APC International, Ltd.

Piezo mechanical and electrostrictive stack and ring actuators:

Product Range & Technical Data

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Contents

Selecting a proper actuator

Guideline:
The main pre-requisite for selecting suitable piezo components is the precise definition of the needed operation profile by the user!
Any supplier of piezo-mechanical components will highly appreciate precise specifications of the requested components beyond "the system shall do as much as possible".
Putting definite numbers on the needed piezo-parameters is helpful to avoid over-sizing and mismatch. Poorly selected system components are ineffective and therefore expensive.

Please try to analyze the needs for operating your mechanics successfully according to the following:

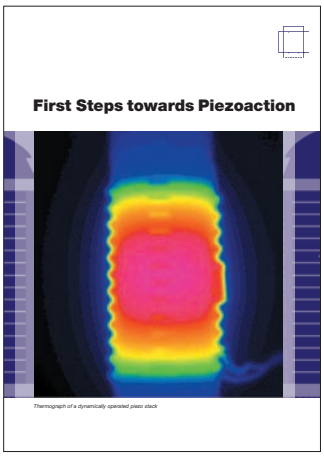
A, what shift/stroke shall be achieved?
B, what force variation shall be generated by the piezo action?
C, what static preload is acting on the actuator from the beginning?

D, what is the desired maximum operation frequency?
E, what is the desired stroke at maximum frequency (D)?
F, what is the desired max. frequency at maximum stroke (see A)?
G, shortest achievable rise-/fall-time?
H, what external masses shall be attached to the actuator?

A, to C, allow an actuator selection for low dynamic operation according
D, to H, aims for the best match for the designated dynamic operation.

Selecting the amplifier
The above selection process results in a piezo-actuator of distinct voltage range and electrical capacitance. Only amplifiers with a matched voltage range should be considered for use.
Do not use amplifiers providing higher voltage!

The dynamic operation profile D, to H, defines the needed current levels (I_{peak} and $I_{average}$).
When the power consumption of the actuator exceeds the Watt-range, self-heating of the piezo-ceramics can occur.
See brochure: First Steps towards Piezoaction



Thermograph of a dynamically operated piezo stack

For details see brochure:
"First Steps towards Piezoaction"

General comments

Low voltage stacks:
Co-fired multilayer actuators (CMA): also called “monolithic” stacks, involve no gluing, but a high temperature sintering of the complete ceramic electrode pile. Operating voltages areup to 200 V. Rectangular cross sections are typical due to the ease of cutting processes in production.

High voltage stacks:
Composite structures made by the stacking of separately finished piezoceramic discs and metal electrode foils that are joined through the use of adhesives. Operating voltages ranging from 500 V thru 1000 V are typical. Cylindrical shapes are most common.

Ring actuators:
A stack with center bore: made with rings instead of discs. This type of actuator is available in both low and high voltage form.

Actuators with integral preload:

The standard preload shows forces of about 10 – 20% of the maximum load. This design covers a very wide range of applications.
Preloaded actuators with casings are much more rugged than the bare ceramic stacks and are more likely to withstand “rough” handling and operation, or the impact of other environmental influences.

Dynamic operation:
The real operating frequency of a piezomechanical system is usually held far below the actuator’s resonance frequency
Ask for special low capacitance low voltage actuator’s PSt150hTc
For high dynamic applications
- To reduce power consumption
- To reduce self-heating

Do not misinterpret catalogue data:
Not all operating specifications can be realized at the same time due to simple physical facts.

- Maximum displacement/shift/stroke and maximum force generation /max. blocking force cannot be generated at the same time, only either-or.
- The maximum actuator shifts (strokes) shown in data sheet are only valid under constant load conditions (no force variation!).
- Two values for stroke are stated in the data sheet
  A, for unipolar activation 0 V /+Umax
  B, for semibipolar operation -Umin /+Umax
  The semi-bipolar operation increases the open-loop stroke of a stack by 20 – 30 %.
  Any kind of stack actuator is suitable for semibipolar operation at room temperature.

Example:
Piezostack PSt 150/5x5/20
Unipolar operation 0 V/ +150 V: stroke 20 µm e.g. with a LE 150 unipolar power amplifier
Semi-bipolar operation -30 V/+150 V: stroke 27 µm with a SVR 150 amplifier

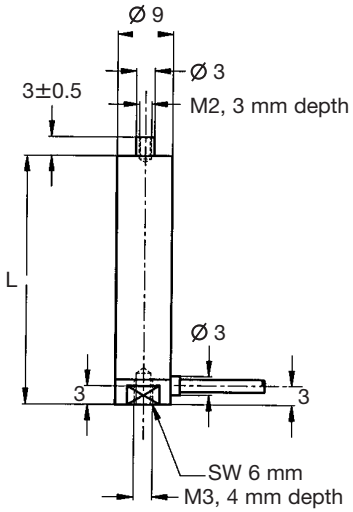
1. Stack type piezo actuators

1.1 Low voltage actuators with preloaded casings VS

PSt 150/4 /... VS9

General data: see brochure: “First Steps towards Piezoaction”

Prestress force = max. tensile force = approx. 40 N
Max. load force: 300 N
Max. force generation: 300 N
Open loop sensitivity at 1 mV amplifier noise for actuator PSt 150/4/7 VS9: approx. 0.05 Nanometer



Type	max. stroke µm	length mm	el. capacitance nF	stiffness N/µm	resonance frequency kHz
PSt 150/4/7 VS9	13/9	19	170	25	40
PSt 150/4/20 VS9	27/20	28	340	12	30

Standard configuration:

