microTRITOR / miniTRITOR

Compact 3-D translation stages

Concept:

With the microTRITOR and miniTRITOR series, **piezosystem jena** offers 3D nanopositioning stages of the smallest size available. The dimensions of 15x15x15 mm^3 and a motion range of 9 µm per axis make the microTRITOR the smallest 3D stage available on the market. The unique design of the flexure hinges allows for excellent usability with zero friction.

The miniTRITOR has dimensions of 19x19x16 mm^3 and can achieve a stroke of 38 µm per axis. The hinge flexure design provides completely frictionless motion without any mechanical play. The high stiffness, in combination with excellent straightness of motion, make the TRITOR series ideal for high precision positioning in the nano meter range for optics, laser-technique, and any other type of high resolution positioning applications.

Specials:

These stages are only built in an open loop version, without a high resolution feedback sensor and are therefore ideally suited for applications where speed and response time are essential. Piezo electrical actuators can act much faster, and with a higher accuracy to signal change, than any motorized drive available. The resolutions of piezo electrical actuators are only limited by the signal noise of the control system. This makes these systems an excellent choice for positioning applications in fiber alignment, optics, wafer handling, medical equipment, etc. Dynamic scan applications are a typical utilization for the elements of the TRITOR series. The simultaneous motion, available in X, Y, and Z directions, offers a large degree of freedom during use. All stage in the TRITOR series can be made with special materials for extraordinary applications such as vacuum or cryogenic applications.

Interfaces:

All stages are constructed with a top and a bottom plate. Thorough holes are used for fixing the stage which is important for all dynamic applications. On the top plate there are several pinholes and threaded holes available for mounting external components. The 3D elements are built with reliable piezo stack actuators with a flexible insulation that is well suited for high dynamic burden.

Image: microTRITOR

Product highlights:

- 3D nanopositioning stage
- compact design
- flexure hinge design without mechanical play
- motion range up to 38 µm
- ultra precise translation based on FEA-optimized parallelogram design
- highest positioning resolution

Applications:

- AFM and SFM microscopy
- fiber alignment
- beam steering/ optical technology
- CRYO-positioning tools

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microTRITOR / miniTRITOR

Technical data:

series TRITOR		unit	microTRITOR	miniTRITOR
part no.		-	T-400-00	T-401-00
axis		-	X, Y, Z	X, Y, Z
motion (±10%)*		µm	9	38
electrical capacitance per axis (±20%)**		µF	0.07	0.16
integrated measurement system		-	-	-
resolution***		nm	0.02	0.07
resonant frequency x/y/z		Hz	2100/2230/2290	540/600/500
stiffness		N/ µm	1.0	0.5
max. force generation x/y/z	**pull**	N	1/1/1	1/1/1
	push		10/10/10	9/9/9
voltage range		V	-20...+130	
connector		-	LEMO 0S.302	
cable length		m	1.2	1.2
material		-	stainless steel/ aluminum	
dimensions (LxWxH)		mm	15 x 15 x 15	19 x 19 x 16
weight		g	12	57

* typical value measured with NV 40/3 amplifier

** typical value for small electrical field strength

*** the resolution is only limited by the noise of the power amplifier and metrology

Additional Variations:

Product name	Description	Specials	Part. no.
microTRITOR Vacuum	Compatible for vacuum application down to 10^-7 hPA	60 cm cable length vacuum side; 2 m cable length air side	T-400-02
miniTRITOR Vacuum			T-401-02

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TRITOR 38

Compact 3-D translation stage

Concept:

With the release of the TRITOR series, **piezosystem jena** was the first company to offer compact 3D piezo-nanopositioning stages worldwide. The dimensions of 25 x 25 x 25 mm³ and a motion range of 38 µm per axis make the TRITOR 38 one of the smallest 3D stages available on the market. The unique design of the flexure hinges allows for excellent usability with zero friction. With a combination of high stiffness and excellent straightness of motion, the TRITOR series is ideal for high precision positioning in the nano meter range for optics, laser-technique, and any other type of high resolution positioning application.

