

## T 3966 EN

### Type 3966 Solenoid Valve



#### Application

Solenoid valve with type of protection flameproof enclosure (Ex d) and intrinsic safety (Ex ia) for controlling pneumatic actuators with NAMUR interface according to VDI/VDE 3845, with integral attachment according to VDI/VDE 3847 or with NAMUR rib according to IEC 60534.

Low-power binary signals issued by automation equipment or fieldbus systems can be used for controlling purposes. Different nominal signals, switching functions and connection types allow the solenoid valve to be optimally adapted for the specific task.

#### General features

- Service life up to 20 million switching cycles
- Ambient temperature from  $-45$  to  $+80$  °C
- Corrosion-resistant enclosure in degree of protection IP 66 or Type 4X for damp and corrosive environmental conditions
- NAMUR interface according to VDI/VDE 3845 and VDI/VDE 3847
- Adapter plate for actuators with NAMUR rib according to IEC 60534-6-1, for panel, wall or rail mounting

#### Electric data

- Electropneumatic binary converter with flapper/nozzle assembly
- Type of protection: flameproof enclosure (Ex d) and intrinsic safety (Ex ia)
- Nominal signal 6, 12, 24 and 120 V DC or 120 and 240 V AC
- Manual override (optional)
- Cable entry M20x1.5 (1/2 NPT)

#### Pneumatic data

- Plug/seat valve with return spring
- 3/2-way function, can be configured as normally closed (NC) or normally open (NO)
- $K_{VS}$  0.9
- Pilot supply pressure max. 6.0 bar
- Operating pressure max. 10.0 bar
- Threaded connection G 1/4 (1/4 NPT)



Fig. 1: Type 3966 Solenoid Valve



Fig. 2: Attachment to NAMUR ribs according to IEC 60534-6-1

## Design and principle of operation

→ Refer to Fig. 3.

The solenoid valve consists of an electropneumatic binary converter (A) with manual override (B) and a 3/2-way poppet valve (C) with return spring.

The pilot supply for the electropneumatic binary converter is fed internally through port 1 or externally through port 9. By turning the turnable gasket on the enclosure, the pilot supply can be changed.

The pressure reducer (5) reduces the pilot pressure to 1.4 bar. In the idle position, the flapper is lifted off the outlet nozzle (1) by the spring (3). As a result, a pressure lower than the deactivation pressure of the poppet valve (C) builds up in the pressure divider, which consists of the restrictor (6) and outlet nozzle. When the solenoid coil (4) is energized by an electric binary signal, the outlet nozzle is closed by the flapper (2) against the force of the spring. This causes the pressure in the pressure divider to rise above the activation pressure of the poppet valve, switching it to the operating position. After the solenoid coil is de-energized, the poppet valve is switched to the idle position again by a return spring.

The 3/2-way poppet valve can be configured either with a normally closed (NC) or normally open (NO) function.

