Data Sheet T 3969 EN

Type 3969 Solenoid Valve

CE Ex certified

Application

Solenoid valve for controlling pneumatic linear actuators with NAMUR rib according to IEC 60534 or pneumatic rotary actuators with NAMUR interface according to VDI/VDE 3845

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

Special features

- High level of operational reliability due to the solenoid with armature and booster valve with ball/seat
- Standard version for nominal signals 14 to 24 V DC
- Type of protection: Ex ia (intrinsic safety)
- ATEX certification
- Power consumption of <60 mW
- Electrical connection using M20x1.5 cable gland
- Corrosion-resistant enclosure with degree of protection IP 65
- Supply air 1.4 to 10 bar
- Ambient temperature –45 to +80 °C, depending on type of protection, temperature class and seals
- Use with safety shut-off valves, certification for safety-instrumented systems according to IEC 61508 (SIL), optional

Version

– 3/2-way solenoid valve with K_{VS} 0.3 and NAMUR interface according to VDI/VDE 3845 and VDI/VDE 3847
– Attachment to linear actuators with NAMUR rib or to rotary actuators with NAMUR interface
– Restrictor plate with exhaust air or supply restrictor (optional)
– 3/2-way booster valve with K_{VS} 2.0 and 4.3 and NAMUR interface according to VDI/VDE 3845 (optional)
– Enclosure material and booster valve material: aluminum

Fig. 1: *Type 3969 Solenoid Valve · Version with K_{VS} 0.3*

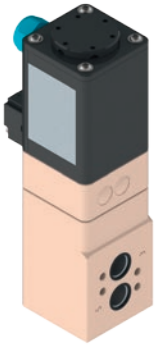

Fig. 2: *Type 3969 Solenoid Valve · Version with K_{VS} 2.0*

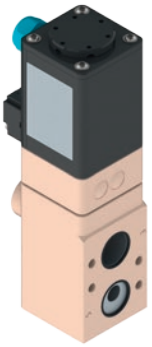

Fig. 3: *Type 3969 Solenoid Valve · Version with K_{VS} 4.3*

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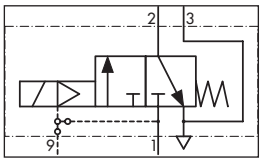
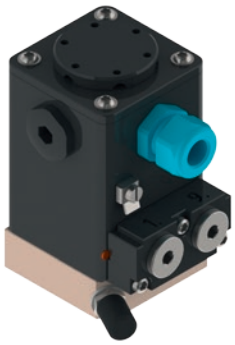
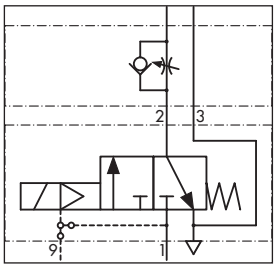
Solenoid valve versions

K_{VS} 0.3

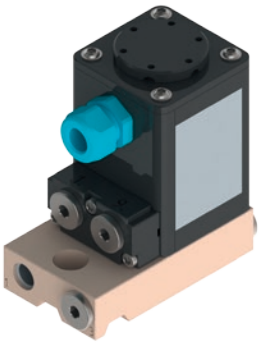


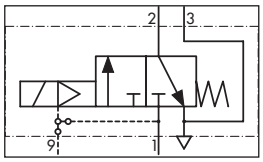
3/2-way function
NAMUR interface ¼



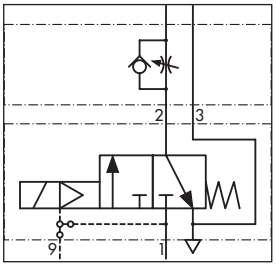


3/2-way function
NAMUR interface ¼
Exhaust air restrictor plate



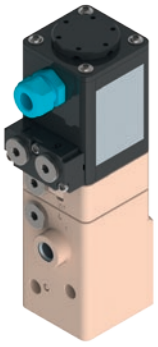


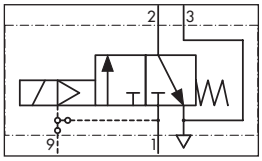
3/2-way function
Adapter plate for linear actuators with
NAMUR rib
Threaded connections ¼"



3/2-way function
NAMUR interface ¼
Supply air restrictor plate

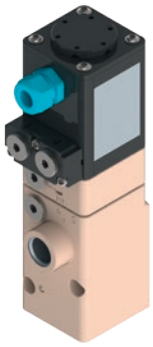
K_{VS} 2.0

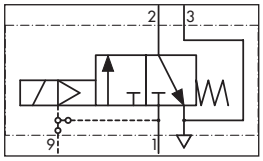




3/2-way function
NAMUR interface ¼

K_{VS} 4.3





3/2-way function
NAMUR interface ½

Function

The solenoid valve consists of an electropneumatic binary converter with manual override and integrated booster valve actuated on one side with return spring.

