Series 3730

Electropneumatic Positioner Type 3730-2 and Type 3730-3 with HART® communication

Application

Single-acting or double-acting positioner for attachment to pneumatic control valves. Self-calibrating, automatic adaptation to valve and actuator.

Reference variable	**4 to 20 mA**
Travels	**3.6 to 200 mm**
Opening angle	**24 to 100°**

The positioner ensures a predetermined assignment of the valve stem position (controlled variable x) to the electric input signal (reference variable w). It compares the control signal received from a controller to the travel or angle of rotation of the control valve and issues a corresponding output signal pressure (output variable y).

Special features

- Simple attachment to common linear and rotary actuators with SAMSON direct attachment interface (Fig. 1), over NAMUR rib (Fig. 2) or to control valves with rod-type yokes according to IEC 60534-6-1 or to rotary actuators according to VDI/VDE 3845 (Fig. 3)
- Any desired mounting position
- Simple one-knob, menu-driven operation
- LCD easy to read in any mounting position due to selectable reading direction
- Configurable with a PC over the SSP serial interface using the TROVIS-VIEW software
- Variable, automatic start-up with four different initialization modes
- Preset parameters - only values deviating from the standard need to be adjusted
- Calibrated travel sensor without gears susceptible to wear
- The "Sub" initialization mode (substitution) allows the positioner to be started up in case of emergency whilst the plant is running without the valve moving through the whole travel range
- Permanent storage of all parameters in non-volatile EEPROM (protection against power failure)
- Two-wire system with a small electrical load between 300 and 410 Ω depending on the version (see Table 1)
- Adjustable output pressure limitation
- Activatable tight-closing function
- Continuous monitoring of zero point
- Temperature sensor and operating hours counter integrated
- Two standard configurable position alarms
- Self diagnostics; alarms issued over fault alarm contact or optional analog position transmitter
- Integrated EXPERT diagnostics (see T 8388 EN)
- Certified according to IEC 61508/SIL

Fig. 1 · Type 3730, direct attachment to Type 3277 Pneumatic Actuator

Fig. 2 · Type 3730, attachment to NAMUR rib

Fig. 3 · Type 3730, attachment according to VDI/VDE 3845

Fig. 4 · Type 3730, external position sensor with Type 3510 Micro-flow Valve

Versions

Electropneumatic positioners with LCD, operable on site, local communication with SSP interface, EXPERT diagnostics

- **Type 3730-2 EXPERT** · Positioner with diagnostic functions
- **Type 3730-2 EXPERT+** · Positioner with extended diagnostic functions (see T 8388 EN)
- **Type 3730-3 EXPERT** · Positioner with communication with HART® protocol, diagnostic functions

Associated Information Sheet **T 8350 EN** **Edition April 2006**

Data Sheet **T 8384-2/3 EN**

– **Type 3730-3 EXPERT+** · Positioner with communication with HART® protocol, extended diagnostic functions (T 8388 EN)
– **Type 3730-3 ESD** · Positioner with partial stroke test function for early detection of any malfunctions of ESD valves in safety-related systems, communication with HART® protocol See Data Sheet T 8388-1 EN
– **Type 3731 Ex d Positioner** · Communication with HART® protocol · See Data Sheet T 8387-3 EN

Additional options

– Inductive limit switch with proximity switch
– Analog position transmitter with two-wire transmitter
– Forced venting function with solenoid valve
– External position sensor (Fig. 4)
– Extended EXPERT+ diagnostics (T 8388 EN)
– Stainless steel housing

Principle of operation

The electropneumatic positioner is attached to pneumatic control valves. It is used to assign the valve stem position (controlled variable x) to the input signal (reference variable w). The input signal received from a control system is compared to the travel or angle of rotation of the control valve and an output signal pressure (output variable y) is produced.

The positioner consists of an electric travel sensor system (2), an analog i/p converter with a downstream booster and the electronics unit with microcontroller (5).

