

Electropneumatic Converter for Direct Current Signals

i/p Converter Type 6116

Application

Devices used to convert a direct-current input signal into a pneumatic output signal for measuring and control. Especially suitable as intermediate element between electric measuring devices and pneumatic controllers or between electric control devices and pneumatic control valves



Type 6116 proportionally converts the electric input signal into a pneumatic output signal. The signal converter accepts a load-independent 4 to 20 mA direct-current input signal. Depending on the supply air pressure, the converter supplies a pneumatic output signal of 0.2 to 1 bar (3 to 15 psi), 0.4 to 2 bar (6 to 30 psi) or pressure ranges up to 8 bar (120 psi). Depending on the signal range, Type 6116 is equipped with Type 6109 or Type 6112 i/p Converter Modules (see Technical data).

Special features

- Continuous, linear characteristic
- High accuracy and excellent dynamic response
- Extremely low air consumption
- Operation without supply pressure regulator possible (see Technical data)
- Switch-off electronic function guarantees venting at zero point

Versions

For **non-hazardous areas**: **Type 6116-0...**

For **hazardous areas**:

Type 6116-1... EEx i according to ATEX and GOST

Type 6116-2... EEx d according to ATEX and GOST

Type 6116-3... Explosion-proof acc. to CSA and FM standards

Type 6116-4... Intrinsically safe acc. to CSA and FM standards

Type 6116-5... Explosion-proof /Australia / IEC

Type 6116-6... Intrinsically safe /Australia / IEC

Type 6116-7... Ex d according to JIS standard /Japan

Type 6116-8... Ex n according to ATEX (manufacturer's declaration only)

Other versions

– **Type 6116-x2xxxxxxxx2xxx**: Temperatures down to -45°C

– **Type 6116-0...**

– AS-interface connection with Type 6150 Slave

– Voltage input (e.g. 0 to 10 V) with Type 6151 u/i Module

– **Electropneumatic converter without booster or switch-off electronic function**

Converters can be combined with SAMSON Type 3760, Type 3766-000 (model index .02 and higher) and Type 4765 Pneumatic Positioners

– **Type 6116-xx060111000xxxx** for attachment to p/p positioners ($\frac{1}{2}$ NPT connection)

