



OPTIBAR FC 1000 Technical Datasheet

Compact flow computer for gas, liquid and steam measurements

- High performance flow and energy calculation
- Quick and easy-to-operate via TFT touch screen
- Enables split-range operation with two pressure transmitters

The documentation is only complete when used in combination with the relevant documentation for the sensor.

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1.1 Compact flow and energy computer OPTIBAR FC 1000

The OPTIBAR FC 1000 is a compact, high performance flow computer for volumetric flow calculation and heat quantity measurement of liquids and gases, including saturated steam and superheated steam. Commissioning and operation of the flow computer is quick and easy thanks to its user-friendly operating philosophy. The full-screen, multi-colour touch screen offers extensive options for customizing the display of process readings to suit any customer applications. Communication and measured data transmission via HART protocol as well as the option for split-range operation allows very accurate differential pressure (DP) flow measurements especially at low working pressures. This makes this device an ideal enhancement for gas measurements with averaging pitot-tubes as well as flow nozzle meters or Venturi meters with high measuring dynamics.

Its compliance with IAPWS-97 for water and steam calculations with condensate detection, makes it particularly useful for differential pressure (DP) flow measurement of saturated and super-heated steam.

In addition, a variety of other calculation models are available for the correction calculation of gases and liquids. For highly accurate measurements, the KROHNE flow computer provides correction of linearity errors of DP flow elements in real-time and in accordance with ISO 5167 requirements.

Highlights

- High performance flow and energy calculation with DP flow elements, volumetric or mass flowmeters
- Enables split-range operation with two pressure transmitters for improved measuring dynamics
- User interface can be customized to suit specific application requirements
- Supports split-range operation and automatic zero calibration
- High system capacity with correction calculation according to complex models such as AGA-8, SGERG-88, AGA-NX 19, ISO 20765-1, AGA-3, AGA-5, AGA-7, AGA-10 and AGA-11
- Optional calculation correction according to the following equations of state: Ideal gas, Redlich-Kwong, Redlich-Kwong-Soave, Peng-Robinson, AGA-8 DC/GC, SGERG 88, AGA-NX19 (gases), IAPWS-97 (water, steam) and value tables (liquids, heat transfer media)
- Digital communication to connected pressure transmitters via HART
- Integrated FSK-modem for 2 analogue inputs: makes parameterization easy and eliminates additional sources of uncertainty in the signal exchange
- HART communication with all common DP transmitters for loss-free measured data transmission and possibility of automatic zero point adjustment

Industries

- Power generation/Utilities
- HVAC
- Food and Beverages
- Pulp and Paper
- Mining and Minerals
- Chemical and Petrochemical

Typical application fluids

- Steam/Heat energy and mass measurement
- Water (condensate, feed-water)
- Heat transfer fluids
- Technical gases
- Compressed air
- Fresh and combustion air
- Flue gases

Typical applications

- High performance dp flow applications
- Energy consumption metering
- Combustion air metering
- Steam measurement
- Heat transfer net metering

Calculation algorithms

- Water and steam: IAPWS-97
- Technical gases: ideal gas law, various real gas equations, natural gas algorithms
- Heat carrier oils: parameterization based on individual properties
- Other fluids: constant characteristics
- Flow meter : special calculation algorithms for differential pressure instruments, ultrasonic flow meters, volumetric instruments and mass flow sensors

Input signals

- Flow: 2 × 0/4 ... 20 mA with FSK-modem for HART-devices, 2 × frequency Input
- Temperature: 2 × Pt100, 2 × 0/4 ... 20 mA
- Absolute pressure: 1 × 0/4 ... 20 mA

Output signals

- Analog: 2 × 0/4 ... 20 mA
- Relay: 1 × mechanical relay, 2 × electronic relays
- Fieldbus interfaces: Modbus RTU and TCP, M-Bus, Profibus DP and Profinet with separate media converter

1.2 Options and variants

Panel mounting housing



- Easy mounting in a panel cut-out
- Robust stainless steel electronics housing
- Degree of protection of display IP54 and of back side (connections) IP20

Wall mounting housing



- Easy mounting via 4 mounting holes
- Robust light aluminum electronics housing
- Degree of protection IP65

2.1 Technical data

- The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).