Specials:

Piezo electrical actuators can act much faster, and with a higher accuracy, than any motorized drive available. The resolutions of piezo electrical actuators are only limited by the signal noise of the control system. Therefore, these systems are an excellent choice for positioning applications in fiber alignment, optics, wafer handling, medical equipment, etc. Dynamic scan applications are a typical utilization for the elements of the TRITOR series. The simultaneous motion, available in X, Y and Z directions, offers large freedom during use. All stages in the TRITOR series can be made with special materials for extraordinary applications such as vacuum or cryogenic applications.

Interfaces:

All stages are constructed with a top and a bottom plate. Through holes are used for fixing the stage which is important for all dynamic applications. On the top plate there are several pin holes and threaded holes for the mounting of external components.

The 3D elements are built with reliable piezo stack actuators, with a flexible insulation that is well suited for a high dynamic burden.

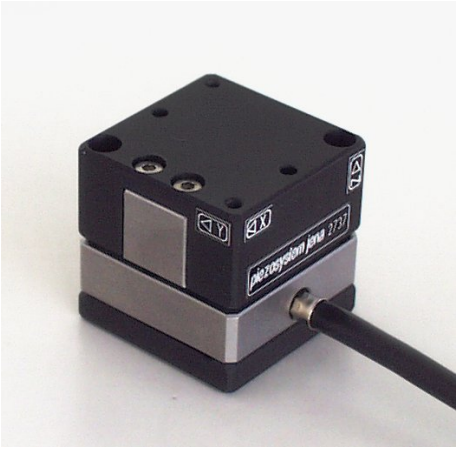

image: TRITOR 38

Product highlights:

- 3D nano positioning stage
- compact design
- flexure hinge design without mechanical play
- motion range up to 38 µm
- ultra precise translation based on FEA-optimized parallelogram design
- highest positioning resolution

Applications:

- AFM and SFM microscopy
- Fiber alignment
- Beam steering/optical technology
- Wafer stepper

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TRITOR 38

Technical data:

Series TRITOR		unit	TRITOR 38	TRITOR 38 SG
part no.		-	T-402-00	T-402-01
axes		-	X, Y, Z	
motion in open loop (±10%)*		µm	38	38
motion in closed loop (±0,2%)*		µm	-	30
electrical capacitance per axis (±20%)**		µF	0.7	
integrated measurement system		-	-	DMS
resolution***		nm	0.07	0.8
typ. repeatability		nm	-	22
typ. non linearity		%	-	0.1
resonant frequency x/y/z		Hz	630/685/915	
stiffness		N/µm	0.5/0.45/0.8	
max. force generation x/y/z	**pull**	N	2/2/3	
	push		19/17/30	
voltage range		V	-20...+130	
connector****	**voltage**	-	LEMO 0S.302	
	sensor	-	-	LEMO 0S.304
cable length		m	1.2	
material		-	stainless steel / aluminum	
dimensions (LxWxH)		mm	25 x 25 x 25	40 x 40 x 33.5
weight		g	115	130

* typical value measured with NV 40/3 amplifier
** typical value for small electrical field strength
*** the resolution is only limited by the noise of the power amplifier and metrology

******Additional Variations:**

Product name	Description	Specials	Part. No Suffix.
TRITOR 38 SG Digital	Version for digital controller series d-Drive and NV40/3 controller in combination with additional functionalities: Interchange ability, ASI	Connector Sub-D 15	T-402-01D
TRITOR 38 SG Extern	Version with sensor pre-amplifier for the use of additional functionalities: Interchange ability, ASI	Connector Sensor: ODU 4pin	T-402-01E
TRITOR 38 Vacuum	Compatible for vacuum applications down to 10^-7 hPa	60 cm cable length vacuum side; 2m cable length air side	T-402-02
TRITOR 38 Non magnetic	Compatible for magnetic sensitive applications e.g. Kerr Microscope		T-402-10

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TRITOR 100

Compact 3-D translation stage

image: TRITOR 100

Concept:

With the TRITOR series, **piezosystem jena** was the first company to offer 3D piezo-nanopositioning stages worldwide. The dimensions of 40 x 40 x 34 mm^3 and the motion range of 100 µm per axis make the TRITOR 100 one of the smallest 3D stages available on the market with integrated feedback sensors for closed loop control. The unique design of the flexure hinges allow for excellent usability with zero friction. High stiffness, in combination with excellent straightness of motion, make the TRITOR series ideal for high precision in the nano meter range for optics, laser-technique, and any other type of high resolution positioning application.