When a deviation occurs, the actuator is pressurized or vented. If required, the changes in the signal pressure can be slowed down by a volume restriction. The signal pressure to the actuator can be limited by software to 1.4, 2.4 or 3.7 bar.

A constant air stream to the atmosphere is created by the flow regulator (9) with a fixed set point. The air stream is used to purge the inside of the case as well as to optimize the air capacity booster. The i/p module (6) is supplied with a constant upstream pressure by the pressure regulator (8) to make it independent of the supply air pressure.

Operation

The positioner is operated with a user-friendly rotary pushbutton. The parameters are selected by turning the knob, pushing it activates the required setting. In the menu, all parameters are listed in one level, meaning there is no need to search in submenus. All parameters can be checked and changed on site.

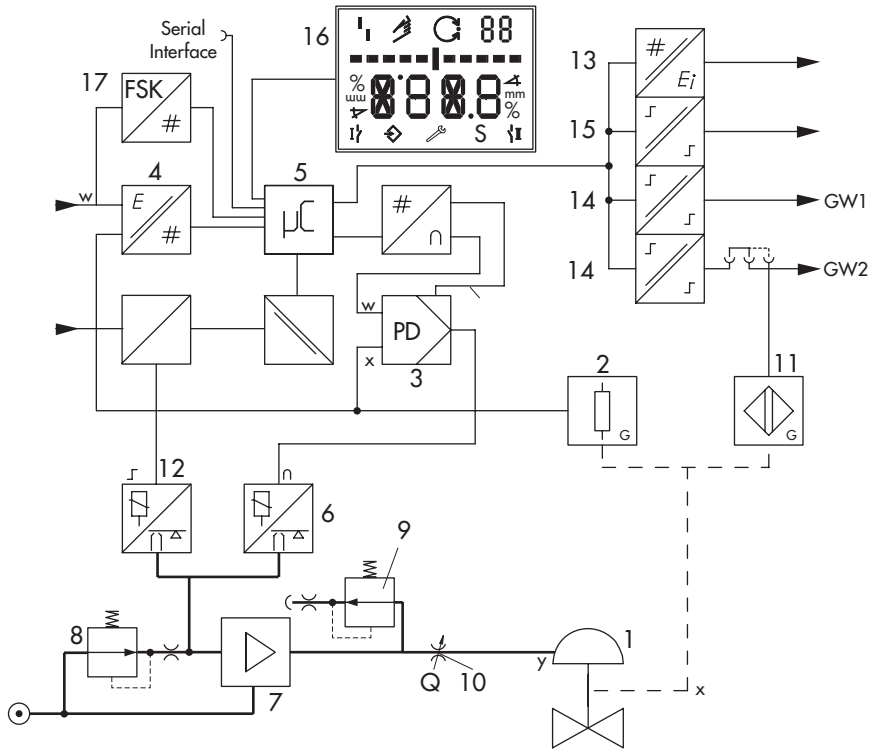
All values are displayed on the LCD. The reading direction of the LCD can be rotated by 180° at the push of a button.

The closing direction of the control valve is indicated to the positioner by the DIP switch "Air to open/Air to close". It assigns the CLOSED position of the control valve to the 0 % reading.

The INIT key activates initialization which is started according to the (pre)set parameters (autotune). After initialization is completed, the positioner immediately starts control operation.

The SAMSON configuration software, TROVIS-VIEW, can be used to configure the positioner. For this purpose, the positioner is equipped with an additional digital interface to be connected to the RS-232 interface of a PC.

The Type 3730-3 Positioner additionally allows access to all parameters over HART communication.



