FOUNDATION™ FIELDBUS Positioner Type 3787

Fig. 1 · Type 3787

FOUNDATION™

Mounting and Operating Instructions

EB 8383-1 EN

Firmware R 1.4x/K 1.4x

Edition November 2004

Contents Page

- *The device may only be assembled, started up, and operated by experienced personnel familiar with this product.*
  In these mounting and operating instructions, the term "experienced personnel" refers to individuals who are able to evaluate the responsibilities assigned to them as well as recognize potential hazards due to their specialized training, knowledge, and experience as well as their special knowledge of the relevant standards.
- *Explosion-protected versions of this device 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.*
- *Any hazards which could be caused by the process medium, the operating pressure, the signal pressure and moving parts of the control valve, must be prevented by means of appropriate measures.*
- *Should inadmissible motions or forces be produced in the pneumatic actuator as a result of the level associated with the supply air pressure, these must be restricted by means of a suitable pressure reducing station.*
- *Proper shipping and appropriate storage of the device are assumed.*

Note: *Devices with the CE mark meet the requirements specified in the Directive 94/9/EC and the Directive 89/336/EEC.*
The Declaration of Conformity can be viewed and downloaded from the SAMSON website at www.samson.de.

Modifications of positioner firmware in comparison to previous versions	
Previous	New
Positioner R 1.41	**R 1.42**
	Correction in the zero calibration activated over software communication

Communication K1.00	**K1.20**
	Version compatible with user interface software version number: Fisher-Rosemount DeltaV in version 5.1 or higher National Instruments Fieldbus Configurator in version 2.3 or higher. All host systems certified by the Fieldbus Foundation Alteration to default values of the following parameters: AO Function Block CHANNEL, PID Function Block GAIN, PID Function Block RESET, PID Function Block BYPASS Resource Block parameter extended: BLOCK_ERROR, page 40 Transducer Block parameters changed/extended: BLOCK_ERR, page 46.
Communication K 1.00	**K1.31**
	The output parameters of the function blocks can be interconnected within a device and with blocks in other devices at the same time. In the previous version, it was only possible to either interconnect function blocks within a device or with blocks in other devices. An Output Failure in BLOCK_ERR of the AO Function Block generates a Block Alarm. The automatic resetting control loop monitor (previously not automatic resetting) is evaluated for the control loop error indication via LED or the message "Calibration Error". This means this alarm or message is automatically reset as soon as the control loop monitor cannot find an error anymore.
Communication K 1.31	**K1.40**
	The default value for RESET in the PID Block has been changed from 0 to 3402823466 x 10^{38} (maximum possible value). The integral-action component of the PID is ineffective at this value as well as at 0. On switching over the operating mode from MAN to AUTO, a smooth switchover is achieved.

Positioner	
Travel Direct attachment to Type 3277 Attachment acc. to IEC 60534-6	Adjustable 5 to 30 mm 5 to 255 mm or 30 to 120° for rotary actuators
Bus connection	Fieldbus interface as per IEC 61158-2, bus-powered Physical Layer Class: 113 (not explosion-protected version) and 111 (Ex-version) Field device according to FM 3610 entity and FISCO.
Permissible operating voltage	9 to 32 V DC; The specifications in the EC Type Examination Certificate additionally apply for explosion-protected devices. Power supply over bus cable
Max. operating current	13 mA
Additional current in case of fault	0 mA
Supply air	Supply air from 1.4 to 6 bar (20 to 90 psi); Air quality as per ISO 8573-1: Max. particle size and density: Class 4; Oil contents: Class 3; Pressure dew point: Class 3
Signal pressure (output)	0 bar up to the pressure of the supply air
Characteristic, adjustable Deviation	Globe valve: linear, equal percentage, reverse equal percentage, SAMSON butterfly valve: linear, equal percentage VETEC plug rotary valve: linear, equal percentage ≤1 %
Dead band (based on rated travel/angle	Adjustable from 0.1 to 10.0 % , default 0.5 %
Resolution (internal measurement)	< 0.05 %
Transit time required	For valve transit time up to 75 s Set point ramp for exhaust and supply air separately adjustable
Operating direction	Reversible, setting by software
Air consumption	Independent of supply air <90 l_n/h
Air supply	Actuator filled: when Δp = 6 bar 9.3 m_n^3/h, when Δp = 1.4 bar 3.5 m_n^3/h Actuator vented: when Δp = 6 bar 15.5 m_n^3/h, when Δp = 1.4 bar 5.8 m_n^3/h
Permissible ambient temperature	–40 to 80 °C The specifications in the EC Type Examination Certificate additionally apply for explosion-protected devices
Effects	Temperature: ≤0.15 %/10 K, supply air: none, Vibrations: none up to 250 Hz and 4 g
Degree of protection	IP 65 using filter check valve included
Electromagnetic compatibility	Requirements acc. to EN 61000-6-2, EN 61000-6-3 and NAMUR Recommendations NE 21 are met
Binary input	Internal power supply 5 V DC, R_i = 100 kΩ for alarm function
Forced venting (activated over an internal switch)	Input 6 to 24 V DC, R_i approx. 6 kΩ at 24 V DC (depending on voltage) Switching point for "1" signal ≥ 3 V, switching point for "0" signal only at 0 V, K_V 0.17

Accessories	
Inductive limit switches	Two Type SJ 2 SN Proximity Switches for connection to a switching amplifier acc. to EN 60947-5-6
Communication	
Data transmission	In accordance with FOUNDATION™ Fieldbus specification Communication Profile Class: 31 PS, 32: Interoperability Test System (ITS) Revision 4.0
Materials	
Case	Die-cast aluminum, chromized and plastic-coated
External parts	Stainless steel 1.4571 and 1.4301
Weight	Approx 1.3 kg

Versions of the positioner

Model			**3787 -**	X	X	X	**0**	X	3	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**						
	Ex ia FM/CSA			**3**						
	⟨Ex⟩ II 3 G EEx ia IIC T6/ II 3 D IP 54 T 80 °C acc. to ATEX			**8**						
Accessories	Limit switches	Without			**0**					
		2 inductive			**2**					**2**
Forced venting	Without (deactivated)					**0**				
	With (activated)					**1**				**2**
Pneumatic connections	NPT 1/4- 18							**1**		
	ISO 228/1-G 1/4							**2**		
Electric connections	Cable gland M20 x 1.5 Nickel-plated brass									
		Quantity: 1								**1**
		2								**2**

1 Design and principle of operation

The digital positioner compares the reference variable, which is cyclically transmitted over the FOUNDATION™ Fieldbus, with the travel or opening angle of the control valve. It then delivers a corresponding signal pressure. It is suitable for attachment to linear and rotary actuators.

The Type 3787 Positioner communicates as per FOUNDATION™ Fieldbus specification with field devices, programmable logic controllers and process management systems. An integrated PID Function Block allows the control of required process variables directly in the field.

The travel of the control valve is picked up by the inductive displacement sensor (1) and supplied to the microcontroller (2) via a converter.
The microcontroller compares the travel with the reference variable and controls the two pneumatic 2/2-way on-off valves (3, 4) when a system deviation occurs. The on-off valves fill (3) or vent (4) the pneumatic actuator via corresponding amplifiers corresponding to the system deviation.
Two LEDs on the inside of the cover indicate the operating status of the positioner.
The positioner is equipped with a standard binary input over which any process information can be signaled via the FOUNDATION™ Fieldbus.
The write protection switch (6) located on the inside of the cover prevents stored configuration data from being overwritten.

Forced venting:
The positioner is controlled over a 6 to 24 V signal which causes the corresponding signal pressure to be applied to the actuator. If the voltage signal drops, the signal pressure is shut off and the actuator is vented. The control valve moves to its fail-safe position regardless of the output variable issued by the microcontroller.

1.1 Optional limit switches

Limit switches can be retrofitted to the standard positioner.

Two proximity switches can be used for fail-safe circuits to indicate the valve's end positions.

1.2 Communication

The positioner is completely controlled via digital signal transmission according to the FOUNDATION™ Fieldbus specification based on the E EN 50170/A1 draft. Data is transmitted as bit synchronous current modulation at a transmission rate of 31.25 kbit/s over twisted pairs according to IEC 61158-2.

Configuration with TROVIS-VIEW
The positioner can be configured using the SAMSON Configuration and Operator Interface, TROVIS-VIEW.
To configure the positioner, connect its additional **SERIAL INTERFACE** to the RS-232 interface of a PC using an adapter cable.
After adapting the positioner to the process requirements, TROVIS-VIEW enables the process to be controlled online.

Configuration with NI-FBUS™ Configurator

The positioner can also be configured using the NI-FBUS™ Configurator from National Instruments.
An interface card installed in a PC is required to connect it to FOUNDATION™ Fieldbus.

The NI-FBUS™ Configurator can be used to configure the whole FOUNDATION™ Fieldbus network.

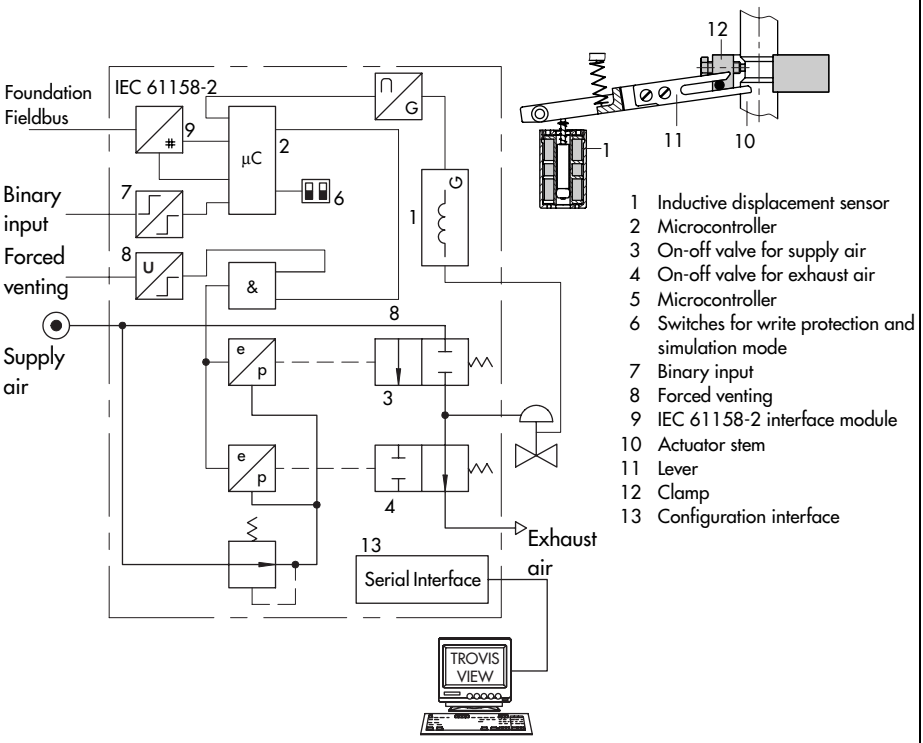


Fig. 2 · Functional diagram

2 Attachment to the control valve

The positioner can be attached either directly to a SAMSON Type 3277 Actuator or to control valves with cast yokes or rod-type yokes according to IEC 60534-6 (NAMUR).
In connection with an intermediate piece, the positioner can also be attached to rotary actuators.

Since the standard positioner is delivered without accessories, please refer to the tables for required mounting parts and their order numbers.

Note!
For fast control valves with small travel volumes (transit time < 0.6 sec.), replace the filter in the signal pressure output with a screw-in throttle, if necessary, to improve the control properties. See also sections 2.1, 2.2 and 2.3.

Important!
The positioner does not have its own venting plug, instead vented air has to escape through venting plugs located on the mounting parts (see Figs. 3, 5 and 7).
A filter check valve for the vented air is included in every positioner delivery (under the transparent protective cap on the back of the positioner). Replace the standard venting plug included in the accessories with this filter check valve. This is the only way to achieve the degree of protection IP 65 by preventing dirt and moisture from entering the device.

2.1 Direct attachment to Type 3277 Actuator

The necessary accessories are listed in the Tables 1, 2 and 3 on page 13.

When looking at the signal pressure connection or the switchover plate (actuator 120 cm^2), the positioner must be attached to the left side of the actuator.
The **arrow** on the black cover of the case (Fig. 11) should point **towards the diaphragm chamber**.
Exception: Control valves in which the plug closes the seat area when the actuator stem retracts. In this case, the positioner has to be attached to the right side of the actuator and the arrow points away from the diaphragm chamber.

1. Screw the clamp (1.2) to the actuator stem, ensuring that the fastening screw is located in the groove of the actuator stem.
2. Screw the assigned pick-up lever D1 or D2 to the transmission lever of the positioner.
3. Fasten the distance plate (15) with seal pointing towards the actuator yoke.
4. Place the positioner on the plate so that the lever D1 or D2 slides centrally over the pin of the clamp (1.2). Then screw tight to the distance plate (15).
5. Mount cover (16).

Actuators with 240, 350 and 700 cm^2

6. Check whether the tongue of the seal (17) is properly aligned at the side of the connection block (Fig. 3, center)

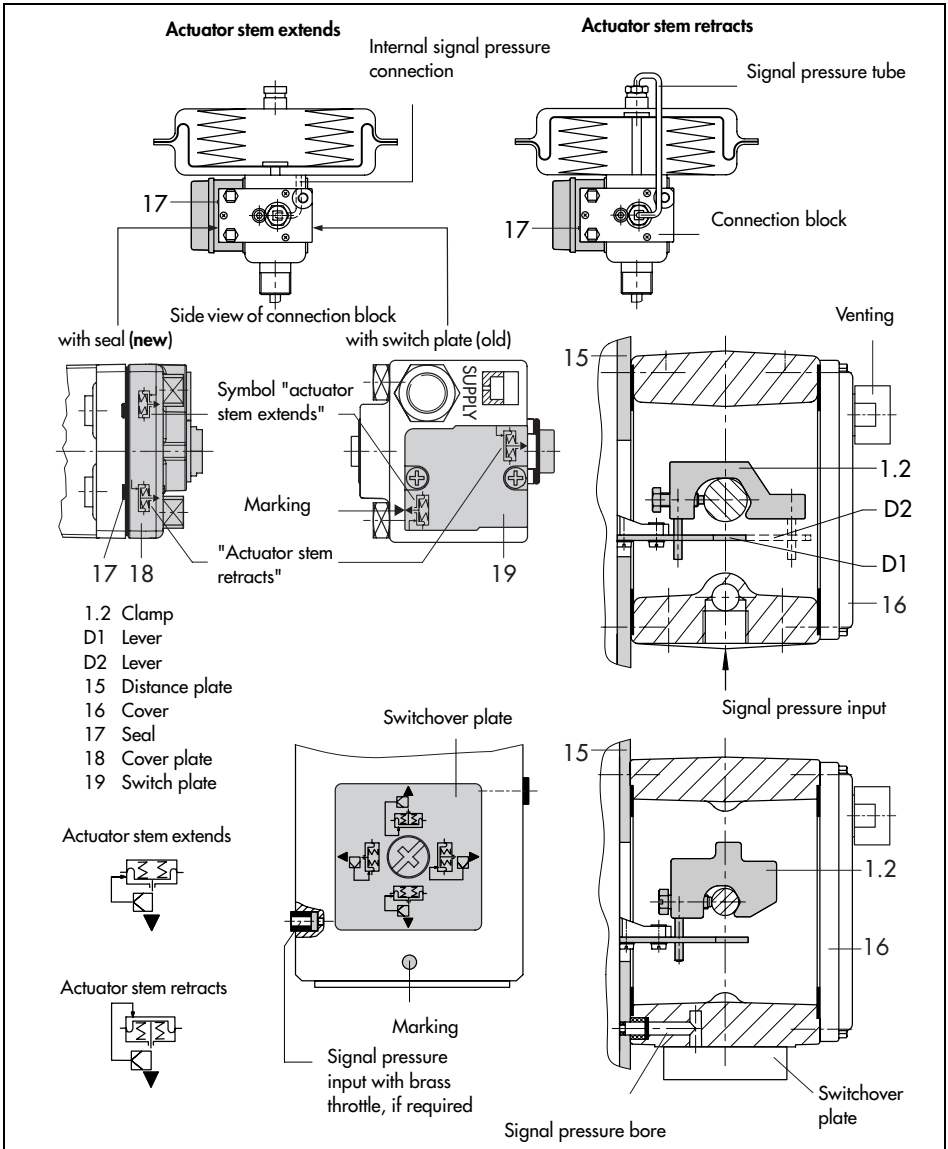


Fig. 3 · Attachment and signal pressure connection for Type 3277 Actuators (top) and 3277-5 with 120 cm² (bottom)

with the actuator symbol "actuator stem extends" or "actuator stem retracts" to match the actuator version used.
If not, remove the three fastening screws and the cover plate (18), turn the seal (17) by 180° and reinsert it.
When the **old** connection block is used, turn the switch plate (19) to align the actuator symbol with the arrow.

7. Place the connection block with its seal rings on the positioner and actuator yoke and screw it tight using the fastening screw.

   For actuators with "actuator stem retracts", additionally attach the ready-made signal pressure line.

Actuator with 120 cm^2

For the Type 3277-5 Actuator with 120 cm^2 effective diaphragm area, the signal pressure is transmitted to the diaphragm chamber via the switchover plate (Fig. 3 bottom).

For a rated travel of 7.5 mm, a brass throttle (see Accessories table on page 13) must be pressed into the seal located in the signal pressure input on the actuator yoke. For a rated travel of 15 mm, this is only required when the supply pressure exceeds 4 bar.

6. Remove the screw plug on the rear of the positioner case and seal the signal pressure output (Output 38) with the plug from the accessories.
7. Mount the positioner so that the bore in the distance plate (15) is aligned with the seal located in the bore of the actuator yoke.
8. Align the switchover plate with the corresponding symbol for left attachment and screw the plate to the actuator yoke.

Important!
If, in addition to the positioner, a solenoid valve or a similar device is attached to the 120 cm^2 actuator, the rear M3 screw must not be removed. In this case, the signal pressure has to be fed from the signal pressure output to the actuator via the required connecting plate (see Table 2). The switchover plate is no longer required.

Note!
For faster control valves with a transit time less than 0.6 seconds, replace the filter in the signal pressure output (output 38) with a screw-in throttle (see Accessories table), if necessary.

Filling the diaphragm chamber with air

If the Type 3277 Actuator's diaphragm chamber must be filled with air exhausted from the positioner, the diaphragm chamber (for version with "actuator stem extends") can be connected to the connection block using a tube (see Table 3). To do this, first remove the screw plug from the connection block.

For the Type 3277-5 Actuator with "actuator stem retracts", the air exhausted from the positioner is constantly supplied to the diaphragm chamber through an internal bore.

Table 1 Required lever with associated clamp and distance plate	Actuator size cm^2	Mounting kit Order no.
D1 (33 mm in length with clamp 17 mm in height)	120 (G 1/4) 120 (1/4 NPT)	1400-6790 1400-6791
D1 (33 mm in length with clamp 17 mm in height)	240 and 350	1400-6370
D2 (44 mm in length with clamp 13 mm in height)	700	1400-6371

Table 2			Order no.
Switchover plate for 120 cm^2 actuators	Actuator 3277-5xxxxxx. **00** (old)		1400-6819
Switchover plate **new**	Actuator with index .**01** or higher (new)		1400-6822
Connecting plate for mounting an additional device, e.g. a solenoid valve	3277-5xxxxxxxx. **00** (old)	G 1/8 1/8 NPT	1400-6820 1400-6821
Connecting plate **new**	Actuator with index .**01** or higher (new)		1400-6823
Note: *For new actuators (index **01**) new switchover and connecting plates can only be used. Old and new plates are not interchangeable.*			
Connection block required for 240, 350 and 700 cm^2 actuators (including seals and fastening screw)		G 1/4	1400-8811
		1/4 NPT	1400-8812

Table 3	Actuator size cm^2	Material	Order no.
Required tubes including fittings For actuator: actuator stem retracts or for filling top diaphragm chamber	240	Steel	1400-6444
	240	Stainless steel	1400-6445
	350	Steel	1400-6446
	350	Stainless steel	1400-6447
	700	Steel	1400-6448
	700	Stainless steel	1400-6449
Accessories Press. gauge mounting kit for supply air and signal pressure [1]		St. steel/brass: 1402-0938	St. steel/St. steel: 1402-0939
Signal pressure throttles (screw-in type and brass throttle)			1400-6964
Filter check valve, replaces vent plug and increases the degree of protection to IP 65 (one included with the delivered positioner)			1790-7408

[1] Order with every pressure gauge kit: 2 restrictions (1790-6121)

2.2 Attachment acc. to IEC 60534-6

The positioner is attached according to NAMUR as shown in Fig. 4 using an adapter housing. The valve travel is transmitted via the lever (18) and the shaft (25) to the bracket (28) in the adapter housing and then to the coupling pin (27) located on the lever of the positioner.
To attach the positioner, you will require the mounting parts listed in Table 4. Which lever should be used depends on the rated valve travel.
The positioner must be attached to the adapter housing with the **arrow** on the black case cover pointing **away from the diaphragm actuator** towards the valve.
Exception: Control valves in which the plug closes the seat area when the actuator stem retracts. In this case, the arrow must point towards the diaphragm actuator.

If the adapter housing cannot be mounted **between** the actuator and valve (e.g. because the actuator is from another manufacturer), the **arrow** on the case cover must point towards the valve!

Note!
For faster control valves with a transit time less than 0.6 seconds, replace the filter in the signal pressure output (output 38) with a screw-in throttle (see Accessories table).

2.2.1 Mounting sequence

Refer to Tables 4 and 5 on page 16 for required mounting parts.

