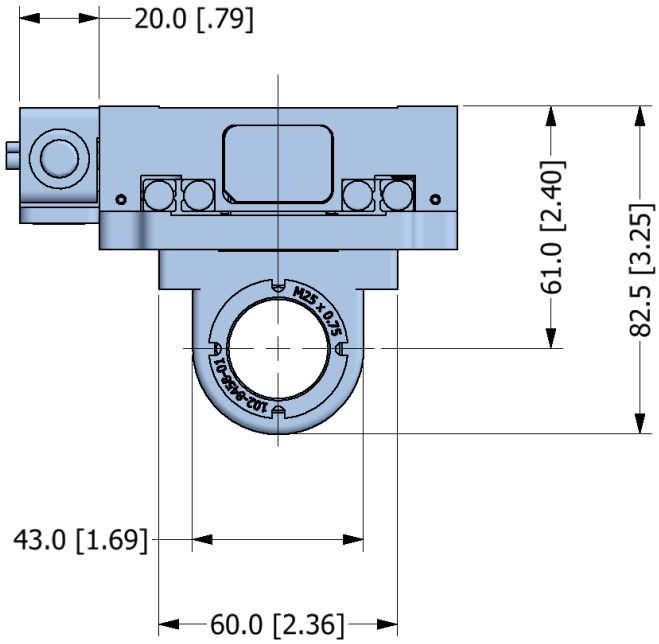
ZFA Series Nano Positioner

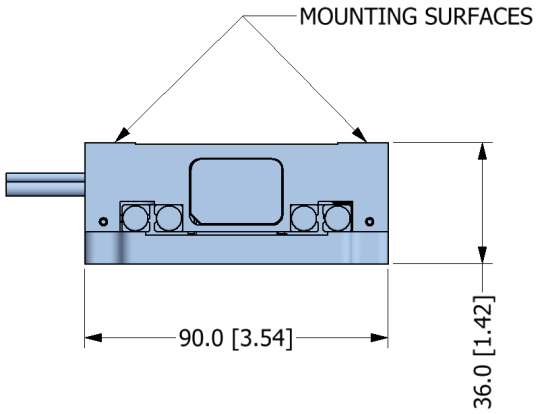
Encoder Specifications

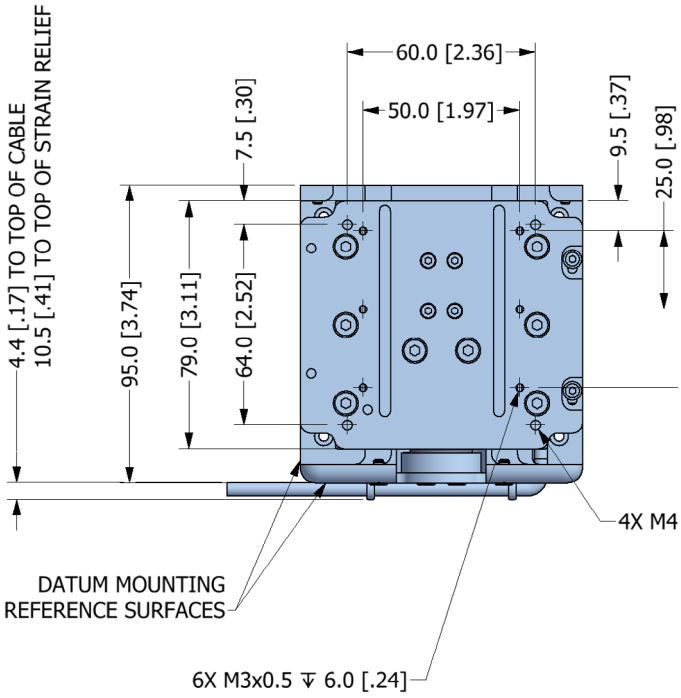
Encoder	Type	Resolution	Scale Accuracy, un-mapped (+/-µm/m)	Clock Speed (MHz)	Supply Voltage (V)	Current (mA)	Scale Thermal Expansion (µm/m/°C)
E1	Digital Incremental (Differential)	2.5 nm	5	20	5 -5%/+10%	200	10.1
SC	1V P-P Sin/Cos Incremental (Differential)	20 µm / Controller DAC	5	n/a	5 +/-10%	100	10.1