Legend

1	Control valve
2	Travel sensor
3	Controller
4	A/D converter
5	Microcontroller
6	i/p module
7	Pneumatic booster
8	Pressure regulator
9	Flow regulator
10	Volume restriction
11	Inductive limit switch (optional)
12	Solenoid valve (optional)
13	Position transmitter (optional)
14	Software limit switches
15	Fault alarm output
16	LCD
17	HART connection (Type 3730-3 only)

Fig. 5 · Functional diagram of Type 3730-2/-3 Positioner

Table 1 · Technical data for Type 3730 Positioner

Common data for Type 3730-... Positioner			
Travel, adjustable		Direct attachment to Type 3277 Actuator: 3.6 to 30 mm Attachment acc. to IEC 60 534-6-1: 3.6 to 200 mm Attachment to rotary actuators: 24° to 100° opening angle	
Travel range	adjustable	Within the initialized travel/angle of rotation; restricted to 1/5 at the maximum	
Reference variable w	Signal range	4 to 20 mA · Two-wire device with reverse polarity protection · Minimum span 4 mA	
	Static destruction limit	100 mA	
Minmum current		3.6 mA for display · 3.8 mA for operation	
Supply air	Supply pressure	1.4 to 6 bar (20 to 90 psi)	
	Air quality acc. to ISO 8573-1 (2001)	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	
Signal pressure (output)		0 bar up to the capacity of the supply pressure · Limitable to 1.4 bar/2.4 bar/3.7 bar ± 0.2 bar over software	
Characteristics	adjustable	Linear/equal percentage/reverse equal percentage User-defined (over operating software and communication) Butterfly valve, rotary plug valve and segmented ball valve: Linear/equal percentage	
	Deviation	≤ 1 %	
Hysteresis		≤ 0.3 %	
Sensitivity		≤ 0.1 %	
Transit time		Up to 240 s separately adjustable for exhaust and supply air via software	
Direction of action		Reversible	
Air consumption, steady-state		Independent of supply air approx. 110 l_n/h	
Air output capacity	Actuator pressurized	At Δp = 6 bar: ≥ 8.5 m_n^3/h · At Δp = 1.4 bar: ≥ 3.0 m_n^3/h · $K_{Vmax\ (20\ °C)}$ = 0.09	
	Actuator vented	At Δp = 6 bar: ≥ 14.0 m_n^3/h · At Δp = 1.4 bar: ≥ 4.5 m_n^3/h · $K_{Vmax\ (20\ °C)}$ = 0.15	
Permissible ambient temperature		–20 to +80 °C · –40 to +80 °C with metal cable gland The limits in the EC Type Examination Certificate additionally apply for explosion-protected devices.	
Influences	Temperature	≤ 0.15 %	
	Supply air	None	
	Vibrations	≤ 0.25 % up to 2000 Hz and 4 g acc. to IEC 770	
Electromagnetic compatability		Complies with EN 61000-6-2, EN 61000-6-3 and NAMUR Recommendation NE 21 requirements	
Electrical connections		One M20x1.5 cable gland for 6 to 12 mm clamping range · Second M20x1.5 threaded connection additionally exists · Screw terminals for 0.2 to 2.5 mm² wire cross-sections	
Degree of protection		IP 66 / NEMA 4X	
Implementation in safety-related systems in compliance with IEC 61508/SIL		Probability of failure on demand of safety functions PFD < 2.8 x 10^{-7} for a confidence level of 95 %. The safe failure fraction (SFF) according to Table A1 in IEC 61508-2 is greater or equal to 0.99. Suitable for implementation in safety-related systems with a hardware fault tolerance of 1 or 2 up to and including SIL 4.	
Explosion protection			
ATEX, IECEx, FM/CSA, etc.		See summary of explosion protection certificates	
Binary contacts		1 fault alarm contact 2 software limit switches with configurable limit values, with reverse polarity protection	
Signal status	Version	Without explosion protection	Explosion-protected
	No response	Conductive (R = 348 Ω)	≥ 2.1 mA
	Response	Non-conducting	≤ 1.2 mA
Operating voltage		For connection to binary input of the PLC acc. to EN 61131, P_{max} = 400 mW or for connection to NAMUR switching amplifier acc. to EN 60947-5-6	Only for connection to NAMUR switching amplifier acc. to EN 60957-5-6
Materials			
Housing		Die-cast aluminum EN AC-43400 / DIN EN 1706 · Chromated and powder paint coated Special version in stainless steel 1.4581	
External parts		Stainless steel 1.4571 and 1.4301	
Cable gland		Nickel-plated brass, M20 x 1.5	
Weight		Approx. 1.0 kg	