Specials:

Piezo electrical actuators can act much faster, and with a higher accuracy to a signal change, than any motorized drive available. The resolutions of piezo electrical actuators are only limited by the signal noise of the control system. Therefore, these systems are an excellent choice for positioning applications in fiber alignment, optics, wafer handling, medical equipment, etc. Each axis can be controlled separately in closed loop mode. An integrated sensor system is an available option that guarantees accuracy in the nano meter range. Dynamic scan applications are a typical utilization of the elements of the TRITOR series. The simultaneous motion, available in X, Y, and Z directions, offers a large degree of freedom during use. All stages of the TRITOR series can be made with special materials for extraordinary applications such as vacuum or cryogenic applications.

Interfaces:

All stages are constructed with a top and a bottom plate. Through holes are used for fixing the stage which is important for all dynamic applications. On the top plate there are several pin holes and threaded holes available for the mounting of external components. The 3D elements are built with reliable piezo stack actuators, with a flexible insulation that is well suited for a high dynamic burden.

Product highlights:

- 3D nano positioning stage
- compact design with integrated feedback sensors option
- flexure hinge design without mechanical play
- motion range up to 100 µm
- ultra precise translation based on FEA-optimized parallelogram design
- highest positioning resolution

Applications:

- AFM and SFM microscopy
- fiber alignment
- beam steering/ optical technology
- semiconductor technology

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TRITOR 100

Technical data:

series TRITOR		unit	TRITOR 100	TRITOR 100 SG	TRITOR 100 CAP
part no.		-	T-403-00	T-403-21	T-403-06
axes		-		X, Y, Z	
motion in open loop (±10%)*		µm	100	100	100
motion in closed loop *		µm	-	80	80
electrical capacitance per axis		µF	1.8	1.8	1.8
integrated measurement system		-	-	SG	CAP
resolution***		nm	0.2	2	1
typ. repeatability		nm	-	30	20
resonant frequency x/y/z		Hz		500/550/480	
stiffness		N/µm		1/1/1	
max. force generation x/y/z	**pull**	N		10/10/10	
	push			100/100/100	
voltage range		V		-20…+130	
connector******	**voltage**	-		LEMO 0S.302	
	sensor	-	-	LEMO 0S.304	LEMO 0S.650
cable length		m	1.2	1.2	1.6
material		-		stainless steel/ aluminum	
dimensions (LxWxH)		mm	40 x 40 x 34	40 x 40 x 34	65 x 65 x 44
weight		g	165	160	550

* typical value measured with NV 40/3 CLE amplifier

** typical value for small electrical field strength

*** the resolution is only limited by the noise of the power amplifier and metrology

****Additional Variations:

Product name	Description	Specials	Part. No Suffix.
TRITOR 100 SG Digital TRITOR 100 CAP Digital	Version for digital controller series d-Drive and NV40/3 controller in combination with additional functionalities: Interchange ability, ASI	Connector Sub-D 15	T-403-21D T-403-06D
TRITOR 100 SG Extern TRITOR 100 CAP Extern	Version with sensor pre-amplifier for the use of additional functionalities: Interchange ability, ASI	Connector sensor ODU 4pin	T-403-21E T-403-06E
TRITOR 100 Vacuum	Compatible for vacuum application down to 10^-7hPa	60 cm cable length vacuum side; 2m cable length air side	T-403-02

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TRITOR 101 and TRITOR 102

3D piezo positioning stages with central opening

Image: TRITOR 102

Concept:

The piezo 3D stage series TRITOR 101 and 102 are extremely compact and offer motions of up to 100 µm in XYZ direction. The unique cube like mechanical design allows motion without play. They are well suited for many applications reaching from optical research to OEM systems. Probe alignment in microscopes usually requires an open center space (e. g. for the passage of light). The 3D piezo stage models TRITOR 101 and 102 with their central apertures of 30 mm and 40 mm were developed considering such applications. High stiffness, in combination with excellent straightness of motion, make the TRITOR series ideal for high precision in the nano meter range for optics, laser–technique, and any other type of high resolution positioning application.

