FOUNDATION™ FIELDBUS Positioner
Type 3730-5

Fig. 1 · Type 3730-5

FOUNDATION™

Mounting and Operating Instructions

EB 8384-5 EN

Firmware version K 1.1x/ R 1.4x

Edition August 2005

Contents

General safety instructions

- *The positioner may only be assembled, started up or operated by trained and experienced personnel familiar with the product.*
  According to these mounting and operating instructions, trained personnel is referred to as individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the relevant standards.
- *Explosion-protected versions of this positioner may only be operated by personnel who have undergone special training or instructions or who are authorized to work on explosion-protected devices in hazardous areas.*
  Refer to section 11 on Servicing explosion-protected versions.
- *Any hazards that could be caused by the process medium, the operating pressure, the signal pressure or by moving parts of the control valve are to be prevented by means of the appropriate measures.*
- *If inadmissible motions or forces are produced in the actuator as a result of the supply pressure level, it must be restricted by means of a suitable supply pressure reducing station.*
  Do not operate the positioner with the back of it/exhaust air opening facing upwards. Never seal the exhaust air opening when the positioner is mounted on site.
- *Proper shipping and appropriate storage are assumed.*

Note! *The device with a CE marking fulfils the requirements of the Directives 94/9/EC (ATEX) and 89/336/EEC (EMC).*
The declaration of conformity is available on request.

Article code	Type 3730-5	X	X	X	0	0	0	X	X	0	X	0	0	X	0	X	X
Explosion protection																	
Without		0															
⟨Ex⟩ II 2 G EEx ia IIC T6/II 2 D IP 65 T 80 °C acc. to ATEX		1															
CSA/FM applied for		3															
⟨Ex⟩ II 3 G EEx nA/nL II T6/II 3 D IP 65 T 80°C acc. to ATEX		8															
Additional equipment																	
Inductive limit switch	Without		0														
	With Type SJ 2-SN		1														
Solenoid valve SIL 4	Without			0													
	24 V DC			4													
Binary input 1 Binary input 2	Standard							0									
	Add. floating contact							1									
Diagnostics	EXPERT								1								
	EXPERT+ (extended)								2								
Housing material	Aluminum									0							
	Stainless steel 1.4581									1							
Positioner for special applications	Without													0			
	Free of substances that impair painted surfaces													1			
	Exhaust air with pneum. connection ¼ NPT		0	0				0						2			
Special versions	Without														0	0	0

1 Design and principle of operation

The digital positioner receives the reference variable (reference variable w) transmitted cyclically over FOUNDATION™ Fieldbus and compares it to the travel or rotational angle of the control valve (controlled variable x). The positioner issues a pneumatic signal pressure (output variable y) to correct the valve position.

The Type 3730-5 Positioner communicates with field devices, logic solvers, and process control system over FOUNDATION™ Fieldbus protocol.
An integrated PID function block permits the required process variable to be controlled directly in the field.

The positioner is designed depending on the corresponding accessories for direct attachment to SAMSON Type 3277 Actuators or for attachment to actuators according to IEC 60534-6 (NAMUR).

Additionally, a coupling wheel included in the accessories is required to transfer the rotary motion for rotary actuators according to VDI/VDE 3845.
Springless rotary actuators require a reversing amplifier to allow the positioner to operate in either direction.

The positioner basically consists of a travel sensor system that functions proportional to the resistance, an analog i/p module with downstream booster as well as the electronic unit with a microcontroller.
The position of the valve is transmitted as an angle of rotation to the travel sensor (2) and to an analog PD controller (3).

Simultaneously, an A/D converter (4) transmits the position of the valve to the microcontroller (5). The PD compares this actual position to the FOUNDATION™ Fieldbus reference variable transmitted cyclically by the control equipment.
In case of a system deviation, the operation of the i/p converter (6) is changed so that the actuator (1) is filled or vented via the downstream air capacity booster (7). This causes the closure member of the control valve to move to the position determined by the reference variable.

The pneumatic air capacity booster (7) and the pressure regulator (8) are provided with supply air. An intermediate flow regulator (9) with fixed settings is used to purge the positioner and also guarantees trouble-free operation of the pneumatic booster. The output signal pressure supplied by the booster can be limited over the software.
The volume restriction Q (10) is used to optimize the positioner.

1.1 Additional equipment

Version with solenoid valve

If the operating voltage for the solenoid valve (12) fails, the supply pressure for the i/p module is vented to the atmosphere. The positioner can no longer operate and the control valve moves to the fail-safe position determined by the actuator, independent of the reference variable.

Version with inductive limit switch

The rotary shaft of the positioner carries an adjustable tag which actuates the installed proximity switch.

Version with binary contact

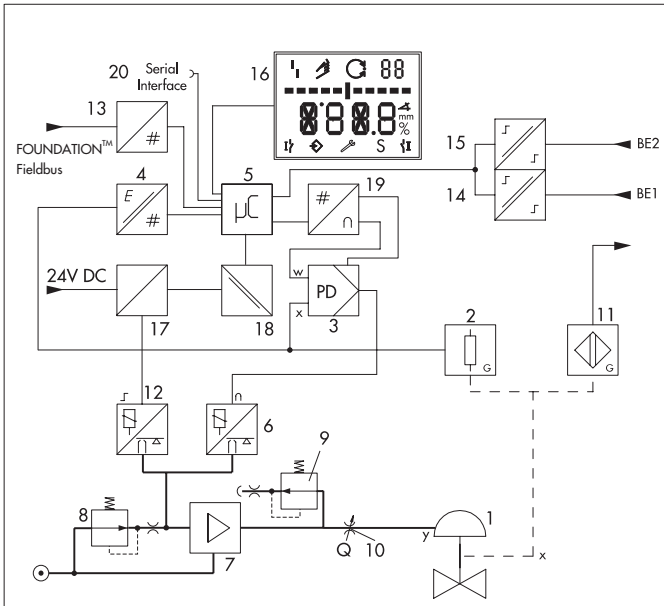
All positioners are fitted with a binary input for DC voltage signals over which process information over FOUNDATION™ Fieldbus can be issued.
Another optional binary input is an active input powered by the positioner to connect a floating contact. Its switching condition can also be issued over FOUNDATION™ Fieldbus.

1.2 Communication

The positioner is completely controlled over the digital signal transmission implemented by FOUNDATION™ Fieldbus specification as per the draft E EN 50170/A1.
Data transmission is implemented as bit-synchronous current modulation at a rate of 31.25 kbit/s over twisted-pair cables conforming to EN 61158-2.

Configuration using TROVIS-VIEW software

The positioner can be configured using TROVIS-VIEW Configuration and Operator Interface software.
The positioner is equipped with an additional digital **SERIAL INTERFACE** to allow a



1 Control valve
2 Travel sensor
3 PD controller
4 A/D converter
5 Microcontroller
6 i/p converter
7 Air capacity booster
8 Pressure regulator
9 Flow regulator
10 Volume restriction
11* Inductive limit switch
12* Solenoid valve
13* EN 61158-2 interface module
14 Binary input, passive
15* Binary input, active
16 Display
17* Solenoid valve control
18* Galvanic isolation
19 D/A converter
20 Communication interface

* Optional

Fig. 2 · Functional diagram

computer to be connected over an adapter cable from the RS-232 interface of the computer to the positioner.
The TROVIS-VIEW software enables the user to easily set parameters in the positioner and view process parameters online.

Configuration using the NI-FBUS™ Configurator

The NI-FBUS™ Configurator from National Instruments can also be used to configure the positioner. For this purpose, an interface card must be installed in a computer to connect it to the FOUNDATION™ Fieldbus.
The planning of whole FOUNDATION™ Fieldbus network can be performed using the NI-FBUS™ Configurator.

1.3 Technical data

Positioner	
Nominal travel, adjustable	Direct attachment to Type 3277: 3.6 to 30 mm, attachment acc. to IEC 60534-6: 3.6 to 200 mm or 24° to 100° opening angle for rotary actuators
Travel range	Adjustable within the nominal travel, max. ratio 1 : 5
Bus connection	Feldbus interface acc. to EN 61158-2 bus-powered Physical Layer Class: 113 (without explosion protection) und 111 (with ex. protection) Field device acc. to FM 3610 Entity and FISCO.
Perm. operating voltage	9 to 32 V DC, power supply over bus line
Maximum operating current	15 mA
Additional current in case of failure	0 mA
Supply air	Supply pressure from 1.4 to 6 bar (20 to 90 psi), Air quality acc. to ISO 8573-1 Edition 2001: Max. particle size and density: Class 4 Oil content: Class 3, pressure dew point: Class 3 or at least 10 K beneath the lowest ambient temperature to be expected
Signal pressure (output)	0 bar up to supply pressure, limitable to 1.4/2.4/3.7 ±0.2 bar via software
Characteristic, user-defined adjustable over operating software	Linear/equal percentage/reverse equal percentage/butterfly valve linear/ butterfly valve eq. percentage/rotary plug valve linear/rotary plug valve eq. percentage/segmented ball valve linear/segmented ball valve eq.percentage Deviation from terminal-based conformity ≤ 1 %
Hysteresis	≤ 0.3 %
Sensitivity	≤ 0.1 %
Direction of action	Reversible
Air consumption, steady state	Independent from supply pressure approx. 110 l_n/h
Air delivery Actuator pressurized Actuator vented	 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 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, with metal cable gland The limits specified in the EC Type Examination Certificate additionally apply for explosion-protected devices.
Influences	Temperature: ≤ 0.15 %/10 K Supply air: None Vibration: ≤ 0.25 % up to 2000 Hz and 4 g acc. to IEC 770
Electromagn. compatability	Complying with EN 61000-6-2, EN 61000-6-3 and NAMUR Recommendation NE 21
Explosion protection	⟨Ex⟩ II 2 G EEx ia IIC T6 / II 2 D IP 65 T 80 °C ⟨Ex⟩ II 3 G EEx nA/nL II T6 / II 3 D IP 65 T 80 °C
Degree of protection	IP 65

Binary contact 1	
Input	5 to 30 V DC reverse polarity protection, static destruction limit 40 V / 5.8 mA, current consumption 3.5 mA at 24 V, galvanically isolated
Signal	Signal “0” at Ue > 5 V Signal “1” at Ue < 3 V
Binary contact 2 for floating contact	
Switching input	R < 100 Ω, contact loadability 100 mA, static destruction limit 20 V / 5.8 mA, galvanically isolated
Solenoid valve	SIL 4 approval acc. to IEC 61508
Input	24 V DC, max. 40 V, reverse polarity protection, static destruction limit 40 V;
Signal	Signal "0" no pick-up ≤ 15 V Signal "1" safe pick-up >19 V
Service life	>2 x 10^5 switching cycles
Implementation in safety-relevant systems in compliance with IEC 61508	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. The valves are therefore suitable for implementation in safety-related systems with a hardware fault tolerance of 1 or 2 up to and including SIL 4.
Inductive limit switch	
Type SJ 2SN Proximity Switch	For connection to switching amplifier acc. to EN 60947-5-6
Communication	
(Local) Software requirements (SSP)	Over SAMSON SSP interface and serial interface adapter SAMSON TROVIS-VIEW with database module 3730-5
(Bus communication)	Data transmission as per FOUNDATION™ Fieldbus specification Communication Profile Class: 31 PS, 32; Interoperability tested according Interoperability Test System (ITK) Revision 4.6.
Materials	
Housing: External parts:	Die-cast aluminum GD AlSi12 acc. to DIN 1725 (3.2582), chromated and plastic-coated, special version CrNiMo (1.4581); Stainless steel 1.4571 and 1.4301. Cable gland M20x1.5, black polyamide
Weight	Approx. 1.0 kg

2 Attachment to the control valve – Mounting parts and accessories

The positioner can be attached either directly to a SAMSON Type 3277 Actuator or according to IEC 60534-6 (NAMUR) to control valves with cast yokes or rod-type yokes as well as to rotary actuators according to VDI/VDE 3845.

For attachment to the various actuators, corresponding mounting parts and accessories are required. These are listed with their order numbers in Tables 1 to 5.

On attaching the positioner, it is important to observe the assignment between lever and pin position according to the travels listed in the travel tables.

The tables show the maximum adjustment range at the positioner. The travel that can be implemented at the valve is restricted by the pin position used and additionally by the actuator spring compression required.
The positioner is standard equipped with the lever **M** (pin position **35**).

Note!
If the standard mounted lever M (pin position 35) is replaced, the newly mounted lever must be moved once all the way as far as it will go in both directions to adapt it to the internal measuring lever.

Travel table for direct attachment to Type 3277 Actuator

Type 3277-5 and 3277 Actuators	Actuator size cm^2	Rated travel mm	Adjustment range at positioner Min.	Travel	Max.	Required lever	Assigned pin position
	120	7.5	5.0		25	M	25
	120/240/350	15	7.5		35.4	M	35
	700	30	10.0		50.0	M	50

Travel table for attachment according to IEC 60534-6 (NAMUR)

SAMSON valves			Other valves/actuators			Required lever	Assigned pin position
	cm^2	Rated travel mm	Min.	Travel	Max.		
Type 3271 Actuator	60 and 120 with Type 3510 Valve	7.5	3.6		17.7	S	17
	120	7.5	5.0		25.0	M	25
	120/240/350	15	7.0		35.4	M	35
	700/1400/2800	15 and 30/30	10.0		50.0	M	50
	1400/2800	60	14.0		70.7	L	70
	1400/2800	60	20.0		100	L	100
	1400/2800	120	40.0		200	XL	200
Rotary actuators			Angle of rotation 24 to 100°			M	90°

Table 1	Direct attachment to Type 3277-5 Actuator, see Fig. 3		Order no.
Mounting parts	For actuators with 120 cm² effective diaphragm area		1400-7452
Accessories for the actuator	Switchover plate (old) for Actuator Type 3277-5xxxxxx.**00** (old)		1400-6819
	Switchover plate **new** for Actuator Type 3277-5xxxxxx.**01** (new)		1400-6822
	Connecting plate for additional attachment of a solenoid valve G 1/8 Connecting plate (old) for Actuator Type 3277-5xxxxxx.**00** (old) 1/8 NPT		1400-6820 1400-6821
	Connecting plate **new** for Actuator Type 3277-5xxxxxx.**01** (new)		1400-6823
	***Note**: Only new switchover and connecting plates can be used with new actuators (Index 01). Old and new plates are not interchangeable.*		
Accessories for the positioner	Connecting plate (6)	G ¼: 1400-7461	¼ NPT: 1400-7462
	or pressure gauge bracket (7)	G ¼: 1400-7458	¼ NPT: 1400-7459
	Pressure gauge mounting kit (8) (output/supply)	St. st./Bs: 1400-6950	St. st./St. st.: 1400-6951

Table 2	Direct attachment to Type 3277 Actuator, see Fig. 4		
Accessories	Mounting parts for actuators with 240, 350 and 700 cm²		1400-7453
	Required piping with screw fittings for "Actuator stem retracts" or when the top diaphragm chamber is filled with air	cm² / Steel / Stainless steel 240 / 1400-6444 / 1400-6445 350 / 1400-6446 / 1400-6447 700 / 1400-6448 / 1400-6449	
	Connection block with seals and screw	G ¼: 1400-8811	¼ NPT: 1400-8812
	Pressure gauge mounting kit (output and supply)	St.st./Bs: 1400-6950	St.st/St.st.: 1400-6951

Table 3	Attachment to NAMUR ribs or control valves with rod-type yokes (rod diameter Ø 35 mm or smaller) according to IEC 60534-6, see Fig. 5		
Travel in mm	Lever	For actuators	Order no.
7.5	S	Type 3271-5 Actuator with 60/120 cm² on Type 3510 Valve, see Fig. 6	1400-7457
5 to 50	Without (lever M on basic model)	Actuators from other manufacturers and Type 3271 with 120 to 700 cm²	1400-7454
14 to 100	L	Actuators f. other manufacturers and Type 3271 w. 1400 cm²	1400-7455
40 to 200	XL	Actuators from other manufacturers and Type 3271 with 1400/2800 cm², 120 mm travel	1400-7456
30 or 60	L	Type 3271 Actuator with 1400 cm² (120 cm travel), Type 3271 Actuator with 2800 cm² (30 or 60 mm travel)	1400-7466
Mounting brackets for Emerson and Masoneilan linear actuators In addition, a mounting kit acc. to IEC 60534-6 is required depending on the travel. See row above.			1400-6771

Accessories	Connecting plate	G ¼: 1400-7461 ¼ NPT : 1400-7462
	or pressure gauge bracket (7)	G ¼: 1400-7458 ¼ NPT: 1400-7459
	Pressure gauge mounting kit (output/supply)	St.st./Bs: 1400-6950 St.st./St.st.: 1400-6951

Table 4	Attachment to rotary actuators (VDI/VDE 3845 for all sizes of fixing level 2) see Figs. 7 and 8			
Mounting parts	With follower clamp and coupling wheel	VDI/VDE 3845 for all sizes of fixing level 2 for Type 3278 Actuator with 160/320 cm^2 for Camflex II		1400-7448 1400-7614 1400-9120
Accessories	Connecting plate		G ¼: 1400-7461	¼ NPT: 1400-7462
	or pressure gauge bracket (7)		G ¼: 1400-7458	¼ NPT: 1400-7459
	Pressure gauge mounting kit (output/supply)		St.st./Bs: 1400-6950	St.st./St.st: 1400-6951
Table 5	General accessories			
Accessories	Pneumatic reversing amplifier for double-acting actuators		G ¼ ¼ NPT	1079-1118 1079-1119
	Cable gland M20 x 1.5	Nickel-plated brass		1890-4875
	Adapter M 20 x 1.5 to ½ NPT, aluminum			0310-2149
	Retrofit kit for inductive limit switch 1x SJ 2-SN			1400-7460
	Cover plate with list of parameters and operating instructions		English (standard)	1190-5328

2.1 Direct attachment

2.1.1 Type 3277-5 Actuator

Refer to Table 1 on page 12 for the required mounting parts as well as the accessories with their order numbers.
Note the travel table on page 11!

Actuator with 120 cm²

Depending on the type of positioner attachment, the signal pressure is routed either left or right of the yoke through a bore to the actuator diaphragm. Depending on the fail-safe action of the actuator "Actuator stem extends" or "Actuator stem retracts" (valve closes or opens if the supply air fails), the switchover plate (9) must first be attached to the actuator yoke. Align the switchover plate with the corresponding symbol for left or right attachment according to the marking (view looking onto the switchover plate).

1. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges onto the positioner, making sure both seal rings (6.1) are seated properly.
2. Remove vent plug (4) on the back of the positioner and close the signal pressure output "Output 38" on the connecting plate (6) or on the pressure gauge bracket (7) with the stopper (5) included in the accessories.
3. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
4. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 3, left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
5. **15 mm travel:** Keep the follower pin (2) at lever **M** (1) on the back of the positioner in the pin position **35** (delivered state).
   7.5 mm travel: Remove the follower pin (2) from the pin position **35**, reposition it in the bore for pin position **25** and screw tight.
6. Insert formed seal (15) in the groove of the positioner casing.
7. Place positioner on the cover plate (10) in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 12).
   The lever (1) must rest on the follower clamp with spring force.
   Mount the positioner on the cover plate (10) using the two fixing screws. During the installation make sure that the seal ring (10.1) is inserted in the bore of the cover plate.
8. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.

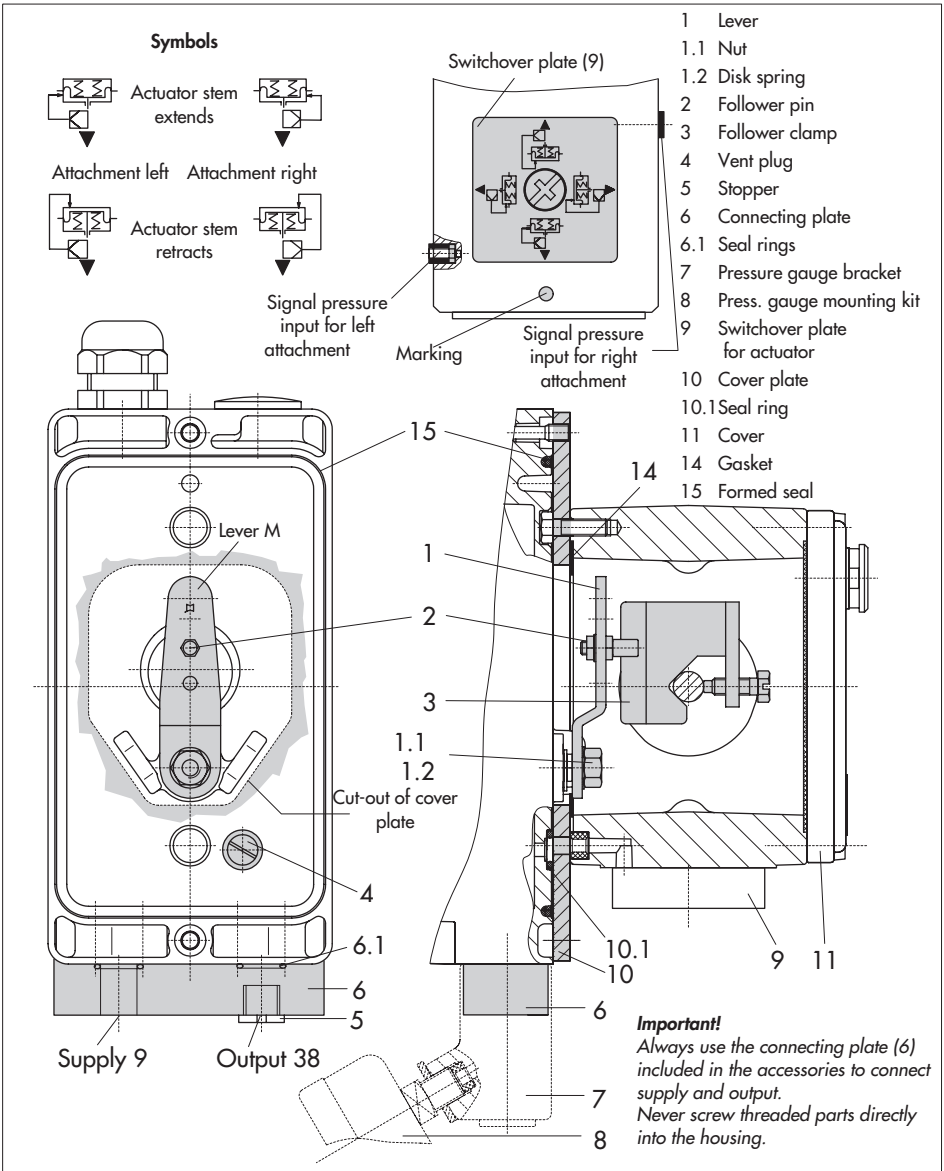


Fig. 3 · Direct attachment - Signal pressure connection for Type 3277-5 Actuator with 120 cm²

2.1.2 Type 3277 Actuator

Refer to Table 2 on page 12 or the required mounting parts as well as the accessories with their order numbers.
Note the travel table on page 11!

Actuators with 240 to 700 cm²

The positioner can be mounted either on the left or on the right side of the yoke. The signal pressure is routed to the actuator over the connection block (12), for actuators with fail-safe action "Actuator stem extends" internally through a bore in the valve yoke and for "Actuator stem retracts" through external piping.

1. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
2. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 4, on the left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
3. For actuators with 700 cm², remove the follower pin (2) at lever **M** (1) on the back of the positioner from pin position **35**, reposition it in the bore for pin position **50** and screw tight.
   For actuators 240 and 350 cm² with 15 mm travel, the follower pin (2) remains in pin position **35**.
4. Insert formed seal (15) in the groove of the positioner casing.
5. Place positioner on the cover plate in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch (Fig. 12). The lever (1) must rest on the follower clamp with spring force. Mount the positioner on the cover plate (10) using the two fixing screws.
6. Make sure that the tip of the gasket (16) projecting from the side of the connection block (12) is positioned above the actuator symbol that corresponds with the actuator with fail-safe action "Actuator stem extends" or "Actuator stem retracts." If necessary, remove the three fixing screws and the cover. Then reposition the gasket (16) turned by 180°. The previous version of the connection block (Fig. 4, bottom) requires the switch plate (13) to be turned such that the corresponding actuator symbol points to the marking.
7. Place the connection block (12) with the associated seal rings against the positioner and the actuator yoke. Screw it tight using the fixing screw (12.1). For actuators with fail-safe action "Actuator stem retracts", additionally remove the stopper (12.2) and fit on the external signal pressure piping.
8. Mount cover (11) on the other side. Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.

1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Follower clamp
10 Cover plate
11 Cover
12 Connection block
12.1 Screw
12.2 Stopper or connection for external piping
13 Switch plate
14 Gasket
15 Formed seal
16 Gasket

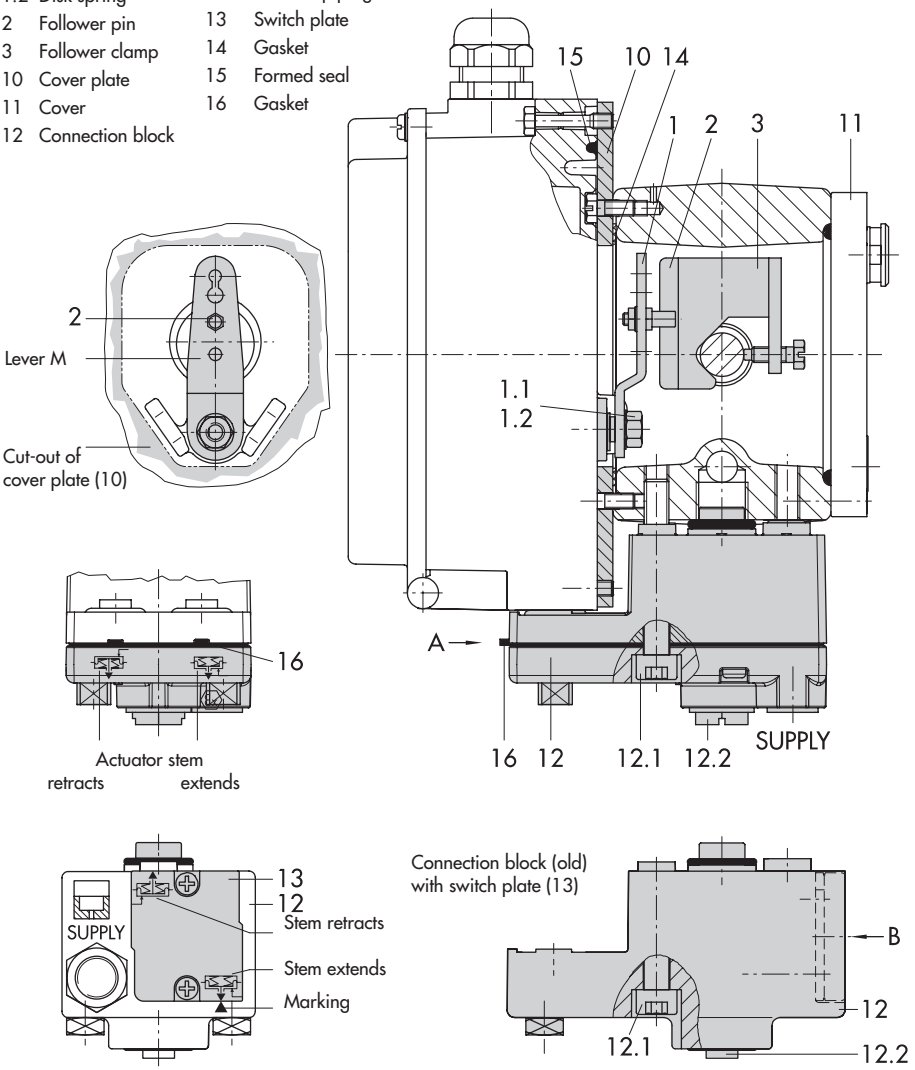


Fig. 4 · Direct attachment – Signal pressure connection for Type 3277 Actuator with 240, 350 and 700 cm²

2.2 Attachment according to IEC 60534-6

The positioner is attached to the control valve with a NAMUR bracket (10).

Refer to Table 3 on page 12 for the required mounting parts as well as the accessories with their order numbers.
Note the travel table on page 11!

1. Screw the two bolts (14) to the bracket (9.1) of the stem connector (9), place the follower plate (3) on top and use the screws (14.1) to tighten.

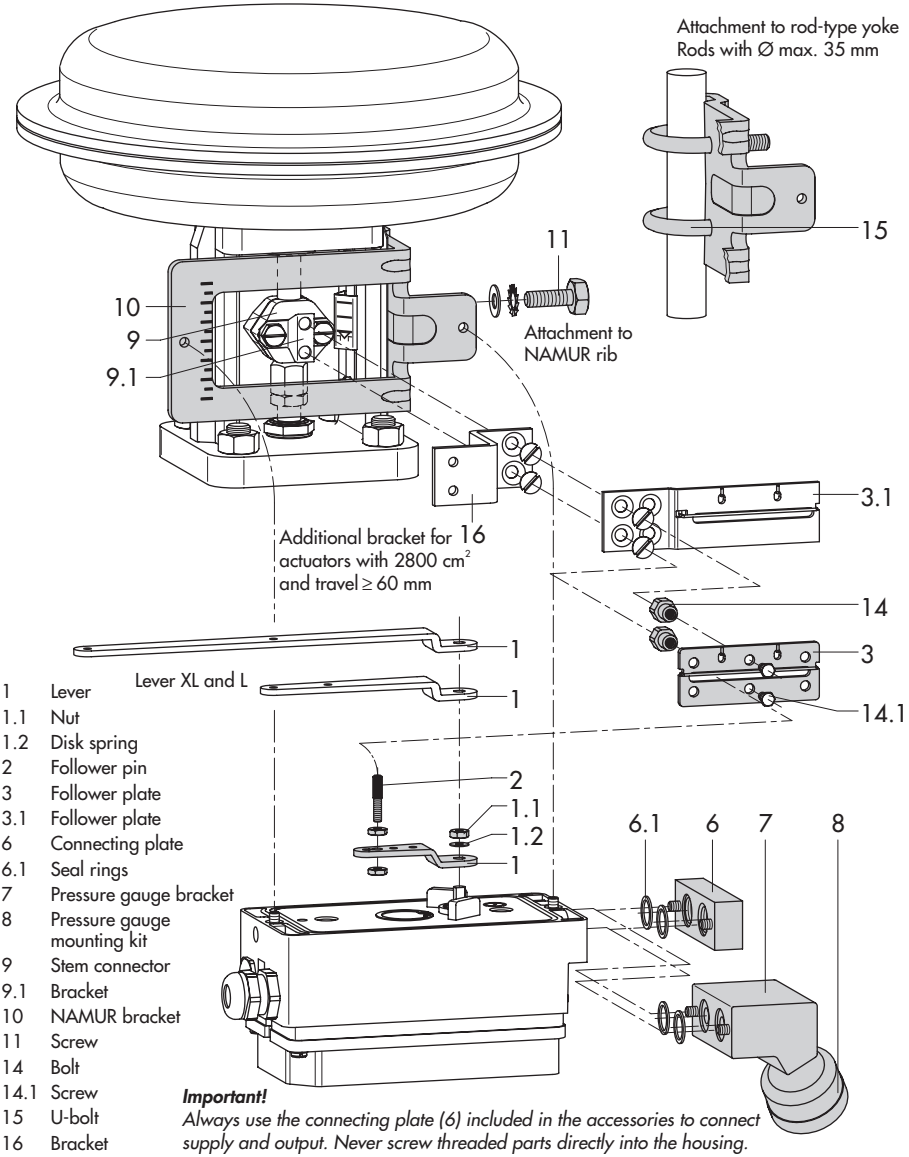
Actuator size 2800 cm² and 1400 cm² (120 mm travel):
For a travel of 60 mm or smaller, screw the longer follower plate (3.1) directly to the stem connector (9). For a travel exceeding 60 mm, mount the bracket (16) first and then the follower plate (3) to the bracket together with the bolts (14) and screws (14.1).