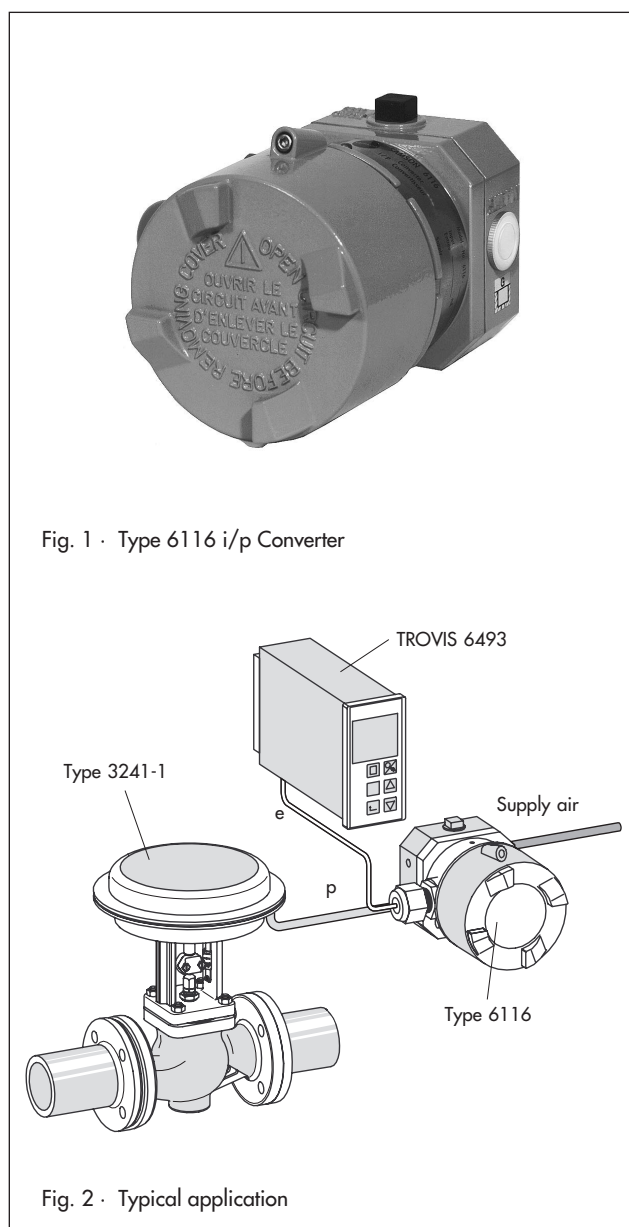


Fig. 1 · Type 6116 i/p Converter

Fig. 2 · Typical application

– **Type 6116-xx060112000xxxx** for attachment to p/p positioners (M20 x 1.5 connection)

Principle of operation

The electropneumatic converter consists of an i/p converter module, which operates according to the force-balance principle, and a connected volume booster.

When operated, the supplied direct current (4) flows through the plunger coil (2) located in the field of a permanent magnet (3). At the balance beam (1), the force of the plunger coil which is in proportion to the current is balanced against the force of the dynamic back-pressure. The back-pressure is produced on the flapper plate (6) by the air jet leaving the nozzle (7).

The nozzle is supplied with air from the pneumatic output (36). With an input signal of 0 mA, an output pressure of approximately 100 mbar already exists due to the offset spring.

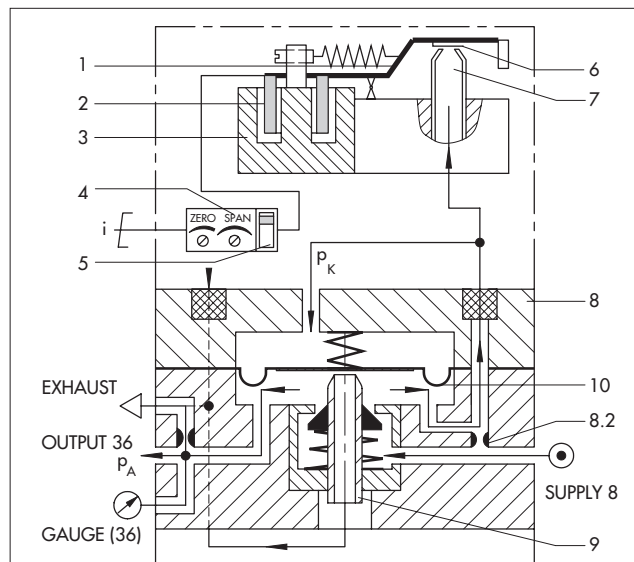
The air supply (8) flows into the lower diaphragm chamber and a certain amount of air flows to the output. When the current increases, the flapper moves closer to the nozzle. The force of the dynamic back-pressure which is produced pushes both the diaphragm (10) and the sleeve (9) downward, allowing additional air to enter the lower diaphragm chamber. The passing air volume increases until the forces acting on the diaphragm obtain a state of equilibrium. When the current decreases, this action is reversed. The dynamic back-pressure caused by the nozzle and flapper decreases and the diaphragm is pressed upward. In this process, it releases the sleeve (9), if applicable, and opens the vent (EXHAUST) until the forces on the diaphragm are equal again.

Switch-off electronic function (Fig. 4)

Converter modules with an input signal range from 4 to 20 mA have a slide switch which activates the switch-off electronic function. This function causes the pneumatic output to be vented up to approx. 100 mbar when the input signal falls below 4.08 mA tolerance. In this way, the tight shut-off function of a valve can be guaranteed.

Combined with a Type 3760, Type 3766-000 or Type 4765 Pneumatic Positioner

The Type 6116-xx06011x000xxxx i/p Converter without booster or switch-off electronic function can be combined with the above listed positioners to form a version in a flameproof enclosure (Ex d). With Type 3760 and Type 4765 Positioners, the i/p converter is attached to the control valve according to NAMUR and its piping connected to the positioner (as shown in Fig. 5). The Type 3766-000 Positioner can be connected direct to the i/p converter. The positioner type should be specified when ordering any accessories.