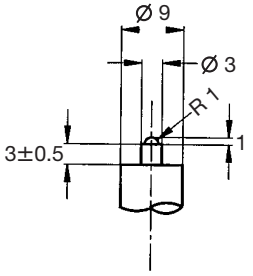
Tapped hole in moving end
Electrical connection: 1 m coaxial cable RG 178 with BNC connector

Options:

Coaxial cable RG 178 with LEMO connectors 00250 or 0S250
Moving end with spherical end piece **VbS**
UHV compatibility

Accessories see section 3

Stroke A/B A: for –30 V thru +150 V
B: for 0 V thru +150 V
Max. force generation: for –30 V thru +150 V

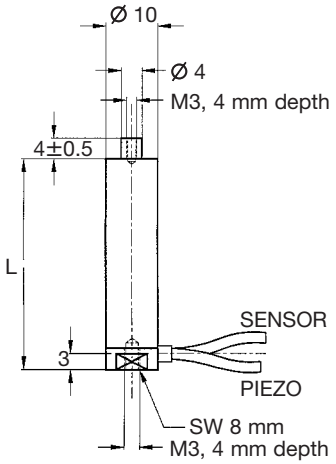


VbS

PSt 150/5/... VS10

General data: see brochure: “First Steps towards Piezoaction”

Prestress force = max. tensile force = approx. 150 N
Max. load force: 800 N
Max force generation: 800 N
Open loop sensitivity at 1 mV amplifier noise for actuator PSt 150/5/7 VS10: 0.05 Nanometer



Type	max. stroke µm	length mm	el. capacitance nF	stiffness N/µm	resonance frequency kHz
PSt 150/5/7 VS10	13/9	19	350	50	40
PSt 150/5/20 VS10	27/20	28	800	25	30
PSt 150/5/40 VS10	55/40	46	1600	12	20
PSt 150/5/60 VS10	80/60	64	2400	8	15
PSt 150/5/80 VS10	105/80	82	3200	6	12
PSt 150/5/100 VS10	130/100	100	4000	5	10

Standard configuration:

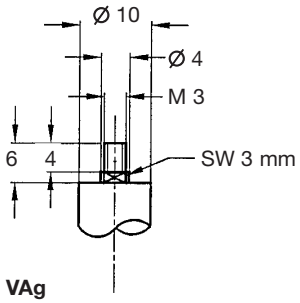
Tapped hole in moving end
Electrical connection: 1 m coaxial cable RG 178 with BNC connector

Options:

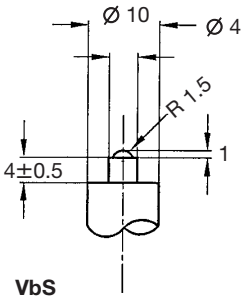
Coaxial cable RG 178 with LEMO connectors 00250 or 0S250

Moving end with spherical end piece **Vbs**
Moving end with threaded pin **VAg**
Moving end plane **pF**
Thermostable modification
Low temperature modification
UHV compatibility
Position detection

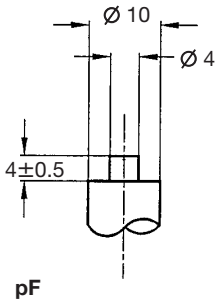
Accessories see section 3



VAg



VbS

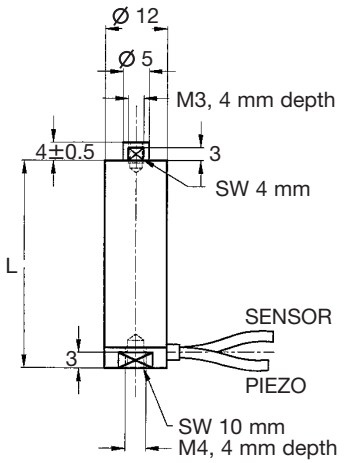


pF

PSt 150/7/... VS12

General data: see brochure: “First Steps towards Piezoaction”

Prestress force = max. tensile force = 300 N
Max. load force: 1800 N
Max. force generation: 1800 N
Open loop sensitivity at 1 mV amplifier noise for actuator PSt 150/7/7: 0.05 Nanometer



Type	max. stroke µm	length mm	el. capacitance µF	stiffness N/µm	resonance frequency kHz
PSt 150/7/7 VS12	013/9	19	0.7	120	40
PSt 150/7/20 VS12	27/20	28	1.8	60	30
PSt 150/7/40 VS12	55/40	46	3.6	25	20
PSt 150/7/60 VS12	80/60	64	5.4	15	15
PSt 150/7/80 VS12	105/80	82	7.2	12	12
PSt 150/7/100 VS12	130/100	100	9	10	10
PSt 150/7/120 VS12	160/120	118	11	8	8
PSt 150/7/140 VS12	190/140	136	13	7	6
PSt 150/7/160 VS12	210/160	154	15	6	5

Standard configuration:

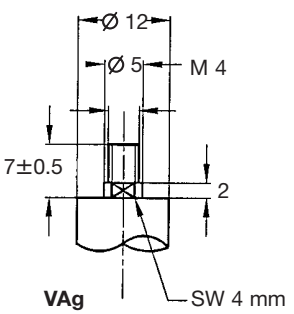
Tapped hole in moving end
Electrical connection: 1 m coaxial cable RG 178 with BNC connector

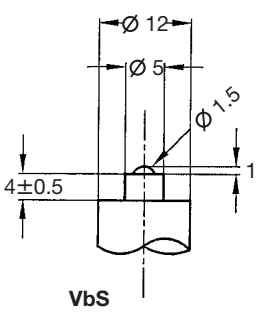
Options:

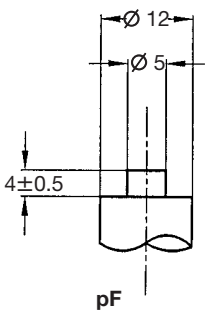
Coaxial cable RG178 with LEMO connectors 00250 or 0S250

Moving end with spherical end piece **VbS**
Moving end with threaded pin **VAg**
Moving end plane **pF**
Thermostable modification
Low temperature modification
UHV compatibility
Position detection

Accessories see section 3



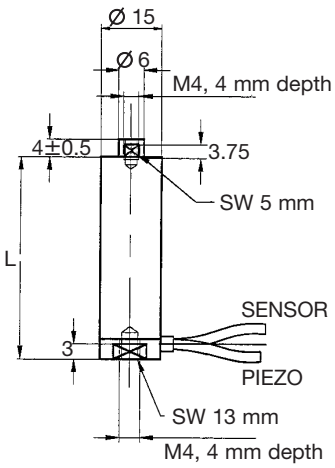




PSt 150/10/... VS15

General data: see brochure: “First Steps towards Piezoaction”

Prestress force = max. tensile force = approx. 400 N
Max. load force: 4000 N
Max. force generation: 3500 N
Open loop sensitivity at 1 mV amplifier noise for actuator PSt 150/10/7 VS15: 0.05 Nanometer.



Type	max. stroke µm	length mm	el. capacitance µF	stiffness N/µm	resonance frequency kHz
PSt 150/10/20 VS15	27/20	28	3.6	120	30
PSt 150/10/40 VS15	55/40	46	7.2	60	20
PSt 150/10/60 VS15	80/60	64	11	35	14
PSt 150/10/80 VS15	105/80	82	14	25	12
PSt 150/10/100 VS15	130/100	100	18	20	10
PSt 150/10/120 VS15	160/120	118	21	15	8
PSt 150/10/140 VS15	190/140	136	25	14	7
PSt 150/10/160 VS15	210/160	154	28	13	6
PSt 150/10/180 VS15	240/180	172	33	11	5
PSt 150/10/200 VS15	270/200	190	37	10	4

Standard configuration:

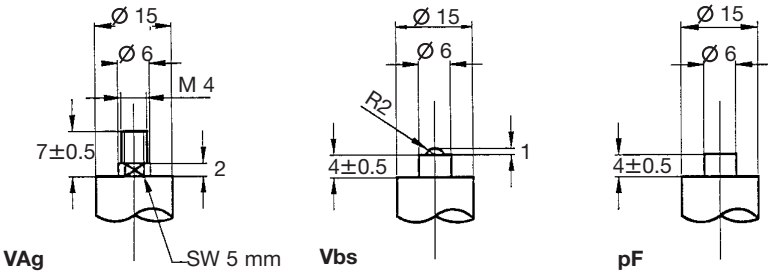
Tapped hole in moving end
Electrical connection: 1 m coaxial cable RG 178 with BNC connector

Options:

Coaxial cable RG 178 with LEMO connectors 00250 or 0S250

Moving end with spherical end piece **Vbs**
Moving end with threaded pin **VAg**
Moving end plane **pF**
Thermostable modification
Low temperature modification
UHV compatibility
Position detection

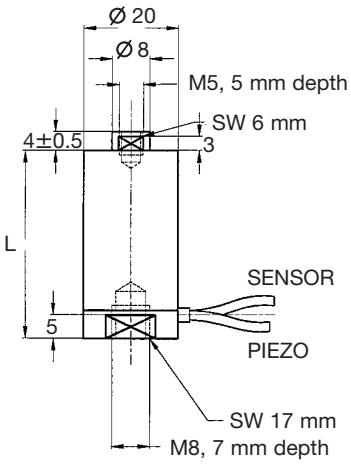
Accessories see section 3



PSt 150/14/… VS20

General data: see brochure: “First Steps towards Piezoaction”

Prestress force = max. tensile force = approx. 1000 N
Max. load force: 7000 N
Max. force generation: 7000 N
Open loop sensitivity at 1 mV amplifier noise for actuator PSt 150/14/20: approx. 0.1 Nanometer



Type	max. stroke µm	length mm	el. capacitance µF	stiffness N/µm	resonance frequency kHz
PSt 150/14/20 VS20	27/20	35	7	250	30
PSt 150/14/40 VS20	55/40	53	14	120	20
PSt 150/14/60 VS20	80/60	71	22	70	14
PSt 150/14/80 VS20	105/80	89	30	50	12
PSt 150/14/100 VS20	130/100	107	39	40	10
PSt 150/14/120 VS20	160/120	125	47	35	8
PSt 150/14/140 VS20	190/140	143	55	30	7
PSt 150/14/160 VS20	210/160	161	63	25	6
PSt 150/14/180 VS20	240/180	179	71	22	5
PSt 150/14/200 VS20	270/200	197	80	20	4

Standard configuration:

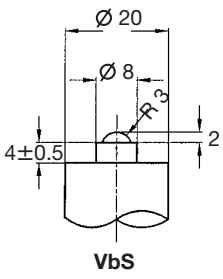
Tapped hole in moving end
1 m coaxial cable RG 178 with BNC connector

Options:

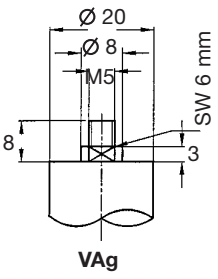
Coaxial cable RG178 with LEMO connectors 00250 or 0S250
Coaxial cable RG 316 for power applications

Moving end with spherical end piece **Vbs**
Moving end with threaded pin **VAg**
Moving end plane **pF**
Thermostable modification
Low temperature modification
UHV compatibility
Position detection

