

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 measure and control. Especially suitable as intermediate element between electrical measuring devices and pneumatic controllers or between electrical control devices and pneumatic control valves.



The signal converter accepts a load-independent 4 to 20 mA direct current input signal.

Depending on the supply air pressure, the converter provides a pneumatic output signal of 0.2 to 1 bar (3 to 15 psi) or 0.4 to 2 bar (6 to 30 psi). The i/p converter is delivered with two different i/p modules designated Type 6109 or Type 6112. The Type 6112 model offers further output signal ranges (see "Technical data").

Special features:

- Small dimensions, low weight and robust enclosure
- Excellent dynamic response
- Relatively large air output with low air supply consumption
- Central venting
- Low vibration influences
- Versions with reversed characteristic are available (only Type 6112 i/p module)
- Option of connecting a pressure gauge parallel to the output
- Operation possible without an admission-pressure regulator
- Zero reset at a specific mA-value when a venting (switch-off) function is enabled (function can be activated as required)

Versions

For use in **non-hazardous areas**: Type 6116-0

For use in **hazardous areas**:

Type 6116-1 EEx i according to Cenelec, CZ and GOST

Type 6116-2 EEx d according to PTB, CZ and GOST

Type 6116-3 Explosion-proof acc. to CSA/FM standard; EEx d acc. to CZ

Type 6116-4 Intrinsically safe acc. to CSA/FM standard

Type 6116-5 Explosion-proof /Australia

Type 6116-6 Intrinsically safe /Australia

Special versions

Type 6116-0 for output pressures up to 8 bar (120 psi) on request

Type 6116-1 for range from -40°C to +70°C (-40 to +160°F)

Type 6116-2 for range from -20°C to +60°C (-4 to +140°F)

Type 6116-x101100 i/p converter without booster or switch-off electronic function and always with Type 6109 i/p Converter Module for combination with Type 3760, 3766-000 or 4765 Positioner.

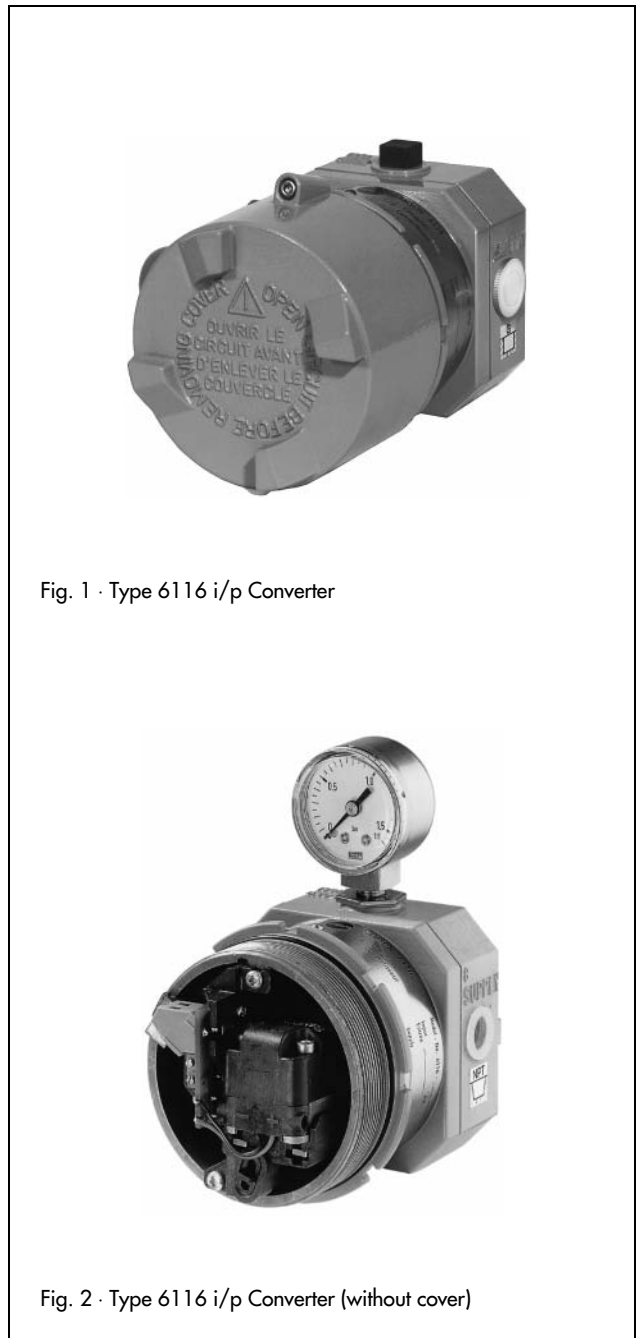


Fig. 1 · Type 6116 i/p Converter

Fig. 2 · Type 6116 i/p Converter (without cover)

Principle of operation

The electropneumatic converter consists of an i/p module which operates according to the principle of force equilibrium and a connected volume amplifier.

