TZID and TZID EX d

Intelligent Positioner

Operating Instructions

42-18-54 EN

ep0005rxa)

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Software revision level at the time when this document is printed: Rev. 5.0

Applications and brief description

(also see Fig. 1 “Basic circuit diagram”)

Positioners are add-on devices for control valves.

They are used for controlling the position with a positioning signal until reaching a given set point. Changing operating conditions or friction in the valves are compensated and, therefore, do not impair the controlling torque.

TZID or TZID Ex d positioners are designed for pneumatic actuators (linear actuators for strokes or rotary actuators for angles of rotation). The actuators may be single acting (with spring return) or double acting (driven pneumatically in both directions).

The positioners can be mounted to both linear actuators to DIN/IEC 534 (lateral mounting to linear NAMUR actuators) or rotary actuators to VDI/VDE 3845 (rotary NAMUR actuators).

Parameters are set electronically. Adaptation of the operating parameters is in part automatic (Autostroke) and in part manual. For manual adjustment either the built-in operator panel or the communication port (HART communication) can be used.

The functional heart of the TZID positioner is its CPU. The mechanical and pneumatic assembly groups only have secondary functions. The input signal (set point) and the position (actual value) are fed into the processor via A/D converter. An output signal is computed on the basis of the control deviation and a PD control algorithm. The signal is output to an I/P module via a D/A converter and is used for analog modulation of the I/P module. The I/P module provides for pneumatic adjustment of a 3/3 way valve. The cross-sectional area of the valve air ducts for filling the actuator with air or evacuating air from the actuator is changed in proportion with the adjustment.

Continuous signal modulation yields optimal results in terms of precise and rapid control until reaching the set point and in terms of the adaptation to actuators of different sizes and different supply pressures.

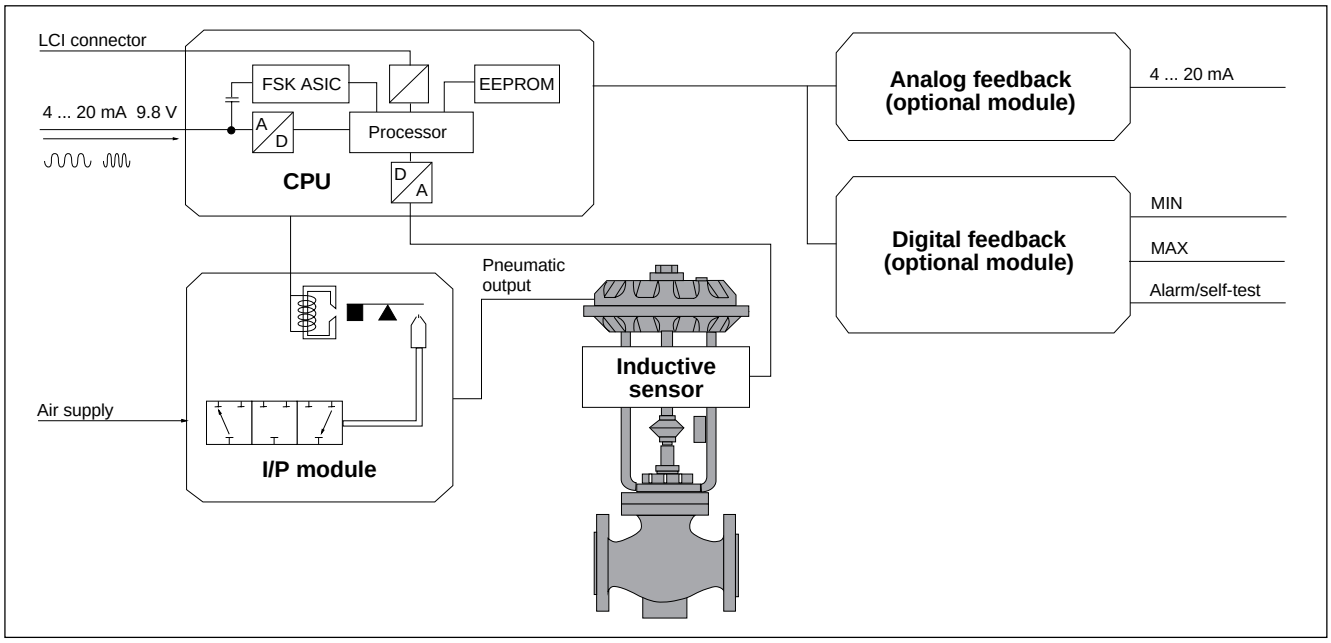


Fig. 1 Basic circuit diagram

Deliverables

For details on the deliverable models of the TZID and TZID Ex d positioners and their accessories please refer to data sheet 18-0.20 EN, which also includes the catalog numbers of the individual items.

Installing and commissioning

1. Scope of delivery

Check the shipment (items and scope of delivery) immediately upon arrival to see if it is in accordance with your order.

The following loose accessories are delivered with the device if ordered:

- Mounting material, type and number as ordered
- EEx d cable gland (only with TZID Ex d)
- Pressure gauge block or individual pressure gauges, as ordered
- Filter regulator, as ordered

Positioners are frequently ordered together with actuators and are already mounted when being delivered. In these cases the positioners, their accessories and the actuators or valves are considered as common delivery items.

2. Conformity declaration

We herewith declare that we are the manufacturer of the TZID and TZID Ex d positioners and that the devices meet the requirements of EC regulation 89/336/EWG as of May 1989 because they comply with the following regulations:

Basic technical regulations/product regulations

RFI suppression	EN 55022 as of May 1995 EN 50081-1 as of March 1993
EMI/RFI shielding	EN 50082-1 as of March 1993

TZID and TZID Ex d meet the requirements of the EC regulation for the CE conformity label.

3. Safety and precautions

Important instructions for your safety!
Read and observe!

Correct and safe operation of the TZID and TZID Ex d positioners calls for appropriate transportation and storage, expert installation and commissioning, and correct operation and meticulous maintenance.

Only persons familiar with the installation, commissioning, operation and maintenance of these positioners or similar instruments and who have the required qualification are allowed to work on the devices.

Observe:

- these operating instructions,
- the safety regulations and standards pertaining to the installation and operation of electrical systems,
- the standards, regulations and directives governing explosion protection, if explosion-proof devices are used.

The regulations, standards and directives referred to in these operating instructions are applicable in Germany. When using the positioners in other countries, the national regulations, standards and directives applicable in the respective country must be observed.

The positioners have been manufactured and tested in accordance with DIN VDE 0411 Part 1

>Safety Requirements for Electronic Measuring Apparatuses<

and have been delivered in a safe condition. These operating instructions contain warnings and cautions marked with ⚠. The instructions given in these sections must be observed to retain the devices in a safe condition and to ensure safe operation. Otherwise, persons can be endangered or the devices themselves or other equipment may be damaged or fail.

If you should need information that is not contained in the present operating instructions please do not hesitate to contact us.

4. Mounting

4.1 Mounting the positioner - General

No further steps are required if TZID or TZID Ex d is already mounted to an actuator when it is delivered.

These operating instructions describe how to mount the positioner to linear actuators in accordance with DIN/IEC 534 (lateral attachment to NAMUR) and to rotary actuators in accordance with VDI/VDE 3845. Customized positioners for **actuator-specific** attachment require **special** instructions, which are already delivered with the device or can be ordered from us.

Special attention must be paid not only to the mechanical installation, but also to proper linkage to enable correct conversion of the stroke or angle of rotation for position feedback (see Fig. 2).

- The correct angle of rotation for proper position feedback is 60° for attachment to linear actuators, and 120° for attachment to rotary actuators.
- Due to the high resolution A/D conversion (> 8000 steps) no extra adjustment of the used angle of ration is necessary when mounting the device. Fine adjustment is done later during commissioning through electronic configuration (Autostroke).
- For safety reasons the actually used range of the angle of rotation should stay away from the limits by 2%. During commissioning you can check where in the range the actually used angle of rotation is located by using an electronic parameter.
- The actually used angle of rotation should be at least 20% of the total range. This can also be checked during commissioning through an electronic parameter.

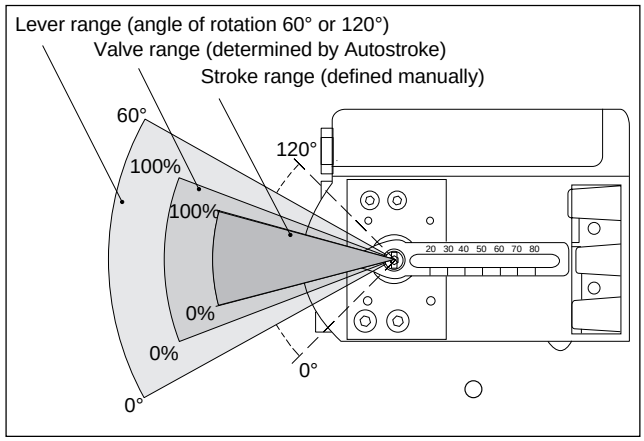


Fig. 2 Range definition for position sensing

4.2 Operating conditions at the installation site

⚠ **Before mounting the positioner, check if it meets the measurement and safety requirements of the installation site (actuator or control valve).**

Ambient temperature:	-40...+85 °C (-40 ... +185 °F)
Protection:	IP 65
Explosion protection:	CENELEC EEx ia or EEx d BRITISH Standards Ex N FM intrinsically safe FM explosion proof (see additional information in section “Technical data”)
Mounting position:	any, no overhead mounting

4.3 Mounting the positioner to linear actuators in accordance with DIN/IEC 534

(see “Dimensional drawings” for dimensions)

A mounting kit is available for mounting the positioner to a linear actuator in accordance with DIN/IEC 534. Fig. 3 shows the individual parts of the mounting kit. The lever (item 4) is already mounted to the positioner when the device is delivered. All other items are delivered in a separate package.

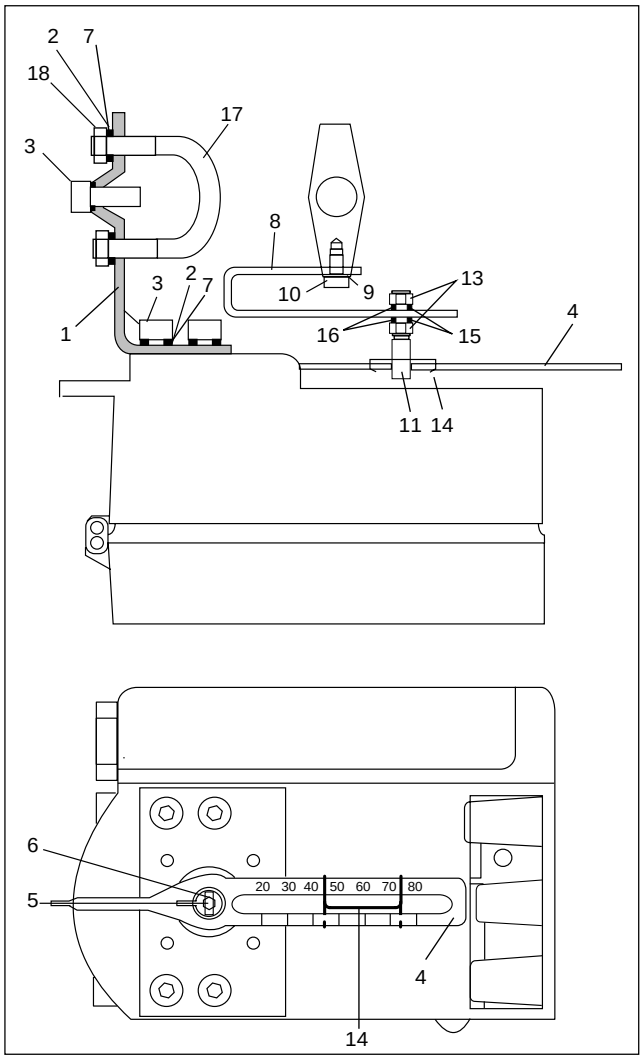


Fig. 3 Mounting kit for linear actuators

Screw the angular slide rod (item 8) with two M6 screws (item 10) and the spring washers (item 9) to the actuator stem. Actuators ready for attachment to DIN/IEC 534 have two threaded holes M6 in the stem, one placed right above the other.