- | | | | |
|---|--|----|---------------|
| 1 | Balance beam | 6 | Flapper plate |
| 2 | Plunger coil | 7 | Nozzle |
| 3 | Permanent magnet | 8 | Supply |
| 4 | Input | 9 | Sleeve |
| 5 | Slide switch, switch-off electronic function | 10 | Diaphragm |

Fig. 3 · Functional principle of Type 6116

For output 0.2 to 1 bar Residual pressure approx. 0.1 bar

For output 0.8 to 2.7 bar Residual pressure approx. 0.3 bar

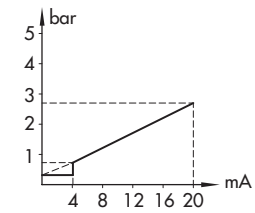
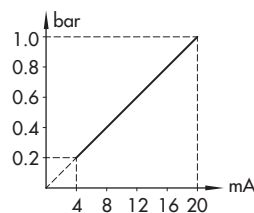


Fig. 4 · Switch-off electronic function

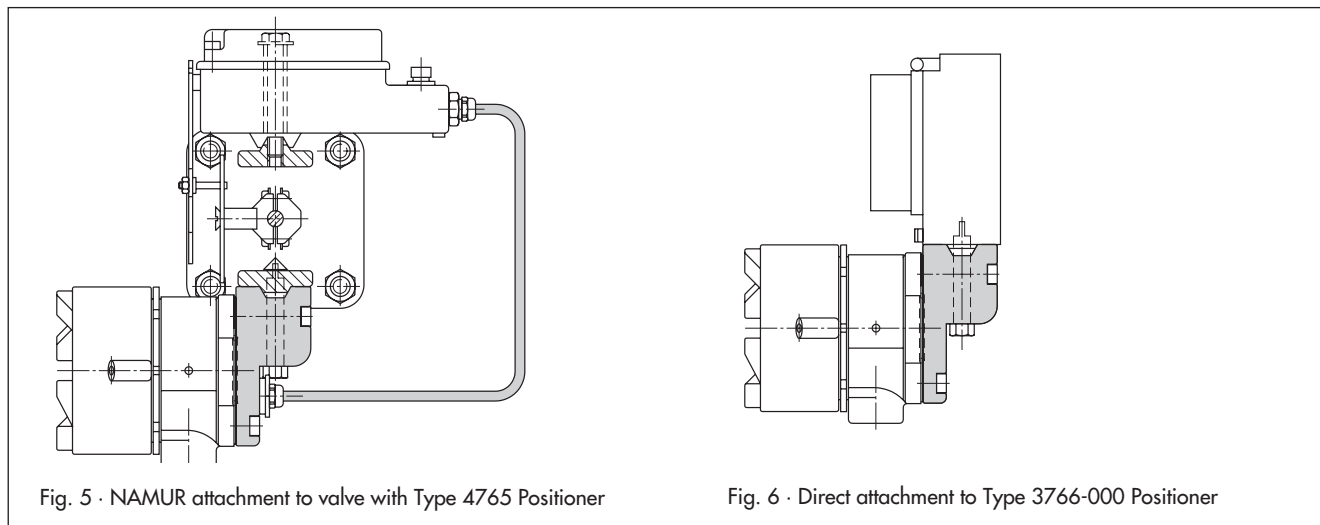


Fig. 5 · NAMUR attachment to valve with Type 4765 Positioner

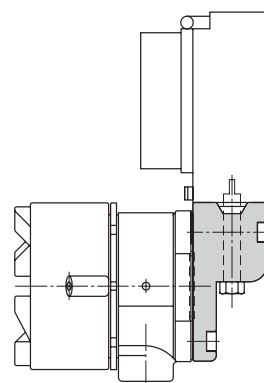


Fig. 6 · Direct attachment to Type 3766-000 Positioner

Table 1 · Technical data

Type	W/o explosion protection	6116-0
	With explosion protection	Types 6116-1/-2/-3/-4/-5/-6/-7, see summary of explosion protection certificates
Input ⁶⁾		4 to 20 mA; other signals on request Minimum current > 3.6 mA; load ≤ 6 V (corresponds to 300 Ω at 20 mA) For explosion-protected versions: load 7 V (corresponds to 350 Ω at 20 mA) Devices without switch-off electronic function R _i = 200 Ω ± 7.5 %
Output ⁶⁾		0.2 to 1 bar (3 to 15 psi) (Type 6109 i/p Module) 0.4 to 2 bar (6 to 30 psi) (Type 6112 i/p Module) Special ranges for Type 6112, adjustable according to customer specification Output range = Initial value ¹¹⁾ + Span Δp corresponds to Module 6112 0.1 to 0.4 bar + 0.75 to 1.0 bar Module A 0.1 to 0.4 bar + 1.0 to 1.35 bar Module B 0.1 to 0.4 bar + 1.35 to 1.81 bar Module C 0.1 to 0.8 bar + 1.81 to 2.44 bar Module D 0.1 to 0.8 bar + 2.44 to 3.28 bar Module E 0.1 to 0.8 bar + 3.28 to 4.42 bar Module F 0.1 to 1.2 bar + 4.42 to 5.94 bar Module G 0.1 to 1.2 bar + 5.94 to 8.0 bar Module H ¹⁰⁾
