

T 8387-5 EN

Type 3731-5 Electropneumatic Ex d Positioner With FOUNDATION™ fieldbus communication



Application

Positioners for attachment to pneumatic control valves

Rated travels from 3.6 to 200 mm · Opening angle 24 to 100°

Smart, bus-powered field device complying with FOUNDATION™ fieldbus specifications based on IEC 61158-2 transmission technology. Integrated function blocks: PID process controller, analog output (AO), one binary input for DC voltage signals (DI1) or for connection of one floating contact (DI2).

The positioner ensures a predetermined assignment of the valve position (controlled variable x) to the input signal (reference variable w). It compares the reference variable cyclically transmitted over the FOUNDATION™ fieldbus network to the travel or opening angle of the control valve and produces the corresponding signal pressure output (output variable y).

The Type 3731-5 Positioner communicates according to FOUNDATION™ fieldbus specification with field devices, programmable logic controllers and process control systems. An integrated PID function block allows the control of process variables required directly in the field. The shift to distributed control reduces the number of control tasks to be performed by the higher-level automation system.

Other benefits provided by the smart positioner:

- Simple attachment to all common linear actuators with interface for SAMSON direct attachment, NAMUR rib or valves with rod-type yokes according to IEC 60534-6-1 or to rotary actuators according to VDI/VDE 3845
- Any desired mounting position of the positioner
- One-knob, menu-driven operation also in hazardous areas
- Variable, automatic start-up with four different initialization modes
- LCD easy to read in any mounting position thanks to selectable reading direction
- Monitoring and diagnostic functions
- Extended diagnostics in EXPERTplus version. Refer to Data Sheet ▶ T 8389 for more details.
- Online changing of control parameters
- Automatic zero monitoring
- Two DI function blocks to analyze binary input signals
- Calibrated travel sensor without gears susceptible to wear
- All parameters saved in non-volatile memory
- Adjustable output pressure limitation
- Adjustable tight-closing function
- Configurable with a computer over the SSP interface using the TROVIS-VIEW software



Fig. 1: Type 3731-5 Positioner with FOUNDATION™ fieldbus communication

Additional options

The digital positioner functions can be optionally extended:

- Binary input
- Forced venting

Principle of operation

The positioner is mounted on pneumatic control valves and used to assign the valve position (controlled variable x) to the control signal (reference variable w). The positioner compares the electric control signal of a control system to the travel or rotational angle of the control valve and issues a signal pressure (output variable y) for the pneumatic actuator.

The positioner mainly consists of an electric travel sensor system, an analog i/p module with a downstream air booster and the electronics with the microcontroller.

When a set point deviation occurs, the actuator is either vented or filled with air. The signal pressure supplied to the actuator can be limited by software or on site to 1.4, 2.4 or 3.7 bar.

The fixed flow regulator ensures a constant air flow to the atmosphere, which is used to flush the inside of the positioner enclosure and to optimize the air booster. The i/p module is supplied with a constant upstream pressure by the pressure regulator to compensate for any fluctuations in the supply pressure.

The positioner communicates and is powered using IEC 61158-2 transmission technology conforming to FOUNDATION™ fieldbus specification.

Operation

A single rotary pushbutton facilitates operation. The parameters are selected by turning the rotary pushbutton, pushing it activates the required setting. 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°.

The closing direction of the control valve is indicated to the positioner. It assigns the CLOSED position of the control valve to the 0 % reading.

The initialization is started according to the (pre)set parameters. After initialization is completed, the positioner immediately starts closed-loop operation.

Configuration using the TROVIS-VIEW software

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 computer. TROVIS-VIEW adapts the positioner to any process requirements and allows the process to be checked while the process is running. The control valve is linked to the process over the FOUNDATION™ fieldbus network.

The PID function block integrated in the positioner can also be configured using TROVIS-VIEW. The configuration of the network connections for the PID function block is made by the NI-FBUS configurator or a corresponding digital process control system.