The lever (item 4) is available in two lengths: for 10 to 85 mm strokes, and for 10 to 150 mm strokes. Normally, the lever for 10 to 85 mm strokes is already mounted to the positioner when it is delivered. The lever for 10 to 150 mm strokes has to be ordered separately and is delivered as a separate item.

Fasten the angular mounting plate (item 1) to the positioner and the cast iron yoke or columnar yoke of the actuator using the spring washers and screws (items 2 and 3). Proceed as shown in Fig. 5a and Fig. 5b.

Items	Qty.	Description
1	1	Right-angle mounting plate
2	9	Spring washer B8
3	5	Screw M8 x 20
4.1	1	Lever, short, stroke 10 ... 85 mm
4.2	1	Lever, long, stroke 10 ... 150 mm
5	1	Screw M4 x 8
6	1	Spring washer B4
7	8	Plain washer A8,4
8	1	Angular slide rod
9	2	Spring washer B6
10	2	Screw M6 x 10
11	1	Bolt
13	2	Nut M6
14	1	Spring
15	2	Spring washer B6
16	2	Plain washer A6,4
17	2	Fastening bow
18	4	Nut M8

The mounting kit (to be ordered separately) includes the following items 1 - 2 - 3 - 7 - 8 - 9 - 10 - 11 - 13 - 15 - 16 - 17 - 18.

Items 4.1 - 5 - 6 - 14 are included in the scope of delivery of TZID.

Item 4.2 has to be ordered separately.

The positioning travel (stroke) is transmitted to the positioner via the bolt (item 11) as an angle of rotation. The relationship between the linear movement and the angle of rotation can be modified by moving the link bolt in the slot (see Fig. 4).

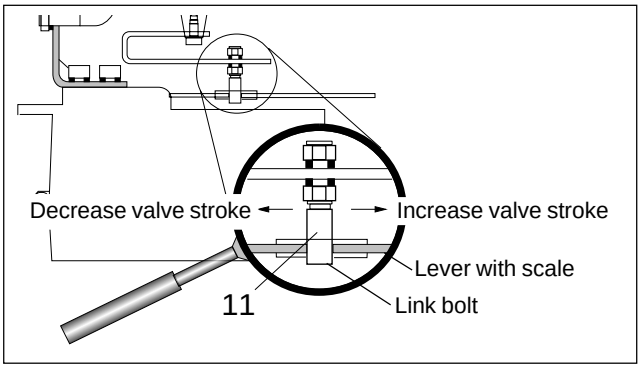


Fig. 4 Adjusting the stroke

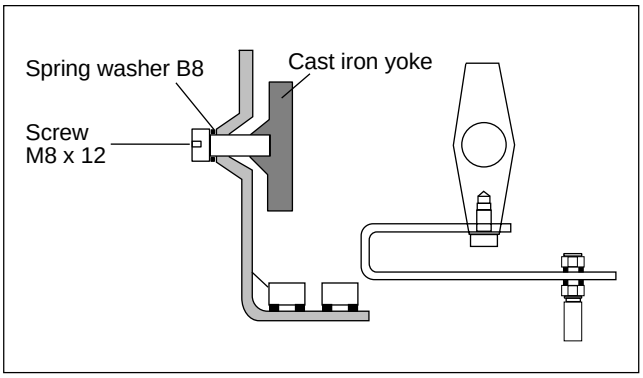


Fig. 5a Mounting the actuator with cast iron yokes

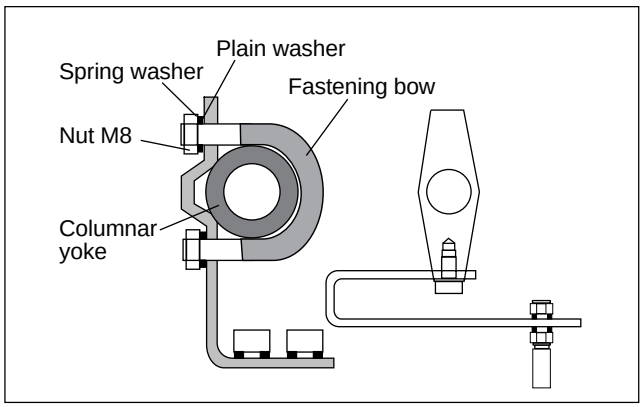


Fig. 5b Mounting the actuator with columnar yokes

The positioner should be mounted to the cast iron yoke or columnar yoke such that the lever (item 4) seems to be horizontal when the actuator is at 50% motion.

The mounting position of the bolt (item 11) can be modified by moving it in the slot of the angular slide rod (item 8). Adjust the position in dependence of the scale on the lever (item 4). The scale indicates the conversion of the positioning travel (stroke) for position feedback. A rough adjustment using this scale is sufficient. The fine adjustment will be done later through the Autostroke function during commissioning.

4.4 Mounting the positioner to rotary actuators in accordance with VDI/VDE 3845

(see “Dimensional drawings” for dimensions)

To allow for correct mounting to rotary actuators in accordance with VDI/VDE 3845, the positioner has a shaft with proper dimensions and an adapter for coupling to the actuators shaft, and 4 threaded holes M6 on a hole circle diameter of 50 mm. The following additional mounting material is needed:

- Screws, plain washers and spring washers as shown in Fig. 6 (included in the positioner’s scope of delivery).
- Mounting bracket for linking the positioner with the actuator (to be ordered separately)

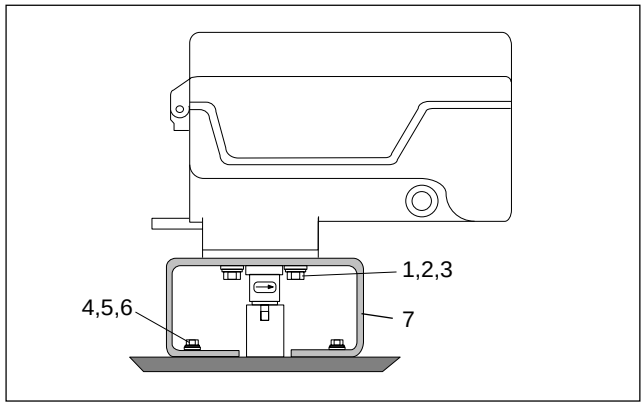


Fig. 6 Mounting kit for rotary actuators

Item	Qty.	Description
1	4	Hexacon head cap screw DIN 933 - M6x12-A2
2	4	Plain washer A6.4, DIN 127-A2
3	4	Spring washer B6, DIN 127-A2
4	4	Hexagon head cap screw DIN 933 - M5x10-A2
5	4	Plain washer A5, 3 DIN 127-A2
6	4	Spring washer B5, DIN 127-A2

When mounting the positioner to rotary actuators you should pay attention to the following:

- Position feedback of the positioner is only possible through counterclockwise rotation (seen from the front of the device). A built-in return spring rotates the shaft until reaching the right stop in the unloaded state.
- Mind the direction of rotation (counterclockwise or clockwise) of the rotary actuator when the output signal y_1 is applied by the positioner.
- Check how the positioner is mounted to the actuator (in parallel or shifted by 90 °).
- Before mounting the positioner to double acting rotary actuators, the shaft must be set to the same position which single acting actuators reach through the spring load or which the air signal y2 of the positioner causes.
- The groove in the shaft of the rotary actuator should make a 90° angle to the longitudinal axis.

Observe the following recommendations when mounting the positioner:

4.4.1 Mounting the positioner to actuators turning **counterclockwise**, positioner **in parallel with** actuator

The positioner is ready for this linkage when it is delivered.

Couple the positioner shaft with the actuator shaft, then turn the positioner by **around 15°** to the **righ**t (see Fig. 7a). Fasten the positioner with screws.

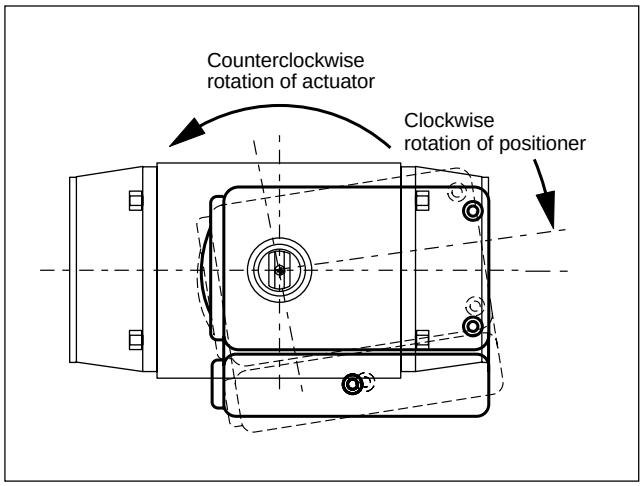


Fig. 7a

4.4.2 Mounting the positioner to actuators turning **counterclockwise**, positioner shifted **by 90 °** compared to the actuator

When mounting the positioner in this way, shift the shaft adapter at the back of the positioner by 90°, referred to the factory setting (see Fig. 7c).

Couple the positioner shaft with the actuator shaft, then turn the positioner by **around 15°** to the **right** (see Fig. 7b). Fasten the positioner with screws.

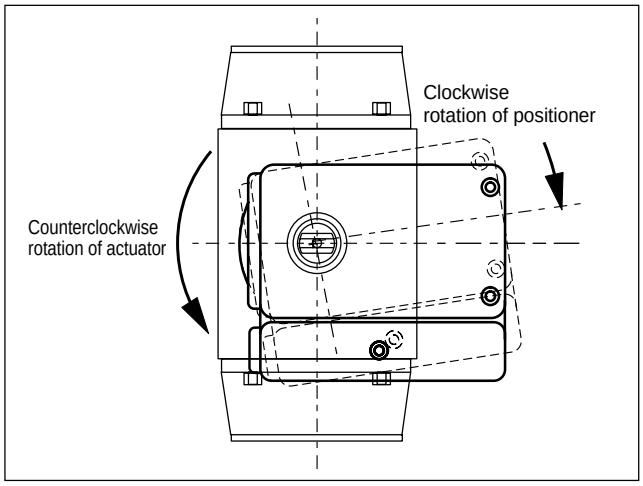


Fig. 7b

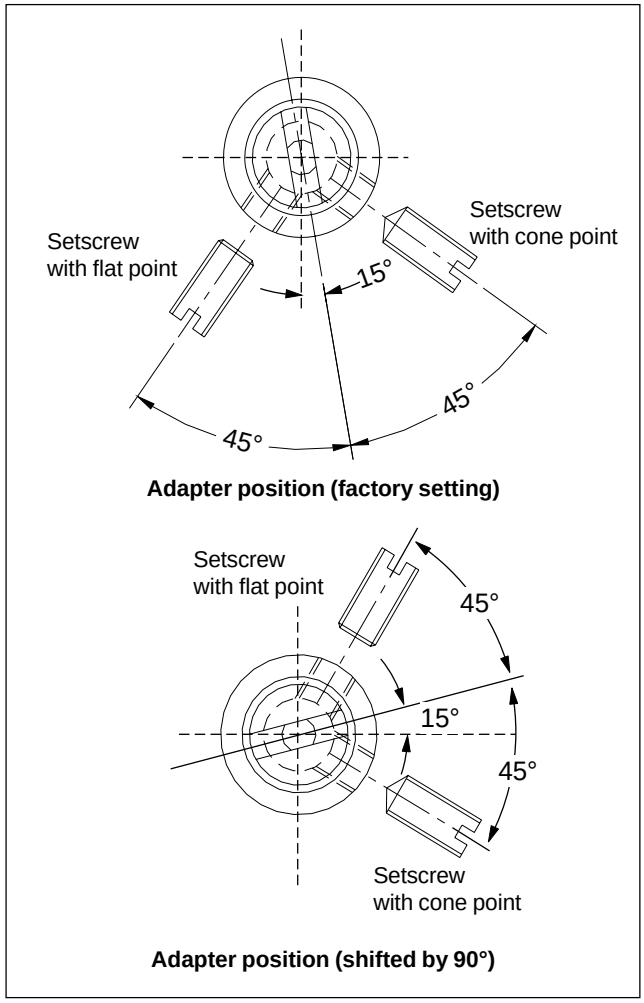


Fig. 7c

4.4.3 Mounting the positioner to actuators turning **clockwise**, positioner **in parallel with** actuator

When mounting the positioner in this way, shift the shaft adapter at the back of the positioner by 90°, referred to the factory setting (see Fig. 7c).