	Air output capacity ³⁾	2.0 m ³ /h at output 0.6 bar (0.2 to 1.0 bar) 2.5 m ³ /h at output 1.2 bar (0.4 to 2.0 bar) 8.5 m ³ /h at output 5.0 bar (0.1 to 8.0 bar)
Supply air		At least 0.4 bar above upper range value, max. 10 bar without supply pressure regulator, max. 6 bar for EEx d version
	Air consumption ²⁾	0.08 m ³ /h at 1.4 bar 0.1 m ³ /h at 2.4 bar Max. 0.26 m ³ /h at 10 bar
Characteristic		Output linear to input
	Hysteresis	≤ 0.3 % of upper range value; more exact value on request
	Deviation from terminal-based conformity	≤ 1 % of upper range value; more exact value on request
	Effect in % of the upper range value	Supply air: 0.1 %/0.1 bar ²⁾ Alternating load, supply air failure, interruption of the input current: < 0.3 % Ambient temperature: lower range value < 0.03 %/K, span < 0.03 %/K
Dynamic response ⁴⁾		
	Limiting frequency	5.3 Hz
	Phase shift	-130°
Effect of variable mounting position		Max. 3.5 % depending on attachment: ± 1 % when horizontal (Type 6109) Max. 1 % depending on attachment: ± 0.3 % when horizontal (Type 6112)
Ambient conditions, degree of protection, weight		
Storage temperature		-45 to +80 °C
Ambient temperature	With Type 6109	-30 to +70 °C ⁷⁾ ; -30 to +60 °C ¹⁾
	With Type 6112	-40 to +70 °C ^{7) 8)} ; -40 to +60 °C ^{1) 8)}
Degree of protection		IP 54 ⁵⁾ , IP 65 ⁹⁾ , NEMA 4
Weight	Approx.	0.85 kg
Materials		
Housing		Die-cast aluminum, chromated, plastic-coated

¹⁾ Details (including electric specifications and installation instructions) can be found in the EC Type Examination Certificate

