

## Series PA

### Stack Type Actuators

#### Concept:

The PA series actuators are based on stack type actuators made by using multilayer technology. The PA series stack type actuators are internally pre-loaded by a mechanical spring, making them ideal for dynamic applications.

The ability to generate a large force, and be subjected to high mass loading, make them particularly useful for machine tools and dynamic scanning systems. These actuators have a uniform diameter of 14 mm.

#### Mounting:

Actuators should be fastened with screws or clamps on the bottom plate of the actuator. During the installation and use, it is important not to subject the actuator tip to non-axial forces. The actuator head is available in two versions, round head piece for standard version and flat head piece with M3 thread on demand.

#### Configuration:

Please choose the suitable stroke, head piece, feedback and electrical interface to your application or ask our sales.



Image: Piezo Actuator Series PA

#### Product Highlights:

- Excellent dynamic properties due to high resonant frequencies
- Integrated mechanical preload
- Tensile forces up to 150 N
- Motion up to 140  $\mu\text{m}$   
(larger ranges of motion on demand)
- High stiffness of up to 190 N/ $\mu\text{m}$
- Vacuum and low temperature versions on request
- Flat or round head pieces available

#### Applications:

- Nanopositioning
- Scanning microscopy
- Micromanipulation
- Microinjection
- Optical adjustment
- Laser fine tuning
- Mirror adjustment
- Mirror positioning
- Vibration generation and cancellation

## Series PA

### Technical Data:

Series PA	Unit	PA 8/14	PA 16/14	PA 25/14	PA 35/14	PA 45/14	PA 50/14	PA 60/14	PA 70/14	PA 80/14	PA 90/14	PA 100/14	
<b>Part No.</b>	-	B-201-00	B-202-00	B-203-00	B-204-00	B-205-00	B-206-00	B-207-00	B-208-00	B-209-00	B-210-00	B-211-00	
<b>Motion (-10/+20%)</b>	µm	10	20	30	40	50	60	70	80	90	100	110	
<b>Capacitance (±20%)<sup>(1)</sup></b>	µF	0.8	1.8	2.6	3.6	4.4	5.4	6.2	7.2	8.0	9.0	9.8	
<b>Resolution<sup>(2)</sup></b>	nm	0.02	0.04	0.06	0.08	0.10	0.12	0.15	0.17	0.19	0.21	0.23	
<b>Series PA SG with Integrated Strain Gauge Measurement System</b>		<b>PA 8/14 SG</b>	<b>PA 16/14 SG</b>	<b>PA 25/14 SG</b>	<b>PA 35/14 SG</b>	<b>PA 45/14 SG</b>	<b>PA 50/14 SG</b>	<b>PA 60/14 SG</b>	<b>PA 70/14 SG</b>	<b>PA 80/14 SG</b>	<b>PA 90/14 SG</b>	<b>PA 100/14 SG</b>	
<b>Part No.</b>	-	B-201-01	B-202-01	B-203-01	B-204-01	B-205-01	B-206-01	B-207-01	B-208-01	B-209-01	B-210-01	B-211-01	
<b>Motion (±0.2%)</b>	µm	8	16	24	32	40	48	56	64	72	80	88	
<b>Integrated Measurement System</b>	-	SG											
<b>Resolution in Closed Loop</b>	nm	0.1	0.3	0.5	0.7	0.9	1.0	1.3	1.6	1.8	2.0	2.2	
<b>Typ. Repeatability</b>	nm	1.2	1.2	1.4	1.5	1.5	2	1.6	2.3	3.6	2.6	6.7	
<b>Series PA und PA SG</b>													
<b>Resonance Frequency</b>	kHz	40	22	15	12	8.8	8	7	6	5.2	4	4.4	
<b>Stiffness</b>	N/µm	85	43	28	21	17	14	12	11	9	9	8	
<b>Blocking Force</b>	N	850											
<b>Preload</b>	N	150											
<b>Operating Voltage</b>	V	-20 ... +130											
<b>Connector/Voltage</b>	-	LEMO/ODU											
<b>Cable Length</b>	m	1											
<b>Dimensions</b>	<b>Housing Length</b>	mm	26	35	44	53	62	71	80	89	98	107	116
	<b>Total Length</b>	mm	28	37	46	55	64	73	82	91	100	109	118
	<b>Diameter</b>	mm	Ø 14										

<sup>(1)</sup> Typical value for small electrical field strength

<sup>(2)</sup> Resolution is limited only by the noise of control signal.