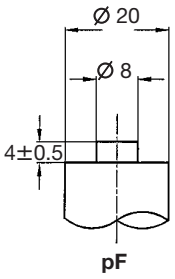
Accessories see section 3



VbS



VAg

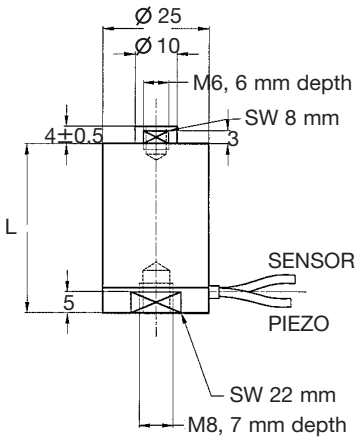


pF

PSt 150/20/… VS25

General data: see brochure: “First Steps towards Piezoaction”

Prestress force = max. tensile force = approx. 1500 N
Max. load force: 14000 N
Max. force generation: 11000 N
Open loop sensitivity at 1 mV amplifier noise for actuator PSt 150/20/20 VS25: approx. 0.1 Nanometer



Type	max. stroke µm	length mm	el. capacitance µF	stiffness N/µm	resonance frequency kHz
PSt 150/20/20 VS25	25/20	37	11	500	28
PSt 150/20/40 VS25	50/40	57	22	250	18
PSt 150/20/60 VS25	75/60	77	33	160	13
PSt 150/20/80 VS25	95/80	97	44	100	11
PSt 150/20/100 VS25	120/100	117	55	80	9
PSt 150/20/120 VS25	150/120	137	66	65	7
PSt 150/20/140 VS25	175/140	157	77	55	6
PSt 150/20/160 VS25	200/160	177	88	50	5
PSt 150/20/180 VS25	230/180	197	100	45	4
PSt 150/20/200 VS25	250/200	217	110	40	3

Standard configuration:

Tapped hole in moving end
Electrical connection: 1 m coaxial cable RG 178 with BNC connector

Options:

Coaxial cable RG178 with LEMO connectors 00250 or 0S250
Coaxial cable RG 316 for power applications
Modifi ed end pieces on request

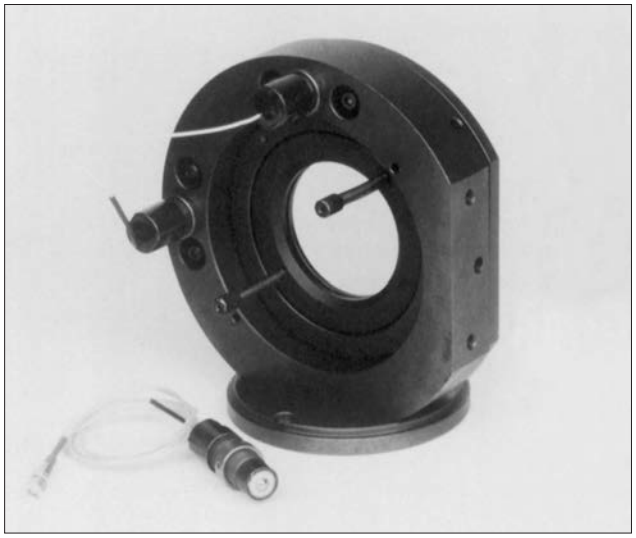
Stroke A/B A: for –30 V thru +150 V
B: for 0 V thru +150 V
Max. force generation: for –30 V thru +150 V

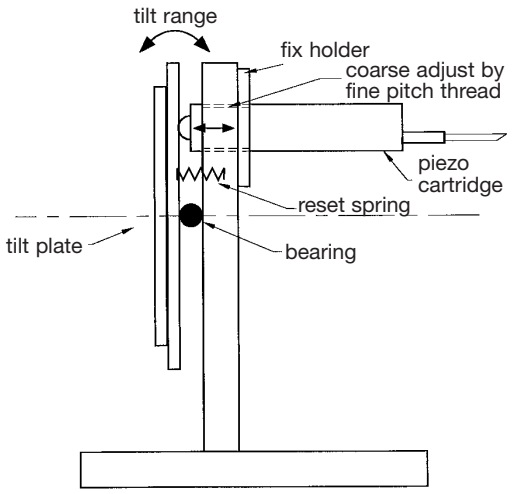
Thermostable modification
Low temperature modification
UHV compatibility
Position detection

Accessories see section 3

1.2 Piezocartridges:
Low voltage actuators in casings with front mount threading

Stack actuators in cartridge-version offer elegant design features by simple attachment of an actuator to the mechanics using a front mounting thread. Using this thread a coarse adjustment for the system is provided. Piezocartridges can retrofit conventional lead screws. Mechanical arrangements for adjusting purposes can be very simply upgraded by using piezocartridges.





Schematic of a mirror mount based on piezo cartridges for coarse adjust by mounting screw and ultra fine adjustment by piezo action.

The stiffness of piezo cartridges is reduced compared to a normally mounted stack because of the force transmission from mounting plate to moving end via stack + casing, and in addition by the quality the screw mount. A lock nut is provided to increase attaching force.

Piezocartridges can therefore withstand high loads, but force generation is reduced due to the lower stiffness. Most applications (e.g. for adjusting purposes) use constant loading.