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 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).

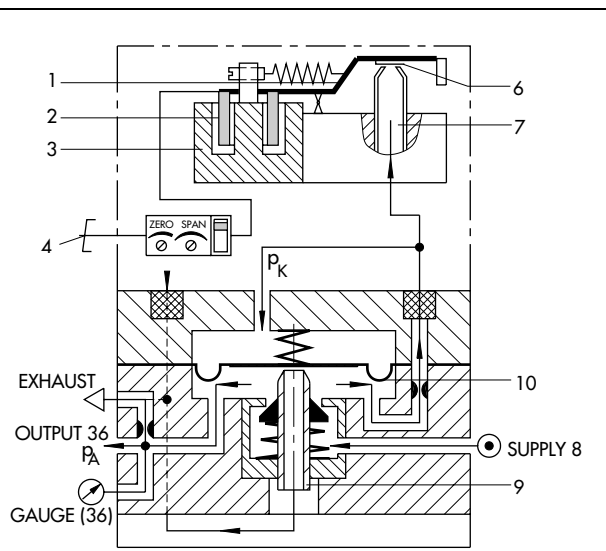
The nozzle is supplied with air from the pneumatic output (36). With an input signal of 0 mA, an output pressure of approximately 100 mbar already exists due to the offset spring.

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) downwards, 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 upwards. In this process, it releases the sleeve (9), if applicable, and opens the vent (EXHAUST) until the forces on the diaphragm are equal again.

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 (1.45 psi) when the input signal falls below 4.08 mA \pm tolerance. In this way, the tight shut-off function of a valve can be guaranteed.

Combined with Types 3760, 3766-000 or 4765 Pneumatic Positioner

The Type 6116-x101100 i/p Converter without booster or switch-off electronic function can be combined with the above listed positioners to form an explosion-proof version. 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. 4). The Type 3766-000 Positioner can be directly connected to the i/p converter. The positioner type should be specified when ordering any accessories.



- | | |
|--------------------|--------------|
| 1 Balance beam | 7 Nozzle |
| 2 Plunger coil | 8 Supply |
| 3 Permanent magnet | 9 Sleeve |
| 4 Input | 10 Diaphragm |
| 6 Flapper plate | 36 Output |

Fig. 3 · Functional principle

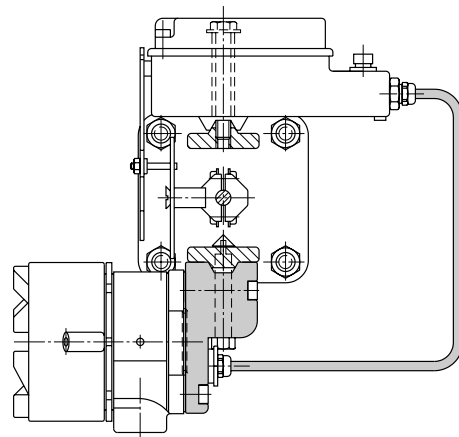


Fig. 4 · NAMUR attachment to the control valve with Type 4765 Positioner

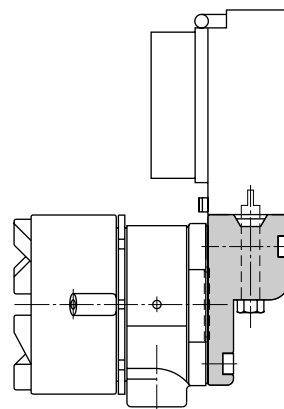


Fig. 5 · Direct attachment to Type 3766-000 Positioner

Table 1 · Technical data

 (Conversion: bar x 14.5 = psi and m³/h x 35.3 = ft³/h (cfh))