## Series PA

Series PA	Unit	PA 105/14	PA 110/14	PA 120/14	
Part No.	-	B-212-00	B-213-00	B-214-00	
Motion (-10/+20%)	µm	120	130	140	
Capacitance (±20%) <sup>(1)</sup>	µF	10.8	11.6	12.6	
Resolution <sup>(2)</sup>	nm	0.25	0.27	0.29	
Series PA SG with Integrated Strain Gauge Measurement System		PA 105/14 SG	PA 110/14 SG	PA 120/14 SG	
Part No.	-	B-212-01	B-213-01	B-214-01	
Motion (±0.2%)	µm	96	104	112	
Integrated Measurement System	-	SG			
Resolution in Closed Loop	nm	2.4	2.6	2.8	
Typ. Repeatability	nm	9	12	12	
Series PA und PA SG					
Resonance Frequency	kHz	4	3.8	3	
Stiffness	N/µm	7	7	6	
Blocking Force	N	850			
Preload	N	150			
Operating Voltage	V	-20 ... +130			
Connector/ Voltage	-	LEMO / ODU / Sub-D			
Cable Length	m	1			
Dimensions	Housing Length	mm	125	134	143
	Total Length	mm	127	136	145
	Diameter	mm	Ø 14		

## Series PA

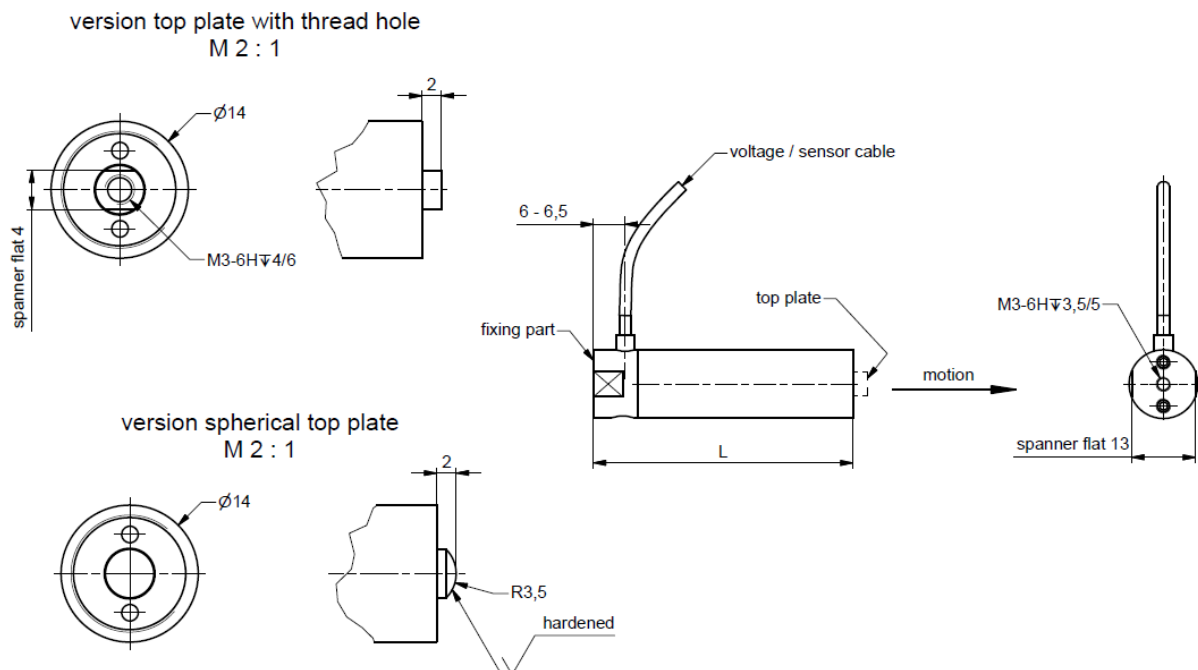
### Standard:

- Head piece round: part-no. B-299-66
- Additional part-no. for needed cable will added by our sales, depending from the requested electronic

### Options:

- Head piece M3 thread: part-no. B-299-65  
(Please use the spanner flat to fix the actuator head during installations over M3 screw.)
- Vacuum and low temperature application on request

### Drawings:



Specifications subject to change without notice!