Couple the positioner shaft with the actuator shaft, then turn the positioner by **around 105°** to the **right** (see Fig. 7e). Fasten the positioner with screws.

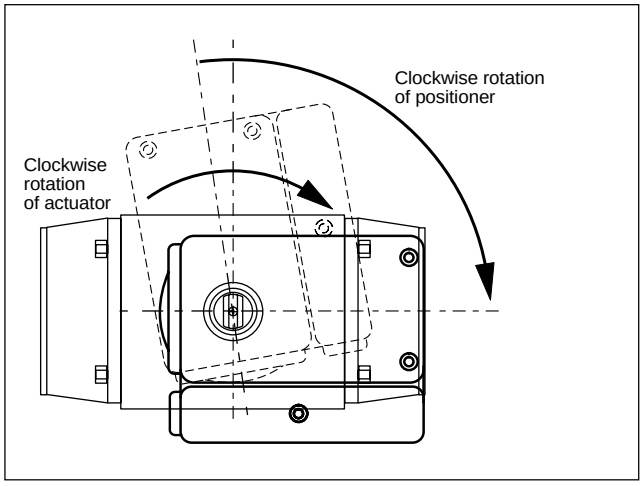


Fig. 7d

4.4.4 Mounting the positioner to actuators turning **clockwise,** positioner shifted **by 90 °** compared to the actuator

When mounting the positioner in this way, the shaft adapter at the back of the positioner can remain unchanged.

Couple the positioner shaft with the actuator shaft, then turn the positioner by **around 105°** to the **right** (see Fig. 7e). Fasten the positioner with screws.

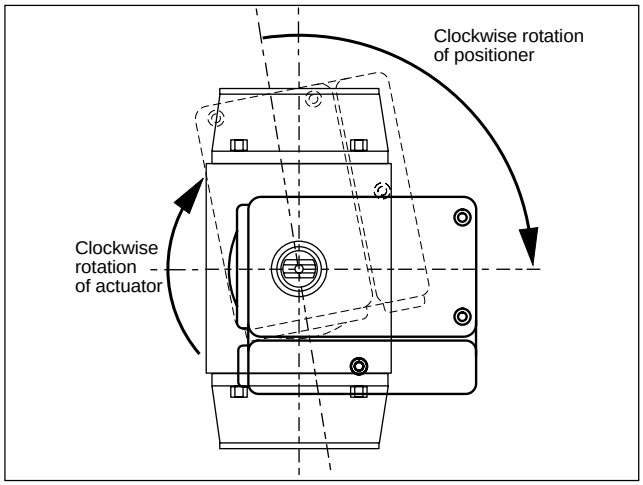


Fig. 7e

When mounting the positioner make sure that there is a loose fit between the adapter at the positioner and the actuator shaft.

It must be possible to move the adapter manually within the range of 0.1 to 0.3mm. If necessary, loosen the screws (Fig. 6, item 4) and readjust the bracket.

5. Connecting

All connections (electrical and pneumatic) are located on the right side of the device (see Fig. 8a).

Depending on the ordered model, the positioner has threaded holes Pg. 13.5 or 1/2-14 NPT or M 20 x 1.5 for cable entry and threaded holes G 1/4 or 1/2-14 NPT for the pneumatic connections.

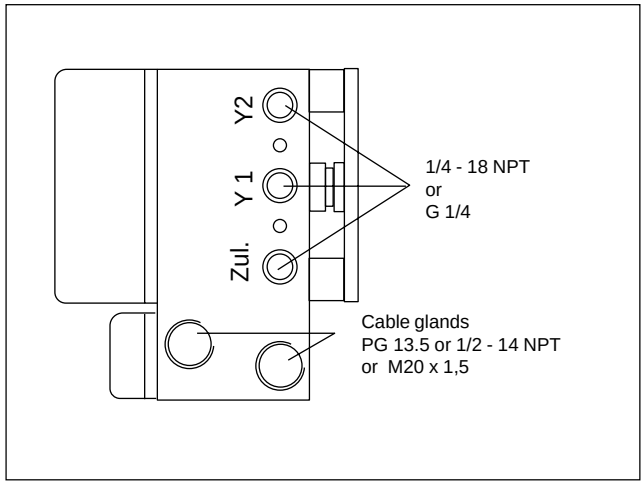


Fig. 8a Pneumatic connections and cable glands

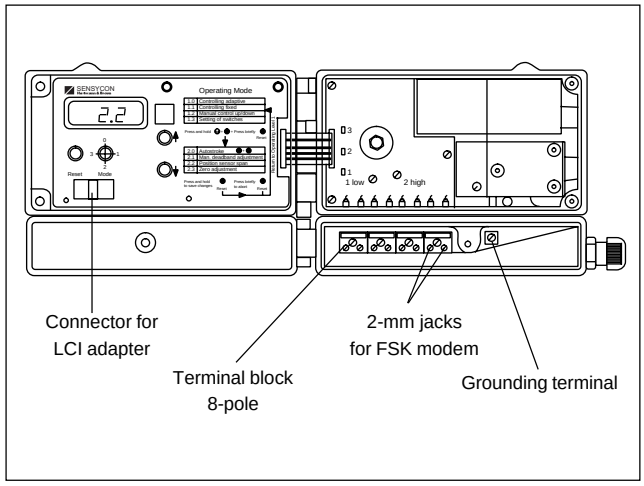


Fig. 8b Electrical connections of TZID

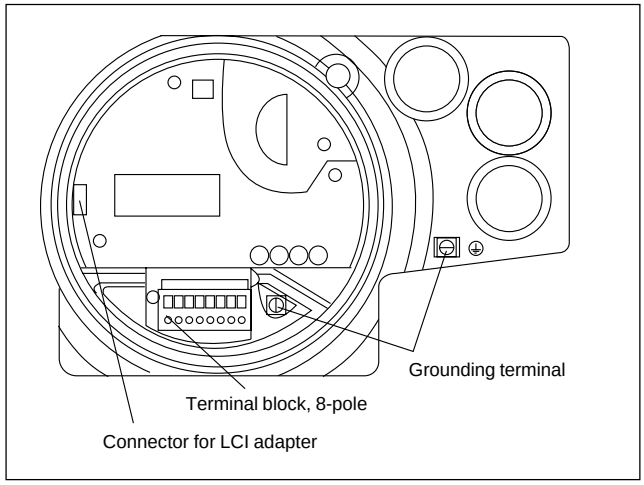


Fig. 8c Electrical connections of TZID Ex d

5.1 Electrical connections

The positioner has a screw terminal block inside the case for connecting wires with a cross-sectional area of max. 2.5 mm². The required wiring efforts depend on the number of the supplementary modules used. Refer to the type label or the catalog number for this. Fig. 9 shows the number of terminals and their assignment for the individual equipment variants.

The cable is entered into the case through cable glands.

TZID with a Pg 13.5 thread is delivered with a pre-installed cable gland.

The cable gland for TZID Ex d with a M20x1.5 thread has to be ordered separately. The cable gland is approved for Ex d type operation and must be installed by the customer.

When making the electrical installation, observe

- the regulations, standards, and safety requirements pertaining to the installation and operation of electrical systems,
- the standards, regulations and directives governing explosion protection, if explosion-proof devices are used.

Do not lay the signal line for the transmission of measured values close to power lines. Power lines produce interference in their near vicinity which impairs the measured values on the signal line.

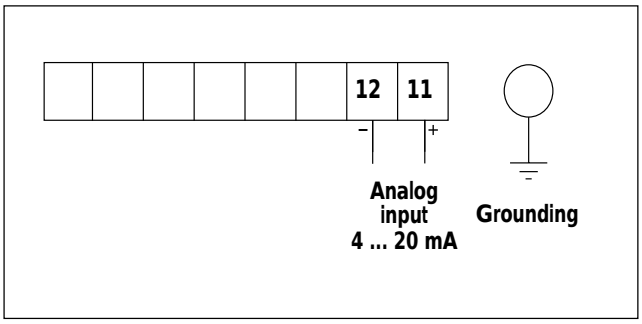
When making the electrical wiring, observe the electrical rating specified in "Technical data". For explosion-proof positioners also heed the specifications in the explosion protection approval.

Exclusively connect signal circuits with a load-independent current of 4 ... 20 mA to terminals 11/12 (analog inputs). In case of a disturbance the max. current must not exceed 300 mA (150 mA for intrinsically safe positioners). In case of polarity reversal the max. current must not exceed 150 mA.

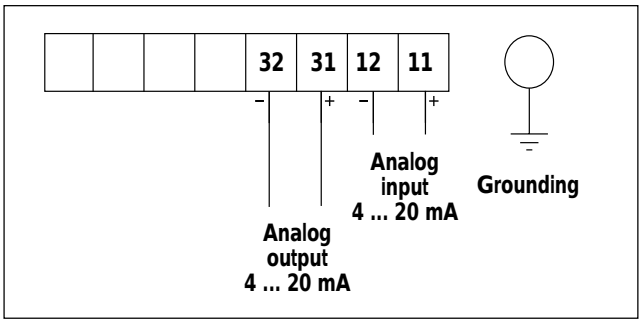
When using an intrinsically safe positioner with flammable gas, observe the special conditions specified in the second supplement to conformity certificate PTB-No. Ex-94.C.2133X.

Only use cable glands with full Ex-d approval for EEx d operation. Partly approved cable glands labeled "U" are not sufficient.

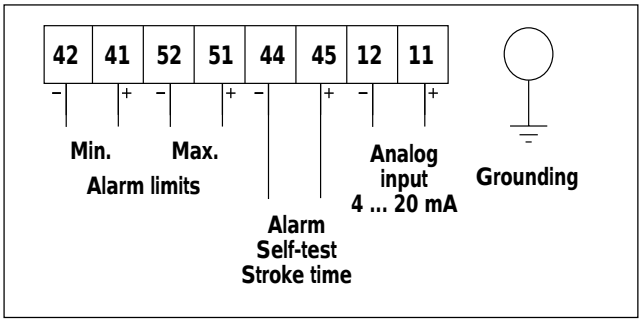
Fix the screwed-in Ex-d cable gland with glue to secure it against loosening. Loctite 242/243 or similar glues are suitable.



