

## NELES® POSITIONERS

### ELECTRO-PNEUMATIC SERIES NE700

### PNEUMATIC SERIES NP700

Metso's Neles NE700 and NP700 are proportional positioners for control valves. The NP is a fully pneumatic unit while the NE is an electro-pneumatic unit that provides pneumatic output proportional to a standard milliampere DC input. Both units can be used with either cylinder or diaphragm type actuators for rotary or linear valves to provide excellent repeatability and accuracy in a wide range of throttling applications.

#### FEATURES

##### Excellent vibration resistance

Rugged construction, few parts, small moving mass, compact design and rigid mounting provide outstanding vibration resistance.

##### Field reversible

Positioner can be set for direct or reverse-acting modes by simply turning around the changeover piece and feedback cam without touching or changing tubings between actuator and positioner. Split-range and reverse actions are standard on the feedback cam.

##### Easy and fast to calibrate

Calibrations can be easily made with the positioner cover removed. You can fine-tune zero and range adjustments with minimal effect on set points.

##### Fast response times

Multiple pilot valve sizes are used to match positioner capacity compatibility with actuator stroke volume, minimizing response time.

##### Stable operation

Changes in supply pressure and valve load have minimal effect on positioner operation.

##### NE positioners

These electro-pneumatic positioners operate on a milliampere signal from a controller. They accurately position the control valve assembly in response to a change in input signal. The nominal input resistance is 190 ohms. The moving force coil assembly has low mass and is accurately balanced to assure proper function even in severely vibrating applications. The dynamic behaviour of the positioner can be changed by choosing different size pilot valves (see table in page 3) and adjusting the internal gain.

##### NP positioners

The NP positioner operates on a pneumatic signal. It responds to a change in pneumatic instrument signal and accurately re-positions the control valve assembly. The diaphragm piston and feedback spring are force balanced. The rugged beam and few parts provide excellent vibration resistance. The positioner capacity can be changed by choosing different size pilot valves (see table in page 3).



##### NE and NP positioners

The direction of operation for NE or NP positioners can be changed simply by reversing the built-in changeover piece and the cam. External piping need not to be modified. The same housing is utilized for both styles of positioner and in both double-acting and single-acting versions.

##### CE-mark

NE700 positioners carry the CE-mark for countries which belong to the European Economic Area.

