HART Positioner Type 3780

Application

Single-acting or double-acting positioner for attachment to pneumatic control valves. Supplied with a standardized electric input signal from 4 to 20 mA · For **rated travels from 5 to 255 mm and opening angles up to 120°**

Smart instrument according to the HART® Field Communication Protocol. Designed for types of protection **EEx ia** and **EEx d**.

The microprocessor-controlled positioner ensures a preset assignment of the valve stem position to the electric input signal. It compares the 4 to 20 mA reference input signal received from the control device to the travel of the control valve and generates the corresponding pneumatic output signal pressure (output variable).

Suitable for attachment to both linear and rotary actuators

The Type 3780 HART Positioner is equipped with an interface which complies with the HART® Field Communication Protocol, enabling connection to a PC or HART®-compatible handheld communicator (configurator) for bidirectional data exchange. SAMSON's TROVIS-VIEW software and the device-specific database module can be used to configure and parameterize the HART positioner. The positioner can, however, also be operated with other suitable software packages.

Version with type of protection "Intrinsical safety EEx ia IIC T6" or in combination with Type 3770 Field Barrier with type of protection "Flameproof enclosure EEx d" for hazardous areas

The digital data processing feature offers the following advantages over conventional positioners:

- Automatic adjustment of zero and span when initializing the positioner
- Automatic detection of errors in the actuator or pneumatic system
- Operating direction selectable using software functions, therefore independent of the mounting position
- Selectable characteristics
- Simple modification of control parameters even during operation
- Monitoring and diagnosis functions, e.g. self-test functions for fault alarm output, software limit switches and position transmitters; total valve travel (travel integral)
- Supports advanced valve diagnosis using SAMSON's TROVIS-EXPERT software
- Continuous monitoring and adjustment of zero
- Minimum air consumption
- Permanent storage of all parameters in the EEPROM
- Optionally available with forced fail-safe venting action to vent the actuator via the 3/2-way valve (Fig. 4, item 4) upon failure of the external signal. As a result, the control valve is forced to move to its fail-safe position. This function can be activated using a hardware switch.

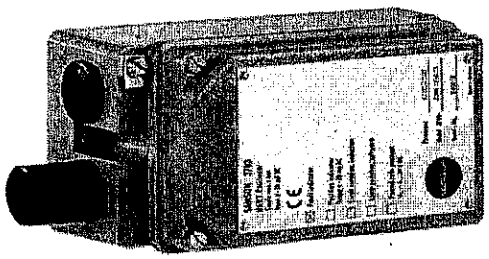


Fig. 1 · Type 3780 HART Positioner

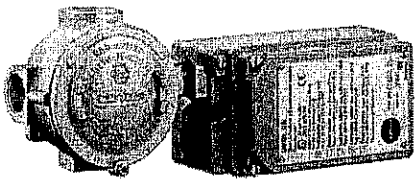
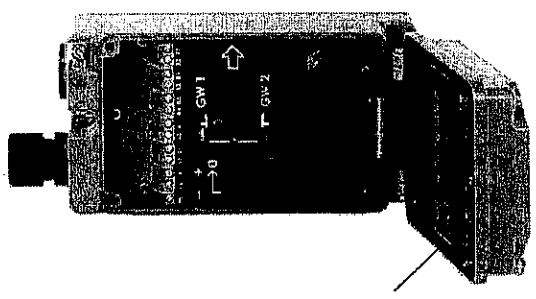


Fig. 2 · Ex d positioner with Type 3770 Field Barrier



Write protection switch

Fig. 3 · Type 3780 HART Positioner with opened case

Principle of operation

The travel of the final control element is detected using the non-contact inductive displacement sensor (1) and transmitted to the microcontroller (2) via a converter. In the microcontroller, the travel is compared to the set point, and the two pneumatic 2/2-way switching valves (3, 4) are activated whenever a deviation (i.e. error) occurs. Depending on the error, these valves either add air to (3) or vent air from (4) the pneumatic actuator using corresponding boosters.

A second microcontroller (5) manages the communication according to the HART® Field Communication Protocol. The frequency shift keying (FSK) signal used for communication is superimposed on the standardized electric current signal.