2. Mount NAMUR bracket (10) to the control valve as follows:
   For attachment to the NAMUR rib, use an M8 screw (11), washer, and toothed lock washer directly in the yoke bore.
   For attachment to valves with rod-type yokes, use two U-bolts (15) around the yoke.
   Align the NAMUR bracket (10) in such a way that the slot of the follower plate (3) is centrally aligned with the NAMUR bracket at mid valve travel.
3. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges (8) on the positioner, making sure both seal rings (6.1) are seated properly.
4. Select required lever size (1) **M**, **L** or **XL** and pin position according to the actuator size and valve travels listed in the table on page 11.
   Should you require a pin position other than position **35** with the standard installed lever **M**, or require a lever size **L** or **XL**, proceed as follows:
5. Screw the follower pin (2) in the assigned lever bore (pin position) as listed in the table. Only use the longer follower pin (2) included in the mounting kit.
6. Place lever (1) on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).

Note!
If you have mounted a new lever (1), you must move it once all the way as far as it will go in both directions.

---

7. Place positioner on the NAMUR bracket in such a manner that the follower pin (2) rests in the slot of the follower plate (3, 3.1). Adjust the lever (1) correspondingly.
   Screw the positioner to the NAMUR bracket using both its fixing screws.



1	Lever
1.1	Nut
1.2	Disk spring
2	Follower pin
3	Follower plate
3.1	Follower plate
6	Connecting plate
6.1	Seal rings
7	Pressure gauge bracket
8	Pressure gauge mounting kit
9	Stem connector
9.1	Bracket
10	NAMUR bracket
11	Screw
14	Bolt
14.1	Screw
15	U-bolt
16	Bracket

Important!

Always use the connecting plate (6) included in the accessories to connect supply and output. Never screw threaded parts directly into the housing.

Fig. 5 · Attachmet according to IEC 60534-6 (NAMUR)

2.3 Attachment to Type 3510 Micro-flow Valve

The positioner is attached to the valve yoke using a bracket.

Refer to Table 3 on page 12 for the required mounting parts as well as the accessories with their order numbers.
Note the travel table on page 11!

1. Place clamp (3) on the valve stem connector, align at a right angle and screw tight.
2. Screw bracket (10) to the valve yoke using two screws (11).
3. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges to the positioner, making sure both seal rings (6.1) are seated properly..
4. Unscrew the standard installed lever **M** (1) including follower pin (2) from the positioner shaft.
5. Take lever **S** (1) and screw follower pin (2) in the bore for pin position **17**.
6. Place lever S on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).
   Move lever once all the way as far as it will go in both directions.
7. Place positioner on the bracket (10) in such a manner that the follower pin slides into the groove of the clamp (3). Adjust the lever (1) correspondingly. Screw the positioner to the bracket (10) using both its hexagon screws.

1 Lever
1.1 Nut
1.2 Disk spring
2 Follower pin
3 Clamp
6 Connecting clamp
6.1 Seal rings
7 Pressure gauge bracket
8 Pressure gauge mounting kit
10 Bracket
11 Screw

Important!
Always use the connecting plate (6) included in the accessories to connect supply and output.
Never screw threaded parts directly into the housing.

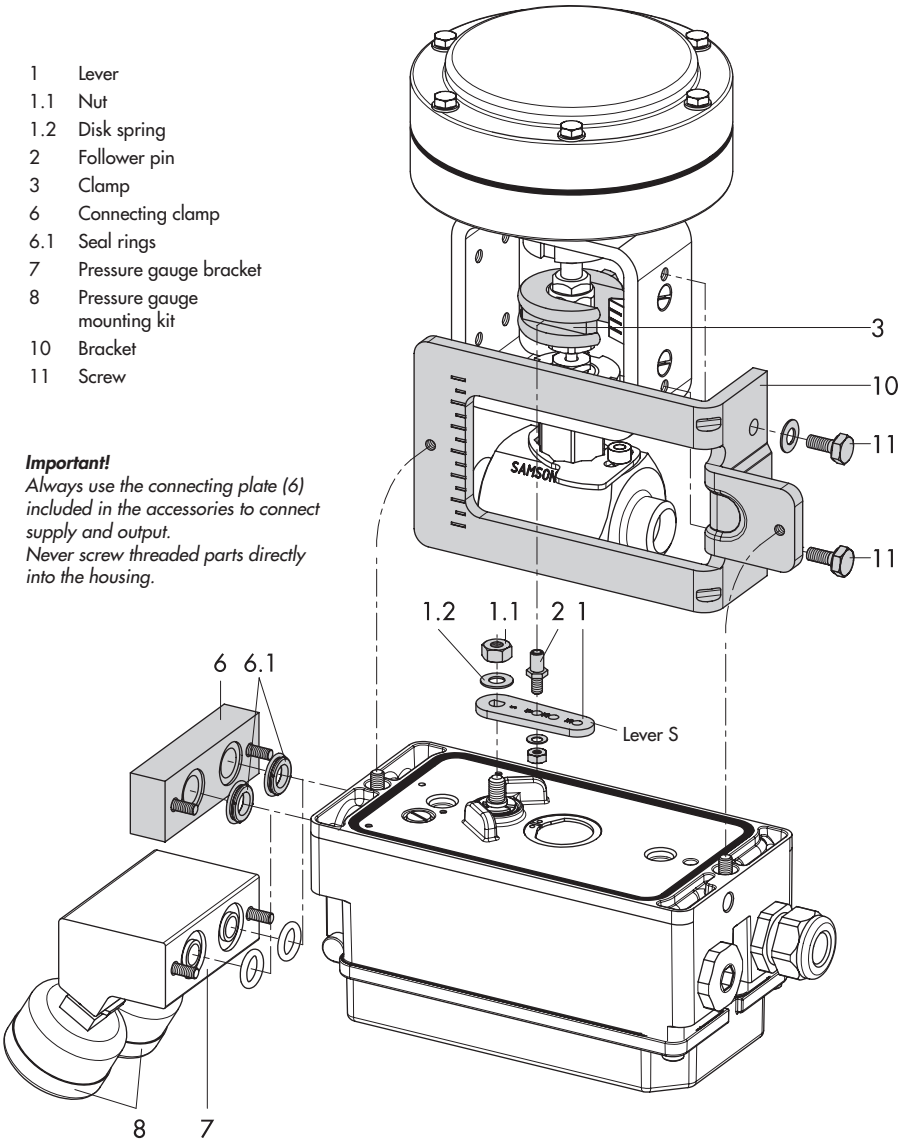


Fig. 6 · Attachment to Type 3510 Micro-flow Valve

2.4 Attachment to rotary actuators

The positioner is mounted to the rotary actuator using two pairs of double brackets.

Refer to Table 4 on page 13 for the required mounting parts as well as the accessories with their order numbers.

Prior to the attachment of the positioner to the SAMSON Type 3278 Rotary Actuator, you have to mount the associated adapter (5) to the free end of the rotary actuator shaft.

Note!
During the installation of the positioner as described below, it is imperative that the actuator's direction of rotation be observed.

---

1. Place follower clamp (3) on the slotted actuator shaft or the adapter (5).
2. Place coupling wheel (4) with flat side facing the actuator on the follower clamp (3). Refer to Fig. 8 to align slot so that it matches the direction of rotation when the valve is in its closed position.
3. Screw coupling wheel and follower clamp tightly onto the actuator shaft using screw (4.1) and disk spring (4.2).
4. Screw the bottom pair of brackets (10.1) with the bends pointing either to the inside or to the outside (depending on the actuator size) to the actuator case. Position top pair of brackets (10) and screw tight.
5. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges to the positioner, making sure both O-rings are seated properly.
   For **double-acting**, springless rotary actuators, a reversing amplifier is required to attach the positioner to the actuator, see section 2.5.
6. Unscrew the standard follower pin (2) from the positioner's lever **M** (1). Use the metal follower pin (Ø5) included in the mounting kit and screw tight into the bore for pin position **90**°.
7. Place positioner on the top pair of brackets (10) and screw tight. Considering the actuator's direction of rotation, adjust lever (1) so that it engages in the slot of the coupling wheel (4) with its follower pin (see Fig. 8). It must be guaranteed that the lever (1) is parallel to the long side of the positioner when the actuator is at half its angle of rotation.
8. Stick scale plate (4.3) on the coupling wheel so that the arrow tip indicates the closed position, and it can be easily read when the valve is installed.

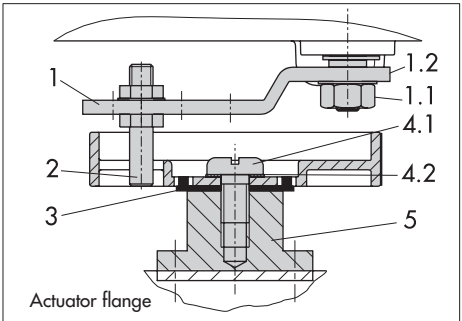
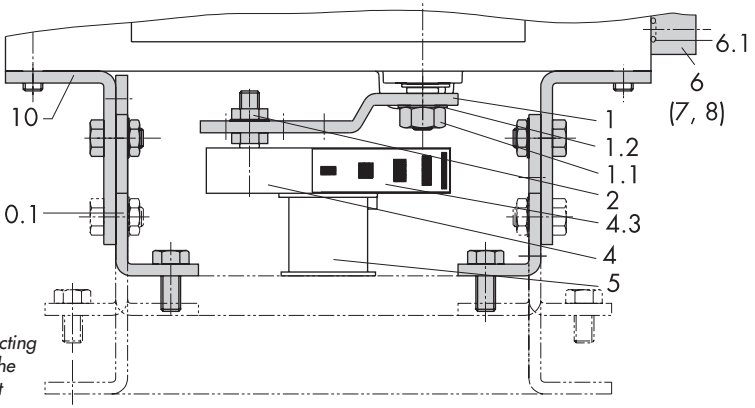
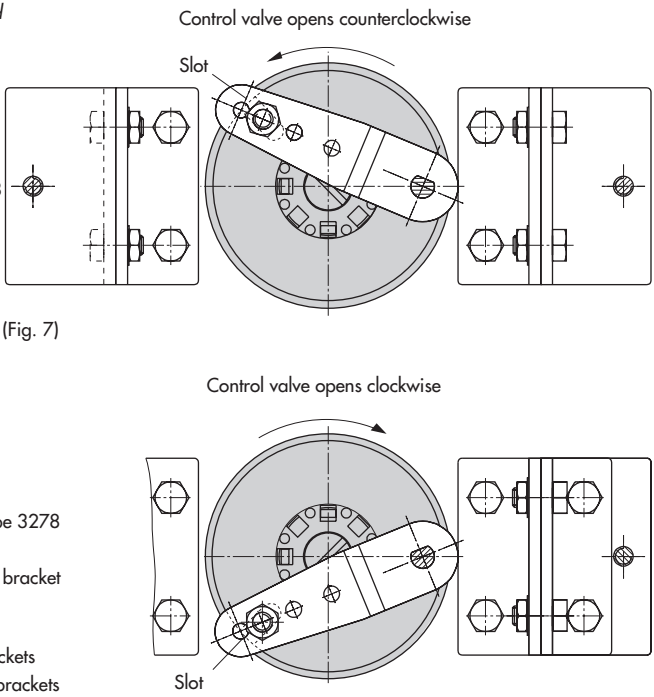


Fig. 7 · Mounting the coupling wheel with Type 3278



Important!
Always use the connecting plate (6) included in the accessories to connect supply and output. Never screw threaded parts directly into the housing.



Legends Figs. 7 and 8

1	Lever
1.1	Nut
1.2	Disk spring
2	Follower pin
3	Follower clamp (Fig. 7)
4	Coupling wheel
4.1	Screw
4.2	Disk spring
4.3	Scale plate
4.3	Scale plate
5	Actuator shaft Adapter for Type 3278
6.1	Seal rings
7	Pressure gauge bracket
8	Pressure gauge mounting kit
10	Top pair of brackets
10.1	Bottom pair of brackets

Fig. 8 · Attachment to rotary actuators

2.5 Reversing amplifier for double-acting actuators

For the use with double-acting actuators, the positioner must be fitted with a reversing amplifier. The reversing amplifier is listed as an accessory in the Table 5 on page 13.

The output signal pressure of the positioner is supplied at the output **A_1** of the reversing amplifier. An opposing pressure, which equals the required supply pressure when added to the pressure at **A_1**, is applied at output **A_2**.
The rule **A_1** + **A_2** = **Z** applies.

Mounting

1. Mount the connecting plate (6) from the accessories in Table 5 to the positioner. Make sure that both O-rings (6.1) are seated correctly.
2. Thread the special nuts (1.3) from the accessories of the reversing amplifier into the boreholes of the connecting plate.
3. Insert the gasket (1.2) into the recess of the reversing amplifier and push both the hollowed special screws (1.1) into the connecting boreholes **A_1** and **Z**.
4. Place the reversing amplifier onto the connecting plate (6) and screw tight using both the special screws (1.1).
5. Use a screwdriver (8 mm wide) to screw the enclosed filters (1.6) into the connecting boreholes **A_1** and **Z**.

Note!
The sealing plug (1.5) in the Type 3730 Positioner should not be unscrewed out of the reversing amplifier.
The rubber seal (1.4) is not required and can be removed when the sealing plug is used.

Signal pressure connections

A_1: Output **A_1** leading to the signal pressure connection at the actuator which opens the valve when the pressure increases

A_2: Output **A_2** leading to the signal pressure connection at the actuator which closes the valve when the pressure increases

Set slide switch on positioner to
AIR TO OPEN.

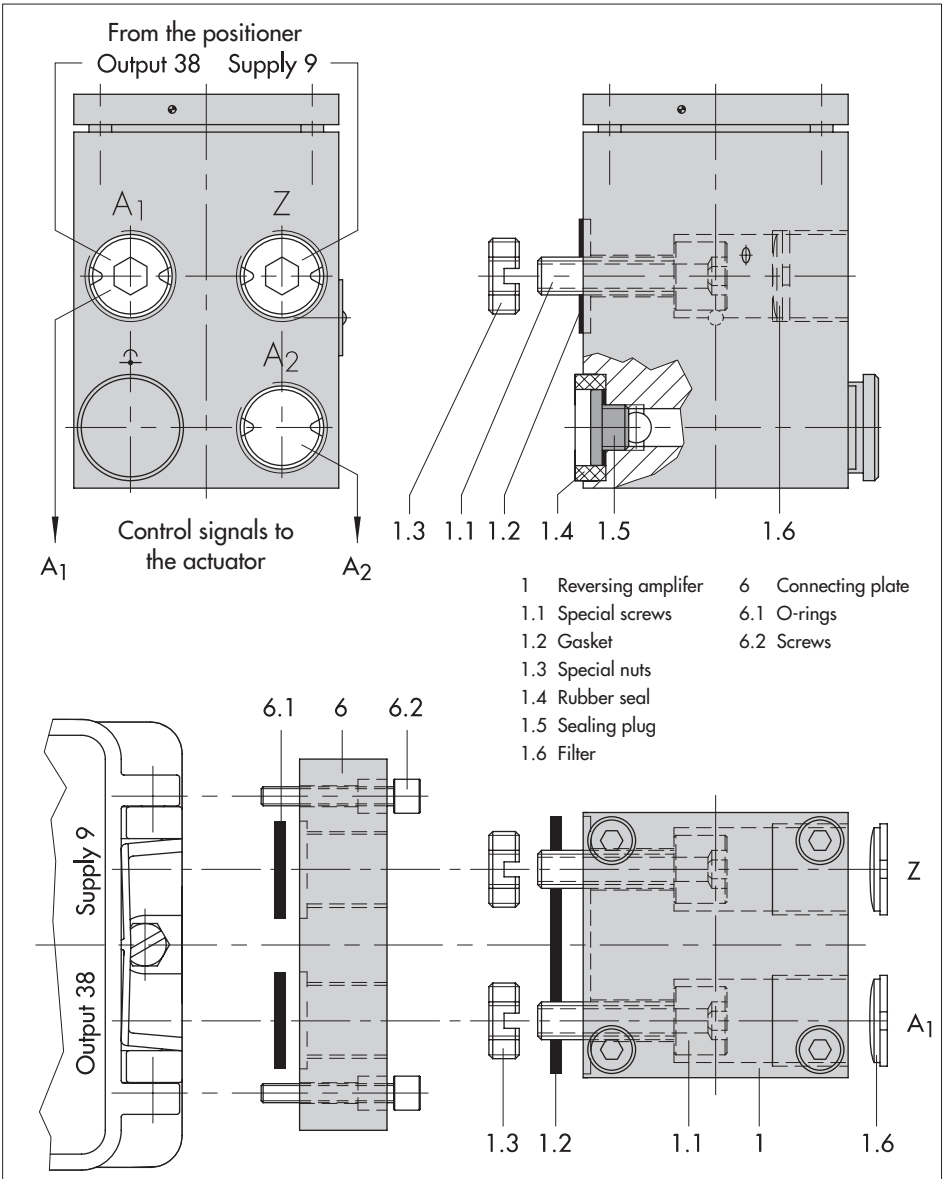


Fig. 9 · Mounting a reversing amplifier

3 Connections

3.1 Pneumatic connections

Caution!
The threads in the positioner housing are not designed for direct air connection!

The screw glands must be screwed into the connecting plate, the pressure gauge mounting block or the connection block from the accessories. The air connections are optionally designed as a bore with ¼ NPT or G ¼ thread.
The customary fittings for metal and copper pipes or plastic hoses can be used.

Note!
The supply air must be dry and free from oil and dust. The maintenance instructions for upstream pressure reducing stations must be observed.
Blow through all air tubes and hoses thoroughly prior to connecting them.

If the positioner is attached directly to the Type 3277 Actuator, the connection of the positioner's output pressure to the actuator is fixed. For attachment according to IEC 60534-6 (NAMUR), the signal pressure can be routed to either the top or bottom diaphragm chamber of the actuator, depending on the actuator's fail-safe action "Actuator stem extends" or "Actuator stem retracts".
For rotary actuators, the manufacturer's specifications for connection apply.

3.1.1 Signal pressure gauges

To monitor the supply air (Supply) and signal pressure (Output), we recommend that pressure gauges be attached (see accessories in Tables 1 to 5).

3.1.2 Supply pressure

The required supply air pressure depends on the bench range and the actuator's operating direction (fail-safe action).
The bench range is registered on the nameplate either as spring range or signal pressure range depending on the actuator. die The direction of action is marked **FA** or **FE**, or by a symbol.

Actuator stem extends FA (Air to open ATO)

Fail-safe position "Valve Closed"
(for globe and angle valves):

Required supply pressure = Upper bench range value + 0.2 bar, minimum 1.4 bar.

Actuator stem retracts FE (Air to close ATC)

Fail-safe position "Valve Open"
(for globe and angle valves):
For tight-closing valves, the maximum signal pressure pst_{max} is roughly estimated as follows:

$$pst_{max} = F + \frac{d^2 \cdot \pi \cdot \Delta p}{4 \cdot A} \text{ [bar]}$$

d = Seat diameter [cm]
Δp = Differential pressure across the valve [bar]
A = Actuator diaphragm area [cm^2]
F = Upper bench range of the actuator [bar]

If there are no specifications, calculate as follows:

Required supply pressure =
Upper bench range value + 1 bar

Note!
The signal pressure at the output (Output 38) of the positioner can be limited to 1.4, 2.4 or 3.7 bar over Code 16 or the pressure limit can be deactivated (MAX).

3.2 Electrical connections

For electrical installation, you are required to observe the relevant electrotechnical regulations and the accident prevention regulations that apply in the country of use. In Germany, these are the VDE regulations and the accident prevention regulations of the employers' liability insurance association.

The following standards apply for assembly and installation in hazardous areas: EN 60079-14: 2003 (VDE 0165 Part 1/ 8.98) "Electrical apparatus for explosive gas atmospheres" and EN 50281-1-2: 1999 (VDE 0165 Part 2/11.99) "Electrical apparatus for use in the presence of combustible dust".

For the interconnection of intrinsically safe electrical equipment, the permissible maximum values specified in the EC type examination certificate apply (U_i or U_0; I_i or I_0; P_i or P_0; C_i or C_0, and L_i or L_0).

The following applies for equipment with type of protection EEx nA (non-sparking apparatus) according to the standard EN 50021 (1999): Connecting, interrupting, or switching circuits while energized is only allowed during installation, maintenance or repair work.

The following applies for equipment connected to energy-limited circuits with type of protection EEx nL (energy-limited apparatus) according to the standard EN 50021 (1999): This type of equipment may be switched under normal operating conditions.

For the interconnection of equipment to energy-limited circuits with type of protection EEx nL IIC, the permissible maximum values specified in the statement of conformity or the addenda to the statement of conformity apply.

Caution!
The terminal assignment specified in the certificate must be adhered to. Reversing the assignment of the electrical terminals may cause the explosion protection to become ineffective!
Do not tamper with enameled screws inside or on the housing.

Note on the selection of cables and wires:
To install intrinsically safe circuits, observe section 12 of the standard EN 60079-14: 2003 (VDE 0165 Part 1). To run multi-core cables or lines with more than one intrinsically safe circuit, section 12.2.2.7 of this standard applies.
An additional cable gland can be installed when connecting the device over two separate cables. Cable entries left unused must be sealed with blanking plugs. Devices used at ambient temperatures down to –20 °C must have metal cable entries.

Cable entry

Cable entries with M20x1.5 cable gland, clamping area 6 to 16 mm.
There is a second M20x1.5 entry in the housing which can be used to install an additional connection, if required.
The screw terminals are designed for 0.2 to 2.5 mm wire cross sections and for a tightening torque of 0.5 Nm.

Bus line

The shielded fieldbus connecting cable is to be routed over the electromagnetic-compatible brass cable gland (standard) in the positioner to the terminals. The shield, which is placed over the clamping insert, is connected over a large area to the gland and housing.

1. To connect the bus line, loosen the gland nut and the clamping insert from the positioner and remove the dust cap.
2. Slide the gland nut and clamping insert over the connecting cable.
3. Strip the insulation off the end of the bus line to the required connecting length and cut the wire shield off up to a length of approx. 13 mm. If necessary, cut off any cable core filling as well.
4. Disentangle the braided shield and pull it over the clamping insert.
5. Press the clamping insert into the connecting screw gland and screw tight the gland nut until the connecting cable is clamped tightly.
6. Route the two-wire bus line to the screw terminals marked "EN 61158-2", whereby no polarity has to be observed.

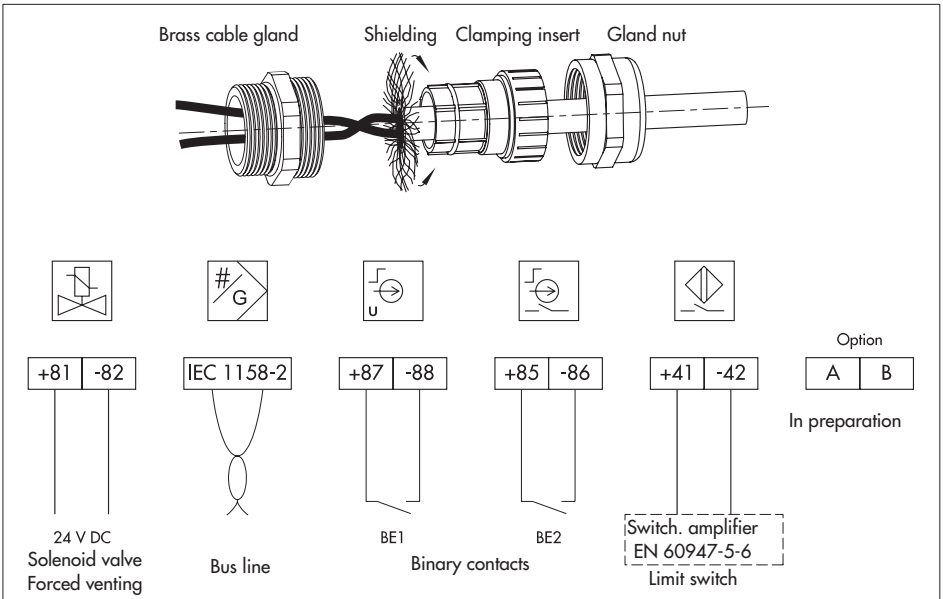


Fig. 10 · Electrical connections

Note!
To connect the limit switch, binary inputs, and forced venting, an additional cable gland that needs to be fitted in place of the existing blanking plug is necessary.
Open cable glands are not permissible as the degree of protection IP 65 only applies when the positioner housing is sealed.

Note!
If there is no voltage connected for the solenoid valve at terminals +81 and –82 or when the voltage signal is interrupted, the positioner vents the actuator and does not respond to the reference variable.
Observe the switching thresholds specified in the technical data.

Limit switch

For operation of the limit switches, switching amplifiers have to be connected in the output circuit. Their function is to control the limit values of the control circuit according to EN 60947-5-6, thus ensuring operational reliability of the positioner. If the positioner is installed in hazardous areas, the relevant regulations must be observed.

Binary input 1

An active contact can be operated at binary input 1. The positioner can report the switching state over the bus protocol.

Binary input 2

A passive, floating contact can be operated at binary input 2.
The positioner can report the switching state over the bus protocol.

Solenoid valve (forced venting function)

For positioners fitted with the optional solenoid valve for the forced venting function, a voltage of 24 V DC must be connected to the relevant terminals +81 and –82.

3.2.1 Establishing communication

The communication structure between the controller, logic solvers (PLC) or automation system, or between a PC or work station and the positioner(s) is implemented to conform with EN 61158-2.

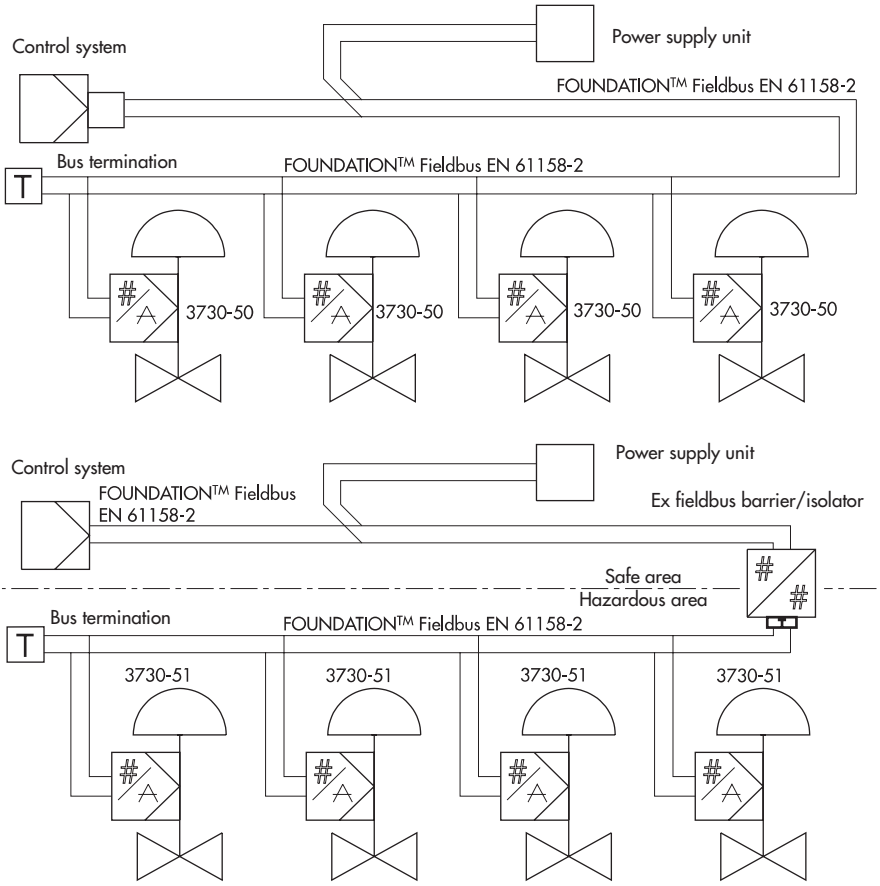


Fig. 11 · Connection according to FOUNDATION™ Fieldbus, for safe areas (top) and hazardous areas (bottom)

4 Operation

Note!
A summary about operating and start up can be found in section 8 on page 54. A leaflet including the same summary is also enclosed with the positioner.

4.1 Operator controls and display

Rotary pushbutton

The positioner is mainly operated with the rotary pushbutton.

Turn the ⊛ button to select and set codes, parameter and values. Press it to confirm them.

Slide switch AIR TO OPEN or AIR TO CLOSE

This switch is used to adapt the positioner to the operating direction of the actuator.

For actuator where the supply pressure opens the valve, fail-safe position: "springs close valve": switch position AIR TO OPEN.

For actuator where the supply pressure closes the valve, fail-safe position: "springs open valve": switch position AIR TO CLOSE.

For positioners with an attached reversing amplifier for double-acting rotary actuators (section 2.5): switch position AIR TO OPEN.

The switch position is prompted prior to an initialization. After initialization has been completed, changing the switch position does not have any effect on the operation of the positioner.

Volume restriction Q

The volume restriction is used to adapt the air delivery to the actuator size. Two fixed settings are possible depending on how the air is routed at the actuator:

- For actuators smaller than 240 cm^2 with a loading pressure connection at the side (Type 3271-5), set restriction to MIN SIDE.
- For a connection at the back (Type 3277-5), set restriction to MIN BACK.
- For actuators 240 cm^2 and larger, set to MAX SIDE for a side connection and to MAX BACK for a connection at the back.

Displays

Symbols appear on the LC display that are assigned to parameters, codes, and functions.
The bar graph in the operating modes Manual and Automatic indicates the system deviation that depends on the sign (+/–) and the value. One bar graph element appears per 1 % system deviation.