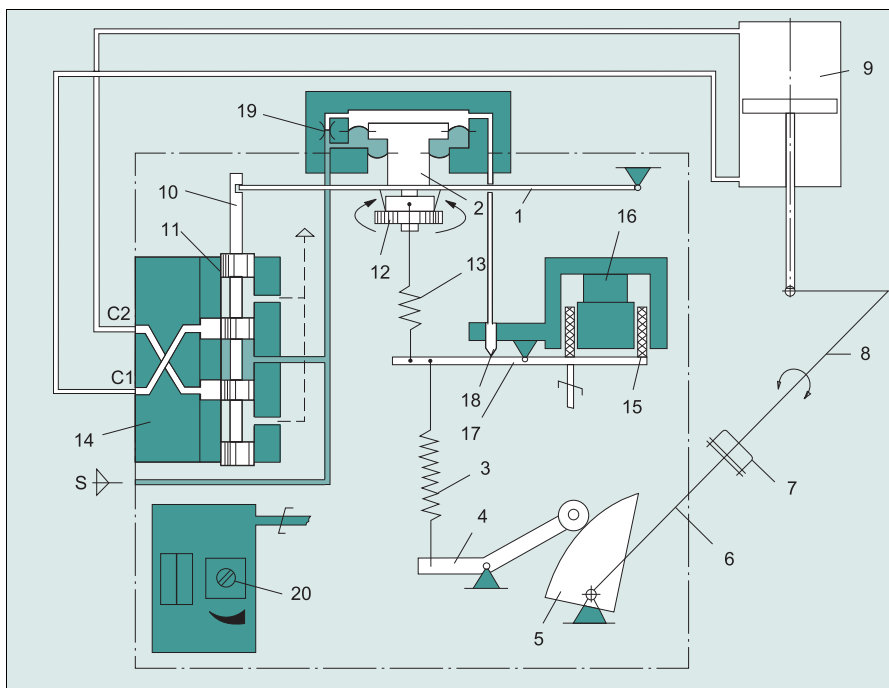
##### Options

- protection through constructional safety ATEX II 2 G c (only NP series)
- flame proof enclosure ATEX approved (II 2 G EEx d IIC T4/T5/T6) or FM and CSA approved (Class I, II, Div. 1, Gr. B - G) (only NP series).
- dust proof enclosure (IP 65).
- electric plug connector DIN 43650/ISO4400.
- high temperature construction up to +120 °C / +250 °F.
- natural gas service.
- pressure gauge kit.
- bypass kit (only NP series).
- filter regulator.
- attachment to rotary actuators to VDI/VDE 3845.

### NE Principle of operation

- 1 = beam
- 2 = diaphragm piston
- 3 = feed-back spring
- 4 = lever
- 5 = cam
- 6 = feedback shaft
- 7 = coupling
- 8 = actuator shaft
- 9 = actuator
- 10 = pilot valve spool
- 11 = pilot valve body
- 12 = zero adjustment
- 13 = internal feed-back spring
- 14 = changeover piece
- 15 = force coil
- 16 = permanent magnet
- 17 = balance beam
- 18 = nozzle
- 19 = restriction
- 20 = range adjustment

- = supply pressure
- = cylinder pressure
- = nozzle & diaphragm pressure
- = fixed parts
- = moving parts



The force coil (15) located in the permanent magnetic field creates a torque proportional to the signal current on the balance beam (17). The feed-back spring (3) causes a countertorque on the balance beam (17) in relation to the turning angle of the actuator shaft. Turning is transmitted through coupling (7), feed-back shaft (6), cam (5) and lever (4) to the lower end of the feed-back spring (3). Nozzle (18) senses the torque balance on beam (17). When, e.g., the signal increases, the beam will close the nozzle (18) further, the nozzle pressure will increase and the dia-

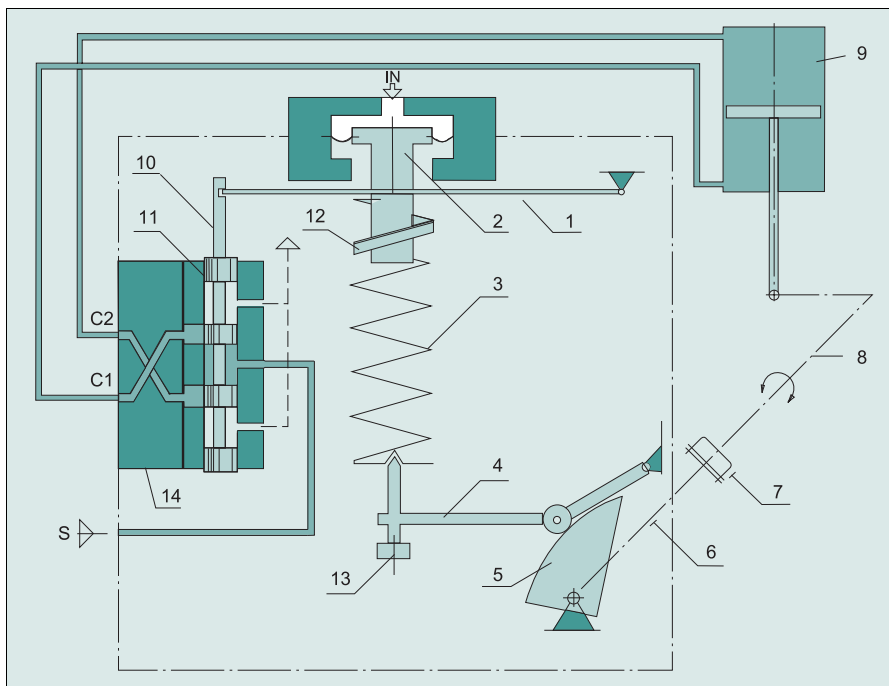
phragm piston (2), beam (1) and spool (10) will move downwards. The pilot valve (10, 11) distributes air flow to the upper side of the actuator piston and from the lower side to the exhaust port. Due to the pressure difference, the piston force overcomes friction and dynamic torques to move the actuator shaft in to a position corresponding exactly to the new signal. Torques on the beam (17) are then in balance. The spring (13) causes negative feed-back between the first amplification stage consisting of nozzle (18), restriction (19) and diaphragm piston (2) and the sec-