The TROVIS-VIEW software package can be used to adjust and select all required parameters and download these to the HART positioner. After that, the positioner can operate independently of the PC or handheld communicator.

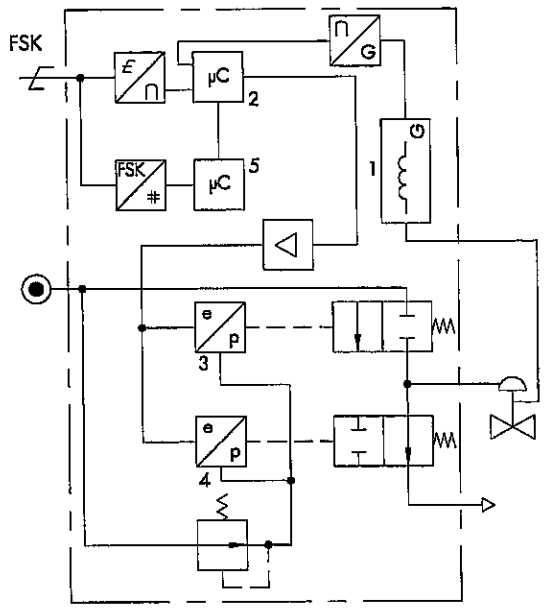
By default, the positioner is equipped with a fault alarm output used to signalize various errors and other relevant messages.

A write protection switch located on the inside of the cover prevents that saved configuration data are overwritten unintentionally.

Accessories

Options to extend the function range of the positioner include:

- Two inductive limit switches (proximity switches) or two software limit switches (to be configured via the program)
- One analog position transmitter which, independently of the reference input signal, converts the valve stem position into an analog output signal (operating direction can be configured via the software)



1	Inductive displacement sensor	4	3/2-way valve
2	Microcontroller	5	Microcontroller
3	3/2-way valve	FSK	Frequency shift keying signal for communication

Fig. 4 · Functional diagram of Type 3780 HART Positioner

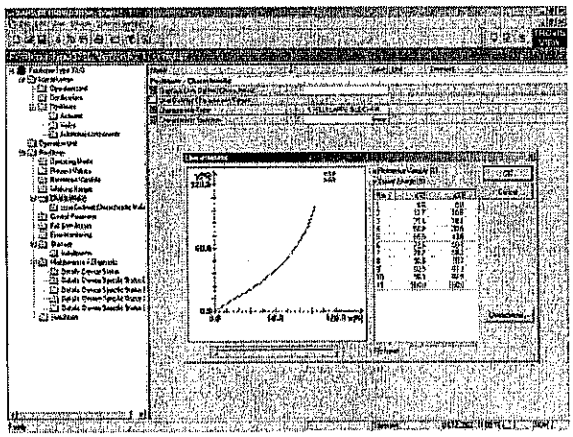


Fig. 5 · TROVIS-VIEW Configuration and Operator Interface, dialog box for user-defined characteristic