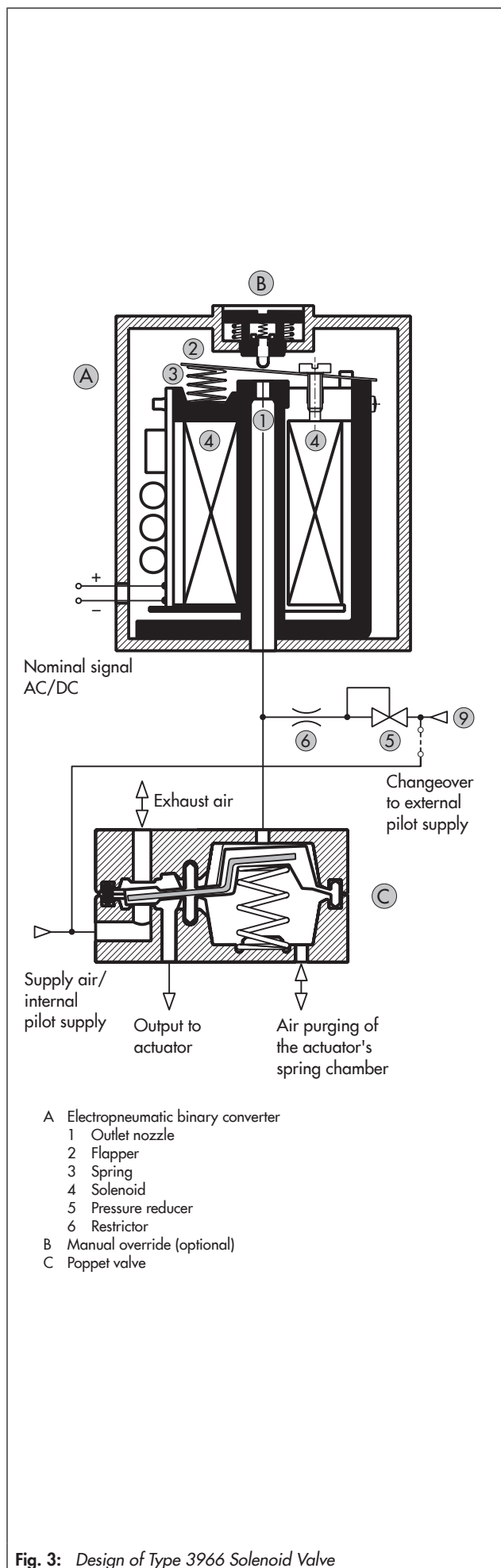


Fig. 3: Design of Type 3966 Solenoid Valve

## Sample applications

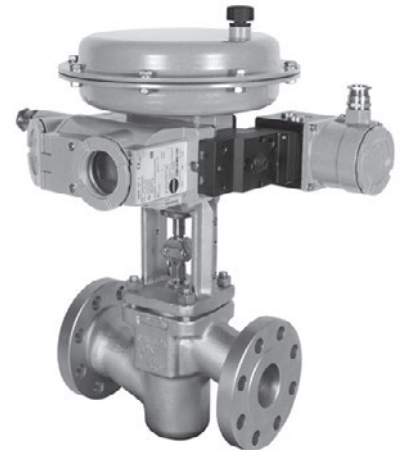
Attachment to rotary actuators with NAMUR interface according to VDI/VDE 3845



Attachment to linear actuators with NAMUR rib according to IEC 60534-6-1



Attachment to mounting block with positioner for Type 3277 Linear Actuator



Wall and panel mounting

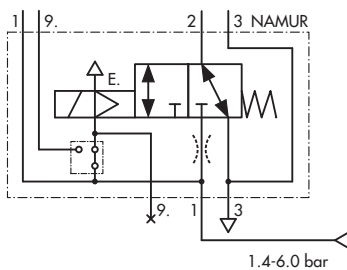


Rail mounting according to EN 60715

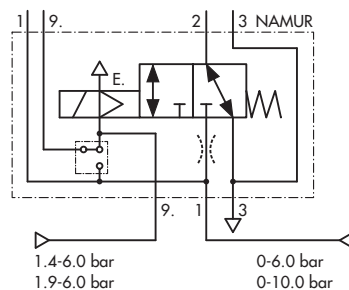


## Switching functions

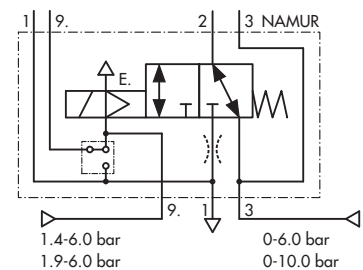
**Normally closed (NC) · Internal pilot supply**



