

## T 6116 EN

### Type 6116 i/p Converter

Electropneumatic Converter for Direct Current Signals



#### Application

Used to convert a direct-current input signal into a pneumatic output signal for measuring and control tasks · Particularly suitable as intermediate element between electric measuring devices and pneumatic controllers or between electric control devices and pneumatic control valves.

The Type 6116 i/p Converter 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, the Type 6116 is equipped with a Type 6109 or Type 6112 i/p Converter module (see 'Technical data').

#### Special features

- Continuous, linear characteristic
- High accuracy and excellent dynamic response
- Extremely low air consumption
- Operation without supply pressure regulator possible
- Switch-off electronics guarantee venting at zero point

#### Versions

- For safe areas: Type 6116-0...
- For hazardous areas:
  - **Type 6116-1...** Ex i according to ATEX and EAC Ex
  - **Type 6116-2...** Ex d according to ATEX, IECEx and EAC Ex
  - **Type 6116-3...** Explosion-proof acc. to CSA and FM standards
  - **Type 6116-4...** Intrinsically safe according to CSA and FM standards
  - **Type 6116-5...** Explosion-proof/IECEX/Korea
  - **Type 6116-6...** Intrinsically safe/IECEX

#### Further versions

- **Type 6116-x2xxxxxxxxx2xxx:** temperatures down to -45 °C
- **Type 6116-0...**
  - AS-interface connection with Type 6150 Slave

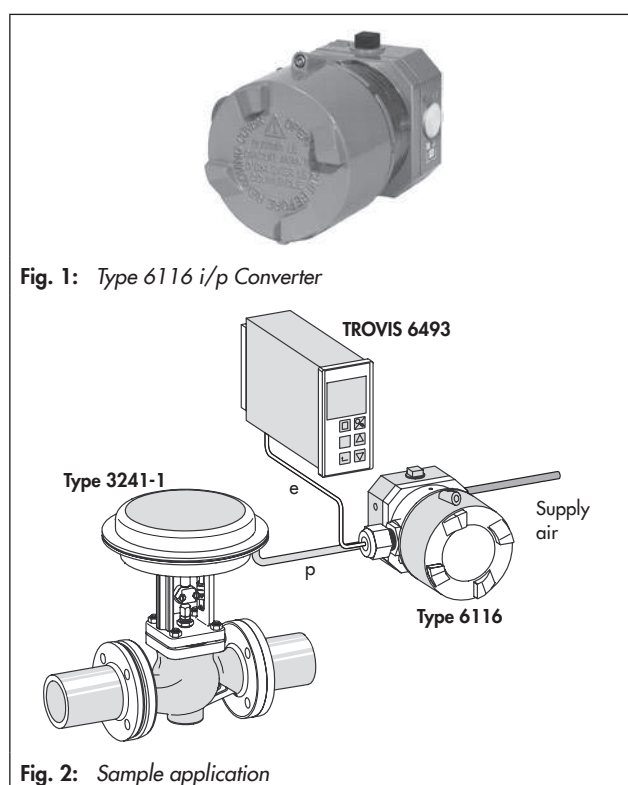


Fig. 1: Type 6116 i/p Converter

Fig. 2: Sample application

- Voltage input (e.g. 0 to 10 V) with Type 6151 u/i Module
- Electropneumatic converter without booster or switch-off electronics
- 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 (½ NPT connection)
- **Type 6116-xx060112000xxxx** for attachment to p/p positioners (M20x1.5 connection)

## Principle of operation (see Fig. 4)

The electropneumatic converter consists of an i/p converter module, which operates according to the force-balance principle and a downstream 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 backpressure. The backpressure 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 is already issued due to the offset spring.

The supply air (8) flows in the lower diaphragm chamber and a certain amount flows to the output. When the current increases, the flapper moves closer to the nozzle. The force of the resulting backpressure pushes both the diaphragm (5) and sleeve (8) downwards, allowing additional air to enter the chamber. The passing air volume increases until the forces on the diaphragm obtain a state of equilibrium. When the current decreases, this action is reversed. The backpressure created by the nozzle and flapper decreases and the diaphragm is pressed upwards. In this process, it releases the sleeve, if applicable and opens the vent (EXHAUST) until the forces on the diaphragm are balanced again.