Type	Without expl. protection	Type 6116-0																	
	With explosion protection	Types 6116-1/-2/-3/-4/-5/-6, s. list of the approved explosion protection certifications																	
Input ⁹⁾	4 to 20 mA; other signals available on request Minimum current > 3.6 mA; Load ≤ 6 V (corresponds with 300 Ω at 20 mA)																		
Output ⁹⁾	0.2 to 1 bar (3 to 15 psi) (Types 6109 and 6112 i/p module) 0.4 to 2 bar (6 to 30 psi) (Type 6112 i/p module) Special ranges: (Type 6112)																		
	<table border="0"> <tr> <td>Lower range value</td> <td>Span Δp</td> </tr> <tr> <td>0.1 to 0.4 bar;</td> <td>0.75 to 1.0 bar</td> </tr> <tr> <td>0.1 to 0.4 bar;</td> <td>1.0 to 1.35 bar</td> </tr> <tr> <td>0.1 to 0.4 bar;</td> <td>1.35 to 1.81 bar</td> </tr> <tr> <td>0.1 to 0.8 bar;</td> <td>1.81 to 2.44 bar</td> </tr> <tr> <td>0.1 to 0.8 bar;</td> <td>2.44 to 3.28 bar</td> </tr> <tr> <td>0.1 to 0.8 bar;</td> <td>3.28 to 4.42 bar</td> </tr> <tr> <td>0.1 to 1.2 bar;</td> <td>4.42 to 5.94 bar</td> </tr> <tr> <td>0.1 to 1.2 bar;</td> <td>5.94 to 8.0 bar</td> </tr> </table>		Lower range value	Span Δp	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;
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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	Minimum 0.4 bar (6psi) above the upper range value, maximum 10 bar (145psi) without admission-pressure regulator, maximum 1.5 bar for devices in EExd version																		
Air consumption ²⁾	0.08 mn ³ /h at 1.4 bar 2.8 Sft ³ /h (Scfh) at 21 psi 0.1 mn ³ /h at 2.4 bar 3.5 Sft ³ /h (Scfh) at 36 psi Maximum 0.26 mn ³ /h at 10 bar Max. 9.2 Sft ³ /h (Scfh) at 145 psi																		
Characteristic	Characteristic: Output linear to input																		
Hysteresis	≤ 0.3 % of upper range value; exacter value available on request																		
Deviation from terminal-based conformity	≤ 1 % of upper range value; exacter value available on request																		
Effect in % for upper range value	Supply air: 0.1 %/0.1 bar ²⁾ (0.1%/1.45 psi ²⁾)																		
	Alternating load, supply air failure, interruption of the input current: < 0.3 %																		
	Ambient temperature: Lower range value < 0.02 %/°C, span < 0.03 %/°C																		
Dynamic response ⁴⁾																			
Limiting frequency	5.3 Hz																		
Phase shift	-130 °																		
Effect of variable mounting position	Maximum 3.5 % depending on attachment; ± 1 % when horizontal (with Type 6109) Maximum 1 % depending on attachment; ± 0.3 % when horizontal (with Type 6112)																		
Environmental conditions, degree of protection, weights																			
Ambient temperature	-25 to +70 °C ¹⁾ , 40 to +70 °C ^{1) 5)} , -20 to +60 °C ⁷⁾ -13 to +160 °F ¹⁾ , -40 to +160 °F ^{1) 5)} , -4 to +140 °F ⁷⁾																		
Degree of protection	IP 54/ IP 55 ⁶⁾ , IP 65 ⁸⁾																		
Weights	Approx.	0.85 kg (1.9 lb)																	
Materials																			

1) Details (including electric specifications and installation notes) can be found in the PTB Certificate of Conformity

2) Measured at medium output pressure

3) Measured with 2 m hose 4 x 1

4) Measured according to IEC 770

5) Special version available on request

6) Note recommended mounting position

7) Limitations according to BVS

8) Possible when accessories used

9) When combined with a positioner, see Table 2

Table 2 · Technical data of Type 6116-x101100

Input	4 to 20 mA, other signals available on request, Internal resistance approx. 200 Ω at 20 °C (70°F)
Output	0.2 to 1 bar (3 to 15 psi) for positioner

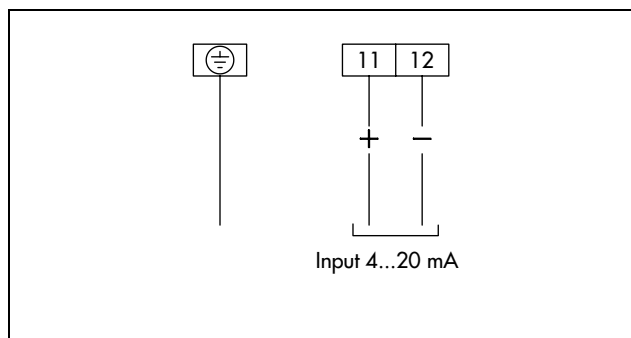
Only with Type 6109 i/p Converter module; all other data are the same as in Table 1.