**Normally closed (NC) · External pilot supply**



**Normally open (NO) · External pilot supply**



## Technical data

General data	
Design	Solenoid with flapper/nozzle assembly and poppet valve
Material	
Enclosure	Aluminum, powder coated, gray beige RAL 1019 (pilot valve), Black anodized aluminum (poppet valve), stainless steel (optional)
Mounting plate for internal/ external pilot supply	Aluminum, powder coated, gray beige RAL 1019 or stainless steel (optional)
Gaskets and diaphragms	Nitrile butadiene rubber (NBR), vinyl methyl silicone rubber (VMQ)
External parts	Stainless steel
Electromagnetic compatibility	Complying with EN 61000-6-2, EN 61000-6-3 and NAMUR Recommendation NE 21
Degree of protection	IP 66, Type 4X
Explosion protection	See Summary of explosion protection approvals on page 9.
Mounting position	Any (see mounting and operating instructions ► EB 3966)
Electrical connection	M20x1.5 (½ NPT)
Cable entry	To a two-pole screw terminal and two equipotential bonding terminals (inside and outside)
Connecting cable	Wire cross-section 0.2 to 2.5 mm <sup>2</sup> (flexible) or 0.2 to 4 mm <sup>2</sup> (rigid)
Pneumatic connection	G ¼ (¼ NPT) and NAMUR interface ¼" according to VDI/VDE 3845
Ambient temperature <sup>1)</sup>	-20 to +80 °C -45 to +80 °C
Weight, approx.	1.60 kg, 1.95 kg with aluminum adapter plate

- <sup>1)</sup> The maximum permissible ambient temperature depends on the permissible ambient temperature of the cable gland, type of protection and temperature class.

Pneumatic data	
Design	Plug/seat poppet valve with return spring
Switching function	3/2-way function, can be configured as normally closed (NC) or normally open (NO)
$K_{VS}$ <sup>1)</sup>	
Normally closed (NC)	0.35 (supply flow direction from 1 to 2 including restriction) 0.90 (supply flow direction from 1 to 2 without restriction) 0.90 (exhaust flow direction 2 to 3)
Normally open (NO)	0.90 (supply flow direction from 3 to 2) 0.90 (exhaust flow direction from 2 to 1 without restriction) 0.35 (exhaust flow direction from 2 to 1 including restriction)
Compressed air quality according to ISO 8573-1	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
Flow rate	At least 1.6 times greater $K_{VS}$ coefficient than the $K_{VS}$ coefficient of the device
Pilot supply pressure	
Internal (1)	1.4 to 6.0 bar
External (9)	1.4 to 6.0 bar (with 0 to 6.0 bar operating pressure), 1.9 to 6.0 bar (with 0 to 10.0 bar operating pressure)
Operating pressure	0 to 6.0 bar <sup>2)</sup> 0 to 10.0 bar <sup>3)</sup>
Air consumption of the pilot valve with 1.4 bar pilot supply	≤25 l/h (in operating position) ≤80 l/h (in idle position)