Table 1 · Technical Data

Travel Direct attachment to Type 3277: Attachment acc. to DIN IEC 534 (NAMUR):		**Adjustable** 5 to 30 mm 5 to 255 mm or 30° to 120° with rotary actuators
Reference input signal w Minimum current Load impedance		Signal range: 4 to 20 mA, span: 4 to 16 mA · Static destruction limit: 500 mA 3.6 mA ≤ 10.8 V (corresponds to 540 Ω at 20 mA)
Supply air		1.4 to 6 bar (20 to 90 psi)
Output signal pressure		0 bar up to capacity of supply air pressure
Characteristic		Adjustable: linear/equal percentage/reverse equal percentage/freely programmable Deviation from characteristic ≤1 %
Dead band		Adjustable from 0.1 to 10 %, default: 0.5 %
Resolution		≤ 0.05 %
Transit time		240 s separately adjustable for exhaust and supply air
Operating direction		Reversible, selection via software
Air consumption		Independent of supply air < 90 l_n/h
Air output capacity	Add air to actuator	At Δp = 6 bar: 9.3 m_n^3/h, at Δp = 1.4 bar: 3.5 m_n^3/h
	Vent air from actuator	At Δp = 6 bar: 15.5 m_n^3/h, at Δp = 1.4 bar: 5.8 m_n^3/h
Permissible ambient temperature		–20 to 80 °C · –40 to 80 °C with metal cable gland For devices equipped with position feedback indication only –20 to 80 °C The values of the EC type examination certificate specified in Table 3 additionally apply to Ex devices.
Temperature influence		≤ 0.15 %/10 K
Supply influence		None
Effect of vibration		None up to 250 Hz and 4 g
Explosion protection		EEx ia IIC T6 (see Table 3)
Degree of protection		IP 54, (IP 65 special version)
Electromagnetic compatibility		Requirements met according to EN 50 081/50 082 and NAMUR Recommendation 21
Electrical connection		1 plastic cable gland M20x1.5, black Second additional tapped hole M20x1.5
Weight		Approx. 1.3 kg
Fault alarm output		For connection to signal converter according to EN 60 947-5-6 · Static destruction limit: 16 V
Communication		
Hardware requirements		TROVIS-VIEW Configuration and Operator Interface (see Data Sheet T 6661 EN) · Handheld communicator, e.g. Type 275 by Fisher Rosemount · DTM acc. to Specification 1.2 · Integration of other user interfaces possible
Data transmission		HART® Field Communication Protocol Impedance in HART frequency range: receive 350 to 450 Ω, send approx. 115 Ω
Software functions		Automatic start-up; adjustment of characteristic, operating direction, reference input signal range and transit time; limitation of the travel range; cross-over correction; automatic zero correction; fault alarms; total valve travel (travel integral); diagnosis messages; device information; non-volatile storage of data; test functions; logging via IBIS
Forced fail-safe venting action Input K_V value		To be activated via internal switch 6 to 24 V dc · R_i approx. 6 KΩ at 24 V dc (voltage-dependent) Switching point for 1-signal at values ≥ 3 V · Switching point for 0-signal only at 0 V 0.17
Accessories		
Inductive limit switches		For connection to signal converter according to EN 60 947-5-6, two Type SJ2-SN inductive proximity switches
Software limit switches		For connection to signal converter according to EN 60 947-5-6, two configurable limit values Hysteresis: 1 %
Analog position transmitter Output Characteristic Hysteresis Ripple content of dc signal Operating range Power supply Permissible load Resolution High-frequency influence Influence of power supply Temperature influence		Two-wire transmitter 4 to 20 mA ; operating direction reversible Linear (deviation ≤ 1%, incl. influence of mechanical deflection for NAMUR attachment) ≤ 0.3 % 0.6 % at 28 Hz/IEC 381 T1 –10 to +114 % 12 to 35 V dc $R_B = \frac{U_S - 12\ V}{20\ mA}$ ≤ 0.05 % < 2 % at 50 to 80 MHz None Same as positioner

Table 2 · Materials

Case	Die-cast aluminum, chromated and plastic-coated
External parts	Stainless steel WN 1.4571 and WN 1.4301

Table 3 · Data which additionally apply to explosion-proof Type 3780-1.... HART Positioner

Permissible maximum values for	Signal circuit	Position transmitter	Forced fail-safe venting action	Inductive limit switches Type 3780-12	Software limit switches Type 3780-13	Fault alarm output
U_i	28 V			15.5 V	20 V	
I_i	115 mA			52 mA	60 mA	
P_i	1 W		0.5 W	169 mW	250 mW	
C_i	5.3 nF		Negligibly small	40 nF	5.3 nF	
L_i	Negligibly small			60 µH	Negligibly small	

Ambient temperature ranges in °C				
Temperature class		T6	T5	T4
Signal circuit Forced fail-safe venting action Fault alarm output Software limit switches		–40 to 60 °C	–40 to 70 °C	–40 to 80 °C
Inductive limit switches at	I_i = 52 mA	–40 to 45 °C	–40 to 60 °C	–40 to 75 °C
	I_i = 25 mA	–40 to 60 °C	–40 to 80 °C	–40 to 80 °C
Position transmitter		–20 to 60 °C	–20 to 70 °C	–20 to 80 °C