## Switch-off electronics (see Fig. 5)

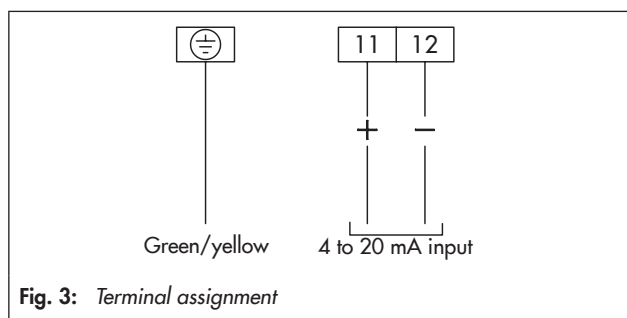
Converter modules with an input signal range from 4 to 20 mA have a slide switch which activates the switch-off electronics. The electronics cause the pneumatic output to be vented up to approx. 100 mbar when the input signal falls below  $\pm 4.08$  mA tolerance. In this way, the tight shut-off function 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 electronics 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 hooked up to the positioner (see Fig. 6).

The Type 3766-000 Positioner can be connected directly to the i/p converter. The positioner type must be specified when ordering any accessories.

## 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.

Ideally, 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 must be corrected using the ZERO adjuster.

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

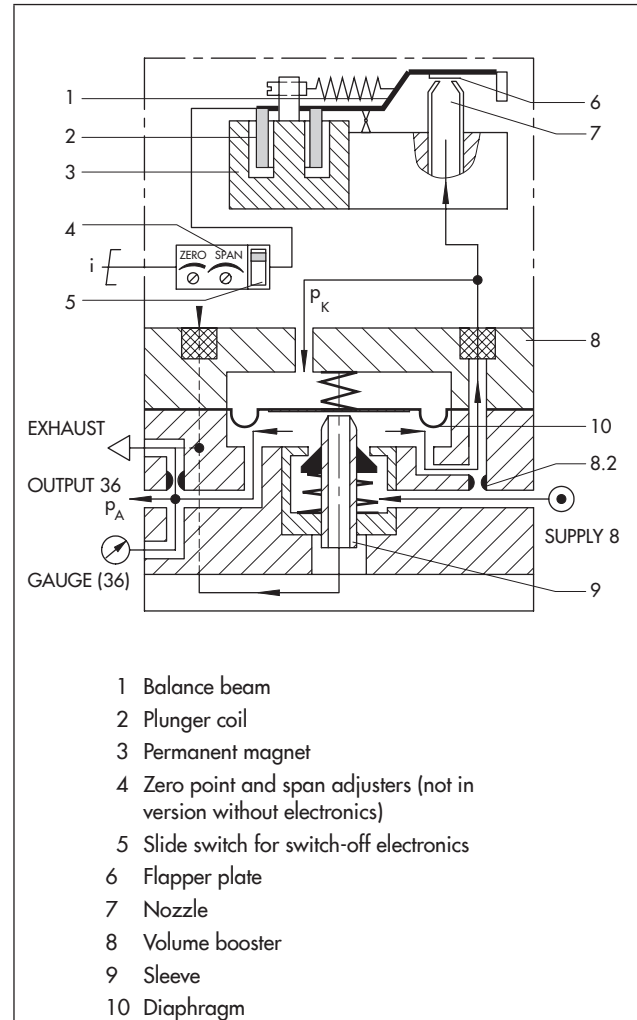
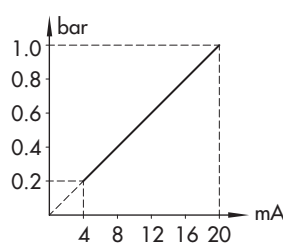