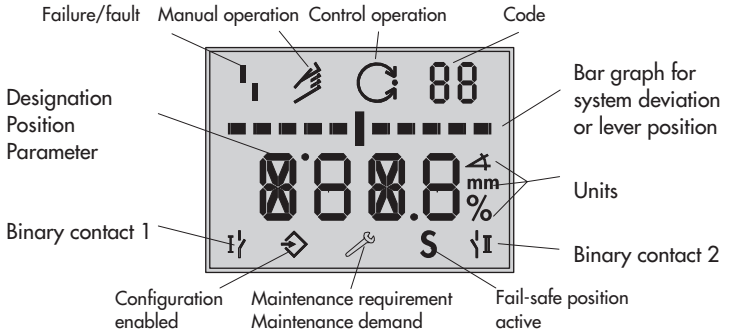
If the device has not yet been initialized (see section 4.3.1), the lever position in degrees in relation to the longitudinal axis is indicated instead of the system deviation. One bar graph element corresponds to approximately a 5° angle of rotation.

If the fifth element blinks (value displayed > 30°), the permissible angle of rotation has been exceeded. Lever and pin position must be checked.

Displays and their meaning

AUtO	Automatic mode	***NO***	Not available	***TunE***	Initialization in progress
CL	Clockwise	***NOM***	Nominal travel	***YES***	Available
CCL	Counterclockwise	***ON***	ON	***ZP***	Zero calibration
Err	Error	***OFF***	OFF	***tEStinG***	Test function active
ESC	Escape	***RES***	Reset	↗↗	Increasing/increasing
LOW	w too small	***RUN***	Start	↗↘	Increasing/decreasing
MAN	Manual mode	***SAFE***	Fail-safe position		
MAX	Maximum range	***SUb***	Substitute calibration		

Blinking Controlled operation
Blinking Not initialized



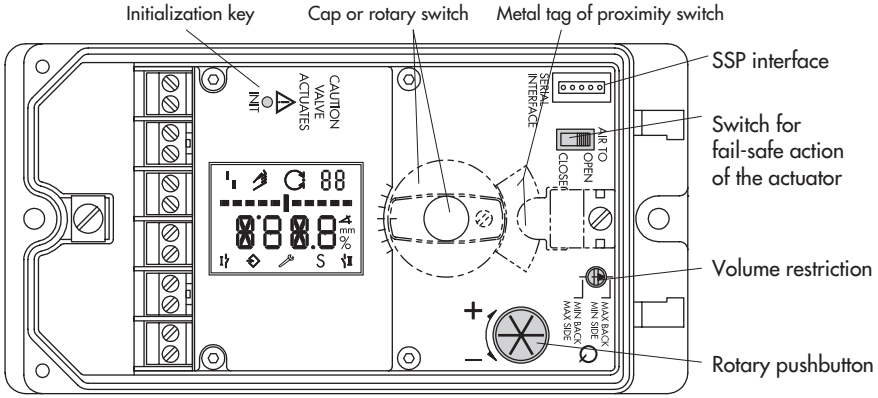
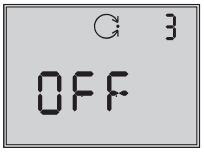


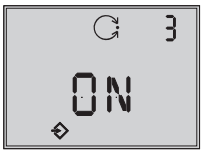
Fig. 12 · Display and operator controls

4.2 Enabling and selecting parameters

The codes which are marked with an asterisk (*) in section 12 on page 59 onwards must be enabled with Code 3 before the associated parameters can be configured as described below.



Code ***3***
Configuration
not enabled

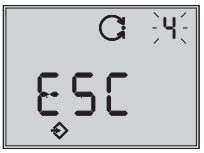


Configuration
enabled

- From the current display, turn the rotary pushbutton until Code **3** and OFF appear on the display.
  Confirm Code **3** by pressing the ⊛ button, the code number blinks.
- Turn ⊛ button until ***ON*** appears.
  Confirm setting by pressing the ⊛ button.

Configuration is enabled and is indicated by ⇨ symbol appearing on the display.
Now you can adjust the codes, parameters and values for the control valve in any desired order by turning the ⊛ button. Confirm settings by pressing the ⊛ button.

Note!
*To cancel a value that you have just entered under a code, turn the ⊛ button until **ESC** appears on the display and press to confirm.*



Canceling the setting

Note! *If no settings are entered within 120 seconds, the enabled configuration function becomes invalid and the display resets to Code **0**.*

The code list on page 59 onwards in section 12 shows all parameters that can be adjusted, including their description and their default settings.

Important!
After attaching the positioner to the valve as well as setting the fail-safe position and the volume restriction, it is sufficient for standard operation to press the initialization key in order to ensure optimum positioner operation (section 5.6 on page 39).
For this purpose, the positioner must be operated with its default values. If necessary, a reset must be carried out (section 5.9 on page 48).

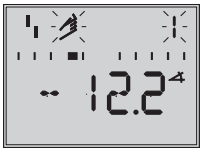
4.3 Operating modes

4.3.1 Automatic and manual operating modes

Prior to initialization:

If the positioner has not been initialized yet, the automatic operating ***AUtO*** cannot be selected.
The valve can only be positioned manually with the positioner.

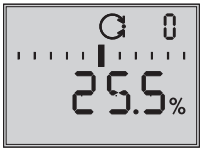
To proceed, turn ⊛ button clockwise until Code ***1*** appears, then confirm Code ***1*** by pressing the ⊛ button.



If both the code number and the hand symbol are blinking, the valve can be manually positioned by turning the ⊛ button.

After initialization:

After successful initialization in the ***MAX***, ***NOM*** or ***MAN*** mode (section 5.6.1), the positioner is in the automatic control operation mode ↻.

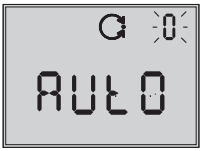


Default

Switching to manual operating mode

Over Code ***0***, press the ⊛ button, ***AUtO*** appears in the display, Code ***0*** blinks.

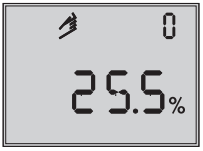
Turn ⊛ button until ***MAN*** appears.

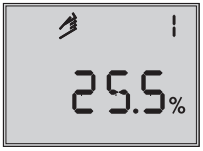


Press ⊛ button to switchover to the manual operating mode ☝.

The switchover is smooth since the manual operating mode starts up with the set point last used during automatic operating mode. The current position is displayed in %.

Adjusting the manual set point





Turn ⊛ button until Code ***1*** appears.

Press ⊛ button to confirm, Code ***1*** blinks.

While Code ***1*** is blinking, you can move the valve to the position required by turning the button. To proceed, turn the button until enough the positioner has built up enough pressure and the control valve starts to react. The positioner automatically returns to manual mode with Code ***0*** if the button is not activated within two minutes.
Switching from manual to automatic operating mode works in the same manner. First, you must reset the positioner over Code ***0*** to automatic mode ***AUtO*** and confirm this setting.

4.3.2 SAFE – Fail-safe position

If you want to move the valve to fail-safe position, proceed as follows:

Select Code ***0***, press the ⊛ button, ***AUtO*** or ***MAN*** appears on the display, Code ***0*** blinks.

Turn the ⊛ button until ***SAFE*** appears.

Press the ⊛ button to confirm this setting.

Caution!
The valve moves to the fail-safe position. Symbol ***S*** for the fail-safe position appears on the display.

Once the positioner is initialized, the current valve position is indicated on the digital display in %.

If you want to return the valve from the fail-safe position to the operating mode ***AUtO*** or ***MAN***, the ⊛ button must be pressed while Code ***0*** is active.

When the code number blinks, turn the ⊛ button to switch to the desired operating mode.
Press the ⊛ button to confirm.

5 Start-up and settings

Note!
A summary about start-up and operation can be found in section 8 on page 54. A leaflet including the same summary is also enclosed with the positioner.

- Connect pneumatic supply air (Supply 9), making sure the pressure is correct as described in section 3.1.
- For the electric power supply, route the two-wire bus line to the screw terminals marked "IEC 1158-2". No particular polarity is necessary.
- The voltage supply >19 V DC for version with a solenoid valve must be connected at terminals 81 (+) und 82 (–).

5.1 Determining the fail-safe position

To adapt the positioner to the operating direction of the actuator, set slide switch to AIR TO OPEN or AIR TO CLOSE .

AIR TO OPEN = Signal pressure opens the valve, for fail-safe position: actuator stem extends/valve closed
AIR TO CLOSE = Signal pressure closes the valve, for fail-safe position: actuator stem retracts/valve open.

The switch position is prompted prior to an initialization. After an initialization has been completed, changing the switch position does not have any effect on the operation of the positioner.

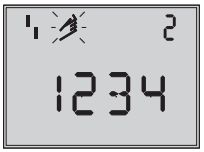
5.2 Setting the volume restriction Q

- For actuators smaller than 240 cm² with a loading pressure connection at the side (Type 3271-5), set restriction to MIN SIDE.
- For a connection at the back (Type 3277-5), set restriction to MIN BACK.
- For actuators 240 cm² and larger, set to MAX SIDE for a side connection and to MAX BACK for a connection at the back.

Note! *The positioner must re-initialized if the volume restriction setting is changed after the positioner has already been initialized.*

5.3 Adapting the display

The data representation on the positioner display can be turned by 180°.
If the displayed data appear upside down, proceed as follows:



Reading direction for right attachment of pneumatic connections

Reading direction for left attachment of pneumatic connections

Turn the ⊛ button until Code ***2*** appears, and press the ⊛ button to confirm Code ***2***, Code ***2*** blinks.

Turn ⊛ button until the display is adjusted to the desired direction, then confirm reading direction by pressing the ⊛ button.

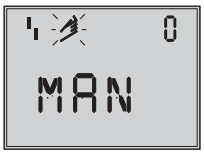
5.4 Limiting the signal pressure

If the maximum actuator force may cause damage to the valve, the signal pressure must be limited. Select Code ***3*** to enable configuration and then access Code ***16*** to set the pressure limit to 1.4, 2.4 or 3.7 bar.

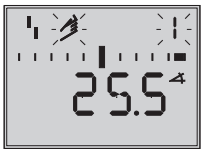
The required signal pressure limit is only automatically recognized on initialization when the fail-safe position AIR TO OPEN is set.

5.5 Checking the operating range of the positioner

To check the mechanical attachment and the proper functioning, the valve should be moved through the operating range of the positioner in the manual operating mode with the manual reference variable.



Code 0
Select
manual operation
Default ***MAN***



Code 1
Position valve using the rotary pushbutton, the current angle of rotation is indicated

1. Turn the ⊛ button until Code ***0*** appears, then confirm Code ***0*** by pressing the ⊛ button.

2. Turn the ⊛ button until ***MAN*** appears in the display, i.e. manual operating mode, confirm selected operating mode by pressing the ⊛ button.
3. Turn the ⊛ button until Code ***1*** appears, confirm Code ***1*** by pressing ⊛ button. The hand symbol and Code ***1*** blink.
4. Position control valve by turning the ⊛ button several times until pressure builds up, and the control valve moves to its final positions so that the travel/angle of rotation can be checked.
   The angle of rotation on the back of the positioner is indicated. A horizontal lever (mid position) is equal to 0°.
   The permissible range has been exceeded when the displayed angle is higher than 30°, and the outer right or left bar graph element blinks.
   If this is the case, it is absolutely necessary to check lever and pin position as described in section 2.

Note!
If the selected pin position is smaller than intended for the respective travel range and exceeds 30°, the positioner switches to the ***SAFE*** *mode, the valve moves to the fail-safe position (see section 4.3.2 on page 36).*

---

5. Initialize positioner as described in section 5.6.

5.6 Initialization

During initialization the positioner adapts itself optimally to the friction conditions and the signal pressure demand of the control valve.
The type and extent of self-adaptation depends on the set initialization mode (see section 5.6.1).
MAX is the default setting for initialization based on the maximum nominal range.

If configuration is enabled via Code ***3***, Code ***6*** can be used to change to other initialization modes.

If the positioner has been initialized once already, it will automatically go to the operating mode used last after the electrical reference variable is applied, Code ***0*** appears on the display.
If the positioner has not yet been initialized, the symbol appears on the display and the symbol starts to blink.

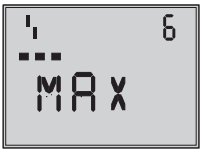
Note!
Every time you re-initialize the positioner, it should be reset to its basic setting including the default values. Refer to section 5.9 on page 48.

▶ **Start the initialization process by pressing the INIT key with a suitable tool.**

The time required for an initialization process depends on the transit time of the actuator and take several minutes.
Positioners with EXPERT+ diagnostic functions start plotting the reference graphs after the initialization process has been completed. See note at the end of this section.

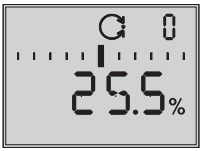
Warning!
During the initialization, the control valve moves through its entire travel/angle of rotation range. Therefore, do not start initialization while a process is running, but only during start-up, when all shut-off valves are closed.

Note!
*The initialization procedure can be interrupted while running by pressing . **StOP** appears three seconds long and the positioner then moves to the fail-safe position.*
*The fail-safe position can be canceled again over Code **0**.*



Alternating displays
Initialization running
Symbol depending on initialization mode selected

Bar graph display indicating the progress of the initialization



Initialization successful, positioner in automatic operating mode

After a successful initialization, the positioner runs in control operation indicated by the control symbol.

The control position in % predetermined by the reference variable appears on the display.

A malfunctioning leads to the process being interrupted. The initialization error appears on the display according to how it has been classified by the condensed status. See section 5.7 on page 47.

If the slide switch is set to AIR TO CLOSE, the positioner automatically switches to the direction of action increasing/decreasing (↗↘) on successful completion of initialization. This results in the following assignment between reference variable and valve position:

Fail-safe position	Direction of action	Valve Closed at	Open at
Actuator stem extends FA AIR TO OPEN	↗↗	0 %	100 %
Actuator stem retracts FE AIR TO CLOSE	↗↘	100 %	0 %

The tight-closing function is activated.
Set Code ***15*** (final position w>) to 99 % for three-way valves.
Further settings relevant for the valve can be entered subsequently.

Note on EXPERT+:
Positioner with integrated EXPERT+ diagnostics automatically start to plot the reference graphs (control signal Y d1 and hysteresis d2) after initialization has been completed. TEST d1 and d2 appear on the display in an alternating sequence.
An unsuccessful plotting of the reference graphs are indicated on the display by Code 81 (see error code list).

After the initialization has been successfully completed, the positioner still works properly, even though the reference graph plotting has not been completed successfully. The plotting of the reference graphs can be interrupted by pressing ⊛.
The reference graphs are required for the extended diagnostic functions of EXPERT+.

5.6.1 Initialization modes

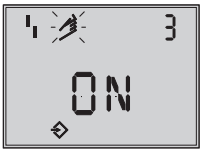
After enabling configuration with Code ***3*** and accessing Code ***6***, you can choose one of the initialization modes ***MAX***, ***NOM***, ***MAN*** or ***SUb*** to start initialization.
ZP, the zero calibration is described in section 5.8 on page 48.

MAX – Initialization based on maximum range

Initialization mode for simplified start-up for valves with two clearly defined mechanical travel stops, e.g. three-way valves.

The positioner determines travel/angle of rotation of the closing member from the CLOSED position to the opposite side and adopts this travel/angle of rotation as the operating range from 0 to 100 %.

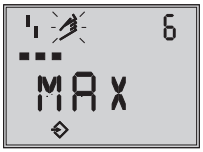
Enable configuration:



Default ***OFF***

Turn ⊛ →Code ***3***, press ⊛,
turn ⊛ → ***ON***, press ⊛.

After enabling:



Default ***MAX***

Turn ⊛ →Code ***6***, press ⊛,

turn ⊛ →***MAX***, press ⊛.

▶ **Press INIT key to start initialization!**

The initialization procedure may take several minutes, depending on the actuator size, as the valve moves through its entire travel/angle of rotation range.

Positioners with EXPERT+ diagnostic functions automatically start plotting the reference graphs after the initialization process has been completed. See page 40.

Note!
*For this **MAX** initialization, the positioner cannot indicate the nominal travel/angle of rotation in mm/° at first, Code **5** remains disabled. In addition, the lower (Code **8**) and the upper (Code **9**) x-range value can only be displayed in % and modified .*

If you want the display to indicate mm/°, proceed as follows after configuration has been enabled:

Turn ⊛ →Code ***4***, press ⊛,

turn ⊛ →Select pin position determined on attachment, press ⊛.

If you now switch to Code ***5***, the nominal range appears in mm/°.
The lower and upper x-range values for Code ***8*** and ***9*** are displayed in mm/° and can be adapted accordingly.

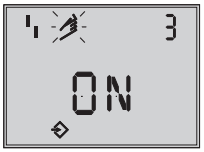
NOM – Initialization based on nominal range

Initialization mode for globe valves, especially for valves with maximum ranges that are clearly greater than the required nominal range.
For this initialization mode, the following parameters must be entered: pin position (Code ***4***) and nominal travel/angle (Code ***5***).

The calibrated sensor enables the effective valve travel to be preset very accurately. During the initialization procedure, the positioner checks whether the control valve can move through the indicated nominal range (travel or angle) without collision. In case of a positive result, the indicated nominal range is adopted with the limits of lower x-range and upper x-range values as the operating range.

Note!
*The maximum possible travel must always be greater than the nominal travel entered. If this is not the case, the initialization is interrupted (error indication Code **52**) because the nominal travel is not achieved.*

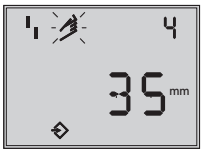
Enable configuration:



Default ***OFF***

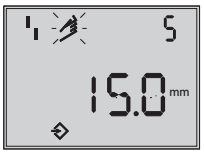
Turn ⊛ →Code ***3***, press ⊛,
turn ⊛ →***ON***, press ⊛.

After enabling:



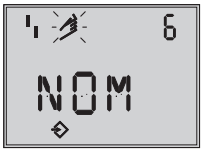
Default ***OFF***

Turn ⊛ →Code ***4***, press ⊛,
press ⊛ →Select pin position determined on attachment,
press ⊛.



Default ***15***

Turn ⊛ → Code ***5***, press ⊛,
turn ⊛ →Enter nominal travel/angle,
press ⊛.



Default ***MAX***

Turn ⊛ →Code ***6***, press ⊛,
turn ⊛ →***NOM***, press ⊛.

Press INIT key to start initialization!

The initialization procedure may take several minutes, depending on the actuator size, as the valve moves through its entire travel/angle of rotation range.

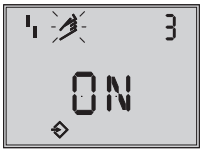
Positioners with EXPERT+ diagnostic functions automatically start plotting the reference graphs after the initialization process has been completed. See page 40.

Check the direction of action and, if necessary, set over Code ***7***.

MAN – Initialization based on a manually selected range

(with default upper x-range value by means of manual adjustment).
Initialization mode just as ***NOM***, however, for starting up valves with unknown nominal range.
In this mode, the positioner expects the control valve to be moved manually to the desired OPEN position prior to enabling the initialization procedure.
The upper range travel/angle of rotation value is adjusted using the rotary pushbutton. The positioner uses this OPEN position and the CLOSED position to calculate the differential travel/angle and accepts it as the operating range with the lower x-range value and upper x-range value being the limits.

Enable configuration:



Default ***OFF***

Turn ⊛ →Code ***3***, press ⊛,

turn ⊛ →***ON***, press ⊛.

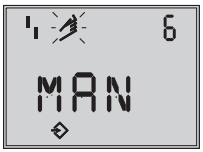
After enabling:

Turn ⊛ →Code ***4***, press ⊛,

turn ⊛ →Select pin position determined on attachment, press ⊛.

Turn ⊛ →Code ***6*** , press ⊛,

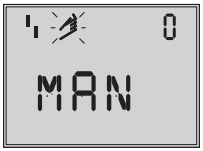
turn ⊛ →***MAN***, press ⊛.



Default ***MAX***

Turn ⊛ →Code ***0***, press ⊛,

turn ⊛ →***MAN***, press ⊛.



Default ***MAN***

Turn ⊛ →Code ***1***, press ⊛,
Code 1 blinks.

Turn ⊛ until the valve reaches its OPEN position, press ⊛.

Press INIT key to start initialization!

The initialization procedure may take several minutes, depending on the actuator size, as the valve moves through its entire travel/angle of rotation range.

Positioners with EXPERT+ diagnostic functions automatically start plotting the reference graphs after the initialization process has been completed. See page 40.

SUb
(substitute configuration, without initialization)

A complete initialization procedure takes several minutes and requires the valve to move through its entire travel range several times. In the event a positioner must be replaced while the plant is running, this mode allows the replacement to be performed with the minimum amount of disruption to the plant.

This initialization mode is an emergency mode. The positioner parameters are estimated and not determined by an initialization procedure, so that a high stationary accuracy cannot be expected.
You should always select a different initialization mode if the plant allows it.

The initialization mode ***SUb*** is used to replace a positioner while the process is in operation. For this purpose, the control valve is

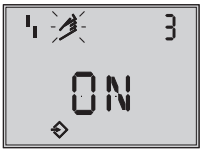
usually fixed mechanically in a certain position, or pneumatically by means of a pressure signal which is routed to the actuator externally. The blocking position ensures that the plant continues to operate with this valve position.

The spare positioner should not be initialized. If necessary, reset the spare positioner using Code ***36***.

After the old positioner has been replaced with a new one, the following parameters must be entered: pin position (Code ***4***), nominal range (Code ***5***), direction of action (Code ***7***) and closing direction (Code ***34***). The default travel limit of 100 % (Code ***11***) must be disabled with ***OFF***.
In addition, the blocking position (Code ***35***) must be adjusted with the ⊛ button so that it matches the position of the previously blocked valve.

The parameters KP (Code ***17***), TV (Code ***18***) and the pressure limit (Code ***16***) should remain set to their default values. If the configuration data of the new positioner are known, it is recommended to accept its KP and TV values.
After setting the AIR TO OPEN/CLOSE switch for the fail-safe position, setting the volume restriction and pressing the INIT key, the positioner calculates its configuration data on the basis of the blocking position and the closing direction as well as the other entered data.
The positioner switches to manual operation, subsequently the blocking position should be canceled as described on page 46.

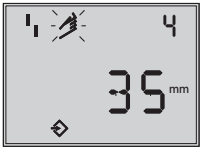
Enable configuration:



Default ***OFF***

Turn ⊛ →Code ***3***, press ⊛,
turn ⊛ →***ON***, press ⊛.

After enabling:

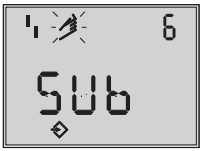


Default ***OFF***

Turn ⊛ →Code ***4***, press ⊛,
press ⊛ →Select pin position determined on attachment,
press ⊛.

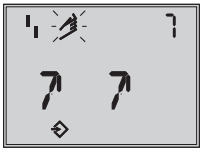
Default ***15***

Turn ⊛ → Code ***5***, press ⊛,
turn ⊛ →Enter nominal travel/angle,
press ⊛.



Default ***MAX***

Turn ⊛ →Code ***6***, press ⊛,
turn ⊛ →***SUb***, press ⊛.

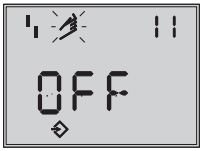


Default ↗↗

Turn ⊛ →Code ***7***, press ⊛,

turn ⊛ →Retain direction of action ↗↗ or select ↗↘.

Press ⊛.

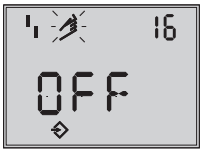


Default ***100.0***

Turn ⊛ →Code ***11***, press ⊛,

turn ⊛ →Deactivate travel limit,

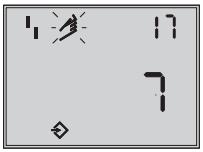
press ⊛.



Default ***OFF***

Turn ⊛ →Code ***16***,

Retain default value for pressure limit, change value only if necessary.



Default ***7***

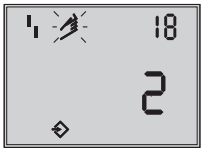
Turn ⊛ →Code ***17***

Retain default. Proceed as follows only if known:

Press ⊛,

turn ⊛ →Select K_P,

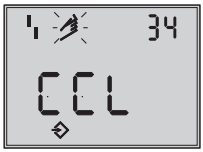
press ⊛.



Default ***2***

Turn ⊛ →Code ***18***,

Retain default T_V, change only if known.



Default ***CCL***

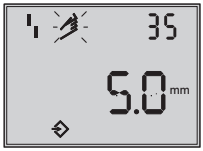
Turn ⊛ →Code ***34***, press ⊛,

turn ⊛ →Select closing direction.

CCL = counterclockwise and ***CL*** = clockwise.

Direction of rotation which causes the valve to move to the CLOSED position (view onto the rotary switch movement while positioner cover is open).

Press ⊛.



Default ***0.0***

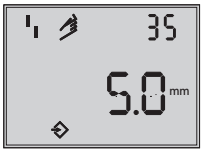
Turn ⊛ →Code ***35***, press ⊛,

turn ⊛ →Enter blocking position, e.g. 5 mm (read off at travel indicator scale of the blocked valve or measure with a ruler).

Press ⊛.

- Set switch for **fail-safe position** AIR TO OPEN or AIR TO CLOSE as described in section 5.1 on page 36.
- Set volume restriction as described in section 5.2 on page 37.
- **Press INIT key!**

The positioner switches to manual operating mode!



The adjusted blocking position is indicated

As initialization has not been carried out completely, the error code ***76*** (no emergency mode) and possibly also error code ***57*** may appear on the display.
These alarms do not influence the positioner's readiness for operation.

Canceling the blocking position

For the positioner to follow its reference variable again, the blocking position must be canceled and the positioner must be set to automatic operation ***AUtO*** as follows:

Press ⊛ →Code ***1***, press ⊛,

turn ⊛ in order to move the valve slightly past the blocking position, then cancel mechanical blocking.

Press ⊛.

Turn ⊛ →Code ***0***, press ⊛,
Code ***0*** blinks.

Turn ⊛ until ***AUtO*** appears on the display.

Press ⊛ to confirm the operating mode.

The positioner switches to automatic operating mode!

The current valve position is indicated in %.

Note!
If the positioner shows a tendency to oscillate in automatic operating mode, the parameters K_P and T_V must be slightly corrected. Proceed as follows:
*Set T_V to 4 (Code **18**).*
*If the positioner still oscillates, the gain K_P (Code **17**) must be decreased until the positioner shows a stable behavior.*

Zero point correction

Finally, if process operations allow it, the zero point must be adjusted according to section 5.8 on page 48.

Caution!
The positioner automatically moves to zero point.

5.7 Fault/failure

All status and fault alarms are assigned a classified status in the positioner.

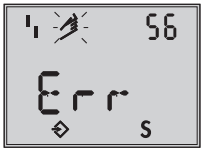
To provide a better overview, the classified alarms are summarized in a condensed status for the positioner (see section 6).

The condensed status appears on the display with the following symbols:

Condensed status	Display
Maintenance alarm	
Maintenance required/ Maintenance requested	
Function check	Text
No alarm	

If the positioner has not been initialized, the fault symbol appears on the display as the positioner cannot follows its reference variable.

To access the error codes, turn the button past the Code ***50***.
Err appears on the display with the respective error code.
For the cause of the fault and its remedy, refer to the codes listed on page 59 onwards.



Display indicating an error code

After an error code has occurred, you should first try to confirm it as follows:

Enable configuration:

Turn → Code ***3*** , press ,

turn → ***ON***, press .

Turn until the error code number appears, then press to confirm it.

Should the error occur again, read the remedy instructions in the error code list.

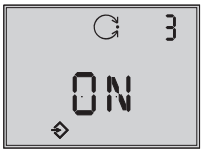
Occurrences such as when the total valve travel is exceeded or when the temperature leaves the permissible temperature range affect the condensed state and cause a fault alarm to be displayed depending on its classification.

The optional EXPERT+ diagnostics generates additional diagnostic alarms which are included in the condensed status with their corresponding status classification.
When a diagnostic alarm is issued by EXPERT+, this is displayed by Code 79 (see error code list).

5.8 Zero calibration

In case of discrepancies with the closing position of the valve, e.g. with soft-sealed plugs, it may become necessary to recalibrate the zero point.

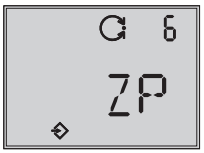
Enable configuration:



Default ***OFF***

Turn ⊛ →Code **3**, press ⊛,
turn ⊛ →***ON***, press ⊛.

After enabling:



Default ***MAX***

Turn ⊛ → Code ***6***, press ⊛,
turn ⊛ →***ZP***, press ⊛.

▶ **Press INIT key!**

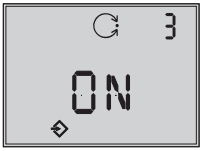
Zero calibration is started, the positioner moves the control valve to the CLOSED position and readjusts the internal electrical zero point.

⚠ *The valve briefly moves from the current travel/angle of rotation position to the closed position.*

5.9 Reset to default values

This function resets all parameters to the factory default values (see code list in section 12).

Enable configuration:



Default ***OFF***

Turn ⊛ →Code ***3***, press ⊛,
turn ⊛ →***ON***, press ⊛.

After enabling:

Default ***OFF***

Turn ⊛ →Code ***36***, press ⊛,
turn ⊛ →***RUN***, press ⊛.

All parameters are reset and can be reconfigured.

5.10 Start-up via local interface (SSP)

The positioner can either be commissioned, configured, and operated on site, using the Fieldbus configuration or operating system, or TROVIS-VIEW operator interface connected over the serial interface in the positioner.

Use the TROVIS-VIEW software with 3730-5 device module installed.

To connect the positioner directly to the PC via the local serial interface, an adapter (order no. 1400-7700) is required.

The positioner can be supplied with power by connecting it to a fieldbus segment or over a DC voltage source (9 to 32 V) connected to the bus terminals in the positioner. The simultaneous operation of TROVIS-VIEW and the fieldbus system is possible without any restrictions when connected to a FOUNDATION Fieldbus bus segment.

6 Status and diagnostic alarms

The Type 3730-5 Positioner contains integrated diagnostics to generate classified status and diagnostic alarms.

There are two different types of on-board diagnostics available: the standard integrated diagnostics (EXPERT) and the optional extended EXPERT+ diagnostics.

Due to the numerous diagnostic functions provided, the positioner generates classified status alarms and diagnostic alarms.

6.1 Standard EXPERT diagnostics

The standard EXPERT diagnostics provides information about positioner states such as operating hours counter, process monitoring, number of zero calibrations and initializations, total valve travel, temperature, initialization diagnostics, zero/control loop errors, logging of the last 30 alarms, etc.

In addition, the standard EXPERT diagnostics generates diagnostic and status alarms which allow faults to be pinpointed quickly when a fault occurs.

In addition to the alarms being displayed on the positioner display, the classified alarms are also available over the device description (DD).

Alarms are classified in the following main groups:

- Status
- Operation
- Hardware
- Initialization

- Data memory
- Temperature

6.2 Extended EXPERT+ diagnostics

In addition to the standard EXPERT diagnostic features, the optional EXPERT+ extended diagnostics provides the following online and offline test functions which enable significant statements on the condition of the entire control valve.

