

compact 2-axis translation stages

series PXY AP

- variable travel range selection per axis based on VTRselect - concept
- extremely flat design for microscopy
- XY-motion up to 700 x 700 μm
- bi-directional actuating nanoX® design for high dynamic range
- central aperture 100 x 100 mm
- integrated feedback sensors
- with series MIPOS XYZ solution

applications:

- microscopy / lithography
- nanopositioning and scanning
- materials research
- wafer handling and mask alignment
- semiconductor testing equipment
- biotechnology

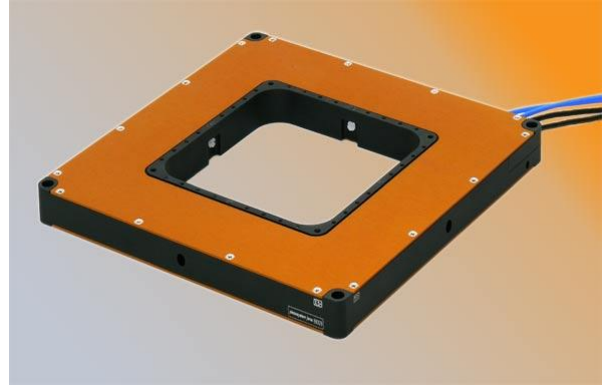


fig.: PXY 500 AP

Concept

The series PXY AP is designed as an extremely flat scanning stage with an extra large aperture. Key features are the variable motion generating elements – **VTRselect** concept- which offers flexible motion in the range from 24 μm up to 700 μm for each axis. The required motion per axis can be pre-selected. These systems offer excellent dynamic properties during use, which are needed for certain applications.

To get the best results for high dynamic and high precision scanning applications, the flexure hinges are made with the unique **nanoX®** technology. Setting and resetting forces are generated by two different actuating systems. This provides the user a microsec settling time and a high stiffness even under heavy loads. Overshooting is actively minimized. To avoid crosstalk, the motion is monitored by independent sensor systems in real time.

In combination with the series MIPOS - objective positioning systems for z-axis motion – a XYZ solution with sub-nm accuracy can be offered.

Specials

The FEA - optimized parallel kinematics of the actuator guarantee high guidance accuracy without any mechanical play. Based on the load optimized actuating system, the shortest settling time can be achieved. In combination with an integrated high resolution sensor system – the PXY AP “CAP” series – very accurate position stability can be achieved. The sensor system is designed for non-contact direct metrology. High resolution capacitive sensors measure the motion of the moving platform.

This enables the system to operate with outstanding performance during high dynamic scans.

An additional stage insert is available (part no. T-240-99) which can be used to hold 3inch standard slides, Petri dishes, Lab-Tek™-Holder and PH2-Incubators.

Upon request the series PXY AP can be offered in a vacuum compatible version and as well as a cryogenic version. The stage body also can be made of titanium or thermally stable material Invar.

Mounting/Installation

The raster tapped and thru holes allow for an easy integration of this stage into any application and mechanical setup. As a piggyback solution, the series of PXY AP stages can be assembled with motorized XY scanning stages with long travel range.

The resolution of the piezo electrical system is only limited by the noise of the applied electronics signal. The piezo amplifier and controller systems from piezosystem jena are especially designed for this.

Piezo electrical actuating systems can operate independent of magnetic fields.

When using under vacuum conditions please note the low insulation behavior of gas by 0.01 hPa up to 100hPa.

technical data:

series PXY AP	unit	PXY 24 AP	PXY 500 AP
part no.	-	T-242-xx	T-250-xx
actuating elements		nanoX® – design with applied resetting forces	
motion per axis open loop ($\pm 10\%$)*	μm	30	700
motion per axis with feedback sensor ($\pm 0.2\%$)*	μm	24	500
capacitance per axis ($\pm 20\%$)**	μF	3	12
resolution*** open loop	nm	0.06	1.4
resonant frequency @ 100g	Hz	300/300	120/120
stiffness	N/ μm	1.5	0.15
push/pull force open loop	N	45/45	150/150
max. load in z	N	100	
voltage range	V	-20...+130	
cabel length ($\pm 10\%$)	m	1.2	
material	-	aluminium/stainless steel	
dimension (l x w x h)	mm	185 x 185 x 15	
free aperture	mm	100 x 100	
weight	g	480	850
series PXY AP with integrated measurement system	unit		
integrated feedback system	-	capacitive	
resolution*** closed loop	nm	tbd	tbd
typ. repeatability	nm	5	20
push/pull force closed loop	N	4.5/4.5	12.5/12.5
cable length	m	2	
PXY AP –Y-axis drive module		P*Y 24 AP	P*Y 500 AP
part no.	-	T-242-MY	T-250-MY
actuating elements		nanoX® – design with applied resetting forces	
motion per axis open loop ($\pm 10\%$)*	μm	30	700
motion per axis with feedback sensor ($\pm 0.2\%$)*	μm	24	500