Fig. 4: Functional drawing of Type 6116

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



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

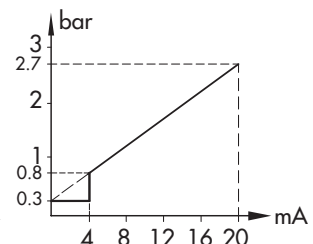
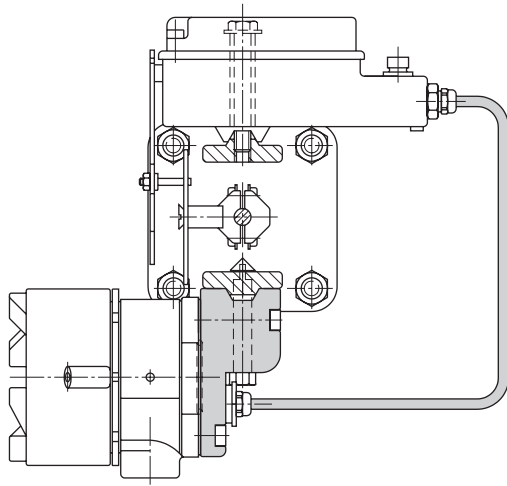
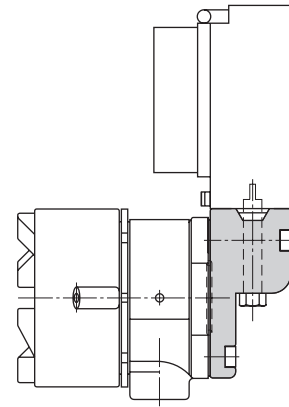


Fig. 5: Switch-off electronics




**Fig. 6:** NAMUR attachment to valve with Type 4765 Positioner



**Fig. 7:** Direct attachment to Type 3766-000 Positioner

**Table 1:** Technical data

Type	No explosion protection	6116-0
	With explosion protection	Types 6116-1/-2/-3/-4/-5/-6 (see summary of explosion protection certificates in Table 3)
Input <sup>5)</sup>	4 to 20 mA, other signals on request Minimum current >3.6 mA, load impedance ≤6 V (corresponding to 300 Ω at 20 mA) Versions with explosion protection: load impedance 7 V (corresponding to 350 Ω at 20 mA) Versions without switch-off electronics: R <sub>i</sub> = 200 Ω ± 7.5 %	
Output <sup>5)</sup>	0.2 to 1 bar (3 to 15 psi) (Type 6109 i/p Converter Module) 0.4 to 2 bar (6 to 30 psi) (Type 6112 i/p Converter Module) Special ranges adjustable according to customer specifications: <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div> <b>Output range = Initial value <sup>10)</sup> + Span Δp</b>            0.1 to 0.4 bar + 0.75 to 1.0 bar            0.1 to 0.4 bar + 1.0 to 1.35 bar            0.1 to 0.4 bar + 1.35 to 1.81 bar            0.1 to 0.8 bar + 1.81 to 2.44 bar            0.1 to 0.8 bar + 2.44 to 3.28 bar            0.1 to 0.8 bar + 3.28 to 4.42 bar            0.1 to 1.2 bar + 4.42 to 5.94 bar            0.1 to 1.2 bar + 5.94 to 8.0 bar         </div> <div> <b>With Type 6112 i/p Module</b>            Module A            Module B            Module C            Module D            Module E            Module F            Module G            Module H <sup>9)</sup> </div> </div>	
Max. air output capacity <sup>3)</sup>	2.0 m³/h with an output of 0.6 bar (0.2 to 1.0 bar) 2.5 m³/h with an output of 1.2 bar (0.4 to 2.0 bar) 8.5 m³/h with an output of 5.0 bar (0.1 to 8.0 bar)	
Supply air		At least 0.4 bar above the upper signal pressure range value Max. 10 bar without supply pressure regulator Max. 6 bar with devices in Ex d version
	Air quality acc. to ISO 8573-1: 2001	Maximum particle size and density: Class 4 Oil content: Class 3 Pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected
	Air consumption <sup>2)</sup>	0.08 m <sub>n</sub> <sup>3</sup> /h at 1.4 bar 0.1 m <sub>n</sub> <sup>3</sup> /h at 2.4 bar Max. 0.26 m <sub>n</sub> <sup>3</sup> /h at 10 bar