Summary of the approved explosion protection certificates for Type 3780

Certificate type	Certificate number	Date	Comments
Certificate of Conformity	PTB No. Ex-94.C.4069	1994-11-09	EEx ia IIC T6
First Addendum		1996-10-14	Changes in the construction
Second Addendum		1998-05-08	New initiators
EC Type Examination Certificate	PTB 00 ATEX 2038	2000-05-03	⟨Ex⟩ II 2G EEx ia IIC T6
First Addendum		2000-10-10	Changes in EMC
Statement of Conformity	PTB 02 ATEX 2033 X	2000-04-05	⟨Ex⟩ II 3G EEx nAa II T6
SEV Certificate	98.7.70563.01	1998-08-12	EEx ia IIC T4-T6
CZ Certificate	FTZÜ 99 Ex 0110	1999-06-23	Ex II 1G EEx ia IIC T6
BKI Certificate (first extension)	Ex-97.C.163	2000-05-10	EEx ia IIC T6
FMRC Certificate	J.I.OD6A3.AX	1998-02-25	Classes I, II, III; Div. 1, Groups A-G; Div. 2, Groups A, B, C, D; NEMA Type 4X
Revision		2002-02-20	3.3-volt version
CSA Certificate	LR 54227-29	1998-08-14	Class I; Div. 1; Groups A, B, C, D Type 4 Enclosure
	1181233	2002-04-15	Class 1, Zone 0, Ex ia IIC T6; 3.3-V version
GOST Certicifate	A-0711	1997-07-25	1 Ex ia IIC T6
AUS Certificate	AUS Ex 3621 X	2000-07-18	Ex ia IIC T6, Class I, Zone 0 Ex n IIC T6, Class I, Zone 2
JIS Certficate	C 15863	May 2002	Ex ia IIC T6, 3.3-volt version

The test certificates are included in the mounting and operating instructions and are available on request.
For EEx d certificates concerning the Type 3770 Field Barrier, refer to Data Sheet T 8379 EN.

Electrical connection

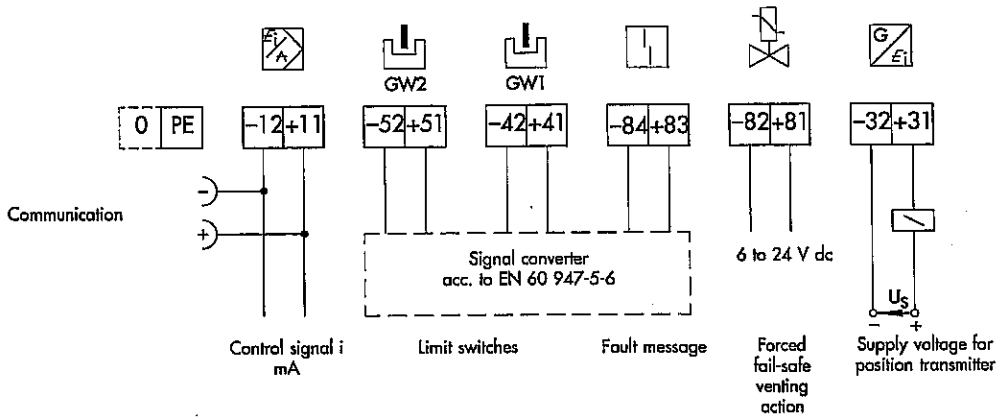


Fig. 6 · Electrical connection for Type 3780 Positioner including accessories

Connecting the HART Positioner

The Type 3780 HART Positioner can be operated as a single unit (point-to-point communication), in multi-drop mode or on the FSK bus. Figs. 7 to 9 illustrate how the unit is to be connected.

The isolating amplifiers in the explosion-proof version (4) are only required when Type 3780 HART Positioner is used in hazardous areas.

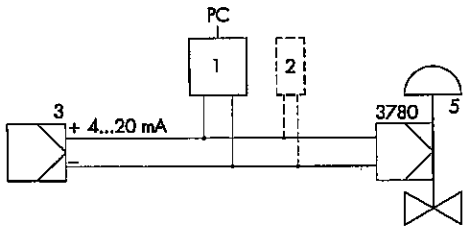


Fig. 7 · Point-to-point communication of Type 3780

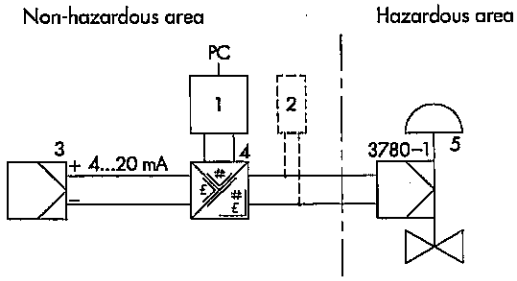


Fig. 8 · Point-to-point communication of Type 3780-1 Positioner in hazardous area