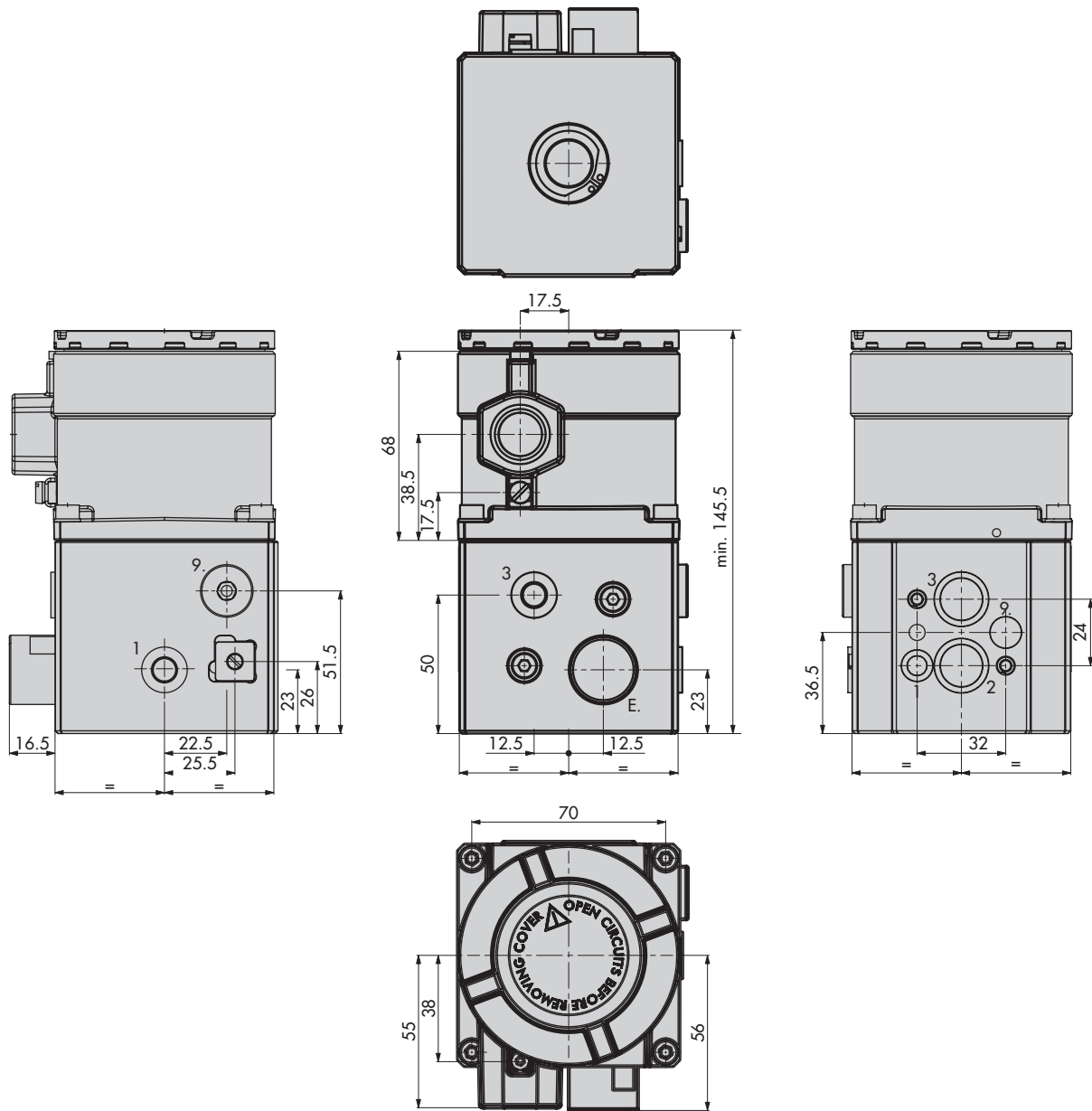
- <sup>1)</sup> The air flow rate when  $p_1 = 2.4$  bar and  $p_2 = 1.0$  bar is calculated using the following formula:  $Q = K_{VS} \times 36.22$  in m<sup>3</sup>/h.  
<sup>2)</sup> With internal pilot supply  
<sup>3)</sup> With external pilot supply, operating pressure max. 6.0 bar with type of protection Ex d