* typical value measured with 30V300 nanoX amplifier

** typical value for small electrical field strength

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

Please note: The existing line of scanning stage PXY AP will be extended permanently
The current status is updated on our web site www.piezोजना.com in the area “PXY AP series”.

Pay attention please to the “handling instructions” you can download from our homepage.

VTRselect

Variable Travel Range selection allows the user to select a combination of different motion ranges for each axis. By selecting the travel range according to the user's required range of motion, the best dynamic properties for each axis can be achieved! The selection of 3 part numbers generates a customized stage configuration

Ordering procedure

Step 1: selection of part 1 - basic stage module according to user's required motion range

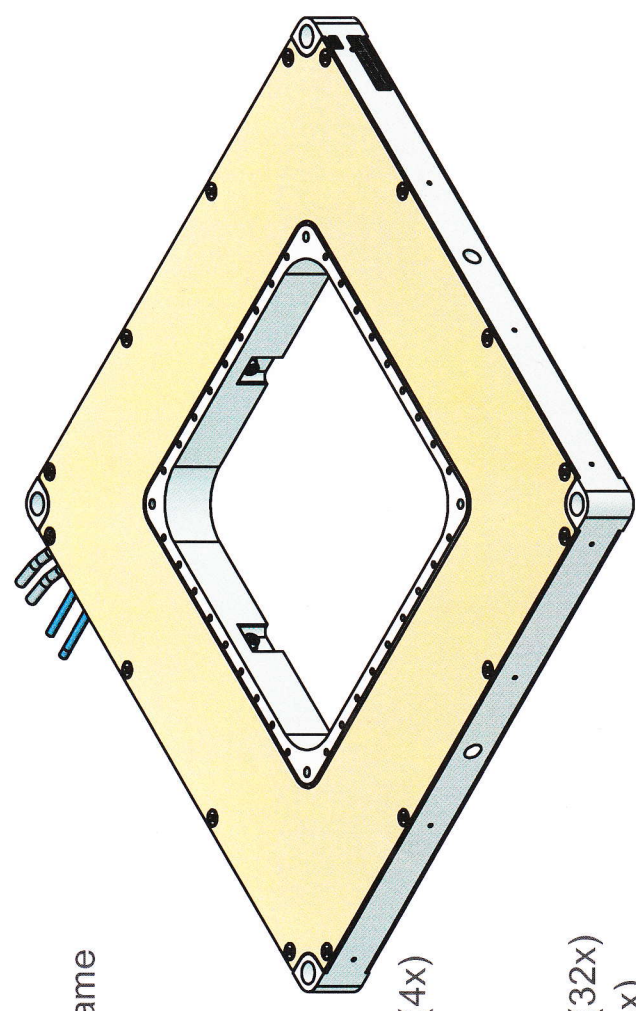
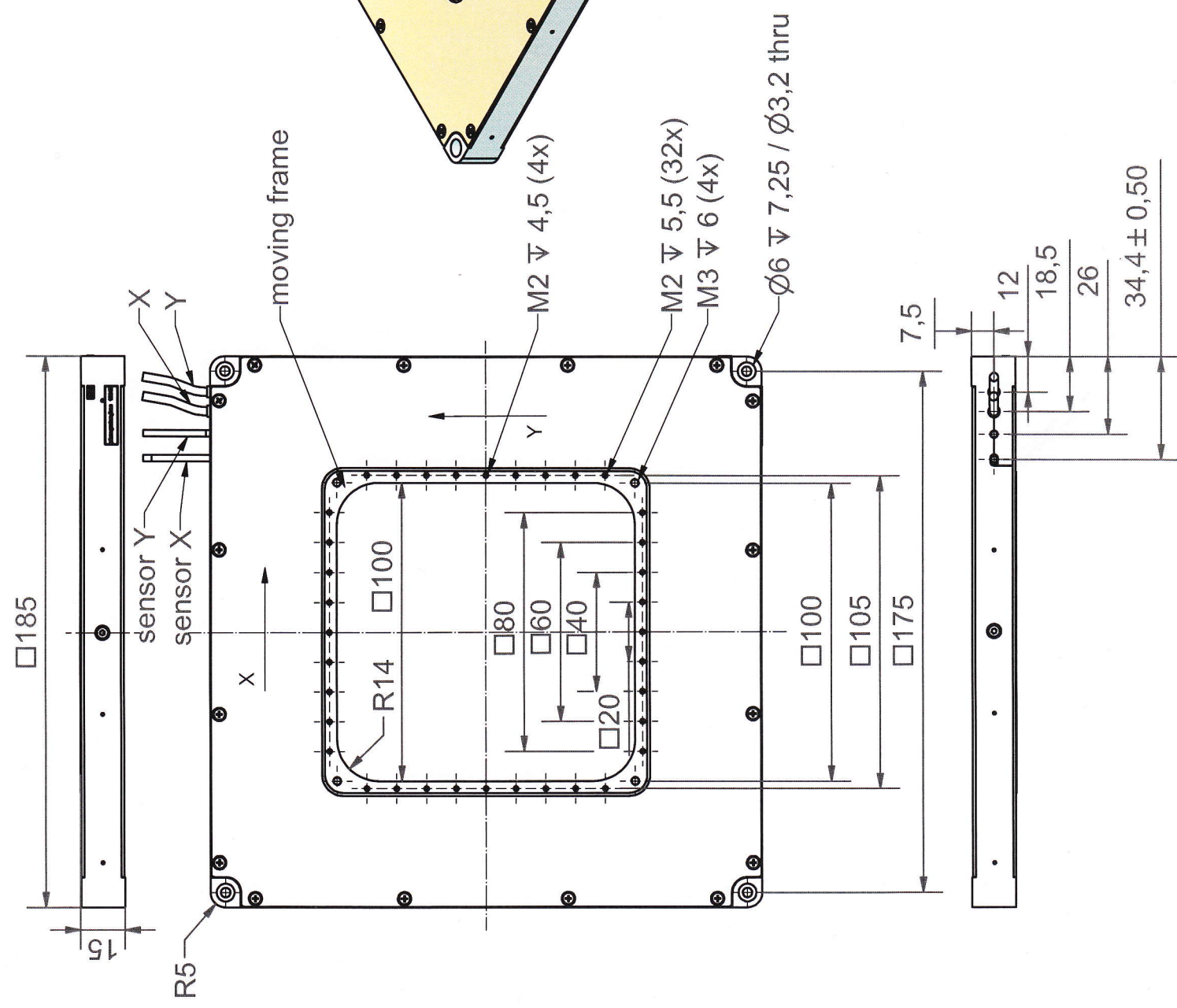
Step 2: selection of part 2 - y-axis module according to required motion range