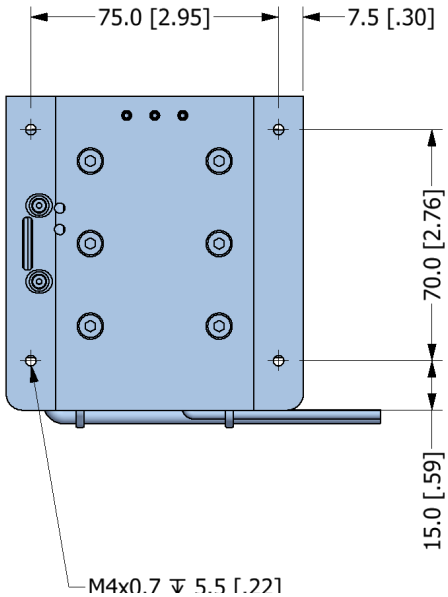
ZFA Series Nano Positioner

Dimensions – mm [in]





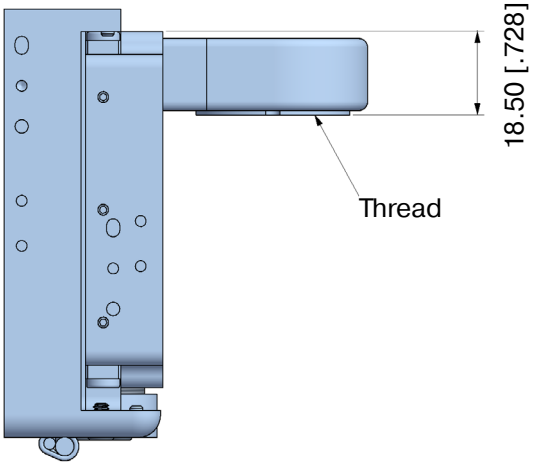




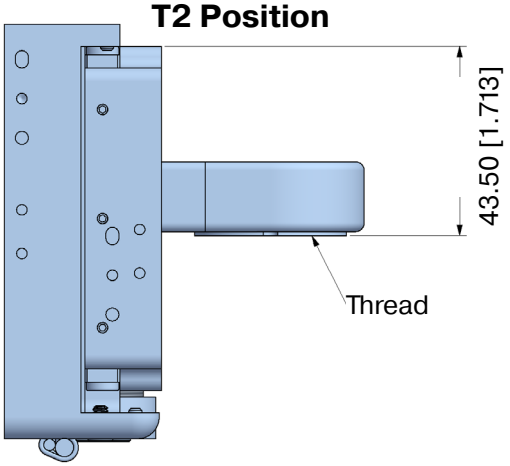
ZFA Series Nano Positioner

Objective Positions Dimensions – mm [in]