Characteristic		Characteristic: Output linear to input	
	Hysteresis	≤0.3 % of final value	
	Deviation from terminal-based conformity	≤1 % of upper range value (for upper range values up to 5 bar); more exact values on request ≤1.5 % of upper range value (for upper range values above 5 bar)	
Effect in % of the upper range value		Supply: 0.1 %/0.1 bar <sup>2)</sup>	
		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	Limiting frequency	5.3 Hz	
	Phase shift	−130°	
Variable position		Max. 3.5 % depending on how the device is attached: ±1 % in horizontal position (Type 6109) Max. 1 % depending on how the device is attached: ±0.3 % in horizontal position (Type 6112)	
Ambient conditions, degree of protection, compliance and weight			
Storage temperature		−45 to +80 °C	
Ambient temperature <sup>1)</sup>	With Type 6109	−30 to +70 °C <sup>6)</sup> ; −30 to +60 °C <sup>1)</sup>	
	With Type 6112	−40 to +70 °C <sup>6) 7)</sup> ; −40 to +60 °C <sup>1) 7)</sup>	
Degree of protection		IP 54 <sup>4)</sup> , IP 65 <sup>8)</sup> , NEMA 4	
Compliance			
Weight		Approx. 0.85 kg	
Explosion protection			
ATEX, IECEx, ...		Refer to Table 3	
Materials			
Enclosure		Die-cast aluminum, chromated and plastic coated	
Cable gland (standard)		Black polyamide (6 to 12 mm clamping range, −20 to +80 °C) <sup>12)</sup>	

<sup>1)</sup> Details (including electric specifications and installation instructions) can be found in the EC type examination certificate

<sup>2)</sup> Measured with average output pressure

<sup>3)</sup> Measured with 2 m hose with 4 mm inside diameter

<sup>4)</sup> Observe recommended mounting position

<sup>5)</sup> See Table 2 when combined with a positioner

<sup>6)</sup> Devices without explosion protection

<sup>7)</sup> Special version down to –45 °C, temperature range on request

<sup>8)</sup> Possible by using accessories

<sup>9)</sup> Max. possible output pressure 8 bar

<sup>10)</sup> Initial value raised up to 3.0 bar (special version)





<sup>11)</sup> Metal cable glands and vent plugs are required for temperatures below –20 °C.

<sup>12)</sup> Devices with type of protection "Flameproof enclosure" are delivered without cable gland.

**Table 2: Technical data (positioner attachment)**

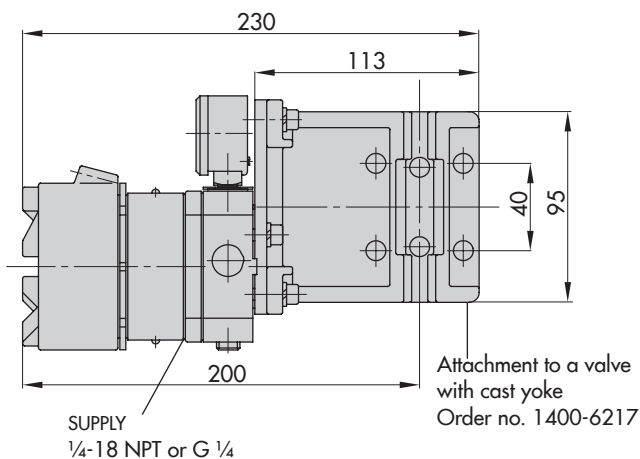
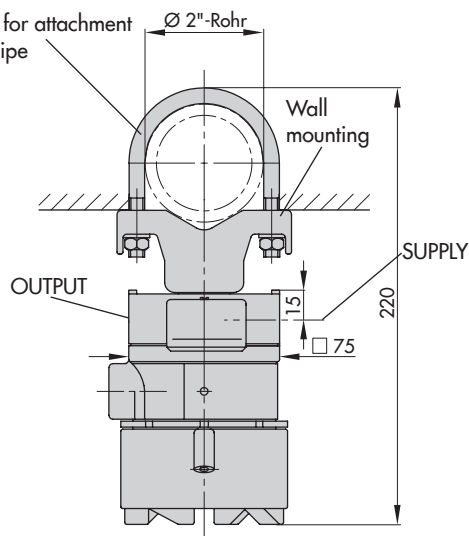
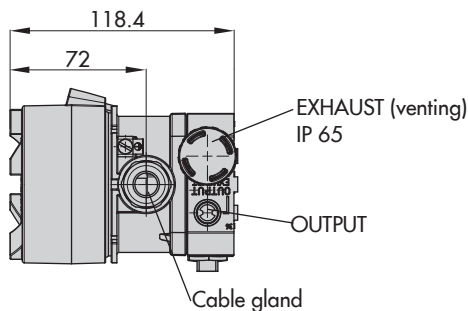
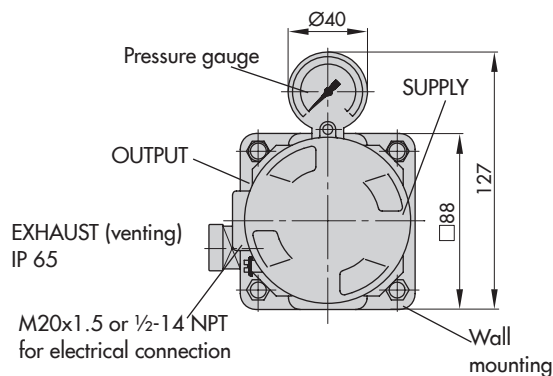
Type 6116-xx06011x000xxxx (for positioner attachment) · Further data same as in Table 1	
Input	4 to 20 mA, other signals on request Internal resistance approx. 200 Ω at 20 °C
Output	0.2 to 1 bar for positioner