Electric data								
Type 3966		-0001	-0002	-0003	-0004	-0005	-0006	
Nominal signal	$U_N$	6 V DC	12 V DC	24 V DC	120 V DC	240 V AC	120 V AC	
	$U_{max}^{1)}$	36 V	60 V	60 V	240 V	340 V	240 V	
	$f_N$	-	-	-	-	50 to 60 Hz		
Switching point	ON	$U_{min. +80\text{ °C}}$	≥4.8 V	≥8.6 V	≥15.6 V	≥87 V	≥188 V	≥97 V
		$I_N$	≥1.4 mA	≥1.4 mA	≥1.4 mA	≥1.9 mA	≥2.0 mA	≥1.9 mA
		$P_N$	≥5.3 mW	≥10.4 mW	≥19.7 mW	≥209 mW	≥459 mW	≥225 mW
	OFF	$U_{max. -45\text{ °C}}$	≤1.0 V	≤2.2 V	≤4.2 V	≤26 V	≤55 V	≤29 V
<b>Type of protection Ex d IIC<sup>2)</sup></b>								
Type 3966		-2101	-2102	-2103				
Nominal signal	$U_N$	6 V DC	12 V DC	24 V DC				
See EU type examination certificate PTB 08 ATEX 1024 for permissible ambient temperature								
<b>Type of protection Ex ia IIC, Ex ia IIIC, Ex tb IIIC<sup>2)</sup></b>								
Type 3966		-1101	-1102	-1103				
Nominal signal	$U_N$	6 V DC	12 V DC	24 V DC				
See EU type examination certificate PTB 12 ATEX 2021 for maximum permissible values when connected to a certified intrinsically safe circuit.								
<b>Type of protection Ex ia IIC, Ex ia IIIC, Ex tb IIIC<sup>2)</sup></b>								
Type 3966		-8101	-8102	-8103				
Nominal signal	$U_N$	6 V DC	12 V DC	24 V DC				
See EU type examination certificate PTB 12 ATEX 2021 for maximum permissible values when connected to a certified intrinsically safe circuit.								