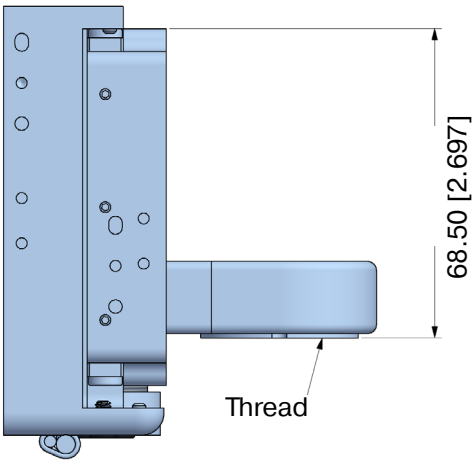
T1 Position



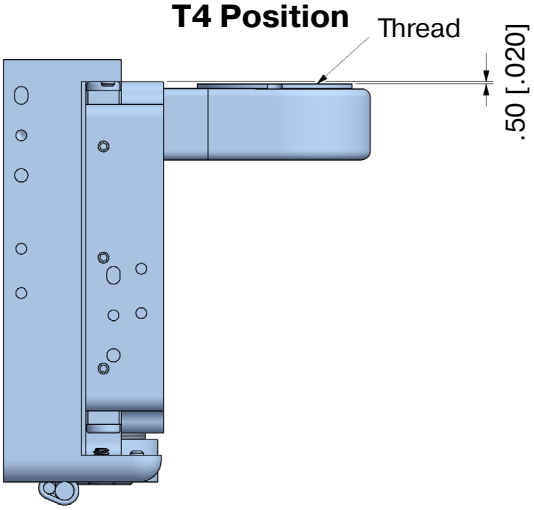
T2 Position



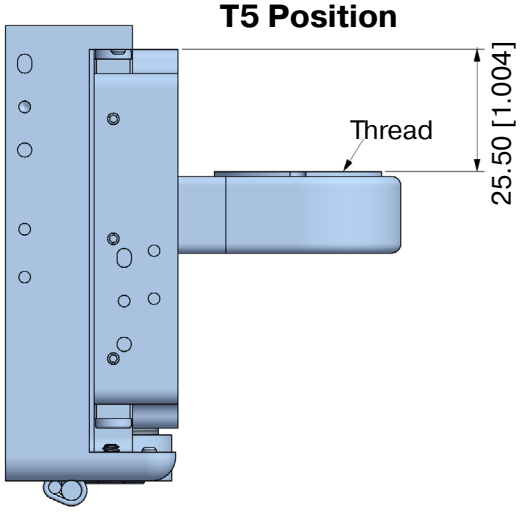
T3 Position



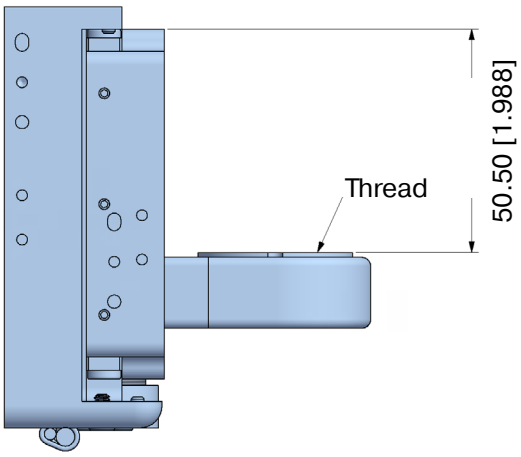
T4 Position



T5 Position



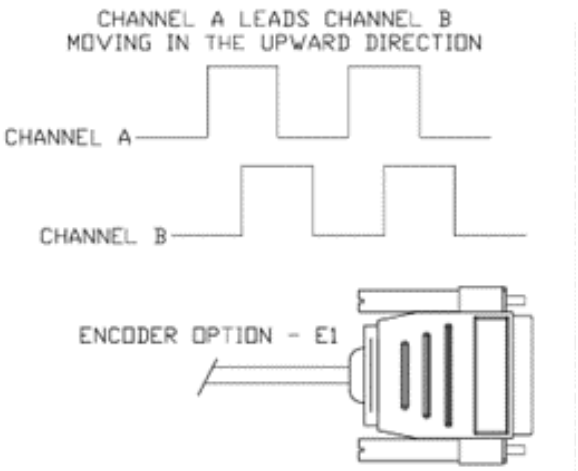
T6 Position



ZFA Series Nano Positioner

ZFA Feedback Cable Specifications

ZFA E1 Encoder Option - Digital Encoder Connector Pinout

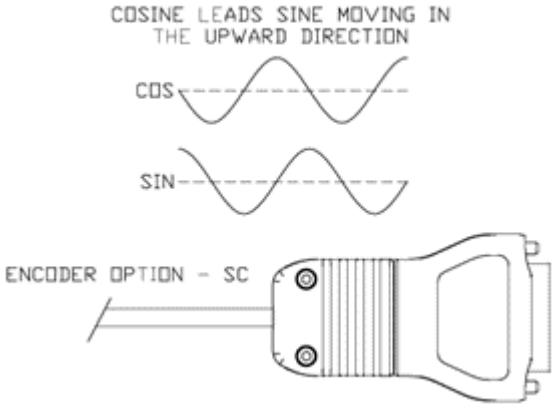


Digital Encoder With 15 Pin Male D-SUB			
Color	**AWG**	**PIN #**	**Function**
BRN	32	7, 8	5V
WHT	32	2, 9	0V
RED	32	14	A+
BLU	32	6	A-
YEL	32	13	B+
GRN	32	5	B-
VLT	32	12	Z+
GRY	32	4	Z-
PNK	32	11	NO CONNECT
BLK	32	10	NO CONNECT
ORG	32	3	E
CLR	32	1	CAL
SHLD		CASE	SHLD