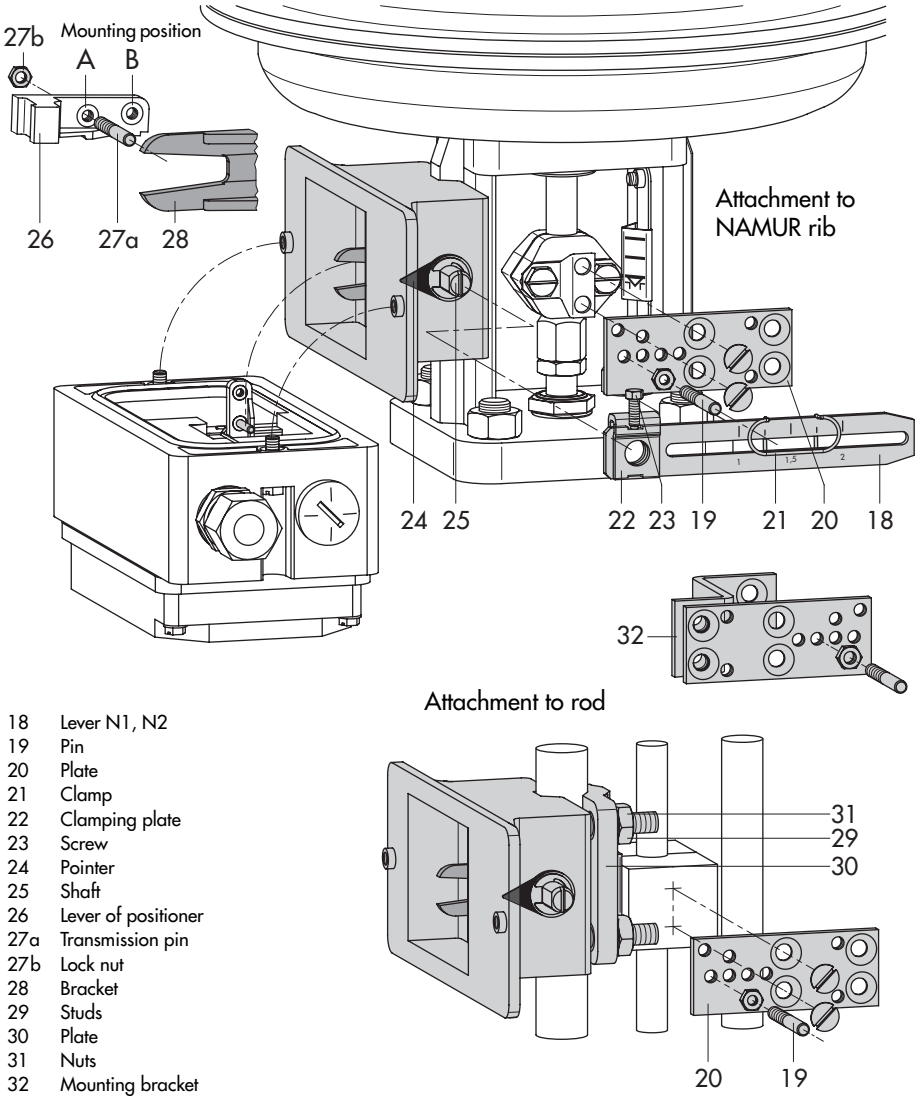
Note!
Prior to mounting the parts, apply signal pressure to the actuator so that the valve is set to 50 % of its travel. This is the only way to make sure that the lever (18) and bracket (28) are exactly aligned.

Control valve with cast yoke

1. Use countersunk screws to fix the plate (20) to the coupling which connects the plug stem and actuator stem. With actuators 2100 and 2800 cm^2, use additional mounting bracket (32).
2. Remove rubber plug from the adapter housing and fasten the housing to the NAMUR rib with hexagon head screw.

Control valve with rod-type yoke

1. Screw plate (20) to the follower clamp of the plug stem.
2. Screw the studs (29) into the adapter housing.
3. Place the housing with the plate (30) on either the right or left side of the valve stem and fasten tight using the nuts (31). On doing so, make sure the housing is aligned at a height which will still allow the lever (18) to be attached horizontally.
4. Screw the pin (19) into the center row of holes in the plate (20) and lock into place so that it is located approximately above the correct lever marking (1 to 2)



18	Lever N1, N2
19	Pin
20	Plate
21	Clamp
22	Clamping plate
23	Screw
24	Pointer
25	Shaft
26	Lever of positioner
27a	Transmission pin
27b	Lock nut
28	Bracket
29	Studs
30	Plate
31	Nuts
32	Mounting bracket

Fig. 4 · Attachment according to IEC 60534-6 (NAMUR)

for the assigned travel, see Table 5. Intermediate values must be calculated. Move the clamp (21) beforehand to clasp the pin.

5. Measure the distance from the middle of the shaft (25) to the middle of the pin (19). This value must be entered later when the positioner is being configured.

2.2.2 Presetting the valve travel

1. Adjust the shaft (25) in the adapter housing so that the black pointer (24) is aligned with the casted marking on the adapter housing.
2. Screw the clamping plate (22) tight in this position using the screw (23).
3. Screw the coupling pin (27) into the positioner lever (26) on the side with the

Table 4 Attach. acc. to IEC 60534-6	Control valve		Travel in mm	With lever	Order no.
NAMUR mounting kit See Fig. 4 for parts	Valve with cast yoke		7.5 to 60	N1 (125 mm)	1400-6787
			30 to 120	N2 (212 mm)	1400-6789
	Valve with rod-type yoke with rod diameter in mm	20 to 25		N1	1400-6436
		20 to 25		N2	1400-6437
		25 to 30		N1	1400-6438
		25 to 30		N2	1400-6439
		30 to 35		N1	1400-6440
		30 to 35		N2	1400-6441
Attachment to Fisher and Masoneilan linear actuators (one each of both mounting kits is needed per one actuator)					1400-6771 and 1400-6787
Accessories	Press. gauge mounting block	G 1/4:	1400-7458	1/4 NPT:	1400-7459
	Pressure gauge set	St. st./brass:	1400-6957	St. st./St. st.:	1400-6958
	Signal pressure throttles (screw-in type and brass throttle)				1400-6964
	Filter check valve, replaces vent plug and increases the degree of protecton to IP 65 (one included with the delivered positioner)				1790-7408

Table 5 Attachment according to IEC 60534-6										
Travel mm *)	7.5	15	15	30	30	60	30	60	60	120
Pin on mark *)	1		1	2	1	2	1	2	1	2
Corresp. distance: pin/lever pivot	42		42	84	42	84	84	168	84	168
With lever	N1 (125 mm in length)						N2 (212 mm in length)			
Transmission pin (27) at position	A		A		B		A		B	

*) Deviating travels (intermediate values) must be calculated accordingly

insert nuts and secure the pin on the other side with a hex nut. Observe the mounting position **A** or **B** explained in Table 5 and Fig. 4.

4. Place the positioner onto the adapter housing, making sure the coupling pin (27) is positioned within the arms of the bracket (28).
   To do so, insert a 2.5 mm Allen key or a screwdriver from the front into the bore located below the oblong hole on the cover plate, and push the positioner lever into the required position.
5. Screw positioner to the adapter housing.
6. Relieve signal pressure from the actuator.

2.3 Attachment to rotary actuators

The positioner can also be attached to rotary actuators in accordance with VDI/VDE 3845 by using the mounting parts and accessories listed in Table 6. In this arrangement, the actuator's rotary motion is converted via the cam disk of the actuator stem and the feeler roll of the positioner lever into a linear motion which is required for the inductive displacement sensor.
Each cam disk has two curves for the ranges of rotational angle from 0 to 90° (recommended for all angles of rotation smaller than 90°) and 0 to 120° (recommended for all angles of rotation larger than 90°).

Table 6 Rotary actuators (Complete mounting parts, but without cam disks)

Attachment acc. to VDI/VDE 3845, level 1	SAMSON Type Actuator		Attachment to Masoneilan actuator		
	Actuator 160 cm²	Actuator 320 cm²	Camflex I DN 25 ...100	Camflex I DN 125...250	Camflex II
	Order no.				
1400-8815	1400-7103	1400-7104	1400-7118	1400-7119	1400-7120
	Piping kit 8 x 1 stainless steel				
	G: 1400-6670	NPT: 1400-6672			
	G: 1400-6669	NPT: 1400-6671			

Accessories	Order no.	
Reversing amplifier for double-acting actuators without springs	G: 1079-1118	NPT: 1079-1119
Cam disk (0050-0089) with accessories, angle of rotation 0 to 90° and 0 to 120°	1400-6959	
Cam disk (0050-0089) specially for VETEC, adjustable per software from 0 to 75°	1400-6960	
Cam disk (0050-0090) specially for Camflex, adjustable per software from 0 to 50°	1400-6961	
Pressure gauge mounting block	G 1/4: 1400-7458; 1/4 NPT: 1400-7459	
Pressure gauge set	St. steel/Brass: 1400-6957	St. steel/St. steel: 1400-6958
Signal pressure throttles (screw-in type and brass throttle)	1400-6964	
Filter check valve, replaces vent plug and increases the degree of protec tion to IP 65 (one included with the delivered positioner)	1790-7408	

For double-acting, springless rotary actuators, a reversing amplifier must be attached to the positioner housing on the side where it is connected to the actuator (see section 2.3.4).

If the positioner is attached to a SAMSON Type 3278 Rotary Actuator, the air exhausted from the positioner is admitted to the inside of the actuator without any additional tubing.
If the positioner is attached to actuators from other manufacturers (NAMUR), the air is applied to the diaphragm chamber through a tube with a tee connecting the actuator and the exhaust connection of the intermediate piece.

Note!
For faster control valves with a transit time less than 0.6 seconds, replace the filter in the signal pressure output (output 38) with a screw-in throttle (see Accessories Table 6).

2.3.1 Mounting the lever with feeler roll

1. Place lever with attached feeler roll (35) on the transmission lever (37) and secure it with the supplied screws (38) and washers.

2.3.2 Mounting the intermediate piece

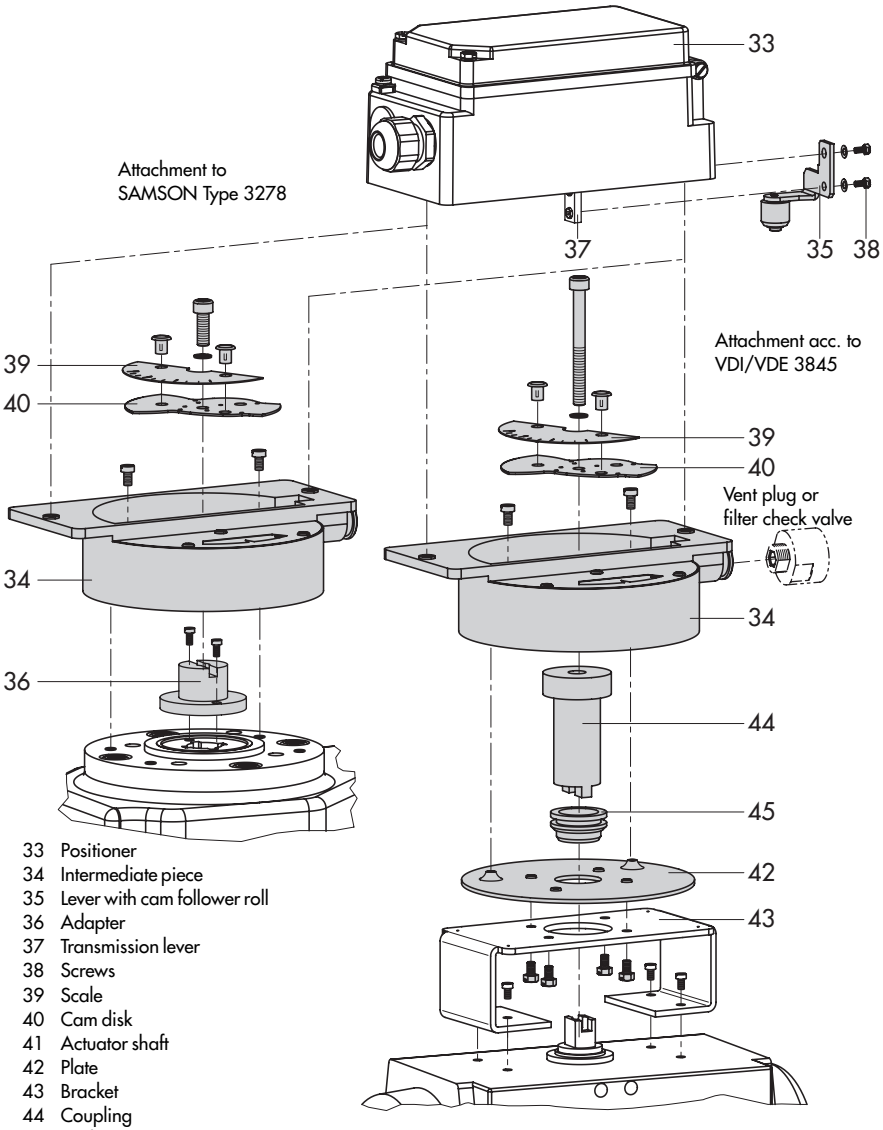
SAMSON Type 3278 Actuator:

1. Screw adapter (36) to the free end of the rotary actuator shaft, using two screws.
2. Position intermediate piece (34) on the actuator housing and secure it with two screws. Align the intermediate piece so that the air connections of the positioner face the side of the diaphragm case.

Actuators according to VDI/VDE 3845

1. Place the whole intermediate piece (34, 42, 44 and 45) onto the bracket included in the delivery scope of the actuator (fixing level 1 VDI/VDE 3845) and secure with screws.
2. Align the cam disk (40) and scale (39) as described in section 2.3.3 and screw tight.

With springless actuators, the reversing amplifier must be screwed to the side of the positioner case. See section 2.3.4.



33 Positioner
34 Intermediate piece
35 Lever with cam follower roll
36 Adapter
37 Transmission lever
38 Screws
39 Scale
40 Cam disk
41 Actuator shaft
42 Plate
43 Bracket
44 Coupling
45 Seal

Fig. 5 · Attachment to rotary actuators

2.3.3 Aligning and mounting the cam disk

In rotary actuators with spring-return mechanism, the actuator springs determine the fail-safe position and the direction of rotation of the control valve.
With double-acting, springless rotary actuators, the direction of rotation depends on both the actuator and valve version used. The initial position is always based on a closed valve!

Whether the control valve should open or close when the reference variable increases must be set in the software (direction of action increasing/increasing or increasing/decreasing).

1. Place the cam disk with scale on the adapter (36) or coupling (34), and fasten the screws loosely at first.

The cam disk has two cam sections. The starting point of each section is marked by a small hole.

Note!
When the valve is closed, the starting point (hole) of the disk must be aligned so that the pivot of the cam disk, the 0° position of the scale and the arrow mark on the viewing window are in one line.
The starting point for the closed valve position should never be below the 0° position!

In actuators with fail-safe position "valve OPEN", the maximum signal pressure must be applied to the actuator prior to aligning the cam disk.
In springless actuators, the supply air must be connected.

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2. On aligning the cam disk, clip on the double-sided scale disk so that the scale matches the direction of rotation of the control valve. Only then secure the cam disk with the fastening screws.

Securing the aligned cam disk

If you want to additionally secure the cam disk to prevent it from being turned, proceed as follows:

There are four holes arranged around the center hole on the cam disk. Select a suitable hole from the four holes to secure the cam disk.
Drill a hole in the adapter (36) or coupling (44) through the hole chosen and insert a 2 mm dowel pin.

3. Attach the positioner to the intermediate piece (34) so that the lever (35) touches the cam disk with its feeler roll.
   To do so, insert a 2.5 mm Allen key or screwdriver from the front into the bore hole located below an oblong hole in the cover plate and bring the positioner lever in the required position.
4. Screw positioner to the intermediate piece.

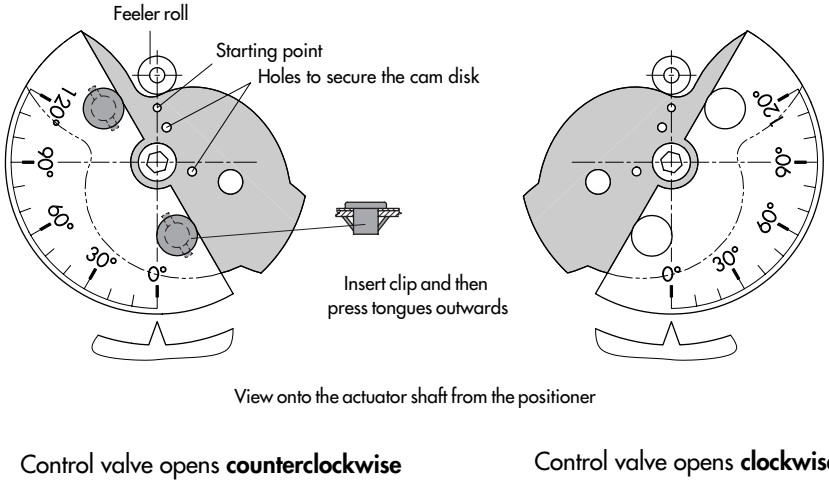


Fig. 6 · Aligning the cam disk

2.3.4 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 6 on page 17.

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

Note!
Prior to mounting the reversing amplifier, remove the sealing plug (1.5). The rubber seal (1.4) must be remain attached.

1. Thread the special nuts (1.3) from the accessories of the reversing amplifier into the threaded ports of the positioner.
2. Insert the gasket (1.2) into the recess of the reversing amplifier and push both the hollowed special screws (1.1) into the connecting ports A1 and Z.
3. Place the reversing amplifier onto the positioner and screw tight using both the special screws (1.1).
4. Screw the supplied filter (1.6) using a screwdriver (8 mm wide) into the connecting bore holes A1 and Z.

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

- Enter the actuator as "Double-acting without spring-return mechanism" in the user interface software under Start-up → Type of actuator.

2.4 Fail-safe action of the actuator

Note!
If the fail-safe action of the actuator is changed subsequently by converting the actuator springs from "actuator stem extends" to "actuator stem retracts", the mechanical zero must be recalibrated and the positioner reinitialized.

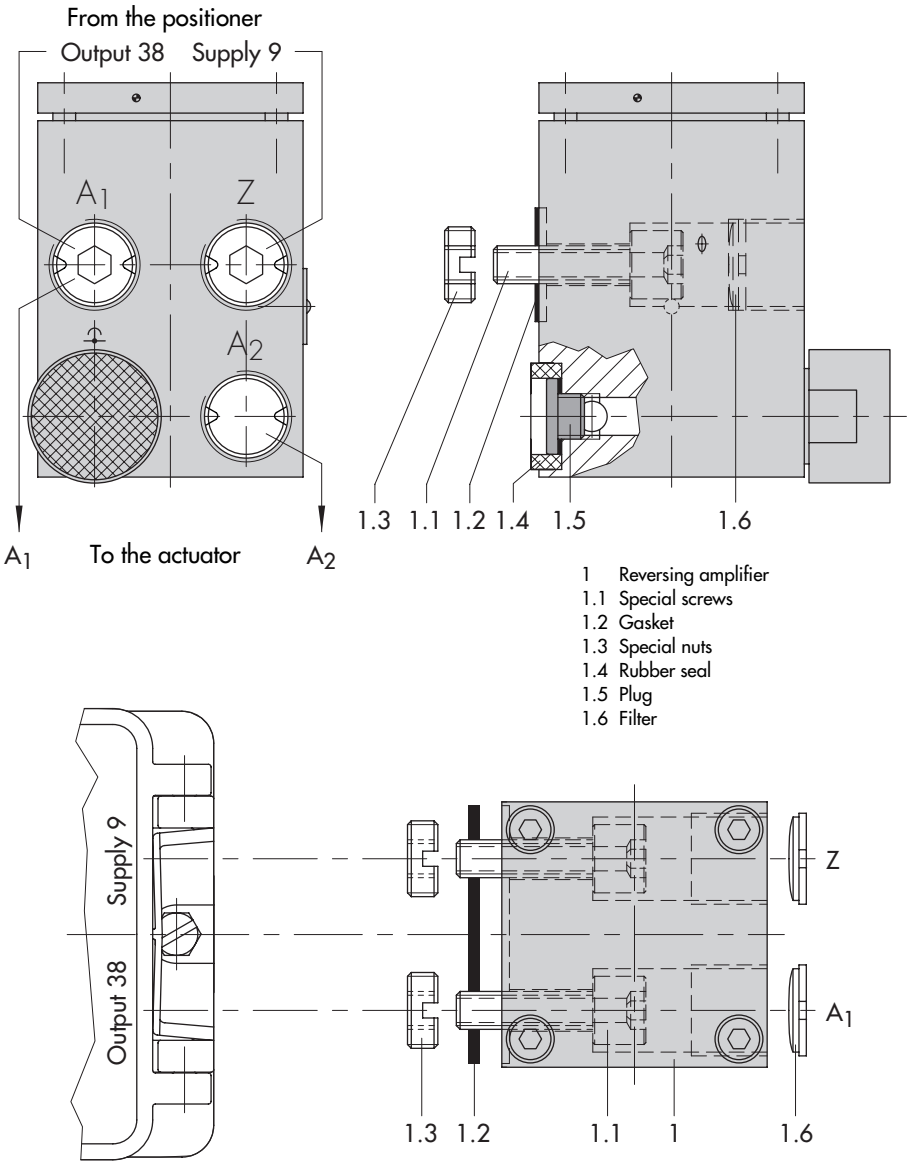


Fig. 7 · Mounting a reversing amplifier

3 Connections

3.1 Pneumatic connections

The air connections are either 1/4 NPT or G 1/4 tapped holes. Customary fittings for metal and copper pipes or plastic tubes can be used.

Note!
The supply air must be dry and free from oil and dust. Observe the maintenance instructions for upstream pressure reducing stations. Carefully purge all tubes before connecting them.