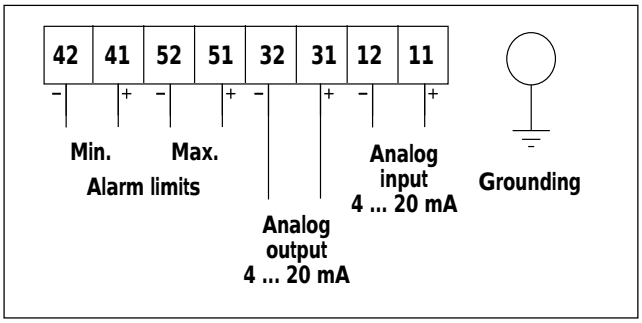
Basic model



Basic model with "analog feedback" module



Basic model with "digital feedback" module



Basic model with "analog feedback" module and mechanical kit for "digital feedback"

Fig. 9 Assignment of the 8-pole terminal block

5.2 Pneumatic connections

Tube fittings for the threaded holes G 1/4 or 1/4 -14 NPT have to be provided by the customer. The tubing of the marked connections has to be made as shown in the table below:

Mark	Tubing/connection
SUP / ZUL / IN	Air supply, pressure 1.4...6 bar
Y_1 / OUT_1	Output pressure, to actuator
Y_2 / OUT_2	Output pressure, to actuator (2nd connection for double-acting actuators)

The recommended pipe dimension is 6 x 1 mm. Dust, splinters or any other particles must be blown off the pipe before connecting.

When using double-acting actuators, connect the Y_2 / OUT_2 output with the actuator chamber which provides for the same action as the return spring of single-acting actuators.

The supply air pressure must be matched to the positioning pressure in the actuator which is required for the control torque. The limit values of the positioner are 1.4 bar and 6 bar. Take the necessary measures to make sure that the supply air pressure will not exceed the permissible limits of the positioner or the actuator, even in case of troubles.

⚠ **The supply air must be free of oil, water and dust in accordance with DIN/IEC 770.**

Dust, splinters or any other particles must be blown off the pipe before connecting.

A pressure gauge block (TZID) or individual pressure gauges (TZID Ex d) for indicating the supply air pressure and the output pressure are available. These units are delivered as loose parts and have to be mounted during commissioning.

Mount the pressure gauge block to the side of TZID and fasten it with the two screws delivered with the positioner as seen in Fig. 10. Make sure that the O-ring seals are positioned properly to ensure tight fitting.

The pressure gauges of TZID Ex d must be screwed into the appropriate threaded holes. Remove the pressure plugs before (see Fig. 11).

Additionally, a filter regulator is available upon request as a loose part. When mounting the filter regulator, make sure that the case is oriented vertically to allow that condensed water is drained off. In addition to the required mounting steps for attaching the filter regulator to the pressure gauge block or to TZID Ex d, commissioning includes the adjustment of the supply air pressure using the adjustment spindle. Note that, on the input side of the filter regulator, this pressure must not exceed 16 bar.

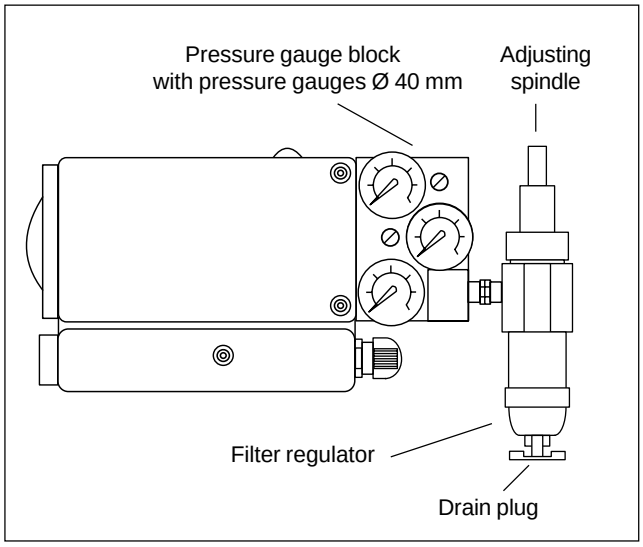


Fig. 10 TZID with pressure gauge block and filter regulator

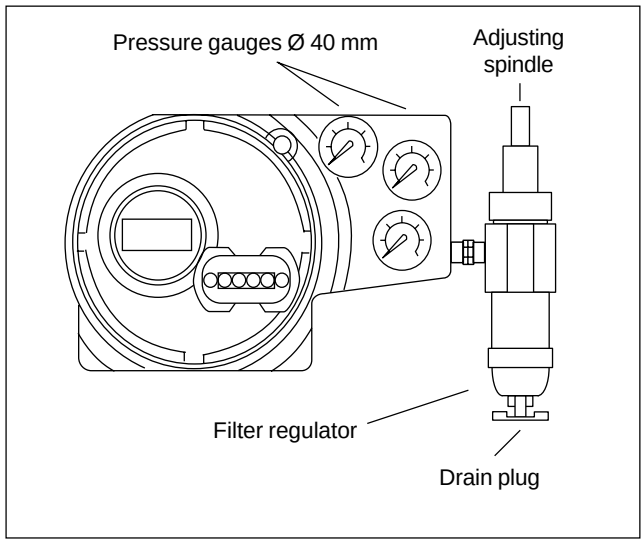


Fig. 11 TZID Ex d with pressure gauges and filter regulator

6. Commissioning

During commissioning the positioner must be configured, i.e. it must be adapted electronically to the operational data of the actuators or control valves. Several methods are possible:

- **Commissioning the positioner via the built-in operator panel**

  This method only requires little technical effort. The positioner must be supplied with a 4...20 mA current signal and with compressed air of 1.4...6 bar. Commissioning is in this case limited to matching the positioner to the operational data of the actuator or control valve. Any adjustment that goes beyond this scope requires the method described below.

- **Commissioning the positioner with a PC and a special TZID software**

  Commissioning through the PC is done via the communication port and a special adapter. With this method the full range of the intelligent positioner's adjustment and adaptation capabilities is available.

These operating instructions only describe commissioning via the built-in operator panel. Please refer to a separate document for the necessary information about commissioning the TZID via the communication port and a connected PC.

⚠ **When commissioning the positioner, first supply air and then apply the 4...20 mA current signal.**

Before commissioning, read the necessary information about the design and operation of the display and operator panel (Appendix 4).

6.1 Adapting the positioner to the actuator

The positioner can be adapted to the operational data of the actuator in the "Autostroke" mode. In this operating mode, a program is started which determines all relevant data and transmits them to the positioner. No manual adjustment is required. Refer to Appendix 4, operating level 2, "Display 2.0 = Autostroke" for details about the Autostroke.

Successful self-adaptation using the Autostroke function requires that the angle of rotation for position feedback is within the permissible range. The range that is actually used for position feedback can be scanned electronically. Refer to Appendix 4, operating level 2, "Display 2.2 = Position sensor span" for details. Based on a displayable range of 0...100%, the following requirements must be met:

- Angle of rotation > 2 % and < 98 %
- Range > 20 % (High-Low)

If these requirements are not met, the mechanical link converting the movement into an angle of rotation must be readjusted (see sections 4.3 and 4.4).

If Autostroke is initialized although the requirements listed above are not met, Autostroke is aborted automatically and the respective error code (see Appendix 7) is shown by the display.

6.2 Adjusting the dead band

The value of the effective dead band depends upon the air capacity and the friction of the actuator (control valve). The span is from 0.3 % to 10.0 % (referred to a movement of 100%). The smallest possible value is determined by Autostroke, checked while the positioner is running in "adaptive" control mode, and corrected if required. If it is necessary to improve stability, you can set higher values by manual data entry via the operator panel. For details refer to Appendix 4, operating level 2, section "Display 2.1 = Man. dead band adjustment".

6.3 Adjusting the valve action (effective direction)

The positioner works with two types of valve action:

Direct:	Signal 4...20 mA	Position 0...100 %
Reverse:	Signal 20...4 mA	Position 0...100 %

The valve action can be adjusted on the operator panel as described below (factory setting defaults to "direct action"):

Changing over from direct to reverse action

- Call up operating level 2, display 2.0 = Autostroke
- Press the "Down" push button and **hold**
- **Wait** until displayed countdown from 3 to 0 is finished, **then release** the "Down" button
- Press "Down" again and **hold**
- **Wait** until displayed countdown from 3 to 0 is finished, **then release** "Down"

The display shows the code "P31", which is flashing in the beginning and then changes over to a permanent display. After another 2 seconds, it is replaced with a flashing colon. Save the newly set parameters in the non-volatile memory as described in Appendix 4, section "Exiting operating level 2".

Changing over from reverse to direct action

The procedure is the same as described above. However, in this case you must press the "Up" button instead of the "Down button". The code shown in the display is "P32" instead of "P31".

6.4 Setting parameters for current operation

Normally, "Controlling adaptive" at operating level 1 is selected for current operation. It is only necessary to select "Controlling fixed" if the positioner is working unstable in adaptive mode.

6.5 Adjusting low and high alarm limits (supplementary modules for digital feedback)

For positioners with a supplementary module for "digital feedback" the low and high alarm limits are adjusted electronically. Adjustment is only possible after the positioner has been mounted to the actuator and after an Autostroke has been performed. For details refer to Appendix 4, operating level 1, "Display 3 = Setting of switches".

6.6 Adjusting low and high alarm limits (supplementary “mechanical kit for digital feedback”)

For positioners with the supplementary module “mechanical kit for digital feedback” the low and high alarm limits are set mechanically. Adjustment is only possible after the positioner has been mounted to the actuator and after an Autostroke has been performed. Note that TZID and TZID EX d have different adjustment mechanisms. Observe the direction of action of the “NC” and NO” switches.

Direction of action NC

Control vane **out of** slot-type initiator
-> state 1 (control current > 3 mA)

Control vane **within** slot-type initiator
-> state 0 (control current < 1 mA)

Direction of action NO

Control vane **out of** slot-type initiator
-> state 0 (control current < 1 mA)
Control vane **within** slot-type initiator
-> state 1 (control current > 3 mA)

Adjusting alarm limits of TZID

TZID has two screws for alarm limit adjustment (see Fig. 12). The screws are protected against unwanted turning. To adjust the alarm limits, push in the adjustment screws with a screw driver to enable snapping in. Before making the mechanical adjustment, set the actuator manually to the desired switching position (see Appendix 4, operating level 1, “Manual control”). The low and the high alarm limit have to be adjusted separately.

Adjusting alarm limits of TZID Ex d

To adjust the alarm limits of TZID Ex d, turn the disks (item 1 and item 2 in Fig. 13) on the shaft for position feedback.

Relationship between disks and effective direction of the switches:

Low contact

Disk (item 1), wired with terminal 41/42,
inserted into slot-type initiator (item 3)
when turning clockwise

High contact

Disk (item 2), wired with terminal 51/52,
inserted into slot-type initiator (item 4)
when turning counterclockwise

In order to adjust the disks (items 1 and 2) on the shaft first remove the protective plastic cover and then untighten (do not remove) the nut (item 5).

Use a tool (e.g. a small screw driver) to adjust disks 1 and 2 with the control vane on the shaft to establish a contact. To allow for exact adjustment first set the actuator manually to the desired switching position (for details refer to Appendix 4, operating level 1, “Manual control). The low and the high alarm limit have to be adjusted separately.

Tighten the nut (item 5) and put on the plastic cover again.