Online test functions (monitoring functions)

- Data logger
- Histograms
- Cycle counter
- Valve end position trend
- Y = f (X) diagram (control signal)
- Hysteresis test

Offline test functions (manual functions)

- Y = f (X) diagram over the entire valve travel range
- Hysteresis test over the entire valve travel range
- Static characteristic
- Step response test

The diagnostic tests are completely integrated in the positioner. The DD allows parameters to be entered and test results to be read out. The graph format depends on the control system used.
Further status alarms are generated from the extensive information gained in the diagnostic tests of EXPERT+ which provide the user with information covering the whole control valve.
The required reference curves are automatically plotted after initialization and saved in the positioner if EXPERT+ is activated.
The optional diagnostic functions provided by EXPERT+ can be selected when ordering the positioner. Additionally, it is possible to activate EXPERT+ at a later point in time in an existing positioner.
For this purpose, an activation code can be ordered, specifying the serial number of the positioner.

6.3 Classification of the status alarms and the condensed status

The alarms are classified in the positioner, i.e. when an alarm is issued, it is assigned a status. The classification of the states can be altered.
To provide a better overview, the positioner state is summarized in a condensed state. This CONDENSED_STATE is made up from a summary of all classified status alarms issued by the positioner and is available in the RESOURCE_BLOCK.
In addition, the CONDENSED_STATE also appears on the display of the positioner.
The status of the individual alarms can be assigned as required in the ERROR_OPTS parameter. The following states can be selected:

- **No message**
  When this classification is active, it does not have any affect on the condensed status.

- **Maintenance alarm**
  The positioner cannot perform its control task due to a functional fault in the device or in one of its peripherals or an initialization has not yet been successfully completed.
- **Maintenance required**
  The positioner still performs its control task (with restrictions). A maintenance demand or above average wear has been determined. The wear tolerance will soon be exhausted or is reducing at a faster rate than expected. Maintenance is necessary in the medium term.
- **Maintenance requested**
  The positioner still performs its control task (with restrictions). A maintenance demand or above average wear has been determined. The wear tolerance will soon be exhausted or is reducing at a faster rate than expected. Maintenance is necessary in the short term.
- **Function check**
  Test or calibration procedures are being performed. The positioner is temporarily unable to perform its control task until this procedure is completed.

The table below containing the CONDENSED_STATE is reached from the summary of active alarms.

In addition to the condensed status, the block error alarms from the RESOURCE_BLOCK and TRANSDUCER_BLOCK can also be assigned to the events.
In this case, the individual alarms must be classified in the ERROR_OPTS parameter with another status for block errors.
The following classifications are possible:

- No message
- Maintenance soon
- Maintenance now

The block error results from the summary of classified alarms that are active.

Condensed status	Positioner display
No message	
Maintenance required	
Maintenance requested	
Maintenance alarm	
Function check	Text

Logging and displaying diagnostic functions/alarms

The last 30 alarms are logged in the positioner. An alarm that is repeated is only logged when it first occurs.

The alarms and the CONDENSED_STATE appear on the display as described in the code list (section 12). In addition, the diagnostic parameters are available over the DD.

The diagnostic functions can easily be displayed and configured using the TROVIS-VIEW software connected over the local interface (SSP).

7 Adjusting the limit switch

The positioner version with an inductive limit switch has one adjustable tag (1) mounted on the shaft which operates the proximity switch (3).

For operation of the inductive limit switch, the corresponding switching amplifier (see section 3.2.1) must be connected to the output.

If the tag (1) is inside the field of the switch, the switch assumes a high resistance. If the tag is outside of the field, the switch assumes a low resistance.

Normally, the limit switch is adjusted such that it will provide a signal in both end positions of the valve. The switch, however, can also be adjusted to indicate intermediate valve positions.

The desired switching function, i.e. whether the output relay shall be picked up or released when the tag has entered the field, has to be determined, if necessary, at the switching amplifier.

Setting the switching point:

Important!
During adjustment or testing, the switching point must always be approached from mid-position (50 %).

To ensure safe switching under any ambient conditions, the switching point should be adjusted to a value of approx. 5 % before the mechanical stop (OPEN – CLOSED).

For CLOSED position:

1. Initialize positioner.
2. Use the ***MAN*** function to move the positioner to 5 % (see LC display).
3. Adjust the tag using the yellow adjustment screw (2) until the tag enters or leaves the field and the switching amplifier responds. You can measure the switching voltage as an indicator.

Contact function:
Tag leaving the field > contact is made.
Tag entering the field > contact is opened.

For OPEN position:

1. Initialize positioner.
2. Use the ***MAN*** function to move the positioner to 95 % (see LC display).
3. Adjust the tag (1) using the yellow adjustment screw (2) until the tag enters or leaves the field of the proximity switch (3).
   You can measure the switching voltage as an indicator.

Contact function:

Tag leaving the field > Contact is made.
Tag entering the field > Contact is opened.

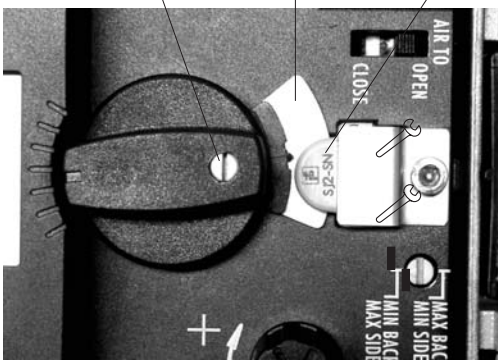


Fig. 13 · Adjustment of the limit switch

8 Quick start-up guide

8.1 Mounting

Direct attachment

to SAMSON Type 3277 Actuator

Travel mm	Actuator cm²	Pin position
7.5	120	25
15	120/240/350	35
15/30	700	50

Note!
Standard delivery includes lever M ready assembled with the follower pin on 35 mm pin position for 15 mm travel!

To mount the positioner, lift the lever so that the follower pin rests on the follower clamp of the actuator stem.

NAMUR attachment

- Determine the maximum travel range of the control valve from the closed position to as far it will go in the other direction.
- Select the lever to match the maximum travel range as well the next largest pin position and screw onto the shaft of the positioner.
- Lever option/pin distance:
  see pin position table (Code 4) or cover plate on the positioner.
- Screw the NAMUR bracket onto the valve yoke so that it is aligned centrally to the slot of the follower plate when the travel position is at 50 %.
- Secure the positioner to the NAMUR bracket, making sure that the follower pin is in the slot of the follower plate.
  Make sure the lever can still move.

Attachment to rotary actuators

- Lever M pin position 90°
- Put the valve into the closed position, determine the opening direction.
- Place the follower plate on the slotted actuator shaft and fasten it to the coupling wheel. Attach the top pair of brackets and the bottom pair of brackets to the actuator.
- Place the positioner on the brackets and screw tight, making sure that the lever with its follower pin engages the slot of the coupling wheel, while taking into account the opening direction.
  It is important to make sure that the lever's mid position corresponds to the mid travel of the valve (lever's mid position = the lever is parallel to the long side of the positioner casing).

Pneumatic connections

- Screw the threaded connections only into the attached connection block, connecting plate or pressure gauge block from the accessories.

8.2 Start-up

- Connect pneumatic supply air (1.4 to 6 bar).
- Route the two-wire bus line to the screw terminals marked " IEC 1158-2", the polarity does not need to be observed.

Set the fail-safe position

Position the slide switch according to fail-safe position of the control valve:
AIR TO OPEN or AIR TO CLOSE.

Adapt the volume restriction Q to the actuator size

Only set the restriction for actuators < 240 cm^2 to:
MIN SIDE for connection at the side or
MIN BACK for connection at the back.

Note!
After each change of the volume restriction setting, the positioner must be re-initialized.

Changing the reading direction of the display

(if necessary)

Turn ⊛ →Code ***2***, press ⊛,

turn ⊛ →Display ok, press ⊛.

Operation

Selecting the parameters or values

Each parameter has a code number which is shown in the display. Use the button to select.
Turn the ⊛ button to select parameters or values and then **push** to confirm.

Select and confirm ***ESC*** to prevent an entered value from being accepted.

Enabling parameters

Parameters that have a code marked with an asterisk (*) can only be changed when they are enabled beforehand using Code ***3***.

The configuration mode is shown in the display with the ⇨ symbol.

See the code list on page 59 onwards or cover plate of the positioner for a description of the menu codes.

8.3 Initialization

Important!
*Perform a reset (Code **36**) prior to each initialization*

Turn ⊛ →Code ***3***, ↵

turn ⊛ →ON, ↵

turn ⊛ →Code ***36***, ↵

select ***RUN***, ↵

Caution!
During initialization, the valve runs through its whole range of travel/angle of rotation.

8.3.1 Simplest method (*MAX*)

*Mount and start up the positioner and press the **INIT key**!*
READY!
The positioner adapts itself automatically to the maximum travel/angle of rotation range of the control valve.

8.3.2 Precise method (*NOM*)

Positioner adapts itself precisely to the nominal travel/rotational angle of the control valve!

Mount and start up the positioner, then proceed as follows:

Turn →Code ***3***, ↵

turn →***ON***, ↵

turn →Code ***4***, ↵
Select pin position, ↵

turn →Code ***5***, ↵

Enter nominal travel/range, ↵

turn →Code ***6***, ↵

select ***NOM***, ↵

Press **INIT key!**

8.3.3 Manual method (MAN)

Initialization mode same as ***NOM***, but for start-up of control valves with unknown nominal ranges. The final position of travel/angle of rotation (valve open) is entered manually.

Mount and start up the positioner, then proceed as follows:

Turn →Code ***0***, ↵,

turn →select ***MAN***, ↵

turn →Code ***1***, ↵,

turn →valve **open** position, ↵

turn →Code **3**, ↵,

turn →***ON***, ↵

turn →Code ***6***, ↵, select ***MAN***, ↵

Press **INIT key!**

Note!
*After imposing the electrical reference variable, the positioner is in the last used operating mode. Code **0** appears in the display. If the positioner has not yet been initialized, the fault symbol appears on the display and the symbol blinks.*

9 Retrofitting an inductive limit switch

Required retrofit kit:
Limit switch Order no. 1400-7460

1. Take off the rotary pushbutton (3) and cap (1), unthread the five fixing screws (2) and lift off the plastic cover (9).
2. Use a knife to cut an opening at the marked location (4).
3. Push the connector (11) with cable through the opening and secure the proximity switch (7) on the cover with a dot of glue.
4. Remove the jumper at the socket ST1 of the top board and insert the cable connector (11).
5. Guide the cable in such a manner that the plastic cover can be placed back onto the positioner. Insert the fixing screws (2) and screw tight. Attach the clamping plate (8) onto the proximity switch.
6. Attach the rotary switch (5). Make sure the flattened side of the positioner shaft is turned so that the rotary switch (5) can be attached with the metal tag next to the proximity switch.
7. **Important!**
   On start-up of the positioner, set the option "inductive alarm" under Code ***38*** from ***NO*** to ***YES***.

1	Cap	6	Metal tag
2	Screws	7	Proximity switch
3	Rotary pushbutton	8	Clamping plate
4	Marking	9	Plastic cover
5	Rotary switch		

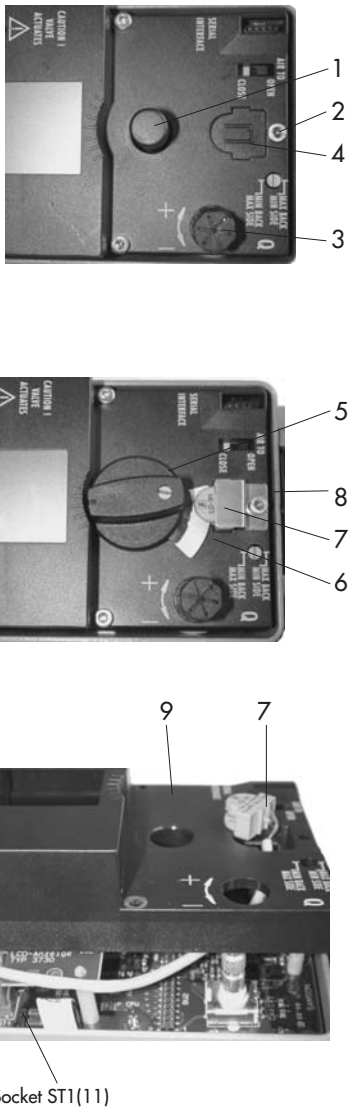


Fig. 14 · Retrofitting an inductive limit switch

10 Maintenance

The positioner does not require any maintenance.

There are filters with a 100 µm mesh size in the pneumatic connections for supply and output which can be removed and cleaned, if required.

The maintenance instructions of any upstream supply air pressure reducing stations must be observed.

11 Servicing explosion-protected devices

If a part of the positioner on which the explosion protection is based needs to be serviced, the positioner must not be put back into operation until an expert has inspected the device according to explosion protection requirements, has issued a certificate stating this or given the device a mark of conformity.

Inspection by an expert is not required if the manufacturer performs a routine test on the device prior to putting it back into operation. The passing of the routine test must be documented by attaching a mark of conformity to the device.

Explosion-protected components may only be replaced by original, checked components from the manufacturer.

Devices that have already been used outside of hazardous areas and are intended for use in hazardous areas in future must comply with the safety demands placed on repaired devices. Prior to operation, they must be tested according to the specifications stipulated for "Repairing explosion-protected devices".

12 Code list

Code no.	**Parameter** – Display, values [default setting]	Description
Important! Codes with marked with an asterisk (*) must be enabled with Code 3 prior to configuration.		
0	**Operating mode** [MAN] AUtO SAFE ESC	AUtO = Automatic mode MAN = Manual mode SAFE = Fail-safe position ESC = Escape Switchover from automatic to manual mode is smooth. In fail-safe mode, the symbol **S** appears on the display. In MAN and AUtO mode, the system deviation is represented by the bar graph elements. When the positioner is initialized, the numerical display indicates the valve position or the angle of rotation in %, otherwise the position of the sensor in relation to the central axis is displayed in degrees °.
1	**Manual w** 0 to 100 [0] % of the nominal range	Adjust the manual set point with the rotary pushbutton, the current travel/angle is displayed in % when the positioner is initialized, otherwise the sensor position in relation to the central axis is indicated in degrees °.
2	**Reading direction** Normal or upside down ESC	The reading direction of the display is turned by 180°.
3	**Enable configuration** [OFF] ON ESC	Enables the option to modify data (automatically deactivated when the rotary pushbutton has not been operated for 120 s.) ***FF*** blinks on the display when the on-site operation is locked. Codes marked with an asterisk (*) can only be read and not overwritten. Likewise, codes can only read over the SSP interface.

<table>
<tr><td>4*</td><td>Pin position
[OFF]
17, 25, 35, 50 mm
70, 100, 200 mm,
90° with rotary actuators
ESC

Note!
If you select a pin position in Code 4 that is too small, the positioner switches to SAFE mode for reasons of safety</td><td>For initialization using NOM or SUb, the follower pin must be inserted into the correct pin position according to the valve travel/angle of rotation.
<table><tr><th>Pin position
Code 4</th><th>Standard
Code 5</th><th>Adjustment range
Code 5</th></tr><tr><td>17</td><td>7.5</td><td>3.6 to 17.7</td></tr><tr><td>25</td><td>7.5</td><td>5.0 to 25.0</td></tr><tr><td>35</td><td>15.0</td><td>7.0 to 35.4</td></tr><tr><td>50</td><td>30.0</td><td>10.0 to 50.0</td></tr><tr><td>70</td><td>40.0</td><td>14.0 to 70.7</td></tr><tr><td>100</td><td>60.0</td><td>20.0 to 100.0</td></tr><tr><td>200</td><td>120.0</td><td>40.0 to 200.0</td></tr><tr><td>90°</td><td>90.0</td><td>24.0 to 110.0</td></tr></table></td></tr>
<tr><td>5*</td><td>Nominal range
mm or angle °
ESC</td><td>For initialization using NOM or SUb, the nominal travel/angle of rotation of the valve must be entered.
The permissible adjustment range depends on the pin position according to the table.
After initialization has been successfully completed, the maximum nominal travel/angle reached on initialization is displayed.</td></tr>
<tr><td>6*</td><td>Init mode
[MAX]
NOM
MAN
Sub
ZP
ESC</td><td>Select the initialization mode
MAX: Maximum range of the control valve, the travel/angle of the closure member from the CLOSED position to the opposite stop in the actuator.
NOM: Nominal range of the control valve, the travel/angle of the closure member measured from the CLOSED position to the indicated OPEN position.
MAN: Manual adjustment: upper x-range value
SUb: No self-adjustment (emergency mode)
ZP: Zero calibration</td></tr>
<tr><td>7*</td><td>w/x
[↗↗]
↗↘
ESC</td><td>Direction of action of the reference variable w in relation to the travel/angle of rotation x (increasing/increasing or increasing/decreasing)

Automatic adaptation:
AIR TO OPEN:
On completing initialization, the direction of action remains increasing/increasing (↗↗), a globe valve opens as the mA signal increases.

AIR TO CLOSE:
On completing initialization, the direction of action changes to increasing/decreasing (↗↘), a globe valve closes as the mA signal increases.</td></tr>
</table>

8*	**Lower x-range value** 0.0 to 80.0 [0.0] % of the nominal range, Specified in mm or angle ° provided Code 4 is set ESC	Lower range value for the travel/angle of rotation in the nominal or operating range. The **operating range** is the actual travel/angle of the control valve and is limited by the lower x-range value (Code 8) and the upper x-range value (Code 9). Usually, the operating range and the nominal range are identical. The nominal range can be limited to the operating range by the lower and upper x-range values. Value is displayed or must be entered. The characteristic is adapted. See also the example in Code 9!
9*	**Upper x-range value** 20.0 to 100.0 [100.0] % nominal range, Specified in mm or angle ° provided Code 4 is set ESC	Upper range value for the travel/angle of rotation in the nominal or operating range. Value is displayed or must be entered. The characteristic is adapted. Example: The operating range is modified, for example, to limit the range of a control valve which has been sized too large. For this function, the entire resolution range of the reference variable is converted to the new limits. 0 % on the display corresponds to the set lower limit and 100 % to the set upper limit.
10*	**Lower x-limit** [OFF] 0.0 to 49.9 % of the operating range ESC	Limitation of the travel/angle of rotation downwards to the entered value, the characteristic is not adapted. The characteristic is not adapted to the reduced range. See also example in Code 11.
11*	**Upper x-limit** [100 %] 50.0 to 120.0 [100] % of the operating range or OFF ESC	Limitation of the travel/angle of rotation upwards to the entered value, the characteristic is not adapted. Example: In some applications, it makes sense to limit the valve travel, e.g. if a certain minimum medium flow is required or a maximum flow must not be reached. The lower limit must be adjusted with Code 10, and the upper limit with Code 11. If a tight-closing function has been set up, it has priority over the travel limitation! When set to OFF, the valve can be opened past the nominal travel with a reference variable outside of the 0 to 100 % range.

14*	**Final position w <** 0.0 to [1.0] % of the span adjusted via Code 12/13 OFF ESC	If w approaches the percentage adjusted at the final value that causes the valve to close, the actuator is immediately completely vented (with AIR TO OPEN) or filled with air (with AIR TO CLOSE). This action always lead to maximum tight-closing of the valve. Codes 14/15 have priority over Codes 8/9/10/11.
15*	**Final position w >** [OFF] 50.0 to 100.0 % of the span adjusted via Code 12/13 ESC	If w approaches the percentage adjusted at the final value that causes the valve to open, the actuator is immediately completely filled with air (with AIR TO OPEN) or vented (with AIR TO CLOSE). This action always lead to the valve being completely opened. Codes 14/15 have priority over Codes 8/9/10/11. Example: Set the final position w > to 99 % for three-way valves.
16*	**Pressure limit** [OFF] 1.4 2.4 3.7 bar ESC	The pressure limit determined during initialization is displayed and can changed. (Only for fail-safe position valve closed/AIR TO OPEN, for valve open/AIR TO CLOSE, always set it to ***OFF*** after initialization, i.e. complete supply pressure to the actuator. The signal pressure can also be limited already prior to initialization to protect against impermissibly high actuating forces). **Note**: After changing a pressure limit already set, the actuator must be vented once (e.g. by selecting the fail-safe position over Code 0). The pressure limit must always be set to **OFF** after initialization for double-acting actuators.
17*	**KP step** 0 to 17 [7] ESC	Displaying or changing K_P Note on changing the K_P and T_V steps: During the initialization of the positioner, the K_P and T_V values are optimized. Should the positioner show a tendency for impermissibly high post-pulse oscillation due to additional interference, the K_P and T_V steps can be adapted after the initialization. For this, either the T_V step can be increased in increments until the desired response behavior is reached or, when the maximum value of 4 is reached, the K_P step can be decreased in increments. **CAUTION**! Changing the K_P step influences the system deviation. This effect decreases as the K_P step increases.

18*	**TV step** [2] 1 2 3 4 OFF ESC	Displaying or changing T_V, See note under K_P step A change of the T_V step has no effect on the system deviation.
19*	**Tolerance band** 0.1 to 10.0 [5] % of the operating range ESC	Used for error monitoring Determination of the tolerance band in relation to the operating range. Associated lag time [30] s is a reset criterion. If, during initialization, a transit time is determined which is 6 times > 30 s, the 6fold transit time is accepted as lag time.
20*	**Characteristic** 0 to 9 [0] ESC	Select the characteristic: 0: Linear 1: Equal percentage 2: Reverse equal percentage 3: Butterfly valve linear 4: Butterfly valve eq. percentage 5: Rotary plug valve linear 6: Rotary plug valve eq. perc. 7: Segmented ball valve linear 8: Segmented ball valve eq. p. 9: User-defined * * Definition over SAMSON TROVIS-VIEW software or FF communication
21*	**w-ramp Open** 0 to 240 s [0] ESC	The time required to pass through the operating range when the valve opens. Limitation of the transit time (Code 21 and 22): For some applications it is recommendable to limit the transit time of the actuator to prevent it from engaging too fast in the running process.
22*	**w-ramp Closed** 0 to 240 s [0] ESC	The time required to pass through the operating range when the valve closes.
23*	**Total valve travel** 0 to 9999 [0] subsequently 10E3-99E7 RES ESC	Totaled double valve travel. Can be reset to 0 via RES. Exponential display for 10 000 travel cycles onwards.

24*	**LV total valve travel** 1000 to 9999 [100 000] subsequently 10E3-99E7 ESC	Limit value of total valve travel. If the limit value is exceeded, the fault symbol and the wrench symbol appear. Exponential display for 10 000 travel cycles onwards.
34*	**Closing direction** CL [CCL] ESC	CL: Clockwise, CCL: Counterclockwise Turning direction in which the valve is moved to the CLOSED position (view onto the rotary switch motion when the positioner cover is open). Needs only be entered in initialization mode SUb (Code 6).
35*	**Blocking position** [0] mm/° /% ESC	Entering the blocking position. Distance up to the CLOSED position. Only necessary in initialization mode SUb.
36*	**Reset** [OFF] RUN ESC	Resets all parameters to default (factory setting). **Note:** After setting **RUN**, the positioner must be re-initialized.
38*	**Inductive alarm** [NO] YES ESC	Indicates whether the inductive limit switch option is installed or not.
39	**System deviation e info** –99.9 to 999.9 %	Display only, indicates the deviation from the position required.
40	**Transit time Open info** 0 to 240 s [0]	Display only, minimum opening time is determined during initialization
41	**Transit time Closed info** 0 to 240 s [0]	Display only, minimum closing time is determined during initialization
42	**Auto-w info** 0.0 to 100.0 % of the span 4 to 20 mA	Display only, indicates the supplied automatic reference variable.
43	**Firmware info** Xxxx	Display only, indicates the current firmware version of the positioner.

44	**y info** [0] OP 0 to 100 % MAX	Display only, disabled prior to initialization. After initialization: indicates the actuator pressure in %. 0 to 100 % corresponds to the pressure range which adjusts the travel/angle range from 0 to 100 %. If the actuator pressure is 0 bar, e.g. due to tight-closing on bottom or fail-safe action, ***0 P*** appears on the display. If the actuator pressure is higher than the pressure required for X = 100 %, e.g. due to tight-closing on top, ***MAX*** appears on the display. Value is determined during initialization.
45	**Solenoid valve info** Yes No	Display only, indicates whether a solenoid valve is installed or not. If a voltage supply is connected at the terminals of the installed solenoid valve, *YES* and *HIGH* appear on the display in alternating sequence. If a voltage supply is not connected (actuator vented, fail-safe position indicated on the display by the S symbol), *YES* and *LOW* appear on the display in alternating sequence.
46*	**Polling address** 0 to 63 [0] ESC	Select bus address
47*	**Write protection FF** YES [NO] ESC	When the write protection function is activated, device data can only be read, but not overwritten over FF communication.

48	**Diagnostics**	
	d	Diagnostic parameters
	d0 Current temperature –55 to 125	Operating temperature [°C] inside the positioner
	d1 Minimum temperature [20]	The lowest temperature below 20 °C that has ever occurred.
	d2 Maximum temperature [20]	The highest temperature above 20 °C that has ever occurred.
	d3 Number of zero calibrations	The number of zero calibrations since the last initialization.
	d4 Number of initializations	The number of initializations that have been performed.
	d5 Zero point limit [5 %] 0.0 to 100.0 %	Limit for the zero point monitoring.
	d6 Condensed status	Condensed status, made up from the individual states. OK: Okay, C: Maintenance requirement, CR: Maintenance demand, B: Failure, I: Function check.
	d7 Start reference run [OFF] ON ESC 1	Triggering of a reference run for the functions: Control signal Y stationary and control signal Y hysteresis. The reference run can only be activated in manual operation as the valve moves through its entire travel range. If EXPERT$^+$ is activated at later point in time, the reference graphs must be plotted in order to activate the diagnostic functions.
	d8 EXPERT$^+$ activation	Enter the activation code for EXPERT$^+$. After the activation procedure has been successfully completed, ***YES*** appears under d8.

FF parameters FF-P	
F0 Firmware Rev. Communication	
F1 Binary input1	1 Active 0 Inactive
F2 Binary input2	1 Active 0 Inactive
F3 Simulate	Activation of simulation mode
F4	
F5	
F6	
F7	
AO Function Block A	
A0 Target Mode	Required operating mode
A1 Actual Mode	Actual operating mode
A2 CAS_IN Value	Display of the analog reference variable adopted from an up-stream function block
A3 CAS_IN Status	and its status
A4 SP Value	Displays the set point (reference variable)
A5 SP Status	and its status
A6 Out Value	Displays the manipulated variable (output value)
A7 Out Status	and its status
A8 Block Error	Displays the current block error

	PID Function Block P	
	P0 Target Mode	Required operating mode
	P1 Actual Mode	Actual operating mode
	P2 CAS_IN Value	Display of the analog reference variable adopted from an up-stream function block
	P3 CAS_IN Status	and its status
	P4 SP Value	Displays the set point (reference variable)
	P5 SP Status	and its status
	P6 Out Value	Displays the manipulated variable (output value)
	P7 Out Status	und its status
	P8 Block Error	Displays the current block error
	Transducer Blocks A0, DI1, DI2 t	
	t0 Target Mode AO Trd	Required operating mode
	t1 Actual Mode AO Trd	Actual operating mode
	t2 Transducer State	State of the Transducer Block
	t3 Block Error AO Trd	Displays the current block error
	t4 Target Mode DI1	Required operating mode
	t5 Actual Mode DI1 Trd	Actual operating mode
	t6 Block Error DI1 Trd	Displays the current block error
	t7 Target Mode DI2 Trd	Required operating mode
	t8 Actual Mode DI2	Actual operating mode
	t9 Block Error DI2	Displays the current block error
	Resource Block S	
	S0 Resource Target Mode	Required operating mode
	S1 Resource Actual Mode	Actual operating mode
	S2 Resource Block Error	Displays the current block error

	DI1 Function Block I	
	I0 Target Mode DI1	Required operating mode
	I1 Actual Mode DI1	Actual operating mode
	I2 Field_Val_D.Value	Displays the discrete input variable
	I3 Field_Val_D.Status	and its status
	I4 OUT_D.Value	Displays the discrete output variable
	I5 OUT_D.Status	and its status
	I6 Block Error	Displays the current block error
	D2 Function Block L	
	L0 Target Mode DI2	Required operating mode
	L1 Actual Mode DI2	Actual operating mode
	L2 Field_Val_D.Value	Displays the discrete input variable
	L3 Field_Val_D.Status	and its status
	L4 OUT_D.Value	Displays the discrete output variable
	L5 OUT_D.Status	and its status
	L6 Block Error	Displays the current block error

Error codes – Remedy		Condensed status alarm active, when prompted, ***Err*** appears.
Initialization error (indicated on the display by the condensed status with the corresponding classification)		
50	**x < range**	The value supplied by the measuring signal is either too high or too low, the measuring sensor is close to its mechanical limit. • Pin positioned incorrectly. • Bracket slipped in case of NAMUR attachment or positioner is not central. • Follower plate incorrectly attached.
	Remedy	Check attachment and pin position, set operating mode from SAFE to MAN and re-initialize the positioner.
51	**Δx > range**	The measuring span of the sensor is too low. • Pin positioned incorrectly. • Wrong lever. A rotational angle smaller than 11° at the positioner shaft creates just an alarm. An angle below 6° leads to the initialization being canceled.
	Remedy	Check attachment and re-initialize the positioner.
52	**Attachment**	• Positioner attachment incorrect. • Nominal travel/angle (Code 5) could not be achieved on initialization under NOM or SUB (no tolerance downwards permissible) • Mechanical or pneumatic error, e.g. wrong lever selected or supply pressure too low to move to the required position or pneumatic fault
	Remedy	Check attachment and supply pressure. Re-initialize the positioner. Under certain circumstances, it may be possible to check the maximum travel/angle by entering the actual pin position and then performing an initialization under MAX. After initialization has been completed, the Code 5 indicates the maximum achieved travel or angle.
53	**Init time >**	The initialization routine lasts too long. The positioner returns to its previous operating mode. • No pressure on the supply line or there is a leak. • Supply air failure during initialization.