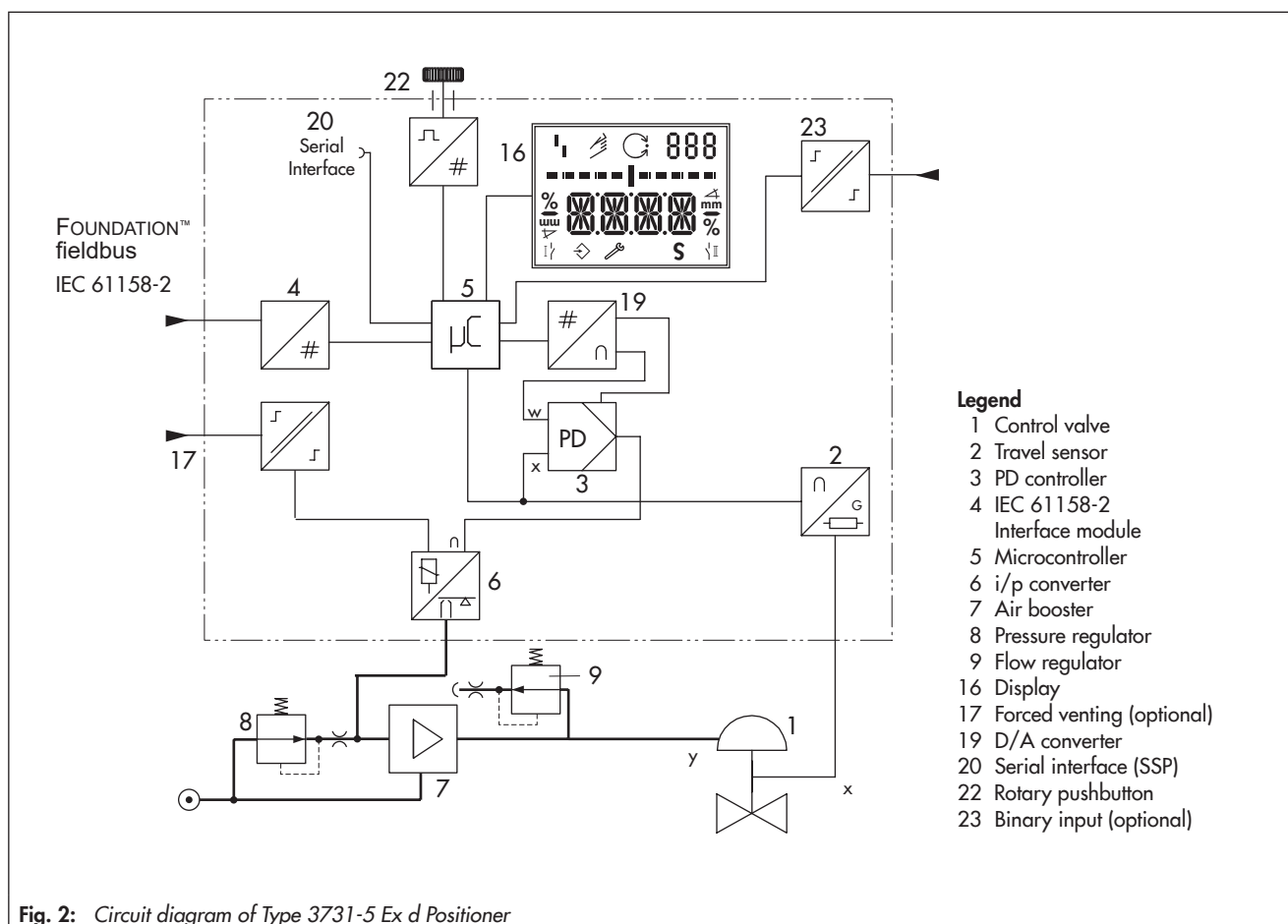




Fig. 2: Circuit diagram of Type 3731-5 Ex d Positioner

Table 1: Technical data

Type 3731-5 Positioner with FOUNDATION™ fieldbus communication (technical data in test certificates additionally apply to explosion-protected devices)		
Rated travel	Adjustable	Direct attachment to Type 3277 Actuator: 3.6 to 30 mm Attachment according to IEC 60534-6 (NAMUR): 3.6 to 200 mm Rotary actuators (VDI/VDE 3845): 24 to 100° opening angle
Travel range	Adjustable	Adjustable within the initialized travel/angle of rotation; travel can be restricted to 1/5 at the maximum
Bus connection		Fieldbus interface according to IEC 61158-2, bus-powered Physical Layer Class 113 (without explosion protection) 111 (explosion-protected version) Field device according to FM 3610 entity and FISCO
Communication		
Fieldbus		Data transmission conforming to FOUNDATION™ fieldbus specification Communication Profile Class: 31 PS, 32 L Firmware version 1.4x (FF Device Rev 1): Interoperability tested according to ITK 4.6 Firmware version 1.6x (FF Device Rev 3): Interoperability tested according to ITK 6.2.0
Execution times		Firmware version 1.4x (FF Device Rev 1): AO FB: 20 ms DI FB: 40 ms PID: 60 ms Firmware version 1.6x (FF Device Rev 3): AO FB: 30 ms DI FB: 20 ms PID: 40 ms
Local communication		SAMSON SSP interface and serial interface adapter Software requirements (SSP): TROVIS-VIEW with database module 3731-5
Permissible operating voltage		9 to 32 V DC · Powered by bus line The limits specified in the examination certificate additionally apply.
Maximum operating current		15 mA
Additional current in case of error		0 mA
Supply air	Supply air	Type 3731-521, Type 3731-527: 1.4 to 7 bar (20 to 105 psi) Type 3731-523: 1.4 to 6 bar (20 to 90 psi)
	Air quality acc. to ISO 8573-1 (2004 edition)	Max. particle size and density: Class 4 · Oil content: Class 3 Moisture and water: Class 3 Pressure dew point: at least 10 K below the lowest ambient temperature to be expected
