

I/P signal converter

Operating manual

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1 Safety and precautions



Warning

**Important instructions for your safety!
Read and observe!**

1.1 General safety instructions

Correct and safe operation of the Signal Converter calls for appropriate transportation and storage, expert installation and commissioning, correct operation and careful maintenance.

Only those persons familiar with the installation, commissioning, operation and maintenance of this signal converter or similar instruments and who have the required qualification are allowed to work on the device.

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 signal converter in other countries, the national regulations, standards and directives applicable in the respective country must be observed.

The signal converter has been manufactured and tested in accordance with DIN VDE 0411 Part 1

“Safety Requirements for Electronic Measuring Apparatuses”
and has been supplied in a safe condition.

Prior to delivery, all devices have been tested for proper and safe operation. These operating instructions contain warnings and cautions marked with \triangle . The instructions given in these sections must be observed to retain the device in a safe condition and to ensure safe operation. Otherwise, persons can be endangered or the device itself 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.

1.2 Requirements/conditions for safe use of explosion-proof signal converters (type Doc. 900771



Prior to installing check to ensure that the specifications in terms of safety and control applicable to the signal converter will not be exceeded.

When making the electrical connections observe the specifications in section "Technical data" and the specifications in the explosion protection certificate.

The device must be supplied with instrument air that is free of oil, water and dust. Do not use flammable gas nor oxygen or oxygen-enriched gas.

Do not open the device immediately after switch-off. Wait for at least 4 minutes.

Handle the cover with care. Otherwise, the thread may be damaged. This will void the explosion protection (Ex d).



Warning

Exclusively use cable glands with full Ex-d approval for EEx-d operation.

Secure the cable and tube entries against turning and loosening by using security adhesive of medium strength.

If the signal converter is used at an ambient temperature above 60 °C (140°F) or below -20 °C (-4 °F), use cable entries and cables approved for a service temperature corresponding to the maximum ambient temperature increased by 10 K or corresponding to the minimum ambient temperature, respectively.

Devices which – in the new state – comply with type of protection “Ex-ia” and “Ex-d” should not be used intrinsically safe “Ex-ia” once they have been commissioned and used in an environment with type of protection “Ex-d”, since the electronics may have been damaged.

Specifications:

Input signal

(0) 4...20 mA

Supply pressure, depending on type:

1.4 - 10 bar

1.4 - 4 bar

other ranges depending on type

Thermal specifications for explosion protection type Ex d:

The following limit values for the temperature classes must be observed for the intrinsically safe versions of the control unit:

Temperature class	Input current [mA]	Ambient temperature [°C]
T6	50 mA	-40° C...60° C
T6	60 mA	-40° C...55° C
T5	60 mA	-40° C...70° C
T4	60 mA	-40° C...85° C
T5	100 mA	-40° C...55° C
T4	100 mA	-40° C...85° C
T5	120 mA	-40° C...45° C
T4	120 mA	-40° C...80° C
T4	150 mA	-40° C...70° C

The following limit values for the temperature classes must be observed for the non-intrinsically safe versions of the control unit:

Temperature class	Input current [mA]	Ambient temperature [°C]
T6	50 mA	-40° C...55° C
T5	50 mA	-40° C...70° C
T4	50 mA	-40° C...85° C

2 General

2.1 Application and brief description

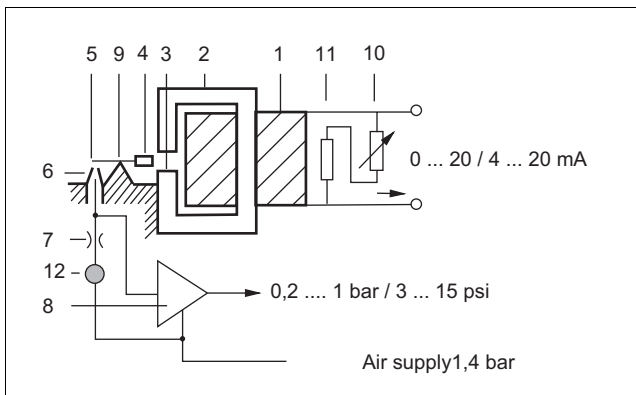


Fig. 1 Functional diagram

The Signal Converter converts electrical into pneumatic standard signals, e.g. 4...20 mA into 0.2...1 bar. It is therefore a connecting link between the electrical/electronic and the pneumatic systems. The patented signal conversion principle is based on the force balance method. Force balancing takes place at the lever arm which is pivoted with a tension band at (9).