Standard configuration:

Casing: stainless steel
Electrical connection: 1 m coaxial cable RG 178 with BNC connector

Stroke A/B A: for –30 V thru +150 V
B: for 0 V thru +150 V

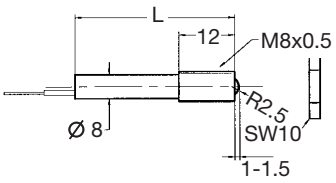
Max. force generation: for –30 V thru +150 V

Options:

Coaxial cable RG178 with LEMO connectors
00250 or 0S250
Position detection
Thermostable

FPSt 150/4/… M8x0.5

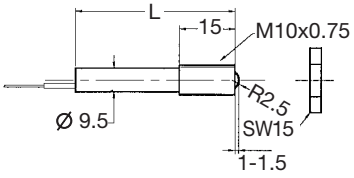
(no internal prestress)
Maximum load: 150 N
Open loop sensitivity at 1 mV amplifier noise for actuator FPSt 150/4/20: approx. 0.1 Nanometer



Type	max. stroke µm	length mm	el. capacitance nF
FPSt 150/4/20 M8	27/20	22	340
FPSt 150/4/40 M8	55/40	40	700
FPSt 150/4/60 M8	80/60	58	1000

FPSt 150/5/… M10x0.75

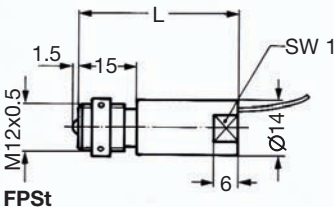
(no internal prestress)
Maximum load 600 N
Open loop sensitivity at 1 mV amplifier noise for actuator FPSt 150/5/20: approx. 0.1 Nanometer



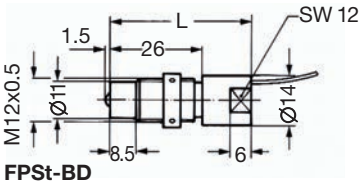
Type	max. stroke µm	length mm	el. capacitance nF
FPSt 150/5/20 M10	27/20	23	800
FPSt 150/5/40 M10	55/40	41	1600
FPSt 150/5/60 M10	80/60	59	2400
FPSt 150/5/80 M10	105/80	77	3200
FPSt 150/5/100 M10	130/100	95	4000

FPSt 150/5/… M12x0.5(-BD) (former versions MPSt(-BD)

(no internal prestress)
For retrofi tting translation stages MRL 80.25 and Newport mirror mounts SL
Maximum load: 600 N
Open loop sensitivity at 1 mV amplifier noise for actuator FPSt 150/5/20 : approx. 0.1 Nanometer



FPSt

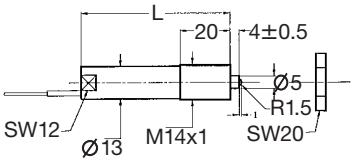


FPSt-BD

Type	max. stroke µm	length mm	el. capacitance nF
FPSt 150/5/20 M12 (BD)	27/20	25	800
FPSt 150/5/30 M12 (BD)	40/30	34	1200
FPSt 150/5/40 M12 (BD)	60/40	43	1600
FPSt 150/5/60 M12 (BD)	80/60	61	2400
FPSt 150/5/80 M12 (BD)	105/80	79	3200
FPSt 150/5/100 M12 (BD)	130/100	97	4000
FPSt 150/5/120 M12 (BD)	160/120	115	4800
FPSt 150/5/140 M12 (BD)	190/140	133	5600

FPSt 150/7/... M14x1

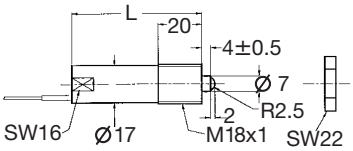
Prestress force = max. tensile force = 200 N
Maximum load: 1500 N
Open loop sensitivity at 1 mV amplifier noise for actuator FPSt 150/7/20: approx. 0.1 Nanometer



Type		max. stroke µm	length mm	el. capacitance µF
FPSt 150/7/20	M14	27/20	28	1.8
FPSt 150/7/40	M14	60/40	46	3.6
FPSt 150/7/60	M14	80/60	64	5.4
FPSt 150/7/80	M14	105/80	82	7.2
FPSt 150/7/100	M14	130/100	100	9
FPSt 150/7/120	M14	160/120	118	11
FPSt 150/7/140	M14	190/140	136	13
FPSt 150/7/>140	M14	/>140	on request	

FPSt 150/10/... M18x1

(with internal prestress)
Prestress force = max. tensile force = 400 N
Maximum load: 3000 N
Open loop sensitivity at 1 mV amplifier noise for actuator FPSt 150/10/20: approx. 0.1 Nanometer



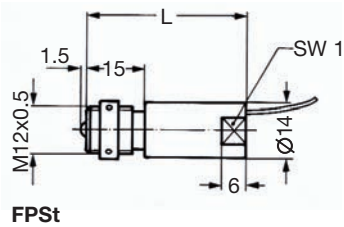
Type		max. stroke µm	length mm	el. capacitance µF
FPSt 150/10/20	M18	27/20	28	3.6
FPSt 150/10/40	M18	55/40	46	7.2
FPSt 150/10/60	M18	80/60	64	11
FPSt 150/10/80	M18	105/80	82	14
FPSt 150/10/100	M18	130/100	100	18
FPSt 150/10/120	M18	160/120	118	21
FPSt 150/10/140	M18	190/140	136	25
FPSt 150/10/>140	M18	>/140	on request	

Electrostrictive stacks, frontmount cartridges versions

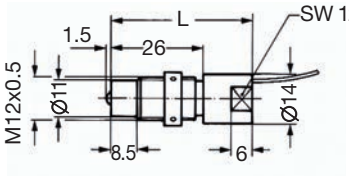
FESt 150/5/… M10x0.75 on request

FESt 150/5/… M12x0.5(-BD)

Maximum load: 500 N
Open loop sensitivity for 1 mV amplifier noise
with FESt 150/5/12 M12: approx. 0.1 Nanometer