	Remedy	Check attachment and supply pressure. Re-initialize the positioner.
54	**Init – Solenoid valve**	1) A solenoid valve is installed (Code 45 = YES) and was not or not properly connected so that an actuator pressure could not be built up. The message appears when you attempt to initialize the positioner. 2) If you attempt to initialize the device from the fail-safe position (SAFE).
	Remedy	Re. 1) Check connection and supply voltage of the solenoid valve. Re. 2) Set the ***MAN*** operating mode over Code 0. Then initialize the positioner.
55	**Transit time <**	The actuator transit times determined during the initialization are so short that the positioner cannot adapt itself optimally.
	Remedy	Check the volume restriction setting as described in section 4.1, re-initialize the positioner.
56	**Pin pos.**	Initialization was canceled because you are required to enter the pin position for the selected initialization modes ***NOM*** and ***SUb***.
	Remedy	Enter pin position over Code **4** and nominal travel/angle over Code **5**. Re-initialize the positioner.
Operational error (indicated on the display by the condensed status with the corresponding classification)		
57	**Control loop** Additional alarm at the fault alarm contact!	Control loop error, the control valve does not react within the tolerable times of the controlled variable (tolerance band alarm Code 19). • Actuator mechanically blocked. • Attachment of the positioner subsequently postponed. • Supply pressure not sufficient.
	Remedy	Check attachment.
58	**Zero point**	Zero point incorrect. Error may arise when the mounting position/linkage of the positioner moves or when the valve seat trim is worn, especially with soft-sealed plugs.
	Remedy	Check valve and mounting of the positioner. If OK, perform a zero calibration over Code 6 (see section 5.8 on page 48).

59	**Autocorrection**	Should an error occur in the data range of the positioner, the self-monitoring function recognizes it and automatically corrects it.
	Remedy	Automatic
60	**Fatal error** Additional alarm at the fault alarm contact!	An error was detected in the data relevant for safety, autocorrection is not possible. This may be due to EMC disturbances. The control valve moves to its fail-safe position.
	Remedy	Reset over Code 36. Re-initialize the positioner.
Hardware error (indicated on the display by the condensed status with the corresponding classification)		
62	**x signal** Additional alarm at the fault alarm contact!	Determination of the measured value for the actuator has failed. Conductive plastic element is defective. The positioner continues to run in emergency mode, but should be replaced as soon as possible. The emergency mode on the display is indicated by a blinking control symbol and 4 dashes instead of the position indication. Note on the control: If the measuring system has failed, the positioner is still in a reliable state. The positioner switches to emergency mode where the position cannot be accurately controlled anymore. However, the positioner continues operation according to its reference variable signal so that the process remains in a safe state.
	Remedy	Return the positioner to SAMSON AG for repair.
64	**i/p converter** (y)	The circuit of the i/p converter has been interrupted.
	Remedy	Cannot be remedied. Return the positioner to SAMSON AG for repair.

Error appendix		
65	**Hardware** Additional alarm at the fault alarm contact!	A hardware error has occurred, the positioner moves to the fail-safe position ***SAFE***.
	Remedy	Confirm error and return to the automatic operating mode, or perform a reset and re-initialize the device. If this is not successful, return device to SAMSON AG for repair.
66	**Data memory** Additional alarm at the fault alarm contact!	The writing of data to the data memory does not work anymore, e.g. when the written data deviate from the read data. Valve moves to the fail-safe position.
	Remedy	Return the positioner to SAMSON AG for repair.
67	**Test calculation** Additional alarm at the fault alarm contact!	The hardware positioner is monitored by means of a test calculation.
	Remedy	Confirm error. If this is not possible, return the positioner to SAMSON AG for repair.
Data error		
68	**Control parameter** Additional alarm at the fault alarm contact!	Control parameter error, e.g. due to EMC disturbances.
	Remedy	Confirm error, perform reset and re-initialize the positioner.
69	**Poti parameter** Additional alarm at the fault alarm contact!	Parameter error of the digital potentiometer.
	Remedy	Confirm error, perform reset and re-initialize the positioner.
70	**Calibration**	Error in the production calibration data, e.g. due to EMC disturbances. Subsequently, the device runs on default values
	Remedy	Return the positioner to SAMSON AG for repair.

71	**General parameters**	Parameter errors that are not critical for the control.
	Remedy	Confirm error. Check and, if necessary, reset required parameters.
72	**Start-up parameters**	Start-up parameter errors
	Remedy	Confirm error, perform reset and re-initialize the positioner.
73	**Internal device error 1**	Internal device error
	Remedy	Return the positioner to SAMSON AG for repair.
74	**FF parameter**s	Parameter errors that are not critical for the control.
	Remedy	Confirm error and perform reset.
76	**No emergency mode**	The travel measuring system of the positioner has a self-monitoring function (see Code 62). A controlled emergency mode is not available on certain actuators, such as double-acting actuators. For this reason, the positioner moves to the fail-safe position when a measuring error occurs. During the initialization, the positioner checks whether the actuator has such a function or not.
	Remedy	Merely information, confirm, if necessary. No further action necessary.
77	**Program loading error** Additional alarm at the fault alarm contact!	When the device starts operation for the first time after the input signal has been applied, it carries out a self-test (***tEStinG*** runs across the display). If the device loads a program that does not correspond to that of the positioner, the valve moves to the fail-safe position. It is not possible to make the valve leave this fail-safe position again by operating the positioner.
	Remedy	Interrupt fieldbus signal and restart positioner. Otherwise, return the positioner to SAMSON AG for repair.

78	**Options parameter**	Errors in options parameters, e.g. due to EMC disturbances.
79	**Diagnostic alarms**	Alarms are generated in the EXPERT+ extended diagnostics if EXPERT+ has been successfully activated in Code 48.
80	**Diagnostic parameters**	Errors that are not critical for control.
	Remedy	Confirm error. Check and, if necessary, start new reference run.
81	**Reference graphs**	Error on plotting the reference graphs of control signal y stationary or control signal y hysteresis. • Reference run was interrupted • Reference line y stationary or y hysteresis was not adopted.

13 Parameter description

13.1 General

These instructions are based on the following:

Fieldbus Foundation Specification "Function Block Application Process Part 1 to 3" Revision 1.5.
Fieldbus Foundation Specification "Transducer Block Application Process Part 1 to 2" Revision PS 3.0.

13.2 Device description (DD)

For integration of the device described into the host system, the following device description files are needed:

Device Description: < 0101.ffo >, < 0101.sym > Capabilities File: < 010101.cff >

These device description files can be downloaded from the Internet, for example, at www.fieldbus.org or www.samson.de.

13.3 Notes concerning the parameters

All time specifications in the Resource Block are specified in the unit of 1/32 ms according to the Fieldbus Specification Version 1.5.
In the Device Description Library supplied by FOUNDATION Fieldbus which the device description of 3730-5 is also based upon, these parameters are incorrectly specified as ms. The specified values supplied by the device are, however, always to be interpreted as the unit of 1/32 ms.
Due to the same reason, "Fault state to value" is indicated as "Fault state type" in the IO_OPTS parameter of the AO Function Block.
Several parameters can only be modified in certain modes (see Read/write capability in the parameter description). In this case, not the actual mode is decisive, but the target mode.

13.3.1 Legend for the parameters

r = Read capability
w = Write capability
Index = Index number of the parameters in each block
O/S = Out of service mode
MAN = Manual mode
LO = Local override mode
AUTO = Automatic mode
CAS = Cascade mode
RCAS = Remote cascade mode
ROUT = Remote output mode
S = Static parameter
N = Non volatile parameter
D = Dynamic parameter

13.4 FOUNDATION™ Fieldbus block model

FOUNDATION Fieldbus assigns all the functions and data of a device to three different types of blocks. Each type of block has a different range of tasks to fulfill in the block model.
The following types of blocks are implemented in the SAMSON Type 3730-5 Positioner:

- **One Resource Block**
  The Resource Block contains all the specific characteristics associated with a device on the Fieldbus, for example, device name, manufacturer number and serial number.
  A device can only have one Resource Block.
- **One AO Transducer Block**
  Each AI or AO Function Block has a Transducer Block which contains all data and device-specific parameters to connect the device to the process value (sensor or actuator).
  The positioner output signal can be directly influenced over the AO Transducer Block.
- **Two DI Transducer Blocks**
  The DI Transducer Blocks connect binary input signals for transmission and processing over the fieldbus.
- **One Analog Output Function Block**
  Function blocks are responsible for the control behavior of a FOUNDATION Fieldbus device. A FOUNDATION Fieldbus application can be configured by connecting the inputs and outputs of function blocks.
  The AO Function Block converts the output value from an upstream function block into a control value for the valve.

- **Two Discrete Input Function Blocks**
  The DI Function Blocks are used as inputs to control binary signals. They support the selection of binary switching conditions of various functions.
- **One PID Function Block**
  The PID controller has a flexible proportional-integral-differential control algorithm which can be configured as required to match the application.

13.5 Resource Block

The Resource Block contains all the data that identify the device. It is similar to an electronic device tag.

Resource Block parameters include device type, device name, manufacturer ID, serial number as well as parameters which affect the behavior of all other blocks of the device.

13.5.1 Resource Block parameters

Memory class	
ACK_OPTION S Index no.: 38 Read/write capability: r, w Range: Initial value:	Determines whether an alarm is to be automatically acknowledged in the positioner, i.e. without intervention of the Fieldbus host system. Undefined — No selection DISC ALM — Discrete alarm (write lock changed) BLOCK ALM — Block alarm Undefined Note! The alarm is broadcast to the Fieldbus host system, but not acknowledged by it.
ALARM_SUM S Index no.: 37 Read/write capability: r, w Display:	Determines the current state of the process alarms in the Resource Block. DISC ALM — Discrete alarm (write lock changed) BLOCK ALM — Block alarm

ALERT_KEY S Index no.: 4 Read/write capability: r; w Range: Initial value:	Used to specify the identification number of the plant section. This information can be used by the Fieldbus host system to group alert and events. 1...255 0 Note! "0" is not a permissible value and will be rejected when transferring data to the device (error).
BLOCK_ALARM D Index no.: 36 Read/write capability: r; w	Indicates all configuration, hardware, connection failure, or system problems in the block and indicates the current block state. Note! In addition, an active block alarm can be acknowledged manually in this parameter group.
BLOCK_ERR D Index no.: 6 Read/write capability: r Display:	Reflects the active errors associated with a block. SIMULATE ACTIVE Simulation jumper active, simulation possible OUT OF SERVICE Block mode is out of service. LOST STATIC DATA Data in EEPROM lost DEVICE NEEDS MAINTENANCE SOON Maintenance required soon. Block Alarm (BLOCK_ALM) in Resource Block is triggered. DEVICE NEEDS MAINTENANCE NOW Maintenance required immediately. Block Alarm (BLOCK_ALM) in Resource Block is triggered. Note! The assignment of error or diagnostic alarms to the desired function block is determined using the ERROR_OPTION parameter in the Transducer Block.
BUS_ADDRESS D Index no.: 55 Read/write capability: r	Bus address
CLR_FSTATE D Index no.: 30 Read/write capability: r,w	Use to manually clear the Fault State of the AO Function Block.

CONDENSED_STATE D Index no.: 59 Read/write capability: r	Indicates the condensed state of the device. Each possible event or error is classified according to NA 64. This assignment can be modified in the Transducer Block. The condensed state provides a summary of all classified status alarms. 0: OK 1: Maintenance required 2: Maintenance requested 3: Maintenance alarm 7: Function check The state is also indicated on the LCD of the positioner. "Maintenance required" and "Maintenance requested" are indicated by a wrench symbol, "Maintenance alarm" by two lines. "Function check" is indicated as a text alert.
CONFIRM_TIME S Index no.: 33 Read/write capability: r, w Initial value:	Specifies the time the device waits for confirmation that an alert report was received before trying again. 640000 1/32 ms
CYCLE_TIME S Index no.: 20 Read/write capability: r, w Range: Initial value:	Specifies the block execution method determined by the Fieldbus host system. SCHEDULED COMPLETION OF BLOCK EXECUTION SCHEDULED Note! The block execution method is selected directly in the Fieldbus host system.
CYCLE_TYPE **S** Index no.: 19 Read/write capability: r Display:	Indicates the block execution method supported by the device. SCHEDULED COMPLETION OF BLOCK EXECUTION
DD_RESOURCE S Index no.: 9 Read/write capability: r	Specifies the resource of the device description file in the device. Note! If the device contains no device description, "zero" appears on the display.

DD_REV S Index no.: 13 Read/write capability: r	Specifies the revision number of the device description file.
DESCRIPTOR S Index no.: 46 Read/write capability: r, w	Any desired text to describe the application; the text is saved in the field device.
DEV_REV S Index no.: 12 Read/write capability: r	Indicates the manufacturer's revision number associated with the device.
DEV_TYPE S Index no.: 11 Read/write capability: r Display:	Indicates the manufacturer's model number associated with the device in decimal format. 2 for Type 3730-5
DEVICE_CERTIFICATION N Index no.: 45 Read/write capability: r	Specifies the type of protection of the device, i.e. whether explosion protection certificates are available for the field device.
DEVICE_ PRODUCT_ NUM N Index no.: 48 Read/write capability: r	Specifies the positioner's product number
DEVICE_ SER_NUM N Index no.: 44 Read/write capability: r	Specifies the positioner's serial number; allows the field device to be clearly identified in conjunction with the MANUFAC_ID and DEV_TYPE parameters.
DEVICE_MESSAGE N Index no.: 47 Read/write capability: r, w	Any desired text; the text is saved in the field device.
FAULT_STATE N Index no.: 28 Read/write capability: r	Indicates the current status of the Fault State of the Analog Output Function Block
FEATURES S Index no.: 17 Read/write capability: r	Specifies the additionally supported Resource Block options, see FEATURES_SEL.

FEATURES_SEL S Index no.: 18 Read/write capability: r, w Range:	Enables selection of additionally supported Resource Block options. REPORTS Fieldbus host system needs to acknowledge receipt of an alert report. HARD W LOCK Hardware Evaluating write lock switch FAULTSTATE Fault State can be triggered (see SET_FSTATE /CLR_FSTATE) OUT READBACK Current valve position issued in the PV parameter of the Analog Function Block (otherwise SP).
FREE_SPACE D Index no.: 24 Read/write capability: r, w	Indicates the memory in percent available for implementation of additional function blocks. Note! This parameter is not supported as no further function blocks may be added to the Type 3730-5.
FREE_TIME D Index no.: 25 Read/write capability: r	Indicates the block processing time in percent that is free to process additional blocks. Note! This parameter is not supported as no further function blocks may be added to the Type 3730-5.
GRANT_DENY D Index no.: 14 Read/write capability: r	Grants or denies access of a Fieldbus host system to the field device. Note! This parameter is not used by Type 3730-5.
HARD_TYPES S Index no.: 15 Read/write capability: r, w Display:	Indicates the types of output signal (hardware) available for the Analog Output Function Block. SCALAR OUTPUT
HW_REVISION S Index no.: 43 Read/write capability: r	Specifies the hardware revision number of the electronic/mechanical components
ITK_VER S Index no.: 41	Specifies the version of the Interoperability Tester used by the FIELDBUS Foundation on certifying the device as interoperable.
LIM_NOTIFY S Index no.: 32 Read/write capability: r, w Range: Initial value:	Specifies the number of alert reports that the device can send without getting a confirmation. 0 to 8 8

LOCAL_OP_ENA N Index no.: 56 Read/write capability: r, w	Locks/enables local operation.
MANUFAC_ID **S** Index no.: 10 Read/write capability: r Display:	Indicates the manufacturer's identification number. 0x 00E099 = SAMSON AG
MAX_NOTIFY **S** Index no.: 31 Read/write capability: r Display	Specifies the maximum number of alert reports that the device can send without getting a confirmation. 8
MEMORY_SIZE S Index no.: 22 Read/write capability: r	Indicates the memory in kilobytes available for additional function blocks. Note! This parameter is not supported as no further function blocks may be added to the Type 3730-5.
MIN_CYCLE_T S Index no.: 21 Read/write capability: r Display:	Indicates the shortest cycle interval that the device can perform (execution time of AO function block 20 ms). 640 1/32 ms
MODE_BLK N Index no.: 5 Read/write capability: r, w Display:	Indicates the actual operating mode of the Resource Block, the permitted modes supported by the Resource Block, and the normal mode. AUTO O/S The Resource Block supports the following modes: AUTO (automatic) The Function Blocks (AO and PID) are enabled in this mode. O/S (out of service) In this mode, the processing of the Function Blocks (AO and PID) is stopped. The blocks are set to "out of service".
NV_CYCLE_T S Index no.: 23 Read/write capability: r	Specifies the minimum time interval between non-volatile data are written to the non-volatile memory. Note! The Type 3730-5 saves non-volatile data immediately after transmission.

READING_DIRECTION D Index no.: 54 Read/write capability: r, w	Rotates the display contents by 180°.
RESTART D Index no.: 16 Read/write capability: r, w Range:	Enables the positioner to be reset in various ways. RUN — Normal operating state. RESOURCE — (not supported) DEFAULTS — Device is reset to the default settings listed in the specification. PROCESSOR — Configuration and calibration remain unchanged, only the processor is restarted.
RS_STATE D Index no.: 7 Read/write capability: r Display:	Indicates the current operating state of the Resource Block. ONLINE — Standard operating state; the function block is in AUTO mode. STANDBY — The Resource Block is in O/S mode. ONLINE LINKING — The configured links between the function blocks have not been established yet.
SELECT_BINARY_INPUT1 N Index no.: 57 Read/write capability: r, w	Used to select the data to be processed in Discrete Input Block 1. The following options are supported: DI1 contact — Switching state of binary input 1 DI1 internal solenoid valve — Switching state of internal solenoid valve DI1 discrete final valve position Current valve position as discrete information. 1 Current valve position < x % 2 Current valve position > x % 3 Intermediate position The limits for < x % or > x % are set using FINAL_POSITION_VALUE_LIMITS parameter [0.5, 99.5]. DI1 condensed state 0 OK 1 Maintenance required 2 Maintenance requested 3 Maintenance alarm 7: Function check

SELECT_BINARY_INPUT2 N Index no.: 58 Read/write capability: r, w	Used to select the data to be processed in Discrete Input Block 2. The following options are supported: DI2 contact Switching state of binary input 1 DI2 internal solenoid valve Switching state of internal solenoid valve DI2 discrete final valve position Current valve position as discrete information. 1 Current valve position < x % 2 Current valve position > x % 3 Intermediate position The limits for < x % or > x % are set using the FINAL_POSITION_VALUE_LIMITS parameter [0.5, 99.5]. DI2 condensed state 0 OK 1 Maintenance required 2 Maintenance requested 3 Maintenance alarm 7: Function check
SET_FSTATE D Index no.: 29 Read/write capability: r, w	Enables manual activation of the Fault State of the Analog Output Function Block.
SHED_RCAS S Index no.: 26 Read/write capability: r, w	Determines how long function blocks are supposed to check that the connection between the Fieldbus host system and the PID Block exists in RCAS mode. When the time has elapsed, the PID Block switches from RCAS mode to the operating mode set by the SHED_OPT parameter.
SHED_ROUT S Index no.: 27 Read/write capability: r, w Initial value:	Determines how long function blocks are supposed to check that the connection between the Fieldbus host system and the PID Block exists in ROUT mode. When the time has elapsed, the PID Block switches from ROUT mode to the operating mode set by the SHED_OPT parameter. 640000 1/32 ms
ST_REV N Index no.: 1 Read/write capability: r	Indicates the revision number of static data. Note! The revision state is incremented by one each time a static parameter in the block is written.

STRATEGY S Index no.: 3 Read/write capability: r, w Initial value:	Permits strategic grouping and thus faster processing of blocks. Blocks are grouped by entering the same number in the STRATEGY parameter of each block. 0 Note! These data are neither checked nor processed by the Resource Block.
SW_REVISION N Index no.: 42 Read/write capability: r	Indicates the firmware version (communication/control)
TAG_DESC S Index no.: 2 Read/write capability: r, w Initial value:	Assigns a unique 32 character description to each block for clear identification No text
TEST_RW D Index no.: 8 Read/write capability: r, w	Note! This parameter is required for conformity tests only and is not used in normal operation.
TEXT_INPUT_1 N Index no.: 49 Read/write capability: r, w	Any desired text
TEXT_INPUT_2 N Index no.: 50 Read/write capability: r, w	Any desired text
TEXT_INPUT_3 N Index no.: 51 Read/write capability: r, w	Any desired text
TEXT_INPUT_4 N Index no.: 52 Read/write capability: r, w	Any desired text
TEXT_INPUT_5 N Index no.: 53 Read/write capability: r, w	Any desired text
UPDATE_EVT D Index no.: 35 Read/write capability: r	Indicates that static data were changed, including date and time stamp.

WRITE_ALM D Index no.: 40 Read/write capability: r, w	Indicates the state of the write protection alarm. Note! The alarm is triggered when the WRITE_LOCK parameter is unlocked.
WRITE_LOCK S Index no.: 34 Read/write capability: r, w	Indicates the state of the write-lock alarm. LOCKED NOT LOCKED Write protection can be unlocked by setting Code 47 to ON. If setting data are to be changed by remote transmission, set Code 47 to OFF.
WRITE_PRI S Index no.: 39 Read/write capability: r, w Range: Initial value:	Used to set the priority for the WRITE_ALM parameter. 0 Write alarm is not processed 1 Write alarm is not broadcast to Fieldbus host system 2 Reserved for block alarms 3...7 Write alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high). 8...15 Write alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high). 0

13.5.2 Analog Output Transducer Block

The Transducer Block allows the input and output variables of a function block to be influenced. In this way, process data can be used to calibrate measured and control data, linearize characteristics, or convert engineering units.

Transducer Block parameters include information on the type of actuator, attachment, engineering units, commissioning, diagnostics as well as device-specific parameters.

The Standard Advanced Positioner Valve Transducer Block receives an output value from an upstream Analog Output Function Block. This value is used to position a control valve. The block contains parameters to adapt the positioner to the actuator and valve as well as for valve commissioning and diagnostics.

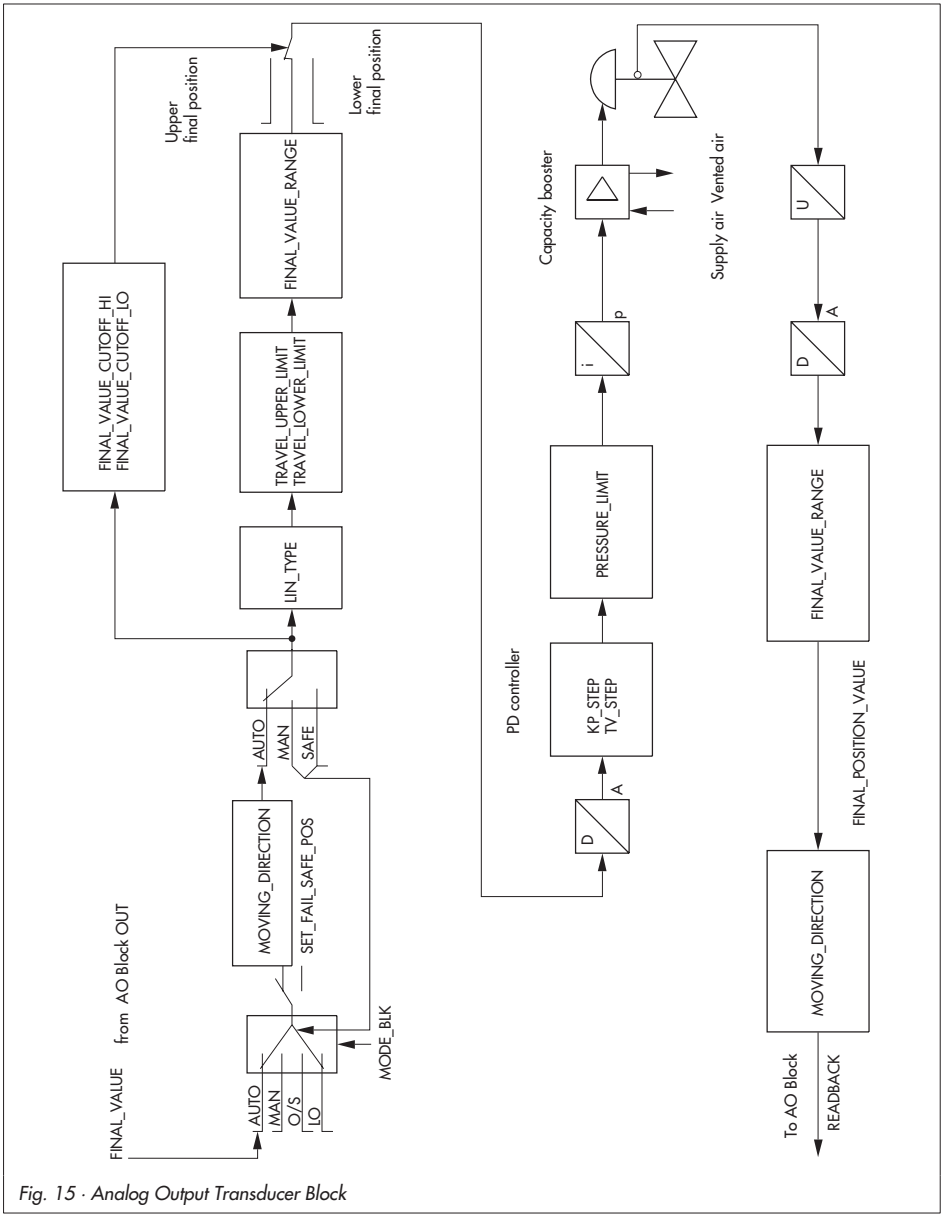


Fig. 15 · Analog Output Transducer Block

Analog Output Transducer Block parameters

This Block contains parameters describing the actuator and valve on which the positioner is mounted. The parameters of this block are used to adapt the positioner to the valve and for commissioning and diagnostics of the entire control valve.

ACT_FAIL_ACTION D Index no.: 21 Read/write capability: r Display:	Sets the fail-safe action to be performed by the actuator in case of a supply air failure, determined automatically during initialization. UNINITIALIZED — Not initialized, not defined CLOSING — Closing (to 0 % position) OPENING — Opening (to 100 % position) INDETERMINATE — No fail-safe action
ACT_MAN_ID D Index no.: 22 Read/write capability: r, w	Specifies the actuator manufacturer's identification number. Clearly identifies the manufacturer of the actuator used with the positioner.
ACT_MODEL_NUM S Index 23 Read/write capability: r, w	Specifies the type/model number of the actuator used with the positioner.
ACT_SN S Index 24 Read/write capability: r,w	Specifies the serial number of the actuator used with the positioner.
ACT_STROKE_TIME_DEC D Index no.: 67 Read/write capability: r	Specifies the minimum transit time to reach CLOSED position The minimum transit time to reach CLOSED (0 % position) position is the actual time in seconds that the system consisting of positioner, actuator, and valve needs to move through the rated travel/rotational angle range and close the valve (measured during initialization).
ACT_STROKE_TIME_INC D Index no.: 68 Read/write capability: r	Specifies the minimum transit time to reach OPEN position The minimum transit time to reach OPEN (100 % position) position is the actual time in seconds that the system consisting of positioner, actuator, and valve needs to move through the rated travel/rotational angle range and open the valve (measured during initialization).

ADVANCED_PV_BASIC D Index no.: 0 Read/write capability: r, w Display:	Indicates block-specific and device-specific data. BLOCK_TAG Block designation DD_MEMBER 0 (0x0) DD_ITEM Initial index of Analog Output Transducer Block DD_REVIS Revision index of DD PROFILE 33037 (0x810d) PROFILE_REVISION 1 (0x1) EXECUTION_TIME Execution time of the block EXECUTION_PERIOD Repetition interval NUM_OF_PARAMS Number of block parameters NEXT_FB_TO_EXECUTE Next function block to be executed VIEWS_INDEX Initial address of View objects NUMBER_VIEW_3 Number of View-3 objects NUMBER_VIEW_4 Number of View-4 objects
ALERT_KEY S Index no.: 4 Read/write capability: r, w Range: Initial value:	Used to specify the identification number of the plant section. This information can be used by the Fieldbus host system to group alert and events. 1...255 0 Note! "0" is not a permissible value and will be rejected when transferring data to the device (error).
AUTOSTART D Index no.: 111 Read/write capability: r, w	Indicates the interval at which the step response function is repeated. Available in versions with ESD diagnostics and higher
BINARY_INPUT2 D Index no.: 53 Read/write capability: r	Indicates the state of DI2. The value of the output depends on CONFIG_BINARY_INPUT2.
BLOCK_ALARM D Index no.: 8 Read/write capability: r, w	Indicates all configuration, hardware, connection failure, or system problems in the block and indicates the current block state. Note! In addition, an active block alarm can be acknowledged manually in this parameter group.

BLOCK_ERR D Index no.: 6 Read/write capability: r Display:	Reflects the active errors associated with a block. OUT OF SERVICE Block mode is out of service. DEVICE NEEDS MAINTENANCE NOW Maintenance required immediately (error in the electronics). DEVICE NEEDS MAINTENANCE SOON Maintenance required soon (zero error, positioner fault, or total valve travel exceeded). LOCAL OVERRIDE Positioning value set to "local operation" using TROVIS-VIEW, or forced venting function/zero calibration or initialization currently in process. INPUT FAILURE Position feedback error or device not initialized OUTPUT FAILURE Device not initialized MEMORY FAILURE Memory error LOST STATIC DATA Check sum error
BLOCKING_POSITION D Index no.: 76 Read/write capability: r, w Code 35	Indicates and modifies the blocking position.
CLOSING_DIRECTION S Index no.: 66 Read/write capability: r, w Code 34	Indicates and modifies the closing direction.
COLLECTION_ DIRECTORY D Index no.: 12 Read/write capability: r	Parameter is not processed by Type 3730-5.