**PEIPORT** 彼岸科航有限公司  
PEIPOINT SCIENTIFIC AERO LIMITED

Room 1302, Westlands Centre, 20 Westlands Road, Quarry Bay, Hong Kong

Tel: (852)2885 9525

Fax: (852):28863241

Email: sales@peiport.com.hk

BEIJING 010-68082790 / SHANGHAI 021-62311092 / GUANGZHOU 020-87375739 / WUHAN 027-87440766 / CHENGDU 028-86669976 / XIAN 029-81298922 / YUNNAN 0871-63601385



Phone: +49 (3641) 66880 • Fax: +49 (3641) 668866  
[info@piezojena.com](mailto:info@piezojena.com) • [www.piezosystem.com](http://www.piezosystem.com)

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## Piezo High Load Actuators

### Series PAHL

#### Concept:

The PAHL series of actuators consists of high number of piezoelectrical plates. Based on their large size, they are ideally suited for high loads. They have high blocking forces and can move large masses. Due to the integrated mechanical pre-load, they can work under tensile forces and work well in dynamic applications. Their high resonant frequency guarantee fast setting times.

These actuators are useful for applications with precision mechanics, valve technologies and other fields, where high resolutions and high forces are critical.

#### Specials:

The resolution PAHL series is in sub-nanometer range and is limited only the signal noise.

As an option, these actuators are available with strain gage sensors for motion control.

The pre-loaded stack type actuator is designed for dynamical use.



image: high load actuators series PAHL

#### Product highlights:

- stack type actuator in multilayer technique
- integrated pre-load for dynamic use
- high tensile forces up to 350 N
- motion up to 200  $\mu\text{m}$   
(larger motions available on request)
- high stiffness up to 165 N/ $\mu\text{m}$
- blocking force 3500 N

#### Applications:

- wafer alignment
- micro positioning
- scanning
- mirrors tilting
- vibration generation and cancellation
- injection valve control
- nanometrology

## Piezo High Load Actuators

### Technical data

series PAHL		unit	PAHL 18/20	PAHL 40/20	PAHL 60/20	PAHL 80/20	PAHL 100/20	PAHL 120/20	PAHL 140/20	PAHL 160/20	PAHL 180/20	PAHL 200/20
part. no.			P-171-00	P-172-00	P-173-00	P-174-00	P-175-00	P-176-00	P-177-00	P-178-00	P-179-00	P-180-00
motion (-10/+20)%*		µm-	21	42	63	84	105	125	145	165	180	200
capacitance (±20%)**		µF	7	14	21	28	35	42	50.4	56	63	70
resolution***		nm	0.04	0.08	0.13	0.17	0.2	0.25	0.29	0.33	0.36	0.4
resonant frequency		kHz	22	12	8	6	5	4	3	3	3	2
stiffness		N/µm	165	83	55	41	33	28	24	21	19	17
blocking force		N	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
pre-load		N	350	350	350	350	350	350	350	350	350	350
operating voltage		V	-20...+130									
connector voltage		-	LEMO 0S.302									
cable length		m	1									
dimensions	length L	mm	36	54	72	90	108	126	144	162	180	198
	diameter D	mm	20	20	20	20	20	20	20	20	20	20
series PAHL with spherical end R 2,5		unit	PAHL 18/20 R 2,5	PAHL 40/20 R 2,5	PAHL 60/20 R 2,5	PAHL 80/20 R 2,5	PAHL 100/20 R 2,5	PAHL 120/20 R 2,5	PAHL 140/20 R 2,5	PAHL 160/20 R 2,5	PAHL 180/20 R 2,5	PAHL 200/20 R 2,5
part. no.			P-171-50	P-172-50	P-173-50	P-174-50	P-175-50	P-176-50	P-177-50	P-178-50	P-179-50	P-180-50
dimensions length L		mm	38.5	56.5	74.5	92.5	110.5	128.5	146.5	164.5	182.5	200.5
series PA SG with integrated measurement system		unit	PAHL 18/20 SG	PAHL 40/20 SG	PAHL 60/20 SG	PAHL 80/20 SG	PAHL 100/20 SG	PAHL 120/20 SG	PAHL 140/20 SG	PAHL 160/20 SG	PAHL 180/20 SG	PAHL 200/20 SG
part. no.			P-171-01	P-172-01	P-173-01	P-174-01	P-175-01	P-176-01	P-177-01	P-178-01	P-179-01	P-180-01
motion (±0.2)%* closed loop		µm-	17	34	50	67	84	100	116	132	144	160
integrated measurement system			strain gage									
resolution closed loop		nm	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0
typ. repeatability		nm	6	8	12	15	20	21	21	21	24	32
dimensions length L		mm	40	58	76	94	112	130	148	166	184	202
series PA SG with integrated measurement system spherical end R 2,5		unit	PAHL 18/20 SG R 2,5	PAHL 40/20 SG R 2,5	PAHL 60/20 SG R 2,5	PAHL 80/20 SG R 2,5	PAHL 100/20 SG R 2,5	PAHL 120/20 SG R 2,5	PAHL 140/20 SG R 2,5	PAHL 160/20 SG R 2,5	PAHL 180/20 SG R 2,5	PAHL 200/20 SG R 2,5
part. no.			P-171-51	P-172-51	P-173-51	P-174-51	P-175-51	P-176-51	P-177-51	P-178-51	P-179-51	P-180-51
dimensions length L		mm	42.5	60.5	78.5	96.5	114.5	132.5	150.5	168.5	186.5	204.5