FPSt



FPSt-BD

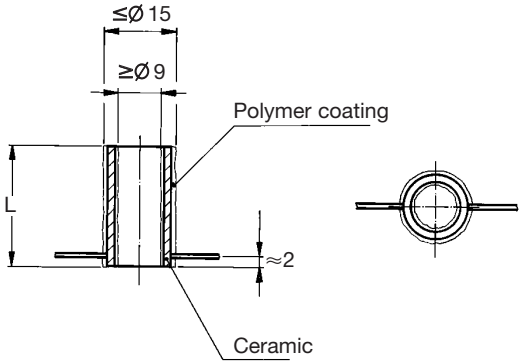
Type	max. stroke µm	length mm	el. capacitance nF
FESt 150/5/12 M12 (BD)	12	31	1200
FESt 150/5/18 M12 (BD)	18	40	1800
FESt 150/5/25 M12 (BD)	25	48	2400
FESt 150/5/40 M12 (BD)	40	67	3600

2. Ring Actuators (stack type hollow cylinders)

2.1 Low voltage ring actuators without casing

HPSt 150/14-10/xx

Stroke A/B: A: for –30 V thru +150 V
B: for 0 V thru +150 V
Max. force generation: for –30 V thru +150 V

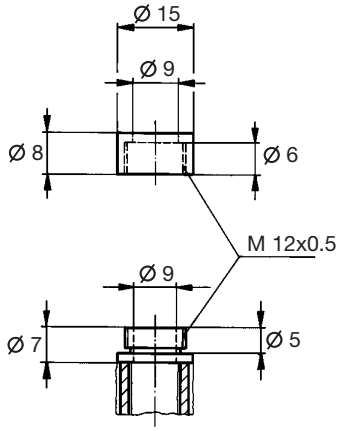


Maximum force generation: 4500 N
Open loop sensitivity for 1 mV amplifier noise for actuator HPSt 150/14-10/12: approx. 0.1 Nanometer

Type	max. stroke µm	length mm	el. capacitance µF	stiffness N/µm	resonance frequency kHz
HPSt 150/14-10/12	16/12	13.5	2.6	250	75
HPSt 150/14-10/25	32/25	27	5.2	120	22
HPSt 150/14-10/40	50/40	on request			
HPSt 150/14-10/55	70/55	on request			

Options:

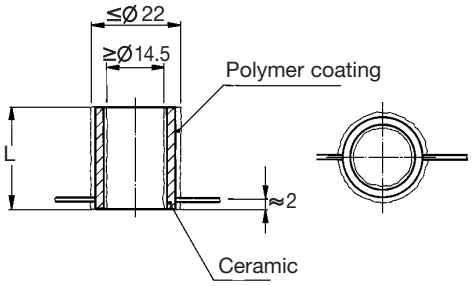
Threaded end pieces **HAg**
(together with 1 screw cap)
Optics adaptor 0A ½ ˝ (see section 3)



HAg

HPSt 150/20-15/xx

Maximum load: 11000 N
Maximum force generation: 8000 N
Open loop sensitivity for 1 mV amplifier noise for actuator HPSt 150/20-15/12: approx. 0.1 Nanometer

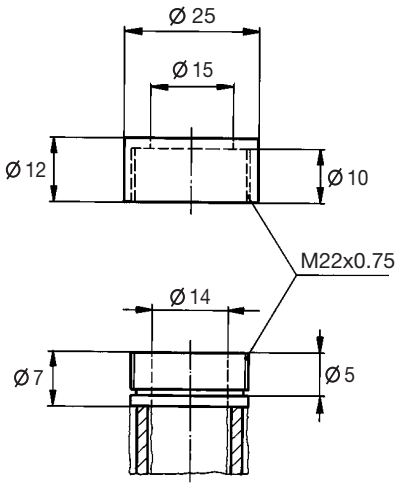


Type	max. stroke µm	length mm	el. capacitance µF	stiffness N/µm	resonance frequency kHz
HPSt 150/20-15/12	16/12	13.5	5	450	75
HPSt 150/20-15/25	32/25	27	10	230	22
HPSt 150/20-15/40	50/40	40.5	15	150	15
HPSt 150/20-15/55	70/55	54	20	100	10

Options:

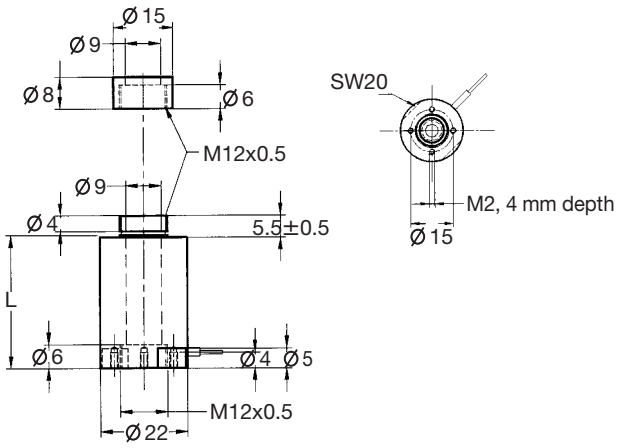
Threaded end pieces **HAg**
(together with 1 screw cap)
Optics adaptor 0A 1 ˝ (see section 3)

Stroke A/B: A: for –30 V thru +150 V
B: for 0 V thru +150 V
Max. force generation: for –30 V thru +150 V



HPSt 150/14-10/... VS22

Prestress force = max. tensile force = 400 N
Maximum load: 6000 N
Maximum force generation: 4500 N
Open loop sensitivity for 1 mV amplifier noise for actuator HPSt 150/14-10/12 VS22: approx. 0.1 Nanometer