The air supply for the electropneumatic binary converter is fed internally through port 1 or externally through port 9. By turning the turnable gasket, the air supply can be changed (▶ EB 3969).

In the idle position, the armature is pressed against the seat of the supply air port by the spring. The solenoid coil is energized by an electric binary signal which causes the armature to be lifted out of the seat of the supply air port against the force of the spring and drawn into the exhaust air port. This causes the pressure to rise above the switch-on pressure of the integrated booster valve and switches it to the operating position. After the solenoid coil is de-energized, the integrated booster valve is switched to the idle position again by a return spring.

Optionally, the solenoid valve can be upgraded to become a pneumatic booster valve actuated on one side. This results in higher K_{VS} coefficients (see Data Sheet ▶ T 3756).

Functional diagram

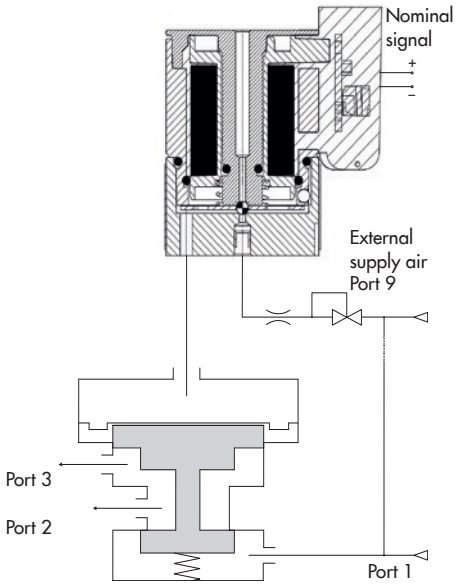


Fig. 4: *Solenoid valve with seat/plug switching element as a booster valve (K_{VS} 0.3)*

Technical data

General data		
Design		Solenoid with armature and ball/seat valve with return spring
Degree of protection		IP 65 with filter check valve
Compliance		**CE · RoHS**
Materials	Enclosure	Black anodized aluminum (C35)
	Connecting plate	Black anodized aluminum (C35)
	Adapter plate	Aluminum, powder coated, gray beige RAL 1019
	Screws	Stainless steel A4-70
	Springs	Stainless steel 1.4310
	Seals	Silicone rubber
Environmental conditions acc. to EN 60721-3	Storage	1K5 (relative humidity ≤95 %)
	Transport	2K4
	Operation	4K3 –45 to +80 °C [1]
Ambient temperature [1]		–45 to +80 °C
Mounting position		Any desired position
Resistance to vibration		According to EN 60068-2-27 According to EN 60068-2-47 Recommended continuous duty ≤150 m/s²

[1] The maximum permissible ambient temperature depends on the permissible ambient temperature of the components, type of protection and temperature class.

Electric data			
Nominal signal		U_N	14 to 24 V DC
Switching point	ON	$U_{80\,°C}$	≥14.1 V
		I	≥6.1 mA
		$P_{20\,°C}$	≥71.6 mW
	OFF	I	≤0.5 mA
Input impedance		$R_{20\,°C}$	1.87 kΩ
Temperature influence			0.39 %/°C
Type of protection [2]			Intrinsic safety II 2G Ex ia IIC T4 Gb
Output voltage [3]		U_i (V)	28
Output current [3]		I_i (mA)	115
Power dissipation [3]		P_i (W)	500 [1]
Outer capacitance [3]		C_i (nF)	Negligibly small
Outer inductance [3]		L_i (mH)	Negligibly small
Ambient temperature [4]			–45 to +80 °C (temperature class T4)
Electrical connection			Screw terminal, 2-pole, with cable gland M20 x 1.5
Grounding terminal			External (A_{max} = 4 mm²)

[1] Maximum permissible value at 100 % duty cycle. The maximum permissible value U_i applies to explosion-protected versions.
[2] According to EC type examination certificate and statement of conformity
[3] Permissible maximum values when connected to a certified intrinsically safe circuit.
[4] The maximum permissible ambient temperature depends on the permissible ambient temperature of the components, type of protection and temperature class.