**Table 3: Summary of explosion protection certificates for Type 6116 i/p Converter <sup>1)</sup>**

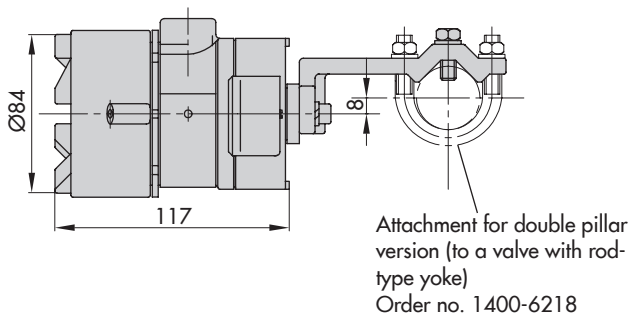
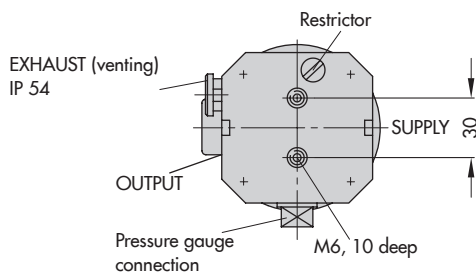
Type	Certification			Type of protection/comments
6116	<b>STCC</b>	Number	ZETC/22/2018	0Ex ia IIC T6 X 1Ex d IIC T6
		Date	2018-04-27	
		Valid until	2021-04-26	
	 EC type examination certificate	Number	PTB 02 ATEX 2199	II 2 G Ex ia IIC T6 Gb
		Date	2003-03-07	
		On request		1Ex ia IIC T6/T5/T4 Gb X
	 EC type examination certificate	Number	PTB 98 ATEX 1024 X	II 2 G Ex d IIC T6
		Date	2002-07-03	
		Number	BVS 14 ATEX E 104 X	II 2 G Ex d IIC T6/T5/T4 Gb
		Date	2014-06-27	
	<b>IECEX</b>	Number	IECEX BVS 14.0066X	Ex d IIC T6/T5/T4 Gb
		Date	2014-07-01	
		On request		1Ex d IIC T6/T5/T4 Gb X
	<b>CSA</b>	Number	1471157	Class I, Groups B,C,D; Class II, Groups E,F,G; Class III; Type 4 Enclosure
		Date	2014-11-14	
	<b>FM</b>	Number	1W5A4.AE	Class I,II,III; Div. 1, Groups B,C,D,E,F,G Class I, Div. 2, Groups B,C,D Class II, Div. 2, Groups F,G Class III Type 4X Enclosure
		Date	1993-04-01	
	<b>CSA</b>	Number	1607866	Ex ia IIC T6; Class I, Zone 0: Class I, Div. 1, Groups A,B,C,D; Class II, Div. 1, Groups E,F,G; Class III; Class I, Div. 2, Groups A,B,C,D; Class II, Div. 2, Groups E,F,G; Class III; Type 4 Enclosure
		Date	2005-09-16	
	<b>FM</b>	Number	3020228	IS, Class I,II,III; Div. 1, Groups A,B,C,D,E,F,G Class I, Zone 0, AEx ia IIC NI, Class I, Div. 2, Groups A,B,C,D; S, Class II, Div. 2, Groups F,G; S, Class III; Type 4X Enclosure
		Date	2015-10-12	
	<b>KCS Korea</b>	Number	11-KB4BO-0213	Ex d IIC T6/T4
		Date	2011-10-24	
	<b>IECEX</b>	Number	IECEX TSA 05.0015	Ex d IIC T6/T4
		Date	2005-04-22	
	<b>IECEX</b>	Number	IECEX TSA 05.0008X	Ex ia IIC T6 Ex nA IIC T6
		Date	2005-04-04	
	<b>JIS</b> (no longer available since 2020)	Number	TC 13622	Ex d IIC T6
		Date	2017-05-20	
		Valid until	2020-05-19	