2.1.1 Connections and interfaces

Electrical connection

AC power supply	100 ... 240 V AC ± 10 %; 50 ... 60 Hz ± 5 %
DC power supply (optional)	18 ... 30 V DC ± 10 %
Power consumption	max. 20 VA

Inputs

Analog inputs	
Number	4 (2 of which have HART [®] capability ¹)
Measuring range	0/4 ... 20 mA
Percentage error	0.1 % of measured value or 0.05 % of upper range value
Burden	22 Ω (262 Ω for the HART [®] -enabled inputs)
Pt100 / RTD inputs	
Number	2
Connection type	3- or 4-wire connection
Measuring range	-200 ... +750 °C
Divergence	typ. ± 0.005 K
Feed current	250 μ A
Pulse / frequency inputs	
Number	2
Switching threshold	0 signal: 0 ... 2 V; 1 signal: 3 ... 24 V
Frequency range	0 ... 10 kHz; EN 1434 Cl. IB, IC, ID, IE

Outputs

Analog outputs	
Number	2
Output range	0/4 ... 20 mA; output voltage 15 V
Percentage error	0.1 % of the output value or 0.05 % of the upper range value
Burden	max. 500 Ω
Switching outputs	
Number	3
1 × mechanical relay (normally open/normally closed)	230 V AC; 6 A
1 × electronic relay (normally open)	40 V AC/60 V DC; 120 mA max. switching frequency: 150 Hz
1 × electronic relay (normally closed)	40 V AC/60 V DC; 120 mA max. switching frequency: 150 Hz
Digital interfaces	
USB port	logging function and updates
Ethernet interface	Modbus Slave TCP and web interface that displays the measured data
First digital interface	Modbus Slave RTU or Modbus Master RTU or M-Bus (ordering option); (optional connection of an external converter to Profibus DP Slave or Profinet Slave)
Second digital interface (optional)	Modbus Slave RTU or Modbus Master RTU (optional connection of an external converter to Profibus DP Slave or Profinet Slave)

Table 2-1: Technical data: connections and interfaces

¹ Compatible differential pressure transmitters for use with the HART® interface:

KROHNE OPTIBAR DP 7060
 KROHNE OPTIBAR DP 3050
 Siemens SITRANS P DS III, P320, P420
 Endress+Hauser Deltabar S PMD 75
 ABB 266MST
 VEGA VegaDif 65, VegaDif 85
 Yokogawa DPharp EJX 110A
 Rosemount 3051C
 others on request

2.1.2 User interface

Touch display

Dimension	95 W × 53.5 H (in mm ²)
Aspect Ratio/Resolution	16:9; 480 pixels × 272 pixels
Technology	TFT color display with capacitive touch screen

Table 2-2: Technical data: user interface

2.1.3 Housing and dimensions

Panel mounting housing

Material

Display front	Plastic
Electronics housing	Stainless steel

Dimensions

Display front	144 mm × 83 mm × 14 mm
Electronics housing	135 mm × 65 mm × 119 mm
Panel breakout	136.5 ± 1 mm × 70 ± 3 mm
Degree of protection	
Display front	IP54
Electronics housing	IP20
Environmental conditions	
Operating temperature	−20 ... 55 °C
Storage temperature	−40 ... 85 °C
Relative air humidity	0 ... 95 %; non-condensing
Installation height	Up to 2000 m