If the positoner is attached directly to Type 3277 Actuator, the connection for the signal pressure is fixed. For NAMUR attachment, the signal pressure can be applied to either the top or bottom diaphragm chamber depending on the fail-safe position "actuator stem extends or retracts".

Exhaust air: The exhaust air connection of the positioner is included in the mounting parts. For direct attachment of the positioner, there is a vent plug on the plastic cover of the actuator. For NAMUR attachment, this plug is on the adapter housing and for attachment to rotary valves, it is on the intermediate piece or reversing amplifier.

3.1.1 Pressure gauge

We recommend mounting pressure gauges for supply air and signal pressure to monitor the positioner. The parts are listed as accessories in Tables 3, 4 and 6.

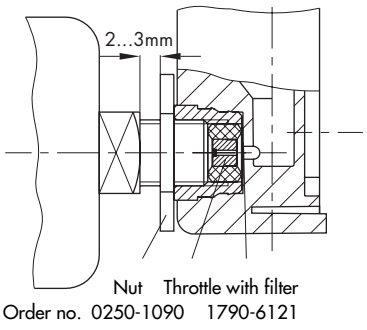


Fig. 8 · Mounting the pressure gauge

3.1.2 Supply air pressure

The required supply air pressure depends on the bench range and the operating direction (fail-safe position) of the actuator.
The bench range is mentioned on the nameplate as spring range or signal pressure range.

Actuator stem extends:
Required supply air pressure =
Upper bench range value + 0.2 bar,
min. 1.4 bar.

Actuator stem retracts:
The required supply air pressure for tight-closing valves is calculated from the maximum signal pressure pst_{max}

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

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

If there are no specifications, calculate as follows:
Required supply air pressure = Upper bench range value + 1 bar

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 installation in hazardous areas:
EN 60079-14: 2003 (VDE 0165 Part 1) ***"Electrical apparatus for explosive gas atmospheres"*** *and*
EN 50281-1-2: 1999 (VDE 0165 Part 2) ***"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).
For EEx nA equipment (non-sparking apparatus), the standard EN 50021: 1999 specifies that connecting, interrupting, or switching circuits while energized is only allowed during installation, maintenance or repair work.
For EEx nL equipment (energy-limited apparatus), the standard EN 50021: 1999 allows this type of equipment to be switched under normal operating conditions.

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 –40 °C must have metal cable entries.

The terminal assignment can be found in Fig. 9 as well as on the labels on the cover plate of the positioner case.

Cable entries

The cable entry with M20x1.5 cable gland, 7 to 12 mm clamping range.
There is a second M20x1.5 cable gland in the housing that can be used for additional connection, if required.
The screw terminals are designed for wire cross-sections of 0.2 to 2.5 mm^2. Tighten by at least 0.5 Nm.

Bus line

The shielding of the Fieldbus connecting cable is connected to the equipotential bonding system on the process control system side. At the positioner side, the shielded cable must be routed over the EMI-proof brass cable gland (standard) of 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.

- To connect the bus line, loosen the coupling nut and the clamping insert from the positioner and remove the dust cap.
- Slide the coupling nut and clamping insert over the connecting cable.
- Insulate 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.
- Disentangle the braided shield and pull it over the clamping insert.
- Press the clamping insert into the connecting screw gland and screw tight the coupling nut until the connecting cable is clamped tight.
- Route the two-wire bus line to the screw terminals marked "IEC 1158-2", whereby no polarity has to be observed.

In exceptional cases, when the plant may not allow such a connection, feed the cable shield through the cable gland and connect it to be capacitive over the terminal "S". However, make sure that a conducting connection cannot occur from the shield to the cable gland or housing.

If the shielding is not placed on both sides, we recommend installing an additional sup-

pressor kit (order no. 1400-9324). Separate installation instructions are included.

Note!
The connection of limit switches, binary input and forced venting function requires an additional cable gland that must replace the cap fitted on the housing.
Accessories: *Cable gland M20 x 1.5, nickel-plated brass, order no. 8808-0143*

Limit switches

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 NAMUR, thus ensuring operational reliability of the positioner.
If the positioner is installed in hazardous areas, the relevant regulations must be observed.

Binary input

A passive floating contact can be used at the binary input. The positioner signals the status over the bus protocol.

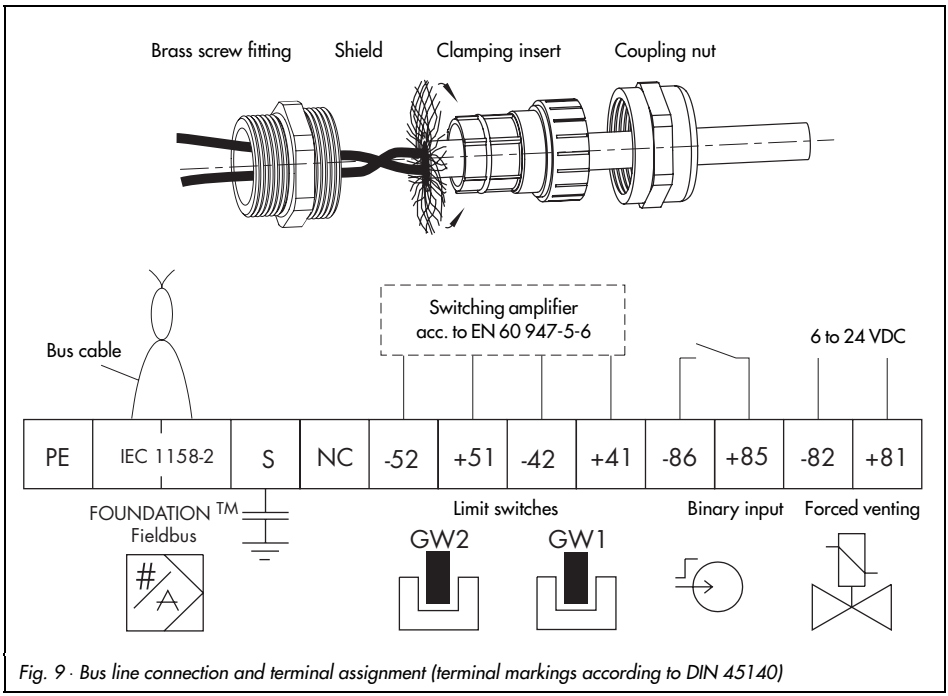


Fig. 9 · Bus line connection and terminal assignment (terminal markings according to DIN 45140)

Forced venting

For the positioners with forced venting function, a voltage between 6 and 24 V DC must be connected to the terminals 81 and 82.

Note!
If there is no voltage connected or the voltage drops, the positioner vents the actuator and does not respond to the reference variable.

3.2.1 Establishing communication

Communication between positioner, programmable logic controller or automation system or between PC and workstation and positioner(s) is established in accordance with IEC 61158-2.

If positioners are used in hazardous areas, ex-barriers must be used.

A maximum of 32 control valves can be operated in one segment. The number of positioners that can be connected is reduced when they are used in hazardous areas.

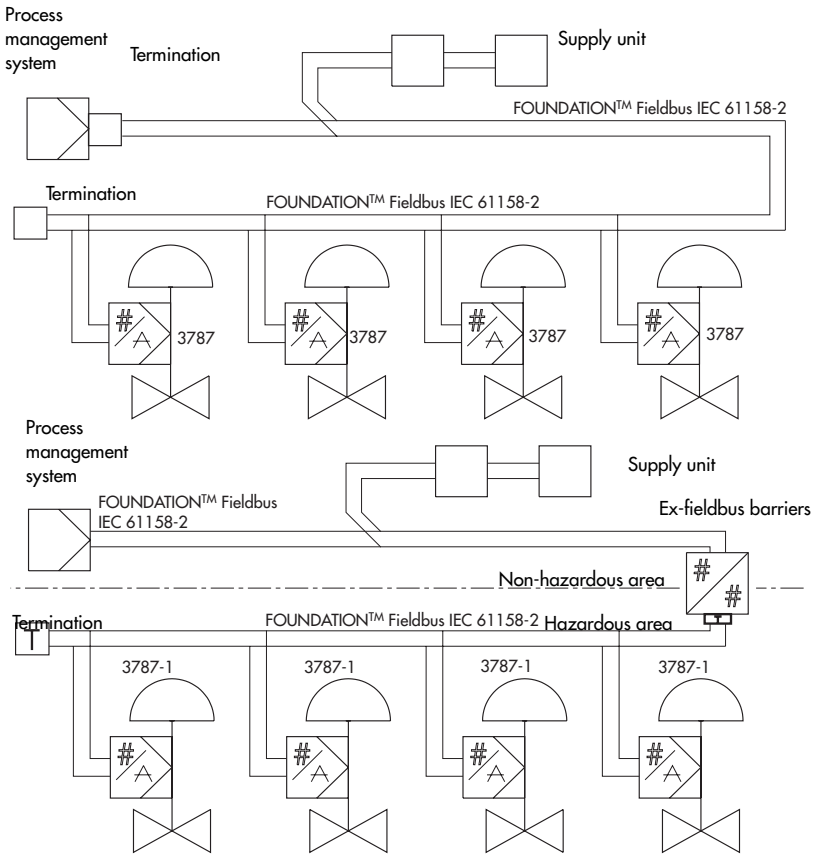


Fig. 10 · FOUNDATION™ Fieldbus connection, for non-hazardous areas (top) and for hazardous areas (bottom)

4 Operation

Warning!
Before you take the control valve into operation, carefully move the control valve to its end position by covering the hole (manual operation) on the cover plate (Fig. 11). On doing so, check whether the lever mechanism works properly. If the maximum angle of rotation is exceeded because the wrong lever mechanism has been selected or incorrectly sized, the positioner may be ruined.

4.1 LEDs

There are two LEDs located inside the cover used to monitor the positioner during start-up, operation and to indicate possible faults.

General meaning of LEDs:

Red Device start-up or error, no control operation possible

Green No error detected, control operation or fail-safe position (e.g. if not initialized)

Red and green Error detected, control operation possible

See table below for detailed description.

Description	LED
Device start-up:	Red on
No error detected: Device connected to bus, cold start completed, initialization required Initialization or zero calibration running Device is initialized, no valid set point Device is initialized, valid set point, control operation	Green, generally Green blinks slowly Green blinks quickly Green blinks 3x quickly + long interval Green on
Error in the control loop: Zero point error Control loop fault	Red and green Red and green blink slowly Red and green blink quickly
Error leading to first initialization being cancelled (Device does not go to standard operation) Zero point error Mechanics/pneumatics failure Control loop fault	Red, generally Red blinks slowly Red on Red blinks quickly
Device errors causing the control operation to be left Device has detected an internal fault	 Red blinks 3x quickly + long interval

4.2 Write protection and simulation switches

There are two microswitches inside the hinged cover to activate the write protection and enable simulation.

When the write protection switch is ON, the configuration data of the positioner are write-protected and cannot be overwritten. The switch must be set to OFF before any configuration data can be changed over the communications.

The simulation switch enables the simulation of the position value for Analog Output Function Block using the Simulate parameter.

4.3 Activate/deactivate forced venting function

For models with index .0**3** or higher:

1. Remove cover plate on the inside of the positioner lid by unscrewing the four screws.
2. Unscrew the central screw on the board and push the board to one side.
3. Set switch to desired position:
   1 ENABLED > Function activated
   2 DISABLED > Function deactivated.

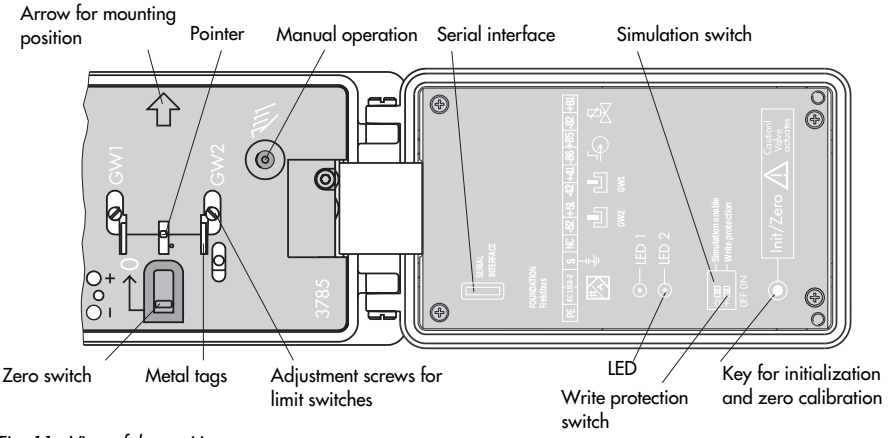


Fig. 11 · View of the positioner cover open

4.4 Default setting

All parameters are set to default values. See chapter 7 on description of parameters.

Note!
Manual operation and activated final position functions can cause the actuator to filled with the maximum supply pressure. Should this lead to impermissible forces occurring, the supply pressure must be restricted by a reducing station.

4.4.1 Adjusting mechanical zero

Note!
Zero must be calibrated when the valve is closed (with actuator stem extended in three-way valves).

- Firmly push the zero switch, located on the cover plate inside the positioner, in the direction indicated by the arrow as far as it will go once. The yellow pointer will then be aligned with the white line.

For control valves which are open in their initial position, e.g. when the actuator's fail-safe position is "actuator stem retracts", the positioner must be first supplied with air. The manual operation function must then be activated so that the supply pressure builds up and moves the valve to the closed position. Then press the zero switch.

4.4.2 Initialization

After connecting the supply air and electrical connections to the bus cable, initialization must be started. During initialization, the positioner adapts itself optimally to the friction conditions and signal pressure requirements of the control valve.

Caution!
Initialization takes several minutes to complete. During this time, the control valve moves. Therefore, never initialize while a process is running, but only during the start-up phase when the shut-off valves in the plant section are closed. Alternatively, remove the control valve with positioner from the plant and initialize on a test bench.

- Enter data on valve and actuator under "Start-up" in the operating software.
- Set "Type of initialization" to "Rated range", select "Maximum range" only for three-way valves.
- Start initialization.

A successful initialization is indicated in the operating software and over the LEDs (see chapter 4.1).

- Carry out the configuration suitable for the valve type.

The following setting is recommended:

- **Fail-safe position "Actuator stem extends":**
  Direction of action: increasing/increasing (>>), the globe valve opens with increasing reference variable
  Final position at a reference variable less than 1% (tight closing),
  Final position at a reference variable larger than 125 % (function deactivated).
- **Fail-safe position "Actuator stem retracts":**
  Direction of action: increasing/decreasing (<>), the globe valve closes with increasing reference variable
  Final position at a reference variable less than –2.5% (function deactivated),
  Final position at a reference variable larger than 99 % (tight closing).
- Set delay time to 30 s at the minimum.
- Enter tag reference.
- If necessary, other configuration, e.g. special characteristics for rotary valves.

If there is **no communication** set up on the valve, initialization directly at the valve is also possible.

- Connect positioners that are not mounted on a valve to a power supply and initialize the positioner as described in chapter 4.4.2.
  If communication is not possible, the default setting must be used.
- Mount positioner and set the mechanical zero as described in chapter 4.4.1.

Start initialization by pressing the **Init/Zero** key on the positioner case cover using a suitable tool.

The initialization is completed when the positioner takes on the position predetermined by the reference variable.

Note!
After the positioner has been initialized successfully for the first time, pressing the ***Init/Zero*** *key subsequently only starts a zero calibration.*

A new initialization routine can only be started after this when the communication is connected.

A completed initialization can be cancelled via the communication with the command "Reset to default values". After this, the Init/Zero key can be pressed to start a complete initialization.

Electric zero calibration

If, during the valve's operation, the mechanical zero has shifted, an electric zero calibration can be carried out. To do this, press the Init/Zero key located on the inside of the cover (Fig. 11).

Caution!
The control valve moves to its final position.

- Firmly press the zero switch, located on the cover plate of the positioner, in the direction indicated by the arrow as far as it will go once. The yellow pointer will then be aligned with the white line.
- Press the key again to start the electric calibration.

After the key is pressed twice, it is locked for approximately one minute!
The electric calibration has been completed when the positioner takes on the position predetermined by the reference variable.

4.5 Operation via TROVIS-VIEW

In addition to using the fieldbus configuration or operating system via fieldbus communication, the positioner can also be operated with SAMSON's TROVIS-VIEW user interface via the serial port integrated in the device.

You can configure all the parameters using the device module intended for the TROVIS-VIEW software.

For connection of the positioner to the serial port of the PC, you will need an adapter (order no. 1400-7700).

You can either connect the power supply to the device using a fieldbus segment, or by connecting a voltage source (9 to 32 V) to the bus terminals on the device.

When the device is connected to a Foundation Fieldbus bus segment, you can simultaneously operate TROVIS-VIEW and the fieldbus system without any restrictions.

4.5.1 Initialization

When you initialize the device via the fieldbus system or TROVIS-VIEW, the initialization routine is started over the parameter SELF_CALIB_CMD.

You can select an initialization routine based on either the nominal range or maximum range by setting the parameter INIT_METHOD accordingly.

During initialization based on nominal range, the following parameters must be set:

- VALVE_TYPE
  Option: Rotary or linear actuator
- MOUNTING_POSITION
  Positioner alignment to actuator (for linear actuator).
- ATTACHMENT
  Defines the attachment of the positioner (Select: Namur/integrated).
- RATED_TRAVEL
  Rated travel or nominal angle of the valve
- ACTUATOR_VERSION
  Determines whether the actuator is single acting or double acting.

Options for linear actuator with NAMUR attachment:

- TRANSM_LENGTH
  Specifies the length of the lever
- TRANSM_PIN_POS
  Specifies the position of the pin on the lever.

Options for linear actuator with integrated attachment:

- TRANSM_CODE
  Determines the size of the travel pick-off for integrated attachment.

Options for rotary actuator:

- TRANSM_CODE
  Determines the cam disk used.

During initialization, the following parameters are determined:

- ACT_FAIL_ACTION
  Fail-safe action of the actuator when the supply air fails.
- ACT_STROKE_TIME_DEC
  Minimum transit time to CLOSED position
- ACT_STROKE_TIME_INC
  Minimum transit time to OPEN position

- MAX_HUB
  Maximum travel/angle of rotation in percent of the rated travel/nominal angle.

The integrated LEDs and the parameters

- SELF_CALIB_STATUS
- SELF_CALIB_WARNUNG

indicate if the initialization has been successfully completed or whether errors have occurred.

4.5.2 Testing the control valve

Upon successful initialization, you can easily test the control valve using TROVIS-VIEW software. This function allows you to run the valve for test purposes without the use of a complex fieldbus system and without requiring knowledge about the function blocks and their configuration.

Proceed as follows:

1. **Set the Transducer Block to "Local override" mode:**
   In the menu "Positioner-> Operating mode TRD" under "Required operating mode" select "Local override (LO)".
   Deactivate the option "Fail safe position (O/S)".
2. **Defining a positioning value:**
   In the menu "Positioner-> Process data", you can select a positioning value for the valve over "Positioning value TRD" (FINAL_VALUE).
   Note that the status of the positioning value must be set to "Good".
   The position feedback can be retrieved via "Current valve position" (FINAL_POSITION_VALUE).
3. **Set the Transducer Block to the "Auto" mode.**
   In the menu "Positioner-> Operating mode TRD" under "Required operating mode" select "Automatic (AUTO)".
   Deactivate the option "Local override (LO)".

4.6 Setting the inductive limit switches

The positioner version with inductive limit switches has two adjustable tags that are mounted on the shaft of the positioner lever and operate the associated proximity switches. For operation of the inductive limit switches, the corresponding switching amplifiers have to be connected to the output. If the tag is in the inductive field of the switch, the switch assumes a high resistance. If the tag is out of the field, the switch assumes a low resistance.
Normally, the limit switches are adjusted such that they will provide a signal in both end positions of the valve. These switches, 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 selected, if necessary, at the switching amplifier.

Adjusting the switching point:
The limit switches are marked GW1 and GW2 on the inside of the case cover. Yellow tags and the associated adjustment screws (Fig. 11) are located below these markings.
Each switching position can optionally be indicated when the tag has entered the field, or when it has left the field.

- Move the valve to the switching position and adjust the tag of the required limit switch GW1 or GW2 by turning the related adjustment screw until the switching point is reached. This is indicated by the LED at the switching amplifier.

In so doing, one edge of the yellow tag will be in alignment with the white, horizontal line on the case cover. This indicates the side from which the tag enters the inductive field of the proximity switch.

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).

5 Maintenance

The positioner is maintenance-free. Pneumatic connection 9/Supply contains a sieve with a mesh size of 100 µm. If required, the sieve can be unscrewed and cleaned.

Please also observe the maintenance instructions for upstream pressure reducing stations for supply air, if applicable.

6 Servicing explosion-protected versions

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".

7 Parameter description

7.1 General

The section is based on:

Fieldbus Foundation Specification "Function Block Application Process Part 1 to 3" Revision 1.4.

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

7.2 Device Description (DD)

The following Device Description files are required for integrating the device described into host systems:

Device Description: < 0201.ffo >, < 0201.sym >

Capabilities File: < 020101.cff >

You can order these Device Description files on disk (3 1/2") from SAMSON under the product number 1400-7705 or you can download them from the Internet at *www.samson.de* or *www.fieldbus.org*.

Note: *The file < Positioner 3787_Rev2.fhx > is required for integration into the System DeltaV from Fisher-Rosemount, instead of the capabilities file from Fieldbus Foundation. This file can be provided by SAMSON.*

7.3 Notes on the parameters

All times specified in the Resource Block are in 1/32 ms units in accordance with the Fieldbus specification Version 1.4.
In the Device Description Library supplied by the Fieldbus Foundation on which the Device Description of the Type 3787 is based, these parameters are incorrectly shown with the ms unit. The numerical values supplied by the device should, however, always be interpreted as units of 1/32 ms.
Due to the same reason, the IO_OPTS parameter in the AO Block displays "Fault state to value" as "Fault state type".
Several parameters can only be altered in certain modes (see "Access" in Parameter description).
Therefore, it is important that the Target Mode is set and not the Actual Mode.