The coil (1) and yoke (2) generate a magnetic field in the air gap (3) which applies a force to the magnet (4) on the lever arm. The force changes in proportion to the current (input signal) flowing through the coil (1).

On the other side of the lever arm a counterforce is applied through the dynamic air pressure present at the air nozzle (6)

and the flapper (5). The force is controlled in such a way that a balance of the two torques is achieved. If a torque imbalance occurs, the lever arm is rotated. This rotation changes the air gap between the nozzle (6) and the flapper (5) and, thus, the dynamic air pressure.

Air is permanently supplied to the nozzle (6) through the throttle (7). The power stage (8) converts the dynamic air pressure into a 0.2...1 bar or 3...15 psi output signal.

The pneumatic module needs permanent air supply with a pressure of 1.4 bar for proper operation.

Zero adjustment can be done on the tension band suspension (9), and range adjustment on the potentiometer (10).

Special features of the signal converter are its relatively small dimensions and high operational stability when submitted to shock and vibration. The stability is due to the light weight (only 100 mg) of the moving system, which consists of the lever arm with the magnet (4) and the flapper (5).

The air filter (12) prevents malfunctions caused by polluted air. Note that the filter capacity is only sufficient for collecting dirt that occurs occasionally (e.g. residual dirt in the air pipes at first use). It is no substitute for proper air conditioning.

2.2 Deliverables

For details on the deliverable signal converter models and their accessories please refer to data sheet 10/18-0.10 EN, which also includes the catalog numbers of the individual items.

2.3 Scope of delivery

Check the delivery (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 unit as extra items:

- Terminal boards for the 19" slide-in unit (needed for the installation in a sub-rack)
- Mounting bracket for the aluminum or stainless steel field housing unit (for wall or 2" pipe mounting)
- Cable entry for signal converter with "EEx d" explosion protection

2.4 CE compliance information

We herewith declare that we are the manufacturer of the signal converter and that the device meets the requirements of the EC directive 89/336/EEC as of May 1989 due to compliance with the following standards:

RFI suppression

EN 55011 as of 1991

EMI/RFI shielding

EN 50082-1 as of January 1991

EN 50082-2 (PR) as of November 1993

The signal converter meets the requirements of the EC directive for CE conformity certification.

3 Mounting

3.1 Operating conditions at the installation site



Prior to mounting check to ensure that the specifications in terms of safety and control applicable to the signal converter will not be exceeded.

Ambient temperature:

40...+85 °C or -55...+85 °C, depending on the ordered model (see also additional information under "Technical Data")

Protection:

IP 20	with control room housing unit for rail or block mounting
IP 20	with 19" slide-in unit, front
IP 00	with 19" slide-in unit, rear
IP 54	with plastic housing
IP 65	with aluminum/stainless steel field housings

Explosion protection:

ATEX EEx ia or EEx d

CENELEC EEx ia or EEx d

BRITISH Standards Ex N

FM/CSA intrinsically safe

FM/CSA explosion proof

(see also additional information under "Technical Data")

Mounting orientation:

any orientation allowed

3.2 Mounting the control room housing unit for rail mounting

This model is snap-mounted on a DIN top-hat rail.

The signal converter has a special mounting base. Due to its universal design it is suitable for mounting to EN 50022 - 35x7.5, EN 50045 - 15x5 and EN 50035 - G32 rails. Preferably position the signal converter with the electrical connection towards the left hand side when mounting to a vertical rail, and upwards when mounting to a horizontal rail.

3.3 Mounting the control room housing unit for block mounting

This signal converter model is mounted using a special mounting block for a maximum of 4 signal converters. 2, 3 or 4 mounting blocks can be arranged in a group, such that units of 4, 8, 12 or 16 signal converters are formed.

The material for grouping the mounting blocks is delivered as a mounting kit to be assembled by the customer. The kit includes the mounting blocks, and the necessary screws and packings (O-rings), see Fig. 2 for the parts and for the required mounting steps.

Air is supplied to all connected devices through the central connection block. A non-return coupling is provided in the supply pipe for every signal converter. As a result, it is possible to leave individual connection points of the block unused, or to connect/disconnect signal converters while the system is running.