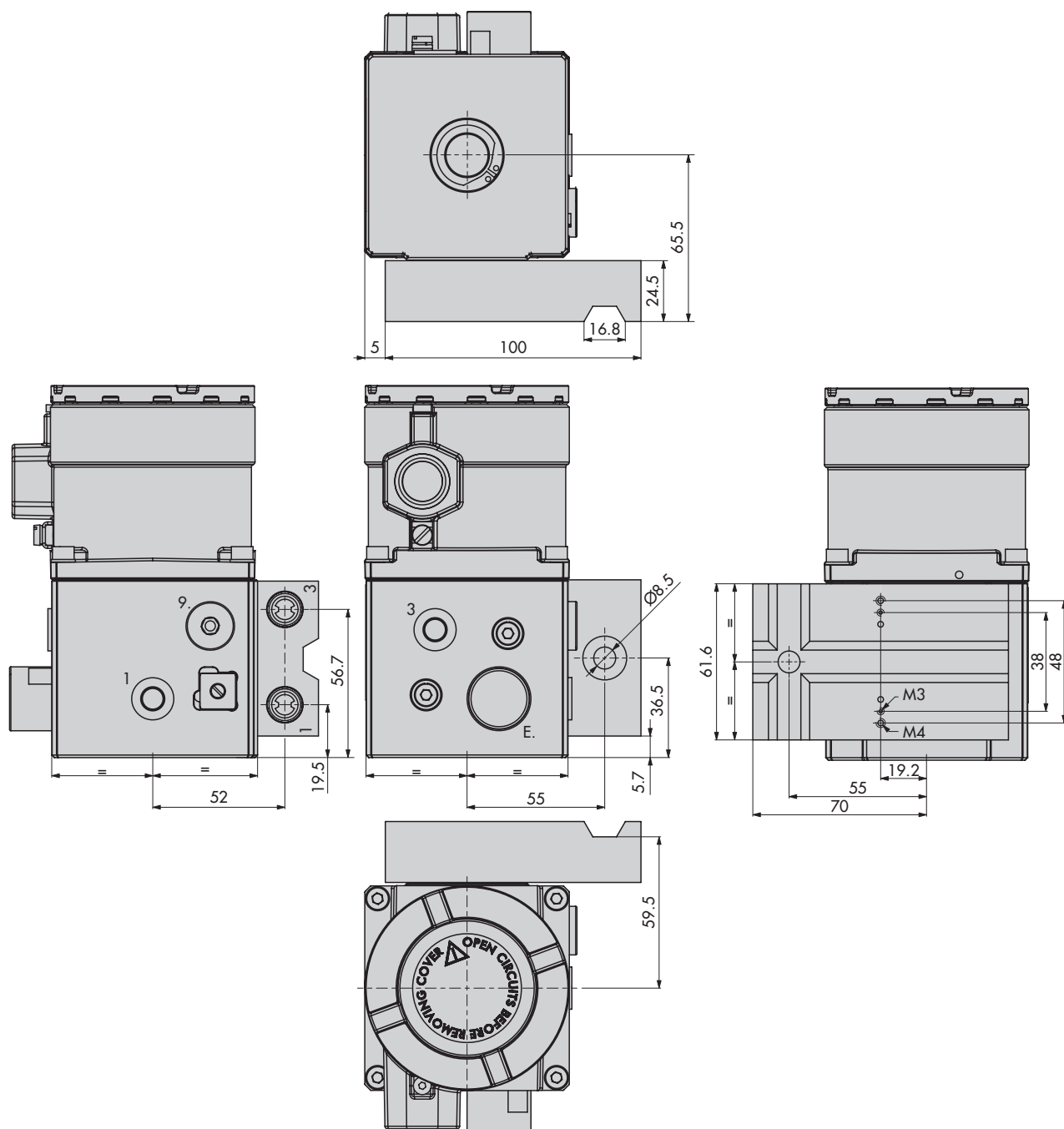
<sup>1)</sup> Duty cycle 100 %

<sup>2)</sup> See Summary of explosion protection approvals on page 9 for type of protection

Type 3966 Solenoid Valve with NAMUR interface according to VDI/VDE 3845  
for rotary actuators or mounting block with positioner for Type 3277 Linear Actuators



**Type 3966 Solenoid Valve with adapter plate**  
 Linear actuators with NAMUR rib according to IEC 60534-6-1, for panel, wall or rail mounting



**Article code**

Solenoid valve	Type 3966-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
<b>Type of protection</b>																			
No explosion protection		0	0	0															
<b>ATEX</b>	II 2 G Ex ia IIC T6 Gb																		
	II 2 D Ex ia IIIC T80°C Db IP66 II 2 D Ex tb IIIC T85°C Db IP66	1	1	0															
<b>ATEX</b>	II 2 G Ex d IIC T6	2	1	0															
	II 2 D Ex tD A21 IP66 T80°C																		
<b>FM</b>	AEx d IIC T6 ... T4	2	3	0															
<b>CSA</b>	Class I, Div 1 + 2, Groups A, B, C, D																		
	Class II, Div 1 + 2, Groups E, F, G																		
	Class III	2	3	1															
	Class 1, Zone 1, EX d IIC, T6... T4 Class II, Zone 21, EX tb IIIC T85 °C Type 4X, IP 66																		
<b>ATEX</b>	II 3 G Ex ic IIC T6 Gc	8	1	0															
	II 3 G Ex nAc II T6 Gc II 3 D Ex tc IIIC T80°C Dc IP66																		
<b>Nominal signal</b>																			
6 V DC					1														
12 V DC					2														
24 V DC					3														
120 V DC					4														
240 V AC					5														
120 V AC					6														
<b>Manual override</b>																			
Without					0														
Pushbutton underneath the enclosure cover					1														
<b>Switching function</b>																			
Without (pilot valve as spare part)					0														
3/2-way function with spring-return mechanism					1														
<b>Attachment</b>																			
Without (pilot valve as spare part)					0														
Rotary actuators with NAMUR interface according to VDI/VDE 3845					1														
Linear actuators with NAMUR rib according to IEC 60534, for panel, wall or rail mounting					2														
Mounting block with positioner for SAMSON Type 3277 Pneumatic Actuator					3														
<b>K<sub>vs</sub><sup>1)</sup></b>																			
Without (pilot valve as spare part)										0	0								
0.9										0	1								
<b>Enclosure material</b>																			
Aluminum											1								
<b>Pneumatic connection</b>																			
Without (pilot valve as spare part)												0							
G ¼													1						
¼ NPT														2					
<b>Pilot supply</b>																			
Internal supply over port 1 (when mounted onto actuators for on/off service)																			1
External supply over port 9 (when mounted onto actuators for throttling service or mounting block with positioner)																			2