7.3.1 Legends assigned to the parameters

r = Read
w = Write
Index = Relative index of the parameter in each block
O/S = Out of Service
MAN = Manual
AUTO = Automatic
CAS = Cascade
RCAS = Remote Cascade
ROUT = Remote Output
S = Static parameter
N = Non-volatile parameter
D = Dynamic parameter

7.3.2 Notes on parameter storage classes S, N and D

Static and non-volatile parameters are stored in the positioner's EEPROM.
If such parameters are changed over acyclic FOUNDATION Fieldbus communication, the changes are saved in the EEPROM.
The number of write accesses granted to the EEPROM is limited due to technical restrictions.
Writing of transducer block parameters is limited to 10,000 accesses. For all other blocks, the limit is 1 million.

These access limits must be observed. If they are exceeded, integrity of the stored data and thus the function of the positioner can no longer be guaranteed due to data being overwritten.
Make sure these parameters are not constantly overwritten by acyclic FOUNDATION Fieldbus transfers.

When transferring data to the positioner using cyclic, scheduled FOUNDATION Fieldbus publishing (Publisher/Subscriber), these data are not saved in the EEPROM.

7.4 Block structure

FOUNDATION Fieldbus assigns all functions and data of a device to three different block types. Each block type has a different area of application.

A FOUNDATION Fieldbus device has the following block types:

- One Resource Block
  The Resource Block contains all the hardware specific characteristics.
- One or more Transducer Blocks
  The Transducer Block contains all the data and device-specific parameters to link the device to the process data (sensor or actuator).
- One or more Function Blocks
  Function Blocks provide generally useable automation functions.
  There are various different types of Function Block, e.g. Analog Input Function Block, Analog Output Function Block, PID Function Block and other input, output and processing blocks.
  Each of these Function Blocks can be used for processing various application functions in the entire automation system.

Various tasks can be solved depending on how individual blocks are arranged and connected.

The SAMSON Type 3787 Foundation Fieldbus Positioner contains the following blocks:

- One Resource Block.
- One Standard Advanced Positioner Valve Transducer Block.
- Two Function Blocks:
  one Analog Output Function Block,
  one PID Function Block.

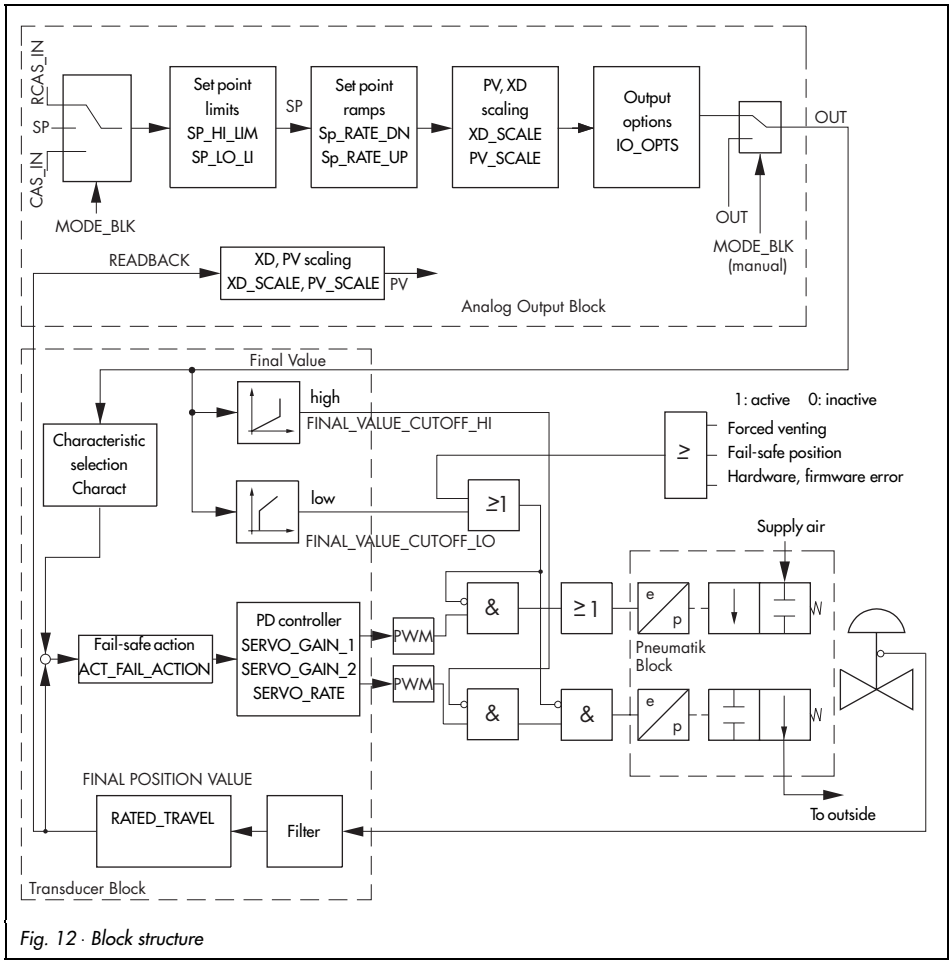


Fig. 12 · Block structure

7.4.1 Resource Block

The Resource Block contains all the data that clearly identifies the device. It is, so to speak, the electronic nameplate of the device.
The Resource Block's parameters include, for example, device type, device name, manufacturer ID, serial number as well as parameters which affect the behavior of all other Blocks in the device.

Parameters of the Resource Block

	Storage class:	
ACK_OPTION Index: 38 Access: r, w Options: Default:	S	This parameter allows you to choose whether an alarm associated with this block should be automatically acknowledged, i.e. without any influence from fieldbus host system. Undefined — No option DISC ALM — Write protection has been changed BLOCK ALM — Block alarm Undefined Note: The alarm is sent to the fieldbus host system, but it is not acknowledged by it.
ALARM_SUM Index: 37 Access: r, w Display:	S	Shows current status of process alarms in the Resource Block. DISC ALM — Write protection has been changed BLOCK ALM — Block alarm Note: Additionally, the process alarms can be cleared in this parameter group.
ALERT_KEY Index: 4 Access: r; w Input: Default:	S	The identification number of the plant unit. This information may be used in the fieldbus host system for sorting alarms and events. 1…255 0 Note: The value 0 (default) is not a tolerated value and is therefore rejected with an error message when writing to the device.
BLOCK_ALARM Index: 36 Access: r; w	D	Shows the current block status with information about existing configuration, hardware or system errors. Note: Additionally, the active block alarm can be manually acknowledged in this parameter group.
BLOCK_ERR Index: 6 Access: r Display:	D	Shows the active block error. SIMULATE ACTIVE — Simulation possible, Simulation Enable set. OUT OF SERVICE — The block model is O/S . LOST STATIC DATA — Data loss in EEPROM DEVICE NEEDS MAINTENANCE SOON (Zero error, control loop disturbed or total valve travel. exceeded). This alert triggers a block alarm (BLOCK_ALM) of the ResourceBlock.

CLR_FSTATE Index: 30 Access: r, w	D	Writing a Clear to this parameter will clear the fault state of the Analog Output Function Block.
CONFIRM_TIME Index: 33 Access: r, w Default:	S	Default of confirmation time for event report. If the device does not receive any confirmation within this time, the event report is sent again. 640000 1/32 ms
CYCLE_TIME Index: 20 Access: r, w Options: Default:	S	Block execution methods predetermined by fieldbus host system. SCHEDULED COMPLETION OF BLOCK EXECUTION SCHEDULED Note: The execution method is selected directly in the fieldbus host system.
CYCLE_TYPE Index: 19 Access: r Display:	S	Shows the block execution methods supported by the device. SCHEDULED COMPLETION OF BLOCK EXECUTION
DD_RESOURCE Index: 9 Access: r	S	Shows the string for the Device Description in the device. Note: If there is not Device Description in the device, "null" appears in the display.
DD_REV Index: 13 Access: r	S	Shows revision number of Device Description.
DESCRIPTOR Index: 46 Access: r, w	S	Description, freely available space for entering text to describe the application, stored in the field device.
DEV_REV Index: 12 Access: r	S	Shows the revision number of the device.
DEV_TYPE Index: 11 Access: r Display:	S	Shows the device type in decimal number format. 1 for Type 3787
DEVICE_ CERTIFICATION Index: 45 Access: r	N	Type of protection, indicates whether Ex approvals for this field device are available.
DEVICE_MESSAGE Index: 47 Access: r, w	N	Message, freely available space for entering text stored in the field device.
DEVICE_ PRODUCT_NUM Index: 48 Access: r	N	Product number of the positioner.

DEVICE_SER_NUM N Index: 44 Access: r	Serial number of the device, allows together with MANUFAC_ID and DEV_TYPE the clear identification of the field device.
FAULT_STATE N Index: 28 Access: r	Shows current status of the fault state of the Analog Output Function Block.
FEATURES S Index: 17 Access: r	Shows additional functions supported by the device, see FEATURES_SEL.
FEATURES_SEL S Index: 18 Access: r, w Options:	Used to select the additional functions supported by the device. REPORTS The fieldbus host system must acknowledge receipt of the event report. HARD W LOCK Hardware write protection switch is interpreted. FAULTSTATE Fault state can be initiated (see SET_FSTATE /CLR_FSTATE) OUT READBACK Current valve position is issued in PV of the Analog Output Function Block (otherwise SP).
FREE_TIME D Index: 25 Access: r	Shows the free system time (in percent) which is available to process additional function blocks. Note: This parameter is not supported as the function blocks of the Type 3787 are configured invariably.
FREE_SPACE D Index: 24 Access: r, w	Shows the free memory (in percent) which is available to process additional function blocks. Note: This parameter is not supported as the function blocks of the Type 3787 are configured invariably.
GRANT_DENY D Index: 14 Access: r	Grant or deny access of host computer to the field device. Note: This parameter is not interpreted by the Type 3787.
HARD_TYPES S Index: 15 Access: r, w Display:	Shows the types of output signal for the Analog Output Function Block. SCALAR OUTPUT scalable analog output variable
HW_REVISION S Index: 43 Access: r	Hardware edition of electronics /mechanics.
ITK_VER S Index: 41	Version number of the interoperability test system used to certify this device.
LIM_NOTIFY S Index: 32 Access: r, w Option: Default:	Maximum number of unacknowledged event reports allowed. 0 to 8 8

MANUFAC_ID Index: 10 Access: r Display:	S	Shows the manufacturer identification number. 0 x 00E099 = SAMSON AG
MAX_NOTIFY **Index: 31** **Access:** r Display	S	Shows the maximum number of unacknowledged event reports possible. 8
MEMORY_SIZE Index: 22 Access: r	S	Shows available configuration memory in kilobyte. Note: This parameter is not supported as the function blocks of the Type 3787 are configured as permanent.
MIN_CYCLE_T **Index: 21** **Access:** r Display:	S	Shows time duration of the shortest cycle interval of which the device is capable (execution time of the AO Function Block 50 ms). 1600 1/32 ms
MODE_BLK **Index: 5** **Access:** r, w Display:	N	Shows the actual, target, permitted and normal modes of the Resource Block. AUTO O/S The Resource Block supports the following modes: AUTO In this mode, the execution of the function blocks is (AO and PID Function Blocks) granted. O/S In this operating mode, the execution of the function blocks is (AO and PID Function Blocks) is stopped. These blocks then go into O/S mode.
NV_CYCLE_T **Index: 23** **Access:** r	S	Shows the minimum time interval for copying device data to non-volatile memory. Note: Non-volatile data are saved directly after being transferred in the Type 3787.
RESTART **Index: 16** **Access:** r, w Option:	D	Allows a manual restart to be initiated. Several degrees of restart are possible. RUN — Standard operation RESOURCE — (is not supported) DEFAULTS — Device data and connection of the function blocks are reset to the values determined in the specification. PROCESSOR — Reset of the device, reboost of the processor.

RS_STATE **Index: 7** **Access:** r Display:	D	Shows the actual operating state of the Resource Block. ONLINE Standard operation, the block is in the operating mode AUTO. STANDBY The Resource Block is in the operating mode O/S. ONLINE LINKING The configured links among the function blocks are still not set up.
SET_FSTATE **Index: 29** **Access:** r, w	**D**	Allows the Fault State condition of the Analog Output Function Block to be manually initiated by selecting Set.
SHED_RCAS **Index: 26** **Access:** r, w	S	Determines monitoring time for checking the link between the fieldbus host system and the PID Block in the RCAS mode. After the monitoring time has elapsed, the PID Block changes from RCAS mode to the mode selected in SHED_OPT.
SHED_ROUT **Index: 27** **Access:** r, w Default:	S	Determines monitoring time for checking the link between the fieldbus host system and the PID Block in the ROUT mode. After the monitoring time has elapsed, the PID Block changes from ROUT mode to the mode selected in SHED_OPT. 640000 1/32 ms
SW_REVISION Index: 42 Access: r	N	Firmware version (communication/positioner)
STRATEGY Index: 3 Access: r, w Default:	S	The strategy field can be used to identify grouping of blocks to allow a faster analysis of the blocks. Enter the same number in the STRATEGY parameter of each block to group blocks. 0 Note: This data is not checked or processed by the Resource Block.
ST_REV Index: 1 Access: r	N	Shows the revision level of the static data. Note: The revision level will be incremented each time a static parameter in the block is changed.
TAG_DESC Index: 2 Access: r, w Default:	S	For entering a user-specfic text of max. 32 characters to clearly identify and assign the block. No text
TEST_RW Index: 8 Access: r, w	D	Note: This parameter is only required for conformity tests and has no meaning in standard operation.
TEXT_INPUT_1 Index: 50 Access: r, w	N	Freely available space for entering text
TEXT_INPUT_2 Index: 51 Access: r, w	N	Freely available space for entering text

TEXT_INPUT_3 Index: 52 Access: r,w	N	Freely available space for entering text.
UPDATE_EVT Index: 35 Access: r	D	This alert is generated by any change to the static data, including date and time.
WRITE_ALM Index: 40 Access: r, w	D	Shows status of the write protection alarm. Note: This alert is generated if the write lock parameter is cleared. In addition, the active write protection alarm can be manually acknowledged in this parameter group.
WRITE_LOCK Index: 34 Access: r, w Option:	S	For hardware write protection: Shows status of the write protection For software write protection: Enable/clear write protection LOCKED NOT LOCKED
WRITE_PRI Index: 39 Access: r, w Input: Default:	S	Determines the handling when a write protection alarm is generated (parameter "WRITE_ALM"). 0 The write protection alarm is not interpreted 1 The fieldbus host system is not alerted when a write protection alarm is generated 2 Reserved for block alarms 3...7 The write protection alarm is issued with the corresponding priority (3 = low priority, 7 = high priority) to notify the user. 8...15 The write protection alarm is issued with the corresponding priority (8 = low priority, 15 = high priority) as a critical alarm. 0
WRITE_PROTECT_SWITCH Index: 49 Access: r	D	Position of the write protection switch in the device 0 = Not write-protected 1 = Write-protected

7.4.2 Transducer Block

The Transducer Block enables the input and output variables of a function block to be influenced. In this way, measured and control data can be calibrated, characteristics can be linearized or physical variables can be converted with the aid of process data.
Parameters of the Transducer Blocks include, for example, information about the actuator type, attachment, engineering units, start-up, diagnostics as well as device-specific data.
The Standard Advanced Positioner Valve Transducer Block receives a correction value from an upstream connected Analog Output Function Block. This value is used to position a control valve. The Block contains parameters for adaptation to actuator and valve, for start-up and for control valve diagnosis.

Parameters of the Standard Advanced Positioner Valve Transducer Block

This Block contains parameters for descriptions about actuator and valve, to which the positioner is attached. The parameters of this block are used to adapt the positioner to the valve and for start-up and diagnosis of the control valve.

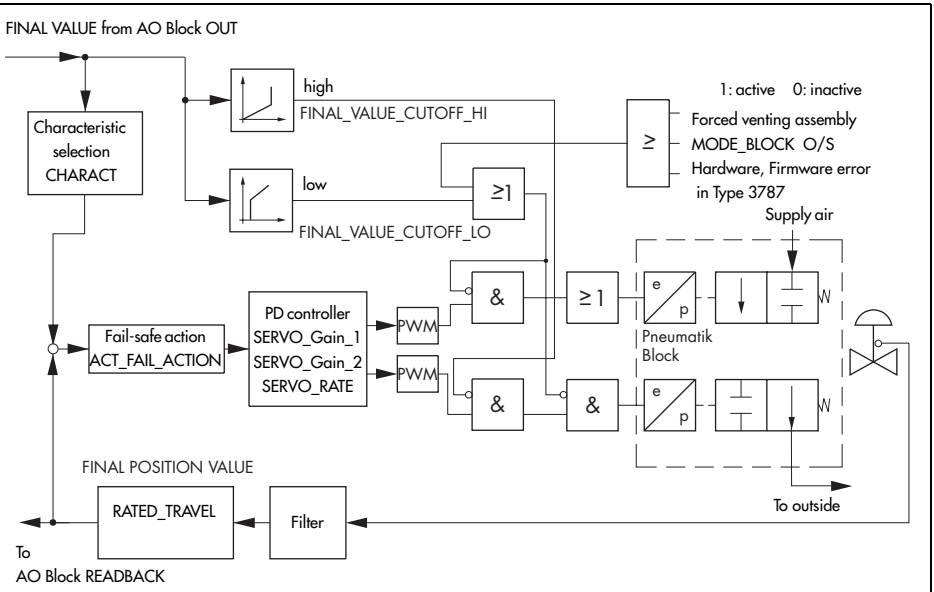


Fig. 13 · Transducer Block

Note:
When initialization based on maximum range (default) is selected, the positioner can be started up directly after being attached to the control valve via the SELF_CALIB_CMD parameter.
The results of the initialization are saved in SELF_CALIB_STATUS. When this type of initialization is used, other parameters in this block generally do not require any adaptation.

ACT_FAIL_ACTION Index: 21 Access: r Display:	S	Fail-safe position of the actuator when the auxiliary power fails. It is determined automatically during initialization. UNINITIALIZED Not initialized, undefined SELF-CLOSING Closing (in direction 0 % position) SELF-OPENING Opening (in direction 100 % position) INDETERMINATE None
ACT_MAN_ID **Index: 22** **Access:** r, w	S	Manufacturer of actuator Clearly identifies the manufacturer of the actuator associated with the positioner.
ACT_MODEL_NUM Index: 23 Access: r, w	S	Type / version of the actuator associated with the positioner.
ACT_SN Index: 24 Access: r,w	S	Serial number of the actuator associated with the positioner.
ACT_STROKE_TIME_DEC Index: 59 Access: r	S	Minimum transit time CLOSED position The minimum transit time CLOSED (in direction 0 % position) is the actual time in seconds which the positioner, actuator and valve need to move through the rated travel/nominal angle to close the valve (measured during initialization).
ACT_STROKE_TIME_INC Index: 60 Access: r	S	Minimum transit time OPEN position The minimum transit time OPEN (in direction 100 % position) is the actual time in seconds which the positioner, actuator and valve need to move through the rated travel/nominal angle to open the valve (measured during initialization).
ACTUATOR_TYPE Index: 46 Access: r Display:	N	Type of actuator associated with the positioner. ELECTRO PNEUMATIC
ACTUATOR_VERSION Index: 48 Access: r, w Input: Default:	S	Actuator design with or without spring-return mechanism. SINGLE ACTING single acting, with spring-return mechanism DOUBLE ACTING double acting, without spring-return mechanism SINGLE ACTING

ALERT_KEY S Index: 4 Access: r, w Input: Default:	The identification number of the plant unit. This information can be used by the fieldbus host system to sort the alarms and events. 1...255 0 Note: The value 0 (default) is not a tolerated value and is therefore rejected with an error message when writing to the device.
ATTACHMENT S Index: 47 Access: r, w Input: Default:	Defines the attachment of the positioner to the control valve (with linear actuator). INTEGRATED Attachment used with SAMSON Type 3277 Actuator. NAMUR Attachment acc. to DIN /IEC 534 (NAMUR). INTEGRATED Note: Only the attachment acc. to VDI /VDE 3845 (NAMUR) is possible with rotary actuators. In this case, the parameter has no effect.
BINARY_INPUT D Index: 41 Access: r Display:	Status of the binary input. NOT ACTIVE ACTIVE NOT EVALUATED
BLOCK_ALARM D Index: 8 Access: r, w	Shows the current block status with information about configuration, hardware and system errors. Note: Additionally, the active block alarm can be manually acknowledged in this parameter group.
BLOCK_ERR D Index: 6 Access: r Display:	Shows active block error. OUT OF SERVICE DEVICE NEEDS MAINTENANCE NOW (electronics defective) DEVICE NEEDS MAINTENANCE SOON (Zero error, control loop distrubed or total valve travel exceeded). LOCAL OVERRIDE Positioning value over TROVIS-VIEW for on-site operation or option forced venting or zero calibration or initialization in progress. INPUT FAILURE Position feedback defective or device not initialized OUTPUT FAILURE Device not initialized MEMORY FAILURE LOST STATIC DATA Checksum error

CHARACT S Index: 42 Access: r, w Input: Default:	Selection of characteristics to assign the correction value to the travel range/angle of rotation. LINEAR EQUAL PERCENTAGE EQUAL PERCENTAGE REVERSE SAMSON BUTTERFLY LINEAR SAMSON BUTTERFLY EQUAL PERCENTAGE VETEC ROTARY LINEAR VETEC ROTARY EQUAL PERCENTAGE LINEAR
COLLECTION_DIRECTORY Index: 12 Access: r	Note: This parameter is not processed in the Type 3787.
DEADBAND S Index: 35 Access: r, w Range: Default:	Dead band in percent of the rated travel /nominal angle. 0.1 ... 10 % 0.5 %
DELAY_TIME S Index: 37 Access: r, w Range: Default:	Reset criteria for running control loop monitoring. If the DELAY_TIME entered is exceeded and the system deviation is not within the TOLERANCE_BAND, a control loop fault is reported. It is determined from the minimum transit time during initialization. 1 ... 240 s 10 s
DEVIATION D Index: 34 Access: r	Deviation of the positioner
FINAL_VALUE N Index: 13 Access: r	This parameter contains the correction value received from the upstream connected Analog Output Function Block.
FINAL_VALUE_CUTOFF_HI S Index: 15 Access: r, w Range: Default:	Final position if the set point exceeds the entered value, the valve is moved towards the final position that corresponds to 100 % of the manipulated variable. This is done by completely venting or filling the actuator (depending on the fail-safe position). 0 ... 125 % 99 % Note: The function is cleared when –2.5 % is entered. Since the actuator is completely filled or vented when this function is activated, the control valve moves to its absolute final position. Limitations in the functions "travel range" or "mechanical limit stops" do not apply here. In case, impermissibly high positioning forces arise due to this, the function must be cleared.