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

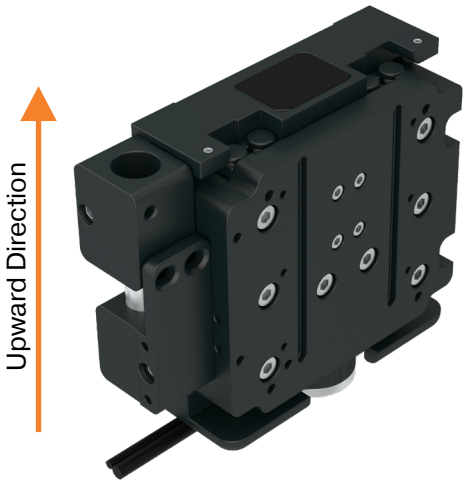
ZFA Accessories

Part Number	Description
102-8457-01	Objective Bracket (M32x0.75 Thread)
102-8458-01	Objective Adapter (M25x0.75 Thread)
102-8458-02	Objective Adapter (M26x0.706 Thread)
102-8458-03	Objective Adapter (M27x0.75 Thread)
102-8458-04	Objective Adapter (M27x1.00 Thread)
102-8458-05	Objective Adapter (SM1 Thread)
102-8458-06	Objective Adapter (RMS Thread)

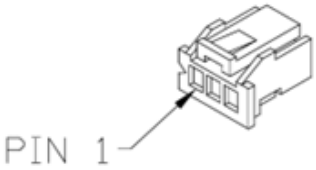
ZFA Series Nano Positioner

ZFA Power Cable Specifications

Stage Direction



Motor Connector Input

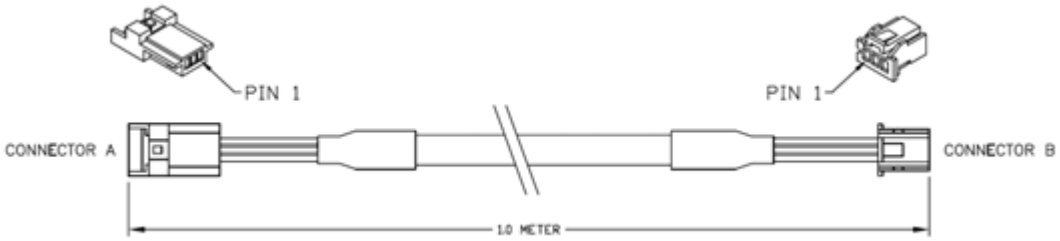


Motor Power Connector			
Color	**AWG**	**PIN #**	**Function**
BLK	24	3	PHASE N
RED	24	2	PHASE P
DRAIN	24	1	DRAIN

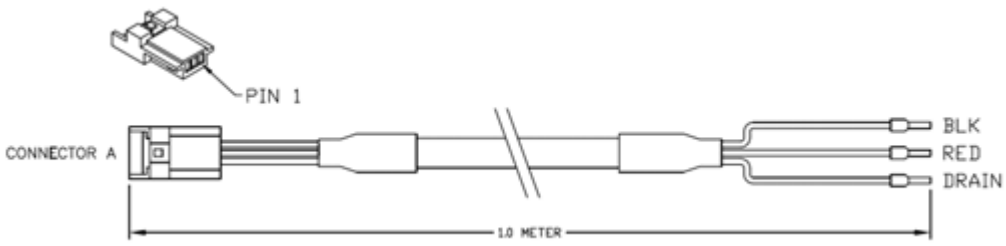
Feedback Extension Cable - 15 Pin D-Sub Male to Female

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	– E5	– 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**