Type	max. stroke µm	length mm	el. capacitance µF	stiffness N/µm	resonance frequency kHz
HPSt 150/14-10/12 VS22	16/12	31	2.6	250	30
HPSt 150/14-10/25 VS22	32/25	44	5.2	120	20
HPSt 150/14-10/40 VS22	50/40	58	7.8	70	14
HPSt 150/14-10/55 VS22	70/50	71	11	50	9

Standard configuration:

Coaxial cable RG 178 length 1 m with BNC connector

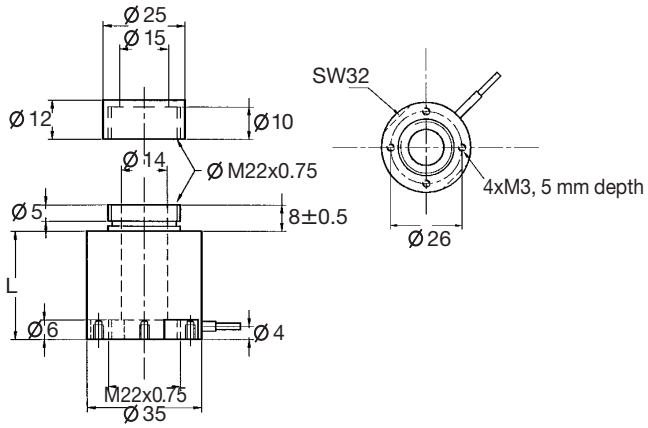
Options:

Coaxial cable RG 178 length 1 m with LEMO 00250 or 0S250 connector
UHV compatibility
Low temperature application
Thermostable modification
Position sensor
Optics adaptor 0A ½": see section 3
Adaptor rings AR: see section 3

Stroke A/B: A: for –30 V thru +150 V
B: for 0 V thru +150 V
Max. force generation: for –30 V thru +150 V

HPSt 150/20-15/… VS35

General data: see brochure: “First Steps towards Piezoaction”
Prestress force = max. tensile force = 700 N
Maximum load: 11000 N
Maximum force generation: 8000 N
Open loop sensitivity for 1 mV amplifier noise for actuator HPSt 150/20-15/12 VS35: approx. 0.1 Nanometer



Type	max. stroke µm	length mm	el. capacitance µF	stiffness N/µm	resonance frequency kHz
HPSt 150/20-15/12 VS35	16/12	31	5	450	30
HPSt 150/20-15/25 VS35	32/25	44	10	230	20
HPSt 150/20-15/40 VS35	50/40	58	15	150	17
HPSt 150/20-15/55 VS35	70/50	71	20	100	15

Standard configuration:

Coaxial cable RG 178 length 1 m with BNC connector

Options:

Coaxial cable RG 178 length 1m with LEMO 00250 or 0S250 connector
UHV compatibility
Low temperature application
Thermostable modification
Position detector
Optics adaptor 0A 1”: see section 3
Adaptor rings AR: see section 3

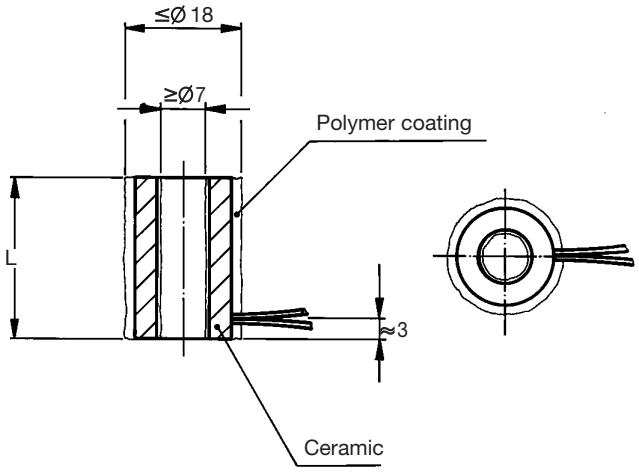
Stroke A/B: A: for –30 V thru +150 V
B: for 0 V thru +150 V
Max. force generation: for –30 V thru +150 V

2.3 Electrostrictive low voltage ring actuators

General data: see brochure: “First Steps towards Piezoaction”

HESt 150/15-8/… bare rings, without casing

Maximum force load: 5000 N



Type	max. stroke µm	length mm	el. capacitance µF	stiffness N/µm
HESt 150/15-8/2	2	3	4	1500
HESt 150/15-8/4	4	6	8	750
HESt 150/15-8/6	6	9	12	500
HESt 150/15-8/12	12	18	22	250

Mechanical end piece **HAg** as Piezo ring actuators HPSt…/15-8/…
Optics adaptor 0A ½”: see chapter 3

HESt 150/15-8/… VS 22 casing with internal prestress

Prestress force = max. tensile force = 400 N
Maximum load: 5000 N
Open loop sensitivity for 1 mV amplifier noise for actuator
HESt 150/15-8/6 VS22: 0.05 Nanometer

Type	max. stroke µm	length mm	el. capacitance µF	stiffness N/µm
HESt 150/15-8/6 VS22	6	26	12	500
HESt 150/15-8/12 VS22	12	35	22	250
HEST 150/15-8/>12 VS22		on request		

Standard configuration:

Coaxial cable RG 178 length 1 m with BNC connector

Options:

UHV compatibility
Optics adaptor 0A ½": see section 3
Adaptor rings AR: see section 3