CONFIG_BINARY_ INPUT2 D Index no.: 56 Read/write capability: r, w Initial value:	Sets the logic state of DI2. The parameter is processed by the BINARY_INPUT2 parameter. The parameter settings do not depend on Transducer Block DI2. NOT EVALUATED ACTIVELY OPEN ACTIVELY CLOSED ACTIVELY OPEN – LEAKAGE SENSOR ACTIVELY CLOSED – LEAKAGE SENSOR
COUNTER_INIT_START D Index no.: 85 Read/write capability: r	Specifies the number of initialization cycles that have been performed since the last reset.
DATALOGGER_ PROGRESS D Index no.: 95 Read/write capability: r Display:	Indicates the state of the data logger. 1 Trigger selected 2 Trigger not selected 3 Trigger started by travel condition 4 Trigger started by solenoid condition 5 End measuring, memory full Available in versions with EXPERT+ extended diagnostics and higher
DATALOGGER_SELECT D Index no.: 88 Read/write capability: r, w Display:	Permits selection of data logger recording method. 1 Permanent 2 Trigger Available in versions with EXPERT+ extended diagnostics and higher
DEAD_TIME_FALLING D Index no.: 115 Read/write capability: r	Specifies the time that has elapsed until a change in the valve position X occurs after a falling step change of the reference variable W (during diagnostic test). Available in versions with EXPERT+ extended diagnostics and higher

DEAD_TIME_RISING D Index no.: 114 Read/write capability: r	Specifies the time that has elapsed until a change in the valve position X occurs after a rising step change of the reference variable W (during diagnostic test). Available in versions with EXPERT+ extended diagnostics and higher
DELAY_TIME S Index no.: 46 Read/write capability: r, w Range: Initial value:	Specifies the delay time. Reset criterion when control loop monitoring is in progress. If the entered DELAY_TIME is exceeded the system deviation is outside the specified TOLERANCE_BAND, a control loop error is issued. Determined from the min. transit time during initialization. 1 to 240 s 10 s
DEVIATION_MAX D Index no.: 98 Read/write capability: r	Specifies the positioner's maximum system deviation that have occurred. Available in versions with EXPERT+ extended diagnostics and higher
DEVIATION_MIN D Index no.: 97 Read/write capability: r	Specifies the positioner's minimum system deviation. Available in versions with EXPERT+ extended diagnostics and higher
DEVICE_ CHARACTERISTICS S Index no.: 32 Read/write capability: r, w Display:	Reflects positioner-specific data. ACTUATOR_SIZE — Effective actuator area ACTUATOR_VERSION — Model ATTACHMENT — Attachment PRESSURE_RANGE_START — Lower pressure range limit PRESSURE_RANGE_END — Upper pressure range limit SUPPLY_PRESSURE — Supply pressure BOOSTER — Booster STUFFING_BOX — Stem sealing SEALING_EDGE — Sealing surface PRESSURE_BALANCING — Pressure balancing FLOW_CHARACTERISTIC — Plug characteristics FLOW_DIRECTION — Direction of flow

	NOM_DIAMETER Standard nominal sizes NOM_DIAMETER_DN Nominal size DN KVS_UNIT K_{VS} unit KVS_VALUE K_{VS} coefficient SEAT_DIAM_VALVE Valve seat diameter
DEVICE_INIT_STATE D Index no.: 64 Read/write capability: r	Indicates whether the device was initialized.
DIAG_LEVEL D Index no.: 101 Read/write capability: r Display:	Indicates the currently installed diagnostic version. EXPERT EXPERT+ ESD (Emergency Shut Down)
ELAPSED_HOURS_METERS D Index no.: 82 Read/write capability: r, w Display:	Indicates the hours the device has been in operation. ELAPSED_HOURS_TOTAL Total hours the device has been switched on ELAPSED_HOURS_IN_CLOSED_LOOP Hours in closed loop control ELAPSED_HOURS_SWITCHED_ON_SINCE_ INIT Hours the device has been switched on since last initialization ELAPSED_HOURS_IN_CLOSED_LOOP_SINCE_INIT Hours in closed loop control since last initialization

ENHANCED_DIAG_CMD D Index no.: 81 Read/write capability: r, w Display:	Indicates an extended diagnostic test. 1 No function 2 Start data logger 3 Cancel data logger 4 Online hysteresis test 5 Cancel online hysteresis test 6 Start step response 7 Cancel step response 8 Start tests in turn
ERROR_OPTION_DATA_FAILURE S Index no.: 39 Read/write capability: r, w Display:	Indicates the masking of data errors. 1 Control parameter 2 Potentiometer parameter 3 Adjusted parameter 4 General parameter 5 Internal device error 1 6 Valve dimension parameter 7 Info parameter 8 Check sum program code
ERROR_OPTION_ENH_DIAGNOSTIC_1 S Index no.: 40 Read/write capability: r, w	Specifies the masking of diagnostic status or alarms.
ERROR_OPTION_ENH_DIAGNOSTIC_2 S Index no.: 41 Read/write capability: r, w	Specifies the masking of diagnostic status or alarms.
ERROR_OPTION_ENH_DIAGNOSTIC_3 S Index no.: 42 Read/write capability: r, w	Specifies the masking of diagnostic status or alarms.

ERROR_OPTION_ENH_DIAGNOSTIC_4 S Index no.: 43 Read/write capability: r, w	Specifies the masking of diagnostic status or alarms.
ERROR_OPTION_ENH_DIAGNOSTIC_5 S Index no.: 44 Read/write capability: r, w	Specifies the masking of diagnostic status or alarms.
ERROR_OPTION_HW_FAILURE S Index no.: 38 Read/write capability: r, w Display:	Specifies the masking of hardware errors. 1 x signal 2 i/p converter 3 Hardware 4 Data memory 5 Control calculation 6 Program loading error
ERROR_OPTION_INIT_FAILURE S Index no.: 36 Read/write capability: r, w Display:	Specifies the masking of initialization errors. 1 x > range 2 Delta x < range 3 Mechanics / pneumatics 4 Init. time exceeded 5 Init./solenoid valve 6 Travel time too short 7 Pin position 8 No emergency mode

ERROR_OPTION_ OPERATION_FAILURE S Index no.: 37 Read/write capability: r, w Display:	Specifies the masking of operating errors. 1 Control loop 2 Zero point 3 Autocorrection 4 Fatal error 5 w too small 6 Total valve travel exceeded
ERRORBYTE D Index no.: 106 Read/write capability: r	Specifies the cancellation flag of the step response (criterion for cancellation). Available in versions with EXPERT$^+$ extended diagnostics and higher
EVENT_LOGGING_1 D Index no.: 86 Read/write capability: r	Indicates the logs 0 – 14 with the time they were recorded.
EVENT_LOGGING_2 D Index no.: 87 Read/write capability: r	Indicates the logs 15 – 29 with the time they were recorded.
FINAL_POSITION_ VALUE D Index no.: 20 Read/write capability: r	Specifies the current valve position in % in relation to the operating range FINAL_VALUE_RANGE.
FINAL_POSITION_ VALUE_DISC D Index no.: 52 Read/write capability: r, w	Specifies FINAL_POSITION_VALUE, e.g. limit values reached or value state.
FINAL_POSITION_ VALUE_LIMITS D Index no.: 51 Read/write capability: r, w Display:	Indicates the limit of FINAL_POSITION_VALUE. This actual value is sent to the Analog Output Transducer Block directly from the valve. FINAL_POSITION_VALUE_LIMITS FINAL_POSITION_VALUE_HIGH_LIMIT FINAL_POSITION_VALUE_LOW_LIMIT

FINAL_VALUE N Index no.: 13 Read/write capability: r, w	Contains the output value received from the upstream Analog Output Function Block.
FINAL_VALUE_ CUTOFF_HI S Index no.: 15 Read/write capability: r, w Range: Initial value: Code 15	Final position if set point above adjusted value. If the set point exceeds the adjusted value, the valve is moved to the final position that corresponds to 100 % of the manipulated variable. This causes the actuator to either be vented completely or fully filled with air (corresponding to the fail-safe action). 0 ... 125 % 99 % Note! The function is deactivated by entering –2.5 %. As this function causes the actuator to be fully vented or filled with air, the valve moves to its absolute final position. Restrictions set by the travel range or travel limitation functions do not apply. In the case that this creates excessive positioning forces, this function must be deactivated.
FINAL_VALUE_ CUTOFF_HI_ON S Index no.: 75 Read/write capability: r, w	Enables the final position w> (Code 15).
FINAL_VALUE_ CUTOFF_LO S Index no.: 16 Read/write capability: r, w Range: Initial value: Code 14	Final position if set point below adjusted value If the set point falls below the adjusted value, the valve is moved to the final position that corresponds to 0 % of the manipulated variable. This causes the actuator to either be vented completely or fully filled with air (corresponding to the fail-safe action). –2.5 ... 100 % 1 % Note! The function is deactivated by entering –2.5 %. As this function causes the actuator to be fully vented or filled with air, the valve moves to its absolute final positions. Restrictions set by the travel range or travel limitation functions do not apply. In the case that this creates excessive positioning forces, this function must be deactivated.

FINAL_VALUE_CUTOFF_LO_ON S Index no.: 74 Read/write capability: r, w	Enables final position w< (Code 14).
FINAL_VALUE_RANGE S Index no.: 14 Read/write capability: r, w Display: See Code 8, Code 9	Sets the travel/rotational angle range. The set point FINAL_VALUE is sent to the Analog Output Transducer Block directly from an upstream AO Function Block. FINAL_VALUE_RANGE - EU_100 (Code 9) - EU_0 (Code 8) - UNITS_INDEX - DECIMAL
HIS_TEMPERATURE D Index no.: 100 Read/write capability: r Display:	Indicates temperature-specific data. T_CURRENT_TEMPERATURE Current temperature T_MAX_TEMPERATURE Max. temperature HIS_T_ZEIT_MAX_TEMPERATUR Duration of max. temperature T_MIN_TEMPERATURE Min. temperature HIS_T_ZEIT_MIN_TEMPERATUR Duration of min. temperature TEMP_PERIOD_TIME_HIGH Time the temperature above 80 °C TEMP_PERIOD_TIME_LOW Time the temperature below –40 °C
HISTOGRAMM_X D Index no.: 96 Read/write capability: r	Reflects the valve position X. The valve position histogram provides a static evaluation of the recorded travel positions. The histogram indicates, for example the travel range in which the valve has mainly been operating and whether a recent trend can be recognized, indicating a change of the main operating range. Available in versions with EXPERT+ extended diagnostics and higher
HISTOGRAMM_Z D Index no.: 99 Read/write capability: r	The cycle counter records the number of spans and the associated heights of the spans, which are categorized in fixed intervals (classes). The cycle counter histogram provides a static evaluation of the cycle spans, thus furnishing data on the dynamic stress that a bellows or an installed packing are exposed to. Available in versions with EXPERT+ extended diagnostics and higher

HYS_STELL_Y D Index no.: 102 Read/write capability: r, w	Specifies the minimum interval at which hysteresis tests are performed for the control signal. Available in versions with EXPERT+ extended diagnostics and higher
IDENT_LIMIT_SWITCHES D Index no.: 55 Read/write capability: r, w Range: Initial value: Code 38	Specifies whether optional inductive limit switches are installed. Limit switches are not detected automatically; they need to be entered manually. NOT IMPLEMENTED Not installed IMPLEMENTED Installed Corresponding to hardware setup
IDENT_OPTIONS D Index no.: 54 Read/write capability: r Display:	Indicates which optional components are installed. 1 Not implemented 2 Binary input 2 3 Solenoid valve 4 Limit switch
INIT_METHOD S Index no.: 60 Read/write capability: r, w Display: Code 6	Indicates the selected initialization mode. 0 Maximum range 1 Nominal range 2 Manual adjustment 3 Substitute 4 Zero point
KP_STEP S Index no.: 17 Read/write capability: r Code 17	Specifies Kp. This parameter can only be read over FOUNDATION Fieldbus. The value is detected during initialization.

LATENCY_AFTER_STEP S Index no.: 109 Read/write capability: r, w Range: Initial value:	This parameter sets the waiting time required to jump back from the final value of the first step change to the initial value of the second step change (reverse step change). 0 to 120 s 1 s Available in versions with EXPERT+ extended diagnostics and higher
LIN_TYPE S Index no.: 69 Read/write capability: r, w Display: Code 20	Sets the characteristic. 1 Linear 2 Equal percentage 3 Reverse equal percentage 4 SAMSON butterfly valve, linear 5 SAMSON butterfly valve, equal percentage 6 VETEC rotary valve, linear 7 VETEC rotary valve, equal percentage 8 Segmented ball valve, linear 9 Segmented ball valve, equal percentage 10 User-defined
LOGGING_LIMIT D Index no.: 92 Read/write capability: r, w Display:	Indicates the initial value of an event that triggers logging. 1 Lower limit 2 Upper limit Available in versions with EXPERT+ extended diagnostics and higher

MODE_BLK S Index no.: 5 Read/write capability: r, w Range:	Used to indicate/select the actual mode of the Resource Block, the permitted modes supported by the Transducer Block, and the normal mode. The Transducer Block supports the following modes: AUTO (automatic) mode In this operating mode, a positioning value is calculated from the output value from the AO Function Block and the control valve is positioned accordingly. O/S (out of service) mode In this operating mode, the output value from the AO Function Block is not used. The control valve is moved to its mechanical fail-safe position set by ACT_FAIL_ACTION. The mode is also changed to O/S when the forced venting function is triggered. MAN (manual) mode In this operating mode, FINAL_VALUE can be entered manually. LO (local override) mode If the device is locally set to the MAN mode, the Analog Output Transducer Block is set to LO.
MOVING_DIRECTION S Index no.: 65 Read/write capability: r, w Code 7	Specifies the direction of action of the reference variable w in relation to the manipulated variable x.
NO_OF_ZERO_POINT_ADJ D Index no.: 83 Read/write capability: r	Specifies the number of zero calibrations performed since the last initialization.
OVERSHOOT_FALLING D Index no.: 113 Read/write capability: r	Evaluation parameter for step response test. Overshooting of falling reference variable step change Available in versions with EXPERT+ extended diagnostics and higher
OVERSHOOT_RISING D Index no.: 112 Read/write capability: r	Evaluation parameter for step response test. Overshooting of rising reference variable step change Available in versions with EXPERT+ extended diagnostics and higher

PRESSURE_LIMIT S Index no.: 80 Read/write capability: r, w Display: Code 16	Used to set the pressure limit. See Code 16 in section 12. 1 Off 2 3.7 bar 3 2.4 bar 4 1.4 bar
PRESSURE_Y D Index no.: 50 Read/write capability: r Code 44	Specifies the actuator pressure in percent after initialization.
PRETRIGGER_TIME D Index no.: 93 Read/write capability: r, w	The data logger can be triggered as soon as a certain event occurs. The pretrigger function can also be used to display data recorded before this event. This is made possible by a buffer in which all events are saved continuously. For example, if the pretrigger time is set to 1 s, all events that occurred in the second before the data logger was triggered are displayed. Available in versions with EXPERT⁺ extended diagnostics and higher
RAMP_DOWN D Index no.: 108 Read/write capability: r, w Initial value	The dynamic control response of the control valve can be tested by recording step responses. Sets the time in which the reverse step change is expected to fall. 0 Available in versions with EXPERT⁺ extended diagnostics and higher
RAMP_UP D Index no.: 107 Read/write capability: r, w Initial value:	The dynamic control response of the control valve can be examined by recording step responses. Sets the time in which the reverse step change is expected to rise. 0 Available in versions with EXPERT⁺ extended diagnostics and higher

RATED_TRAVEL S Index no.: 58 Read/write capability: r, w Range: Initial value: Code 5	Specifies the rated travel [mm] or rotational angle [degrees] of the valve. 0 to 255.9 15.0 mm Note! The unit [mm] or [degrees] depends on the VALVE_TYPE parameter.
SAMPLE_RATE D Index no.: 90 Read/write capability: r, w	Used to set the sampling rate of the data logger in ms. Available in versions with EXPERT+ extended diagnostics and higher
SELF_CALIB_CMD D Index no.: 61 Read/write capability: r, w Range:	Starts the calibration sequences in the field unit and the resetting of fault alarms. 1 No test, normal operation 2 Start with default values 3 Start initialization 4 Cancel initialization 5 Start zero point adjustment 6 Cancel zero point adjustment 7 Search device 8 Reset total valve travel /* xd_error_ext_1 */ 9 Reset 'Solenoid valve active' 10 Reset 'Total valve travel limit exceeded' 11 Reset 'Control loop' 12 Reset 'Zero point' 13 Reset 'Autocorrection' 14 Reset 'Fatal error' 15 Reset 'Extended diagnostics' 16 Reset 'x > range' 17 Reset 'Delta x < range' 18 Reset 'Attachment' 19 Reset 'Initialization time exceeded'

	20 Reset 'Initialization / solenoid valve' 21 Reset 'Travel time too short' 22 Reset 'Pin position' /* xd_error_ext_2 */ 23 Reset 'x signal' 24 Reset 'i/p converter' 25 Reset 'Hardware' 26 Reset 'Control parameter' 27 Reset 'Potentiometer parameter' 28 Reset 'Adjustment parameter' 29 Reset 'General parameter' 30 Reset 'Internal device error 1' 31 Reset 'No emergency mode' 32 Reset 'Program load error' 33 Reset 'Options parameter' 34 Reset 'Info parameter' 35 Reset 'Data memory' 36 Reset 'Control calculation' 37 Reset 'Data memory enhanced diagnostics'
SELF_CALIB_STATUS D Index no.: 63 Read/write capability: r Display:	Indicates the state of the calibration sequence started with SELF_CALIB_CMD. 1 Not active 2 Running 3 Test canceled 4 Zero point adjustment 5 Maximum point adjustment 6 Detection of mechanical stops 7 Controller optimization 8 Fine tuning 9 Step 1 (step response) 10 Step 2 (step response) 11 Terminated
SERVO_RESET S Index no.: 18 Read/write capability: r, w	This parameter is not processed by Type 3730-5.

SET_FAIL_SAFE_POS S Index no.: 57 Read/write capability: r, w Display:	Allows the valve to be moved to fail-safe position over FOUNDATION Fieldbus. The positioner remains in AUTO mode. Fail-safe position is indicated by an S blinking on the display. 1 Not active 2 Set fail-safe position 3 Clear fail-safe position
SETP_DEVIATION D Index no.: 45 Read/write capability: r Code 39	Indicates the deviation e.
SIGNAL_PRESSURE_ ACTION D Index no.: 77 Read/write capability: r	This parameter is determined during initialization and indicates the position of the slide switch (AIR TO OPEN/CLOSE)! It can only be changed on re-initialization.
SOLENOID_SELECT D **Index no.: 94** Read/write capability: r, w	Indicates the status of the solenoid valve (Code 45). Available in versions with EXPERT+ extended diagnostics and higher
ST_REV S Index no.: 1 Read/write capability: r	The revision level of static data is displayed. Note! The revision level value will be incremented each time a static parameter in the block is changed.
START_VALUE D Index no.: 91 Read/write capability: r, w	The start value is specified for a triggered start condition of the data logger (valve position in %). Available in versions with EXPERT+ extended diagnostics and higher
STEP_PROGRESS D Index no.: 120 Read/write capability: r	The progress of the step response test is indicated. Available in versions with EXPERT+ extended diagnostics and higher
STEP_SAMPLE_RATE D Index no.: 105 Read/write capability: r, w Range: Initial value:	Used to set the sampling rate of the step response logging 0.1 to 120 s 0.1 s Available in versions with EXPERT+ extended diagnostics and higher

STEP_SELECTION D Index no.: 110 Read/write capability: r, w Display:	The dynamic control behavior of the valve can be tested by recording the step responses. Two reference variable steps are performed by default and the course of the valve position X and the manipulated variable Y are plotted until they reach a steady state. The first step starts at a start value defined beforehand and finishes at the determined final value. After the entered waiting time, the second step is performed in reverse starting with the final value back to the initial value. This parameter is used to select whether just one step is to be performed or whether also the reverse step is to be performed after the first step. 1 One step 2 Two steps Available in versions with EXPERT+ extended diagnostics and higher
STEPEND D Index no.: 104 Read/write capability: r, w Range: Initial value:	Used to set the final value to perform the step response. 0 to 100% 100 % Available in versions with EXPERT+ extended diagnostics and higher
STEPSTART D Index no.: 103 Read/write capability: r, w Range: Initial value:	Used to set the initial value to perform the step response 0 to 100% 0 % Available in versions with EXPERT+ extended diagnostics and higher
STRATEGY S Index no.: 3 Read/write capability: r, w Initial value:	Permits strategic grouping and thus faster processing of blocks. Blocks are grouped by entering the same number in the STRATEGY parameter of each block. 0 Note! These data are neither checked nor processed by the Transducer Block.
SUB_MODE_INIT D Index no.: 62 Read/write capability: r	Indicates whether an initialization has been performed in the SUB mode.

TAG_DESC S Index no.: 2 Read/write capability: r, w	Assigns a unique 32 character description to each block for clear identification
TIME_63_FALLING D Index no.: 117 Read/write capability: r	Determined from the step response test T_{63} for the falling step. Available in versions with EXPERT$^+$ extended diagnostics and higher
TIME_63_RISING D Index no.: 116 Read/write capability: r	Determined from the step response test T_{63} for the rising step. Available in versions with EXPERT$^+$ extended diagnostics and higher
TIME_98_FALLING D Index no.: 119 Read/write capability: r	Determined from the step response test T_{98} for the falling step. Available from optional diagnostics version EXPERT$^+$.
TIME_98_RISING D Index no.: 118 Read/write capability: r	Determined from the step response test T_{98} for the rising step. Available in versions with EXPERT$^+$ extended diagnostics and higher
TOLERANCE_BAND S Index no.: 47 Read/write capability: r, w Range: Initial value: See Code 19	Tolerance band 0.1...10 % 5 %
TOT_VALVE_TRAV_LIM S Index no.: 49 Read/write capability: r, w Range: Initial value: Code 24	Indicates limit of absolute total valve travel 0...16 500 000 1 000 000
TOTAL_VALVE_TRAVEL D Index no.: 48 Read/write capability: r Code 23	Indicates absolute total valve travel Sum of the nominal load cycles (double strokes), total number of valve strokes.

TRANSDUCER_ DIRECTORY D Index no.: 9 Read/write capability: r	This parameter is not processed in Type 3730-5.
TRANSDUCER_STATE D Index no.: 34 Read/write capability: r Display:	Indicates the state of the Transducer Block. 1 See operating mode 2 Solenoid valve active 3 Lower travel limit active 4 Upper travel limit active 5 Final position < active 6 Final position > active 7 Fail-safe position active 8 Normal operation
TRANSDUCER_TYPE N Index no.: 10 Read/write capability: r	Indicates the type of transducer. Standard Advanced Positioner Valve in this case.
TRANSM_PIN_POS S Index no.: 59 Read/write capability: r, w See Code 4	The pin position must be entered for initialization in NOM or SUB modes. The follower pin must be placed in the correct pin position depending on the valve travel/angle of rotation. See Table for pin position (Code 4).
TRAVEL_LOWER_LIMIT S Index no.: 71 Read/write capability: r, w See Code 10	Limits the travel/angle of rotation downwards. The characteristic is not adapted compared to the FINAL_VALUE_RANGE!
TRAVEL_LOWER_ LIMIT_ON S Index no.: 70 Read/write capability: r, w See Code 10	Enables the x lower limit.
TRAVEL_RATE_DEC S Index no.: 79 Read/write capability: r, w See Code 22	Indicates the time required by the valve to move through the operating range when the valve closes.

TRAVEL_RATE_INC S Index no.: 78 Read/write capability: r, w See Code 21	Indicates the time required by the valve to move through the operating range when the valve opens.
TRAVEL_UPPER_LIMIT S Index no.: 73 Read/write capability: r, w Code 11	Limits the travel/angle of rotation upwards. The characteristic is not adapted compared to FINAL_VALUE_RANGE!
TRAVEL_UPPER_ LIMIT_ON S Index no.: 72 Read/write capability: r, w	Enables the x upper limit (Code 11).
TRIGGER_SELECT S Index no.: 89 Read/write capability: r, w Display:	On selecting TRIGGER in DATALOGGER_SELECT parameter, the user can select which events are to trigger the event logger. 1 Valve position 2 Solenoid condition 3 Valve position or solenoid condition Available in versions with EXPERT+ extended diagnostics and higher
TV_STEP S Index no.: 19 Read/write capability: r Code 19	Indicates Tv. This parameter can only be read over Foundation Fieldbus. The value is recorded during the initialization process!
UPDATE_EVT D Index no.: 7 Read/write capability: r, w	Indicates that static data were changed, including date and time stamp.
USER_CHARACTERISTIC S Index no.: 33 Read/write capability: r, w	Allows the user-defined characteristic to be entered. The characteristic to be used is selected over the LIN_TYPE parameter (User defined in this case). The following condition must be fulfilled in this case: $X(t-1) < X(t)$ In other words, the values for X must continually increase!

VALVE_MAN_ID S Index no.: 25 Read/write capability: r, w	Clearly identification of the manufacturer of the valve that the positioner is mounted on.
VALVE_MODEL_NUM S Index no.: 26 Read/write capability: r, w	Indicates the model version of the valve that the positioner is mounted on.
VALVE_SN S Index no.: 27 Read/write capability: r, w	Indicates the serial number of the valve that the positioner is mounted on.
VALVE_TYPE S Index no.: 28 Read/write capability: r, w Range: Initial value:	Indicates type of valve UNINITIALIZED Undefined LINEAR (Control valves with straight moving plug e.g. globe valves) ROTARY (Control valves with rotating closure members) OTHER linear Note! The Type 3730-5 differentiates merely between linear and rotary valves. Undefined and Other are treated as globe valves.
XD_CAL_DATE S Index no.: 30 Read/write capability: r, w	Indicates the time when the last calibration was performed.
XD_CAL_LOC S Index no.: 29 Read/write capability: r, w	Indicates the location where the last calibration was performed.
XD_CAL_WHO S Index no.: 31 Read/write capability: r, w	Indicates the person who performed the last calibration.

XD_ERROR D Index no.: 11 Read/write capability: r Display:	Errors listed in the Transducer Block NONE (0) No error UNSPECIFIED ERROR Unspecified error (device) not initialized, initialization or zero point calibration in progress or total valve travel exceeded). GENERAL ERROR CALIBRATION ERROR (Zero point, internal control loop, or initialization error) CONFIGURATION ERROR (Parameter or characteristic faulty). ELECTRONICS FAILURE MECHANICAL FAILURE DATA INTEGRITY ERROR ALGORITHM ERROR Dynamic values outside of the range
XD_ERROR_EXT D Index no.: 35 Read/write capability: r Display:	Extended errors listed in the Transducer Block 1 xd_error_ext_1 "Device not initialized" "Solenoid valve active" or "SET_FAIL_SAFE_POS active" "Total valve travel limit exceeded" "Control loop" (Code 57) "Zero point" (Code 58) "Autocorrection" (Code 59) "Fatal error" (Code 60) "Extended diagnostics" "x > range" (Code 50) "Delta x < range" (Code 51) "Attachment" (Code 52) "Initialization time exceeded" (Code 53) "Initialization / solenoid valve" (Code 54) "Travel time too short" (Code 55) "Pin position" (Code 56) "Test or calibration running"

	2	xd_error_ext_2	
		"x-signal"	(Code 62)
		"i/p-converter"	(Code 64)
		"Hardware"	(Code 65)
		"Control parameter"	(Code 68)
		"Poti parameter"	(Code 69)
		"Adjustment parameter"	(Code 70)
		"General parameter"	(Code 71)
		"Internal device error 1"	(Code 73)
		"No emergency mode"	(Code 76)
		"Program load error"	(Code 77)
		"Options parameter"	(Code 78)
		"Info parameter"	(Code 75)
		"Data memory"	(Code 66)
		"Control calculation"	(Code 67)
		"Reference test aborted"	(Code 81)
	3	xd_error_ext_3	
	4	AirSupply	
	5	ActuatorSpring	
	6	ShiftingWorkingRange	
	7	Friction	
	8	LeakagePneumatic	
	9	LimitWorkingRange	EXPERT+
	10	DynamicStressFactor	
	11	InnerLeakage	
	12	ExternalLeakage	
	13	ObservingEndPosition	
	14	ConnectionPositionerValve	
	15	WorkingRange	
	16	EmergencyShutDown	
	17	TemperatureError	
ZERO_POINT_LIMIT D Index no.: 84 Read/write capability: r, w	Indicates the zero point limit. Unit in %.		

13.5.3 Discrete Input Transducer Blocks

Discrete Input Transducer Blocks directly connect the physical inputs of the field device to the assigned function blocks.
The CHANNEL parameter is used to assign the Transducer Blocks to the function blocks.
The Type 3730-5 Positioner has two binary inputs that work independently from one another. A Discrete Input Function block exists for each input.

The DI Transducer Blocks are implemented according to the FF Specification and do not contain any manufacturer-specific parameters.

13.5.4 Analog Output Function Block

The Analog Output Function Block processes an analog signal from an upstream function block (e.g. PID Block) into an output value intended for the downstream Transducer Block (e.g. valve positioner). It contains scaling functions and ramp functions as well as other functions.
The AO Block receives its set point depending on the mode (MODE_BLK) from one of the input variables CAS_IN, RCAS_IN or SP. An internal working set point is created from it, taking into account the PV_SCALE, SP_HI_LIM and SP_LO_LIM, SP_RATE_UP and SP_RATE_DN.
Depending on the IO_OPTS and XD_SCALE parameters, an output value OUT is generated which is passed on to the downstream Transducer Block over the CHANNEL parameter.
A Fault State is included in the AO Block which is activated when a fault condition (of the valid set point) last longer than the time determined in FSTATE_TIME or when SET_FSTATE is activated in the Resource Block.
The Fault State is determined over FSTATE_TIME, FSTATE_VAL and IO_OPTS parameters.

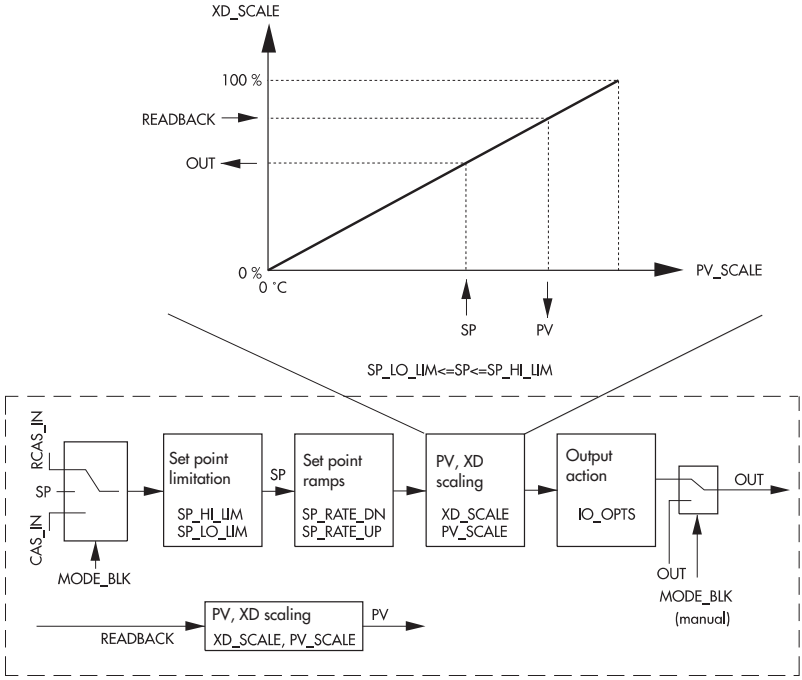


Fig. 16 · Analog Output Function Block

Analog Output Function Block parameters

ALERT_KEYS S Index no.: 4 Read/write capability: r, w Range: Initial value:	Used to specify the identification number of the plant section. This information can be used by the Fieldbus host system to group alert and events. 1...255 0 Note! "0" is not a permissible value and will be rejected when transferring data to the device (error).
BKCAL_OUT D Index no.: 25 Read/write capability: r	Reflects the analog output value and status required by the BKCAL_IN parameter of the upstream Function Block for cascade control. This value provides windup protection in the upstream block and a bumpless transfer on mode changes.