Pneumatic data for solenoid valve with K_{VS} 0.3, actuated on one side		
Switching function		3/2-way function with exhaust air feedback
K_{VS} [1]		0.3
Safety approval		SIL [2]
Compressed air quality according to ISO 8573-1		Max. 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
Supply air	Medium	Instrument air (free from corrosive substances) oil or non-corrosive gases
	Pressure [3]	1.4 to 10 bar
Operating medium		Instrument air, free from corrosive substances
Operating pressure		Max. 10 bar
Switching time		≤60 ms
Connection		G ¼, ¼ NPT or NAMUR interface ¼ [4]
Weight		0.7 kg
		1.05 kg (with adapter plate)

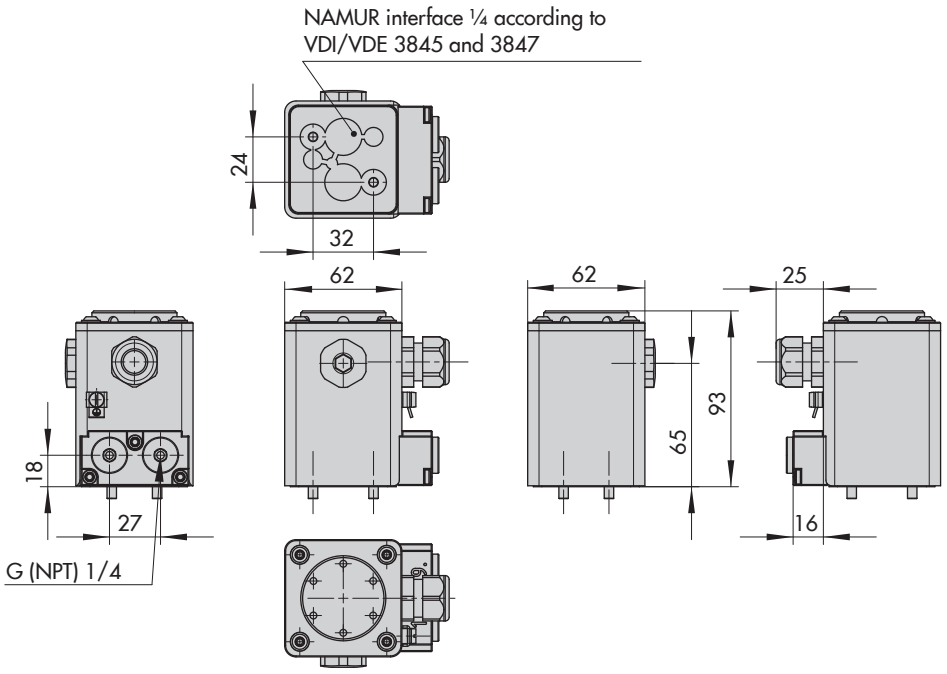
1) The air flow rate when p_1 = 2.4 bar and p_2 = 1.0 bar is calculated using the following formula: $Q = K_{VS} \times 36.22$ in m³/h.
2) SIL according to IEC 61508
3) When using the solenoid valve with an operating pressure of 10 bar, a minimum supply pressure of 1.9 bar is required.
4) NAMUR interface according to VDI/VDE 3845 and VDI/VDE 3847

Booster valve with NAMUR interface, K_{VS} 2.0 or 4.3, actuated on one side			
Switching function		3/2-way function	
K_{VS} [1] (direction of flow)		1.1 (4»3)	1.9 (4»3)
		2.0 (3»5)	4.3 (3»5)
Safety approval		SIL [2]	
Design		Poppet valve with diaphragm actuator, soft seated, with return spring	
Material	Enclosure	Aluminum, powder coated, gray beige RAL 1019 or stainless steel 1.4404	
	Diaphragms	Chloroprene rubber (−20 to +80 °C) or silicone rubber (−45 to +80 °C)	
	Seals	Chloroprene rubber (−20 to +80 °C) or silicone rubber (−45 to +80 °C)	
	Screws	Stainless steel 1.4571	
	Springs	Stainless steel 1.4310	
Operating medium		Instrument air free from corrosive substances or nitrogen [3] Air containing oil or non-corrosive gases [4]	
Compressed air quality according to ISO 8573-1		Max. 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	
Actuation		With VDI/VDE 3847 interface	
Supply air		2.7 to 6 bar [3] 1.4 to 6 bar [4]	
Max. operating pressure		10.0 bar	
Ambient temperature [5]		−20 to +80 °C −45 to +80 °C	
Connection	Supply air	G ¼ or ¼ NPT and NAMUR interface ¼ [6] with G (NPT) ⅜	G ½ or ½ NPT and NAMUR interface ½ [6]
	Exhaust air	G ½ or ½ NPT and NAMUR interface ¼ [6] with G (NPT) ⅜	G ½ or ½ NPT and NAMUR interface ½ [6]
Approx. weight		1.38 kg	1.5 kg