Signal pressure (output)		0 bar up to supply pressure
Characteristic		Linear/Equal percentage/Reverse equal percentage Butterfly valve, rotary plug valve or segmented ball valve: Linear/equal percentage User-defined: adjustable over operating software
	Deviation	≤1 %
Hysteresis		≤0.3 %
Sensitivity		≤0.1 %
Transit time		Up to 240 s separately adjustable for exhaust and supply by software
Direction of action		Reversible
Air consumption		Independent of supply air, approx. < 110 l _n /h
Air output capacity	Actuator (supply)	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 (exhaust)	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		-40 to +80 °C The limits in the test certificate additionally apply.
Permissible storage temperature		-60 to 80 °C
Influences	Temperature	≤0.15 %/10 K
	Supply air	None
	Effect of vibration	≤0.25 % up to 2000 Hz and 4 g according to IEC 770
Electromagnetic compatibility		Complying with EN 61000-6-2, EN 61000-6-3, EN 61326-1 and NAMUR Recommendation NE 21
Electrical connections		Two tapped holes ½ NPT or optionally M20x1.5 · Screw terminals for 2.5 mm ² wire cross-section
Degree of protection		IP 66/NEMA 4X
Conformity		
Materials		
Enclosure		Die-cast aluminum EN AC-ALSi10Mg (Fe) (EN AC-43400) acc. to DIN 1706 · Chromate and powder coating
External metal parts		Stainless steel 1.4404/316L
Weight		Approx. 2.5 kg

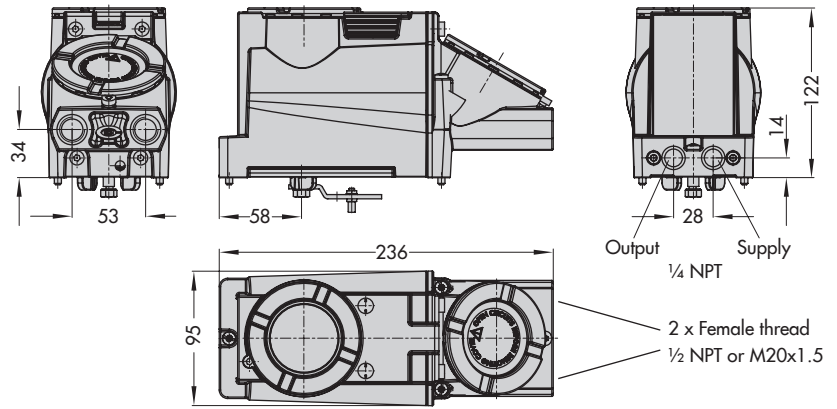
Options for Type 3731-5		
Binary input, galvanically isolated		
Connection	Terminals A-B Voltage input 0 to 30 V DC, reverse polarity protection	Terminals B-C for external floating contact
	Current consumption: 3.5 mA at 24 V	R < 100 Ω; contact load: 100 mA
	Static destruction limit: 40 V	Static destruction limit 20 V/5.8 mA
	Signal "1" when U _e >5 V Signal "0" when U _e <3 V	
Forced venting, galvanically isolated		
Input	0 to 40 V DC/0 to 28 V AC, static destruction limit 45 V DC/32 V AC, input resistance ≥7 kΩ	
Signal	Fail-safe position with input voltage ≤3 V · Normal operation with input voltage >5.5 V	