BLOCK_ALM D Index no.: 30 Read/write capability: r, w	Is used for all configuration, hardware, connection failure, or system problems in the block including details on the time of the alarm (date and time stamp). Note! In addition, an active block alarm can be acknowledged manually in this parameter group.
BLOCK_ERR D Index no.: 6 Read/write capability: r Display:	Reflects the active errors associated with a block. OUT OF SERVICE Block mode is out of service. CONFIGURATION_ERROR A configuration error exists in the block. INPUT FAILURE PV (position feedback) has bad status, e.g. because the Transducer Block is in O/S mode. OUTPUT FAILURE OUT cannot be issued, e.g. because the Transducer Block is not initialized or is in LO mode.
CAS_IN N Index no.: 17 Read/write capability: r, w	Reflects/defines the analog reference variable and its status from an upstream function block.
CHANNEL S Index no.: 22 Read/write capability: r, w in O/S Initial value	Assignment between the output of each Analog Output Function Block and the logical hardware channels (Transducer Block). 3 Note! In order to be able to put the AO Function Block into operation, CHANNEL must be set to a valid value. The valid value is 3 in this case as there are three Transducer Blocks (Standard Advanced Positioner Valve) in the Type 3730-5.
FSTATE_TIME S Index no.: 23 Read/write capability: r, w Initial value:	The length of time, in seconds, that the AO Function Block will wait to set Fault State after the recognition of an error of the valid set point. The Fault State is triggered when the fault still exists after the time interval has elapsed. 0 Note! The Fault State of the AO Function Block is set in IO_OPTS parameter of this block.

FSTATE_VAL S Index no.: 24 Read/write capability: r, w Range: Initial value:	Determines the set point for the AO Function Block when the Fault State is triggered. Value and range of PV_SCALE ±10 % 0 Note! This value is used when the option "Fault State to value" is set in the IO_OPTS parameter.
GRANT_DENY D Index no.: 13 Read/write capability: r, w	Grants or denies access of a Fieldbus host system to the field device. Note! This parameter is not used by Type 3730-5.
IO_OPTS S Index no.: 14 Read/write capability: r, w in O/S Range:	Used to select how the input/output is processed in the AO Block SP-PV Track in MAN The set point tracks the process variable in MAN mode (ACTUAL_MODE) SP-PV Track in LO The set point tracks the process variable in LO mode (ACTUAL_MODE) SP Track retained Target: The set point tracks RCAS_IN or CAS_IN depending on the set TARGET_MODE in LO or MAN mode (ACTUAL_MODE). This option has priority over SP_PV Track in MAN/LO mode. Increase to Close The output value to the Transducer Block is inverted (corresponds to moving direction). Fault State to Value FSTATE_VAL is used as the set point when the Fault State is triggered (see FSTATE_VAL, FSTATE_TIME). Use Fault State Value on Restart FSTATE_VAL is used for the set point until there is a valid value on restarting the device Target to MAN if Fault State activated On triggering the Fault State, the TARGET_MODE is set to MAN. The original target mode is lost as a result. After leaving the Fault State, the block remains in MAN and must be set to the required target mode by the user. Use PV for BKCAL_OUT The process variable is used instead working set point in BKCAL_OUT. If OUT READBACK is set in the FEATURES_SEL parameter in the Resource Block, the current valve position is reported back over BKCAL_OUT.

MODE_BLK N Index no.: 5 Read/write capability: r, w Display:	Indicates the actual mode of the AO Block as well as the target and permitted modes supported by the AO Block and the normal mode. RCAS CAS AUTO MAN O/S The AO Block supports the following modes: O/S (out of service) The AO algorithm of the block is not processed. The last value is issued at OUT or the determined value when the Fault State is activated. MAN (manual) The user can directly determine the output value of the AO Block. AUTO (automatic) The set point determined by the user is used over the SP parameter on implementation of the AO Block. CAS (cascade mode) The AO Function Block receives the reference variable directly from an upstream function block over the CAS_IN parameter to calculate the manipulated variable internally. The AO Block is implemented. RCAS (remote cascade) The AO Function Block receives the reference variable directly from the host system over the RCAS_IN parameter to calculate the manipulated variable internally. The AO Block is implemented.
OUT N Index no.: 9 Read/write capability: r, w in MAN, O/S	Indicates the manipulated variable, value, limit, and status of the AO Function Block. Note! The output value OUT can be set manually if the MAN mode is selected in MODE_BLK. The unit used is adopted from the XD_SCALE parameter group. The range that can be entered corresponds to ±10 % of the OUT_SCALE.
PV D Index no.: 7 Read/write capability: r	Indicates the process variables including their status used for implementation of the function block. The unit used is adopted from the PV_SCALE parameter group. Note! If OUT READBACK is set in the FEATURES_SEL parameter in the Resource Block, PV contains the current valve position (same as FINAL_POSITION_VALUE).

PV_SCALE S Index no.: 11 Read/write capability: r, w in MAN, O/S Initial value:	Definition of the range (initial and final values), the engineering unit and the number of decimal places used for the process variables (PV). 0...100 %
RCAS_IN N Index no.: 26 Read/write capability: r, w	Input and display of the analog reference variable (value and status) provided by the Fieldbus host system for internal calculation of the manipulated variable. Note! This parameter is only active in the RCAS mode.
RCAS_OUT D Index no.: 28 Read/write capability: r	Display of analog reference variable (value and status) after ramping. This value is provided to the Fieldbus host system for back calculation to allow action to be taken under mode changes or limited signals. Note! This parameter is only active in the RCAS mode.
READBACK D Index no.: 16 Read/write capability: r	Reflects current valve position. The valve is determined from the FINAL_POSITION_VALUE parameter of the associated Transducer Block. The unit used is adopted from the XD_SCALE parameter group.

SHED_OPT S Index no.: 27 Read/write capability: r, w :	Determines what action is to be taken when the monitoring time is exceeded (see SHED_RCAS parameter in the Resource Block) while the connection between the Fieldbus host system and the AO Block in RCAS mode is being checked. When the time has elapsed, the AO Block switches from RCAS mode to the mode selected in SHED_OPT. The action to be taken after the Fault State ends is also determined.
Range:	Uninitialized NormalShed_NormalReturn On failure of remote connection, change to next possible mode until RCAS mode is restored. NormalShed_NoReturn On failure of remote connection, change to next possible mode the block remains in this mode. ShedToAuto_NormalReturn On failure of remote connection, change to AUTO mode until RCAS mode is restored. ShedToAuto_NoReturn On failure of remote connection, change to AUTO mode. No attempt is made to restore the mode and the block remains in AUTO mode. ShedToManual_NormalReturn On failure of remote connection, change to MAN mode until RCAS mode is restored. ShedToManual_NoReturn On failure of remote connection, change to MAN mode. No attempt is made to restore the mode and the block remains in MAN mode. ShedToRetainedTarget_NormalReturn On failure of remote connection, the block attempts to attain the retained target mode until RCAS mode is restored. ShedToRetainedTarget_NoReturn On failure of remote connection, the block sets the target mode to the retained target mode.
Initial value:	Uninitialized Note! This parameter is only active in RCAS mode in the AO Block. The AO Block cannot be set to the RCAS mode when the value is set to Uninitialized.

SIMULATE D Index no.: 10 Read/write capability: r, w	The value and status of process variable PV of the block are simulated. Note! During the simulation, the OUT value is not passed on to the Transducer Block. It keeps the last value valid prior to activating the simulation. The simulation can only be activated if the Simulation Enable hardware switch is set in the device (see also Resource Block).
SP N Index no.: 8 Read/write capability: r, w in AUTO, MAN, O/S Range:	Used to enter the set point (reference variable) in AUTO mode. The unit used is adopted from the PV_SCALE parameter group. Value and range of ±10 % of the PV_SCALE.
SP_HI_LIM S Index no.: 20 Read/write capability: r, w Range: Initial value:	Used to enter the high limit of the set point (reference variable). Value and range of ±10 % of the PV_SCALE. 100 Note! This value must be adapted correspondingly if the scale end setting is changed in the PV_SCALE parameter.
SP_LO_LIM S Index no.: 21 Read/write capability: r, w Range: Initial value:	Used to enter the low limit of the set point (reference variable). Value and range of ±10 % of the PV_SCALE. 0 Note! This value must be adapted correspondingly if the scale end setting is changed in the PV_SCALE parameter.
SP_RATE_DN S Index no.: 18 Read/write capability: r, w Initial value:	Used to enter the ramp rate for downward set point changes in AUTO mode. $3402823466 \times 10^{38}$ Note! The set point is used immediately when the ramp rate is set to zero. The rate limit is active for output blocks in the AUTO and CAS modes.

SP_RATE_UP S Index no.: 19 Read/write capability: r, w Initial value:	Used to enter the ramp rate for upward set point changes in AUTO mode. 3402823466 x 10^{38} Note! The set point is used immediately when the ramp rate is set to zero.
ST_REV N Index no.: 1 Read/write capability: r	Indicates the revision number of static data. Note! The revision state is incremented by one each time a static parameter in the block is written.
STATUS_OPTS S Index no.: 15 Read/write capability: r, w in O/S Range: Initial value:	Allows the selection of status options available to determine the handling and processing of the status: Uninitialized Propagate Fault Backward Status of the Transducer Block is passed on to the upstream block over the status of BKCAL_OUT. Uninitialized
STRATEGY S Index no.: 3 Read/write capability: r, w Initial value:	Permits strategic grouping and thus faster processing of blocks. Blocks are grouped by entering the same number in the STRATEGY parameter of each block. 0 Note! These data are neither checked nor processed by the AO Function Block.
TAG_DESC S Index no.: 2 Read/write capability: r, w Initial value:	Assigns a unique 32 character description to each block for clear identification No text
UPDATE_EVT D Index no.: 29 Read/write capability: r	Indicates that static data were changed, including date and time stamp.

XD_SCALE S Index no.: 12 Read/write capability: r, w in MAN, O/S Initial value:	Definition of the range (initial and final values), the engineering unit and the number of decimal places used to display the manipulated variable (OUT). Specified in [%], [mm] or [degrees]. 0.0...100.0 % Note: When [%] is used, the OUT value is based on a scale of 100 %. In case of [mm] (with globe valves) or [degrees] (with rotary valves), the OUT value corresponds to the value set in the RATED_TRAVEL parameter in the Transducer Block which is scaled as 100 %.

13.5.5 Discrete Input Function Block DI1

The Type 3730-5 Positioner is fitted with a standard contact input to process binary voltage signals.
The Discrete Input DI1 Function Block is used for processing the contact input (terminals 87 und 88) and to integrate a FOUNDATION Fieldbus application.

The connected hardware is assigned to the function block by CHANNEL = 1. The OUT_D parameter is used to link the state of the contact to other function blocks.
Alternatively, an integrated solenoid valve MGV, a discrete valve position with three states POS_D as well as the Condensed State (NAMUR Status) can be processed.
The binary signal to be linked can be selected over the SELECT_BINARY_INPUT_1 parameter in the Resource Block.

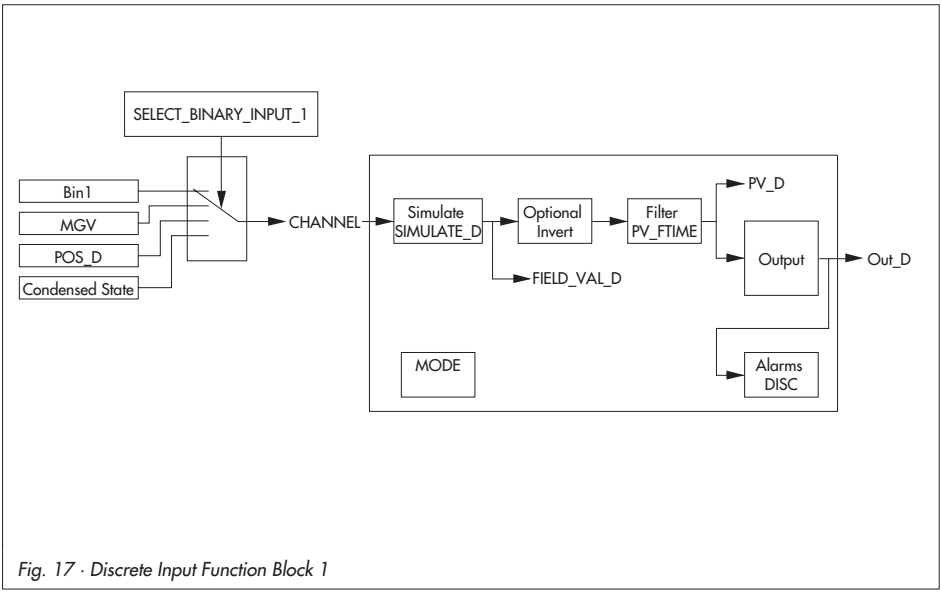


Fig. 17 · Discrete Input Function Block 1

Parameters of the Discrete Input Function Block 1

ACK_OPTION S Index no.: 21 Read/write capability: r,w Range: Initial value:	Determines whether an alarm is to be automatically acknowledged in the positioner, i.e. without intervention of the fieldbus host system. 0 No selection BLOCK_ALM Block alarm DISC_ALM Discrete alarm 0 Note! The alarm is broadcast to the Fieldbus host system, but not acknowledged by it.
ALARM_SUM S+D Index no.: 20 Read/write capability: r,w Display:	Determines the current status of the process alarms in the DI1 Function Block BLOCK_ALM Block alarm DISC_ALM Discrete alarm Note! The process alarms can also be deactivated in this parameter group.
ALERT_KEY S Index no.: 4 Read/write capability: r, w Range: Initial value:	Used to specify the identification number of the plant section. This information can be used by the Fieldbus host system to group alert and events. 1...255 0 Note! "0" is not a permissible value and will be rejected when transferring data to the device (error).
BLOCK_ALM D Index no.: 19 Read/write capability: r, w	Indicates the current block state with information about configuration, hardware, or system failure including details on the time of the alarm (time and date stamp). Note! In addition, an active block alarm can be acknowledged manually in this parameter group.
BLOCK_ERR D Index no.: 6 Read/write capability: r Display:	Reflects the active errors associated with a block. OUT OF SERVICE Block mode is out of service. CONFIGURATION_ERROR A configuration error exists in the block.

CHANNEL S Index no.: 15 Read/write capability: r, w Range: Initial value:	Determines which Transducer Block is assigned to the DI1 Function Block. 1...3 1
DISC_ALM D Index no.: 24 Read/write capability: r, w	Indicates the status of the discrete alarm including details on the time of the alarm (time and date stamp) and on the value which triggered the alarm. The value entered in DISC_LIM is exceeded. Note! In addition, an active block alarm can be acknowledged manually in this parameter group.
DISC_LIM S Index no.: 23 Read/write capability: r, w Range: Initial value:	The state of the discrete input that causes the alarm. 0 / 1 0
DISC_PRI S Index no.: 22 Read/write capability: r, w Range: Initial value:	Determines the action to be taken when the value entered in DISC_LIM is reached. 0 The limit is not processed. 1 Alarm is not broadcast to Fieldbus host system 2 Reserved for block alarms 3...7 Low limit alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high). 8...15 High limit alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high). 0
FIELD_VAL_D N Index no.: 17 Read/write capability: r	Indicates the discrete input value of the DI1 Function Block with details on the status.
GRANT_DENY D Index no.: 12 Read/write capability: r, w	Grants or denies access of a Fieldbus host system to the field device. Note! This parameter is not processed by Type 3730-5

IO_OPTS S Index no.: 13 Read/write capability: r, w in O/S Range:	Used to select how the input/output is processed in the DI1 Block. Invert Used to logically invert the value of FIELD_VAL_D before it is stored as OUT_D.
MODE_BLK N Index no.: 5 Read/write capability: r, w Display:	Indicates the actual mode of the DI1 Block, the permitted modes supported by the DI1 Block, and the normal mode. AUTO MAN O/S The DI1 Block supports the following operating modes: AUTO (automatic) The binary input value FIELD_VAL_D is processed by the Function Block and issued as OUT_D. MAN (manual) The user can directly enter the output value of the Function Block over OUT_D. O/S (out of service) The DI algorithm of the block is not processed. The last value is issued at OUT_D
OUT_D N Index no.: 8 Read/write capability: r, w in MAN, O/S	Indicates/defines the discrete output value of the DI1 Block with the associated status
PV_D D Index no.: 7 Read/write capability: r	Indicates the discrete state used for the Function Block with status. The parameter is identical to the OUT_D in AUTO mode.
PV_FTIME S Index no.:16 Read/write capability: r, w Initial value:	Used to enter the filter time constant (in seconds) of the digital filter until a binary state at the input of the function block is adopted in the PV_D parameter. 0 s

SIMULATE_D S Index no.: 9 Read/write capability: r, w	A discrete input value FIELD_VAL_D can be simulated with status. Note! The simulation can only be activated when this has been enabled at the field device (Code 48/FF-P/F03) as well as in the Function Block.
STATUS_OPTS S Index no.: 14 Read/write capability: r, w in O/S Range: Initial value:	Allows the selection of status options available to determine the handling and processing of the status. Uninitialized Propagate Fail Forward Uninitialized
STRATEGY S Index no.: 3 Read/write capability: r, w Initial value:	Permits strategic grouping and thus faster processing of blocks. Blocks are grouped by entering the same number in the STRATEGY parameter of each block. 0 Note! These data are neither checked nor processed by the DI Function Block.
ST_REV N Index no.: 1 Read/write capability: r	The revision level of static data is displayed. Note! The revision level value will be incremented each time a static parameter in the block is changed.
TAG_DESC S Index no.: 2 Read/write capability: r, w Initial value	Assigns a unique 32 character description to each block for clear identification No text
UPDATE_EVT D Index no.: 18 Read/write capability: r	Indicates that static data were changed, including date and time stamp.

13.5.6 Discrete Input Function Block DI2

The Type 3730-5 Positioner is optionally fitted with a binary input to process a floating contact. The Discrete Input DI2 Function Block is used for processing the contact input (terminals 87 und 88) and to integrate a FOUNDATION Fieldbus application.
The connected hardware is assigned to the function block by CHANNEL = 2.
The OUT_D parameter is used to link the state of the contact to other function blocks.
Alternatively, an integrated solenoid valve MGV, a discrete valve position with three states POS_D as well as the Condensed State (NAMUR Status) can be processed.
The binary signal to be linked can be selected over the SELECT_BINARY_INPUT_2 parameter in the Resource Block.
When a pressure sensor (leakage sensor) is connected, its switching state can be issued as a diagnostic alarm in the XD_ERROR_EXT parameter of the AO Transducer Block. In this case, the option LEAKAGE SENSOR must be activated in CONFIG_BINARY_INPUT2. Alternatively, the switching state of the binary input can be issued in the BINARY_INPUT2 parameter of the AO Transducer Block.

Parameters of the Discrete Input Function Block 2

The parameters of the DI Function Block 2 are the same as the parameters of DI Function Block 1.

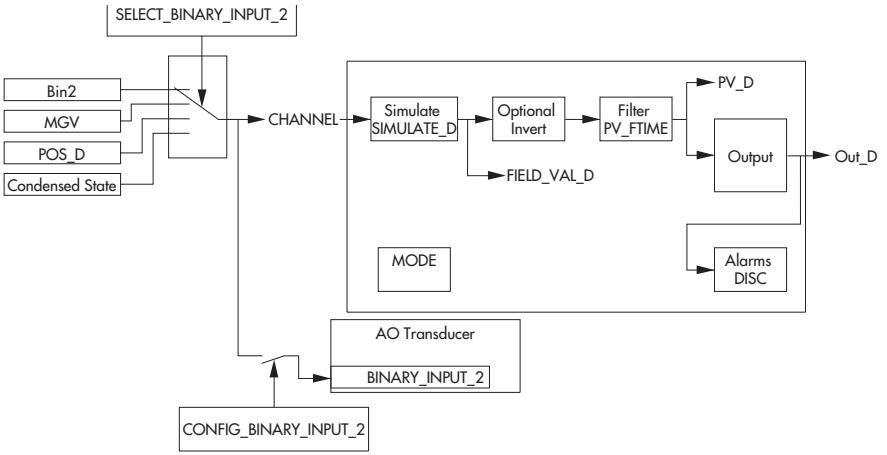


Fig. 18 · Discrete Input Function Block 2

13.5.7 Proportional Integral Derivative Function Block (PID process controller)

A PID Function Block contains the input channel processing, the proportional-integral-derivative (PID) control loop and the analog output channel processing.
The configuration of the PID Block (PID controller) depends on the automation task.
Simple control loops, control loops with manipulate variable feedforwarding, cascade controls and cascade controls with limitation in combination with another controller function block can implemented.
The following options are available for processing the measured variable within the PID Function Block (PID controller): Signal scaling and limiting, mode control, feedforward control, limit control, alarm limit detection and signal status propagation.
The PID Block (PID controller) can be used for various automation strategies. The block has a flexible control algorithm that can be configured to match the application.

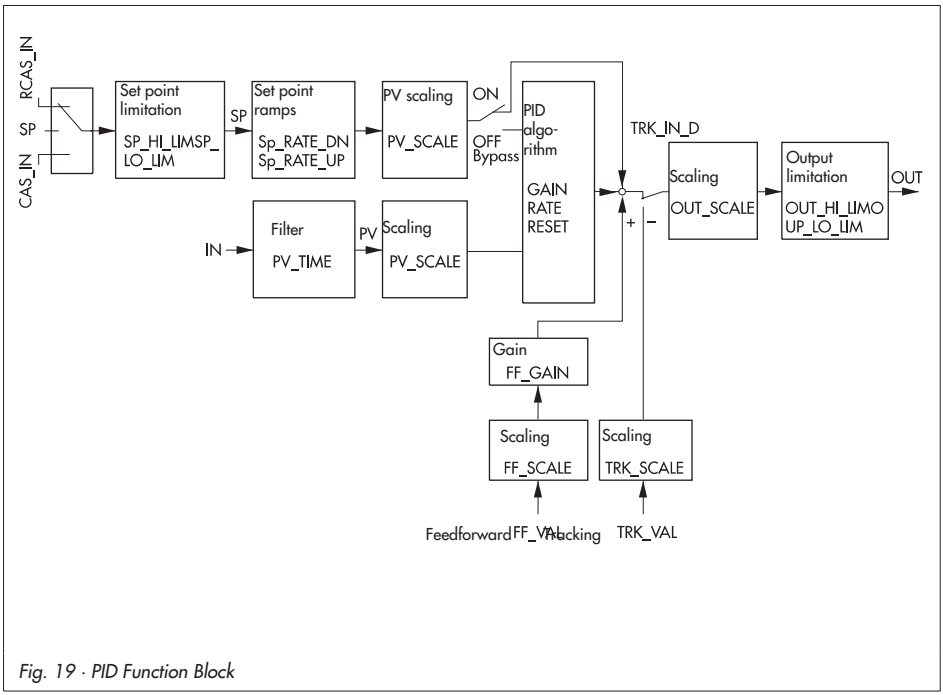


Fig. 19 · PID Function Block

The PID Block receives its set point depending on the mode (MODE_BLK) from the input variables CAS_IN, RCAS_IN or SP. PV_SCALE, SP_HI_LIM, SP_LO_LIM, SP_RATE_UP and SP_RATE_DN are used to generate an internal operating set point. The block receives the actual value over the IN input variable which is used to generate the process variable PV, taking into account the PV_SCALE and the filter of the first order PV_FTIME.

These values are fed to the internal PID algorithm. This algorithm consists of a proportional, an integral and a derivative component. The manipulated variable is calculated from the set point value SP and the process variable PV (actual value) resulting from the system deviation.

The individual PID components are included in the calculation of the manipulated variable as follows:

- Proportional component:
  The proportional component reacts immediately and directly when the set point SP or the process variable PV (actual value). The manipulated variable is changed by the proportional factor GAIN. This change corresponds to the system deviation multiplied by the gain factor. If a controller works only with a proportional component, the control loop has a permanent system deviation.
- Integral component:
  The system deviation resulting from the calculation of the manipulated variable using the proportional component is integrated over the integral component of the controller until it is negligible. The integral function corrects the manipulated variable depending on the size and duration of the system deviation. If the value for the integration time RESET is set to zero, the controller works as a P or PD controller. The influence of the integral component on the control loop increases when the value of the integration time is reduced.
- Derivative component:
  In controlled systems with long delay times, e.g. in temperature control loops, it makes sense to use the derivative component RATE of the controller. Using the derivative component RATE, the manipulated variable is calculated depending on the rate of change of the system deviation.

An output value OUT is formed from the calculated manipulated variable corresponding to the OUT_SCALE, OUT_HI_LIM and OUT_LO_LIM parameters. This output value can be passed on to a downstream connected function block.
The status of the output value OUT can be influenced by the STATUS_OPTS parameter depending on the status of the input variable of the PID Block. This allows, for example, the fault state of a downstream connected output block to be activated.
The BYPASS parameter allows the internal set point to be directly transferred to the correction value. Feedforward is possible over the FF_VAL input variable. TRK_IN_D and TRK_VAL allow the output value to be directly tracked.

PID Function Block parameters

ACK_OPTION S Index no.: 46 Read/write capability: r, w Range: Initial value:	Used to select whether an alarm is to be automatically acknowledged in the positioner, i.e. without intervention of the Fieldbus host system. Undefined — No selection HI_HI_ALM — High high alarm HI_ALM — High alarm LO_LO_ALM — Low low alarm LO_ALM — Low alarm DV_HI_ALM — Deviation high alarm DV_LO_ALM — Deviation low alarm BLOCK ALM — Block alarm Undefined Note! The alarm is broadcast to the Fieldbus host system, but not acknowledged by it.
ALARM_HYS S Index no.: 47 Read/write capability: r, w Range: Initial value:	Used to specify the amount the alarm value must return to within the alarm limit before the associated active alarm condition clears. The hysteresis value affects the following alarms of the PID Function Block: HI_HI_LIM HI_LIM LO_LO_LIM LO_LIM DV_HI_LIM DV_LO_LIM 0...50 % 0.5 % Note! The hysteresis value is based upon the percent of the range of the PV_SCALE parameter group in the PID Function Block.
ALARM_SUM S+D Index no.: 45 Read/write capability: r, w Display:	Indicates the current status of the process alarm in the PID Function Block. HI_HI_ALM — High high alarm HI_ALM — High alarm LO_LO_ALM — Low low alarm LO_ALM — Low alarm

	DV_HI_ALM Deviation high alarm DV_LO_ALM Deviation low alarm BLOCK ALM Block alarm Note! The process alarms can also be deactivated in this parameter group.
ALERT_KEY S Index no.: 4 Read/write capability: r, w Range: Initial value:	Used to specify the identification number of the plant section. This information can be used by the Fieldbus host system to group alert and events. 1...255 0 Note! "0" is not a permissible value and will be rejected when transferring data to the device (error).
BAL_TIME S Index no.: 25 Read/write capability: r, w Initial value:	Used to specify the time constant at which the integral term will move to obtain balance (calculated manipulated variable > OUT_HI_LIM or < OUT_LO_LIM) 0 Note! Balance is immediately obtained when the value 0 (initial value) is set.
BKCAL_HYS S Index no.: 30 Read/write capability: r, w Range: Initial value:	Used to specify the amount the manipulated variable must change away from its range limits OUT_HI_LIM and OUT_LO_LIM before the limit status is turned off. If the manipulated variable moves off a limit, in percent of scale, the limit status is indicated in the OUT parameter and passed on to the following blocks. The range limit status remains active as long as the value of the manipulated variable does not move off the limits again. 0...50 % 0.5 %
BKCAL_IN N Index no.: 27 Read/write capability: r, w	Indicates the analog input value and status from the BKCAL_OUT parameter of a downstream function for a cascade control. This value provides a bumpless transfer on mode changes by backward output tracking.
BKCAL_OUT D Index no.: 31 Read/write capability: r, w	Reflects the analog output value and status required by the BKCAL_IN parameter of the upstream function block for a cascade control. This value provides windup protection in the upstream block and a bumpless transfer on mode changes.

BLOCK_ALM D Index no.: 44 Read/write capability: r, w	Indicates the current block state with information about configuration, hardware, or system failure including details on the time of the alarm (time and date stamp). Note! In addition, an active block alarm can be acknowledged manually in this parameter group.
BLOCK_ERR D Index no.: 6 Read/write capability: r Display:	Reflects the active errors associated with a block. OUT OF SERVICE — The block mode is out of service CONFIGURATION_ERROR — A configuration error exists in the block.
BYPASS S Index no.: 17 Read/write capability: r, w in MAN, O/S Range: Initial value:	Used to activate or deactivate the calculation of the manipulated variable using the PID control algorithm. Uninitialized Same as ON OFF Bypass deactivated: The manipulated variable determined using the PID control algorithm is issued over the OUT parameter. ON BYPASS activated: The value of the reference variable SP is issued directly over the OUT parameter. OFF Note! When "Uninitialized" is set, the block remains in O/S mode. To activate the bypass (set to ON), the bypass must be enabled in the options (CONTROL_OPTS parameters).
CAS_IN N Index no.: 18 Read/write capability: r, w	Used to indicate/define the analog reference variable and its status from an upstream function block.