FINAL_VALUE_CUTOFF_LO S Index: 16 Access: r, w Range: Default:	Final position if the set point falls below the entered value, the valve is moved towards the final position that corresponds to 0 % of the manipulated variable. This is done by completely venting or filling the actuator (depending on the fail-safe position). –2.5 ... 100 % 1 % Note: The function is cleared when –2.5 % is entered. Since the actuator is completely filled or vented when this function is activated, the control valve moves to its absolute final position. Limitations in the functions "travel range" or "mechanical limit stops" do not apply here. In case, impermissibly high positioning forces arise due to this, the function must be cleared.
FINAL_VALUE_RANGE S Index: 14 Access: r	This parameter contains the range of the manipulated variable (XD_SCALE) used in the upstream connected Analog Output Function Block.
FINAL_POSITION_VALUE D Index: 17 Access: r	Current valve stem position in the FINAL_VALUE_RANGE unit.
IDENT_BINARY_INPUT N Index: 44 Access: r, w Input: Default:	Describes whether and how the binary input is evaluated: NOT EVALUATED ACTIVELY OPEN ACTIVELY CLOSED NOT EVALUATED
IDENT_FORCED_VENTING N Index: 43 Access: r Display:	Describes whether the option forced venting is activated: NOT IMPLEMENTED Option not granted, input is not evaluated IMPLEMENTED Option granted, input is evaluated
IDENT_LIMIT_SWITCHES N Index: 45 Access: r, w Input: Default:	Describes whether the option including the limit switches is installed. It is not automatically recognized: NOT IMPLEMENTED Not installed IMPLEMENTED Installed Depends on the hardware
INIT_METHOD S Index: 54 Access: r Input: Default:	Initialization method based on maximum range or on nominal range. Only the range of manipulated variables below the rated travel/nominal angle is taken into account on initialization based on nominal range (e.g. globe valve with a mechanical limit stop on one side). The maximum range of manipulated variable is used on initialization based on maximum range (e.g. three-way valves with mechanical limit stops on both sides). MAXIMUM RANGE Initialization based on maximum range NOMINAL RANGE Initialization based on nominal range MAXIMUM RANGE

MAX_HUB N Index: 58 Access: r	Maximum possible travel /angle of rotation Maximum travel/angle of rotation detected during initialization stated in percent of the rated travel/nominal angle.
MODE_BLK N Index: 5 Access: r, w Option:	Shows/used to select the actual operating mode of the Resource Block, permitted operating modes supported by the Transducer Block and the normal operating mode. AUTO O/S The Transducer Block supports the following operating modes: **AUTO** (Automatic) In this operating mode, a position value is calculated from the correction value received from the AO Function Block and the control valve is positioned correspondingly. **O/S** (Out of Service) In this operating mode, the correction value received from the AO Function Block is not used, the control valve moves to the fail-safe position determined in ACT_FAIL_ACTION. The activation of the forced venting likewise causes the mode to change to O/S. **LO** (Local Override) When functions such as initialization or zero calibration are activated as well as during on-site operation of the device (TROVIS-VIEW) the mode changes to LO. After exiting this mode, the mode changes to the preset target mode.
MOUNTING_POSITION S Index: 49 Access: r, w Input: Default:	Position of the positioner in relation to the actuator (with linear actuators) (Standard setting: integral attachment -> arrow pointing towards the actuator, NAMUR attachment -> arrow pointing away from the actuator). ARROW POINTING AWAY FROM THE ACTUATOR ARROW POINTING TOWARDS THE ACTUATOR ARROW POINTING TOWARDS THE ACTUATOR Note: This parameter has no effect with rotary actuators.
RATED_TRAVEL S Index: 50 Access: r, w Range: Default:	Rated travel [mm] or nominal angle in degree [grad] of the control valve. 5 ... 255 15.0 mm Note: The unit [mm] or [grad] depends on VALVE_TYPE parameter.
SELF_CALIB_CMD Index: 55 Access: r, w Option:	Command to start calibration in the field device. NO TEST, STANDARD OPERATION ZERO CALIBRATION INITIALIZATION RESET TOTAL VALVE TRAVEL RESET "CONTROL LOOP FAULT" RESET TRANSDUCER BLOCK TO DEFAULT ABORT PROCESS IN ACTION

SELF_CALIB_STATUS Index: 56 Access: r Display:	D	Status of sequence started with SELF_CALIB_CMD. UNDETERMINED RUNNING ABORTED RANGE ERROR DEFECTIVE MECHANICS / PNEUMATICS TIMEOUT PROPORTIONAL RANGE RESTRICTED RATED TRAVEL OR TRANSMISSION ERROR MECHANICAL ERROR PNEUMATICAL ERROR INITIALIZATION STATUS: DETERMINATION OF MECHANICAL STOPS INITIALIZATION STATUS: DETERMINATION OF MINIMUM PULSES NITIALIZATION STATUS: DETERMINATION OF MINIMUM TRANSIT TIMES INITIALIZATION ABORTED DUE TO ACTIVATED FORCED VENTING OPTION ZERO ERROR SUCCESSFUL NO VALID DATA FROM APPLICATION
SELF_CALIB_WARNING Index: 57 Access: r Display:	D	Additional alert messages of the sequence started with SELF_CALIB_CMD UNDETERMINED WRONG SELECTION OF RATED TRAVEL OR TRANSMISSION AIR LEAKAGE OF PNEUMATIC SYSTEM SUCCESSFUL NO VALID DATA FROM APPLICATION
SERVO_GAIN_1 Index: 18 Access: r, w Range: Default:	S	Proportional-action coefficient for filling 0.01...10.0 0.5
SERVO_GAIN_2 Index: 19 Access: r, w Range: Default:	S	Proportional-action coefficient for venting 0.01...10.0 1.2
SERVO_RATE Index: 20 Access: r, w Range: Default:	S	Gain factor of derivative element 0...1 0.12

STRATEGY S Index: 3 Access: r, w Default:	The strategy field can be used to identify grouping of blocks to allow a faster analysis of the blocks. Enter the same number in the STRATEGY parameter of each block to group blocks. 0 Note: This data is not checked or processed by the Transducer Block.
ST_REV N Index: 1 Access: r	Shows the revision level of the static data. Note: The revision level will be incremented each time a static parameter in the block is changed.
TAG_DESC S Index: 2 Access: r, w Default:	For entering a user-specific text of max. 32 characters to clearly identify and assign the block. No text
TOL_OVERSHOOT S Index: 36 Access: r, w Range: Default:	Tolerated overshoot 0.1...10 % 0.5 %
TOLERANCE_BAND S Index: 38 Access: r, w Range: Default:	Tolerance band Reset criteria for running control loop monitoring. Enter the system deviation allowed for it. See also DELAY_TIME. 0.1...10 % 5 %
TOTAL_VALVE_TRAVEL S Index: 39 Access: r	Total valve travel Sum of the rated load cycles (double travels), sum of valve travels.
TOT_VALVE_TRAV_LIM S Index: 40 Access: r, w Range: Default:	Total valve travel limit 0...16 500 000 1 000 000
TRANSDUCER_DIRECTORY Index: 9 Access: r	Note: This parameter is not processed in the Type 3787.

TRANSDUCER_STATE D Index: 32 Access: r Display:	State of Transducer Block. SEE ACTUAL MODE OF TRANSDUCER BLOCK FORCED VENTING ACTIVE LOWER TRAVEL LIMIT ACTIVE UPPER TRAVEL LIMIT ACTIVE END POSITION ACTIVE AT < END POSITION ACTIVE AT >
TRANSDUCER_TYPE S Index: 10 Access: r	Type of transducer, here "Standard Advanced Positioner Valve"
TRANSM_CODE S Index: 51 Access: r, w Input: Input:	Transmission code **(only for linear actuators with integral positioner attachment)** Determines the size of the travel pick-off when the positioner is integrally attached. D1, Lever 64 mm D2, Lever 106 mm Transmission code **(only for rotary actuators)** Maximum opening angle of the selected segment of the cam disk installed. S90, 90 degrees segment S120, 120 degrees segment Note: This parameter has no effect with rotary actuators.
TRANSM_LENGTH S Index: 52 Access: r, w Range: Default:	Transmission length **(only for linear actuators with NAMUR attachment)** Lever length, distance between travel pick-off and pivot of the lever. 0 ... 1023 mm 42 mm Note: This parameter is only used with linear actuators with NAMUR attachment; it has no effect on other types of actuators.
TRANSM_PIN_POS S Index: 53 Access: r, w Input: Default:	Transmission pin position **(only for linear actuators with NAMUR attachment)** Position of the pin on the lever of the positioner. See marking on the positioner lever. A B A Note: This parameter is only used with linear actuators with NAMUR attachment; it has no effect on other types of actuators.
UPDATE_EVT D Index: 7 Access: r	This alert is generated by any change to the static data, including date and time.
VALVE_MAN_ID S Index: 25 Access: r, w	Clear identification of the manufacturer of the valve associated with the positioner.

VALVE_MODEL_NUM Index: 26 Access: r, w	S	Type/version of the valve associated with the positioner.
VALVE_SN Index: 27 Access: r, w	S	Serial number of the valve associated with the positioner.
VALVE_TYPE Index: 28 Access: r, w Input: Default:	S	Valve type UNINITIALIZED Undefined LINEAR (Control valve with a straight moving plug, globe valve) ROTARY (Control valve with a rotating plug, part-turn, rotary motion) OTHER linear Note: Type 3787 differentiates merely between linear and rotary control valves. "Undefined" and "other" are treated as globe valves.
XD_CAL_LOC Index: 29 Access: r, w	S	Location of last calibration.
XD_CAL_DATE Index: 30 Access: r, w	S	Date of last calibration.
XD_CAL_WHO Index: 31 Access: r, w	S	The person who carried out the last calibration.
XD_ERROR Index: 11 Access: r Display:	D	Error message of the Transducer Block NONE (0) No error. UNSPECIFIED ERROR (Device not initialized, initialization or zero calibration running or total valve travel exceeded). GENERAL ERROR (General device error) CALIBRATION ERROR (Zero, internal control loop or initialization error). CONFIGURATION ERROR (Parameter or characteristic error). ELECTRONICS FAILURE MECHANICAL FAILURE DATA INTEGRITY ERROR (Checksum error). ALGORITHM ERROR Dynamic values outside of range.

XD_ERROR_EXT Index: 33 Access: r Display:	D	Extended error messages of the Transducer Block. NONE (0) FAILURE MECHANICS FAILURE IN MEASUREMENT NOT INITIALIZED SELFCALIBRATION FAILED ZERO POINT ERROR INTERNAL CONTROL LOOP DISTURBED (Reset over SELF_CALIB_CMD -> RESET 'CONTROL LOOP FAULT'). TRAVEL TIME EXCEEDED (Automatic reset of control loop error message) CHARACTERIZATION INVALID FORCED VENTING ACTIVE DEVICE UNDER SELFTEST (Initialization or zero calibration) TOTAL VALVE TRAVEL LIMIT EXCEEDED

7.4.3 Function Blocks

The Function Blocks contain the fundamental automation functions of the fieldbus device. There are various types of function blocks such as Analog Input Function Block , Analog Output Function Block and PID Block.
Each of these function blocks is used to process various application functions (automation tasks) in the entire system. In this way, local control functions, for example, can be carried out directly in the field, self-diagnosis of the device can be performed and device errors such as a control loop fault can be reported automatically to the automation system.
The function blocks process the input values according to their specific algorithm and their parameters internally available. They create output values which are made available by connecting individual function blocks among one other to further process them in other function blocks.

7.4.3.1 Analog Output Function Block

The Analog Output Function Block processes an analog signal received from an upstream connected block (e.g. PID Block) into a correction value that can be used for the downstream connected Transducer Block (e.g. valve positioner). For this purpose, it contains scaling functions and ramp functions.

The AO Block receives its set point depending on the mode (MODE_BLK) from the CAS_IN, RCAS_IN or SP input variables. Taking into account the PV_SCALE, SP_HI_LIM and SP_LO_LIM, an internal operating set point is formed from the SP_RATE_UP and SP_RATE_DN.
An output value OUT is formed corresponding to the IO_OPTS and XD_SCALE parameters. The output value is passed on to the downstream connected Transducer Block over the CHANNEL.

The AO Block has a fault state handling. It is initiated when a fault condition (of the valid set point) exists longer than the time determined in FSTATE_TIME or the SET_FSTATE parameter in the Resource Block is enabled.
FSTATE_TIME, FSTATE_VAL and IO_OPTS determine the fault state handling.

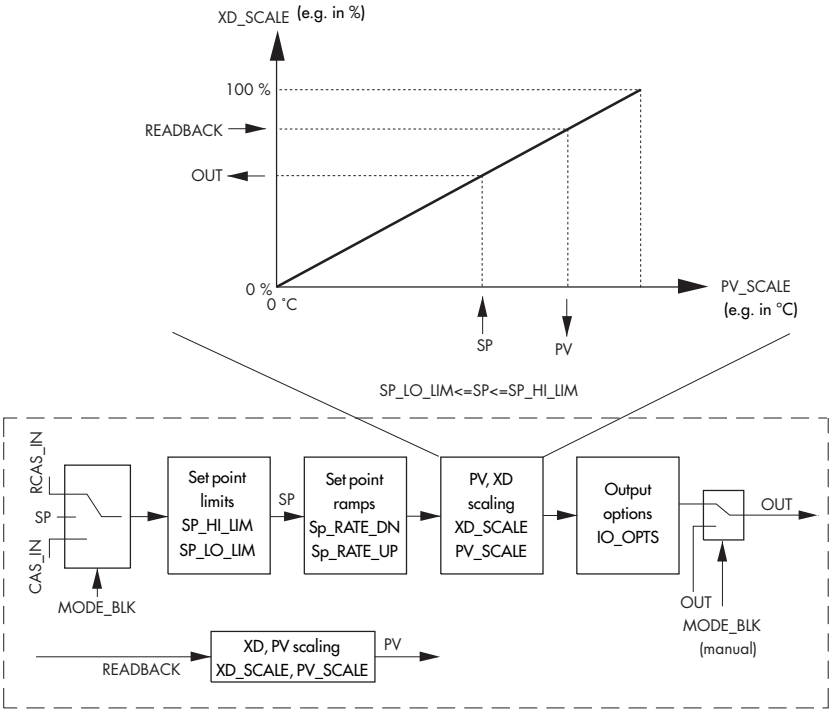


Fig. 14 · Analog Output Function Block

Parameters of the Analog Output Function Block

ALERT_KEY S Index: 4 Access: r, w Input: Default:	The identification number of the plant unit. This information may be used in the fieldbus host system for sorting alarms and events. 1...255 0 Note: The value 0 (default) is not a tolerated value and is therefore rejected with an error message when writing to the device.
BKCAL_OUT D Index: 25 Access: r	Shows the analog output value and status which is passed on to BKCAL_IN of the upstream function block with a cascade control. This value prevents reset windup and provides bumpless transfer to closed loop control.
BLOCK_ALM D Index: 30 Access: r, w	Shows the current block status with information about existing configuration, hardware or system errors including data about when the alarm was generated (date and time) due to an error occurring. Note: Additionally, the active block alarm can be manually acknowledged in this parameter group.
BLOCK_ERR D Index: 6 Access: r Display:	Shows the active block error. OUT OF SERVICE — The block mode is O/S. CONFIGURATION_ERROR INPUT FAILURE — PV (position feedback) has BAD status, e.g. because the Transducer Block is in O/S mode. OUTPUT FAILURE — Correction value OUT cannot be issued, e.g. because the Transducer Block is not initialized or is in LO mode.
CAS_IN N Index: 17 Access: r, w	Shows/determines the analog reference variable and its status taken over from an upstream connected function block.
CHANNEL S Index: 22 Access: r, w in O/S Default:	Assignment among the output of each Analog Output Function Block and the logical hardware channels (Transducer Block). 1 Note: CHANNEL must be set to a valid value before the AO Function Block can be put into operation. This value must be set to "1" as there is only one Transducer Block (Standard Advanced Positioner Valve) available in the Type 3787.
FSTATE_TIME S Index: 23 Access: r, w Default:	The time in seconds from detection of a fault of the valid set point for the AO Function Block in the current mode until the fault state is activated. If the fault still exists after this time interval has elapsed, the fault state is activated. 0 Note: The fault state of the AO Function Block is determined in IO_OPTS of this block.

FSTATE_VAL S Index: 24 Access: r, w Input: Default:	Determines set point for the AO Function Block to be used when the fault state is activated. Value and range of PV_SCALE±10 % 0 Note: This value is used when the option "Fault State to value" is selected in IO_OPTS.
GRANT_DENY D Index: 13 Access: r, w	Grant or limit the access of a fieldbus host system to the field device. Note: This parameter is not evaluated by the Type 3787.
IO_OPTS S Index: 14 Access: r, w in O/S Option:	Used to select the input/output block processing of the AO Block SP-PV Track in MAN: SP follows PV in (ACTUAL_MODE) MAN mode SP-PV Track in LO: SP follows PV in (ACTUAL_MODE) LO mode SP Track retained target: SP follows RCAS_IN or CAS_IN depending on the preset TARGET_MODE in (ACTUAL_MODE) LO or MAN mode. This option has priority over SP_PV Track in MAN /LO modes. Increase to close: Inversion of output value to the Transducer Block (corresponds with the direction of action). Fault State to value: When the fault state is activated, FSTATE_VAL is used as the set point (see FSTATE_VAL, FSTATE_TIME). Use Fault State Value on restart: When the device is started up, FSTATE_VAL is used as the set point default until there is a valid value. Target to MAN if Fault State activated: When the fault state is activated, the TARGET_MODE is set to MAN. The original target mode is lost. After leaving the fault state, the block remains in MAN and the user must set it to the required mode. Use PV for BKCAL_OUT: PV is returned instead of the operating set point over BKCAL_OUT. If the option OUT READBACK is selected in FEATURES_SEL of the Resource Block, the current valve stem position is then reported back over BKCAL_OUT.

MODE_BLK N Index: 5 Access: r, w Display:	Shows the actual mode of the AO Block, the target modes, permitted modes supported by the AO Block and 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 executed. The last value or the value determined during active fault state handling is issued at the OUT parameter. **MAN** (Manual) The output value of the AO Block can be directly preset by the user over the OUT parameter. **AUTO** (Automatic) The set point preset by the user is used on executing the AO Block via the SP parameter. **CAS** (Cascade) The AO Function Block receives the reference variable for internal calculation of the manipulated variable directly from an upstream connected Function Block via CAS_IN. The AO Block is executed. **RCAS** (Remote cascade) The AO Function Block receives the reference variable for internal calculation of the manipulated variable directly from the fieldbus host system via CAS_IN. The AO Block is executed.
OUT N Index: 9 Access: r, w in MAN, O/S	Shows the manipulated variable, value, limit and status of the AO Function Block. Note: If the MAN mode in MODE_BLK is selected, the output value OUT can be entered manually here. The unit used is taken over by the XD_SCALE parameter group. The input range corresponds to OUT_SCALE±10 %.
PV D Index: 7 Access: r	Shows the process variable including status used for the function blocks. The unit used is taken over by the PV_SCALE parameter group. Note: If the option OUT READBACK in FEATURES_SEL in the Resource Block is activated, PV contains the current valve stem position (corresponding to FINAL_POSITION_VALUE).
PV_SCALE S Index: 11 Access: r, w in MAN, O/S Default:	Definition of the range (lower range and upper range value), engineering unit and number of digits behind the decimal place of the process variable (PV). 0...100 %
RCAS_IN N Index: 26 Access: r, w	Shows and used to input the analog reference variable (value and status) provided by the fieldbus host system and used as the set point to calculate the manipulated variable. Note: This parameter is only active in RCAS mode.

RCAS_OUT D Index: 28 Access: r	Shows the analog reference variable (value and status) after ramping. This value is made available to the fieldbus host system to perform back calculations when the operating mode changes or with limited signals. Note: This parameter is only active in RCAS mode.
READBACK D Index: 16 Access: r	Shows current valve stem position. The value is calculated from FINAL_POSITION_VALUE of the associated Transducer Block. The unit used is taken over by the XD_SCALE parameter group.
SHED_OPT S Index: 27 Access: r, w	Used to select the action to be taken when the monitoring time is exceeded (see SHED_RCAS in Resource Block) during the checking of the link between the fieldbus host system and the AO Block in RCAS mode. After the monitoring time has elapsed, the AO Block changes from RCAS mode to the mode selected here. The action to be taken after the fault state is completed is likewise determined.
Option:	Uninitialized NormalShed_NormalReturn: Changes to next possible mode, after leaving the error condition, returns to RCAS mode. NormalShed_NoReturn: Changes to next possible mode, after leaving the error condition, the block remains in this mode. ShedToAuto_NormalReturn Changes to AUTO mode, after leaving the error condition, returns to RCAS mode. ShedToAuto_NoReturn: Changes to AUTO mode, after leaving the error condition, the block remains in AUTO mode. ShedToManual_NormalReturn: Changes to MAN mode, after leaving the error condition, returns to RCAS mode. ShedToManual_NoReturn: Changes to MAN mode, after leaving the error condition, the block remains in MAN mode. ShedToRetainedTarget_NormalReturn: Change to next possible mode, after leaving the error condition, returns to RCAS mode. ShedToRetainedTarget_NoReturn: Change to next possible mode, after leaving the error condition, the block remains in this mode.
Default:	Uninitialized Note: This parameter is only active in the AO Block in the RCAS mode. If it is set to "Uninitialized", the AO Block cannot be put into the RCAS mode.