ond amplification stage consisting of pilot valve (10, 11) and actuator. By changing the lower fastening point of the spring (13) along the beam (17), the dynamics of the positioner can be adapted according to the actuator side. Differential diaphragms effectively compensate the influence of supply pressure variations. Zero is adjusted with a nut (12) and range with a potentiometer (20).

### NP Principle of operation

- 1 = beam
- 2 = diaphragm piston
- 3 = feed-back spring
- 4 = lever
- 5 = cam
- 6 = feedback shaft
- 7 = coupling
- 8 = actuator shaft
- 9 = actuator
- 10 = pilot valve spool
- 11 = pilot valve body
- 12 = range adjustment nut
- 13 = zero adjustment screw
- 14 = changeover piece

- = supply pressure
- = cylinder pressure
- = signal pressure
- = fixed parts
- = moving parts



Operation is based on the force balance principle. One force is caused by signal pressure (IN) transmitted through the diaphragm (2), the other force is caused by the feed-back spring (3). The latter is directly proportional to the position of the lower end of the spring, this in turn depends solely on the actuator shaft (8) position as transmitted through the coupling (7), shaft (6), cam (5), and the lever (4). When these forces are not equal, the beam (1) moves in the direction of the stronger force. The end of

the beam moves the spool (10) in the body (11). Diverted from the balance position, the spool (10) guides supply air to one side of the piston and exhaust air from the other, causing a pressure difference in cylinder (9). The piston moves in the direction of the lower pressure until the tension induced in the feed-back spring by this change counterbalances the force caused by the change in signal pressure. Every signal pressure value corresponds to only one actuator position. In the balanced position, the pres-

sure on both sides of the unloaded actuator's piston is approximately equal, being about 0.7 times the supply pressure. If an external torque acts on the actuator the shaft tends to move towards the torque direction. Through the feed-back system this will produce a change in the position of the spool so that the pressure difference created in the cylinder will counterbalance the external torque.

## TECHNICAL SPECIFICATION

### NE700 technical data

Standard input signal	4 - 20 mA, 0 - 20 mA (direct current)	Performance with moderate constant load actuators
Split ranges	4 - 12 mA, 12 - 20 mA	- dead band < 0.3 %
Input resistance	max. 190 Ω	- hysteresis < 0.7 %
Turning angle of feedback shaft	max. 95°	- linearity < 2 %
Relation between turning angle and signal	linear	Effect on vibration (1.5 g, 5-100 Hz) < 1 %
Supply pressure $p_s$	0.14 - 0.8 MPa 1.4 - 8 barg / 20 - 115 psig	Construction materials:
Effect of supply pressure $p_s$	<0.2 % / 10 kPa / 0.14 %/psi	- Case is anodized aluminum alloy, epoxy coated.
Ambient temperature	-25 to 85 °C / -15 to 185 °F	- Cover is polycarbonate or aluminium alloy. Internal parts are stainless steel and aluminum alloy.
Effect of temperature	<0.05 %/°C / <0.025 %/°F	- Diaphragms and seals are nitrile rubber (standard model).
		Weight approx. 2.3 kg / 4.8 lbs