CONTROL_OPTS S Index no.: 13 Read/write capability: r, w in MAN, O/S Range: Initial value:	Allows selection of controller options available to determine the automation strategy. Bypass Enable — Enable BYPASS parameter Direct Acting — Direct action Track Enable — Enable tracking Track in Manual — Tracking in MAN mode PV for BKCAL_OUT — Value and status of PV parameter used for BKCAL_OUT parameter No OUT Limits in Manual — No output limits in MAN mode None
DV_HI_ALM D Index no.: 64 Read/write capability: r, w	Indicates deviation high alarm status including details of time of alarm (date and time stamp) as well as the value that triggered the alarm. The controlled variable exceeds the reference variable by more than the value determined in DV_HI_LIM parameter. Note! In addition, an active alarm can be acknowledged manually in this parameter group.
DV_HI_LIM S Index no.: 57 Read/write capability: r, w Initial value:	The setting for the alarm limit used to detect the deviation high alarm condition. If the controlled variable exceeds the reference variable by this value, the DV_HI_ALM is issued. $3402823466 \times 10^{38}$
DV_HI_PRI S Index no.: 56 Read/write capability: r, w Range: Initial value:	Determines the action to be taken when the value for the deviation high alarm is exceeded (DV_HI_LIM). 0 The limit for deviation high alarm is not processed. 1 Alarm is not broadcast to Fieldbus host system 2 Reserved for block alarms 3...7 Deviation high alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high). 8...15 Deviation high alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high). 0

DV_LO_ALM D Index no.: 65 Read/write capability: r, w	Indicates deviation low alarm status including details of time of alarm (date and time stamp) as well as the value that triggered the alarm. The controlled variable does not reach the reference variable by more than the value determined in DV_LO_LIM parameter. Note! In addition, an active alarm can be acknowledged manually in this parameter group.
DV_LO_LIM S Index no.: 59 Read/write capability: r, w Initial value:	The setting for the alarm limit used to detect the deviation low alarm condition. If the controlled variable does not reach the reference variable by this value, the DV_LO_ALM is issued. $-3402823466 \times 10^{38}$
DV_LO_PRI S Index no.: 58 Read/write capability: r, w Range: Initial value:	Determines the action to be taken when the value for the deviation low alarm is not reached (DV_LO_LIM). 0 The limit for deviation low alarm is not processed. 1 Alarm is not broadcast to Fieldbus host system 2 Reserved for block alarms 3...7 Deviation low alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high). 8...15 Deviation low alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high). 0
FF_GAIN S Index no.: 42 Read/write capability: r, w in MAN, O/S Initial value:	Used to input the gain of the manipulated variable. 0 Note! The gain is multiplied with the feedforward input (FF_VAL) and the result added to the OUT value.
FF_SCALE S Index no.: 41 Read/write capability: r, w in MAN, O/S Initial value:	Defines the measuring range (upper and lower limits), the engineering unit and the number of decimal places used for the feedforward input (FF_VAL). 0...100 %

FF_VAL N Index no.: 40 Read/write capability: r, w Range:	Indicates/specifies the value and status of the feedforward input. Range and unit of the FF_SCALE Note! The feedforward input is multiplied with the gain (FF_GAIN) and the result added to the OUT value.
GAIN S Index no.: 23 Read/write capability: r, w Initial value:	Specifies the proportional gain (factor). 1.0 Note! The parameter must be set to a value other than 0, otherwise a configuration error will be set in the BLOCK_ERR parameter and the block will go to O/S mode.
GRANT_DENY D Index no.: 12 Read/write capability: r, w	Grants or denies access of a Fieldbus host system to the field device. Note! This parameter is not used by Type 3730-5.
HI_ALM D Index no.: 61 Read/write capability: r, w	Indicates high alarm status (HI_LIM) including details of time of alarm (date and time stamp) as well as the value that triggered the alarm. Note! The unit of the alarm status parameter is taken from the PV_SCALE parameter. An active alarm can also be acknowledged manually in this parameter group.
HI_HI_ALM D Index no.: 60 Read/write capability: r, w	Indicates high high alarm status (HI_HI_LIM) including details of time of alarm (date and time stamp) as well as the value that triggered the alarm. Note! The unit of the alarm status parameter is taken from the PV_SCALE parameter. An active alarm can also be acknowledged manually in this parameter group.
HI_HI_LIM S Index no.: 49 Read/write capability: r, w Range: Initial value:	The setting for the alarm limit used to detect the high high alarm (HI_HI_ALM) condition. If the PV value exceeds this limit, the HI_HI_ALM is issued. Range and unit of PV_SCALE $3402823466 \times 10^{38}$

HI_HI_PRI S Index no.: 48 Read/write capability: r, w Range: Initial value:	Determines the action to be taken when the value for the high high alarm is exceeded (HI_HI_LIM). 0 The limit for high high alarm is not processed. 1 Alarm is not broadcast to Fieldbus host system 2 Reserved for block alarms 3...7 High high alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high). 8...15 High high alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high). 0
HI_LIM S Index no.: 51 Read/write capability: r, w Range: Initial value:	The setting for the alarm limit used to detect the high alarm (HI_ALM) condition. If the PV value exceeds this limit, the HI_ALM is issued. Range and unit of PV_SCALE $3402823466 \times 10^{38}$
HI_PRI S Index no.: 50 Read/write capability: r, w Range:	Determines the action to be taken when the value for the high alarm is exceeded (HI_LIM). 0 The limit for high alarm is not processed. 1 Alarm is not broadcast to Fieldbus host system 2 Reserved for block alarms 3...7 High alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high). 8...15 High alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high).
IN N Index no.: 15 Read/write capability: r, w	Indicates/specifies the analog input variable with details on state and value.
LO_ALM D Index no.: 62 Read/write capability: r, w	Indicates low alarm status (LO_LIM) including details of time of alarm (date and time stamp) as well as the value that triggered the alarm. Note! The unit of the alarm status parameter is taken from the PV_SCALE parameter.

LO_LO_ALM D Index no.: 63 Read/write capability: r, w	Indicates low low alarm status (LO_LO_LIM) including details of time of alarm (date and time stamp) as well as the value that triggered the alarm. Note! The unit of the alarm status parameter is taken from the PV_SCALE parameter. An active alarm can also be acknowledged manually in this parameter group.
LO_LO_LIM S Index no.: 55 Read/write capability: r, w Range: Initial value:	The setting for the alarm limit used to detect the low low alarm (LO_LO_ALM) condition. If the PV value falls below this limit, the LO_LO_ALM is issued. Range and unit of PV_SCALE $-3402823466 \times 10^{38}$
LO_LO_PRI S Index no.: 54 Read/write capability: r, w Range: Initial value:	Determines the action to be taken when the value for the low low alarm is not reached (LO_LO_LIM). 0 The limit for low low alarm is not processed. 1 Alarm is not broadcast to Fieldbus host system 2 Reserved for block alarms 3...7 Low low alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high). 8...15 Low low alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high). 0
LO_LIM S Index no.: 53 Read/write capability: r, w Range: Initial value:	The setting for the alarm limit used to detect the low alarm (LO_ALM) condition. If the PV value falls below this limit, the LO_ALM is issued. Range and unit of PV_SCALE $-3402823466 \times 10^{38}$

LO_PRI S Index no.: 52 Read/write capability: r, w Range: Initial value:	Determines the action to be taken when the value for the low alarm is not reached (LO_LIM). 0 The limit for low high alarm is not processed. 1 Alarm is not broadcast to Fieldbus host system 2 Reserved for block alarms 3...7 Low alarm is issued to notify the operator with the corresponding priority (3 = low, 7 = high). 8...15 Low alarm is issued as a critical alarm with the corresponding priority (8 = low, 15 = high). 0
MODE_BLK S Index no.: 5 Read/write capability: r, w Display:	Indicates the actual mode of the PID Block, the target and permitted modes supported by the PID Block, and the normal mode. ROUT RCAS CAS AUTO MAN O/S The PID Block supports the following modes: O/S (out of service) The PID algorithm of the block is not implemented. The last value or the value determined when the Fault State is activated is issued at OUT parameter. MAN (manual) The output value of the block can directly be entered by the user over the OUT parameter. AUTO (automatic) The set point determined by the user is used to implement the PID Block over the SP parameter. CAS (cascade) The PID Function Block receives the reference variable directly from an upstream function block over the CAS_IN parameter for internal calculation of the manipulated variable. The AO Block is implemented. RCAS (remote cascade) The AO Function block receives the reference variable directly from the Fieldbus host system for internal calculation of the manipulated variable. The AO Block is implemented. ROUT (remote output) The PID Function Block receives the manipulated variable directly from the Fieldbus host system over the ROUT_IN parameter. The manipulated variable is issued again over OUT without the internal PID algorithm being implemented.

OUT N Index no.: 9 Read/write capability: r, w in MAN, O/S	Indicates the manipulated variable, the value, limit, and status of the AO Function Block. Note! If the MAN mode is selected in the MODE_BLK parameter, the output value OUT can be entered manually. The unit used is adopted from the XD_SCALE parameter group. The range that can be entered corresponds to ±10 % of the OUT_SCALE.
OUT_HI_LIM S Index no.: 28 Read/write capability: r, w Range: Initial value:	Specifies the upper limit of the analog manipulated variable (OUT). Range of the OUT_SCALE ±10 %, unit of OUT_SCALE 100
OUT_LO_LIM S Index no.: 29 Read/write capability: r, w Range: Initial value:	Specifies the lower limit of the analog manipulated variable (OUT). Range of the OUT_SCALE ±10 %, unit of OUT_SCALE 0
OUT_SCALE S Index no.: 11 Read/write capability: r, w in MAN, O/S Initial value:	Definition of the range (initial and final values), the engineering unit and the number of decimal places used for the manipulated variable (OUT). 0...100 %
PV D Index no.: 7 Read/write capability: r	Indicates the process variables used to implement the block including their status. Note! The unit used is adopted from the PV_SCALE parameter group.
PV_FTIME S Index no.: 16 Read/write capability: r, w Initial value:	Used to enter the filter time constant (in seconds) of the first-order digital filter. This time is needed to allow a 63 % change of the input IN in the value of PV to become effective. 0 s
PV_SCALE S Index no.: 10 Read/write capability: r, w in MAN, O/S Initial value:	Definition of the range (initial and final values), the engineering unit and the number of decimal places used for the process variable (PV). 0...100 %

RATE S Index no.: 26 Read/write capability: r, w Initial value:	Specifies the time constant for the differential function. 0 s
RCAS_IN N Index no.: 32 Read/write capability: r, w	Input and display of the analog reference variable (value and status) provided by the Fieldbus host system for internal calculation of the manipulated variable. Note! This parameter is only active in the RCAS mode.
RCAS_OUT D Index no.: 35 Read/write capability: r	Display of analog reference variable (value and status) after ramping. This value is provided to the Fieldbus host system for back calculation to allow action to be taken under mode changes or limited signals. Note! This parameter is only active in the RCAS mode.
RESET S Index no.: 24 Read/write capability: r, w Initial value:	Specifies the time constant for the integral-action function. 3402823466 x 10^{38} (maximum value possible) Note! The initial value or 0 deactivates the integral-action function.
ROUT_IN N Index no.: 33 Read/write capability: r, w	Input and display of the manipulated variable (value and status) provided by the Fieldbus host system. Note! This parameter is only active in the ROUT mode.
ROUT_OUT D Index no.: 36 Read/write capability: r	Indicates the analog reference variable (value and status) that has been written to the ROUT_IN parameter. This value is provided by the Fieldbus host system over this parameter to perform back calculation to allow action to be taken under mode changes or limited signals. Note! This parameter is only active in the ROUT mode.

SHED_OPT S Index no.: 34 Read/write capability: r, w	Determines what action is to be taken when the monitoring time is exceeded (see SHED_RCAS parameter in the Resource Block) while the connection between the Fieldbus host system and the PID Block in RCAS or ROUT mode is being checked. When the time has elapsed, the PID Block switches from RCAS or ROUT mode to the mode selected in SHED_OPT. The action to be taken after the Fault State ends is also determined.
Range:	Uninitialized NormalShed_NormalReturn On failure of remote connection, change to next possible mode until RCAS or ROUT mode is restored. NormalShed_NoReturn On failure of remote connection, change to next possible mode the block remains in this mode. ShedToAuto_NormalReturn On failure of remote connection, change to AUTO mode until RCAS or ROUT mode is restored. ShedToAuto_NoReturn On failure of remote connection, change to AUTO mode. No attempt is made to restore the mode and the block remains in AUTO mode. ShedToManual_NormalReturn On failure of remote connection, change to MAN mode until RCAS or ROUT mode is restored. ShedToManual_NoReturn On failure of remote connection, change to MAN mode. No attempt is made to restore the mode and the block remains in MAN mode. ShedToRetainedTarget_NormalReturn On failure of remote connection, the block attempts to attain the retained target mode until RCAS or ROUT mode is restored. ShedToRetainedTarget_NoReturn On failure of remote connection, the block sets the target mode to the retained target mode.
Initial value:	Uninitialized Note! This parameter is only active in RCAS or ROUT mode in the PID Block. The PID Block cannot be set to the RCAS or ROUT mode when the value is set to Uninitialized.

SP N Index no.: 8 Read/write capability: r, w in AUTO, MAN, O/S Range:	Used to enter the set point (reference variable) in AUTO mode. Value and range of ±10 % of the PV_SCALE.
SP_HI_LIM S Index no.: 21 Read/write capability: r, w Range: Initial value:	Used to enter the high limit of the set point (reference variable). Value and range of ±10 % of the PV_SCALE. 100 Note! This value must be adapted correspondingly if the scale end setting is changed in the PV_SCALE parameter.
SP_LO_LIM S Index no.: 22 Read/write capability: r, w Range: Initial value:	Used to enter the low limit of the set point (reference variable). Value and range of ±10 % of the PV_SCALE. 0 Note! This value must be adapted correspondingly if the scale end setting is changed in the PV_SCALE parameter.
SP_RATE_DN S Index no.: 19 Read/write capability: r, w Initial value:	Used to enter the ramp rate for downward set point changes in AUTO mode. $3402823466 \times 10^{38}$ Note! The set point is used immediately when the ramp rate is set to zero. The rate limit is active for output blocks in the AUTO mode.
SP_RATE_UP S Index no.: 20 Read/write capability: r, w Initial value:	Used to enter the ramp rate for upward set point changes in AUTO mode. $3402823466 \times 10^{38}$ Note! The set point is used immediately when the ramp rate is set to zero. The rate limit is active for output blocks in the AUTO mode.

ST_REV S Index no.: 1 Read/write capability: r	Indicates the revision number of static data. Note! The revision state is incremented by one each time a static parameter in the block is written
STATUS_OPT S Index no.: 14 Read/write capability: r, w in O/S Range: Initial value:	Allows the selection of status options available to determine the handling and processing of the status: Uninitialized IFS if Bad IN Trigger IFS substate of downstream AO Function Block, of the input value (IN) changes the status to BAD. IFS if Bad CAS_IN Trigger IFS substate if the external reference variable (CAS_IN) changes the status to BAD. Use Uncertain as Good The status UNCERTAIN is used as GOOD. Target to Manual if Bad IN Reverts to MAN mode if the input value changes the status to BAD. Uninitialized
STRATEGY S Index no.: 3 Read/write capability: r, w Initial value:	Permits strategic grouping and thus faster processing of blocks. Blocks are grouped by entering the same number in the STRATEGY parameter of each block. 0 Note! These data are neither checked nor processed by the PID Function Block.
TAG_DESC S Index no.: 2 Read/write capability: r, w Initial value:	Assigns a unique 32 character description to each block for clear identification No text
TRK_IN_D N Index no.: 38 Read/write capability: r, w	Indicates/specifies the discrete input (value and status) which activates the external or output tracking. On activating tracking, the block changes to LO mode. The manipulated variable at OUT adopts the value defined over the input TRK_VAL.

TRK_SCALE S Index no.: 37 Read/write capability: r, w in MAN, O/S Initial value:	Definition of the range (initial and final values), the engineering unit and the number of decimal places used for external tracking value (TRK_VAL). 0...100 %
TRK_VAL N Index no.: 39 Read/write capability: r, w	Indicates/specifies the analog input value and status from another function block for the external tracking function.
UPDATE_EVT D Index no.: 43 Read/write capability: r	Indicates that static data were changed, including date and time stamp.

13.6 Other parameters

13.6.1 Stale Counter

The Stale Counter serves to judge the "quality" of a process variable received over a configured cyclic connection (publisher/subscriber connection).
These connections are used to transfer the process variable linked amongst the various function blocks. For this purpose, the upstream block (publisher) sends the process variable over the bus at scheduled times. The downstream block(s) (subscriber) responds at the scheduled times. The blocks that are to receive data monitor whether a valid value exists at the scheduled time. A value is valid if it exists with the status "Good" at the scheduled time.
The Stale Counter defines how many "Bad" (stale) values can be accepted in sequence before the Fault State of the block is activated.
This monitoring function is deactivated by setting the Stale Counter to zero.

13.6.2 Link Objects

Link Objects are used to link the inputs and outputs of the function blocks (configurable cyclic connections).
A maximum of 22 Link Objects can be configured for each positioner.

13.6.3 LAS Functionality

The number of links and schedules that can be used is matched to the requirements of standard process control systems available on the market.

The positioner functioning as an LAS can support the following:

- 1 schedule
- 1 subschedule
- 25 sequences per subschedule
- 25 elements per sequence

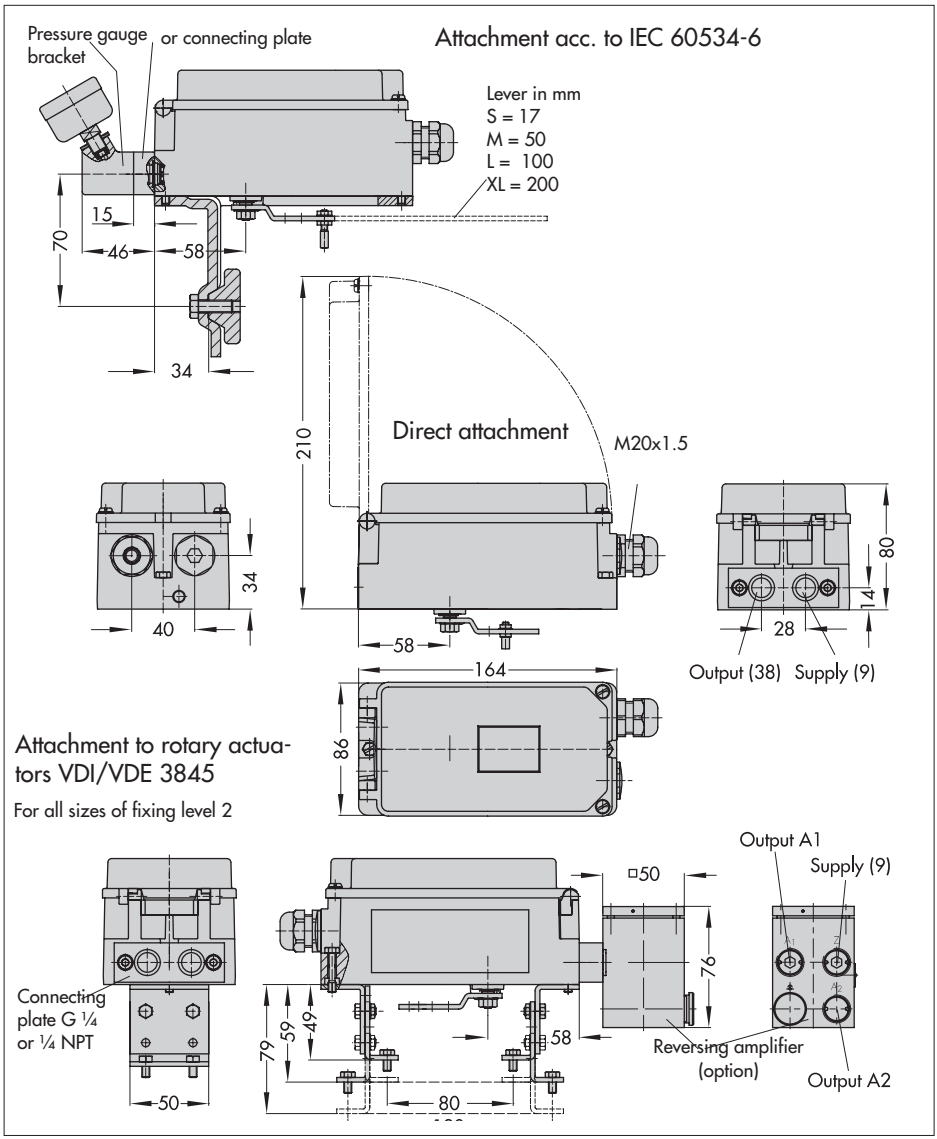
14 Resetting the device

The positioner can be reset in various ways in accordance with FF Specification.

RESTART parameter in the Resource Block:

- DEFAULTS:
  The device data and the link are reset to the values as defined in the FF Specification.
- PROCESSOR:
  Warm start of the positioner, restart of the processor.

15 Dimensions in mm



Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

(1) **EC TYPE EXAMINATION CERTIFICATION**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – **Directive 94/9/EC**

(3) EC Type Examination Certificate Number

PTB 04 ATEX 2109

(4) Equipment: Model 3730-4.. and 3730-5.. I/P Positioners

(5) Manufacturer: SAMSON AG, Mess- und Regeltechnik

(6) Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

(7) The equipment and any acceptable variations thereof are specified in the schedule to this certificate.

(8) The Physikalisch-Technische Bundesanstalt, notified body number 0102 in according to Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres as specified in Annex II to the Directive.

The examination and test results are recorded in confidential report PTB Ex 04-24202.

(9) The Essential Health and Safety Requirements are satisfied by compliance with

EN 50014:1997+A1+A2 EN 50020:2002 EN 50281-1-1:1998

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

(11) This EC Type Examination Certificate relates only to the design and examination of the specified equipment in compliance with Directive 94/9/EC Further requirements of this Directive apply to the manufacture and supply of this equipment. These requirements are not covered by this Certificate.

(12) The marking of the equipment shall include the following:


II 2G EEx ia IIC T6 and II 2D IP 65 T 80 °C

Zertifizierungsstelle Explosionsschutz Braunschweig, 25 October 2004
By order

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

EC Type Examination Certificates without signature and seal are invalid.
This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt., Bundesallee 100, D-38116 Braunschweig
Ptb47-3730-41-51.doc

Elektrische Daten

BUS-Anschluss Signalstromkreis..... in Zündschutzart Eigensicherheit EEx ia IIC/IIB
(Klemmen 11/12) nur zum Anschluss an einen bescheinigten eigensicheren Stromkreis

Der Zusammenhang zwischen der Zündschutzart und den elektrischen Daten ist den folgenden Tabellen zu entnehmen.

Höchstwerte:

Typ 3730-4..

Profibus PA
EEx ia IIC / IIB
U_i = 17,5 V DC
I_i = 380 mA
P_i = 5,32 W

bzw.

Typ 3730-5..

FOUNDATION™-Fieldbus	
EEx ia IIC	EEx ia IIB
U_i = 24 V DC	U_i = 24 V DC
I_i = 360 mA	I_i = 380 mA
P_i = 1,04 W	P_i = 2,58 W

C_i = 5 nF
L_i = 10 µH

Grenzkontakt induktiv ..... in Zündschutzart Eigensicherheit EEx ia IIC
(Klemmen 41/42) nur zum Anschluss an einen bescheinigten eigensicheren Stromkreis

Höchstwerte:

U_i = 16 V
I_i = 52 mA
P_i = 169 mW

L_i = 100 µH
C_i = 30 nF

Maximum values:
Model 3730-4..

EEx ia IIC/IIB
Ui 17,5 V DC
Ii = 380 mA
Pi = 5.32 W

or
Model 3730-5..

FOUNDATION™	
EEx ia IIC	EEx ia IIB
Ui = 24 v DC	Ui = 24 DC
Ii = 360 mA	Ii = 380 mA
Pi = 5.32 W	Pi = 2.58 W

Ci = 5 nF; Li = 10 µH

Inductive proximity switch (terminals 11/12)

Type of protection. Intrinsic safety EEx ia IIC, only for connection to a certified intrinsically safe circuit

Maximum values

Ui = 16 V
Ii = 52 mA
Pi = 169 mW

Li = 100 µH
Ci = 30 nF

or

Ui = 16 V
Ii = 25 mA
Pi = 64 mA

Li = 100 µH
Ci = 30 nF

The correlation between temperature classification, the permissible ambient temperature ranges, the maximum short-circuit currents and the maximum power for analyzers is shown in the table below

Temperature class	Permissible ambient temperature range	Io / Po
T6	45°C	
T5	-40°C ...60°C	52mA / 169mW
T4	75°C	
T6	60°C	
T5	-40°C...80°C	25mA / 64mW
T4	80°C	

Forced venting function (terminals 81/82)

Type of protection: Intrinsic safety EEx ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

Ui = 28 V
Ii = 115 mA
Pi 500 W

Li = negligible
Ci = 5.3 nF

Binary input 1 (terminals 87 / 88)

Type of protection: Intrinsic safety EEx ia IIC/IIB for connection of an active contact circuit

Maximum values:

Ui = 30 V
Ii = 100 mA

Li = negligible
Ci = negligible

Binary input 2 (terminals 85 / 86)

Type of protection: Intrinsic safety EEx ia IIC/IIB for connection of an active contact circuit

Maximum values:

Uo = 5,88 V
Io = 1 mA
Po = 7,2 mW

Physikalisch-Technische Bundesanstalt **PTB**
Braunschweig und Berlin

The correlation between the type of protection and the permissible maximum allowed capacitances and inductances is shown in the table below

EEx ia IIC	EEx ia IIB
Co = 2 µF	Co = 4 µF
Lo = 10 mH	Lo = 1 H

Ci = negligible
Li = negligible

Serial interface BU

Type of protection. intrinsic safety EEx ia IIC

Uo = 8,61 V
Io = 55 mA
Po = 250 mW

The correlation between the type of protection and the permissible maximum allowed capacitances and inductances is shown in the table below

EEx ia IIC	EEx ia IIB
Co = 0,61 µF	Co = 4 µF
Lo = 9 mH	Lo = 9 mH

only for connection to a certified intrinsically safe circuit

Maximum values:

Ui = 16 V
Ii = 25 mA
Pi = 64 mW

Li = negligible
Ci = negligible

For interconnection, the rules for interconnecting intrinsically safe circuits shall be complied with

External positioner sensor (analog PCB pins p9, p10, p11)

Type of protection: Intrinsic safety EEx ia IIC

Maximum values:

Uo = 8,61 V
Io = 55 mA
Po = 250 mW

The correlation between the type of protection and the permissible maximum allowed capacitances and inductances is shown in the table below

EC Type Examination Certificates without signature and seal are invalid.
This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt., Bundesallee 100, D-38116 Braunschweig
Ptb47-3730-41-51.doc

EEx ia IIC	EEx ia IIB
C_o = 0,61 µF	C_o = 4 µF
L_o = 9 mH	L_o = 9 mH

L_i = 370 µH
C_i = 730 nF

(16) Test Report: **PTB Ex 04-24202**

(17) **Special conditions for safe use**

None

(18) **Special Health and Safety Requirements**

In compliance with the standards specified above.

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 25 October 2004

(Signature) (seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

(1) **Statement of Conformity**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – **Directive 94/9/EC**

(3) EC Type Examination Certificate Number

PTB 05 ATEX 2010 X

(4) Equipment: Model 3730-48.. and 3730-58.. Positioners

(5) Manufacturer: SAMSON AG, Mess- und Regeltechnik

(6) Address: Weismüllerstr. 3, D-60314 Frankfurt, Germany

(7) The equipment and any acceptable variations thereof are specified in the schedule to this certificate.

(8) The Physikalisch-Technische Bundesanstalt, notified body number 0102 in according to Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres as specified in Annex II to the Directive.

The examination and test results are recorded in confidential report PTB Ex 05-24319.

(9) The Essential Health and Safety Requirements are satisfied by compliance with

EN 50021:1999 EN 50281-1-1:1998

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

(11) In compliance with the Directive 94/9/EC this Statement of Conformity relates only to the design and construction of the equipment specified. Further requirements of this Directive apply to manufacture and marketing of the equipment.

(12) The marking of the equipment shall include the following:

II 3G EEx nA II T6 or II 3G EEx nL IIC T6 or
II 3D IP 54 T 80 °C or II 2D IP 65 T 80 °C

Zertifizierungsstelle Explosionsschutz Braunschweig, 16 February 2005
By order

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

Statement of conformity without signature and seal are invalid.
This Statement is Conformity may be reproduced in its entirety any changes.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt., Bundesallee 100, D-38116 Braunschweig
Ptb47-Ex n.doc

(13) **S c h e d u l e**

(14) **EC TYPE EXAMINATION CERTIFICATE No PTB 05 ATEX 2010 X**

(15) **Description of Equipment**

The Model 3730-48 and 3730-58.. Positioners are bus-powered field devices with communication capability and serve for translating control signals into valve stem positions. They are intended for attachment to linear or rotary actuators.

For instrument air non-combustible media are used.

The equipment is intended for use inside the hazardous locations.

The correlation between temperature classification, permissible temperature ranges is shown in the tables below:

Temperature class	Permissible ambient temperature range
T6	-40 °C ... 60 °C
T5	-40 °C ... 70 °C
T4	-40 °C ... 80 °C

Electrical data

BUS connection, signal circuit (terminals 11/12)

Type of protection: EEx nA II or Ex nL IIC resp.

Gas group	Maximum values
IIC	U_o = 20V; I_o = 464mA, P_o = 2,32W U_o = 24V; I_o = 261mA, P_o = 1,56W U_o = 30V; I_o = 152mA, P_o = 1,14W
IIB	U_o 20V; I_o 1,17A, P_o 5,88W U_o = 24V; I_o = 650mA, P_o = 3,89W U_o = 30V; I_o = 379mA, P_o = 2,85W

Ci = 5 nF; Li = 10 µH

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

Inductive proximity switch (terminals 41/42)

Type of protection: EEx nA II or Ex nL IIC resp.

Maximum values

Ui = 20 V
Ii = 52 A
Pi = 169 W

Li = 100µH
Ci = 30nF

The correlation between temperature classification, the permissible ambient temperature ranges, the maximum short-circuit currents and the maximum power for analyzers is shown in the table below

Temperature class	Permissible ambient temperature range	Io / Po
T6	+45°C	
T5	-40°C ... +60°C	52mA / 169mW
T4	+75°C	
T6	+60°C	
T5	-40°C...+80°C	25mA / 64mW
T4	+80°C	

Forced venting function (terminals 81/82)

Type of protection: EEx nA II or Ex nL IIC/IIB resp.

Maximum values:

Ui = 30 V
Ii = 100 mA

Li = negligible
Ci = 5.3 nF

Binary input 1 (terminals 87 / 88)

Type of protection: EEx nA II or Ex nL IIC/IIB resp

Maximum values:

Ui = 30 V
Ii = 100 mA

Li = negligible
Ci = negligible

Statement of conformity without signature and seal are invalid.
This Statement is Conformity may be reproduced in its entirety any changes.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt., Bundesallee 100, D-38116 Braunschweig

Ptb47-Ex n.doc

Binary input 2 (terminals 85 / 86)

Type of protection: EEx nA II or Ex nL IIC/IIB resp. only for connection of a floating passive contact circuit

Maximum values:

U_o = 5,88 V
I_o = 1 mA
P_o = 7,2 mW

The correlation between the gas group and the permissible maximum allowed capacitances and inductances is shown in the table below

Gas group IIC	Gas group IIB
C_o = 1,8µF	C_o = 15,8µF
L_o = 9,7mH	L_o = 1H

C_i = negligible
L_i = negligible

Serial interface BU

Type of protection: EEx nA II or Ex nL IIC/IIB resp.

Maximum values (active):

U_o = 8,61 V
I_o = 55 mA
P_o = 250 mW

The correlation between the gas group and the permissible maximum allowed capacitances and inductances is shown in the table below

Gas group IIC	Gas group IIB
C_o = 0,61µF	C_o = 4µF
L_o = 9mH	L_o = 9mH

Maximum values (passive):

U_i = 20V
I_i = 25mA
P_i = 64mW

L_i = negligible
C_i = negligible

External positioner sensor (analog PCB pins p9, p10, p11)

Type of protection: EEx nA II or Ex nL IIC/IIB resp.

Maximum values (active):

U_o = 8,61 V
I_o = 55 mA
P_o = 250 mW

The correlation between the gas group and the permissible maximum allowed capacitances and inductances is shown in the table below

Gas group IIC	Gas group IIB
C_o = 0,61µF	C_o = 4µF
L_o = 9mH	L_o = 9mH

L_i = 370µH
C_i = 730nF

(16) Test Report: **PTB Ex 05-24319**

(17) **Special conditions for safe use**

(18) **Basic safety and health requirements**

In compliance with the standards specified above.

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 16 February 2005

(Signature) (seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

SAMSON AG · MESS- UND REGELTECHNIK
Weismüllerstraße 3 · 60314 Frankfurt am Main · Germany
Phone: +49 69 4009-0 · Fax: +49 69 4009-1507
Internet: http://www.samson.de

EB 8384-5 EN

S/Z 2005-09