3. Accessories

3.1 Electricals

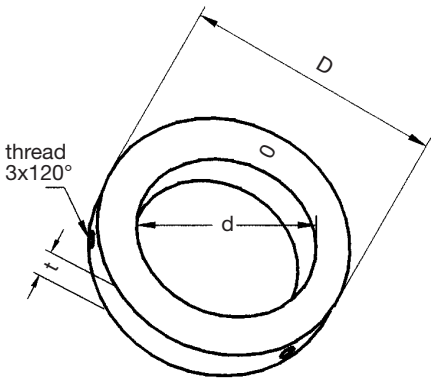
Supply coaxial cables: one side connector, other side free for attaching piezocomponents such as bare stacks etc.
Cable type RG 178 (PTFE), thickness 1.8 mm: length 1.5 m
Connectors available: BNC, LEMO 0S250
Cable type RG 316 (PTFE), thickness 2.5 mm: length 1.5 m
for power applications
Connectors available: BNC, LEMO 0S250

Extension cables:
Connector system LEMO 0S250, length 2 m/4 m/6 m
Cable types RG 178 or RG 316 (see above)

Connecting adaptors for matching different connectingsystems plug (from electronics)/Cable's connector LEMO 0S 250/BNC (this adaptor is used to match amplifi ers with LEMO output to a component, having a BNC connector)
BNC/LEMO 0S250
BNC/LEMO 00250

3.2 Mechanics

Adaptor rings
The adaptor rings are normally used to match the diameter of actuators with casing to mirror mounts, defined for a distinct mirror's diameter. An often used combination are ring actuators (e.g. with casing VS22), which are adopted to 2" mirror mount system. The proper adaptor ring is an AR (51/22).



Designation AR X/Y X external diameter, Y internal diameter (corresponds to actuator's casing's diameter), T thickness of ring (all dimensions in mm)

AR	25/10	t	5
AR	25/12	t	5
AR	25/18	t	5
AR	50/18	t	7
AR	50/20	t	7
AR	50/22	t	7
AR	50/25	t	7
AR	50/35	t	7

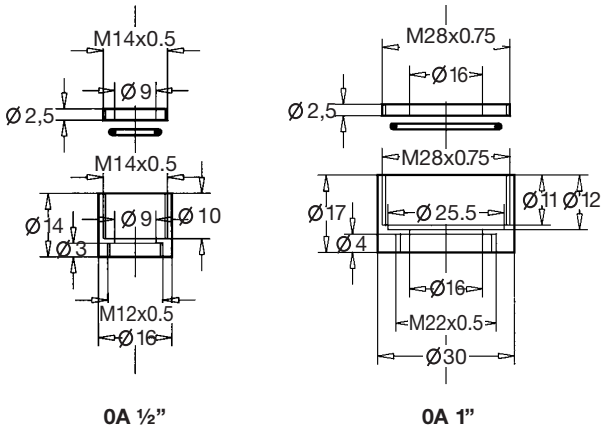
AR	31/12	t	7
AR	31/22	t	7
AR	31/25	t	7
AR	51/18	t	7
AR	51/20	t	7
AR	51/22	t	7
AR	51/22	t	7
AR	51/35	t	7

3.3 Optic adaptor for ring actuators

Ring actuators are often used within optical arrangements for precise adjustment of transmissive optical components e.g. within laser resonators or tunable etalons. The optic adaptors allow the simple mounting and changing of circular optics with the standard diameters 1/2" sand 1".

Optic adaptor 0A ½"
This element allows mounting of optics with diameter 1/2" up to a thickness of 8 mm. It can be simply attached using the M12x0.5 thread to all the corresponding ring actuators with a HAg M12x0.5 end piece (bare rings) such as the HPSt 150/14-10/…, HPSt 500/15-8/…, HPSt 1000/15-8/… or the equivalent cased types with a VS22 casing.

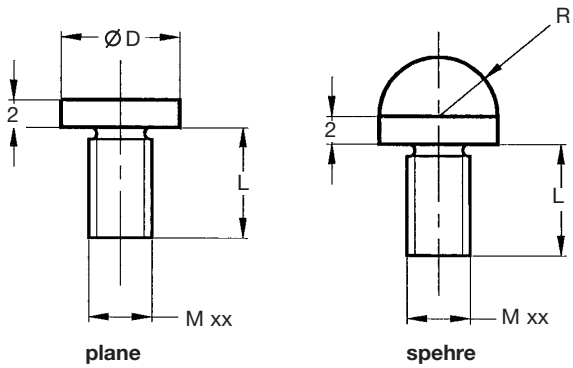
Optic adaptor 0A 1"
This element allows mounting of optics with diameter 1" up to a thickness of 8 mm. It can be simply attached using the M22x0.5 thread to all the corresponding ring actuators with a HAg M22x0.75 end piece (bare rings) such as the HPSt 150/25-15/… or the equivalent cased types with a VS35 casing.



0A ½" **0A 1"**

3.4 Screw in front adaptor SE (For stacks with casings VS)

The adaptors have a threaded pin for simple attachment to the standard front pieces VS with tapped hole and provide a plane or spherical front to match the actuator for various uses. For example small mirrors can be glued onto the plane faces.
Designation: SE xx plane and SE x sphere, where xx represents the casing's diameter, where it is mounted to (e.g. 12 for VS 12).



plane **spehre**

Type	Mx (mm)	D (mm)	L (mm)	R (mm)
SE9	2.3	5	3	2.5
SE10	3	6	3	2.5
SE12	3	7	4	3.5
SE15	4	8	4	3.5
SE18/20	5	10	4	4

Magnetic front pieces
Based on the above described front adaptors, MA components with magnetic plane face are offered for VS10 and VS12 casings (designation MA10 / MA12). Small ferromagnetic components can be easily attached to the moving pin of stack actuators.