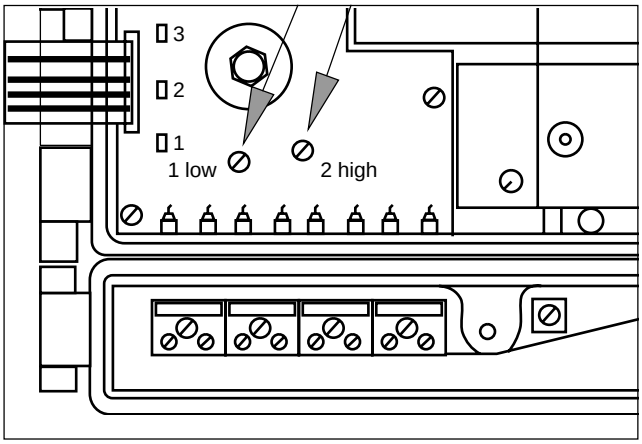


Fig. 12 Adjustment screws for the alarm limits of TZID

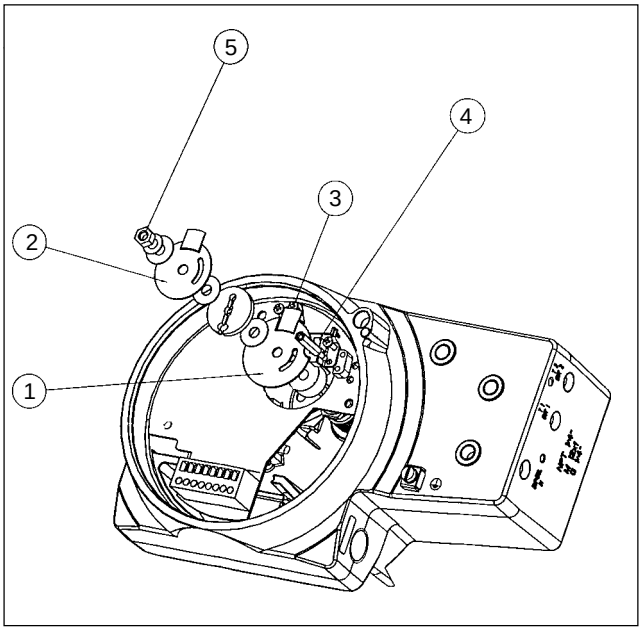


Fig. 13 Elements for adjusting the alarm limits of TZID Ex d

6.7 Restoring the factory setting

Positioners adapted to special operating data can be reset to the factory setting. This may become necessary if, for example, an already configured positioner is mounted to another actuator.

Proceed as described below to restore the factory setting (requires Software Revision 4.5 or higher):

- Select operating level 1, “Manual control”
- Press the “Reset” push button and **hold**,
  wait until displayed countdown from 10 to 0 is terminated
- **Release** “Reset”,
  a flashing colon appears in the display
- Press “Reset” again and **hold**,
  wait until displayed countdown from 10 to 0 is terminated,
  (factory setting is saved in the non-volatile memory)
- **Release** “Reset”

Maintenance

The positioner is maintenance-free. To ensure trouble-free operation make sure that the supply air is free of oil, water and dust in accordance with DIN/IEC 770.

It is recommended to check on a regular basis the textile filter element for the degree of pollution and position control to see if the specified tolerances are met. If the optional filter regulator is used, it collects condensed water which must be drained off periodically.

1. Checking the air filter in the positioner

If the air supplied to the positioner is not clean and dry as specified in DIN/IEC 770, the built-in textile filter can protect the air nozzles and throttles against pollution to a certain degree. However, the filter capacity only allows for collecting residual dirt for a short time. If contaminated air is supplied for a longer time, the filter is clogged up with dirt.

In order to check the degree of pollution , unscrew the plug and remove the filter element using tweezers (see Fig. 14 and Fig. 15). Spare filter elements can be ordered from us under catalog number 7942511. After filter element replacement the positioner will immediately be operational and does not require any further steps (e.g. readjustment).

Switch off air supply before replacing the filter element.

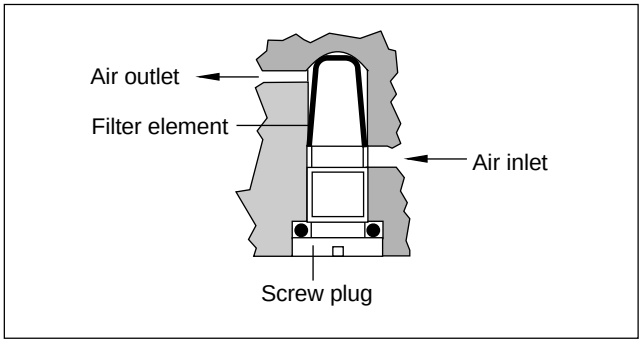


Fig. 14 Air filter in the pneumatic output unit

2. Functional test/Readjustment

An overall functional test can only be carried out via the communication port and a PC with special TZID software.

Otherwise, only a simple visual check can be performed. Due to the electronic function no mechanical adjustment is possible. During operation, the positioner's zero can be checked and readjusted if required (see Appendix 4, operating level 2, "Display 2.3 = Zero adjustment"). When the system is switched off, the Autostroke can be repeated (see Appendix 4, operating level 2, chapter "Display 2.0 = Autostroke") to re-adapt the positioner to the operating conditions.

3. Replacing the pneumatic output unit

The pneumatic output can be replaced (see Fig. 15). It may be necessary to replace this unit for one of the following reasons:

- Pollution with contaminants or oil due to insufficiently cleaned supply air.
- Change of the output from single acting to double acting or vice versa
- Change of the safe state from "air is evacuated" to "output is blocked" and vice versa

The dismount the old pneumatic output unit disconnect the plug of the electrical control, unscrew the three fastening screws (Torx head) and then remove the pneumatic output unit.

Notice the position of the gasket and its holes when mounting the new pneumatic output unit. Torque the three fastening screws to 350 Ncm (31 in-lbs). When connecting the electrical wires from the control unit make sure that the plug is correctly snapped in. The connector is protected against polarity reversal.

Switch off the air supply before replacing the pneumatic output unit.

Notice the correct position of the gasket and its holes when mounting the pneumatic output unit.

Note that a change over to other functions is only possible with Software Rev. 5.00 and higher.

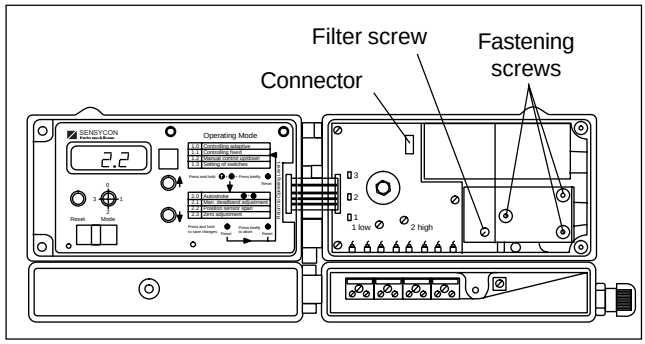


Fig. 15 Pneumatic output unit of TZID

4. Filter regulator

If the optional filter regulator is installed, it collects condensed water which must be drained off at intervals (by opening the drain screw at the filter case). The intervals depend upon the air supply quality. Additionally, the filter element (sintered bronze, 40 µm) may require cleaning or replacement, depending on the air supply quality, too.

Appendix

1 Technical data

1.1 Basic device

Input

Signal range
Nominal range 4...20 mA
Split ranges configurable between 20 and 100 %

Two-wire circuitry
Supply voltage 9.8 VDC without explosion protection
9.8 VDC with Ex d approval
10.8 VDC for intrinsically safe device

Resistance 490 ohms at 20 mA and 9.8 VDC
540 ohms at 20 mA and 10.8 VDC

Output

Signal range
0...6 bar (0...90 psi)

Air capacity
At supply pressure of 1.4 bar (20 psi)
5.5 kg/h = 4.5 Nm^3/h = 2.5 scfm

At supply pressure of 6 bar (90 psi)
13 kg/h = 11 Nm^3/h = 6.5 scfm

(Booster for increase of capacity available on request)

Action
Single or double,
air is evacuated from actuator or actuator is blocked if input signal < 3.9 mA

Shut off value
Setable to 0...20 % of output signal
(if the value falls below the set value, the positioner immediately sets the valve to the closed position)

Stroke movement

Angle of rotation
60 °nominal range for attachment to linear actuators in accordance with DIN/IEC 534

120 °nominal range for attachment to rotary actuators in accordance with VDI/VDE 3845

Used range is 20...100 % of nominal range

Adjusted speed
Can be adjusted separately for each direction as a 0...200 second ramp

Time-out monitoring
Range 0...200 sec
(Monitoring parameter for deviation control in the dead band)

Stroke limiting
Low and high limits,
setable between 0 and 100 % of the stroke

Air supply

Instrument air
Free of oil, water and dust in accordance with DIN/IEC 770

Supply pressure
1.4...6 bar (20...90 psi)
Caution: Do not exceed the max. working pressure of the actuator!

Air consumption
< 0.03 kg/h = 0.025 Nm^3 = 0.0136 scfm
(independent of supply pressure)

Transmission data and influences

Effective direction (output signal or pressure in actuator)

Rising: Rising output signal 4...20 mA
Rising pressure y_1 in actuator

Falling: Rising output signal 4...20 mA
Falling pressure y_1 in actuator

Valve action
Direct: Output signal 4..20 mA = position 0..100 %
Reverse: Output signal 20..4 mA = position 0..100 %

Characteristic curve (stroke movement = f{output signal})
linear,
equal percentage 1:25 or 1:50 or 25:1 or 50:1,
or user-configurable with 20 reference points

Characteristic deviation
≤ 0.5 %

Dead band (sensitivity)
Adjustable from 0.3...10 %

Resolution (A/D conversion)
> 8000 steps

Sample rate
20 msec

Influence of ambient temperature
≤ 0.5 % for every 10 K

Influence of vibration
≤ 1 % up to 10 g and 20...80 Hz

Seismic requirements
Meets requirements of DIN/IEC 68-3-3 class III for strong and strongest earthquakes

Influence of mounting position
Not measurable

EMC
Meets EMC regulation 89/336/EWG as of May 1989

CE mark
Meets the EC regulation for the CE conformity mark

Communication port
Connector for LCI adapter (standard)
FSU module for frequency-modulated tapping (optional)

Environmental capabilities

Climate class
GPF to DIN 40040

Ambient temperature
-40 to +85 °C (-40 to +185 °F) for operation, storage and transport

Explosion protection

CENELEC
EEx ia IIC T4/T5/T6, PTB No. Ex-94.C.2133 X
EEx d IIC T4/T5/T6, BVS No. 96.D.2008 X

BRITISH Standards 6941:1988
Ex N IIC T6, Certificate SCS No: Ex95Y4126X

FM
Intrinsically Safe CL I-II-III, Div 1, Grp A-B-C-D-E-F-G
Nonincendive CL I-II-III, Div 2, Grp A-B-C-D-E-F-G

Explosion Proof CL I-II-III, Div 1, Grp B-C-D-E-F-G

CSA
(under preparation)

Case

Material
Aluminum, protection IP 65 (NEMA 4X)
Surface varnished black, RAL 9005, matt, with thick film epoxy resin electro-dipcoat

Stainless steel 1.4581, protection IP 65 (NEMA 4X)

Electrical connections
Screw terminals, internal, for 2.5 mm^2

Cable gland
Threaded holes Pg. 13.5 or 1/2-14 NPT or M 20 x 1.5 (depending on model and order)

For TZID models “standard“, “intrinsically safe“ or “Ex N IIC“ with Pg. 13.5 thread the PG 13.5 cable glands are delivered with the device.

For TZID model Ex d with thread M 20 x 1.5 the EEx d IIC cable glands are delivered only upon special request (conformity certificate INEX 88B.103.748).

Pneumatic connections
Threaded holes G 1/4 or 1/4-18 NPT

Weight
2.9 kg (TZID with aluminum case)
5.6 kg (TZID with stainless steel case)
5.8 kg (TZID Ex d with aluminum case)

Mounting position
as required, no overhead mounting

1.2 Options

Supplementary module for analog feedback

Signal range 4...20 mA (split ranges configurable)

Two-wire circuitry, power supply 10...30 V DC

Standard or intrinsically safe version

Valve action direct or reverse (as configured)
Characteristic deviation $\leq$ 1 %

(Whether the module is to be used for alarm reporting and whether the output is to be modulated to 3.5 or 21.5 mA can be configured).