Step 3: selection of part 3 - sensor / connector module according to piezo controller unit

1. basic stage module with X-axis drive				2. Y-axis drive module		
typ	description	motion ¹⁾	part.no.	description	motion ¹⁾	part.no.
Standard				P*Y 00 AP	without Y-axis	T-240-MY
Vacuum						
Standard	PX* 24 AP	24/30µm	T-242-X0	P*Y 24 AP	24/30µm	T-242-MY
Vacuum	PX* 24 AP V	24/30µm	T-242-X2			
Standard	PX* 100 AP	100/120µm	T-244-X0	P*Y 100 AP	100/120µm	T-244-MY
Vacuum	PX* 100 AP V	100/120µm	T-244-X2			
Standard	PX* 200 AP	200/250µm	T-246-X0	P*Y 200 AP	200/250µm	T-246-MY
Vacuum	PX* 200 AP V	200/250µm	T-246-X2			
Standard	PX* 300 AP	300/350µm	T-248-X0	P*Y 300 AP	300/350µm	T-248-MY
Vacuum	PX* 300 AP V	300/350µm	T-248-X2			
Standard	PX* 500 AP	500/700µm	T-250-X0	P*Y 500 AP	500/700µm	T-250-MY
Vacuum	PX* 500 AP V	500/700µm	T-250-X2			

¹⁾ motion range depends from the chosen feedback option (with or without feedback control)