1) The air flow rate when p_1 = 2.4 bar and p_2 = 1.0 bar is calculated using the following formula: $Q = K_{VS} \times 36.22$ in m³/h.
2) SIL according to IEC 61508
3) With internal air supply
4) With external air supply
5) The maximum permissible ambient temperature depends on the permissible ambient temperature of the components, type of protection and temperature class.
6) NAMUR interface according to VDI/VDE 3845

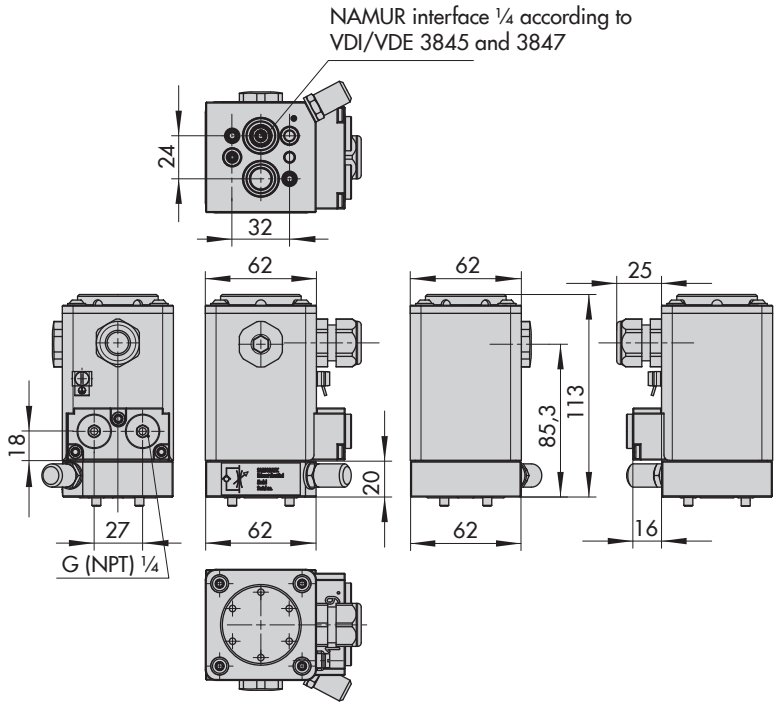
Dimensions (in mm)

Version with NAMUR interface ¼ according to VDI/VDE 3845 and direct attachment according to VDI/VDE 3847



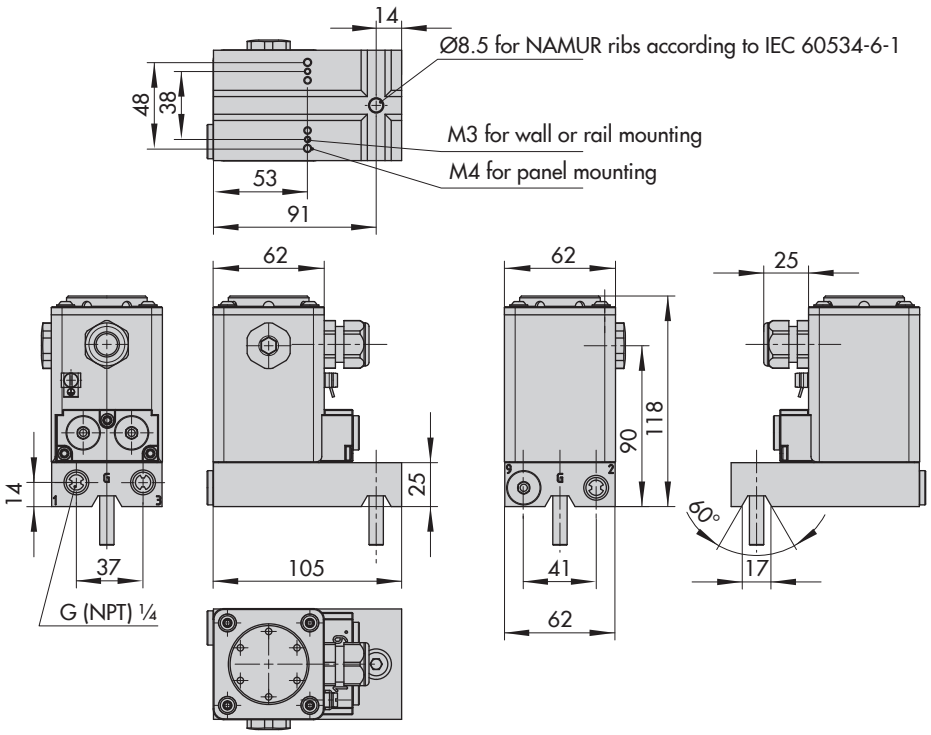
Dimensions (in mm)