SIMULATE D Index: 10 Access: r, w	Using the simulation the value and status of the process variable PV of the block can be simulated. Note: During simulation, the value of OUT is not passed onto the Transducer Block. The Transducer Block keeps the last valid value stored before the simulation was activated. The simulation can only be activated by enabling the switch in the device (see also Resource Block).
SP N Index: 8 Access: r, w in AUTO, MAN, O/S Input:	Used to input the set point (reference variable) in AUTO mode. The unit used is taken over by the PV_SCALE parameter group. Value and range of the PV_SCALE±10 %
SP_HI_LIM S Index: 20 Access: r, w Input: Default:	Used to input the high limit of the set point (reference variable). Value and range of the PV_SCALE±10 % 100 Note: If the high limit of the set point is changed in PV_SCALE, this value should be adapted accordingly.
SP_LO_LIM S Index: 21 Access: r, w Input: Default:	Used to input the low limit of the set point (reference variable). Value and range of the PV_SCALE±10 % 0 Note: If the low limit of the set point is changed in PV_SCALE, this value should be adapted accordingly.
SP_RATE_DN S Index: 18 Access: r, w Default:	Used to input the ramp rate at which downward set point changes are acted on in AUTO mode. $3402823466 \times 10^{38}$ Note: If the ramp rate is set to "0", the set point will be used immediately. The rate limiting will apply for output blocks in AUTO and CAS modes.
SP_RATE_UP S Index: 19 Access: r, w Default:	Used to input the ramp rate at which upward set point changes are acted on in AUTO mode. $3402823466 \times 10^{38}$ Note: If the ramp rate is set to "0", the set point will be used immediately.
ST_REV N Index: 1 Access: r	Shows the revision level of the static data. Note: The revision level will be incremented each time a static parameter is changed.

STATUS_OPTS S Index: 15 Access: r, w in O/S Option: Default:	Used to select available status options to determine the treatment and processing of the status: Uninitialized Propagate Fault Backward Status of the Transducer is passed on to the upstream connected Block using the status of BKCAL_OUT. Uninitialized
STRATEGY S Index: 3 Access: r, w Default:	The strategy field can be used to identify grouping of blocks to allow a faster analysis of the blocks. Enter the same number in the STRATEGY parameter of each block to group blocks. 0 Note: This data is not checked or processed by the AO Function Block.
TAG_DESC S Index: 2 Access: r, w Default:	For entering a user-specific text of max. 32 characters to clearly identify and assign the block. No text
UPDATE_EVT D Index: 29 Access: r	This alert is generated by any change to the static data, including date and time.
XD_SCALE S Index: 12 Access: r, w in MAN, O/S Default:	Definition of the range (lower range and upper range value) of the engineering unit and the number of digits behind the decimal point of the manipulated variable (OUT). Specified in [%], [mm] or [grad]. 0.0...100.0 % Note: On using [%], the value for OUT is scaled based on 100 %. For [mm] (globe valves) or [grad] (rotary valves), the value currently set in RATED_TRAVEL in the Transducer Block is scaled as 100 %.

7.4.3.2 PID Function Block (PID controller)

A PID Function Block includes the input channel processing, the PID control and the analog output channel processing.
The configuration of the PID Block (PID controller) is dependent on each automation task. Simple control loops, feedforward controls, cascade control and cascade control with limits can be implemented in combination with a further controller block.
The following options exist for processing the measured variable within the PID Function Block (PID controller):
Signal scaling, signal limits, control of the modes, feedforward control, limit control, alarm detection and passing on the signal status.

The PID Block (PID controller) can be used for various automation strategies. The Block has a flexible control algorithm which can be configured depending on the application.

The PID Block receives its set point depending on the operating mode (MODE_BLK) from the CAS_IN, RCAS_IN or SP input variables. PV_SCALE, SP_HI_LIM, SP_LO_LIM, SP_RATE_UP and SP_RATE_DN are used to form an internal operating set point.

The Block receives the actual value over the IN input variable. The process variable PV is formed from this, 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, from the process variable PV (actual value) and 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 compo-

nent 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.

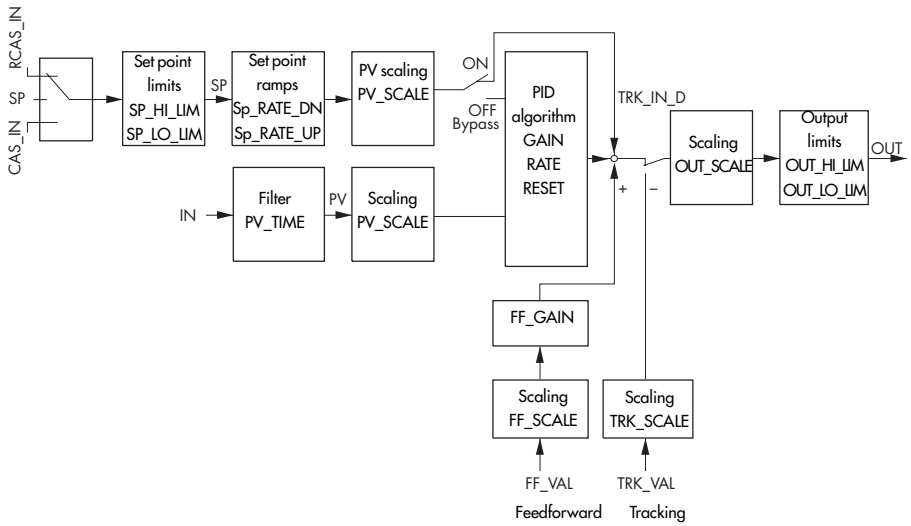


Fig. 15 · PID Function Block (PID controller)

Parameters of the PID Function Block

ACK_OPTION S Index: 46 Access: r, w Option: Default:	This parameter allows you to choose whether an alarm should be automatically acknowledged in the device, i.e. without any influence from the fieldbus host system. Undefined — No option HI_HI_ALM — High high alarm HI_ALM — High alarm LO_LO_ALM — Low low alarm LO_ALM — Low alarm DV_HI_ALM — Limit alarm for upper range deviation DV_LO_ALM — Limit alarm for lower range deviation BLOCK ALM — Block alarm Undefined Note: The alarm is sent to the fieldbus host system, but not acknowledged by it.
ALARM_HYS S Index: 47 Access: r, w Input: Default:	Used to input the hysteresis for the high and low alarm limits. The alarm conditions remain active as long as the measured value is within the hysteresis. The hysteresis value has an effect on the following alarm limits 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 in percent applies to the range of the PV_SCALE parameter group in the PID Function Block.
ALARM_SUM S + D Index: 45 Access: r, w Display:	Shows the current status of process alarms in the PID Function Block HI_HI_ALM — Violation of the high high alarm HI_ALM — Violation of the high alarm LO_LO_ALM — Violation of the low low alarm LO_ALM — Violation of the low alarm DV_HI_ALM — Violation of the limit alarm for the upper range deviation DV_LO_ALM — Violation of the limit alarm for the lower range deviation BLOCK ALM — Block alarm Note: Additionally, the process alarm can be cleared in this parameter group.

ALERT_KEY Index: 4 Access: r, w Input: Default:	S	The identification number of the plant unit. This information may be used in the fieldbus host system for sorting alarms and events. 1…255 0 Note: The value 0 (default) is not a tolerated value and is therefore rejected with an error message when writing to the device.
BAL_TIME Index: 25 Access: r, w Default:	S	Used to input the time constant at which the integral term will move to obtain balance when the output is limited (calculated manipulated variable > OUT_HI_LIM or < OUT_LO_LIM). 0 Note: When 0 (default) is set, the balance is immediately reduced.
BKCAL_HYS Index: 30 Access: r, w Input: Default:	S	Used to input the hysteresis value for the upper and lower limits of the manipulated variable range OUT_HI_LIM and OUT_LO_LIM. If the calculated manipulated variable exceeds or falls below the range defined by the range limits, this range violation is indicated in the OUT parameter and passed on to the downstream connected blocks. The range violation remains active as long as the value of the calculated manipulated variable does not exceed or fall below the hysteresis value again. 0…50 % 0.5 %
BKCAL_IN Index: 27 Access: r, w	N	Shows the analog input value and status which is taken over from the BKCAL_OUT parameter of the downstream connected Function Block with a cascade control. This value provides bumpless transfer to closed loop control by tracking the output.
BKCAL_OUT Index: 31 Access: r, w	D	Shows the analog input value and status which is passed on from the BKCAL_IN parameter of the upstream connected Function Block with a cascade control. This value prevents reset windup and provides bumpless transfer to closed loop control by tracking the output.
BLOCK_ALM Index: 44 Access: r, w	D	Shows the current block status with information about existing configuration, hardware or system errors including data about when the alarm was generated (date and time) due to an error occurring. Note: Additionally, the active block alarm can be manually acknowledged in this parameter group.
BLOCK_ERR Index: 6 Access: r Display:	D	Shows the active block error. OUT OF SERVICE CONFIGURATION_ERROR

BYPASS S Index: 17 Access: r, w in MAN, O/S Option: Default:	This parameter allows the calculation of the manipulated variable by means of the PID control algorithm to be switched on or off. Unintialized Same as ON OFF Bypass switched off: the manipulated variable determined by the PID control algorithm is issued over the OUT parameter. ON BYPASS switched on: the value of the reference variable SP is issued directly over the OUT parameter. OFF Note: On setting "Uninitialized", the block remains in the "O/S" mode. To activate the bypass (ON), the bypass must be enabled in the CONTROL_OPTS parameter.
CAS_IN N Index: 18 Access: r, w	Shows/defines the analog reference variable and its status taken over from an upstream connected Function Block.
CONTROL_OPTS S Index: 13 Access: r, w in MAN, O/S Option: Default:	Used to select the available controller options to determine the automation strategy. Bypass Enable Direct Acting Track Enable Track in Manual PV for BKCAL_OUT No OUT Limits in Manual None
DV_HI_ALM D Index: 64 Access: r, w	Shows status of alarm for the high deviation including details about alarm time (date, time) and about the value which triggered the alarm. The controlled variable exceeds the reference variable by more than the value determined in the DV_HI_LIM parameter. Note: Additionally, the active block alarm can be manually acknowledged in this parameter group.
DV_HI_LIM S Index: 57 Access: r, w Default:	Used to input the limit for the high deviation. If the controlled variable exceeds the reference variable by this value, the deviation alarm DV_HI_ALM is generated. $3402823466 \times 10^{38}$
DV_HI_PRI S Index: 56 Access: r, w Input:	Determines the action to be taken when the high deviation alarm (DV_HI_LIM) is exceeded. 0 The violation of the limit for the high deviation is not evaluated. 1 No message issued when a violation of the limit for the high deviation occurs.

Default:	2 Reserved for block alarms. 3...7 The violation of the limit for the high deviation is issued with the corresponding priority (3= low priority, 7= high priority) to notify the user. 8...15 The violation of the limit for the high deviation is issued with the corresponding priority (8= low priority,15= high priority) as a critical alarm. 0
DV_LO_ALM D Index: 65 Access: r, w	Shows status of alarm for the low deviation including details about alarm time (date, time) and about the value which triggered the alarm. The controlled variable falls below the reference variable by more than the value determined in the DV_LO_LIM parameter. Note: Additionally, the active block alarm can be manually acknowledged in this parameter group.
DV_LO_LIM S Index: 59 Access: r, w Default:	Used to input the limit for the low deviation. If the controlled variable falls below the reference variable by this value, the low deviation alarm DV_LO_ALM is generated. $-3402823466 \times 10^{38}$
DV_LO_PRI S Index: 58 Access: r, w Input: Default:	Determines the action to be taken when the low deviation alarm (DV_LO_LIM) is exceeded. 0 The violation of the limit for the low deviation is not evaluated. 1 No message issued when a violation of the limit for the low deviation occurs. 2 Reserved for block alarms. 3...7 The violation of the limit for the low deviation is issued with the corresponding priority (3= low priority, 7= high priority) to notify the user. 8...15 The violation of the limit for the low deviation is issued with the corresponding priority (8= low priority,15= high priority) as a critical alarm. 0
FF_GAIN S Index: 42 Access: r, w in MAN, O/S Default:	Used to input the gain of the feedforward control. 0 Note: The feedforward gain is multiplied by feedforward input (FF_VAL). The result is added to the output value OUT.
FF_SCALE S Index: 41 Access: r, w in MAN, O/S Default:	Defines the measuring range (low and high limits), the engineering unit and the number of digits behind the decimal point of the disturbance variable (FF_VAL). 0...100 %

FF_VAL N Index: 40 Access: r, w Input:	Used to input and displays the feedforward value and status. Range and unit of the FF_SCALE Note: The feedforward input is multiplied by the gain (FF_GAIN) before it is added to the calculated output value OUT.
GAIN S Index: 23 Access: r, w Default:	Used to input the proportional gain (factor). 1.0 Note: The parameter must be set to a value unequal to 0, otherwise a configuration error is set in the BLOCK_ERR parameter and the block goes into O/S mode.
GRANT_DENY D Index: 12 Access: r, w	Grant or deny access of a fieldbus host system to the field device. Note: This parameter is not evaluated by the Type 3787.
HI_ALM D Index: 61 Access: r, w	Shows the status of the alarm for the high alarm limit (HI_LIM), including details about the alarm timing (date, time) and the value which triggered the alarm. Note: The unit of the alarm status parameter is taken on by the PV_SCALE parameter. Additionally, the active alarm can be manually acknowledged in this parameter group.
HI_HI_ALM D Index: 60 Access: r, w	Shows the status of the alarm for the high high alarm limit (HI_HI_LIM), including details about the alarm timing (date, time) and the value which triggered the alarm. Note: The unit of the alarm status parameter is taken on by the PV_SCALE parameter. Additionally, the active alarm can be manually acknowledged in this parameter group.
HI_HI_LIM S Index: 49 Access: r, w Input: Default:	Input of the alarm limit for the high high alarm (HI_HI_ALM). If the value PV exceeds this limit, the HI_HI_ALM alarm status parameter is issued. Range and unit of the PV_SCALE $3402823466 \times 10^{38}$
HI_HI_PRI S Index: 48 Access: r, w Input: Default:	Determines the action to be taken when the high high alarm limit (HI_HI_LIM) is exceeded. 0 The violation of the high high alarm limit is not evaluated. 1 No message issued when a violation of the high high alarm occurs. 2 Reserved for block alarms. 3...7 The violation of the high high alarm is issued with the corresponding priority (3= low priority, 7= high priority) to notify the user. 8...15 The violation of the high high alarm is issued with the corresponding priority (8= low priority,15= high priority) as a critical alarm. 0
HI_LIM S Index: 51 Access: r, w Input: Default:	Input of the alarm limit for the high warning alarm (HI_ALM). If the value PV exceeds this limit, the HI_ALM alarm status parameter is issued. Range and unit of the PV_SCALE $3402823466 \times 10^{38}$

HI_PRI S Index: 50 Access: r, w Input: Default:	Determines the action to be taken when the high alarm limit (HI_LIM) is exceeded. 0 The violation of the high alarm limit is not evaluated. 1 No message issued when a violation of the high alarm occurs. 2 Reserved for block alarms. 3...7 The violation of the high alarm is issued with the corresponding priority (3= low priority, 7= high priority) to notify the user. 8...15 The violation of the high warning alarm is issued with the corresponding priority (8= low priority,15= high priority) as a critical alarm. 0
IN N Index: 15 Access: r, w	Shows/determines the analog controlled variable with details about status and value.
LO_ALM D Index: 62 Access: r, w	Shows the status of the alarm for the low alarm limit (LO_LIM), including details about the alarm timing (date, time) and the value which triggered the alarm. Note: The unit of the alarm status parameter is taken over by the PV_SCALE parameter.
LO_LO_ALM D Index: 63 Access: r, w	Shows the status of the alarm for the low low alarm limit (LO_LO_LIM), including details about the alarm timing (date, time) and the value which triggered the alarm. Note: The unit of the alarm status parameter is taken over by the PV_SCALE parameter. Additionally, the active alarm can be manually acknowledged in this parameter group.
LO_LO_LIM S Index: 55 Access: r, w Input: Default:	Input of the alarm limit for the low low alarm (LO_LO_ALM). If the PV value exceeds this limit, the LO_LO_ALM alarm status parameter is issued. Range and unit of the PV_SCALE $-3402823466 \times 10^{38}$
LO_LO_PRI S Index: 54 Access: r, w Input: Default:	Determines the action to be taken when the value falls below the low low alarm limit (LO_LO_LIM) . 0 The violation of the low low alarm limit is not evaluated. 1 No message issued when a violation of the low low alarm occurs. 2 Reserved for block alarms. 3...7 The violation of the low low alarm is issued with the corresponding priority (3= low priority, 7= high priority) to notify the user. 8...15 The violation of the low low alarm is issued with the corresponding priority (8= low priority,15= high priority) as a critical alarm. 0

LO_LIM S Index: 53 Access: r, w Input: Default:	Input of the alarm limit for the low alarm (LO_ALM). If the PV value exceeds this limit, the LO_ALM alarm status parameter is issued. Range and limit of the PV_SCALE -3402823466 x 10^{38}
LO_PRI S Index: 52 Access: r, w Input: Default:	Determines the action to be taken when the value falls below the low alarm limit (LO_LIM). 0 The violation of the low alarm limit is not evaluated. 1 No message issued when a violation of the low alarm occurs. 2 Reserved for block alarms. 3...7 The violation of the low alarm is issued with the corresponding priority (3= low priority, 7= high priority) to notify the user. 8...15 The violation of the low alarm is issued with the corresponding priority (8= low priority,15= high priority) as a critical alarm. 0
MODE_BLK S Index: 5 Access: r, w Display:	Shows the actual operating mode of the PID Block, the target modes, permitted modes supported by the PID Block and normal operating mode. ROUT RCAS CAS AUTO MAN OOS The PID Block supports the following modes: **O/S** (Out of Service) The PID Algorithm of the Block is not executed. The last value or the value determined during the active state fault is issued at the OUT parameter. **MAN** (Manual) The output value of the Block can be preset by the user directly over the OUT parameter. **AUTO** (Automatic) The set point preset by the user is used on executing the PID algorithm via the SP parameter. **CAS** (Cascade) The PID Function Block receives the reference variable for internal calculation of the manipulated variable directly from an upstream connected Function Block via CAS_IN. The internal PID algorithm is executed. **RCAS** (Remote cascade) The PID Function Block receives the reference variable for internal calculation of the manipulated variable directly from the fieldbus host system via RCAS_IN. The internal PID algorithm is executed. **ROUT** (Remote output) The PID Function Block receives the reference variable for internal calculation of the manipulated variable directly from the fieldbus host system via ROUT_IN. The manipulated variable is reissued over the OUT parameter, without executing the internal PID algorithm.

OUT N Index: 9 Access: r, w in MAN, O/S	Shows the manipulated variable, value, limit and status of the PID Function Block. Note: If the MAN mode in MODE_BLK is selected, the output value OUT can be entered manually here. The unit used is taken on by the OUT_SCALE parameter group. The input range corresponds to OUT_SCALE±10 %.
OUT_HI_LIM S Index: 28 Access: r, w Input: Default:	Used to input the maximum value of the analog manipulated variable (OUT). Range of OUT_SCALE±10 %, unit of OUT_SCALE 100
OUT_LO_LIM S Index: 29 Access: r, w Input: Default:	Used to input the minimum value of the analog manipulated variable (OUT). Range of OUT_SCALE±10 %, unit of OUT_SCALE 0
OUT_SCALE S Index: 11 Access: r, w in MAN, O/S Default:	Defines the range (lower range and upper range), the engineering unit and the number of digits behind the decimal point of the manipulated variable (OUT). 0...100 %
PV D Index: 7 Access: r	Shows the process variables, including the status, used for executing the block. Note: The unit used is taken over by the PV_SCALE parameter group.
PV_FTIME S Index: 16 Access: r, w Default:	Used to input the filter time constant (in seconds) of the digital filter of first order. This time is required to allow 63 % of a change of the controlled variable to become effective at the input IN in the PV value. 0 s
PV_SCALE S Index: 10 Access: r, w in MAN, O/S Default:	Defines the range (lower range and upper range), the engineering unit and the number of digits behind the decimal point of the process variable (PV). 0...100 %
RATE S Index: 26 Access: r, w Default:	Used to input the time constant for the derivative function. 0 s
RCAS_IN N Index: 32 Access: r, w	Used to input and display the analog reference variable (value and status) provided by the fieldbus host system and used as the set point to calculate the manipulated variable. Note: This parameter is only active in the RCAS mode.
RCAS_OUT D Index: 35 Access: r	Shows the analog reference variable (value and status) after ramping. This value is provided by the fieldbus host system to perform back calculations when the operating mode changes or with limited signals. Note: This parameter is only active in the RCAS mode.