List of the approved explosion protection certifications

Device type	Type of certificate	Certificate number	Date	Comments
6116 i/p Converter	Certificate of Conformity 1st Annex 2nd Annex	PTB No. Ex-92.C.2041	14.04.1992 10.10.1995 05.03.1997	EEx ia II C T6 -45 °C ambient temperature with i/p modules 6112 and 6109
	CZ certification	08.95097/J03063	08.11.1995	Valid until 31.12.98
	GOST certificate	A-0400	05.07.1996	Valid until 2001 1 Ex ia II C T6
6116-2	EC Type Examination Certificate	PTB 98 ATEX 1024 X	30.04.1998	II 2 G EEx d II C T6
	CZ certification	08.950279/Ex95.0341 X	30.10.1995	Valid until 31.12.98
	GOST certificate	A-0398	05.07.1996	Valid until 2001 1 Ex d II C T6, also available with sintered metal filter
6116-3	CSA certification	LR 54227-18	10.11.1992	Class I Groups B, C and D Class II Groups E, F and G Class III
	CSA certification	LR 54227-27	27.02.1997	Encl. 4
	CSA certification	LR 54227-24	31.05.1996	With i/p 6109 and 6112
	FM certification	J.I.1W5A4.AE	01.04.1993	Class I Division 1 Groups B, C and D NEMA 3R
	Application for revision		07.11.1996	With i/p 6109 and 6112 Class II/III Division 1 Groups E, F and G
6116-4	CZ certification			See 6116-2
	CSA certification	LR 54227-16	01.12.1992	Class I Groups A, B, C, D Class I Div 2, Encl. 3
		LR 54227-27	27.02.1997	Groups A, B, C, D, Encl. 4
	FM certification	Jl.3W2A5.AX	05.02.1993	Class I, II and III Division 1 Groups A, B, C, D, E, F and G NEMA 3 R
	FM certification	Jl.5YA3.AX	01.09.1995	Div. 2
6116-5	FM certification	Jl. 3Z1A5.AX	02.04.1997	NEMA 4
	AUS certification 1st Annex	Ex 3003 X	15.09.1993 25.05.1997	Ex d II C T6 IP 65 With 6109 and 6112
6116-6	AUS certification	Ex 1476 X	05.10.1993	Ex ia II C T6 IP 65 Class I Zone 0

The test certificates are included in the "Mounting and operating instructions" and are available on request.

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, tube or directly to the control valve according to NAMUR.

The device is to be installed horizontal, with the pressure gauge (or screw plug) facing upwards. If a different mounting position is required, the zero point is to be corrected using the ZERO adjuster.

With degree of protection IP 55 it is mandatory to install the angle piece for venting facing downwards, vertical to the floor.

Ordering text

i/p Converter Types 6116-0/-1/-2/-3/-4/-5/-6

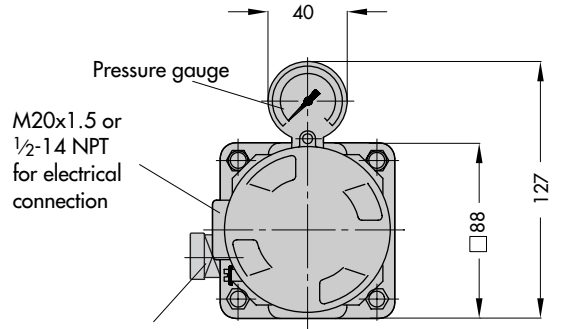
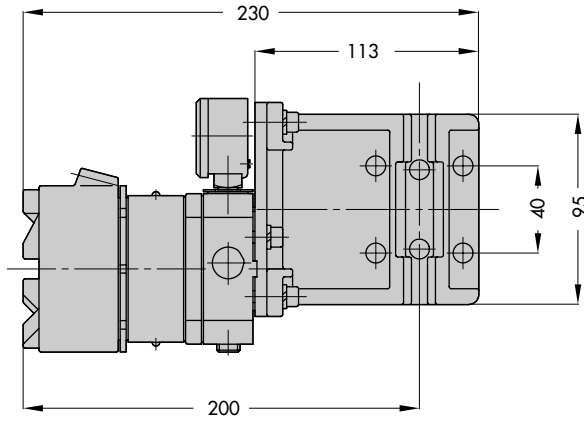
Input ... mA, output ... bar (psi)