3. feedback and connector module			
analogue controller system			
	part.no.	connector	
		voltage	sensor
without feedback sensor	T-24M-00	ODU 3pin	—
with feedback sensor	T-24M-06E	ODU 3pin	ODU 4pin
digital controller system			
	part.no.	connector	
		voltage	sensor
without feedback sensor	T-24M-00D	Sub-D15	—
with feedback sensor	T-24M-06D	Sub-D15	



ORIGINAL

part.-no.	T 248 06 (D)	part.-name	PXY 500 AP CAP (D)
file name	PT 248 06 ÄZ01	OK: date/sign.	18. DEZ. 2010
		scale	1:2
		customers drawing	piezosystem jena



Series **PXY AP**

The unique strategy for high precision positioning

PXY AP Nano Positioning Stages with **VTR select** from piezosystem jena

Highly precise performance

PXY AP – the new stage series with **VTR select**

The world is getting smaller and smaller. Existing structures are more complicated and much more precise than ever. We, **piezosystem jena**, we are at home in the world of smallest movement, smallest structures and high precision engineering – **we are a part of the Nano-World** and based on our unique know how and the special technology, we are a leader in positioning equipments for this world.

Whether individual special system or OEM components - we offer a wide range of high-precision piezoelectric actuators and stages for micro-and nano-positioning as well as nano-automation.

During production and characterization of our products, we rely on modern finite element analysis and special interferometer measurement systems. Thereby we ensure that the products of **piezo-system jena GmbH** guarantee a unique precision in the sub-nanometer range, can generate forces of several thousand Newton and realize precise positioning in few micro seconds.

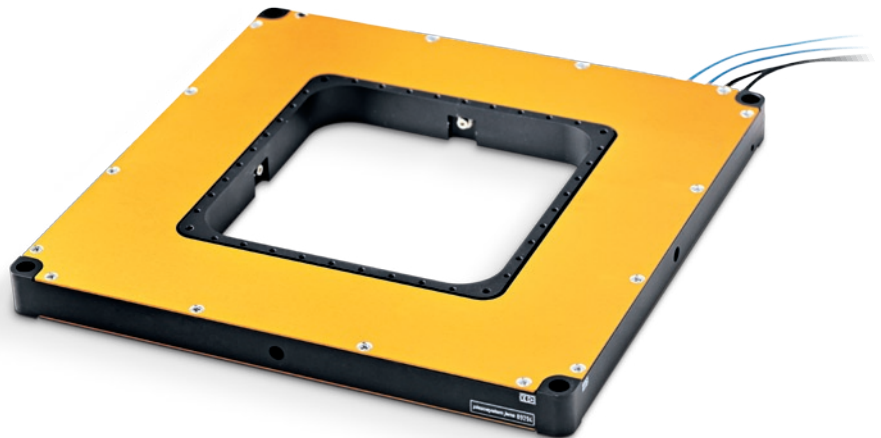
piezosystem jena GmbH was founded in 1991 in Jena – the world wide well known home of high technologies in the areas of research, optics and precision mechanics. A tradition that we are committed: even today, the headquarters for worldwide distribution and marketing of our products on site. And from here we serve our customers from over 40 countries around the world, such as in the U.S., Japan, France, England, Korea, Israel, Italy and Taiwan.

With our highly qualified motivated team and 20 years of experience in the development of special systems and OEM components **piezosystem jena GmbH** has been 20 years of the pacemakers in the development and design of piezoelectric positioning technology. See for yourself!

Piezo-Technology up to date

A new technology – a lot of new applications: in optics and laser technology, automation and semiconductor technology to biotechnology. With its special features piezo technology has many applications. And constantly new fields are added. As a forward-looking technology, the piezo technology offers many advantages:

- nearly unlimited resolution of the motion
- high forces generation
- movement completely free of mechanical play
- low response time
- without abrasion and wear
- usable for vacuum and cryogenic applications



You are looking for a system with the best features and best performance? With piezoelectric actuators and nano-positioning of **piezosystem jena GmbH** you have found what you're looking: piezoelectric nano-positioning systems and a controller unit with the highest standards of accuracy for demanding applications