### NP700 technical data

Standard signal pressure ranges	20 - 100 kPa 0.2 - 1.0 barg / 3 - 15 psig	Performance with moderate constant load actuators
Split ranges	20 - 60 kPa, 60 - 100 kPa 3 - 9 psig, 9 - 15 psig	- dead band < 0.3 %
Turning angle of feedback shafts	max. 95°	- hysteresis < 1.2 %
Relation between turning angle and signal	linear	- linearity < 2 %
Supply pressure $p_s$	0.14 - 1 MPa 1.4 - 10 barg / 20 - 140 psig	Effect on vibration (1.5 g, 5-100 Hz) < 1 %
Effect of supply pressure	<0.2 %/10 kPa / 0.14 %/psi	Construction materials:
Ambient temperature	-40 to 90 °C / -40 to 200 °F	- Case is anodized aluminum alloy, epoxy coated.
Effect of temperature	<0.07 %/°C / <0.025 %/°F <0.15%/°C / <0.05 %/°F	- Cover is polycarbonate or aluminum alloy. Internal parts are stainless steel and aluminum alloy.
		- Diaphragm and seals are nitrile rubber (standard model).
		Weight approx. 1.6 kg / 3.3 lbs

### Metso Actuator/Positioner Selection Chart

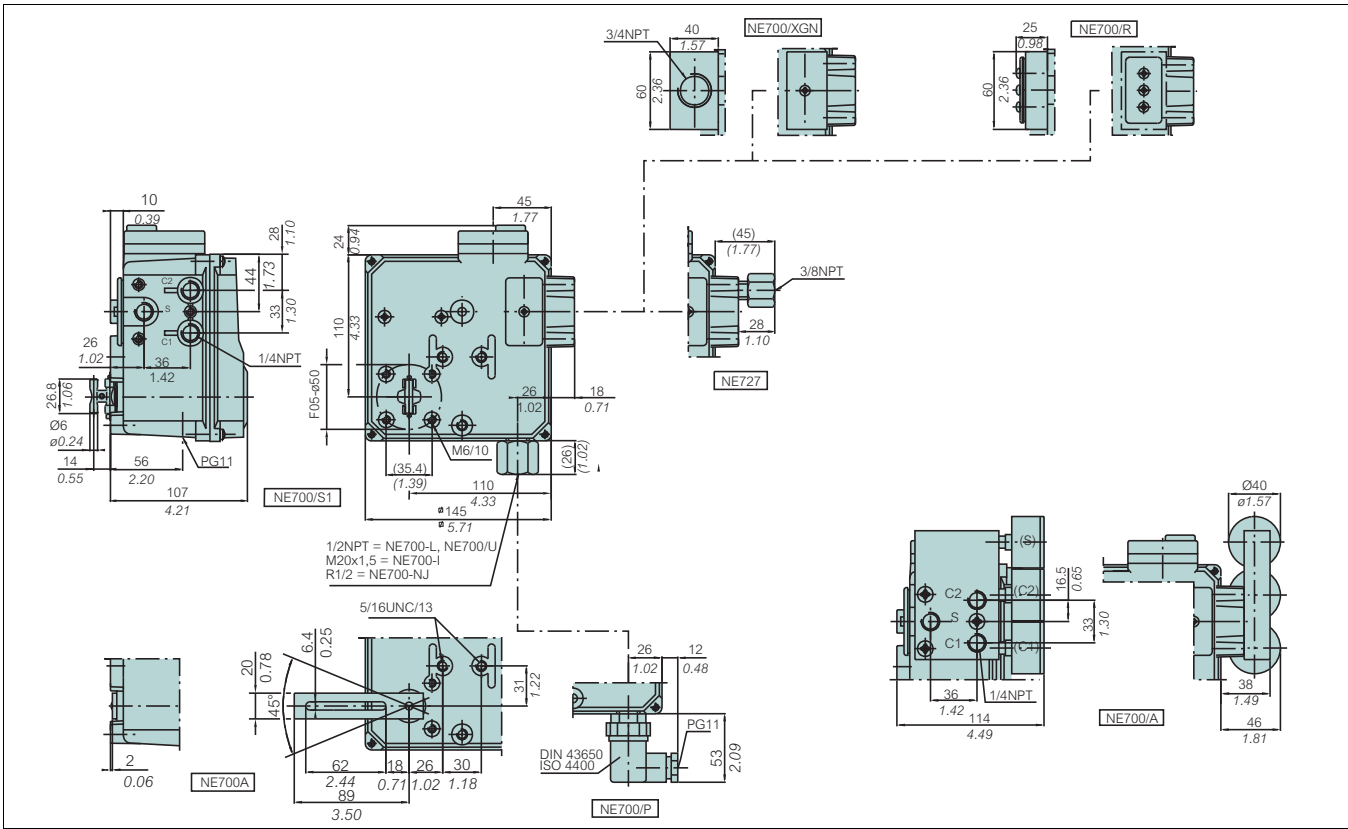
Actuator type	NE	NP
B1CU6 thru B1CU11	NE724	NP723
B1CU13 thru B1CU20, B1JU10 thru B1JU16 QP3 & QP4 Quadra-Powr® DA/RA thru DB/RB diaphragm (linear)	NE724	NP724
B1CU25, B1CU32, B1JU20, B1JU25, QP5 QP6 Quadra-Powr® DC/RC thru DD/RD and DE/RE diaphragm (linear) A46/A47	NE726	NP726
B1CU40 & larger, B1JU32 & larger QP7	NE727	NP727