E5	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

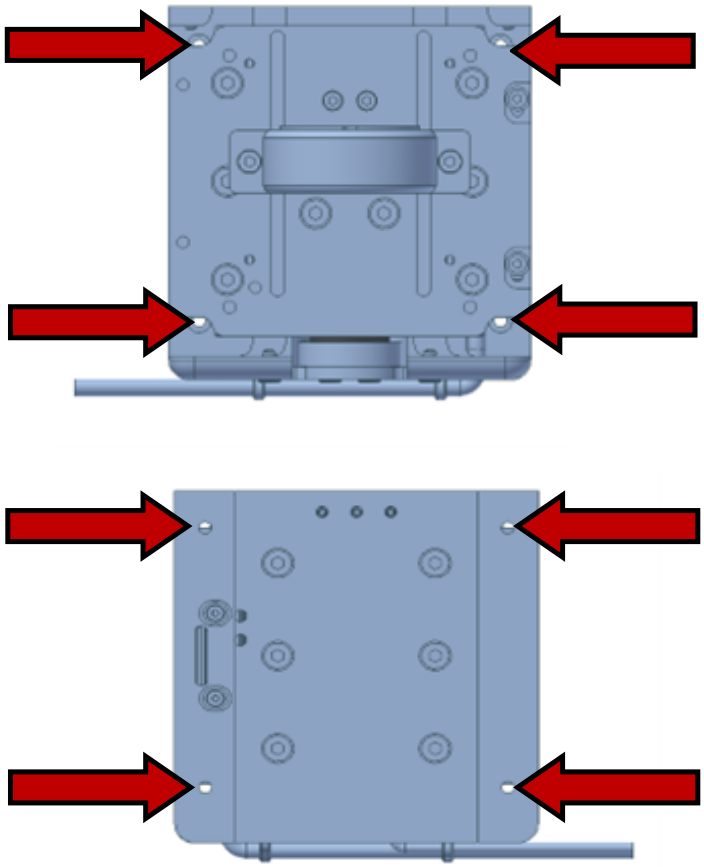
ZFA Series Nano Positioner

Stage Mounting

The ZFA mounting locations are accessible from both the front and back of the stage. From the front, there are four counterbores located in the corners, see Figure 1 below, that are for M3 socket head cap screws. From the back, the holes are tapped for M4 socket head cap screw mounting.

Before you begin any motion of the positioner, the shipping strap (for internal counterbalance only models) or shipping bolt (external counterbalance models) needs removed. See Figures 2 and 3 below.

Figure 1:



ZFA Series Nano Positioner

Stage Mounting

Figure 2:

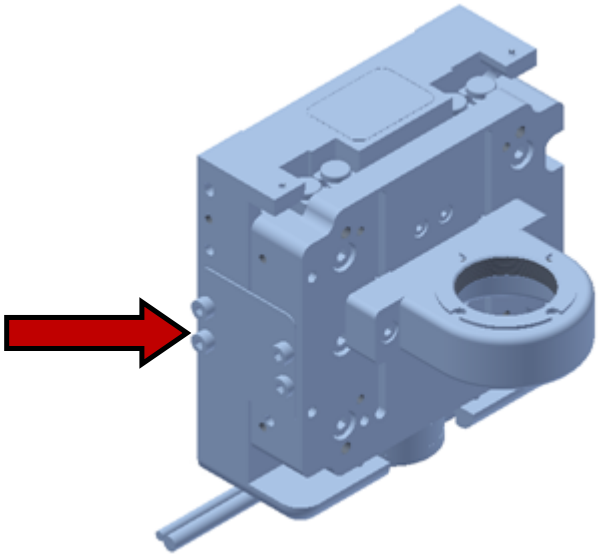
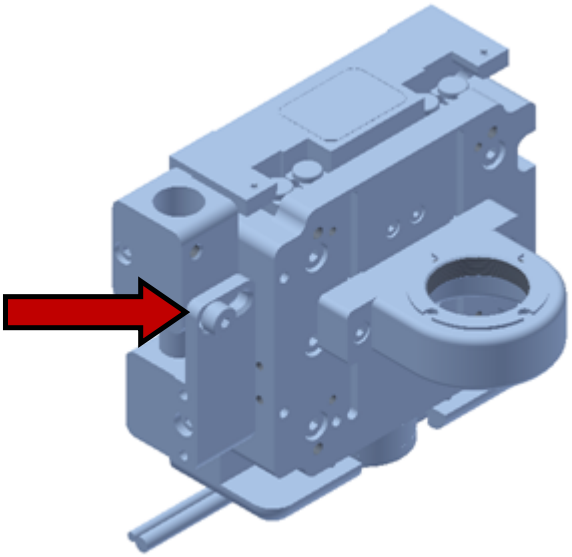


Figure 3:

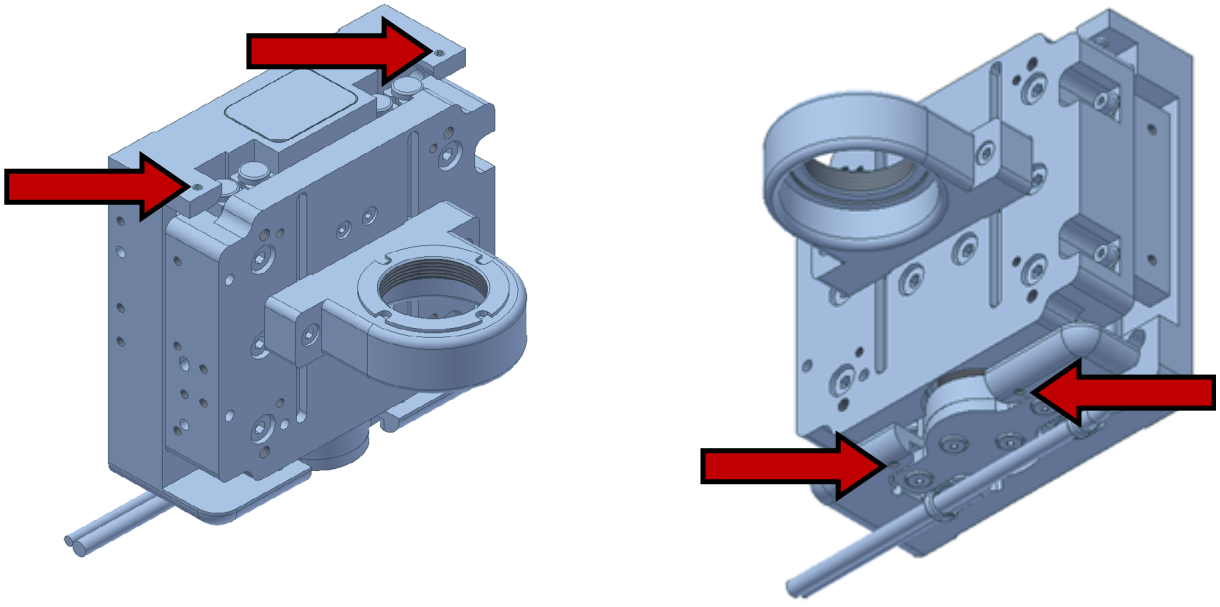


ZFA Series Nano Positioner

Stage Mounting

Figure 4: Hard Stop Adjustment

The ZFA gets a minimum of 9.5mm travel hardstop to hardstop. In the ship kit that comes with the stage, there are flat point M3 set screws that can be used to limit that travel if desired. In the corners of the base, See Figure 4, those set screws can be installed to limit the travel of the stage from one end or the other or both. Take care that at each end the screws are adjusted in the same amount so that they contact the carriage evenly.



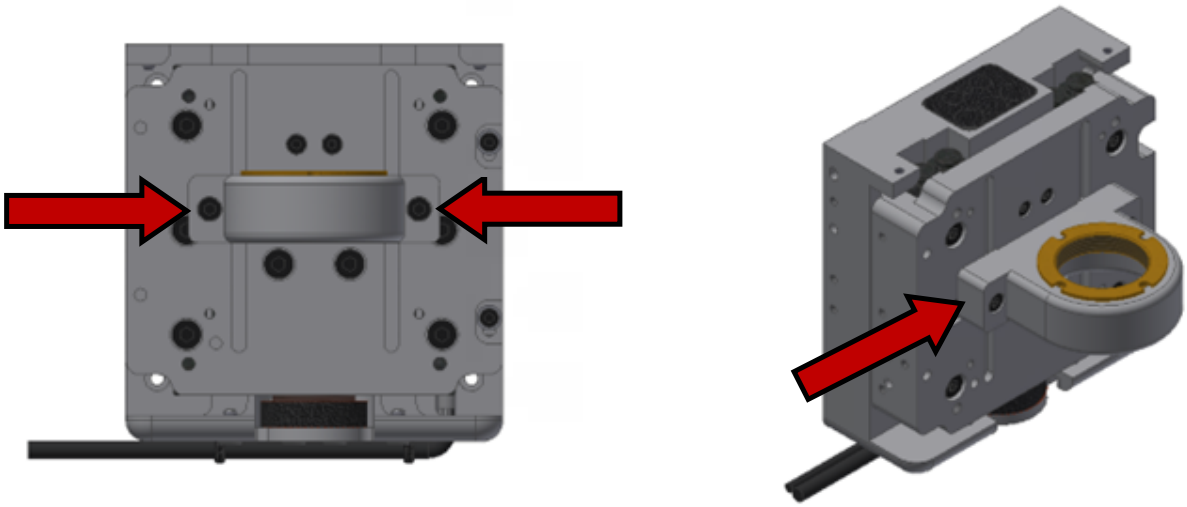
ZFA Series Nano Positioner

Stage Mounting

Objective Bracket and Adapter Mounting
The 102-8457-01 objective bracket can be mounted in one of three possible height locations using quantity 2 M3x0.5 socket head cap screws as shown in Figure 5 below. The bracket should be indexed to the right so that the keying feature in the objective bracket sits against the slot feature in the carriage. This will provide a starting point for objective alignment. If tighter alignment is required, the objective bracket can be indicated to be perpendicular to the travel path.