Specials:

Piezo electrical actuators can act much faster, and with a higher accuracy to a signal change, than any motorized drive available. Each axis can be controlled separately in closed loop mode. An integrated sensor system is an available option that guarantees accuracy in the nanometer range. The simultaneous motion, available in XYZ directions, offers a large degree of freedom during use. All stages of the TRITOR series can be made with special materials for extraordinary applications such as vacuum or cryogenic applications. There is also a version with threading for mounting objectives.

Assembling:

The stages are designed to be mounted, by the use of two through holes located diagonal from each other. Components can be mounted on the top plate by two diagonal tapped holes and can be accurately located by using the precision pin holes.

Product highlights:

- 3D nano positioning stage
- central opening (up to 40 mm)
- XYZ motion range 100 µm
- optional integrated feedback sensors
- motion without mechanical play
- highest positioning resolution
- stage design for microscopy platforms
- high resonant frequency precise for line scanning application
- SG and CAP sensors available
- version with threading (RMS up to M32)

Application:

- AFM and Microscopy
- Micromanipulation
- Cantilever adjustment

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TRITOR 101 and TRITOR 102

Technical data:

series TRITOR 101 (opening Ø 30 mm)		unit	TRITOR 101	TRITOR 101 SG	TRITOR 101 CAP
part no.		–	T–404–00	T–404–01	T–404–06
axes		–		X/Y/Z	
motion in open loop (±10%)*		µm	100	100	100
motion in closed loop *		µm	–	80	80
electrical capacitance per axis (±20%)		µF	1.7	1.7	1.7
integrated measurement system		–	–	SG	CAP
resolution***		nm	0.2	2	1
typ. repeatability		nm	–	±18	±11
resonant frequency (X/Y/Z)		Hz	420/410/360	420/410/360	420/410/360
stiffness (X/Y/Z)		N/µm	1/1/1	1/1/1	1/1/1
max. force generation (X/Y/Z)	**pull**	N	10/10/10	10/10/10	10/10/10
	push		100/100/100	100/100/100	100/100/100
cable length		m	1.0	1.2	1.6
material		–		stainless steel/aluminum	
dimensions (LxWxH)		mm	68 x 68 x 30	68 x 68 x 30	80.5 x 80.5 x 30
central opening Ø		mm	30	30	30
weight		g	480	570	650

series TRITOR 102 (opening Ø 40 mm)		unit	TRITOR 102	TRITOR 102 SG	TRITOR 102 CAP/ TRITOR 102 CAP with threading****
part no.		–	T–405–00	T–405–01	T–405–06/T-405-06D-CT
axes		–		X, Y, Z	
motion in open loop (±10%)*		µm	100	100	100
motion in closed loop *		µm	–	80	80
electrical capacitance per axis (±20%)		µF	1.7	1.7	1.7
integrated measurement system		–	–	SG	CAP
resolution***		nm	0.2	2	1
typ. repeatability		nm	–	±17	±10
resonant frequency x/y/z		Hz	330/320/210	330/320/210	330/320/210
stiffness x/y/z		N/µm	1/1/1	1/1/1	1/1/1
max. force generation x/y/z	**pull**	N	10/10/10N	10/10/10	10/10/10
	push		100/100/100	100/100/100	100/100/100
cable length		m	1.0	1.2	1.6
material		–		stainless steel/aluminum	
dimensions (LxWxH)		mm	80 x 80 x 30	80 x 80 x 30	80 x 80 x 30
central opening Ø		mm	40	40	40
weight		g	520	610	700

* typical value measured with NV40/3 CLE amplifier
** typical value for small electrical field strength
*** the resolution is only limited by the noise of the power amplifier and metrology
**** RMS up to M32 threading available

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TRITOR 101 and TRITOR 102

Types of connectors:

Product name	Description	Specials	Part. No Suffix.
TRITOR 101 Digital TRITOR 101 SG Digital TRITOR 101 CAP Digital TRITOR 102 Digital TRITOR 102 SG Digital TRITOR 102 CAP Digital	Version for digital controller series d–Drive and NV40/3 controller in combination with additional functionalities: Interchange ability, ASI and ASC	connector Sub–D 15	T–404–00 D T–404–01 D T–404–06 D T–405–00 D T–405–01 D T–405–06 D
TRITOR 101 SG Extern TRITOR 102 SG Extern TRITOR 101 CAP Extern TRITOR 102 CAP Extern	Version with sensor pre–amplifier for the use of additional functionalities: Interchange ability, ASI	plug voltage: LEMO 0S.302 plug sensor SG: ODU 4pin plug sensor CAP: LEMO 0S.650	T–404–01 E T–405–01 E T–404–06 E T–405–06 E
TRITOR 101 TRITOR 101 SG TRITRO 101 CAP TRITOR 102 TRITOR 102 SG TRITRO 102 CAP	Connector style according to the piezo controller series ENV, 30V300 OEM and 12V40 OEM	plug voltage : LEMO 0S.302 plug sensor SG: LEMO 0S.304 plug sensor CAP: LEMO 0S.650	T–404–00 T–404–01 T–404–06 T–405–00 T–405–01 T–405–06