### Pilot valve alternatives

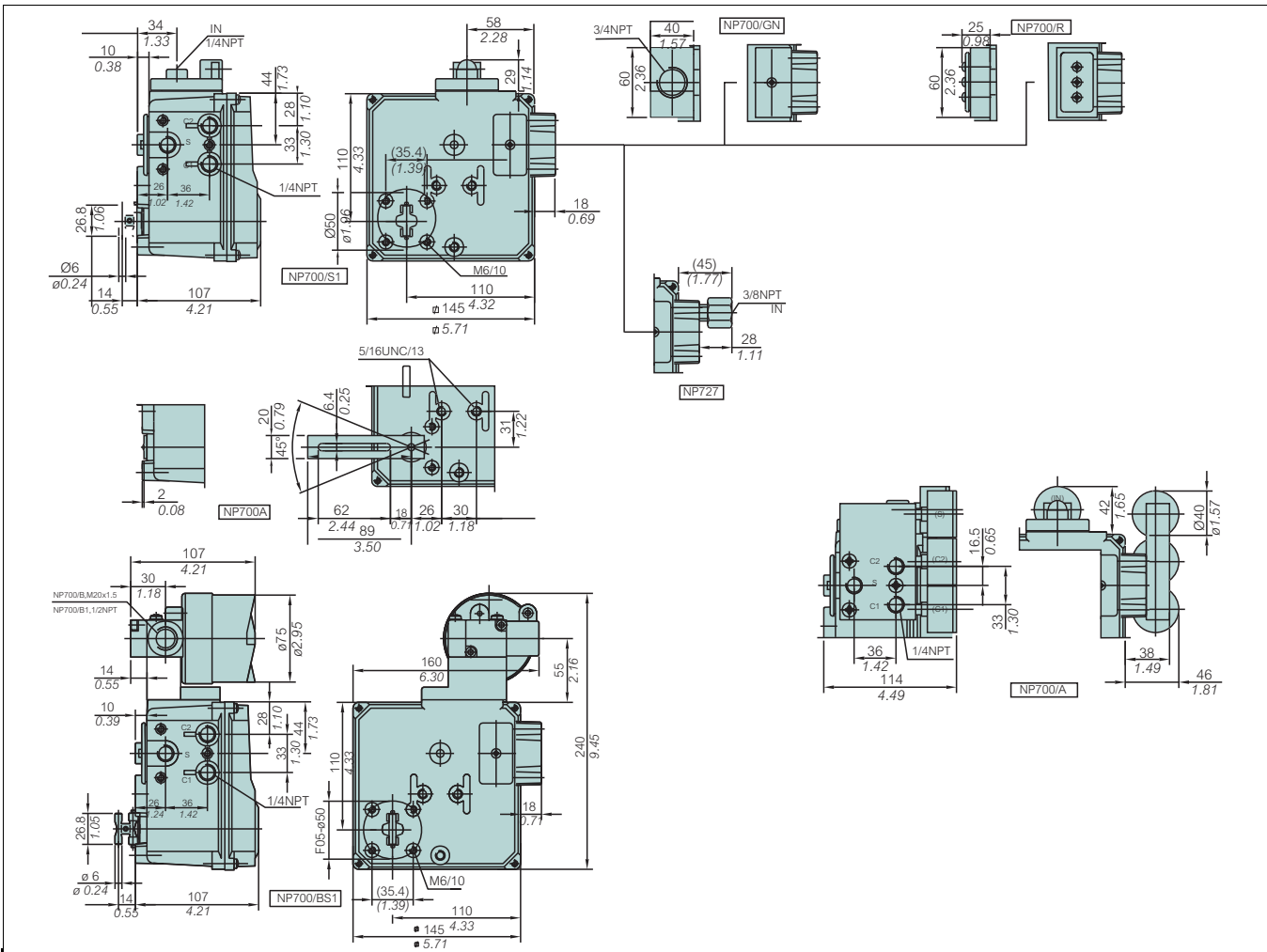
Positioner model	Actuator Swept Volume dm <sup>3</sup> (litres)	Consumption m <sup>3</sup> <sub>n</sub> /h/scfm *		Delivery m <sup>3</sup> <sub>n</sub> /h/scfm*	
		m <sup>3</sup> <sub>n</sub> /h	scfm	m <sup>3</sup> <sub>n</sub> /h	scfm
NE724	1.0 - 8.0	0.9	0.5	12.0	7.0
NE726	8.0 - 30.0	1.2	0.7	18.0	10.4
NE727	> 30	2.1	1.2	32.0	18.6
NP723	0.3 - 1.0	0.6	0.3	12.0	7.0
NP724	1.0 - 8.0	0.6	0.3	12.0	7.0
NP726	8.0 - 30.0	0.9	0.5	18.0	10.4
NP727	> 30	1.8	1.0	32.0	18.6