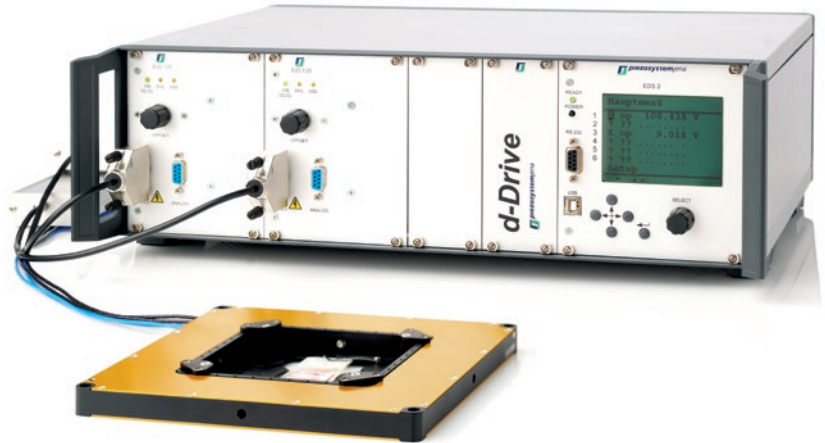
Contact us or our representative in your country and get expert advice! We looking forward for your specific application.

A well balanced team

PXY AP with VTR select – highly precise positioning within milliseconds

piezosystem jena GmbH is expanding the range of its XY scanning stages with the introduction of the new stage series **PXY AP** ushering in the revolutionary **VTR select** concept. The combination of an innovative design, a long travel range and a high load capability in combination with an ultra flat stage design represent a milestone in the field of nano-positioning.

Your advantage: No other system is available on the market featuring an ultra low profile along with a large aperture of 100 mm by 100 mm. These are unique characteristics which make the **PXY AP** a flexible solution to meet the diverse demands of sample positioning.



Key-Features Series PXY AP:

- VTR select allows to combine different travel ranges for different axes
- fast scanning – 2 axes piezo stage with an ultra low profile: height of 15 mm (0.59 inch) only
- large clearance aperture with a size of 100 mm by 100 mm to mount universal stage inserts
- integrated high resolution capacitive feedback sensors
- nanoX® - design with active resetting forces
- parallel kinematics principle with a travel range up to 700 µm (open loop motion)

Key-Applications Series PXY AP:

- nano-positioning and scanning
- materials research
- microscopy / lithography
- semiconductor testing equipments
- wafer handling and mask alignment
- biotechnology

Concept

PXY AP was designed for the fast and highly precise positioning of optical and mechanical components. All systems are optimized to guarantee extremely high z-axis stiffness. Due to optimized parallel kinematics of the actuator the high guidance precision without any mechanical play is always assured. All drive elements in the monolithic

flexure system create a completely play free motion. Overshooting (oscillation) is actively minimized by controllable setting and resetting forces (generated by two different actuating systems). Even under full load pre-selected positions can be reached in milliseconds with nanometer accuracy. This is an essential characteristic especially for high-speed scanning.

Upon request the series **PXY AP** can be offered in a vacuum compatible version and as well as a cryogenic version. The stage body also can be made of titanium, aluminum or thermally stable material Invar and Superinvar.

The optional sensor preamplifier (version external/digital) allows an implementation independent from the cable length.

Specifics

In combination with the integrated high resolution capacitive direct metrology by **piezosystem jena GmbH** the series **PZY AP** is set up for very accurate position stability, linearity and reproducibility in controlled motion.

The digital amplifiers of **piezosystem jena GmbH** enable a dynamic setting of PID control

*The combination of **PXY AP** with the digital controller represents the perfect system setup – adaptation to the current loading scenario included.*

parameter, a slew rate limit and the bandwidth of the notch filter. Mechanical resonance can be measured by the integrated sweep generator and faded out during operation with the bandwidth of the notch filter. This avoids that the system gets affected by its own resonance frequency.

Superior positioned

PXY AP with **VTR select** – modularity brought to the point

Variable travel range selections for each axis make it possible to adjust the nano-positioning system for a wide range of special applications. Just combine the dynamic performances according to your requirements.

For accurate scanning applications two different axis configurations are normally used: a fast axis with a long motion range, and a second axis performing small and precise steps on a linefeed. With **VTR select** you can adapt each axis to your own needs. If the application set-up changes, each axis can be readjusted to a different travel range selection later on with minimum efforts.