1 FSK modem
2 Handheld communicator (suitable for hazardous areas)
3 Controller / control station
4 Isolating amplifier version for hazardous areas
5 Control valve

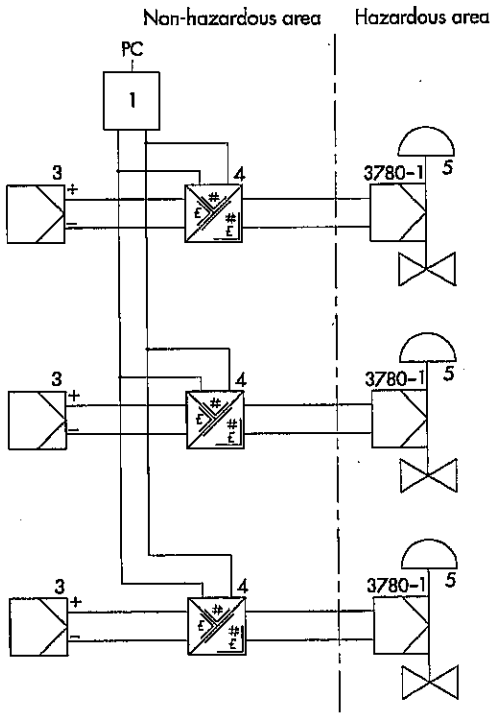


Fig. 9 · FSK bus connection of Type 3780-1 Positioner in hazardous area

Attaching the positioner to the actuator

The Type 3780 HART Positioner can be mounted directly to the Type 3277 Linear Actuator using a connection block: For actuators with fail-safe action "Actuator stem extends" and for Type 3277-5 (effective area of 120 cm^2), the supply pressure is transferred to the diaphragm chamber through an internal bore in the actuator yoke. For actuators with fail-safe action "Actuator stem retracts" and effective areas of 240 cm^2 or larger, the supply pressure is transferred to the diaphragm chamber via a prefabricated external tube connection.

Using an adapter plate, the positioner can also be easily attached to either side of the actuator according to DIN IEC 534 (NAMUR recommendation).

Attachment to the Type 3278 Rotary Actuator or other rotary actuators according to VDI/VDE 3845 requires an intermediate piece. The rotary motion of the actuator is converted into a linear motion via a cam disc. The cam disc is designed for angles of either 0° to 90° or 0° to 120°. The characteristic can be selected using the software.

For double-acting springless actuators (without spring return), a reversing amplifier is required to generate the second opposed signal pressure.