\*) Supply pressure at 0.4 MPa 4 barg / 60 psig.  
(max. air delivery capacity)

**Dimensions - mm / inch for Electro-pneumatic positioner - NE700**



**Dimensions - mm / inch for Pneumatic positioner - NP700**



## AVAILABLE OPTIONS

**Pressure Gauge Kit**

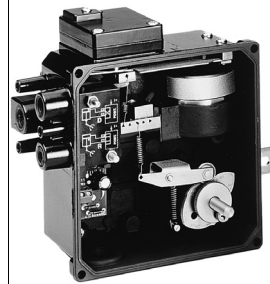
- Stainless steel gauges, diameter 40 mm, Type code: NE7.../AS1, NP7.../AS1.
- Bypass kit Type code: NP7.../A1S1.

**Filter regulator**

- Die-cast aluminum.
- No brass parts.
- Rugged and corrosion resistance.
- Output pressure range 0 - 700 kPa  
7 barg / 100 psig.
- Maximum supply pressure 1750 kPa  
17.5 barg / 250 psig.
- Type code:  
NE7.../K, NP7.../K.

**Flame proof enclosure**

- ATEX approval:  
II 2 G EEx d IIC T4/T5/T6  
Type code: NP70 ... /BS1.
- FM and CSA approval:  
Class I, II, Div. 1, Gr. B - G  
Type code: NP70.../B1S1.
- Input signal 4 - 20 mA.  
Supply pressure 200 - 1000 kPa  
2 - 10 barg / 30 - 145 psig.

**Positioner for linear (globe) valves**

- Applicable to Metso diaphragm actuator.  
DA/RA thru DB/RB  
DC/RC thru DD/RD  
and DE/RE.
- Standard stroke 19 - 57 mm/  
3/4 - 2 1/4 inch.
- Other strokes available on request.
- Type code: NE7...A, NP7...A.