Version with NAMUR interface ¼ according to VDI/VDE 3845 and direct attachment according to VDI/VDE 3847 and restrictor plate

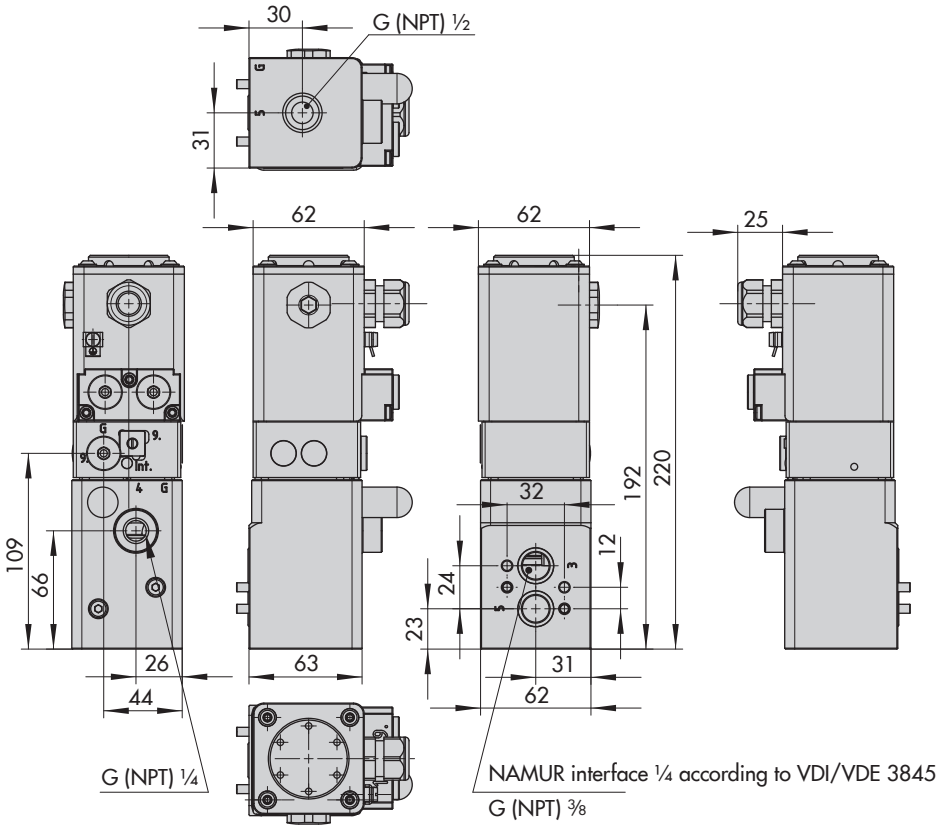


Dimensions (in mm)

Version with adapter plate for linear actuators with NAMUR rib according to IEC 60531-6-1