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

\*\* typical value for small electrical field strength

## Piezo High Load Actuators

### Options:

- vacuum version
- cryogenic temperature version
- full bridge strain gage sensors
- top plate: spherical tungsten carbide (part no./size: see table)
- other options available upon request

### Accessories:

- tip adapter for M4 thread on top plate  
size: diameter 7 mm, length 2.5 mm (part no. P-170-11)
- flexure hinge for PAHL XX/20  
size: diameter 10 mm, length 13 mm (part no. Z-100-03)

**Please pay attention to our “notes for mounting”, which are available as download on our homepage.**

[http://www.piezosystem.com/piezo\\_actuator\\_nanopositioning/downloads\\_publications/technical\\_information/notes\\_for\\_mounting](http://www.piezosystem.com/piezo_actuator_nanopositioning/downloads_publications/technical_information/notes_for_mounting)



Room 1302, Westlands Centre, 20 Westlands Road, Quarry Bay, Hong Kong Tel: (852)2885 9525 Fax: (852):28863241 Email: sales@peiport.com.hk  
BEIJING 010-68082790 / SHANGHAI 021-62311092 / GUANGZHOU 020-87375739 / WUHAN 027-87440766 / CHENGDU 028-86669976 / XIAN 029-81298922 / YUNNAN 0871-63601385

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Tel: +49 (3641) 66880 • Fax: +49 (3641) 668866  
[info@piezोजना.com](mailto:info@piezोजना.com) • [www.piezosystem.com](http://www.piezosystem.com)

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## Series PA/T

### stack type actuator with outside threading

#### Concept:

The series PA/T based on stack type actuators in multilayer design. They are mechanically preloaded to make them ideal for dynamic applications.

The series PA/T have an M14 outside threading that can be used to mount the actuator; it also helps to lock in the position precisely. The ball tip head piece allows movement of components without shear stress on the ceramic inside. Therefore these series of actuators are well suited for high precision mirror adjustment or for integration into optical systems to realize beam steering in real time. A threaded head piece is optionally available.

#### Specials:

The series PA/T can handle loads up to 850 N. The housing of the actuator, in combination with built-in springs, allows a motion without mechanical play. Maximum motions up to 105  $\mu\text{m}$  are available depending on model.

To overcome the effect of drift and hysteresis, the actuator can be equipped with a high resolution strain gage feedback sensor. The typical accuracy is 0.5% of the used motion.

#### Mounting / Installation:

A Special feature is the outside threading of M14 to mount the actuator. It also helps to adjust the position precisely.

These actuators are mechanically preloaded to make them ideal for dynamic applications. The ball tip head piece allows movement of components without shear stress on the ceramic inside.