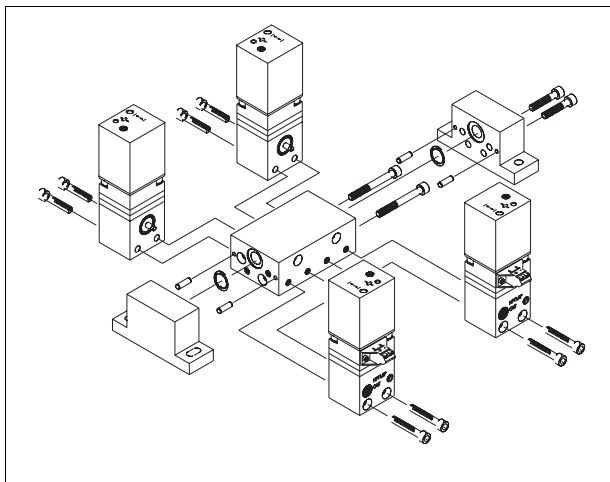


Fig. 2 **Block mounting**

3.4 Mounting the 19" slide-in unit

A sub-rack and a terminal board are needed for installing the 19" slide-in unit.

Off-the-shelf sub-racks, 3 U high and with a width suitable for 7 TE (part units) for each slide-in unit, can be used.

Note that the appropriate terminal boards are especially designed for the device and are only available from us.

The following types are available:

- Terminal board for standard model or for explosion-proof model
- Terminal board for 19" slide-in module with 1 or 2 signal converters

Before installing make sure that the terminal boards and slide-in units fit together.

Install the terminal boards on the inside of the sub-rack rear plate using two M2.5 screws. One terminal board is required for each slide-in unit.

The 2-pin electric plug and the 2 pneumatic module couplings with non-return valves on the inside of the terminal board establish the connection to the slide-in unit. The connections for the electrical cable (2-pole screw-terminal) and the 2 air pipes (two 1/8 NPT threads) are located on the outside.

3.5 Mounting the plastic field housing unit



Warning

When using units for operation with inflammable gas note that only outdoor installation is permissible.

The plastic housing is designed for installation on site. It is attached to the wall or on a vertical 2" pipe.

Preferably orient the unit in such a way that the connections for the input and output signals are at the bottom.

3.6 Mounting the aluminum or stainless steel field housing unit



Warning

Preferably position the unit such that the cable gland is oriented towards the bottom or horizontally to reduce moisture penetration.

The ruggedized housing is suitable for outdoor installation and can be exposed to environmental influences. A stainless steel mounting bracket can be ordered as an accessory part. It is available for either wall-mounting only or as a universal model for both wall mounting and 2" pipe mounting.

4 Connecting

4.1 Electrical connection



When making the electrical installation observe:

- the relevant regulations and safety standards pertaining to the installation and operation of electrical systems.
- the additional regulations, standards and directives governing the installation and operation of explosion-proof systems, if explosion-proof devices are used.
- the specifications in “Technical Data”. For explosion-proof devices also observe the specifications in the explosion protection certificate.

Do not run signal cables close to power lines. Power lines produce interference in their near vicinity which impairs the signals transmitted on the line.

Exclusively 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.

A 2-pole screw-terminal for cables with a max. cross-sectional area of 2.5 mm² is used for making the electrical connection. Observe the +/- polarity when connecting the cable.

The screw-terminal of the control room housing unit for rail or block mounting is located on the side of the device, and the one of the 19" slide-in unit is on the back of the sub-rack. The screw terminal of the plastic, aluminum or stainless steel field housing unit is accommodated inside the housing, i.e. the field housing must be opened for connecting the cable.

The field housings are provided with cable entries of different types:

Plastic field housing unit:

Pg 11 cable gland

Aluminum or stainless steel field housing:

standard or EEx ia or Ex N	Pg 13.5 cable gland
EEx d	M 20x1.5 ¹ thread
FM/CSA "intrinsically safe" or "explosion proof"	1/2 NPT thread

-
1. a cable gland with Ex certificate INIEX 88B. 103. 748 can be delivered as a loose part for EEx d (see "Accessories" in Section "Ordering information" of data sheet 10/18-0.10 EN).

4.2 Pneumatic connection



The supply air must be free of oil, water and dust in accordance with DIN/ISO 8573-1, Class 3. The dew point must be 10 K below the minimum operating temperature.

When using plastic housing units for operation with inflammable gas, an additional pipe for evacuating the gas to a non-hazardous place must be laid.