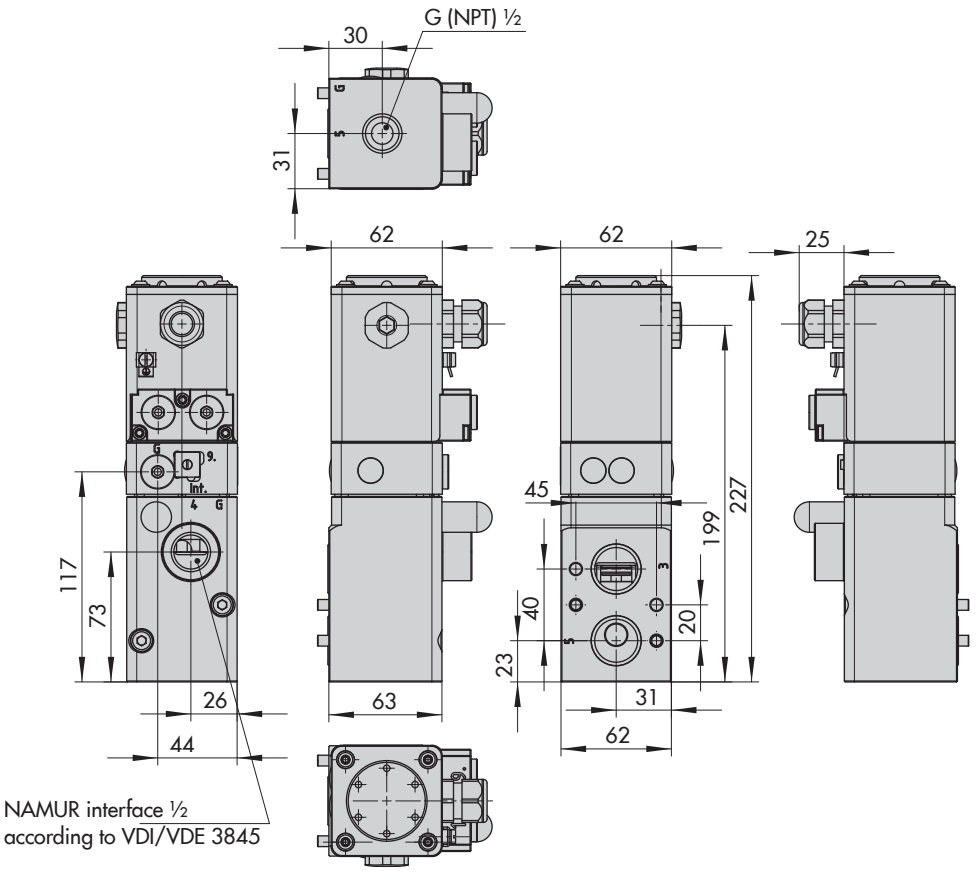


Version with booster valve (K_{VS} 2.0)



Dimensions (in mm)

Version with booster valve (K_{VS} 4.3)



Article code

Solenoid valve	Type 3969-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Type of protection																							
Without explosion protection		0	0	0																			
ATEX	II 2G Ex ia IIC T4 Gb	1	1	0																			
Nominal signal																							
14.7 ... 24 V DC					3																		
Manual override																							
Without						0																	
Pushbutton underneath the enclosure cover						1																	
Switching function																							
3/2-way function with spring-return mechanism							0	0															
Mounting																							
NAMUR interface ¼ according to VDI/VDE 3845 for rotary actuators									0														
NAMUR rib according to IEC 60534-6 for linear actuators/threaded connection									2														
Direct attachment to mounting block with positioner according to VDI/VDE 3847									3														
NAMUR interface ½ according to VDI/VDE 3845 for rotary actuators									4														
NAMUR interface ¼ according to VDI/VDE 3845 for rotary actuators with adapter plate for external air connections									5														
K_{VS} [1]																							
0.3										0													
2.0										2													
4.3										4													
Material																							
Aluminum											1												
Pneumatic connection																							
G ¼												1											
¼ NPT												2											
G ½												3											
½ NPT												4											
Pilot valve connection																							
Without (ports sealed by two screw plugs)													0										
1 (with internal air supply)													1										
2 (with external air supply)													2										
Supply air																							
Internal air supply for actuators for on/off service														0									
External air supply for actuators for throttling service														1									
Electrical connection																							
Without cable gland															0	0							
Cable gland M20x1.5 made of black polyamide															0	1							
M20x1.5 cable gland made of blue polyamide															1	1							
Cable gland M20x1.5 made of black polyamide (Ex e, CEAG)															1	3							
Cable gland M20x1.5 made of blue polyamide (Ex e, CEAG)															1	4							
Cable gland M20x1.5, nickel-plated brass															1	5							
Cable gland M20x1.5, brass, blue															1	6							
Degree of protection																							
IP 65																	0						

[1] The air flow rate when p_1 = 2.4 bar and p_2 = 1.0 bar is calculated using the following formula: $Q = K_{VS} \times 36.22$ in m³/h.

Solenoid valve	Type 3969-	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Ambient temperature [1]																							
−20 to +80 °C																		**0**					
−45 to +80 °C																		**1**					
Fail-safe action																							
Without																			**0**				
SIL [2]																			**1**				
Restrictor plate																							
Without																				**0**	**0**	**0**	
With exhaust air restrictor plate																				**1**	**0**	**0**	
With supply air restrictor plate																				**2**	**0**	**0**	
With exhaust air and supply air restrictor plates																				**3**	**0**	**0**	

[1] The maximum permissible ambient temperature depends on the permissible ambient temperature of the components, type of protection and temperature class.
[2] SIL according to IEC 61508