²⁾ Measured at average output pressure

³⁾ Measured with 2 m hose, 4 x 1

⁴⁾ Measured according to IEC 770

⁵⁾ Observe recommended mounting position

⁶⁾ See Table 2 when combined with a positioner

⁷⁾ Devices without explosion protection

⁸⁾ Special versions down to -45 °C available on request

⁹⁾ Possible when accessories are used

¹⁰⁾ Max. output pressure 8 bar

¹¹⁾ Initial value raised to max. 3.0 bar in special version

Summary of explosion protection certificates for Type 6116 i/p Converter

Version	Type of approval	Certificate number	Date	Type of protection	Comments	
6116-1	EC Type Examination Certificate	PTB 02 ATEX 2199	2003-03-07	⊕ II 2 G EEx ia IIC T6	-45 °C ambient temperature Manufacturer's declaration available for zone 2 and zone 22	
	GOST Certificate	POCC DE ... 637	2009-02-26	1Ex ia IIC T6 X	Valid until 2012-02-26	
6116-2	EC Type Examination Certificate	PTB 98 ATEX 1024 X	1998-04-30	⊕ II 2 G EEx d IIC T6	-45 °C ambient temperature Manufacturer's declaration available for zone 22	
	First Addendum		2002-01-08			
	GOST Certificate	POCC DE ... 637	2009-02-26	1Ex d IIC T6 X	Valid until 2012-02-26	
6116-3	CSA Certificate	LR 54227-18	1992-11-10	Cl. I, II, Div 1, Gr. B, C, D, E, F + G	With Type 6109 or 6112 Encl. NEMA 4	
		LR 54227-24	1996-05-31			
		LR 54227-27	1997-02-27			
	FMRC Certificate	J.I.1W5A4.AX	1993-04-01	Cl. I, II, Div 1, Gr. B, C, D	With Type 6109 or 6112	
	Revision		1996-11-07			
6116-4	CSA Certificate	LR 54227-16	1992-12-01	Cl. I, Div 1, Gr. A, B, C, D Cl. I, Div 2, Gr. A, B, C, D	With Type 6109 or 6112 Zero/span electronics	
		LR 54227-27	1997-02-27	Encl. NEMA 3 and 4		
		LR 54227-28	1997-02-27			
		FMRC Certificate	J.I.3W2A5.AX	1993-02-05	Cl. I, II, III; Div 1 Gr. A, B, C, D, E, F + G	NEMA 3R
			J.I.5YA3.AX	1995-02-01		Div. 2
		J.I.3Z1A5.AX	1997-04-02		NEMA 4	
		Revision	1998-10-20		Zero/span electronics	
6116-5	AUS Certificate	Ex 3003 X	1993-09-15	EEx d IIC T6 IP 65	With Type 6109 or 6112	
	First Extension		2001-11-14			
6116-6	AUS Certificate	Ex 1476 X	1993-09-15	EEx ia IIC T6 IP 65	Class I Zone 0	
6116-7	JIS Certificate	TC 13622	1999-05-20	Ex d IIC T6		
6116-8	-	-	-	Ex II 3 G EEx nA II T6X	Manufacturer's declaration only for zone 2 and zone 22. Statement of conformity not available.	

The test certificates are included in the mounting and operating instructions or, alternatively, can be requested.

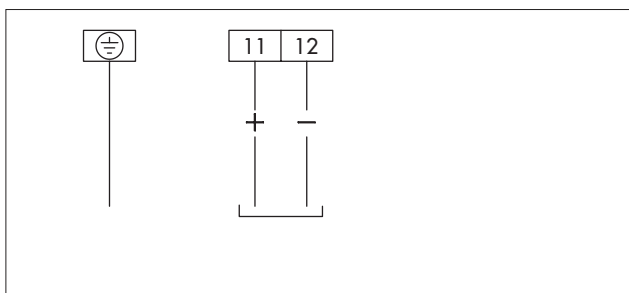
Table 2 - Technical data

Type 6116-xx06011x000xxxx (for positioner attachment) ¹⁾

Input	4 to 20 mA, other signals on request, internal resistance approx. 200 Ω at 20 °C
Output	0.2 to 1 bar for positioner

¹⁾ Only with Type 6109 i/p Converter, other data same as in Table 1

Electrical connection



For connection to intrinsically safe circuits, the specifications stated in the certificate of conformity apply as well.