Additional data for Type 3730-2			
Load impedance		Without explosion protection: ≤ 6 V (corresponding to 300 Ω at 20 mA)	Explosion-protected version: ≤ 7 V (corresponding to 350 Ω at 20 mA)
Communication (local)		SAMSON SSP interface and serial interface adapter	
Software requirements (SSP)		TROVIS-VIEW with database module 3730-2	
Additional data for Type 3730-3			
Load impedance		≤ 8.2 V (corresponding to 410 Ω at 20 mA)	
Communication (local)		SAMSON SSP interface and serial interface adapter	
Software requirements (SSP)		TROVIS-VIEW with database module 3730-3	
Communication (HART)		HART® field communication protocol Impedance in HART frequency range: Receiving 350 to 450 Ω · Sending approx. 115 Ω	
Software requirements (HART)	For handheld communicator	Device description for Type 3730-3	
	For PC	DTM file acc. to Specification 1.2, suitable for integrating the positioner in frame applications that supports the FDT/DTM concept (e.g. PACTware); other integration options (e.g. AMS, PDM) available.	

Table 1a · Options for Type 3730-2 and Type 3730-3 Positioners

Solenoid valve · SIL 4 approval acc. to IEC 61508	
Input	24 V DC · Reverse polarity protection · Static destruction limit 40 V Current consumption $I = \frac{U - 5.6\ V}{4020\ \Omega}$ (corresponding to 4.5 mA at 24 V)
Signal "0" no pick-up	≤ 15 V
Signal "1" safe pick-up	> 19 V
Service life	> 5 x 10^6 switching cycles
Implementation in safety-related systems in compliance with IEC 61508/SIL	Same as positioner pneumatics
Analog position transmitter	Two-wire transmitter
Auxiliary power	12 to 30 V DC · Reverse polarity protection · Static destruction limit 40 V
Output signal	4 to 20 mA
Direction of action	Reversible
Operating range	–10 to +114 %
Characteristic	Linear
Hysteresis	Same as positioner
High-frequency influence	Same as positioner
Other influences	Same as positioner
Fault alarm	Issued by means of a status current < 3.8 mA or > 20.5 mA
Inductive limit switch	
SJ-2SN proximity switch	For connection to switching amplifier acc. to EN 60947-5-6. Can be used in combination with a software limit switch.
External position sensor	
Travel	Same as Type 3730 Positioner
Cable	Max. 10 m · Flexible and durable · With M12x1 connector · Flame-retardant acc. VDE 0472 · Resistant to oils, lubricants, and coolants as well as other aggressive media
Permissible ambient temperature	–40 to +105 °C
Immunity to vibration	Up to 10 g in the range of 5 to 2000 Hz
Degree of protection	IP 67