### HOW TO ORDER NE700 POSITIONERS

<b>1.</b>	<b>2.</b>	<b>3.</b>	<b>4.</b>	<b>5.</b>		<b>6.</b>		□
NE	7	2	6	S	/	S1A	-	CE01

**Example:**  
 This is a single-acting electro-pneumatic positioner for a 4 - 20 mA input signal, with 6 mm pilot, pressure gauge kit and 1/2 NPT conduit entry with filter regulator.

1. sign	PRODUCT GROUP
NE	Electro-pneumatic positioner.

2. sign	SERIES CODE

3. sign	INPUT SIGNAL RANGE
2	4-20 mA; 0-20 mA.

4. sign	PILOT VALVE	CONNECTIONS (S, C1, C2)
4	Ø 4 mm	1/4 NPT
6	Ø 6 mm	1/4 NPT
7	Ø 6 mm HC	3/8 NPT

5. sign	ACTION
-	Suitable for double and single action, without sign.
A	Single action, linear motion. Applicable ONLY to D/R series spring diaphragm linear actuators, max. stroke size 57 mm (2-1/4 in).

6. sign	OPTIONS
	If several options below are needed to the same positioner, the codes shall be marked in presented order from top. Temperature range for various options shall be considered carefully.
-	Standard, IP 54 enclosure. PG 11 conduit entry. S1 always to be defined. Temperature range -25 °C... +85 °C / -13 °F...+185 °F.
R	Water and dustproof enclosure. IP65 / NEMA 4 and 4X.
W	Better vibration resistance. Special flexure pivot and diamond coated pilot.
H	High temperature construction. Viton diaphragms and seals. Temperature range -10 °C... +120 °C / +14 °F... +248 °F. Not available with options A and accessory K.
S1	Positioner attachment face according to standard VDI/VDE 3845, equipped with an H-clip. When positioners are separate deliveries, VDI/VDE ear is supplied. Not applicable to globe valve actuators (5. sign A).
A	Pressure gauges, scale bar/psi/kPa, basic material brass, nickel plated, housing stainless steel, glycerine filled. 5. sign always to be defined. Temperature range -25 °C... +70 °C / -13 °F... +158 °F.
J30	Square shaft and special mounting kit. Available in US only.
Y	Special construction, to be specified.

- □	ACCESSORIES
	Filter regulator for supply air. Pressure gauge, scale bar/psi/kPa, basic material brass, nickel plated, housing stainless steel, glycerine filled. Temperature range -40 °C... +82 °C / -40 °F... +180 °F. Filter size 5 µm. Not available with HC-pilot (4. sign 7). Will be specified in the option sticker.
K	In connection with the Ø6 HC-pilot valve (4. sign 7) must be used large capacity filter regulator (not K) for actuator bigger than B1CU40 and B1JU 32. Installation with mounting bracket.
CE01	PG11 / 1/2 NPT conduit entry nipple. Will be specified in the option sticker.
CE02	PG11 / M20x1.5 conduit entry nipple. Will be specified in the option sticker.
CE03	PG11 / R1/2 (PF1/2) conduit entry nipple. Will be specified in the option sticker.

## HOW TO ORDER NP700 POSITIONERS

1.	2.	3.	4.	5.		6.		□
NP	7	2	4	-	/	S1A	-	K

**Example:**

This is a double-acting pneumatic positioner for a 20 - 100 kPa / 3 - 15 psig input signal, with 4 mm pilot and optional exhaust adapter 3/4 NPT-thread with filter regulator.

1. sign	PRODUCT GROUP
NP	Pneumatic positioner.

2. sign	SERIES CODE

3. sign	INPUT SIGNAL RANGE
0	4-20 mA, only with options B and B1 (6.sign).
2	20-100 kPag, 0.2-1.0 barg/3-15 psig.

4. sign	PILOT VALVE	CONNECTIONS (S, C1, C2)
3	Ø 4 mm LC	1/4 NPT
4	Ø 4 mm	1/4 NPT
6	Ø 6 mm	1/4 NPT
7	Ø 6 mm HC	3/8 NPT

5. sign	ACTION
-	Suitable for double and single action, without sign.
A	Single action, linear motion. Applicable ONLY to D/R series spring diaphragm linear actuators, max. stroke size 57 mm (2-1/4 in).