1/8 NPT, 1/4 NPT or 3/8 NPT connections are provided for connecting the air pipes (for air supply and output, see “Technical data” for details).

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

The connections for air supply and output are marked accordingly.

The supply pressure for the signal converter has to be set to:

1.4 ± 0.1 bar (20 ± 1.5 psi) for output 0.2...1 bar (3...15 psi)

2.5 ± 0.1 bar (40 ± 1.6 psi) for output 0.4...2 bar (6...30 psi)

The max. permissible overload limit for the supply pressure is 4 bar. Make sure that the pressure does not exceed 4 bar (60 psi) even in case of failure.

5 Commissioning

The signal converter is ready for operation immediately after installation and connection.
No further adjustment is required.

6 Maintenance

The signal converter is maintenance-free. Note that the supplied instrument air must be free of oil, water and dust to ensure trouble-free operation.

It is recommended to check on a regular basis the built-in textile filter for the degree of pollution and the signal conversion to see if the values are still within the tolerance limits.

6.1 Checking / replacing the air filter



Warning

Switch off the air supply before replacing the filter element.

If the supply air for the signal converter has not been conditioned properly (see “Technical Data” for air quality specifications), the built-in textile filter protects the sensitive air nozzles and throttles from being obstructed with dirt. However, the filter capacity suffices only for occasionally collecting little dirt. In case of a pollution over a longer time the filter gets choked.

To check the degree of filter pollution first open the screw and then remove the filter element using tweezers (see Fig. 3). Spare filter elements are available from us under catalog number 276138 (17 mm filter element, for aluminum or stainless steel field housings) or 276145 (12 mm filter element, for control room housing or 19” slide-in units).

Due to its special design, the signal converter with plastic housing has not filter element.

The signal converter is ready to operate immediately after the filter element has been replaced. No further measures, like readjustment, are required

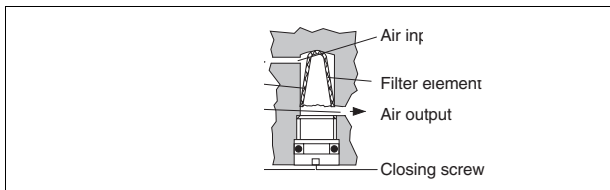


Fig. 3 Air filter (sectional drawing)

6.2 Readjusting the signal converter

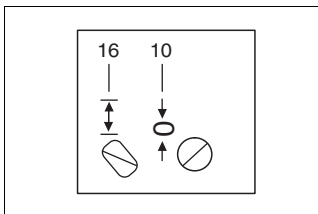


Fig. 4 Adjustment screws

The signal converters are delivered in an adjusted condition.

After longer operating periods, however, the tolerance limits may be exceeded due to aging or drift. This can be eliminated by re-adjustment.

The signal converter can be readjusted by using the two adjustment screws marked "> 0 <" for zero (10) and "<->" for span (16). When using a field housing unit first remove the cover to access the screws.

7 Technical Data

Input

Signal range

0...20 mA or 4...20 mA

0...10 mA or 10...20 mA or 4...12 mA or 12...20 mA
(other ranges on request)

Input resistance

$R_i = 260 \text{ ohms at } 20 \text{ }^\circ\text{C, } T_k + 0.4 \text{ } \%/K$

Overload limit

30 mA (see specifications "Explosion protection",
devices with explosion protection approval)

Capacitance/Inductance

negligible

Output

Signal range

0.2...1 bar or 3...15 psi

0.4...2 bar or 6...30 psi (other ranges on request)

Air capacity (max.)

$\geq 5 \text{ kg/h} = 4.1 \text{ Nm}^3/\text{h} = 2.4 \text{ scfm}$

Load characteristic to VDE/VDI 3520

$\geq 0.95 \text{ kg/h} = 0.9 \text{ Nm}^3/\text{h} = 0.5 \text{ scfm}$

Air supply

Instrument air

free of oil, water and dust to DIN/ISO 8573-1

pollution and oil contents according to Class 3

dew point 10 K below operating temperature

Supply pressure

$1.4 \pm 0.1 \text{ bar or } 20 \pm 1.5 \text{ psi}$ (for output signal 1 bar or 15 psi)

$2.5 \pm 0.1 \text{ bar or } 40 \pm 1.6 \text{ psi}$ (for output signal 2 bar or 30 psi)