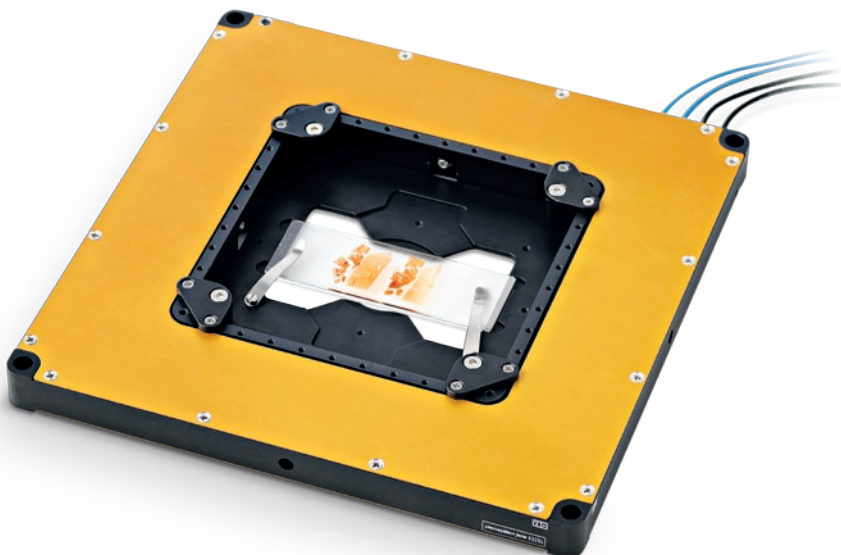
With **VTR select** a free choice out of five different travel ranges per axis is available for you: 24 μm , 100 μm , 200 μm , 300 μm , 500 μm (with sensor integration).

In open loop motion (without sensor integration) the travel range is even higher with 30 μm , 120 μm , 250 μm , 350 μm or 700 μm

- an unique solution for scanning stages with nano precision
- flexible combination of variable travel range selections per system
- customized adjustment of axis parameter according to the specific application needs



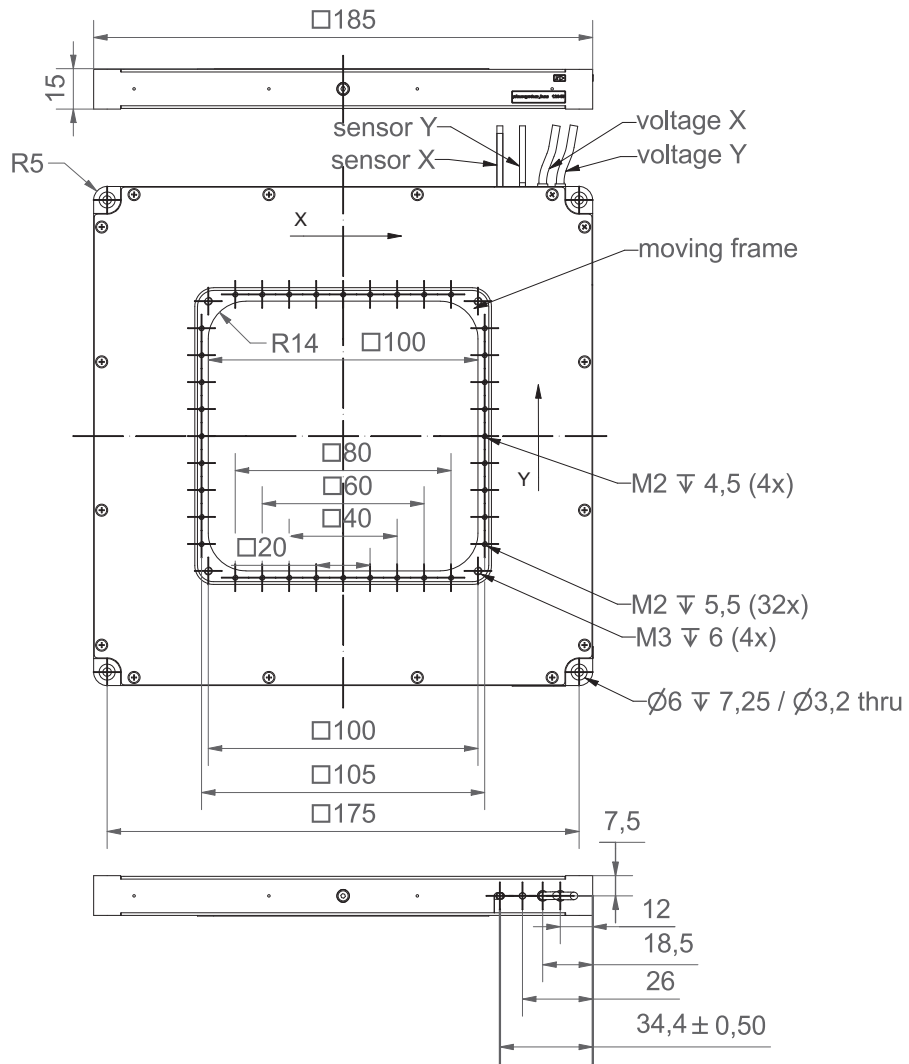
Choices of motion range selections:
(Travel range selection)