Table 2: Explosion protection certificates

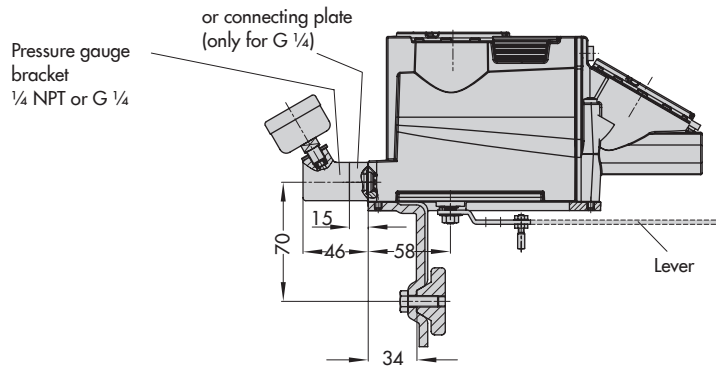
		Certification		Type of protection/comments
Type 3731	-521	 EU type examination certificate	Number PTB 11 ATEX 1014 X Date 2019-04-08	II 2G Ex db IIC T6 Gb II 2G Ex db eb IIC T6 Gb II 2G Ex db [ia Ga] IIC T6 Gb II 2G Ex ia IIC T6 Ga II 2D Ex tb IIIC T80 °C Db
	-521	IECEX	Number IECEx PTB 11.0084X Date 2011-09-14	Ex d IIC T6, T5, T4 Gb Ex d e IIC T6, T5, T4 Gb Ex tb IIIC T80 °C Db IP66
	-521	CCC Ex	Number 2020322307002428 Date 2020-02-10 Valid until 2025-09-27	Ex d IIC T4 ~ T6 Gb Ex de IIC T4 ~ T6 Gb Ex tD A21 IP66 T80 °C
	-521	CCoE	Number A P HQ MH 104 6238 Date 2018-07-01 Valid until 2023-12-31	Ex d IIC T6
	-523	CSA	Number 1709815 Date 2005-10-04	Class I, Zone 1, Group IIB+H2 T4...T6 Class I, Div. 1+2, Groups B, C, D T4...T6 Class II, Div. 1, Groups E, F, G
	-521	EAC	Number RU C-DE.HA65.B.00510/20 Date 2020-03-18 Valid until 2025-03-18	1Ex d IIC T6/T5/T4 Gb X 1Ex d e IIC T6/T5/T4 Gb X 1Ex d [ia Ga] IIC T6/T5/T4 Gb X 1Ex ia IIC T6/T5/T4 Gb X Ex tb IIIC T 80 °C Db X
	-524	EAC	Number RU C-DE.HA65.B.00510/20 Date 2020-03-18 Valid until 2025-03-18	1Ex d IIC T6/T5/T4 Gb X Ex tb IIIC T 80 °C Db X
	-523	FM	Number 3024956 Date 2006-01-30	Class I, Div. 1+2, Groups B, C, D Class I, Zone 1, Groups IIB+H2 Class I, Div. 1+2 Groups E, F, G; Class III
	-527	JIS	Number TC17747 Date 2021-09-12 Valid until 2024-09-11	Ex d IIC T6
	-521	KCS Korea	Number 13-KB4BO-0036 Date 2013-01-31 Valid until 2023-01-31	Ex d IIC T6/T5/T4
	-521	TR CMU 1055	Number ZETC/111/2021 Date 2021-08-25 Valid until 2024-08-24	II 2G Ex db IIC T6 Gb II 2G Ex db eb IIC T6 Gb II 2G Ex db [ia Ga] IIC T6 Gb II 2G Ex ia IIC T6 Ga II 2D Ex tb IIIC T80 °C Db IP66

Dimensions in mm

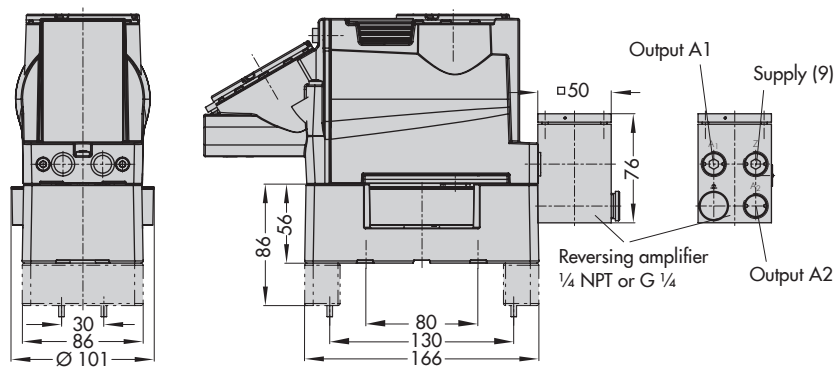
Direct attachment



Attachment according to IEC 60534-6 and NAMUR

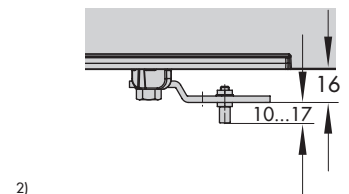
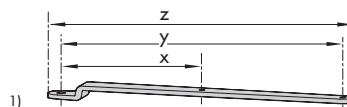