Summary of explosion protection certificates

Type of approval	Certificate number	Date	Type of protection/Comments
Type 3730-2 Positioner			
EC Type Examination Certificate	PTB 00 ATEX 2158	2001-03-01	⟨Ex⟩ II 2 G EEx ia IIC T6
First Addendum		2002-03-01	Position transmitter
Second Addendum		2004-02-16	⟨Ex⟩ II 2 D IP 65 T 80 °C, Zone 21 dust, device index .01
Statement of Conformity	PTB 03 ATEX 2016 X	2003-03-07	⟨Ex⟩ II 3 G EEx nA II T6; Zone 2; Type 3730-28
First Addendum		2005-05-03	II 3 G EEx nL IIC T6; II 3 D IP 54/IP 65 T 80 °C
IECEx	IECEx PTB 05.0007	2005-02-21	Ex ia IIC T6/T5/T4; IP 54 and IP 65 T 80 °C; Type 3730-21.9...
GOST approval	2002.C299	2002-12-26	1 Ex ia IIC T6 X, valid until 2008-01-01
FM approval	ID 3012394	2002-10-30	Instrinsically safe, Class I, II, III; Div. 1, Group A, B, C, D, E, F, G; Class I, Zone 0, AEx ia IIC T6; Non incendive, Class I, Div. 2, Group A, B, C, D; NEMA Type 4; Type 3730-23
Revision		2004-02-04	Div. 2 Gr. F and G
CSA approval	1330129	2003-03-17	Ex ia IIC T6, Cl. I, Zone 0; Instrinsically safe, Class I, Group A, B, C, D; Class II, Group E, F, G; Non incendive, Class I, Div. 2, Group A, B, C, D; Type 4 Enclosure; Type 3730-23
Revision to 1330129	1500997	2004-03-05	Class II, Div. 2, Group E, F, G
JIS approval	C16679		Ex ia IIC T6; Type 3730-27
SIL 4 acc. to IEC 61508	V 60 2004 T1	2004-07-05	Test report by TÜV Rheinland, valid until July 2009
Type 3730-3 Positioner			
EC Type Examination Certificate	PTB 00 ATEX 2174	2002-11-15	⟨Ex⟩ II 2 G EEx ia IIC T6; without position transmitter
First Addendum		2003-06-18	Forced fail-safe venting function
Second Addendum		2004-02-16	⟨Ex⟩ II 2 D IP 65 T 80 °C, Zone 21 dust, model index .01
IECEx	IECEx PTB 05.0008	2005-02-21	Ex ia IIC T6/T5/T4; IP 54 and IP 65 T 80 °C; Type 3730-31.9...
GOST approval	POCC DE. 04.B00267 C3-409/05	2005-01-24	0 Ex ia IIC T6 X; 2 Ex nA II T6 X; DIP A21 Ta 80 °C; IP 65; valid until 2008-01-24; Type 3730-31
NEPSI approval	GYJ04133	2004-02-27	Ex ia IIC T4...T6; valid until 2007-02-27; Type 3730-31
	GYJ04134 and GYJ04135		Ex nA II T4...T6; Ex nL IIC T4...T6 Valid until 2007-02-27; Type 3730-38
Statement of Conformity	PTB 03 ATEX 2180 X	2003-09-30	⟨Ex⟩ II 3 G EEx nA II T6; Zone 2; Type 3730-38
First Addendum		2005-04-26	II 3 G EEx nL IIC T6; II 3 D IP 65 T 80 °C; Zone 22
EC Type Examination Certificate	PTB 03 ATEX 2211 X	2003-10-22	⟨Ex⟩ II 2 G EEx d ia IIC T6; Type 3730-39 with Type 3770-1 Field Barrier
FM approval Model index 01 and higher	3018702	2004-02-02	Intrinsically safe; Class I, II, III; Div. 1, Group A, B, C, D, E, F, G; Class I, Zone 0, AEx ia IIC T6; NEMA Type 4 Non incendive, Class I; Div. 2, Group A, B, C, D; Class II, Div. 2, Group F, G; Type 3730-33
CSA approval Model index 01 and higher	1508990	2004-03-05	Ex ia IIC T6; Cl. I, Zone 0 Intrinsically safe, Class I, Group A, B, C, D; Type 4 Enclosure Class II, Gr. E, F, G; Non incendive, Class I, Div. 2, Group A, B, C, D Class II, Div. 2, Gr. E, F, G; Type 3730-33
SIL 4 acc. to IEC 61508	V 60 2004 T1	2004-07-05	Test report by TÜV Rheinland, valid until July 2009

The test certificates are included in the mounting and operating instructions or are available on request.
Refer to Data Sheet T 8379 EN for EEx d certificates for the Type 3770 Field Barrier.