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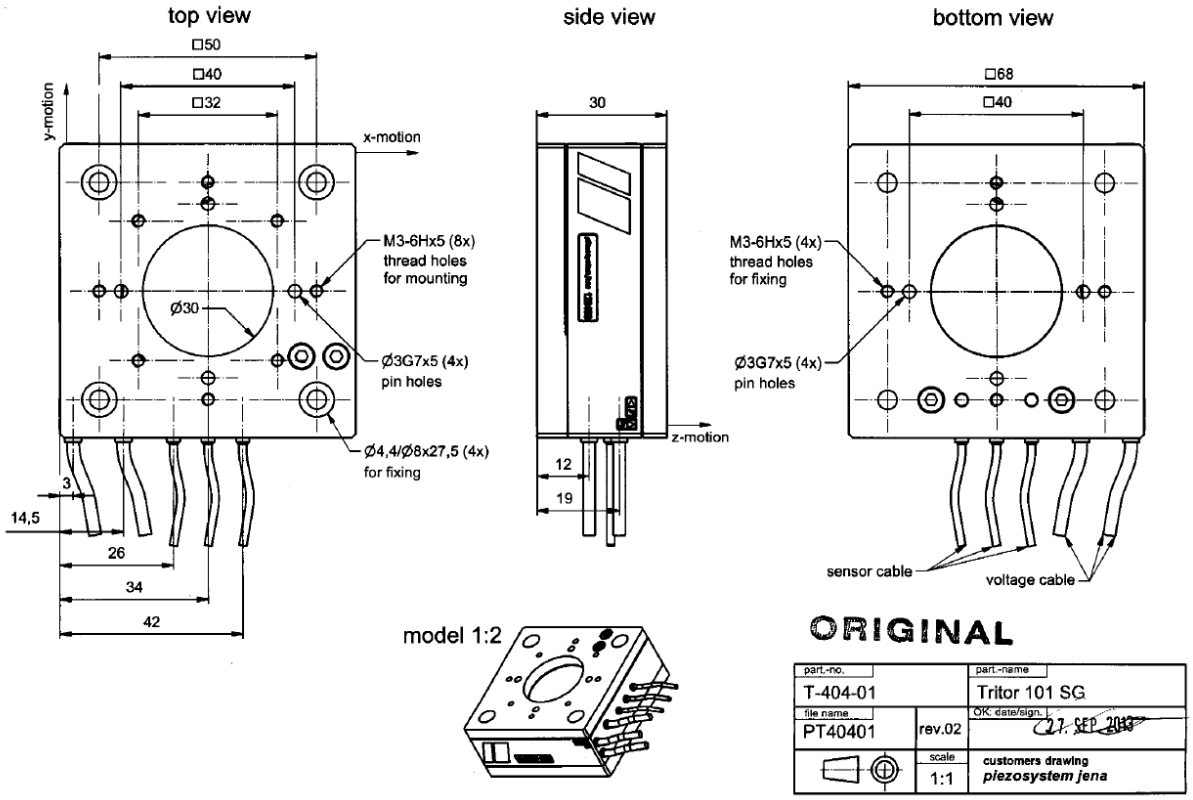
TRITOR 101 and TRITOR 102



Example: TRITOR 101 SG. For further drawings please visit www.piezosystem.com.