Summary of explosion protection approvals

Type	Certification			Type of protection/comments
3969	**SIL**	Number	968/V 1034.0017	Certification for safety-instrumented systems according to IEC 61508
		Date	2017-04-12	
3969-1	EC type examination certificate	Number	TÜV 17 ATEX 8047 X	II 2G Ex ia IIC T4 Gb
		Date	2017-05-22	

Accessories and spare parts

Spare parts	
Order no.	**Designation**
1380-2978	Enclosure cover
0430-3601	Gasket (for enclosure cover)
0070-0858	Blanking plug G ¼, stainless steel 1.4571 (for threaded connections)
0070-0862	Blanking plug ¼ NPT, stainless steel 1.4571 (for threaded connections)
8421-0070	O-ring 14x1.5 made of nitrile butadiene rubber (for blanking plug)
0430-3595	Turnable gasket (for connecting plate)
0180-1523	Fastening screw (for connecting plate) A4-90, 45x20 (1 pc.)
0180-1524	Fastening screw (for connecting plate) A4-90, 45x35 (2 pcs.)
0550-0213	Filter ¼ (for connecting plate)
0430-1883	Formed seal (for NAMUR interface ¼, K_{VS} 0.3)
8421-0364	O-ring 16x2, –20 to +80 °C (for booster valves with NAMUR interface ¼, K_{VS} 2.0)
8421-0368	O-ring 16x2, –45 to +80 °C (for booster valves with NAMUR interface ¼, K_{VS} 2.0)
8421-1077	O-ring 24x2, –20 to +80 °C (for booster valves with NAMUR interface ½, K_{VS} 4.3)
8421-0425	O-ring 24x2, –45 to +80 °C (for booster valves with NAMUR interface ½, K_{VS} 4.3)
8333-1303	Screw M5x60 A4 (for booster valves with NAMUR interface, K_{VS} 2.0)
8392-0651	Spring washer A5-A4 (for booster valves with NAMUR interface, K_{VS} 2.0)
8333-0538	Screw M5x60 A4 (for booster valves with NAMUR interface, K_{VS} 4.3)
8392-0658	Spring washer A5-A4 (for booster valves with NAMUR interface, K_{VS} 4.3)

Order no.	Designation
8808-1011	Cable gland M20x1.5 made of black polyamide, 6 to 12 mm cable diameter
8808-1012	Cable gland M20x1.5 made of blue polyamide, 6 to 12 mm cable diameter
8421-0067	NBR O-ring 18x2 (for cable gland)
8808-0178	Cable gland M20x1.5 made of black polyamide, 5 to 13 mm cable diameter (Ex e, CEAG)
8808-0179	Cable gland M20x1.5 made of blue polyamide, 5 to 13 mm cable diameter
8808-0138	Cable gland M20x1.5, nickel-plated brass, 6 to 12 mm cable diameter
1890-4876	Cable gland M20x1.5, brass, blue, 6 to 12 mm cable diameter
8808-2043	Cable gland M20x1.5, nickel-plated brass, 7 to 12 mm cable diameter (Ex e, CEAG)
8808-2016	Cable gland M20x1.5 made of blue polyamide, 10 to 14 mm cable diameter
8808-1025	Blanking plug M20x1.5, black polyamide (for cable entry)
8421-0067	NBR O-ring 18x2 (for blanking plug)
8808-3513	Blanking plug M20x1.5, nickel-plated brass (Ex e, CEAG) (for cable entry)
0070-0858	Screw plug G ¼ (for pneumatic connection)
0070-0862	Screw plug ¼ NPT (for pneumatic connection)
8421-0067	NBR O-ring 14x1.5 (for screw plug)