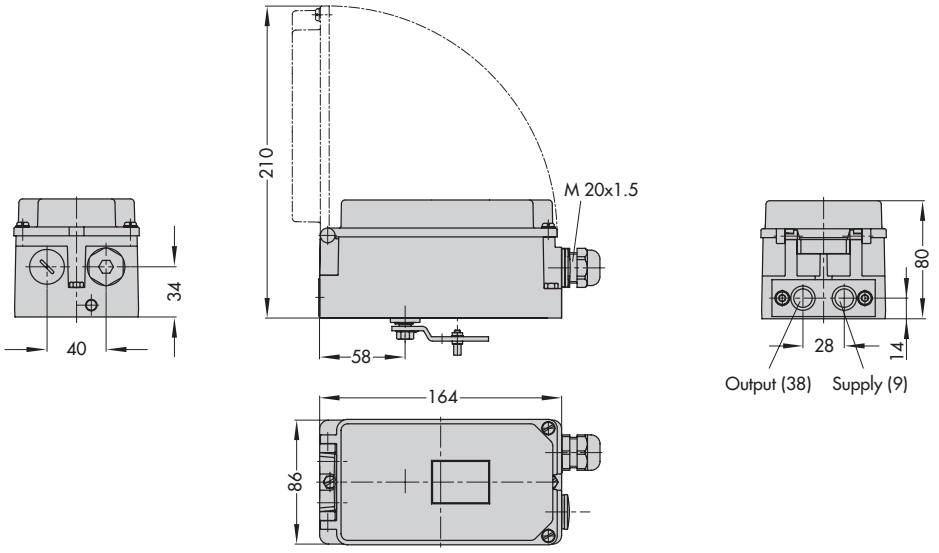
Positioner attachment

The Type 3730 Electropneumatic Positioner can be attached directly to the Type 3277 Actuator over a connection block. In actuators with fail-safe action "Actuator stem extends" and Type 3277-5 Actuator (120 cm²), the signal pressure is routed over an internal bore in the actuator yoke to the actuator. In actuators with fail-safe action "Actuator stem retracts" and in actuators with effective diaphragm areas of 240 cm² or larger, the signal pressure is routed to the actuator over a ready-made external piping. Using the appropriate bracket, the positioner can also be attached according to IEC 60534-6-1 (NAMUR recommendation). The positioner can be mounted on any side of the control valve.

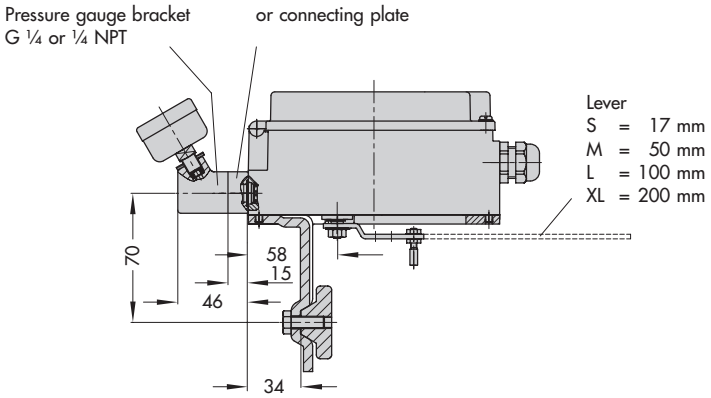
A pair of universal brackets is used for the attachment to Type 3278 Rotary Actuators or other rotary actuators according to VDI/VDE 3845. The rotary motion of the actuator is transferred over a coupling wheel to the positioner.