Air consumption

$< 0.2 \text{ kg/h} = 0.16 \text{ Nm}^3/\text{h} = 0.1 \text{ scfm}$

Transmission data and influences

Characteristic

linear, direct or reverse action

Deviation:

$\leq 0.5\%$

Hysteresis:

$\leq 0.3\%$

Dead band:

$\leq 0.1\%$

Temperature

$\leq 0.5\%$ / 10 K between -20 and +85 °C

$\leq 2\%$ / 10 K between -55 and -20 °C

Air supply

$\leq 0.3\%$ / 0.1 bar pressure change

Mechanical vibration

$\leq 1\%$ up to 10 g and 20...80 Hz

Seismic vibration

meets requirements to DIN IEC 68-3-3 class III for strong and strongest earthquakes

Mounting orientation

$\leq 0.5\%$ at 90 ° change

Step response

10...90 % and 90...10 % 0.6 sec

5...15 % and 15... 5 % 0.25 sec

45...55 % and 55...45 % 0.2 sec

85...95 % and 95...85 % 0.15 sec

Complies with the following directives

EMC directive 89/336/EEC as of May 1989

EC directive for CE conformity certification

Environmental capabilities

Climate class

GPF or FPF to DIN 40040

Temperature -40....+85 °C or -55...85 °C for operation, storage or transportation

Relative humidity 75 % average, 95 % short-time, non-condensing

Observe the following limits:

1. For operation in hazardous areas observe the max. temperature limits specified under "Explosion protection".
2. For operation in hazardous areas and temperatures below -20 °C observe the special mounting conditions specified in the ex. protection certificate.

Explosion protection

ATEX, intrinsically safe 2G EEx ia IIC T4/T5/T6, Tüv 1487 x

ATEX, flameproof enclosure, EEx d IIC T4/T5/T6

CENELEC, intrinsically safe (all models)

EEx ia IIC T4/T5/T6, PTB No. Ex-93.C.2104X

(for control room housing and field housing units)

EEx ia IIC T4/T5/T6, BVS No. 90.C.2001X

(for 19" slide-in unit)

CENELEC, flameproof (only for "metal field housing" units)

EEx d IIC T4/T5/T6, BVS No. 90.C.2016X

Observe the following limits for the temperature classes

Temperature class	Max. short circuit current	Max. ambient temperature
T6	50 mA	60 °C
T6	60 mA	55 °C
T5	60 mA	70 °C
T5	100 mA	55 °C
T5	120 mA	45 °C
T4	60 mA	85 °C
T4	100 mA	85 °C
T4	120 mA	80 °C
T4	150 mA	70 °C

BRITISH Standards (only for "metal field housing" units)

Ex N II T6 for Zone 2, Certificate SSA 914012

FM "intrinsically safe"

(all models **except for** "metal field housing" units)

I.S.: CL I / Div 1 / Grp A B C D

N.I.: CL I / Div 2 / Grp A B C D

FM "intrinsically safe" (only for "metal field housing" units)

I.S.: CL I-II-III / Div 1 / Grp A B C D E F G

N.I.: CL I / Div 2 / Grp A B C

S.: CL II / Div 2 / Grp G

S.: CL III / Div 2

FM "explosion proof" (only for "metal field housing" units)

X.P.: CL I / Div 1 / Grp A B C D

D.I.P.: CL II III / Div 1 Grp E F G

CSA 2 "intrinsically safe"

(all models **except for** "metal field housing" units)

I.S.: CL I / Div 1 / Grp A B C D

CL I / Div 2 / Grp A B C D

CSA "intrinsically safe" (only for "metal field housing" units)

I.S.: CL I / Div 1 / Grp A B C D

CL II / Div 1 / Grp E F G

CL III

CL I / Div 2 / Grp A B C D

CL II / Div 2 / Grp E F G

CSA "explosion proof" (only for "metal field housing" units)

X.P.: CL I / Div 1 / Grp B C D

CL II / Div 1 / Grp E F G

Other explosion protection certificates on request

Control room housing unit for block mounting (EPC3020)

Material/protection

Aluminium housing, IP 20, with plastic cap

Mounting

blockwise, with special mounting blocks (accessory parts),
max. 4 mounting blocks with 4 signal converters, each

Electrical connection

2-pole screw terminal for 2.5 mm²

Pneumatic connection

3/8 NPT thread for air supply
(connected to central connection block)