Supplementary module for digital feedback

3 switches for current circuits in accordance with DIN 19234

Control voltage 8...25 V DC
Control current < 1.2 mA = switching state logical “0“
Control current > 2.1 mA = switching state logical “1“

Direction of action: normally logical “0“ or logical “1“ (as configured)

Standard or intrinsically safe version

Switch assignment: 1 switch for alarms
2 switches for min. or max. position (adjustable between 0 and 100 %)

Mechanical kit for digital position feedback

2 slot-type initiators in accordance with DIN 19234

Control voltage 5...25 V DC
Control current < 1 mA = switching state logical “0“
Control current > 3 mA = switching state logical “1“

Standard or intrinsically safe version[1])

For min. or max. position
Limits adjustable between 0 and 100 %

(Function independent of the software and electronics of the positioner)

Direction of action (logical state):

Slot-type initiator	Position			
	< min.	> min.	< max.	> max.
SJ2-SN (NC)	0	1	1	0
SJ2-S1N (NO) [2])	1	0	0	1

[1]) CENELEC EEx ia IIC T1...T6, PTB No. Ex-83/2022 X
[2]) Lower limit of operating temperature range: - 25 °C

1.3 Accessories

Attachment material

Attachment kit for linear actuators, stroke 10...85 mm
(lateral attachment meets DIN/IEC 534 or NAMUR)

Lever 170 mm for linear actuators, stroke 10...150 mm

Attachment bracket for rotary actuators 90 °
Attachment to VDI/VDE 3845,

dimensions A/B = 80/20 mm
= 80/30 mm
= 130/30 mm
= 130/50 mm

Attachment kit for actuator-specific attachment available on request

Pressure gauges for supply pressure and output pressure

Plastic or stainless steel case, Ø 40 mm

Supply pressure range 0...10 bar/0...140 psi

Output pressure range 0...10 bar/0...140 psi
or 0.....4 bar/0.....60 psi

With connection block and attachment material for the TZID

Connection block made of aluminum with black varnish
or of stainless steel

Filter regulator with attachment material

All metal version, brass, varnished black

Bronze filter element, 40 µm, with condensate drain

Max. pre-pressure 16 bar, output pressure adjustable to 1.4...6 bar

PC adapter for communication

LCI adapter for connector on TZID
FSK modem for frequency-modulated tapping

Software

IBIS for TZID/DOS	3 1/2“ disk
IBIS for TZID/WINDOWS	3 1/2“ disk
Smart Vision® (standard [1])	3 1/2“ disk
Smart Vision® (standard [1])	as CD ROM

[1]) Version for Hart® protocol

Isolating amplifier for signal range 0/4...20 mA

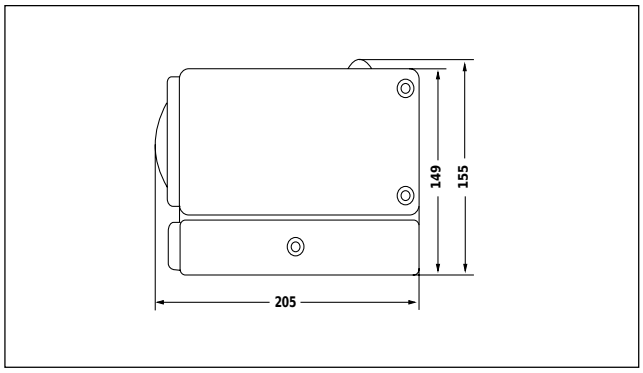
TET 128 or Contrans I or Contrans_remote
(see separate data sheets for details)

2. Spare parts

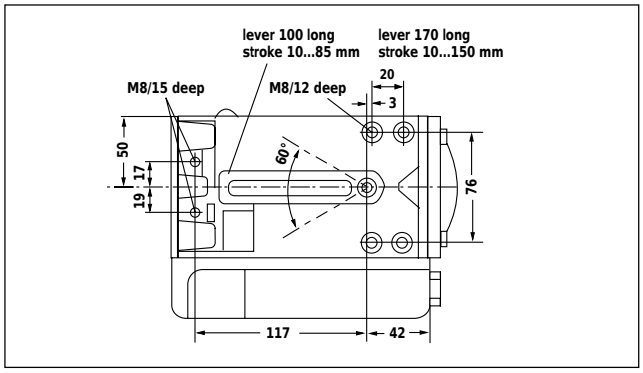
Item	Catalog No.
Filter element (positioner)	7942511
Filter element (sintered bronze, in filter regulator)	7943191
Pneumatic output unit	
Single acting	
Air is evacuated in safe state	7944770
Blocked in safe state	7944771
Double acting	
Air is evacuated in safe state	7944772
Blocked in safe state	7944773
Spring (see page 5, fig. 3, item 14)	7943070

3.1 Dimensional drawings (TZID models “standard” or “intrinsically safe” or “Ex N”)

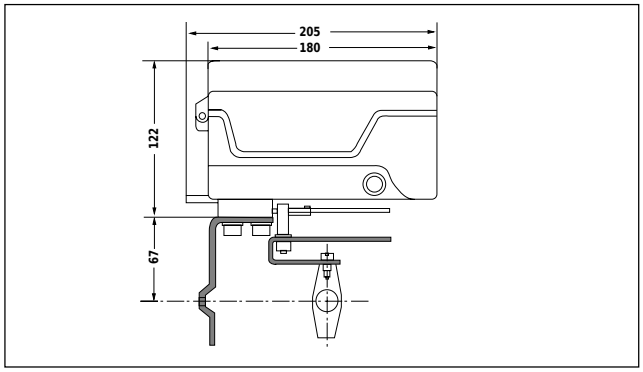
Lateral attachment to DIN / IEC 534



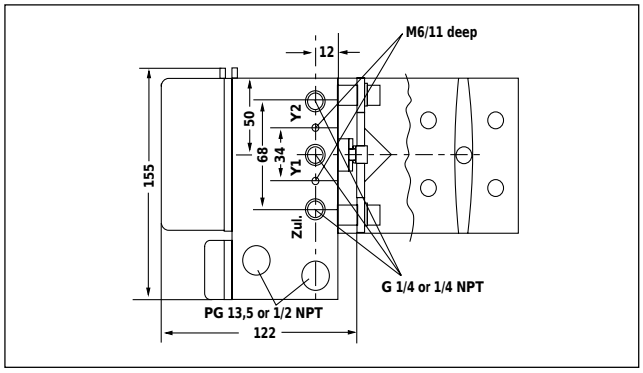
Front view



Rear view

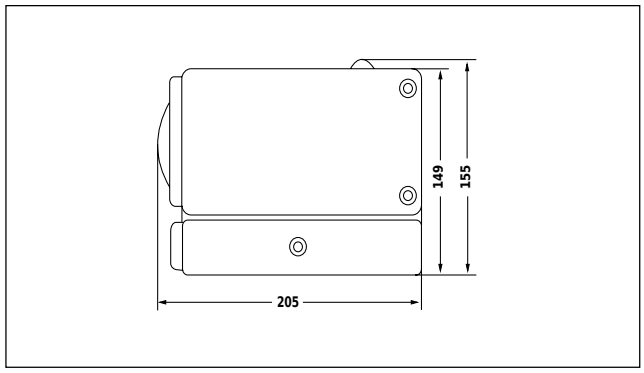


Bottom view

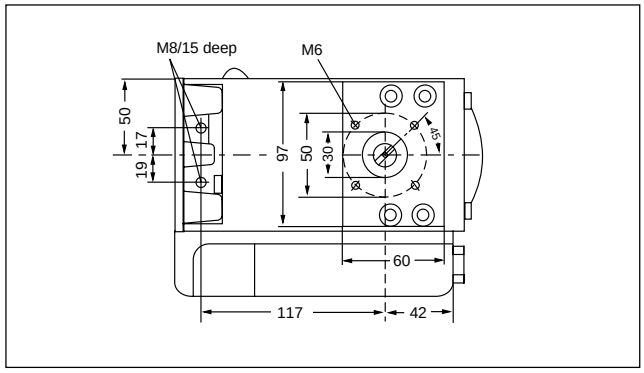


Side view (right)

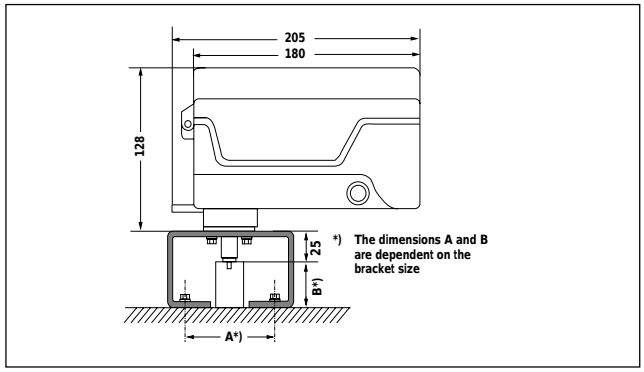
Attachment to rotary actuator to VDI / VDE 3845



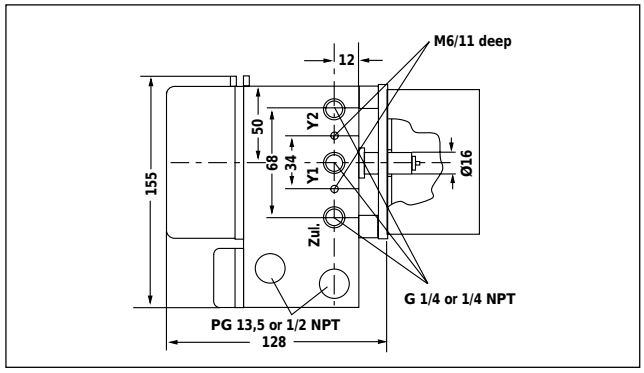
Front view



Rear view



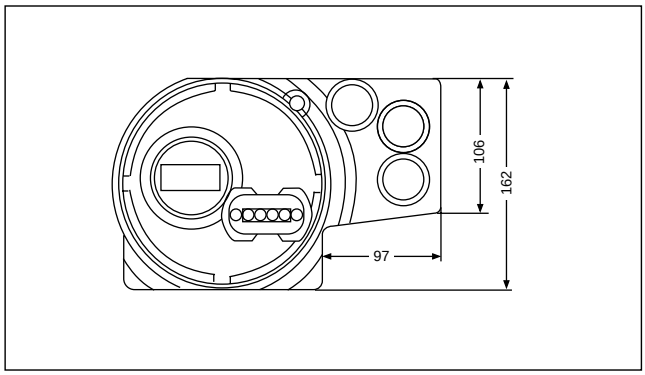
Bottom view



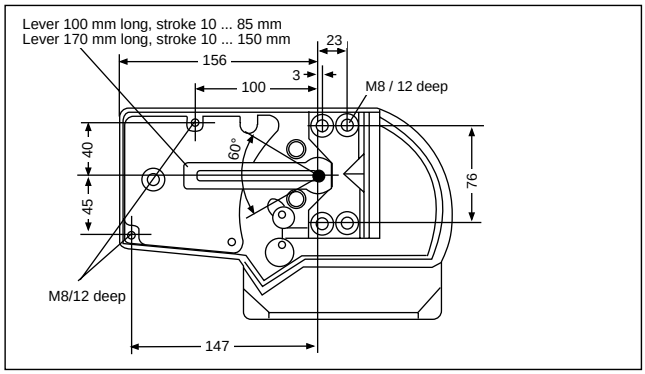
Side view (right)