Dimensions in mm

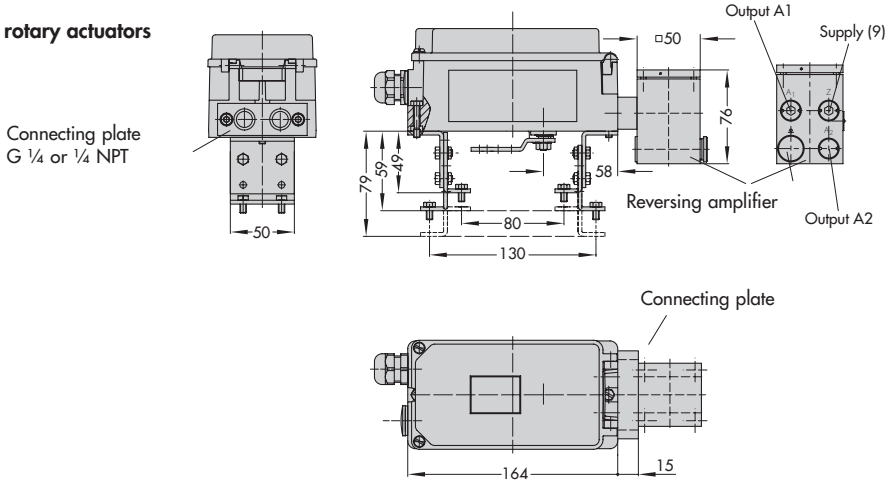
Direct attachment



Attachment acc. to IEC 60534 and NAMUR

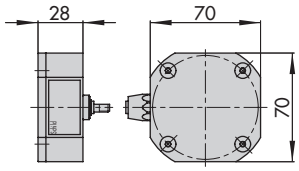


Attachment to rotary actuators



Dimensions in mm

External position sensor



Article code

Positioner **Type 3730-**	x	x	x	x	x	x	0	0	x	0	x	0	0	x	x	x	x
Version with LCD and autotune, 4 … 20 mA reference variable, two software limit switches, 1 fault alarm contact	2																
Version with LCD and autotune, HART® communication, 4 … 20 mA, two software limit switches, 1 fault alarm contact	3																
Explosion protection																	
Without	0																
⟨Ex⟩ II 2 G EEx ia IIC T6 and																	
⟨Ex⟩ II 2 D IP 65 T 80 °C acc. to ATEX	1																
CSA/FM intrinsically safe/non incendive	3																
⟨Ex⟩ II 3 G EEx nA/nL II T6 and ⟨Ex⟩ II 3 D IP 65 T 80 °C	8																
Additional equipment																	
Inductive limit switch																	
Without		0															
Type SJ2-SN		1															
Solenoid valve																	
Without			0														
With, 24 V DC			4														
Position transmitter																	
Without				0													
With				1													
External position sensor																	
Without					0												
With		0			1						0						
Diagnostics																	
EXPERT (standard)									1								
EXPERT+ (extended)									2								
ESD									3								
Housing material																	
Aluminum (standard)											0						
Stainless steel 1.4581					0						1						
Special application																	
Without														0			
Device free of any substances that might impair paint adhesion														1			
Exhaust air connection with ¼-18 NPT thread														2			
Special version																	
None															0	0	0

Ordering text

Type 3730-x... Positioner

- Without pneumatic connecting rail (only for direct attachment to Type 3277 Actuator)
- With pneumatic connecting rail ISO 228/1-G ¼
- With pneumatic connecting rail ¼-18 NPT
- Without/with pressure gauge for signal pressure indication
- Additional cover plate with list of parameters and operating instructions in English/Spanish or English/French (standard version in German/English)
- Attachment to Type 3277 Actuator (120 to 700 cm²)
- Attachment according to IEC 60534-6-1 (NAMUR)
  Travel: ... mm, if applicable, stem diameter: ... mm
- Attachment to Type 3278 Rotary Actuator (160/320 cm²)
- Attachment to rotary actuators acc. to VDI/VDE 3845
- Pneumatic reversing amplifier for double-acting actuators with connection acc. to ISO 228/1 - G ¼ or ¼-18 NPT
- Adapter M20 x 1.5 to ½ NPT
- Metal cable gland
- Special version with CrNiMo steel housing

Specifications subject to change without notice.

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