1/8 NPT for output
(on each signal converter)

Mounting orientation: any

Weight: 0.3 kg (each signal converter)

Dimensions: see dimensional drawing

Aluminium/stainless steel field housing unit (EPC3065)

Material/protection

Aluminium or stainless steel housing, IP 65

Surface

Aluminium housing, varnished, two-component varnish

Bottom part of housing varnished black, RAL 9005

Cover light gray, RAL 9002

Stainless steel housing

Electropolished

Mounting

Wall mounting or 2" pipe mounting

with separate stainless steel mounting bracket (accessory part)

Electrical connection

2-pole screw terminal for 2.5 mm² in housing

with PG 13.5 cable gland

for "standard", "CENELEC intrinsically safe" / ATEX EEx d
and

for "BRITISH Standards Ex N"

with M 20x1.5 thread

for "CENELEC EEx d"/ATEX EEx d

(on request cable gland with Ex d certificate as accessory part)

with 1/2 NPT thread for cable entry

for FM/CSA/ATEX EEx d

Pneumatic connection

two 1/4 NPT threads for air supply and output

Mounting orientation: any

Weight:

0.62 kg with aluminium housing

1.20 kg with stainless steel housing

Dimensions: see dimensional drawing

Accessories

Terminal board for 19" slide-in unit,

Screw terminal for electrical connection,
1/8 NPT thread for pneumatic connection

EEx d cable gland

Made of brass, with M 20x1.5 thread

Stainless steel mounting bracket for wall-mounting or 2" pipe mount.

For aluminium or stainless steel field housing

Material for block mounting

Mounting block for 4 signal converters

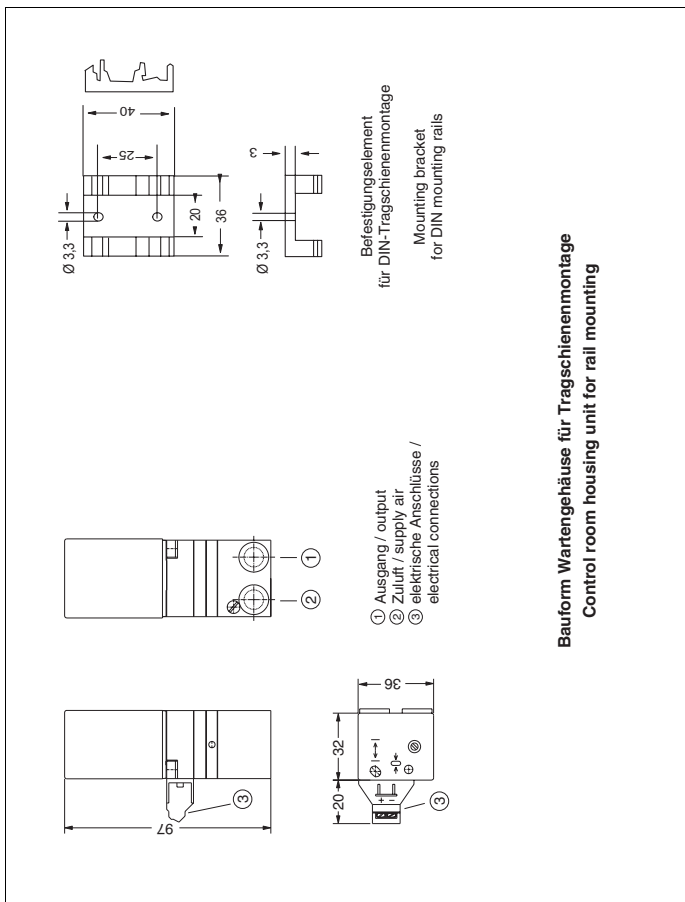
Panel with central 3/8 NPT air connection