The 102-8458 objective adapters can simply be threaded into the objective bracket and tightened using a spanner wrench.

Figure 5:



Parker Hannifin Corporation
Electronic Motion and Controls Division
1140 Sandy Hill Road
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1-800-245-6903

DECLARATION OF INCORPORATION

ACCORDING TO EC DIRECTIVE 2006/42/EC (ANNEX II, PART 1, SECTION B) FOR PARTLY COMPLETED MACHINERIES

MANUFACTURER	**Parker Hannifin Corporation**
AUTHORIZED PERSON	**Brian Favero**
ADDRESS	**Electronic Motion and Controls Division** **1140 Sandy Hill Road** **Irwin, PA 15642**
PRODUCT	ZFA Series Positioners
MODEL/TYPE	ZFA090
YEAR OF MANUFACTURE	From: 2024

The above mentioned Manufacturer/Authorized person declare that the product is complying with the following essential requirements of the machinery directive 2006/42/EC.
Annex 1, Article 1.1.1, 1.1.2, 1.1.3, 1.1.5, 1.3.1, 1.3.2, 1.3.3, 1.3.4, 1.3.7, 1.4.1, 1.5.4, 1.5.8, 1.6.1

EN ISO 12100	Safety Of Machinery - General Principles For Design - Risk Assessment And Risk Reduction
EN 60034-1:2010	Rotating electrical machines – Part 1: Rating and performance
EN 60034-5 Ed. 4.1 b:2006	Rotating electrical machines – Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) – Classification
IEC 60034-18-1 Ed. 2.0 b:2010	Rotating Electrical Machines - Part 18-1: Functional Evaluation Of Insulation Systems - General Guidelines
IEC 60204-1:2005+A1:2008	Safety Of Machinery - Electrical Equipment Of Machines - Part 1: General Requirements
IEC 60085 Ed. 4.0 b:2007	Electrical insulation – Thermal evaluation and designation
RoHS 3 (EU 2015/863)	Restriction of the use of certain hazardous substances

These products must be installed and operated with reference to the instructions in the Product Manual. All instruction, warnings and safety information of the Product Manual must be adhered to.

The partly completed machinery must not be put into service until the final machinery, into which it is to be incorporated, has been declared in conformity with the provisions of directive 2006/42/EC on machinery.

The machinery related special technical documentation according annex VII B has been created

The manufacturer commits to transmit, in response to a reasoned request by the market surveillance authorities, relevant documents on the partly completed machinery electronically by our documentation department. The intellectual rights of the manufacturer of the incomplete machine are not affected.

Brian Favero, Engineering Manager
November 22, 2024

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Parker Hannifin Corporation
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1140 Sandy Hill Road
Irwin, PA 15642
1-800-245-6903

UKCA DECLARATION OF CONFORMITY

In accordance with UK Government guidance

MANUFACTURER	**Parker Hannifin Corporation**
AUTHORIZED PERSON	**Brian Favero**
ADDRESS	**Electronic Motion and Controls Division** **1140 Sandy Hill Road** **Irwin, PA 15642**
PRODUCT	ZFA
MODEL/TYPE	ZFA090
YEAR OF MANUFACTURE	From: 2024

The object of the declaration described above is in conformity with the relevant UK Statutory Instrument (and their amendments):

2016 No. 1091	The Electromagnetic Compatibility Regulations 2016
2008 No. 1597	Supply of Machinery (Safety) Regulations 2008
2012 No. 3032	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

These products must be installed and operated with reference to the instructions in the Product Manual. All instruction, warnings and safety information of the Product Manual must be adhered to.

The partly completed machinery must not be put into service until the final machinery, into which it is to be incorporated, has been declared in conformity with the provisions of directive “Supply of Machinery (Safety) Regulation 2008”.

The manufacturer commits to transmit, in response to a reasoned request by the market surveillance authorities, relevant documents on the partly completed machinery electronically by our documentation department. The intellectual rights of the manufacturer of the incomplete machine are not affected.

This Declaration is issued under the sole responsibility of the manufacturer.

Brian Favero, Engineering Manager
November 22, 2024

ENGINEERING **YOUR** SUCCESS

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