Accessories and spare parts

Accessories for K_{VS} 0.3	
Order no.	**Designation**
	Adapter plate for NAMUR rib according to IEC 60534-6-1, panel, wall or rail mounting, including fastening screw
1400-9598	Aluminum, powder coated, gray beige RAL 1019, G ¼ connection
1400-9599	Aluminum, powder coated, gray beige RAL 1019, ¼ NPT connection
1400-9600	Stainless steel 1.4404, G ¼ connection
1400-9601	Stainless steel 1.4404, ¼ NPT connection
	Mounting base according to EN 60715
1400-5930	G-profile rail 32 (2 pcs. required)
1400-5931	For 35 mm top-hat rail mounting (2 pcs. required)
1400-6726	Mounting plate for wall mounting including fastening screws
	Restrictor plate
1400-9602	With exhaust air restrictor, K_{VS} 0.01 to 0.28, adjustable; made of aluminum, powder coated, gray beige RAL 1019
1402-0141	With exhaust air restrictor, K_{VS} 0.01 to 0.28, adjustable; made of aluminum, powder coated, gray beige RAL 1019, **SIL**
1402-0137	With exhaust air restrictor, K_{VS} 0.01 to 0.28, adjustable; made of stainless steel 1.4404
1402-0142	With exhaust air restrictor, K_{VS} 0.01 to 0.28, adjustable; made of stainless steel 1.4404, **SIL**
1400-9603	With supply air restrictor, K_{VS} 0.01 to 0.28, adjustable; made of aluminum, powder coated, gray beige RAL 1019
1402-0139	With supply air restrictor, K_{VS} 0.01 to 0.28, adjustable; made of aluminum, powder coated, gray beige RAL 1019, **SIL**
1402-0136	With supply air restrictor, K_{VS} 0.01 to 0.28, adjustable; made of stainless steel 1.4404
1402-0140	With supply air restrictor, K_{VS} 0.01 to 0.28, adjustable; made of stainless steel 1.4404, **SIL**
	Adapter plate for NAMUR interface ¼ on NAMUR rib ¼ with external connections
1402-0695	Aluminum, powder coated, gray beige RAL 1019, G ¼ connection
1402-0697	Aluminum, powder coated, gray beige RAL 1019, ¼ NPT connection
1402-0696	Stainless steel 1.4404, G ¼ connection
1402-0698	Stainless steel 1.4404, ¼ NPT connection
	Double-axial adapter
1993-0089	90°, aluminum, powder coated, gray beige RAL 1019
1993-0220	270°, aluminum, powder coated, gray beige RAL 1019
1402-0280	180°, aluminum, powder coated, gray beige RAL 1019
	Adapter plate for NAMUR interface ¼ on NAMUR rib ½
1380-1652	Aluminum, powder coated, gray beige RAL 1019
1380-1797	Stainless steel 1.4404
	Adapter plate with NAMUR interface ¼
1402-0095	For SAMSON Type 3351
1409-3001	For SAMSON Type 3353 and Type 3354
8333-1237	Hexagon socket head screw M5x6 (required in addition to 1409-3001)
0790-6118	M5 seal (required in addition to 1409-3001)

Accessories and spare parts

Accessories for K_{VS} 0.3	
Order no.	**Designation**
	Mounting block for SAMSON Type 3277 Pneumatic Actuator
1400-8817	G ¼ connection
1400-8818	¼ NPT connection
1400-6950	Pressure gauge mounting block, 1x output and 1x supply, made of stainless steel/brass (for mounting block)
	Piping for actuator with fail-safe action "stem retracts"
1400-6444	240 cm² actuator area, zinc-coated steel
1400-6445	240 cm² actuator area, CrNiMo steel
1400-6446	350 cm² actuator area, zinc-coated steel
1400-6447	350 cm² actuator area, CrNiMo steel
1400-6448	700 cm² actuator area, zinc-coated steel
1400-6449	700 cm² actuator area, CrNiMo steel

Accessories for K_{VS} 2.0	
Order no.	**Designation**
	Adapter plate for NAMUR rib acc. to IEC 60531-6-1
1400-6751	Aluminum, powder coated, gray beige RAL 1019, G ¼ connection
1400-9924	Aluminum, powder coated, gray beige RAL 1019, ¼ NPT connection
	Adapter plate for NAMUR interface ¼ on NAMUR rib ½
1380-1652	Aluminum, powder coated, gray beige RAL 1019
1380-1797	Stainless steel 1.4404

Accessories for K_{VS} 4.3	
Order no.	**Designation**
	Adapter plate for NAMUR interface ½ to thread ½
0360-3945	Aluminum, powder coated, gray beige RAL 1019, G ½ connection
0360-3946	Aluminum, powder coated, gray beige RAL 1019, ½ NPT connection
0360-3947	Stainless steel 1.4404, G ½ connection
0360-3948	Stainless steel 1.4404, ½ NPT connection
	Adapter plate for NAMUR interface ½ on NAMUR rib ½
1380-1795	Aluminum, powder coated, gray beige RAL 1019
1380-1796	Stainless steel 1.4404
	Adapter plate for NAMUR rib acc. to IEC 60531-6-1
1402-0827	Aluminum, powder coated, gray beige RAL 1019, G ½ connection
1402-0829	Aluminum, powder coated, gray beige RAL 1019, ½ NPT connection
1402-0828	Stainless steel 1.4404, G ½ connection
1402-0830	Stainless steel 1.4404, ½ NPT connection
	Double-axial adapter
1402-0602	90°, aluminum, powder coated, gray beige RAL 1019
1402-0603	90°, stainless steel 1.4404