Installation

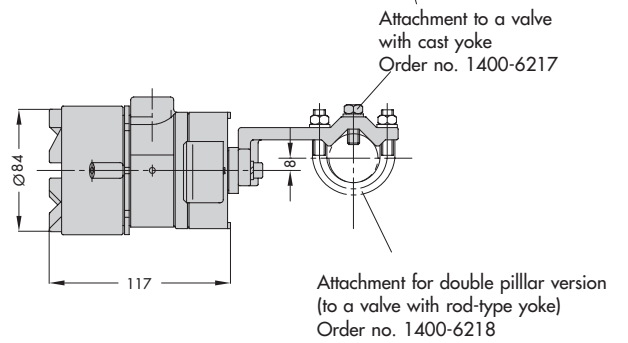
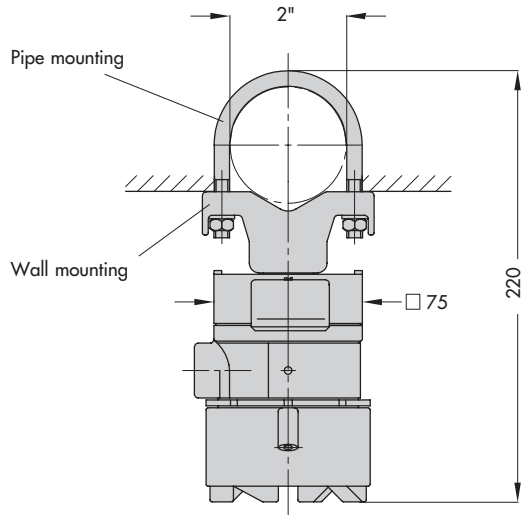
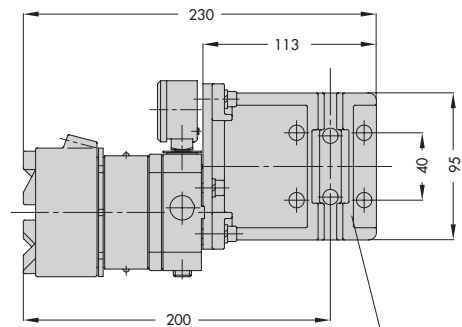
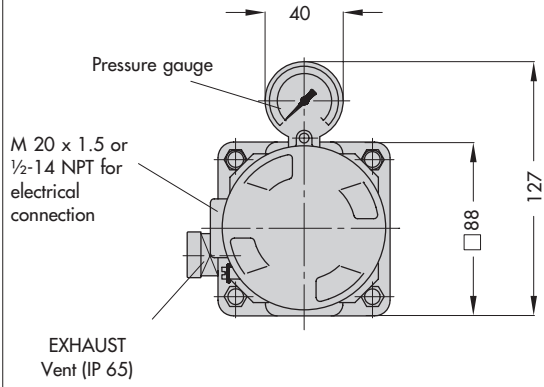
The converter can be mounted to a wall, pipe or directly to the control valve according to NAMUR.

The converter is to be installed horizontally, with the pressure gauge (or screw plug) facing upward. If a different mounting position is used, the zero point is to be corrected using the ZERO adjuster.

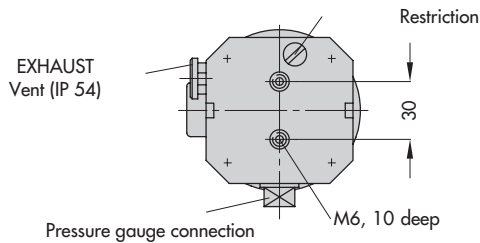
With degree of protection IP 54, the vent must always be installed facing downward to the floor.

Type 6116 with mounting accessories - Dimensions in mm

Wall and pipe mounting, order no. 1400-6216

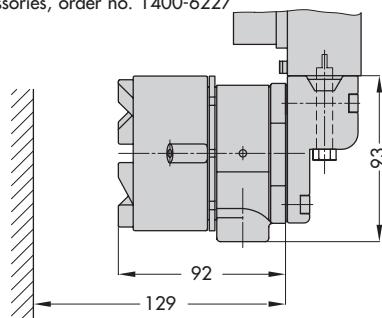


Rear view, without mounting parts

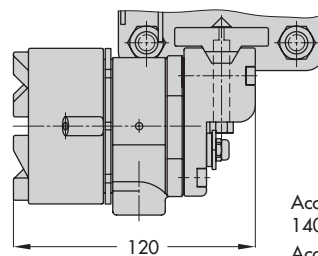


Type 6116-xx06011x000xxx without booster for positioner attachment

Combined with Type 3766-000 Positioner Accessories, order no. 1400-6227



Attachment according to NAMUR with Type 4765 and Type 3760



Accessories, order no. 1400-6223 (Type 4765)
Accessories, order no. 1400-6224 (Type 3760)