Attachment to rotary actuators



Lever

Lever	x	y	z
S	17 mm	25 mm	33 mm
M	25 mm	50 mm	66 mm
L	70 mm	100 mm	116 mm
XL	100 mm	200 mm	216 mm



Article code

Positioner	Type 3731-5 x x x x x x 0 0 0 x 1 x 0 0 0													
With LCD and autotune, FOUNDATION™ fieldbus														
Explosion protection														
ATEX	II 2G Ex db IIC T6 Gb													
	II 2G Ex db eb IIC T6 Gb													
	II 2G Ex db [ia Ga] IIC T6 Gb	2	1								0			
	II 2G Ex ia IIC T6 Ga													
	II 2D Ex tb IIIC T80°C DB IP66													
CSA	Class I, Zone 1, Group IIB+H2 T4...T6													
	Class I, Div. 1+2, Groups B, C, D T4...T6	2	3								0			
	Class II, Div. 1, Groups E, F, G													
FM	Class I, Div. 1+2, Groups B, C, D													
	Class I, Zone 1, Groups IIB+H2	2	3								0			
	Class I, Div. 1+2 Groups E, F, G; Class II													
JIS	Ex d IIC T6	2	7								0			
Option (additional equipment)														
Without														
				0	0									
	Binary input			0	3									
	Forced venting			0	5									
Diagnostics														
EXPERTplus for control valves														
						4								
Electrical threaded connections														
	2x M20x1.5							1						
	2x ½ NPT							2						
Explosion protection certificate														
CCC Ex	Ex d IIC T4 ~ T6 Gb													
	Ex de IIC T4 ~ T6 Gb	2	1								1			
	Ex tD A21 IP66 T80°C													
IECEX	Ex d IIC T6, T5, T4 Gb													
	Ex d e IIC T6, T5, T4 Gb	2	1								2			
	Ex tb IIIC T80°C Db IP66													
EAC	1Ex d IIC T6/T5/T4 Gb X													
	1Ex d e IIC T6/T5/T4 Gb X													
	1Ex d [ia Ga] IIC T6/T5/T4 Gb X	2	1								3			
	1Ex ia IIC T6/T5/T4 Gb X													
	Ex tb IIIC T 80 °C Db X													
KCS	Ex d IIC T6/T5/T4	2	1								5			
CCoE	Ex d IIC T6	2	1											
TR CMU 1055	II 2G Ex db IIC T6 Gb													
	II 2G Ex db eb IIC T6 Gb													
	II 2G Ex db [ia Ga] IIC T6 Gb	2	1								5			
	II 2G Ex ia IIC T6 Ga													
	II 2D Ex tb IIIC T80 °C Db IP66													
EAC	1Ex d IIC T6/T5/T4 Gb X	2	4											
	Ex tb IIIC T 80 °C Db X													
Special applications														
Without														
											0			
Version compatible with paint (IP 41/NEMA 1)														
											1			
Special version														
Without														
												0	0	0

Network and positioner configuration with NI-FBUS™ configurator

The positioner can also be configured over the NI-FBUS™ configurator from National Instruments.

The NI-FBUS™ configurator can be used to perform the planning of the entire FOUNDATION™ fieldbus network. It also allows the use of PID Controller in the positioner to implement autonomous control in the field.

Electrical and bus connection

The Type 3731-5 Positioner with FOUNDATION™ fieldbus communication must be connected to bus segments conforming to IEC 61158-2. A shielded two-wire line is used for both supply power and data communication.

Mounting the positioner

The Type 3731-5 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 hole 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 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 either 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 to the positioner over a coupling wheel.

The characteristic is set over the software.

Ordering text

- Type 3731-5... Positioner
- With pneumatic connecting rail ISO 228/1-G ¼
- Without/with pressure gauge for signal pressure indication
- Attachment to Type 3277 Actuator (175 to 700 cm²)
- Attachment according to IEC 60534-6-1 (NAMUR)
- Travel: ... mm, if applicable, rod diameter: ... mm
- Attachment to Type 3278 Rotary Actuator (160 cm²)
- Attachment to rotary actuators according to VDI/VDE 3845
- Pneumatic reversing amplifier for double-acting actuators with connection acc. to ISO 228/1-G ¼ or ¼-18 NPT

Associated Information Sheet

▶ T 8350