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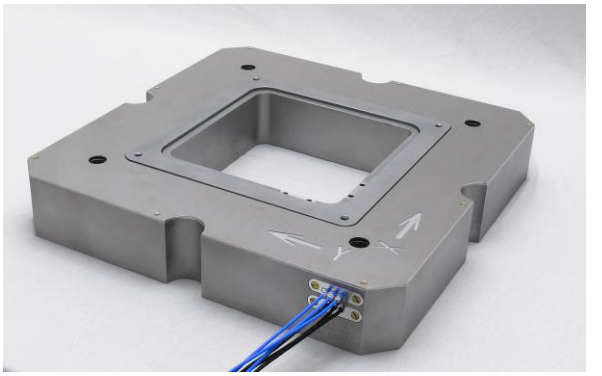
TRITOR 320

Compact 3D translation stage



Concept:

The dimensions of 320 x 320 x 55 mm^3 and the capability to move loads up to 20 kg make the TRITOR 320 one of the most robust piezo driven 3D positioning stages available on the market. The stages can be equipped with integrated feedback sensors for closed loop control. The unique design of the flexure hinges allow for excellent usability with zero friction. High stiffness, in combination with excellent straightness of motion, make the TRITOR series ideal for high precision positioning in the nano meter range of heavy objects such as wafer chucks, bonding tools, and pick and place platforms.

Specials:

Piezoelectrical actuators can act much faster, and with a higher accuracy to a signal change, than any motorized drive available. The resolutions of piezoelectrical actuators are only limited by the signal noise of the control system. Therefore, these systems are an excellent choice for positioning applications in fiber alignment, optics, wafer handling, medical equipment, etc. Each axis can be controlled separately in closed loop mode. An integrated sensor system is an available option that guarantees accuracy in the nano meter range. Dynamic scan applications are a typical utilization of the elements of the TRITOR series. The simultaneous motion, available in X, Y, and Z directions, offers a large degree of freedom during use. All stages of the TRITOR series can be made with special materials for extraordinary applications such as vacuum or cryogenic applications.

Interfaces:

All stages are constructed with a top and a bottom plate. Through holes are used for fixing the stage which is important for all dynamic applications. On the top plate there are several pin holes and threaded holes available for the mounting of external components. The 3D elements are built with reliable piezo stack actuators, with a flexible insulation that is well suited for a high dynamic burden.

Product highlights:

- 3D piezo-stage with 20 kg load capability
- motion range 40/40/320 µm in XYZ
- smallest settling time
- lowest tractor deviation
- 0.8 nm resolution
- 150x150 mm open aperture

Applications:

- automation
- semiconductor
- wafer handling

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TRITOR 320

Technical data:

3D Nanopositioning stage		unit	TRITOR 320		TRITOR 320 CAP
part no.		-	T-406-70		T-406-76
axis		-	X, Y, Z		
motion in open loop mode (±10%)*		µm	50/50/400		
motion in closed loop mode		µm	-		40/40/320
electrical capacitance (±20%)**		µF	44/44/116		
integrated measurement system		-	-		capacitive
resolution*	**open loop mode**	nm	0.1/0.1/0.8		
	closed loop mode	nm	-		1
resonant frequency	**unloaded**	Hz	250/250/150		
	additional load = 12 kg	Hz	140/140/70		
stiffness		N/ µm	36/36/4.2		
typ. repeatability		nm	-		2/2/14
typ. non-linearity		nm	-		10/10/250
max. pushing force		N	1800/1800/1680		
max. pulling force		N	180/180/168		
max. load forces		N	200		
max. pushing forces (rectangular to motion direction)		N	150		
max. tilting during motion (roll, nick, gier) x/y/z		µrad	8/15/2	4/19/2	40/88/70
voltage range		V	-20...+130		
connector	**signal**	-	LEMO 0S.302/SUB-D		
	sensor	-	-		LEMO 0S.650/SUB-D
cable length		m	1		2
material		-	stainless steel (non-magnetic)/ aluminum		
dimensions (LxWxH)		mm	320 x 320 x 55		
clear aperture		mm	150x150		
weight		g	8000		

* typical value measured with d-Drive controller unit
** typical value for small electrical field strength
*** the resolution is only limited by the noise of the power amplifier and metrology
**** max. forces without changing standard calibration values

Additional Variations:

Product name	Description	Specials	Part. No Suffix.
TRITOR 320 CAP Digital	Version for digital controller series d-Drive and NV40/3 controller in combination with additional functionalities: Interchange ability, ASI	Connector Sub-D 15	T-406-76D
TRITOR 320 Digital	Version for digital controller series d-Drive and NV40/3 controller in combination with additional functionalities: Interchange ability, ASI	Connector Sub-D 15	T-406-70D

TRITOR 400

Compact three-axis translation stages

As the first to introduce the compact XYZ nanopositioning stage TRITOR, **piezosystem jena** stands as the only one company with over 20 years of experience in designing and manufacturing three axis stages.