Aperture

Free clearance aperture

The large square aperture of the *PXY AP* with a size of 100 mm by 100 mm allows you to mount a stage insert to hold different kinds of microscopy specimen and accessories. The inner frame of the stage is equipped with 36 pieces of thread M2, as well as 4 pieces of thread M3 to install sample holders and other fixtures. The ultra flat frame design enables you to position asymmetrically mounted components exactly without any impact on the precision and guidance accuracy.



series PXY AP	unit	PXY 24 AP	PXY 500 AP
part number	-	T-242-xx	T-250-xx
actuating elements	-	nanoX®-design with applied resetting forces	
motion per axis open loop (±10%)*	µm	30	700
motion per axis with feedback sensor (±0.2%)	µm	24	500
capacitance per axis (±20%)**	µF	3	12
resolution*** open loop	nm	0.06	1.4
resonant frequency @ 100 g	Hz	300/300	120/120
stiffness	N/µm	1.5	0.15
push/pull force open loop	N	45/45	150/150
max. load in z	N	100	
voltage range	V	-20...+130	
cabel length (±10%)	m	1.2	
material	-	aluminium/stainless steel	
dimension (l x w x h)	mm	185 x 185 x 15	
free aperture	mm	100 x 100	
weight	g	480	850

series PXY AP with integrated measurement system	unit	PXY 24 AP	PXY 500 AP
integrated feedback system	-	capacitive	
resolution*** closed loop	nm	tbd	tbd
typ. repeatability	nm	5	20
push/pull force closed loop	N	4.5/4.5	12.5/12.5
cable length	m	2	

PXY AP – Y-axis drive module	unit	P*Y 24 AP	P*Y 500 AP
part number	-	T-242-MY	T-250-MY
actuating elements	-	nanoX®-design with applied resetting forces	
motion per axis open loop (±10%)*	µm	30	700
motion per axis with feedback sensor (±0.2%)*	µm	24	500

* typical value measured with 30V300 nanoX amplifier
 ** typical value for small electrical field strength
 *** the resolution is only limited by the noise of the power amplifier and metrology

Order Information

The new movement – **PXY AP** with **VTR select**
by piezosystem jena GmbH

1. basic stage module with X-axis drive			
type	description	motion ¹⁾	part number
standard	PX* 24 AP	24/30 µm	T-242-X0
vacuum	PX* 24 AP V	24/30 µm	T-242-X2
standard	PX* 100 AP	100/120 µm	T-244-X0
vacuum	PX* 100 AP V	100/120 µm	T-244-X2
standard	PX* 200 AP	200/250 µm	T-246-X0
vacuum	PX* 200 AP V	200/250 µm	T-246-X2
standard	PX* 300 AP	300/350 µm	T-248-X0
vacuum	PX* 300 AP V	300/350 µm	T-248-X2
standard	PX* 500 AP	500/700 µm	T-250-X0
vacuum	PX* 500 AP V	500/700 µm	T-250-X2

First Step: Selection of part number
Basic stage module with the required motion range selection for the X-axis and special versions

Second Step: Selection of part number
Y-axis module according to the required motion range selection for the Y-axis

Third Step: Selection of part number
Sensor and connector module

2. Y-axis drive module		
description	motion ¹⁾	part number
P*Y 00 AP	without Y-axis	on demand
P*Y 24 AP	24/30 µm	T-242-MY
P*Y 100 AP	100/120 µm	T-244-MY
P*Y 200 AP	200/250 µm	T-246-MY
P*Y 300 AP	300/350 µm	T-248-MY
P*Y 500 AP	500/700 µm	T-250-MY

¹⁾ motion range depends from the chosen feedback option (with or without feedback control)

3. feedback and connector module			
analogue controller system			
	part number	connector style	
		voltage	sensor
without feedback sensor	T-24M-00	ODU 3 pin	–
with feedback sensor	T-24M-06E	ODU 3 pin	ODU 4 pin
digital controller system			
	part number	connector style	
		voltage	sensor
without feedback sensor	T-24M-00D	Sub-D15	–
with feedback sensor	T-24M-06D	Sub-D15	

Important mounting advice!