With/without pressure gauge

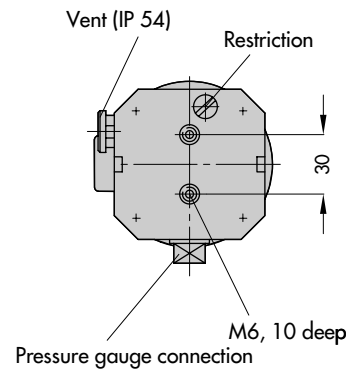
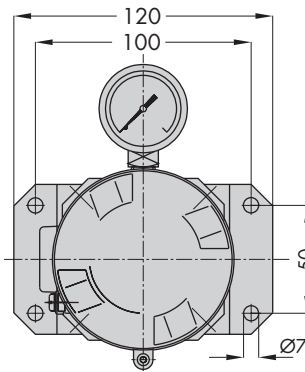
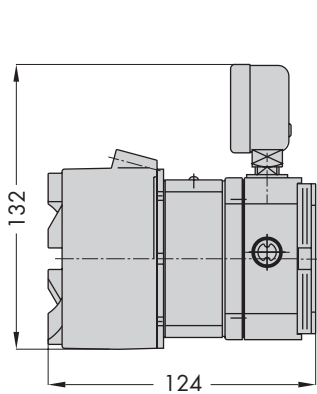
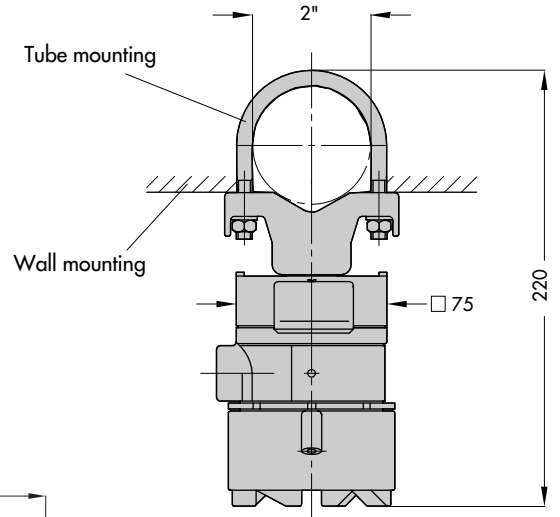
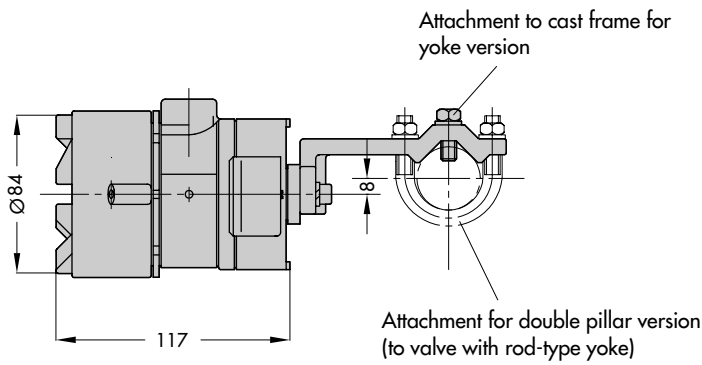
Operating direction **direct/reverse**

When combined with a positioner, Positioner Type ...

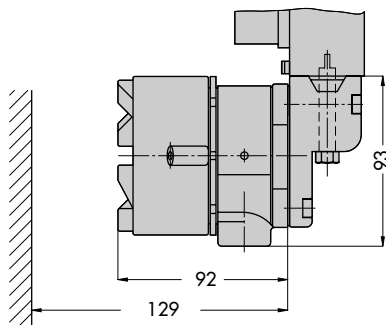
Dimensions in mm



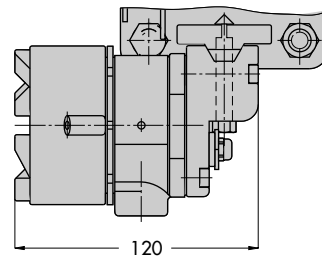
Venting angle for IP 55 according to IEC 529, Encl. 3 and FMRCNEMA 3 R



Combination with Type 3766-000 Positioner



Attachment according to NAMUR for Type 4765 and Type 3760 Positioners





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