The unique TRITOR elements are extremely compact and offer a range of motion of up to 400 µm in all three axes. TRITOR elements can be easily combined with other mechanical positioning systems that make those systems flexible and the first choice to find solutions for diverse tasks in the nanopositioning fields.

Due to FEA-optimization, the Tritor 400 series meets the highest dynamical performance and have excellent guiding accuracy. High loads can be moved with the elements keeping the demand for compact design. The parallel motion is achieved without play, friction due to the stage's special solid hinges. Integrated position control systems (strain gage and capacitive sensors) are available as an option for overcoming the effect of hysteresis and drift, allowing the actuator to reach high resolution and position stability. The Tritor series can be, as an option, be modified for cryogenic, vacuum and ultra-high vacuum environments.

For easy mounting of components and probes, the top plate is equipped with special threads; the stage can be accurately fixed on customer's setup by using the precision diagonal holes.

Image: TRITOR 400 CAP Vacuum

Product highlights:

- highly compact design
- accurate parallel motion by parallelogram design
- high reliability due to solid state hinges
- motion without mechanical play
- high resolution in nm and sub-nm range
- motion up to 400 µm
- precision pin holes for easy mounting

Applications:

- optics
- laser tuning
- fiber positioning
- micro manipulation
- biology
- scanning systems
- vacuum applications
- cryogenic applications

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incredibly precise

TRITOR 400

Technical data:

series TRITOR		unit	TRITOR 400	TRITOR 400 SG	TRITOR 400 CAP
part no.		-	T-406-00	T-406-01	T-406-06
axes		-	XYZ		
motion open loop (±10%)*		µm	400		
motion closed loop (±0,2%)*		µm	-	320	
capacitance (±20%) x/y/z**		µF	14/14/14		6/6/14
integrated measurement		-	-	strain gage	capacitive
resolution open loop* **		nm	0.8	0.8	0.8
resolution closed loop* **		nm	-	35	1
typ. repeatability		nm	-	10/8/9	13/10/10
resonant frequency x/y/z (unloaded)		Hz	180/280/140		
with a load of 20g		Hz	178/236/193		
50g		Hz	162/218/167		
100g		Hz	143/153/142		
300g		Hz	105/115/135		
stiffness x/y/z		N/µm	0.3/0.3/0.25		
max. push force x/y/z		N	120/120/100		
max. pull force x/y/z		-	12/12/10		
max. load		N	100	100	40
voltage range		V	-20...+130		
connector	**power (x/y)**	-	LEMO 0S.302		ODU 3pin
	power (z)	-	LEMO 0S.302		
	sensor	-	-	LEMO 0S.304	LEMO 0S.650
cable length		m	1.0	1.2	1.6
body material		-	stainless steel/ anodized aluminum		
dimensions (l x w x h)		mm	116x106x40	116.5x106.5x40	116x106x40
aperture outside center		mm	Ø12.5		
weight		g	1050	1050	1100

* typical value measured with NV 40/3 amplifier (closed loop NV 40/3 CLE)

** typical value for small electrical field strength

*** Because of the ceramic's solid-state phenomena based extension and the striction- and friction-free guidance design the whole assembly's resolution is onl limited by the noise of the power amplifier and metrology.

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TRITOR 400

Recommended Configurations:

actuator	TRITOR 400	T-406-00
amplifier/controller	3 X ENV 40	E-103-10
power supply unit	ENT 40	E-103-13
PC interface	EDA 4	E-202-40
casing for all modules	63 TE	E-103-97

actuator	TRITOR 400 SG	T-406-01
amplifier/controller	3 X ENV 40 SG	E-240-100
power supply unit	ENT 40	E-103-13
PC interface	EDA 4	E-202-40
casing for all modules	84 TE	E-103-91

Please pay attention to our "notes for mounting", which are available as a download on our homepage.:
http://www.piezosystem.com/piezo_actuator_nanopositioning/downloads_publications/technical_information/notes_for_mounting/

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