Piezo actuators generate their power- and expansion behaviour based on a solid state effect. Thus, the motion resolution is solely dependent on the quality of the control signal.

Piezo actuators are not affected by magnetic fields, nor do they create them. In a cryogenic environment they operate almost down to 0 Kelvin along with a decreasing linear relative expansion.

Under vacuum conditions, piezo actuators can be used at pressures below 1Pa, except in the range from 0,01 hPa to 100 hPa. This effect is caused by the reduced dielectric penetration field strength of air.

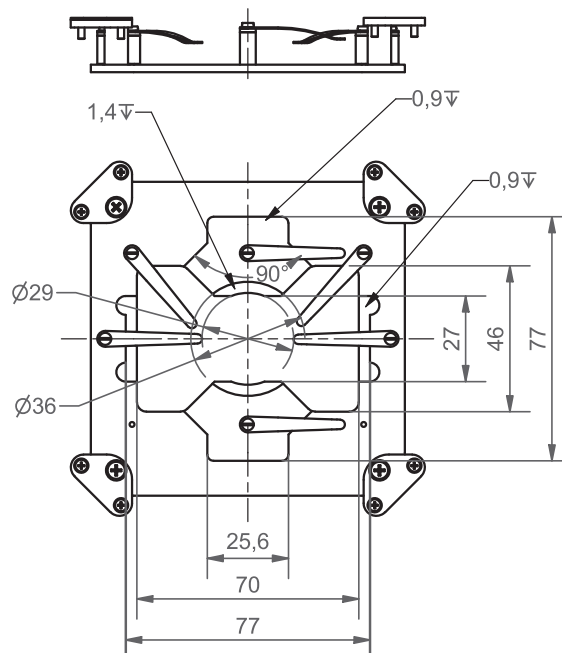
The raster tapped and thru holes allow an easy integration of this stage into any application and mechanical setup.

Recommended Controllers

3. sensor / connector module					
analogue controller interface					
	part number		connector style		analogue
			voltage	sensor	
open loop	T-24M-00		ODU 3 pin	–	30V300 nanoX ENV 40 nanoX ENV 300 nanoX ENV 800 nanoX
closed loop with capacitive sensor	T-24M-06E		ODU 3 pin	ODU 4 pin	30V300 nanoX CLE ENV 300 nanoX CLE ENV 800 nanoX CLE
digital controller interface					
	part number		connector style		analogue
			voltage	sensor	
open loop	T-24M-00D		Sub-D 15	–	EVD 50, EVD 50 CL EVD 125 CL EVD 300 CL 30DV50
closed loop with capacitive sensor	T-24M-06D		Sub-D 15		EVD 50 CL EVD 125 CL EVD 300 CL 30DV50

Accessories

The large square aperture of 100 mm x 100 mm is well suited for a stage insert to hold different kinds of microscopy specimen and accessories. **Piezo-system jena** offers a stage insert (part no.: T-240-99) designed to hold 3inch standard slides, Petri dishes, Lab-Tek™-Holder and PH2-Incubators as additional accessories for the series **PXY AP**. The universal stage insert T-240-99 can be used with upright as well as inverse microscope stands. Other sample holders can be provided upon request.



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STACK TYPE ACTUATORS

COMPACT 1-AXIS TRANSLATION STAGES

HIGH-SPEED PIEZO TRANSLATION STAGES

COMPACT 2-AXIS TRANSLATION STAGES

COMPACT MULTI DIMENSIONAL TRANSLATION STAGES

MIRROR TILTING SYSTEMS

MICROSCOPE OBJECTIVE / LENS POSITIONING SYSTEMS

SPECIAL SYSTEMS

ACCESSORIES – ADAPTER AND EXTENSION CABLES, VACUUM FEED THROUGH

OPTIONS

ELECTRONICS ANALOG

ELECTRONICS DIGITAL