Dummy panel

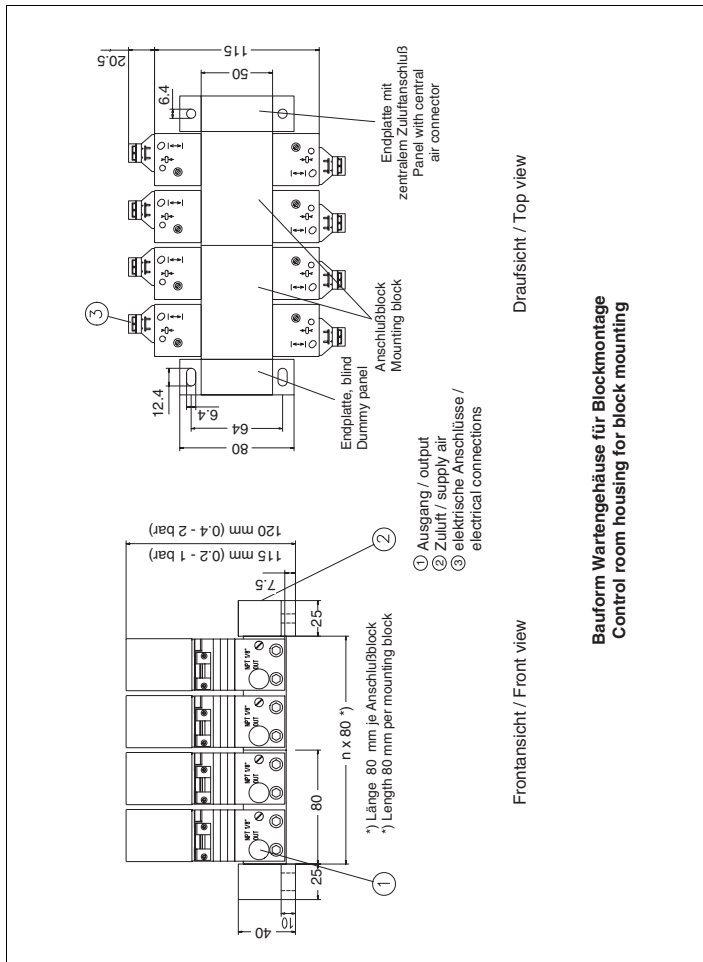
Spare parts

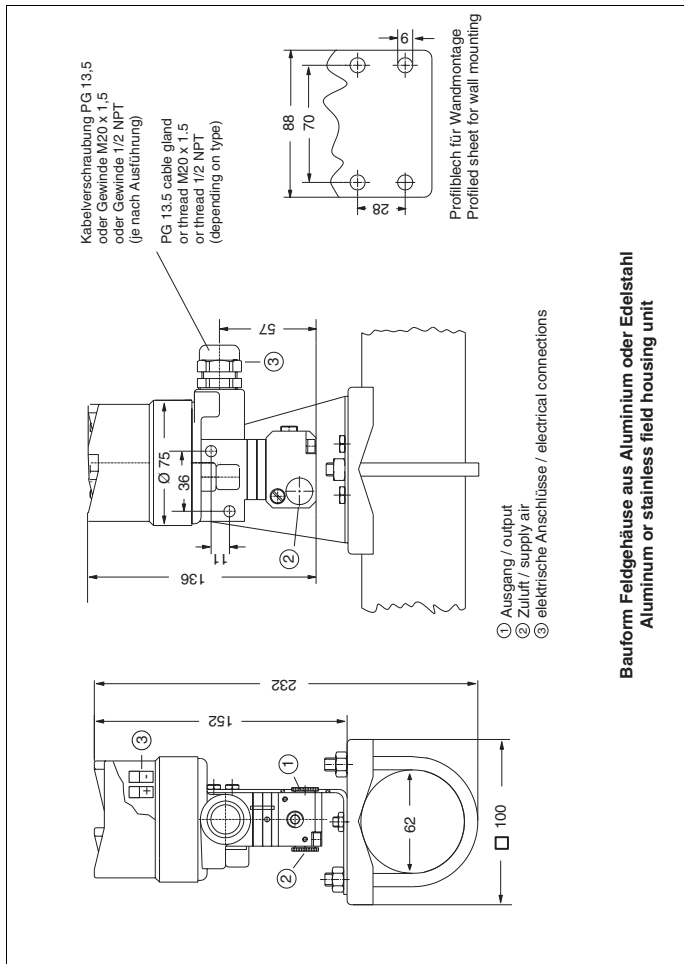
Except for the textile filter, the signal converter is wear free and does not require maintenance. Therefore, filter elements are the only spare parts that should be kept on stock (refer to Section "Maintenance" for the catalog no.)

8 Dimensional drawings, conn. diagrams



Bauform Wartengehäuse für Tragschienenmontage
Control room housing unit for rail mounting





Bauform Feldgehäuse aus Aluminium oder Edelstahl
Aluminium or stainless field housing unit