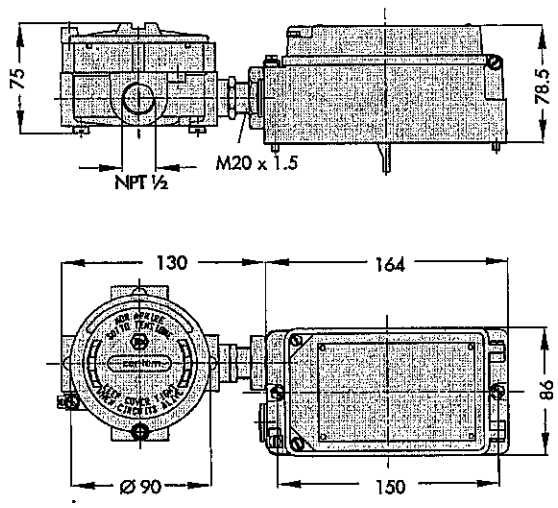
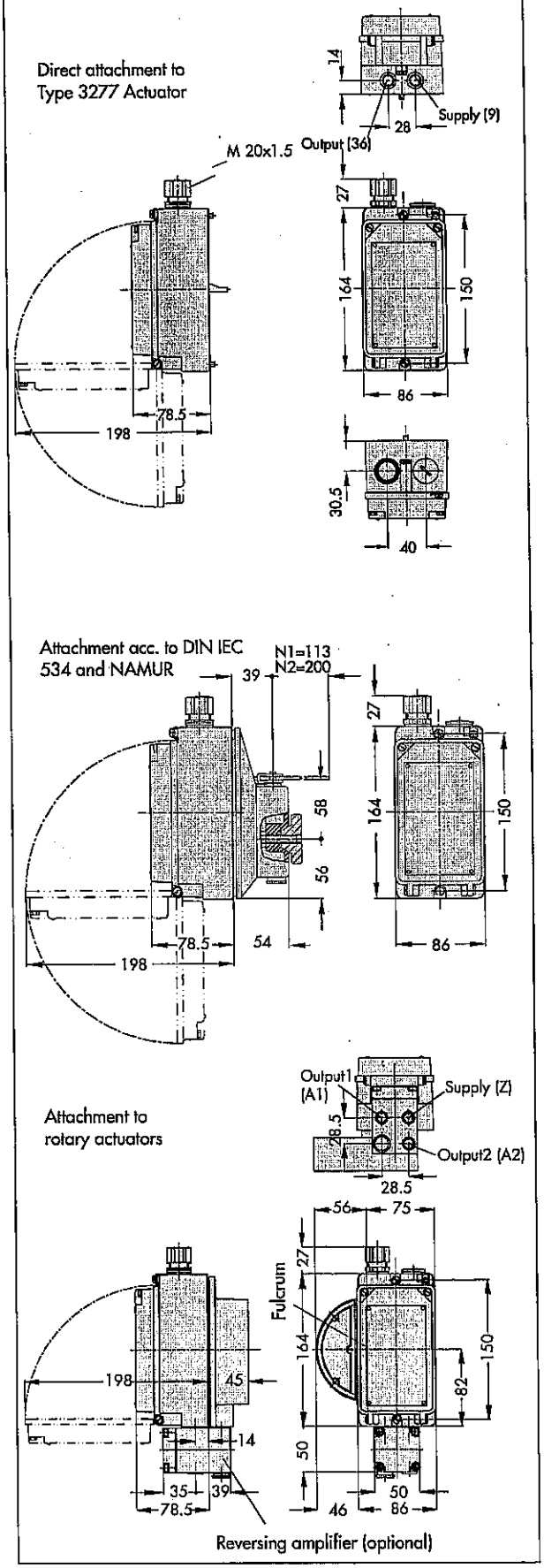


Fig. 10 · Type 3780 Ex d Positioner with Type 3770 Field Barrier

Dimensions in mm



Nomenclature for ordering

Type designation: Type 3780 -	□	□	□	□	□
Explosion protection					
Without	0				
⟨Ex⟩ II 2 G EEx ia IIC T6 acc. to ATEX	1				
⟨Ex⟩ II 3 G EEx nA II T6 acc. to ATEX	8				
Accessories					
Limit switches					
Without		0			
2 inductive		2			
2 software		3			
Forced fail-safe venting action					
Without (deactivated)			0		
With			1		
Position transmitter					
Without				0	
4 to 20 mA				1	
Pneumatic connections					
¼ - 18 NPT					1
ISO 228/1 - G¼					2

Accessories

M 20x1.5 to ½ NPT adapter

Ordering text

HART Positioner	Type 3780-... (see nomenclature)
Optional	IBIS program package
	FSK modem
	Isolating amplifier TET 128 or TET 128-Ex

Pressure gauge to display the signal pressure:
Without
With

For positioners with limit switches:

Tag outside active zone	Contact closed/
Tag inside active zone	Contact opened

Attachment to Type 3277 Actuator:
Actuator sizes 120/ 240/ 350/ 700 cm^2

Fail-safe action:
Actuator stem "Extends"/"retracts"

Attachment according to DIN IEC 534 (NAMUR):
Travel: ... mm
Stem diameter: ... mm (if applicable)
If applicable, control pressure throttling for actuators with small travel volume

Attachment to rotary actuators:
Type 3278, actuator sizes 160/ 320 cm^2

Attachment to single-acting or double-acting rotary actuators according to VDI/ VDE 3845:
If applicable, control pressure throttling for actuators with small travel volume

Specifications subject to change without notice.

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