The given preload does not exceed while the actuator is used dynamical.



figure: series PA/T

#### Product Highlights:

- excellent dynamic behavior by integrated preload
- versatile use by outside threading
- ball tip head piece
- optional: threaded head piece
- very small and compact design
- tensile forces up to 150 N
- motion up to 105  $\mu\text{m}$
- high stiffness up to 20 N/ $\mu\text{m}$

#### Applications:

- nanopositioning
- optical adjustment
- laser fine tuning
- mirror adjustment
- mirror positioning



## Series PA/T

### Technical Data

Series PA/T	Unit	PA 35/T14	PA 50/T14	PA 80/T14	PA 100/T14	PA 120/T14
Part Nr.	-	P-354-00	P-355-00	P-357-00	P-358-00	P-360-00
Motion OL (-10/+20%)*	µm	42	63	84	105	125
Capacitance (±20%)**	µF	3.6	5.4	7.2	9.0	10.8
Resolution***	nm	0.08	0.12	0.17	0.21	0.25
Series PA/T SG		PA 35/T14 SG	PA 50/T14 SG	PA 80/T14 SG	PA 100/T14 SG	PA 120/T14 SG
Part Nr.	-	P-354-01	P-355-01	P-357-01	P-358-01	P-360-01
Motion CL (±0.2%)	µm	34	50	67	84	100
Integrated measurement system	-	SG				
Resolution CL	nm	0.7	1.0	1.0	1.0	1.0
typ. repeatability	nm	3	3	2	7	9
Resonant frequency	kHz	12	8	5	4	4
Stiffness	N/µm	20	13	10	8	7
Blocking force	N	850				
Preload	N	150				
Operating Voltage	V	-20 ... +130				
Connector/Voltage	-	LEMO 05.302				
Cable length	m	1				
Outside threading	mm	M14x1				
Length	mm	53	71	89	107	125
Diameter	mm	Ø 14				

\* typ. value measured with NV40/3 (regulated NV 40/3 CLE)

\*\* typ. value for small electrical field strength

\*\*\* typ. values, measured at -20 V ... +130 V

#### Options:

- vacuum version
- cryogenic temperature version
- threaded head piece
- further options available upon request



彼岸科航有限公司  
PEIPOINT SCIENTIFIC AERO LIMITED

Room 1302, Westlands Centre, 20 Westlands Road, Quarry Bay, Hong Kong  
BEIJING 010-68082790 / SHANGHAI 021-62311092 / GUANGZHOU 020-87375739 / WUHAN 027-87440766 / CHENGDU 028-86669976 / XIAN 029-81298922 / YUNNAN 0871-63601385

phone: +49 (3641) 66880 • fax: +49 (3641) 668866

info@piezोजना.com • <http://www.piezोजना.de>



# PAHS

## Stack Actuator with Direct Translator



*> 4x the stroke at lower capacity  
at only 20% more length*



*Similar repeatability as a  
standard system*



*Works with existing controllers*



*Easy plug and play solution  
when space is critical*



The new actuator series PAHS from piezosystem jena achieves higher motion at similar length as conventional actuators. With **more than 4 times higher travel** than normal piezo actuators, they are a perfect solution when space is limited but still high resolution requirements exist.

PAHS actuators operate with the same **voltage band of 150V** and can therefore easily be integrated into existing systems by using the same con-trollers and amplifiers from piezosystem jena.

Like the PAHL Series, these actuators have high blocking forces and can move large masses. Due to the **integrated mechanical pre-load**, they can work under tensile forces and work well in dynamic applications. Their high resonant frequency guarantees fast settling times.

### Variants:

- Standard
- With strain gauge
- Vacuum

### Recommended Controller:

NV200/D Net

### Applications

- Small space positioning applications
- Larger travel, medium speed dynamic motion
- Quasi static motion for medium masses

# PAHS

## Technical Data

	Unit	closed loop		open loop	
	-	for comparison		for comparison	
Part #	-	P-172-51	<b>P-503-01D</b>	P-173-00	<b>P-505-00</b>
Direct Translation	-	without	<b>with</b>	without	<b>with</b>
Actuator Name	-	PAHL 40/20 SG	<b>PAHS180 SG DIG</b>	PAHL 60	<b>PAHS240</b>
Motion @ -20 .. 130V*	µm	42	<b>188</b>	63	<b>250</b>
Motion CL*	µm	34	<b>160</b>	50	-
Capacitance**	µF		<b>14</b>		<b>20</b>
Resonant Frequency @ 5gr	Hz	12000	<b>540</b>	8000	<b>480</b>
Blocking Force	N	3500	<b>800</b>	3500	<b>800</b>
Resolution OL***	nm	0.08	<b>0.36</b>	0.12	<b>0.54</b>
Resolution CL***	nm	0.8	<b>4</b>	-	-
max. Nonlinearity	nm	130	<b>1060</b>	-	-
	%	0.4	<b>0.663</b>	-	-
Repeatability	mm	1	<b>8</b>	-	-
	%	0.004	<b>0.05</b>	-	-
Casing Diameter	mm		<b>20</b>		<b>20</b>
Casing Length	mm	60.5	<b>76</b>	72	<b>91</b>