6. sign	OPTIONS
-	If several options below are needed to the same positioner, the codes shall be marked in presented order from top. Temperature range for various options shall be considered carefully. Standard, (IP 54 enclosure). 6. sign S1 always to be defined. Temperature range -40 °C... +90 °C / -40 °F... +194 °F.
B	Flameproof enclosure I/P-converter (IP65), ATEX EEx d IIC T6. Input signal range 4-20 mA. M20x1,5 conduit entry. 3. sign always 0. Temperature range -40 °C... +55 °C / -40 °F...+131 °F.
B1	Explosion proof enclosure I/P-converter (IP65), FM/CSA-approval. Class 1, Div. 1, Groups B, C, D. Input signal range 4-20 mA. 1/2 NPT conduit entry. 3. sign always 0. Temperature range -40 °C... +55 °C / -40 °F...+131 °F.
GN	For natural gas. Exhaust adapter, 3/4 NPT-thread. Not usable inside with options B and B1 !
R	Water and dustproof enclosure. IP65 / NEMA 4 and 4X. Not available with option GN.
H	High temperature construction. Viton diaphragm and seals. Not available with options B, B1, A, A1 and accessory K. Temperature range -10 °C... +120 °C / +14 °F... +248 °F.
S1	Positioner attachment face according to standard VDI/VDE 3845, equipped with an H-clip. When positioners are separate deliveries, VDI/VDE ear is supplied. Not applicable to globe valve actuators (5. sign A).
A	Pressure gauges, scale bar/psi/kPa, basic material brass, nickel plated, housing stainless steel, glycerine filled. 5. sign always to be defined. Temperature range -40 °C... +70 °C / -40 °F... +158 °F.
Y2	Brass bearing of small lever arm.
J30	Square shaft and special mounting kit. Available in US only.
Y	Special construction, to be specified.

- □	ACCESSORIES
K	Filter regulator for supply air. Pressure gauge, scale bar/psi/kPa, basic material brass, nickel plated, housing stainless steel, glycerine filled. Temperature range -40 °C... +82 °C / -40 °F... +180 °F. Filter size 5 µm. Not available with HC-pilot (4. sign 7). Will be specified in the option sticker.  In connection with the Ø6 HC-pilot valve (4. sign 7) must be used large capacity filter regulator (not K) for actuator bigger than BC 40 and BJ 32. Installation with mounting bracket.
CE01	PG11 / 1/2 NPT conduit entry nipple. Will be specified in the option sticker.
CE02	PG11 / M20x1.5 conduit entry nipple. Will be specified in the option sticker.
CE03	PG11 / R1/2 (PF1/2) conduit entry nipple. Will be specified in the option sticker.

**Metso Automation Inc.**

**Europe**, Vanha Porvoontie 229, P.O. Box 304, FI-01301 VANTAA, Finland.  
Tel. +358 20 483 150. Fax +358 20 483 151

**North America**, 44 Bowditch Drive, P.O. Box 8044, Shrewsbury, MA 01545, USA.  
Tel. +1 508 852 0200. Fax +1 508 852 8172

**South America**, Av. Independência, 2500- Iporanga, 18087-101, Sorocaba-São Paulo, Brazil.  
Tel. +55 15 2102 9700. Fax +55 15 2102 9748/49

**Asia Pacific**, Haw Par Centre #06-01, 180 Clemenceau Avenue, Singapore 239922.  
Tel: +65 6511 1011. Fax: +65 6250 0830

**China**, 19/F, the Exchange Beijing, No. 118, Jianguo Lu Yi, Chaoyang Dist, 100022 Beijing, China.  
Tel. +86-10-6566-6600. Fax +86-10-6566-2575

**Middle East**, Roundabout 8, Unit AB-07, P.O. Box 17175, Jebel Ali Freezone, Dubai,  
United Arab Emirates. Tel. +971 4 883 6974. Fax +971 4 883 6836

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