Solenoid valve		Type 3966- x x x x x x x x x x x x x x x x x										
<b>Electrical connection</b>												
M20x1.5 cable entry											0	0
½ NPT cable entry											0	1
Cable gland M20x1.5, black polyamide											1	0
Cable gland M20x1.5, blue polyamide											1	1
Cable gland M20x1.5, black polyamide (CEAG)											1	3
Cable gland M20x1.5, nickel-plated brass											1	4
Cable gland M20x1.5, nickel-plated brass, blue											1	5
Cable gland M20x1.5, blue polyamide (CEAG)											1	6
<b>Degree of protection</b>												
IP 66												1
Type 4X												2
<b>Ambient temperature <sup>2)</sup></b>												
-20 to +80 °C												0
-45 to +80 °C												1
<b>Safety function</b>												
Without												0

1) The air flow rate when  $p_1 = 2.4$  bar and  $p_2 = 1.0$  bar is calculated using the following formula:

$$Q = K_{VS} \times 36.22 \text{ in m}^3/\text{h.}$$

2) The maximum permissible ambient temperature depends on the permissible ambient temperature of the cable gland, type of protection and temperature class.

### Summary of explosion protection approvals

		Certification			Type of protection/comments
Type 3966	-110	 EC type examination certificate	Number Date	PTB 10 ATEX 2021 2013-05-27	II 2 G Ex ia IIC T6 Gb II 2 D Ex ia IIIC T80°C Db IP66 II 2 D Ex tb IIIC T85°C Db IP66
	-210	 EC type examination certificate	Number Date	PTB 08 ATEX 1024 2008-05-06	II 2 G Ex d IIC T6 II 2 D Ex tD A21 IP66 T80°C
	-230	FM	Number Date	3037211 2011-03-08	AEx d IIC T6 ... T4
	-231	CSA	Number Date	70004606 2016-06-06	Class I, Div 1 + 2, Groups A, B, C, D Class II, Div 1 + 2, Groups E, F, G Class III Class 1, Zone 1, EX d IIC, T6... T4 Class II, Zone 21, EX tb IIIC T85 °C Type 4X, IP 66
	-810	 EC type examination certificate	Number Date	PTB 12 ATEX 2021 2013-05-27	II 3 G Ex ic IIC T6 Gc II 3 G Ex nAc II T6 Gc II 3 D Ex tc IIIC T80°C Dc IP66