3.2 Dimensional drawings (TZID model “Ex d”, pressure proof)

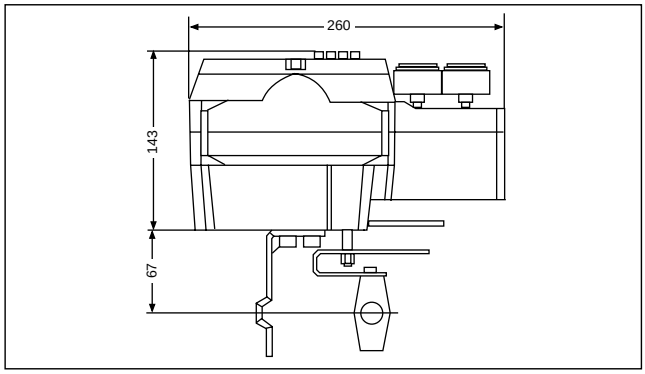
Lateral attachment to DIN / IEC 534



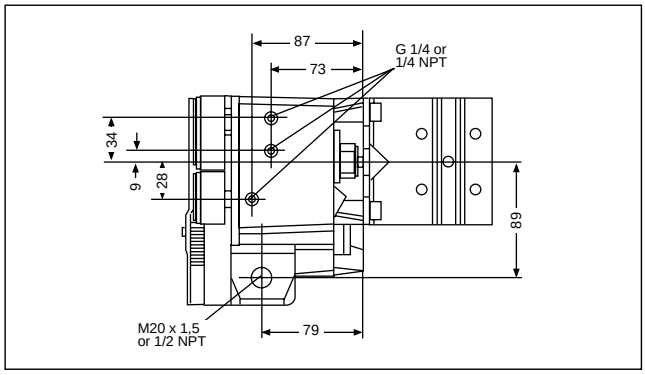
Front view



Rear view

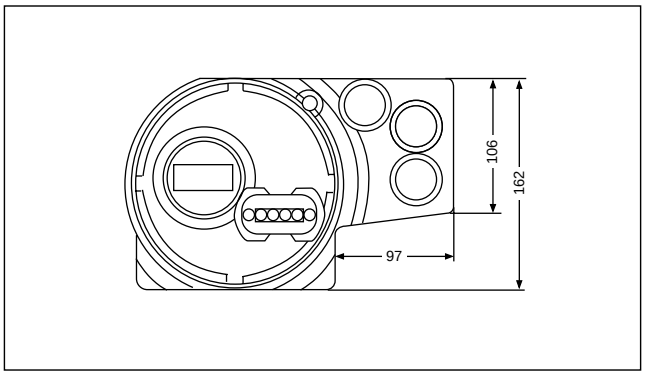


Bottom view

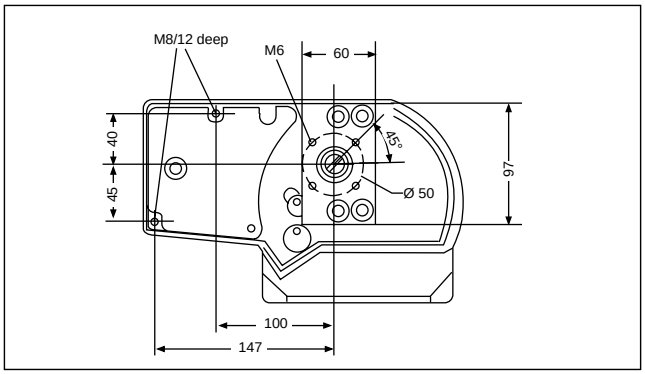


Side view (right)

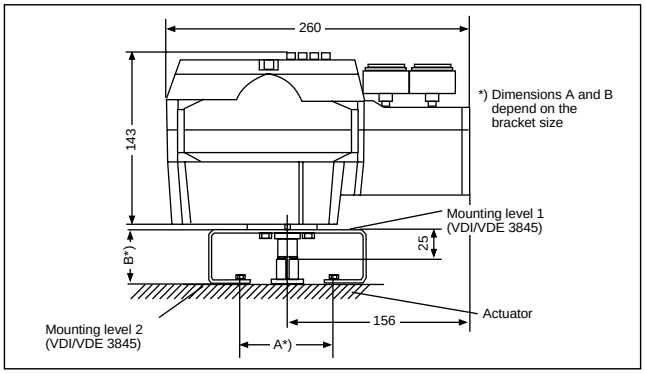
Attachment to rotary actuator to VDI / VDE 3845



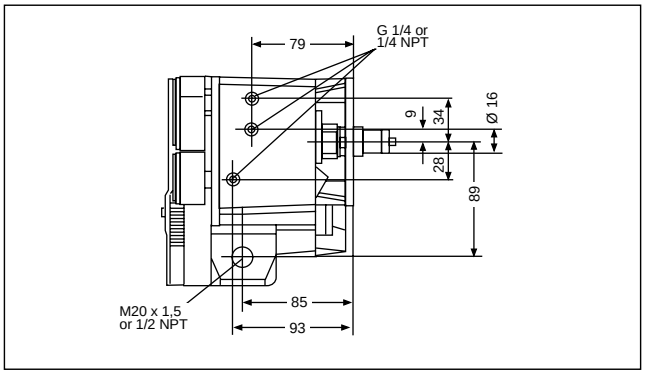
Front view



Rear view



Bottom view



Side view (right)

4. Display and operator panel

The TZID's display and operator panel is accommodated in the hinged cover (see Fig. 16), requiring that the case is opened for operation. The panel of TZID Ex d can be read and controlled from outside (see Fig. 17).

The display and operator panel is designed for two tasks and, therefore, provides two operating levels:

- **Level 1:** Monitoring and special adjustment while the system is running
- **Level 2:** Commissioning and configuration (basic functions)

If troubles occur during operation or commissioning, an error codes is shown by the display. Refer to Appendix 7 for a reference list of the error codes with their reasons and suggestions for help.

When the positioner is started, the software revision level (5.0 at the time when this document is prepared) is shown by the display for a short time.

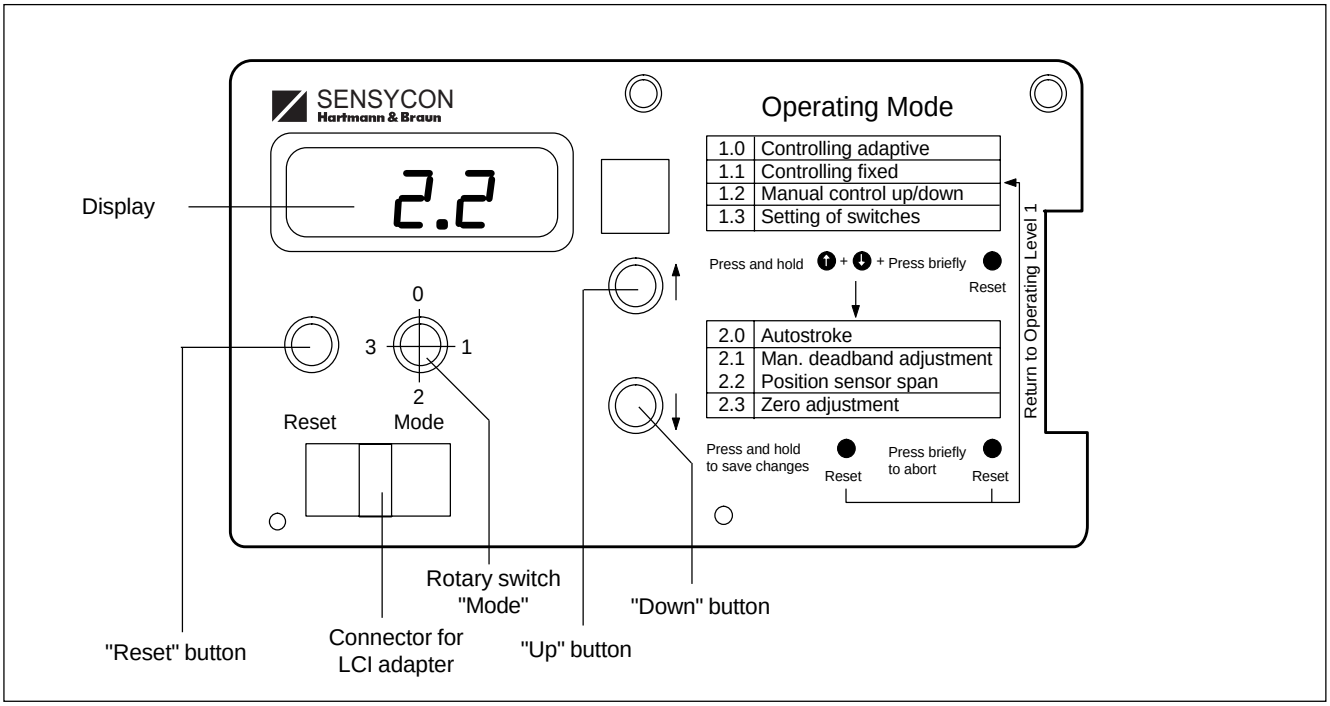


Fig. 16 Operator panel TZID

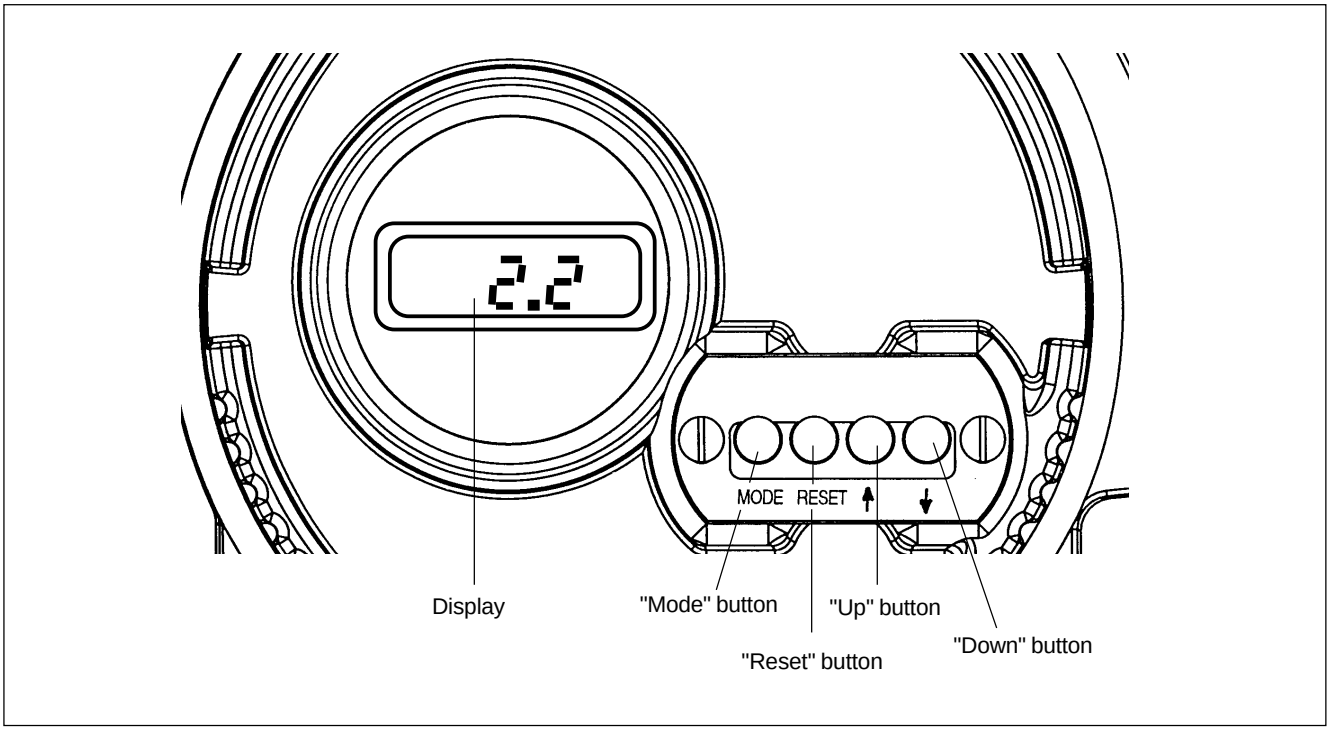


Fig. 17 Operator panel TZID Ex d

Operating level 1

When an input signal > 3.6 mA is applied, the positioner starts up at operating level 1. Four operating modes can be selected through manual control. TZID has a rotary switch with positions 0, 1, 2 and 3. To select the operating mode at TZID Ex d press and hold the “Mode” button and **additionally** press the “Up” or “Down” button. The operating mode (0, 1, 2 or 3) is then shown by the LCD.