\* Typical value measured with 0.3mV Controller

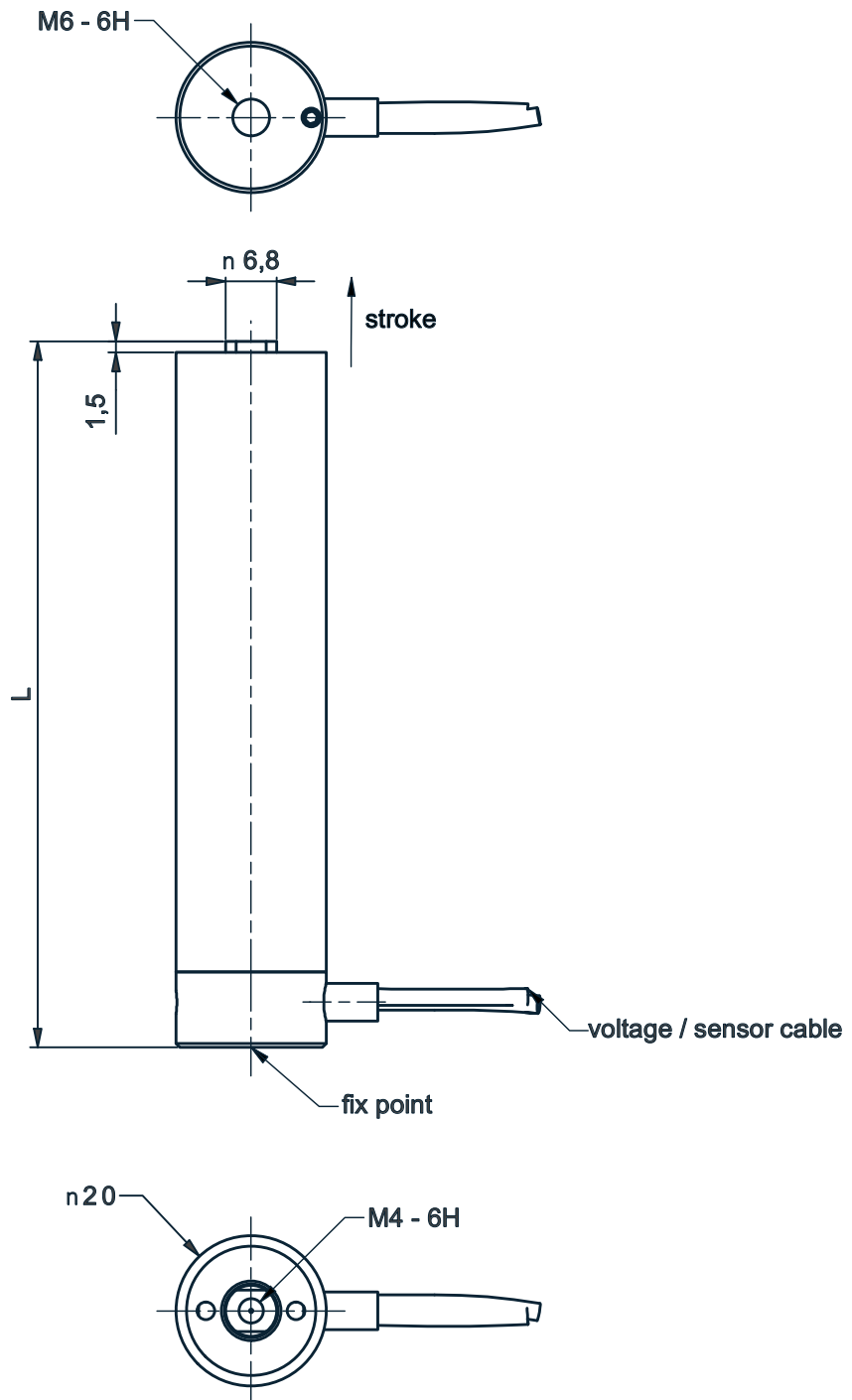
\*\*typical value for a small electrical field strength

\*\*\* Typical values, measured at -20 V ... +130 V

# PAHS

## Technical Drawing

model ( 1 : 2 )



We reserve the right to make changes to technical data and designs in the interest of technical progress.