Article code	Type 6116-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Explosion protection	Without	0																	
	Intrinsically safe II 2 G EEx ia IIC T6 acc. to ATEX and GOST 1) 2)	1																	
	Flameproof II 2 G EEx d IIC T6 acc. to ATEX and GOST 3)	2																	
	Explosion-proof acc. to CSA and FM standards 4) 5)	3																	
	Intrinsically safe acc. to CSA and FM standards 1) 4)	4																3	
	Explosion-proof Ex d IIC T6 IECEx TSA/AUEx (Australia) 4) 6)	5																	2
	Intrinsically safe Ex ia/Ex n IIC T6 IECEx TSA (Australia) 1) 7) Ex d IIC T6 acc. to JIS standard (Japan) 4)	6 2 7																	
i/p module	Type 6109 4)	1	0	1				1											
	Type 6112	2																	
Input	4 to 20 mA		0	1															
	4 to 12 mA 1)	2	0	3															
	12 to 20 mA, without switch-off electronic function 1) 7)	2	0	4															
	0 to 20 mA, without switch-off electronic function 7)	2	0	5															
	4 to 20 mA, without switch-off electronic function 7) for positioner attachment		0	6															
Output	0.2 to 1.0 bar				0	1													
	3 to 15 psi				0	2													
	0.4 to 2.0 bar	2			0	4													
	6 to 30 psi	2			0	5													
	Special ranges: 8)																		
	Initial value 0.1 to 0.4 bar; span 0.75 to 1.00 bar	2			1	1													
	Initial value 0.1 to 0.4 bar; span 1.00 to 1.35 bar	2			1	2													
	Initial value 0.1 to 0.4 bar; span 1.35 to 1.81 bar	2			1	3													
	Initial value 0.1 to 0.8 bar; span 1.81 to 2.44 bar	2			1	4													
	Initial value 0.1 to 0.8 bar; span 2.44 to 3.28 bar	2			1	5													
	Initial value 0.1 to 0.8 bar; span 3.28 to 4.42 bar	2			1	6													
Initial value 0.1 to 1.2 bar; span 4.42 to 5.94 bar	2			1	7														
Initial value 0.1 to 1.2 bar; span 5.94 to 8.00 bar	2			1	8														
Operating direction	Increasing/increasing								1										
	Increasing/decreasing 1)								2										
Electrical connection	½ - 14 NPT									1									
	M20 x 1.5									2									
Pneumatic connection	Positioner attachment (without booster) 9)		0	6	0	1	1		0	0	0								
	¼ - 18 NPT									1									
	ISO-228/1 - G ¼									2									
Degree of protection	Without (vent for positioner attachment)		0	6	0	1	1		0	0	0								
	IP 54										1								
	IP 65										2								
	NEMA 4 10)										3								
Output pressure gauge	Without											0							
	With 1)											1							
Temperature range	T _{min} ≥ -25 °C (Type 6109 standard)	1																0	
	T _{min} ≥ -45 °C (Type 6112 subjected to routine test)	2																1	
	T _{min} ≥ -40 °C (Type 6112 standard)	2																2	
Special version	Without																	0 0 0	

- 1) Not for positioner attachment
- 2) With degree of protection IP 54/IP 65 only
- 3) Output pressure max. 5.6 bar; supply air 6 bar
- 4) Only with 0.2 to 1 bar/3 to 15 psi
- 5) With ½ NPT electrical connection, degree of protection NEMA 4 or positioner attachment
- 6) With ½ NPT electrical connection, degree of protection IP 65 or positioner attachment
- 7) Without switch-off electronic function and without potentiometer for zero point and span correction
- 8) Specify setting range, e.g. set to 0.1 to 4 bar; output pressure max. 8 bar. Initial value raised to max. 3.0 bar in special version.
- 9) Without explosion protection or with EEx d or explosion proof according to CSA/FM standards
- 10) Only with explosion proof or intrinsically safe according to CSA/FM standards

Accessories

Mounting on

- Wall and pipe mounting 1400-6216
- Bracket (1.4301) 1400-7432
- Mounting unit for Type 6116 in various versions M6116
- Mounting to Type 3766 1400-6227
- Mounting to Type 4765 1400-6223
- Mounting to Type 3760 1400-6224
- Mounting on cast yokes acc. to NAMUR 1400-6217
- Mounting on valve with rod-type yokes acc. to NAMUR 1400-6218
- Male screw fitting G ¼ onto 4x1 hose, brass 8582-1452
- Male screw fitting ¼ NPT onto 4x1 hose, brass 8582-1523