RESET S Index: 24 Access: r, w Default:	Used to input the time constant for the integral function. 3402823466 x 10^{38} (maximum possible value) Note: The integral function is cleared by setting to 0 seconds.
ROUT_IN N Index: 33 Access: r, w	Used to input and display the manipulated variable (value and status) provided by the fieldbus host system. Note: This parameter is only active in ROUT mode.
ROUT_OUT D Index: 36 Access: r	Shows the analog reference variable (value and status) which is supplied via the ROUT_IN parameter. This value is made available to the fieldbus host system to perform back calculations when the operating mode changes or with limited signals. Note: This parameter is only active in ROUT mode.
SHED_OPT S Index: 34 Access: r, w Option:	Used to select the action to be taken when the monitoring time is exceeded (see SHED_RCAS in Resource Block) during the checking of the link between the fieldbus host system and the PID Block in RCAS or ROUT mode. After the monitoring time has elapsed, the PID Block changes from RCAS or ROUT mode to the mode selected here. The action to be taken after the fault state is completed is likewise determined. Uninitialized NormalShed_NormalReturn: Changes to next possible mode, after leaving the error condition, returns to RCAS or ROUT mode. NormalShed_NoReturn: Changes to next possible mode, after leaving the error condition, the block remains in this mode. ShedToAuto_NormalReturn Changes to AUTO mode, after leaving the error condition, returns to RCAS or ROUT mode. ShedToAuto_NoReturn: Changes to AUTO mode, after leaving the error condition, the block remains in AUTO mode. ShedToManual_NormalReturn: Changes to MAN mode, after leaving the error condition, returns to RCAS or ROUT mode. ShedToManual_NoReturn: Changes to MAN mode, after leaving the error condition, the block remains in MAN mode. ShedToRetainedTarget_NormalReturn: Changes to next possible mode, after leaving the error condition, returns to RCAS or ROUT mode. ShedToRetainedTarget_NoReturn: Changes to next possible mode, after leaving the error condition, the block remains in this mode.

Default:	Uninitialized Note: This parameter is only active in the PID Block in the RCAS and ROUT modes. If it is set to "Uninitialized", the PID Block cannot be placed into RCAS or ROUT modes.
SP N Index: 8 Access: r, w in AUTO, MAN, O/S Input:	Used to input the set point (reference variable) in AUTO mode. Value and range of the PV_SCALE±10 %
SP_HI_LIM S Index: 21 Access: r, w Input: Default:	Used to input the upper range of the set point (reference variable). Value and range of the PV_SCALE±10 % 100 Note: If the lower range setting is changed in PV_SCALE, this value should be adapted accordingly.
SP_LO_LIM S Index: 22 Access: r, w Input: Default:	Used to input the lower range of the set point (reference variable). Value and range of the PV_SCALE±10 % 0 Note: If the lower range setting is changed in PV_SCALE, this value should be adapted accordingly.
SP_RATE_DN S Index: 19 Access: r, w Default:	Used to input the ramp rate at which downward set point changes are acted on in the operating mode AUTO. $3402823466 \times 10^{38}$ Note: If the ramp rate is set to "0", the set point will be used immediately. The rate limit is active for control blocks in the AUTO mode only.
SP_RATE_UP S Index: 20 Access: r, w Default:	Used to input the ramp rate at which upward set point changes are acted on in AUTO mode. $3402823466 \times 10^{38}$ Note: If the ramp rate is set to "0", the set point will be used immediately. The rate limit is active for control blocks in the AUTO mode only.
ST_REV S Index: 1 Access: r	Shows the revision level of the static data. Note: The revision level will be incremented each time a static parameter is changed.

STATUS_OPTS Index: 14 Access: r, w in O/S Option: Default:		Used to select available status options to determine the treatment and processing of the status: Uninitialized IFS if Bad IN Fault state of the downstream connected AO Function Block initiated, if the controlled variable (IN) changes the status to BAD. IFS if Bad CAS_IN Fault state initiated if the external reference variable (CAS_IN) changes to status to BAD. Use Uncertain as Good The status UNCERTAIN is used as GOOD. Target In Manual if Bad IN Transition to MAN mode if the controlled variable changes the status to BAD. Uninitialized
STRATEGY Index: 3 Access: r, w Default:	S	The strategy field can be used to identify grouping of blocks to allow a faster analysis of the blocks. Enter the same number in the STRATEGY parameter of each block to group blocks. 0 Note: This data is not checked or processed by the PID Function Block.
TAG_DESC Index: 2 Access: r, w Default:	S	For entering a user-specific text of max. 32 characters to clearly identify and assign the block. No text
TRK_IN_D Index: 38 Access: r, w	N	Shows/determines the discrete input (value and status) which initiates external or output tracking. After initiating tracking, the mode is changed to LO. During which, the manipulated variable at the output OUT takes over the value predetermined via the input TRK_VAL.
TRK_SCALE Index: 37 Access: r, w in MAN, O/S Default:	S	Defines the range (lower range and upper range), the engineering unit and the number of digits behind the decimal place of the external track value (TRK_VAL). 0...100 %
TRK_VAL Index: 39 Access: r, w	N	Shows/determines the analog input value and its status entered from another Function Block for external tracking function.
UPDATE_EVT Index: 43 Access: r	D	This alert is generated by any change to the static block data, including date and time.

7.5 Other parameters

7.5.1 Stale counter

The stale counter is used to assess the "quality" of a process variable received via a cyclically configured link (publisher subscriber link).
The process variables that are "connected" among various function blocks are transferred using these links.
For this purpose, the preceding block (Publisher) sends the process variable on the bus at a defined point in time. The successive block(s) (subscriber) "listen" at this point in time on the bus. The receiving blocks check whether there is a valid value at the configured point in time. A value is valid when it has the status "Good" at the expected point in time.
The stale counter defines how many successive stale (bad) values are accepted until the fault state mechanism of the block is enabled.

When the stale counter is set to "0", this monitoring function is cleared.

7.5.2 Link objects

Link objects are used to link Function Block inputs and outputs (configurable cyclic links).
22 link objects can be configured for each positioner.

7.5.3 LAS capabilities

The number of projectable links and schedules is matched to the requirements and possibilities in the DeltaV System from FISHER-ROSEMOUNT.

Functioning as LAS the positioner can support the following:

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

8. Diagnostic messages

8.1 Messages of the XD_ERROR_EXT parameter (Transducer Block)

Failure mechanics
This message is issued when the entered rated travel is not reached on initialization.
- Check mechanics and pneumatics in the valve
- Compare the specifications in the Transducer Block, which describe the valve as well as the actuator and the mechanical structure, with the actual valve.
  Reinitialize.

Failure in measurement
The internal A/D converter does not work properly within its time interval, or the measured values are outside of the physical measured range limit of the A/D converter. If a warm start does not reset the data, repair is necessary.

Not initialized
The device has not been initialized.

Selfcalibration failed
Initialization could not be successfully completed. Exact details about the causes are supplied by the SELF_CALIB_STATUS parameter.

Zero point error
This message indicates any changes exceeding or falling below the value determined during the initialization or zero calibration by more than ± 5%.
Possible sources of error:
Worn-out valve plug/seat
Impurities between valve plug/seat
Automatic reset after initialization has been successfully completed.

Internal control loop disturbed
This message is issued when the positioner is not able to control in the set delay time within the set tolerance band.

Reset using SELF_CALIB_CMD - "Reset Control Loop Fault".

Travel time exceeded
The travel time determined during initialization has been exceeded.

- **Forced venting active**
  Forced venting is activated, i.e. the signal at terminals +81 and -82 is smaller than 3V. The control valve moves to the fail-safe position irrespective of the control loop. It is automatically reset as soon as there is a 6V to 24 V DC signal at terminals +81 and -82.

- **Device under Selftest**
  This message is issued when the device is undergoing initialization or electric zero calibration.

- **Total valve travel limit exceeded**
  The current value for the total valve travel exceeds the entered or preset limit. Reset using "SELF_CALIB_CMD = Reset total valve travel".

8.2 Messages of the XD_ERROR parameter (Transducer Block)

- **Unspecified Error**
  The device has not been initialized or the total valve travel has been exceeded.

- **General Error**
  No production calibration completed.

- **Calibration Error**
  This message is issued when a zero point error occurs, the control loop is disturbed or an error occurred during initialization.

- **Calibration Error**
  Error on transmitting the characteristic to the device.
  Automatic reset after a correct characteristic has been transmitted.

- **Electronics Failure**
  This message is issued if a defect is detected in the electronics module during the cyclic check. Repair necessary.

- **Mechanical Failure**
  This message is issued when the entered rated travel is not at least reached on initialization.

- Check mechanics and pneumatics in the valve
- Compare the specifications in the Transducer Block, which describe the valve as well as the actuator and the mechanical structure, with the actual valve.
  Reinitialize.

Data Integrity Error
Checksum error

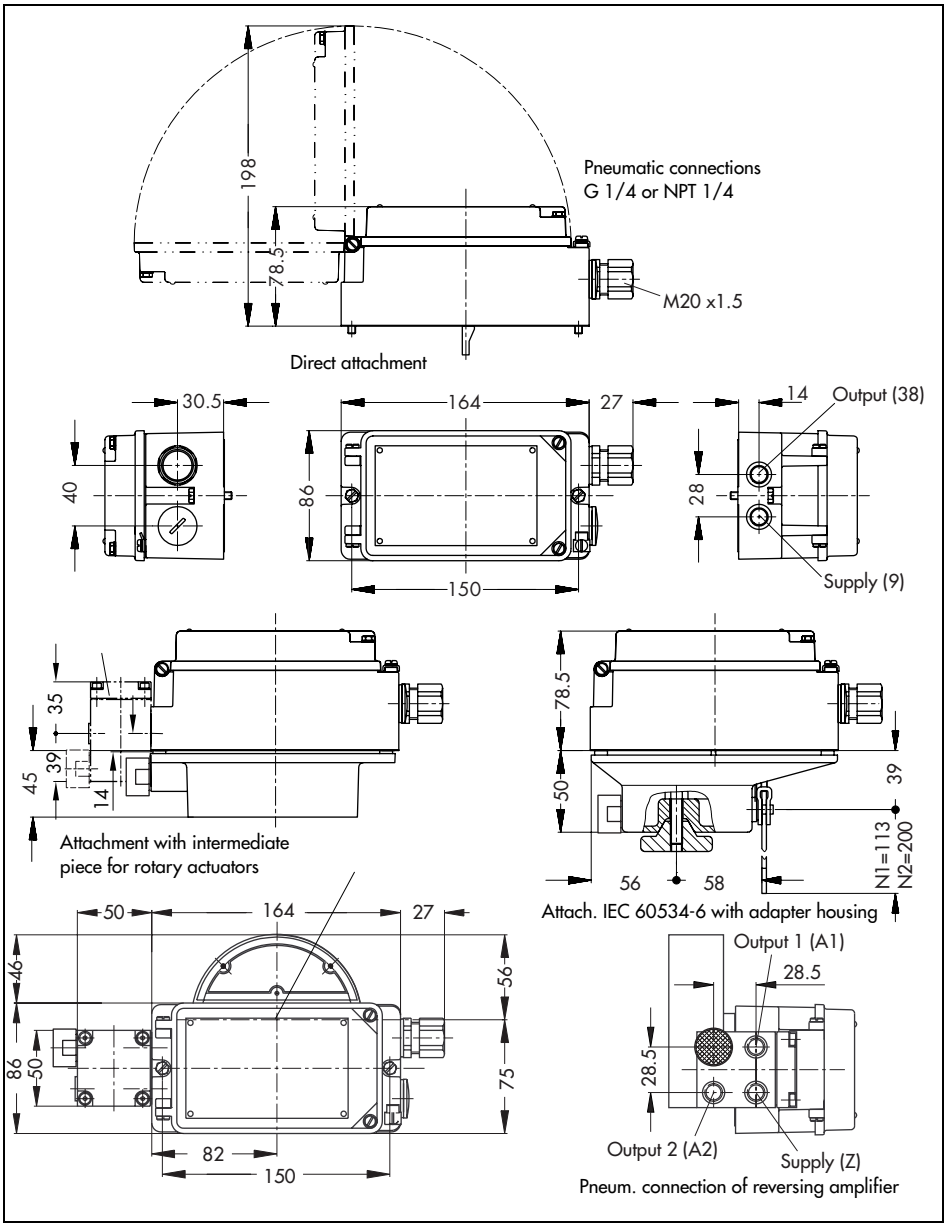
Algorithm Error
Set point value - actual value error

8.3 Messages of the SELF_CALIB_STATUS parameter (Transducer Block)

Proportional band restricted too much

Even the smallest permissible pulses still cause excessive changes in travel. Initialization aborted.

Possible sources of error:
- Supply pressure too high
- Signal pressure throttle missing in actuator with a small volume
- Mechanical failure, especially with attachment according to IEC 60534-6 (NAMUR)
- If a booster valve is mounted with an actuator with a large volume, the bypass should be opened further.


198
78.5
Pneumatic connections
G 1/4 or NPT 1/4
M20 x1.5
Direct attachment
30.5
40
164
27
86
150
14
Output (38)
28
Supply (9)
35
39
45
14
Attachment with intermediate
piece for rotary actuators
78.5
50
39
56
58
N1=113
N2=200
Attach. IEC 60534-6 with adapter housing
50
164
27
46
86
50
56
75
82
150
Output 1 (A1)
28.5
28.5
Output 2 (A2)
Supply (Z)
Pneum. connection of reversing amplifier

(1) **EC TYPE EXAMINATION CERTIFICATE**

(2) Equipment and Protective System Intended for Use in Potentially Explosive Atmospheres - Directive 94/9/EC

(3) EC Type Examination Certificate Number

PTB 01 ATEX 2105

(4) Equipment: **Model 3787-1 . . . Positioner**

(5) Manufacturer: SAMSON AG

(6) Address: Weismüllerstraße 3,
D-60314 Frankfurt am Main, Germany

(7) This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body number 0102 in accordance with 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 given i Annex II to the Directive.

The examination and test results are recorded in confidential report No. **PTB Ex 01-21074**.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with

EN 50014: 1997+A1+A2 EN 50020: 1994

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

(11) According to the Directive 94/9/EG, this EC Type EXAMINATION CERTIFICATE relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the manufacture and supply of the equipment.

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

II 2 G EEx ia IIC T6

Zertifizierungsstelle Explosionsschutz Braunschweig, 06 August 2001
By order

(Signature) (Seal)

Dr.-Ing. U. Johannsmeyer
Oberregierungsrat

Physikalisch-Technische Bundesanstalt
Braunschweig and Berlin

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

(14) **EC TYPE EXAMINATION CERTIFICATE No. PTB 01 ATEX 2105**

(15) **Description of Equipment**

The Model 3787-1 . . . Positioner is a bus powered field device with communication capability intended for attachment to pneumatic control valves.
Communiction is optionally either according to the FOUNDATION™ Fieldbus Specification or according to the FISCO Concept.
The Model 3787-1 . . . Positioner is a passiv two-terminal network that may be connected to any certified intrinsically safe circuit, provided the permissible values of U_i, I_i and P_i are not exceeded.

For pneumatic auxiliary power non-combustble media are used.

The device is intended for use inside and outside of hazardous area.

The correlation between temperature classification and the permissible ambient temperature ranges is shown in the table below:

EEx ia IIC/IIB	Permissible ambient temperature range
T6	+60°C
T5	-40°C ≤ T ≤ +70°C
T4	+80°C

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

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

Schedule to the EC Type Examination Certificate No. PTB 01 ATEX 2105

Temperature class	Permissible ambient temperature range	I_o / P_o
T6	+45°C	52mA / 169mW
T5	-40°C ≤ T_a ≤ +60°C	
T4	+75°C	
T6	+60°C	25mA / 64mW
T5	-40°C ≤ T ≤ +80°C	
T4	+80°C	

Electrical Data

Bus connection signal circuit .....Type of protection. Intrinsic safety EEx ia IIC
(terminals 11/12) or EEx ia IIB

only for connection to a certified intrinsically safe circuit.

The correlation between the type of protection and the electrical data is shown in the table below:
Maximum values:

FOUNDATION™ Fieldbus	
EEx ia IIC	**EEx ia IIB**
U_i = 24V DC I_i = 360mA P = 1,04W	U_i = 24V DC I_i = 380mA P = 2,58W
FISCO Concept	
U = 20V DC I_i = 360mA P_i = 1,54W	U = 24V DC I_i = 380mA P_i = 2,58W
C_i = 5 nF; L_i = 10 μH	

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 change, schedule included. Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Schedule to the EC Type Examination Certificate No. PTB 01 ATEX 2105

Limit switches
(terminals 41/42 and 51/52)

Type of protection: Intrinsic safety EEx ia IIC or EEx ia IIB

Only for connection to a certified intrinsically safe circuit.

Maximum values:

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

The effective internal capacitance is C_i = 60 nF
The effective internal inductance is L = 200 µH
or

U = 16 V
I = 25 mA
P_i = 64 mW

The effective internal capacitance is C_i = 60 nF
The effective internal inductance is L = 200 µH

Forced venting function
(terminals 81/82)

Type of protection. Intrinsic safety EEx ia IIC or EEx ia IIB

Only for connection to a certified intrinsically safe circuit.

Maximum Values:

U_i = 28 V
I = 115 mA
P_i = 0,5W

The effective internal capacitance is Ci = 5 nF
The effective internal inductance is negligible.

Binary input
(terminals 85/86)

Type of protection: Intrinsic safety EEx ia IIC or EEx ia IIB

Maximum Values:

U_o = 5.88 V
I_o = 1 mA
P = 7,2 mW

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

Schedule to the EC Type Examination Certificate No. PTB 01 ATEX 2105

The correlation between the typ of protection and the permissible maximum allowed capacitance and the inductance is shown in the table below:

Maximum values:	
EEx ia IIC	**EEx ia IIB**
C_o = 43µF	C_o = 1000µF
L_o = 1 H	L_o = 1 H

Programming jack

Type of protection: Intrinsic safety EEx ia IIC

Maximum values:

U_o = 5,88 V
I_o = 55 mA
P_o = 298 mW

The effective internal capacitance is C_o = 42µF
The effective internal inductance is L_o = 10 mH

U_i = 20 V
I_i = 60 mA
P_i = 250 mW

C_i negligible, L_i negligible

The rules for interconnecting intrinsically safe circuit shall be complied with.

(16) **Report No.: PTB Ex 01-21074**

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

(18) **Essential Health and Safety Requirements**
In compliance with standards specified above.

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 06 August 2001

(Signature) (Seal)
Dr.-Ing. U. Johannsmeyer
Oberregierungsrat

EC Type examination Certificates without signature and seal are invalid.
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Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

ADDENDUM No.: 1

in compliance with Directive 94/9/EC Annex III Clause 6
to the EC Type Examination Certificate PTB 01 ATEX 2105

Equipment:	Model 3787-1.. Positioner
Marking:	Ex **II 2G EEx ia IIC T6**
Manufacturer:	SAMSON AG, Mess- und Regeltechnik
Address:	Weismüllerstr. 3, D-60314 Frankfurt, Germany

Description of the additions and modifications

The Model 3787-1 Positioners satisfy the requirements of EN 50281-1-1:1998 relating to electrical apparatus with protection privided by the enclsoure.

The positioners are attached to pneumatic control valves or butterfly valves either directly across actuators of the 3277 Series or to conventional actuators via NAMUR adapter plates.

The Model 3787-1.. Positioners shall be rpvided in addition with the following marking:

Ex **II 2D IP 65 T 80 °C**

Alle the other data apply also to this Addendum No. 1 without any change.

Test report: **PTB Ex 03-23396**

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 14. January 2004

(Seal)

Dr. Ing. U. Johannsmeyer

Regierungsdirketor

PTB

TRANSLATION

(1) **Statment of Conformity**

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

(3) Test Certificate Number

PTB 01 ATEX 2117 X

(4) Equipment: Model 3787-8.. Positioner

(5) Manufacturer: SAMSON AG

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

(7) The equipment and any acceptable variation thereof are specified in the schedule to this certificate and the documents referred to therein.

(8) The Physikalisch-Technische Bundesanstalt, certified 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 Requirement relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report.
PTB Ex 21206.

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

EN 50021: 1999

(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.

(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 the manufacture and marketing of the equipment.

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

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

II 3 G EEx nA II T6

Zertifizierungsstelle Explosionsschutz Braunschweig, 05. April 2002
By order

(Signature) (Seal)

Dr. Ing. U. Klausmeyer
Regierungsdirketor

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

Ptb17Ex n.doc

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

Test Report PTB Ex 01-21206

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

(14) **Statement of Conformity PTB 01 ATEX 2117 X**

(15) **Description of Equipment**

The Model 3787-8.. Positioner is a bus-powered filed device with communication capability intended for attachment to pneumatic control valves.

Communication is optionally either according to the FOUNDATION™ Fieldbus Specification or according to the FISCO Concept.

The device is intended for use inside and outside of hazardous area locations

The correlation between temperature classification and the permissible ambient temperature ranges is shown in the table below:

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

The same ambient temperature ranges apply to the version with metallic cable entry.

Electrical data

Bus connection, signal circuit (terminals 11/12)	Type of protection EEx nA II
Limit Switches (terminals 41/42 and 51/52)	Type of protection EEx nA II
Forced ventilation (terminals 81/82)	Type of protection EEx nA II
Binary input (terminals 85/86	Type of protection EEx nA II
Serial interface	Type of protection EEx nA II

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

Test Report PTB Ex 01-21206

(16) **Test-Report PTB Ex 01-21206**

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

The signal circuit (terminals 11/12 shall be provided with a series connected fuse complying with IEC 60127-2/II 250 V F or IEC 60127-2/VI, 250 V T with a maximum current rating $I_N \leq 200$ mA, to be installed outside of the hazardous location.

The serial interface circuit in the V connection shall be provided with a series-connected fuse complying with IEC 60127-2/II 250 V F or IEC 60127-2/VI 250 V T with a maximum current rating $IN \leq 50$ mA, to be installed outside of the hazardous location.

The program interface adapter shall be installed outside of the hazardous location.