## General accessories

Designation	Order no.
¼" screw plug, stainless steel	0070-0799
¼" screw plug, nickel-plated brass	0070-0804
Screw plug G ¼ (for pneumatic connection)	0070-0858
Screw plug ¼ NPT (for pneumatic connection)	0070-0862
NBR O-ring 14x1.5 (for ¼" screw plug)	8421-0070
VMQ switching diaphragm (for poppet valve)	0520-1428
¼" filter (for screwing into the ports)	0550-0213
Stainless steel restriction (for screwing into port 1)	0570-0390
NBR O-ring 7.5x2 (for NAMUR interface, 2 pcs. required)	8421-0273
NBR O-ring 16x2 (for NAMUR interface, 2 pcs. required)	8421-0364
NBR O-ring 40x2 (inner seal between pilot valve and poppet valve)	8421-1002
NBR O-ring 56x2 (middle seal between pilot valve and poppet valve)	8421-0124
NBR O-ring 70x2 (external seal between pilot valve and poppet valve)	0520-0099
NBR O-ring 18x2 (for cable gland)	8421-0067
Hexagon socket screw ISO 4762, M5x20, stainless steel (for fastening the pilot valve onto the poppet valve, 4 pcs. required)	8333-1265
Washer ISO 7089-5, stainless steel (for hexagon socket screws, 4 pcs. required)	8390-0061
Clamp, nickel-plated brass, with ground symbol (for equipotential bonding terminals)	8804-0322
Slotted pan head screw ISO 1580, M4x8, nickel-plated brass (for equipotential bonding terminals)	8330-0688
Spring washer DIN 128, B4 form, stainless steel (for equipotential bonding terminals)	8392-0654
Hexagon socket screw DIN 7984, M4x10, stainless steel (to lock the enclosure cover)	8333-0774
NBR turnable gasket (to convert internal/external pilot supply)	0430-1151
Fastening plate, aluminum, powder coated, gray beige RAL 1019 (for turnable gasket)	0360-2785
Fastening plate, stainless steel (for turnable gasket)	0360-3693
Cap screw with slot ISO 1207, M3x8, stainless steel (for fastening plate)	8333-0095
Cable gland (without explosion protection, Ex i, Ex nA)	
M20x1.5, black polyamide	8808-1011
M20x1.5, blue polyamide	8808-1012
M20x1.5, black polyamide (CEAG)	8808-0178
M20x1.5, blue polyamide (CEAG)	8808-0179
M20x1.5, nickel-plated brass	1890-4875
M20x1.5, nickel-plated brass, blue	1890-4876
Adapter M20x1.5 to ½ NPT made of aluminum, powder coated, gray beige RAL 1019	0310-2149
Mounting base according to EN 60715 including stainless steel mounting material	
For G-profile rail 32 (2 pcs. required)	1400-5930
For 35 mm top-hat rail mounting (2 pcs. required)	1400-5931
Mounting plate for wall mounting including stainless steel mounting material	1400-6726
Filter check valve with sintered polyethylene filter disk polyethylene for noise reduction,	
¼" connection, stainless steel, degree of protection IP 66	1790-7253
¼" connection, stainless steel, degree of protection NEMA 4	1790-9646

**Accessories for direct attachment to Type 3277 Linear Actuators**

Designation	Order no.
Mounting block for SAMSON Type 3277 Pneumatic Actuator	
G ¼ connection	1400-8817
¼ NPT connection	1400-8818
Pressure gauge mounting block, 1x Output and 1x Supply, made of stainless steel/brass (for mounting block)	1400-6950
240 cm <sup>2</sup> actuator area, zinc-plated steel	1400-6444
240 cm <sup>2</sup> actuator area, stainless steel	1400-6445
350 cm <sup>2</sup> actuator area, zinc-plated steel	1400-6446
350 cm <sup>2</sup> actuator area, stainless steel	1400-6447
700 cm <sup>2</sup> actuator area, zinc-plated steel	1400-6448
700 cm <sup>2</sup> actuator area, stainless steel	1400-6449

**Accessories for attachment according to IEC 60534-6**

Designation	Order no.
Adapter plate for linear actuators with NAMUR rib according to IEC 60534-6-1, for panel, wall or rail mounting, including stainless steel mounting material, filters in ports and screw plug made of stainless steel with NBR O-ring in port 9,	
Aluminum, powder coated, gray beige RAL 1019, G ¼ connection	1400-9598
Aluminum, powder coated, gray beige RAL 1019, ¼ NPT connection	1400-9599
Stainless steel, G ¼ connection	1400-9600
Stainless steel, ¼ NPT connection	1400-9601
Mounting parts for valves with rod-type yokes (18 to 32 mm rod diameter)	1400-5342

**Accessories for attachment to rotary actuators**

Designation	Order no.
For K <sub>VS</sub> coefficient 0.9; Adapter plate for NAMUR interface ½ on NAMUR rib ½	
Aluminum, powder coated, gray beige RAL 1019	1380-1652