<sup>1)</sup> The approvals are listed on our website at ► [www.samsunggroup.com](http://www.samsunggroup.com) > Products & Applications > Product selector > Signal converters > 6116.

Wall and pipe mounting · Order no. 1400-6216

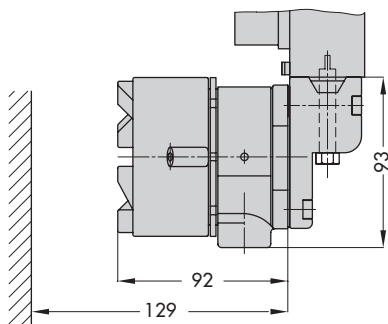


Rear view, without mounting parts

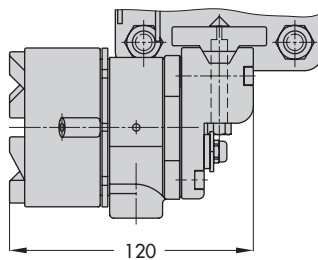


Type 6116-xx06011x000xxxx without booster for positioner attachment

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)

Order no.	Type 6116-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Explosion protection	Without	0																
	ATEX <sup>1) 2)</sup> II 2G Ex ia IIC T6 Gb	1																
	ATEX <sup>3)</sup> II 2G Ex d IIC T6; II 2G Ex d IIC T6/T5/T4 Gb	2																1/2
	CSA <sup>5) 12)</sup> Class I, Groups B, C, D; Class II, Groups E, F, G; Class III; Type 4 Enclosure	3				0	1...5			1/2								0...3
	FM <sup>5) 12)</sup> Class I, II, III; Div. 1, Groups B, C, D, E, F, G; Class I, Div. 2, Groups B, C, D; Class II, Div. 2, Groups F, G; Class III; Type 4X Enclosure									1								0/3
	CSA <sup>1)</sup> Ex ia IIC T6; Class I, Zone 0; Class I, Div. 1, Groups A, B, C, D; Class II, Div. 1, Groups E, F, G; Class III; Class I, Div. 2, Groups A, B, C, D; Class II, Div. 2, Groups E, F, G; Class III; Type 4 Enclosure	4																3
	FM <sup>1)</sup> IS, Class I, II, III; Div. 1, Groups A-G; Class I, Zone 0, AEx ia IIC; NI, Class I, Div. 2, Groups A, B, C, D; Type 4X Enclosure																	
	IECEX <sup>4) 6)</sup> Ex d IIC T6/T4	5				0	1/2			1								0/2
	IECEX <sup>1)</sup> Ex ia IIC T6; Ex nA IIC T6	6	2															2
	JIS <sup>4) 13)</sup> Ex d IIC T6	7				0	1/2											
i/p converter module	Type 6109 <sup>4)</sup>	1	0	1	0	1	1											
	Type 6112	2																
Input	4 to 20 mA		0	1														
	4 to 12 mA <sup>1) 11)</sup>	2	0	3														
	12 to 20 mA, without switch-off electronics <sup>1) 7) 11)</sup>	2	0	4														
	0 to 20 mA, without switch-off electronics <sup>7)</sup>	2	0	5														
	4 to 20 mA, without switch-off electronics <sup>7)</sup> 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 <sup>8)</sup>	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												
Direction of action	Increasing/increasing									1								
	Increasing/decreasing <sup>1)</sup>									2								
Electrical connection	½ - 14 NPT										1							
	M20x1.5										2							
Pneumatic connection	Positioner attachment (without booster) <sup>9)</sup>			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 <sup>10)</sup>											3						
Output pressure gauge	Without															0		
	With <sup>1)</sup>															1		
Temperature range	T <sub>min</sub> ≥ -25 °C (Type 6109 standard)	1																0
	T <sub>min</sub> ≥ -45 °C (Type 6112 subjected to routine test, metal cable gland)	2																1
	T <sub>min</sub> ≥ -40 °C (Type 6112 standard)	2																2