● **Display 0 = Controlling adaptive**

This operating mode is usually selected. “Adaptive” means that the controller permanently adapts itself in an optimal way to the operating conditions by using an “AUTO-tune” function.

The display shows a position between 0 and 100 %, where “0“ indicates that the valve is closed, and “100“ shows that the valve is fully open. The display assignment is adjustable (adjustment parameter).

Newly adapted values are automatically saved in the non-volatile memory at intervals. Data storage, which only takes a short time, is indicated by the two characters “EE” shown by the display.

● **Display 1 = Controlling fixed**

This operating mode should only be selected if “adaptive” control does not yield a stable control of the position until reaching the set point.

“Controlling fixed” means that the values determined by Autostroke are no longer readjusted automatically. The display of the position as a percentage between 0 and 100 % is the same as for “adaptive” control.

● **Display 2 = Manual control**

In this mode the valve can be adjusted manually by pressing the “Up” (towards 100 %) and “Down” (towards 0 %) buttons. Pressing both buttons simultaneously will cause rapid opening/closing of the valve. The order in which the buttons are pressed defines whether the valve is opened or closed.

The LC display shows the manually set position between 0...100 %.

⚠ **Note that the position will not be readjusted if air escapes due to a leakage.**

The configured stroke limits and adjusted speeds are void in manual mode.

● **Display 3 = Setting of switches (alarm limits)**

This mode allows to display and adjust stroke-dependent alarm limits, provided that the supplementary module for digital feedback is plugged into the positioner. Without the module, this function is not active.

Displaying the alarm limits

Press briefly the “Up” (high alarm limit) or “Down” (low alarm limit) button.

The display will change over from the current position between 0 and 100 % to the alarm limit for around 1 second.

Adjusting new alarm limits

First select operating mode “Display 2 = Manual control” at the operator panel and then set the actuator manually to the position of the desired alarm limit.

Then select operating mode “Display 3 = Alarm limits”. Subsequently press the “Up” (high alarm limit) or “Down” (low alarm limit) button and hold it until the displayed countdown from 3 to 0 is terminated.

With this procedure you can adjust and save both alarm limits, one after the other. If you still hold the “Up” or “Down” button after the countdown is finished, “P21” (for the low alarm limit) or “P22” (for the high alarm limit) is shown by the display for a short time. Then the alarm limit in %, referred to the stroke of 0...100%, is shown.

Operating level 2

You can only access and exit operating level 2 for configuration through special manual entries.

● **Calling up operating level 2**

- Press “Up” and “Down” buttons **simultaneously** and **hold**
- Press “Reset” **briefly** and **release**
- **Wait** until displayed countdown from 3 to 0 is finished**,** then **release** “Up” and “Down” buttons

The display first shows the operating mode (e.g. 2.2) and then a flashing arrow (see Fig. 18), which indicates that a change-over to operating level 2 takes place.

If the positioner was working in the mode “Controlling adaptive”, the newly determined values are saved. This is indicated by the characters “EE” shown on the display.

● **Exiting operating level 2**

- Press “Reset” **briefly** and **release.**
  Newly determined values are rejected.
  This is indicated by “EEL“ shown on the display.
  Press “Reset” briefly again to return completely to operating level 1.
- Press “Reset” and **hold**,
  wait until displayed countdown form 3 to 0 is terminated, then **release** “Reset”**.**

  You are returned to operating level 1,
  all new parameters are saved in the non-volatile memory.
  This is indicated by “EEP” shown on the display.

  A flashing colon appears in the display if there are values which have not yet been saved in the non-volatile memory (see Fig. 18).

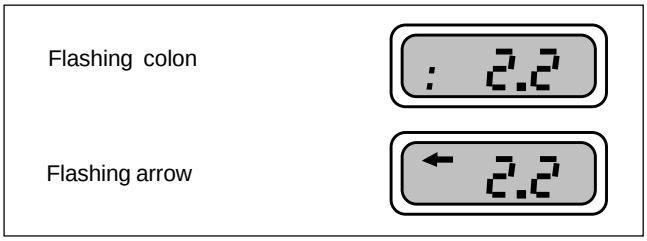


Abb. 18 Symbols shown by the display

After calling up operating level 2 you can also select four operating modes (0 - 1 - 2 - 3).

● **Display 2.0 = Autostroke**

In “Autostroke” mode the positioner adapts itself automatically to the following operating parameters:

- Actuator action
  (direction of action with compressed air)
- Displacement of the actuator/valve
  (from stop 0 to stop 100%)
- Positioning time for both directions
  (filling the actuator with air and evacuating air)
- Control parameters for stable control of the position
- OFFSET for the I/P module

When this mode is called up, “2.0” is shown in the display. To start the Autostroke,

- press the “Up” and “Down” buttons **simultaneously** and **hold,**
- **wait** until the displayed countdown from 3 to 0 is terminated, **then** release the “Up” and “Down” buttons.

The procedure of the Autostroke is continuously indicated by codes that occur in the display (see Appendix 6).

Note that normal control is interrupted while the Autostroke is running.

You can abort the Autostroke at any time by pressing the "Reset" button.

If unpermissible values are determined, the Autostroke is automatically aborted and an error code is shown by the display (see Appendix 7)

- **Display 2.1 = Man. dead band adjustment**

In this mode the positioner can be adapted to the dynamic and the hysteresis of the actuator. When this mode is called up, the display first shows the mode number (2.1) for around 1 second, and then the currently active value.

The adjustable range is between 0.30...10.00 %, the factory setting is 0.3 %. Press the "Up" or "Down" button to change the setting. Note that the adjustment is done on line, i.e. the settings are immediately taken over.

The smallest dead band value is determined during the Autostroke. Via the operator panel only higher values can be set, if this should be required to improve stability.

- **Display 2.2 = Position sensor span**

In this mode the actually used angle of rotation or angular range is scanned. When this mode is called up, the display first shows the mode number (2.2) and then the determined value.

Normally, the default angle of rotation 0...100 %. is indicated. Do not confound this reading with the 0...100% display of the stroke (see Fig. 2). The angle of rotation in % for a stroke of 0 % and of 100 % can be seen by pressing the "Up" and "Down" buttons. Press both buttons together for a quick run. Note that the order in which the buttons are pressed determines the direction.

The scanned values result from the mechanical linkage and the transmission to the shaft for position feedback.

- **Display 2.3 = Zero adjustment**

In this mode a zero adjustment between the 4...20mA input signal and the 0...100 % stroke can be performed. When this mode is called up, the display first shows the mode number (2.3) for around 1 second. Then the position controlled with the currently applied input signal is shown.

Press the "Up" or "Down" button to set the deviation to "0". Deviation "0" means that the positioning signal, e.g. 50% (12 mA) will exactly set the actuator to a position of 50%. The adjustment takes place on line, i.e. the adjusted values are immediately active.

When you return to operating level 1, there is the choice between saving the data in the non-volatile memory and returning without save.

All parameters - although entered in different modes - are saved at the same time.

5. Certificates

Conformity certificates, various explosion protection approvals and declarations stating that the requirements of the EC regulations for EMC and for the CE conformity mark are met are available upon request as separate documents.

6. Steps of the Autostroke

The LC display shows codes that occur during the autostroking procedure. The following is a reference list.

Display	Autostroking function
10	Evacuate air completely from actuator
11	Save position when air is completely evacuated
12	Determine and save resolution (A/D conversion)
20	Fill actuator completely with air
21	Save position when actuator is completely filled with air
30	Prepare determination of stroke time
31	Set valve from 100 % to 0 % position, measure and save stroke time
32	Set valve from 0 % to 100 % position, measure and save stroke time
40	Determine and save dead band (smallest possible value). Determine and save PD control parameters for rapid control of deviation **>** dead band
50 - 120	Determine and save PID control parameters for fine adjustment of control deviation **<** dead band
200	Autostroke finished

The list applies to a full autostroke. When you are using a PC with TZID software it is also possible to perform partial Autostrokes, as listed below:

- Stops only (steps 10 to 32/200)
- Parameters only (steps 40 to 120/200)
- Zero only (refer to the reference list seen below for the steps and their meaning [1])

Display	Autostroking function
10	Drive actuator to closed position
11	Save closed position
12	Determine and save resolution (A/D conversion)
13	Zero adjustment
200	Autostroke finished (determined values must be saved in the non-volatile memory)

[1]) "Zero" autostroking requires that the range has been determined before in the "Adjustment" window of the IBIS software.

7. Error codes shown by the display

Error code shown by display	Reason	Effect	Required user action
E01	Fatal error in boot phase	Control is disturbed	Load factory setting *)
E02	No valid configuration data available in EEPROM	Control is disturbed	Load factory setting *)
E03 - 11 E15 - 17 E90 - 91 E26 + 28 + 35	Internal data error	Air is evacuated from output or output is blocked, depending on model	Press “Reset” button, if this does not solve the problem load factory setting *)
E13 - 14	High or low alarm limit of digital feedback is out of range	None	Correct adjustment of alarm limits
E15 - 17	Internal data error	Air is evacuated from output or output is blocked, depending on model	Press “Reset” button, if this does not solve the problem load factory setting *)
E18	Reached stop of angle of rotation	Control is stopped, current position is blocked	Check mechanical linkage for position sensing, reset to the adjusted range
E19	Positioning time-out	None	Check actuator/valve, check air tubing
E20	Autostroke disabled	None	Enable Autostroke (only possible via PC with appropriate TZID software)
E21	Autostroke time-out (time limit for 1 autostroke step is around 100 sec.)	Autostroke is aborted	Check actuator/valve, check air tubing
E22	Angular range exceeded during Autostroke	Autostroke is aborted	Check mechanical linkage for position sensing, reset to range
E23	Used angular range too small	Autostroke is aborted	Check mechanical linkage for position sensing, set to at least 20% of range
E24	Wrong direction of action of actuator (only for “zero” autostroke)	Autostroke is aborted	Correct direction of action of the actuator (only possible via PC with appropriate TZID software)
E27	Autostroke manually aborted	Autostroke is aborted	Press Reset button to acknowledge
E30/31	Dead band too small (30) or too big (31)	None	Set dead band to permissible range
E32/33	Manual zero adjustment in operating mode 2.3 out of range	None	Set zero to permissible range
E34	Automatic control not active (operating mode 1.2-1.3-2.1-2.2-2.3 or 2.0 during autostroke)	None	Activate automatic control in operating mode 1.0 or 1.1 if you want to terminate the the inactive state.
E37	Signal out of 4...20 mA range	None	Set signal to 4...20 mA range
E40	Configuration disabled	None	Enable configuration (only possible via PC with appropriate TZID software)

*) See "commissioning", 6.7

Error code shown by display	Reason	Effect	Required user action
E41	Output 0 and 100 % not entered manually (only for “zero” autostroke)	Autostroke is aborted	Enter output 0 and 100 % (only possible via PC with appropriate TZID software)
E42	Leakage in actuator or tubes	None	Check actuator or tubes for leakage
E43	Limits of stroke counter or displacement meter for diagnosis exceeded	None	Start appropriate diagnosis steps
E77/80	Total EEPROM data loss	Air is evacuated from output or output is blocked, depending on model	Load factory setting *) or specific setting for TAG
E78/81/82	EEPROM defective, data can only be read (no write access)	Saving data in the non-volatile memory is no longer possible	Replace device
E79/	EEPROM defective	Air is evacuated from output. or output is blocked, depending on model	Replace device
E92	Short-time interruption of input signal for > 20 ms	Air is evacuated from output or output is blocked, depending on model	Check input signal
E93	Watchdog, internal self-monitoring	Air is evacuated from output or output is blocked, depending on model	Press RESET button check environment for EMI

Subject to technical changes.

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