The Model 3878-8.. Positioner shall be installed in an enclosure providing at least degree of protection IP 54 in compliance with IEC Publication 60529:1989.

The wiring shall be connected in such a manner that the connection facilities re not subjected to pull and twisting.

(18) **Basic health and Safety Requirements**

Are satisfied by compliance with the standard specified herein.

Zertifizierungsstelle Explosionsschutz Braunschweig, 05 April 2002
By order

(Signature) (seal)

Dr. Ing. U. Klausmeyer
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
Ptb17Ex n.doc

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

ADDENDUM No.: 1

in compliance with Directive 94/9/EC Annex III Clause 6
to the EC Type Examination Certificate PTB 01 2117 x

Equipment:	Model 3787-8.. Positioner
Marking:	**II 3G EEx nA II T6**
Manufacturer:	SAMSON AG, Mess- und Regeltechnik
Address:	Weismüllerstr. 3, D-60314 Frankfurt, Germany

Description of the additions and modifications

The Model 3787-8.. Positioners satisfy the requirements of EN 50281-1-1:1998 relating to electrical apparatus with protection provided by the enclosure.

the positioners are attached to pneumatic control valves or butterfly valves either directly across actuators of the 3277 Series or to conventional actuators via NAMUR plates.

The Model 3783-8.. Positioners shall be provided in addition with the following marking:

II 3D IP 65 T 80 °C or **II 3D IP 54 T 80 °C**

All the other data apply to this Addendum No. 1 without any change.

Test Report: **PTB Ex 03-23397**

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 14 January 2004

(Seal)

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

Installation Manual for apparatus certified by CSA for use in hazardous loctions.

The **FISCO Concept** allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criteria for interconnection is that the voltage **(U_i)** the current **(Ii)** and the power **(Pi)** which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage **(Uo)** the current **(I_o)** and the power **(Po)** levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance **(Ci)** and inductance **(Li)** of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to **5 nF** and **10 µH** respectively.

In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system The allowed voltage **Uo** of the associeted apparatus is limited to the range of **14V DC**. to **24V DC**. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50 mA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices need to have the parameters in the following range:

Loop resistance R':	15 ... 150 Ohm/km
Inductance per unit length L':	0,4 ... 1 mH/km
Capacitance per unit length C':	80 ... 200 nF/km

C' = C' line/line + 0,5 C' line/screen, if both lines are floating or, C' = C' line/line + C'line/screen, if the screen is connected to one line

Length of spur cable:	≤ 30 m
Length of trunk cable:	≤ 1 km

At each end of the trunk cable an approved infallible line termination with the following parameters is suitable:

R = 90 ... 100 Ohm	C = 0 ... 2,2 µF

One of the allowed terminations might already be intergrated in the associated apparatus.

The number of passive devices connected to the bus segment is not limited due to I.S. reasons. If the above rules are respected, the inductance and capacitance of the cable will not impair the intrinsic safety of the installation.

Notes:

1. Approved associated apparatus must be installed in accordance with manufacturer instructions
2. Approved associated apparatus must meet the following requirements:

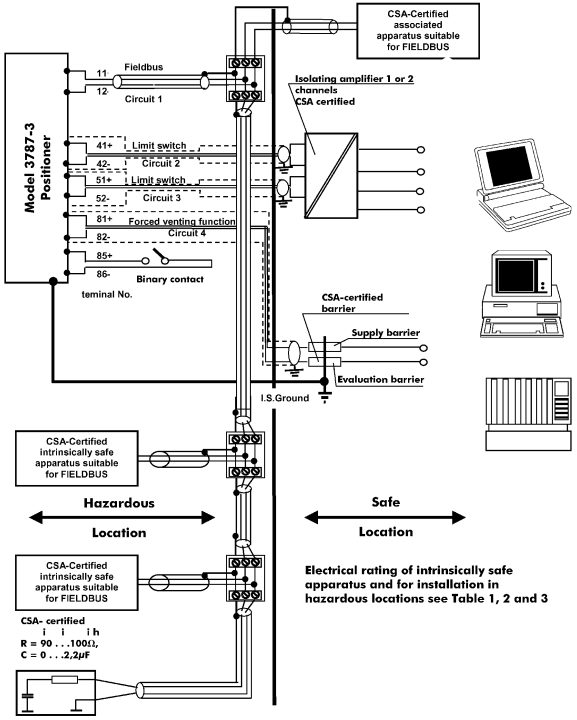
   Uo or $V_{oc} \leq U_i$ or V_{max}, Io or $I_{sc} \leq I_i$ or I_{max}, Po ≤ Pi or P_{max}
3. The maximum non-hazardous area voltage must not exceed 250 V.
4. The installation must be in accordance with the Canadian Electrical code Part 1.
5. Each set of wires must be provided with grounded shield. The shield must extend asclose to the terminal(s) as possible and it must be grounded shield at I. S. Barrier ground.
6. Caution: Use only supply wires suitable for 5 °C above surrounding.
7. Warning: Substitution of components may impair intrinsic safety. PE = I. S. Ground
8. The polarity for connecting 11 and 12 is of no importance due to an internal rectifier.
9. FISCO concept applies to fieldbus / circuit only.
10. Entity parameters apply to circuit 2, 3 and 4 and further required to meet the following conditions: $C_o \geq C_i + C_{cable}$; $L_o \geq L_i + L_{cable}$

Intrinsically safe if installed as specified in manufactureres installation manual.

CSA-certified for use in hazardous locations:

Class I, Zone 0 Ex ia IIC T6
Class I, Division 1, Groups A, B, C, D; Class II, Division 1, Groups F + G

Fieldenclosure: Type 4 Enclosure



Electrical rating of intrinsically safe apparatus and for installation in hazardous locations see Table 1, 2 and 3

Installation Manual for apparatus certified by CSA for use in hazardous loctions.

Electrical rating of intrinsically safe apparatus and apparatus for installation in hazardous locations.

Table 1: **Maximum values**

	Fieldbus				Limit-switches Induktiv	Forced venting-function	Binary-input	Serial-Interface	
	Entity		FISCO					activ	passive
Circuit No.	1		1		2 and 3	4	5	6	6
Terminal No.	11 / 12		11 / 12		41 / 42 and 51 / 52	81 / 82	85 / 86	plug	
Groups	A, B IIC	C, D IIB	A, B IIC	C, D IIB	#/#	#/#	#/#	#/#	#/#
U_i or V_{max} [V]	24	24	20	24	16	28	**V_{0C}** 5,88	**V_{0C}** 5,88	**V_{max}** 20
I_i or I_{max} [mA]	360	430	360	430	25	115	**I_{SC}** 1	**I_{SC}** 55	**I_{max}** 60
P_i or P_{max} [W]	1,04	2,58	1,54	2,58	64 [mW]	#/#	7,2 [mW]	298 [mW]	250 [mW]
C_i [nF]	5				60	5,3	[43 μF]	[42 μF]	0
L_i [μH]	10				100	0	[1 H]	[10 mH]	0

Notes:

1. Entity parameters must meet the following requirements:

   U_0 or $V_{0C} \leq U_i$ or V_{max} , I_0 or $I_{0C} \leq I_i$ or I_{max} , $P_0 \leq P_i$ or P_{max}
   C_0 or $C_a \geq C_i + C_{cable}$ and L_o or $La \geq L_i + L_{cable}$

2. Install in accordance with the Canadian Electrical Code Part I

3. Cable entry M 20 x1,5 or metalconduit acc. to dwg. No. 1050-0539 or 1050-0540

Table 2: CSA – certified barrier parameters of circuit 4

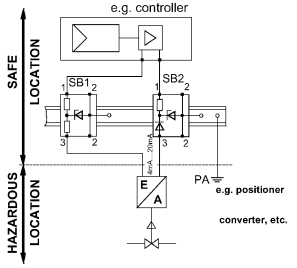
Barrier	Supply barrier				Evaluation barrier		
	V	R	I	P	V	R	I
circuit 4	≤28V	≥300	≤115mA	≤1W	≤28V	#	0mA

The correlation between temperature classification and permissible ambient temperature ranges is shown in the table 3 below:

Table 3:

Temperatur class	Permissble ambient temperature range
T6	+60°C
T5	-40°C ≤ T_a ≤+70°C
T4	+80°C

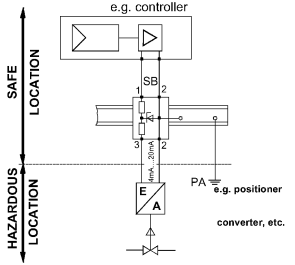
Circuit diagram of a ground- free signal circuit. (*forced venting function circuit 4)*



Ground-free control signal circuit with two barriers

In grounded signal circuits with only one barrier, the return line must be grounded or included in the potential equalization network of the system.

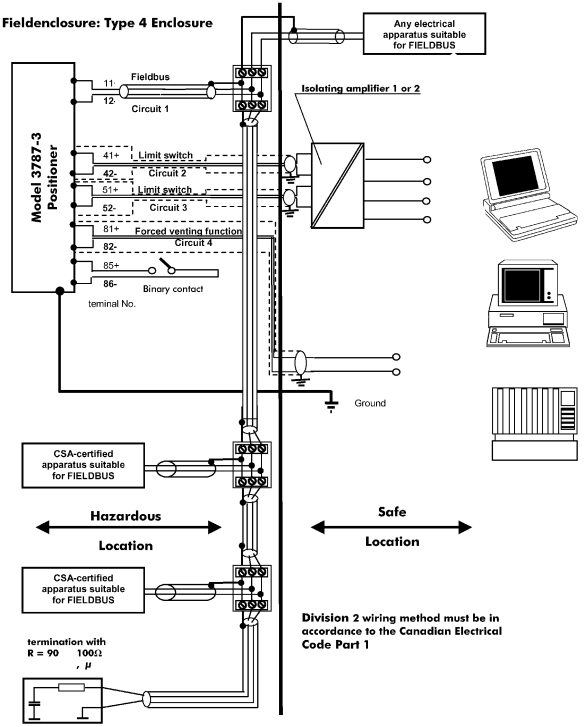
Circuit diagram of a grounded signal circuit *(forced venting function circuit 4)*



Ground signal circuit with one barriers

CSA certified for hazardous locaions:
Class I, Zone 2, Ex nA IIC T6
Class I, II, Division 2, Groups A, B, C, D, F + G

Fieldenclosure: Type 4 Enclosure



Installation Manual for apparatus approved by FM for use in hazardous locations.

The **FISCO Concept** allows interconnection of intrinsically safe apparatus to associated apparatus not specifically examined in such combination. The criteria for interconnection is that the voltage **(U_i)** the current **(Ii)** and the power **(Pi)** which intrinsically safe apparatus can receive and remain intrinsically safe, considering faults, must be equal or greater than the voltage **(Uo)** the current **(I_o)** and the power **(Po)** levels which can be delivered by the associated apparatus, considering faults and applicable factors. In addition, the maximum unprotected capacitance **(Ci)** and inductance **(Li)** of each apparatus (other than the termination) connected to the fieldbus must be less than or equal to **5 nF** and **10 µH** respectively.

In each segment only one active device, normally the associated apparatus, is allowed to provide the necessary energy for the fieldbus system The allowed voltage **Uo** of the associated apparatus is limited to the range of **14V DC**. to **24V DC**. All other equipment connected to the bus cable has to be passive, meaning that they are not allowed to provide energy to the system, except to a leakage current of 50 mA for each connected device. Separately powered equipment needs a galvanic isolation to assure that the intrinsically safe fieldbus circuit remains passive.

The cable used to interconnect the devices need to have the parameters in the following range:

Loop resistance R':	15 ... 150 Ohm/km
Inductance per unit length L':	0,4 ... 1 mH/km
Capacitance per unit length C':	80 ... 200 nF/km

C' = C' line/line + 0,5 C' line/screen, if both lines are floating or, C' = C' line/line + C'line/screen, if the screen is connected to one line

Length of spur cable:	≤ 30 m
Length of trunk cable:	≤ 1 km

At each end of the trunk cable an approved infallible line termination with the following parameters is suitable:

R = 90 ... 100 Ohm C = 0 ... 2,2 µF

One of the allowed terminations might already be intergraded in the associated apparatus.

The number of passive devices connected to the bus segment is not limited due to I.S. reasons. If the above rules are respected, the inductance and capacitance of the cable will not impair the intrinsic safety of the installation.

Notes:

1. Approved associated apparatus shall be installed in accordance with manufacturer instructions
2. Approved associated apparatus must meet the following requirements:
   Uo or Voc ≤ Ui or Vmax, Io or Isc ≤ Ii or Imax, Po ≤ Pi or Pmax
3. The maximum non-hazardous area voltage must not exceed 250 V.
4. The installation shall be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01
5. Each set of wires shall be provided with grounded shield. The shield must extend as close to the terminal(s) as possible and it must be grounded shield at I. S. Barrier ground.
6. Caution: Use only supply wires suitable for 5 °C above surrounding.
7. Warning: Substitution of components may impair intrinsic safety. PE = I. S. Ground
8. The polarity for connecting 11 and 12 is of no importance due to an internal rectifier.
9. FISCO concept applies to fieldbus / circuit only.
10. Entity parameters apply to circuit 2, 3 and 4 and further required to meet the following conditions: Co ≥ Ci + Ccable; Lo ≥ Li + Lcable

Installation Manual for apparatus approved by FM for use in hazardous locations.

Electrical rating of intrinsically safe apparatus and apparatus for installation in hazardous locations.

Table 1: Maximum values

	Fieldbus				Limit-switches inductive	Forced venting-function	Binary-input	Serial-Interface	
	Entity		FISCO					active	passive
Circuit No.	1		1		2 and 3	4	5	6	6
Terminal No.	11 / 12		11 / 12		41 / 42 and 51 / 52	81 / 82	85 / 86	plug	
Groups	A, B IIC	C, D IIB	A, B IIC	C, D IIB	#/#	#/#	#/#	#/#	#/#
U_i or V_{max} [V]	24	24	20	24	16	28	Voc 5,88	Voc 5,88	V_{max} 20
I_i or I_{max} [mA]	360	430	360	430	25	115	Isc 1	Isc 55	I_{max} 60
P_i or P_{max} [W]	1,04	2,58	1,54	2,58	64 [mW]	#/#	7,2 [mW]	298 [mW]	250 [mW]
C_i	5nF				60nF	5,3nF	43 µF	42 µF	0
L_i	10µH				100µH	0	1 H	10mH	0

Notes:

1. Entity parameters must meet the following requirements:

   U_o or V_{OC} ≤ U_i or V_{max} , I_o or I_{OC} ≤ I_i or I_{max}, P_o ≤ P_i or P_{max}
   C_o or C_a ≥ C_i + C_{cable} and L_o or L_a ≥ L_i + L_{cable}

2. Install in shall be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01

3. Cable entry M 20 x1,5 or metal conduit acc. to dwg. No. 1050-0539 or 1050-0540 ½-NPT (optional M20 x 1.5)

Table 2: FM – approved barrier parameters of circuit 4

Barrier	Supply barrier				Evaluation barrier		
	V_{OC}	R_{min}	I_{OC}	P_{max}	V_{OC}	R_{min}	I_{OC}
circuit 4	≤28V	≥300Ω	≤115mA	≤1W	≤28V	#	0mA

Installation Manual for apparatus approved by FM for use in hazardous locations.

Electrical rating of intrinsically safe apparatus and apparatus for installation in hazardous locations.

Table 1: Maximum values

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Terminal No.	11 / 12		11 / 12		41 / 42 and 51 / 52	81 / 82	85 / 86	plug	
Groups	A, B IIC	C, D IIB	A, B IIC	C, D IIB	#/#	#/#	#/#	#/#	#/#
U_i or V_{max} [V]	24	24	20	24	16	28	Voc 5,88	Voc 5,88	V_{max} 20
I_i or I_{max} [mA]	360	430	360	430	25	115	Isc 1	Isc 55	I_{max} 60
P_i or P_{max} [W]	1,04	2,58	1,54	2,58	64 [mW]	#/#	7,2 [mW]	298 [mW]	250 [mW]
C_i	5nF				60nF	5,3nF	43 µF	42 µF	0
L_i	10µH				100µH	0	1 H	10mH	0

Notes:

1. Entity parameters must meet the following requirements:

   U_o or $V_{oc} \leq U_i$ or V_{max}, I_o or $I_{oc} \leq I_i$ or I_{max}, $P_o \leq P_i$ or P_{max}
   C_o or $C_a \geq C_i + C_{cable}$ and L_o or $L_a \geq L_i + L_{cable}$

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circuit 4	≤28V	≥300Ω	≤115mA	≤1W	≤28V	#	0mA

The correlation between temperature classification and permissible ambient temperature ranges is shown in the table 3 below:

Table 3:

Temperature class	Permissible ambient temperature range
T6	+60℃
T5	-40℃ ≤ ta ≤ +70℃
T4	+80℃

For the Model 3787–32 . . . Positioner the correlation between temperature classification, permissible ambient temperature ranges and maximum short- circuit current is shown in the table 4 below:

Table 4:

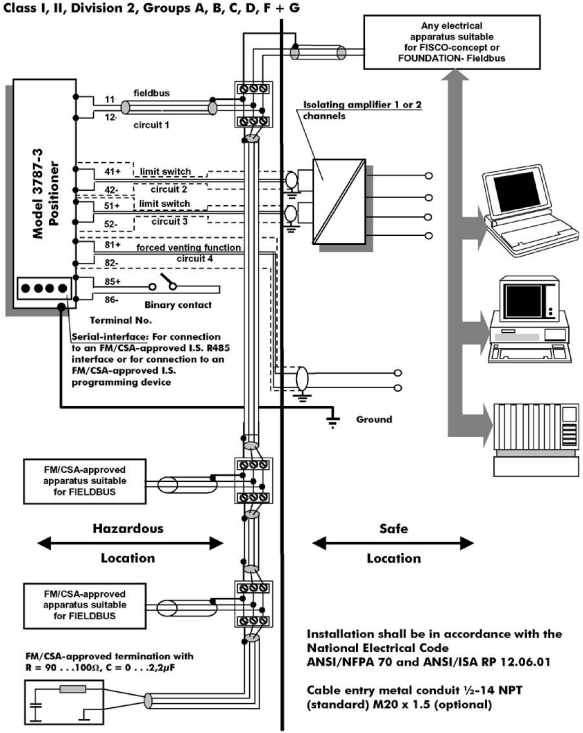
Temperature class	Permissible ambient temperature range	Maximum short-circuit current
T6	45℃	52mA
T5	-40℃ ≤ ta ≤ 60℃	
T4	75℃	
T6	60℃	25mA
T5	-40℃ ≤ ta ≤ 80℃	
T4	80℃	

Table 5:

	Foundation Fieldbus or Profibus PA (Non incendive Field wiring)								Limit-switches (inductive)	Forced venting function	Maximum values for serial-interface and binary input 1 see table 1
Terminal	11 / 12								41 / 42	81 / 82	
Groups	A, B and IIC				C, D and IIB				#/#	#/#	
U_i or V_{max} [VDC]	20V	24V	30V	32V	20V	24V	30V	32V	20V	30V	
I_i or I_{max} [mA]	464	261	152	130	1,117 A	650	379	324	25mA	100mA	
P_i or P_{max} [W]	2,32	1,56	1,14	1,14	5,88	3,89	3,85	2,77	64mW	##	
C_i	5nF								60	5,3	
L_i	10µH								100	0	

FM. approved for hazardous locations:
Class I, Zone 2, Ex nA IIC T6
Class I, II, Division 2, Groups A, B, C, D, F + G

Field enclosure: NEMA 4X

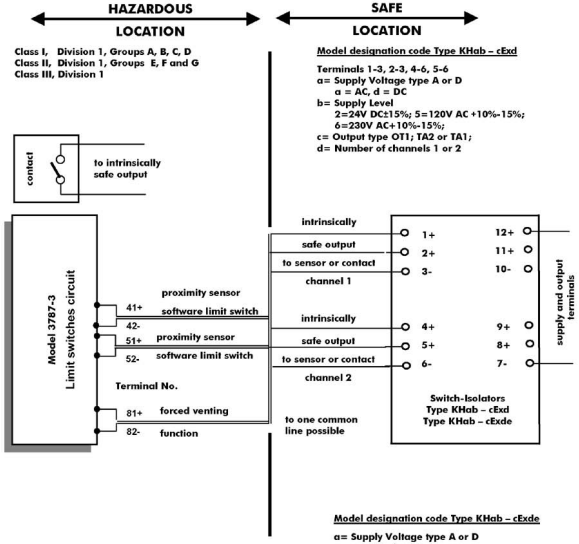


Installation shall be in accordance with the National Electrical Code ANSI/NFPA 70 and ANSI/ISA RP 12.06.01

Cable entry metal conduit ½-14 NPT (standard) M20 x 1.5 (optional)

Maximum values for non incendive field wiring (FNINCO) see table 5

Installation drawing Control Relay KHab-cEx de Model SJ-b-N Proximity Sensors



maximum capacitance of each inductive sensor 60nF
maximum inductance of each inductive sensor 200µH

The total series inductance and shunt capacitance of shield wiring shall be restricted to the following maximum values

Control Relay Terminal No.	Groups	L [mH]	C [µF]	VOC [V]	ISC [mA]
1-3; 2-3 4-6; 5-6	A + B	84,8	1,27	12,9	19,8
	C	299	3,82		
	D	744	10,2		

Model designation code Type KHab – cExde

a= Supply Voltage type A or D
a = AC, d = DC
b= Supply Level
2=24V DC±15%; 5=120V AC +10%-15%;
6=230V AC+10%-15%;
c= Output type RTA/; RW1/; SS1/; SS2/; RS1/; SR/; ST-or SOT
d= Number of channels 1 or 2
e= Power rail designation, P, 2S.P or GS.P (includes Model KHD2-EB-PB Power Feed Module) or Blank

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