Order no.	Type 6116-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Special version	Without																0	0	0
	IECEEx approval: Ex d IIC T6/T5/T4 Gb	2															2	5	1
	EAC Ex approval: on request	1/2															2	5	2
	KCS approval, Korea: on request	5															2	6	2

- <sup>1)</sup> Not for positioner attachment  
<sup>2)</sup> With degree of protection IP 54/IP 65 only  
<sup>3)</sup> Supply pressure max. 6 bar; output 5.6 bar  
<sup>4)</sup> Only with 0.2 to 1 bar/3 to 15 psi  
<sup>5)</sup> With ½ NPT electrical connection, degree of protection NEMA 4 or positioner attachment  
<sup>6)</sup> With ½ NPT electrical connection, degree of protection IP 65 or positioner attachment  
<sup>7)</sup> Without switch-off electronics and without potentiometer for zero point and span correction  
<sup>8)</sup> 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 (special version)  
<sup>9)</sup> Only with Ex d or explosion-proof according to CSA and FM standards  
<sup>10)</sup> Only explosion-proof or intrinsically safe according to CSA and FM standards  
<sup>11)</sup> 4 to 12 mA and 12 to 20 mA input only up to 4.0 bar span  
<sup>12)</sup> Only with 0.2 to 1 bar (3 to 15 psi) and 0.4 to 2 bar (6 to 30 psi) output  
<sup>13)</sup> No longer available since 2020

Accessories	Order no.
Wall and pipe mounting	1400-6216
Mounting bracket (1.4301) for wall mounting	1400-7432
Mounting unit for Type 6116 in various versions	M6116
Attachment to Type 3766 <sup>1)</sup>	1400-6227
Attachment to Type 4765 <sup>1)</sup>	1400-6223
Attachment to Type 3760 <sup>1)</sup>	1400-6224
Mounting on cast yoke according to NAMUR <sup>1)</sup>	1400-6217
Mounting on rod-type yoke according to NAMUR <sup>1)</sup>	1400-6218
Male screw fitting G ¼ on hose with 4 mm inside diameter and 6 mm outside diameter, brass	8582-1452
Male screw fitting ¼ NPT on hose with 4 mm inside diameter and 6 mm outside diameter, brass	8582-1523
Cable gland M20x1.5, black polyamide (6 to 12 mm clamping range)	8808-1011
Cable gland M20x1.5, blue polyamide (6 to 12 mm clamping range)	8808-1012
Cable gland M20x1.5, nickel-plated brass (6 to 12 mm clamping range)	1890-4875
Cable gland M20x1.5, stainless steel 1.4305 (8 to 14.5 mm clamping range)	8808-0160
Cable gland ½ NPT, black polyamide (6 to 12 mm clamping range)	8808-0145
Cable gland ½ NPT, blue polyamide (6 to 12 mm clamping range)	8808-0146
Cable gland ½ NPT, nickel-plated brass (6 to 12 mm clamping range)	8808-0140
Vent plug G ¼, stainless steel 1.4305, IP 66 (-45 to +80 °C)	1790-7253
Vent plug G ¼, stainless steel 1.4305, NEMA 4 (-45 to +80 °C)	1790-9646

- <sup>1)</sup> Only mounting part without assembly and without any possibly required piping. Order together with mounting unit (M6116).