Table 2-3: Technical data: panel mounting housing

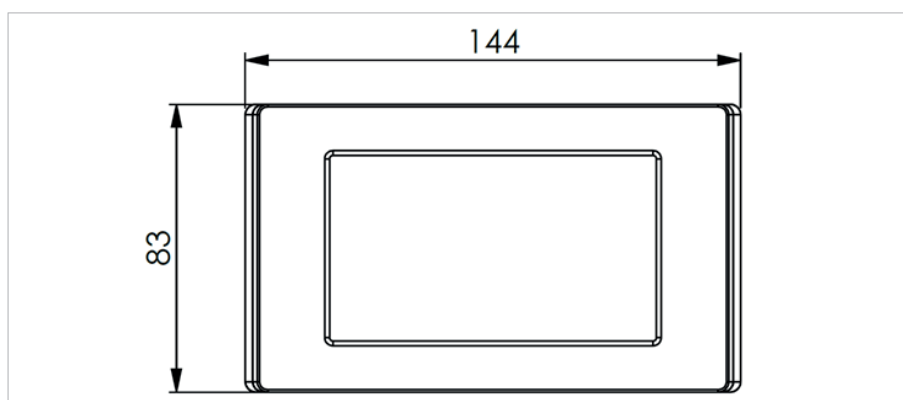


Figure 2-1: Front view

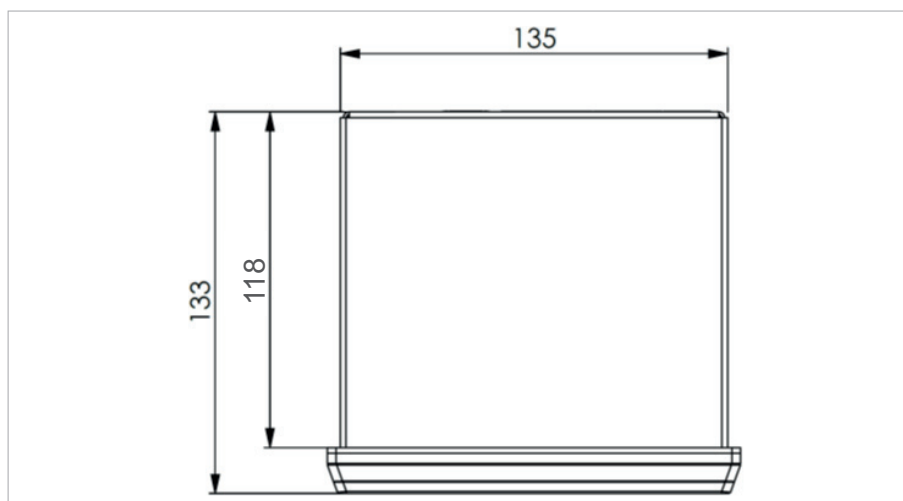


Figure 2-2: Top view

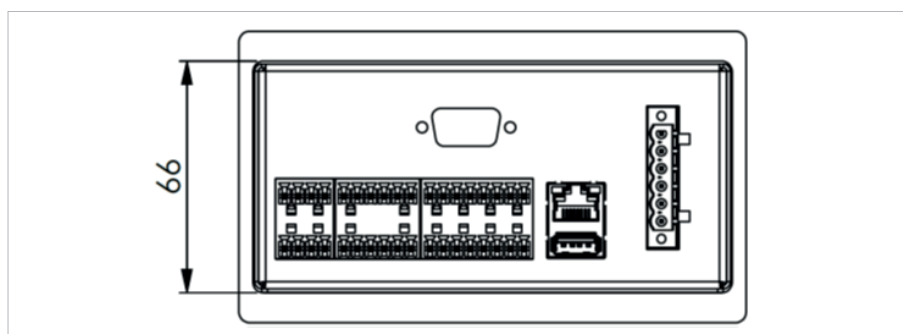


Figure 2-3: Back view

Wall mounting housing

Material

Display front	Glass
Housing	Aluminum

Dimensions

Housing	299 mm × 173 mm × 60.2 mm
Degree of protection	
Housing	IP65
Environmental conditions	
Operating temperature	-20 ... 55 °C
Storage temperature	-40 ... 85 °C
Installation height	Up to 2000 m

Table 2-4: Technical data: wall mounting housing

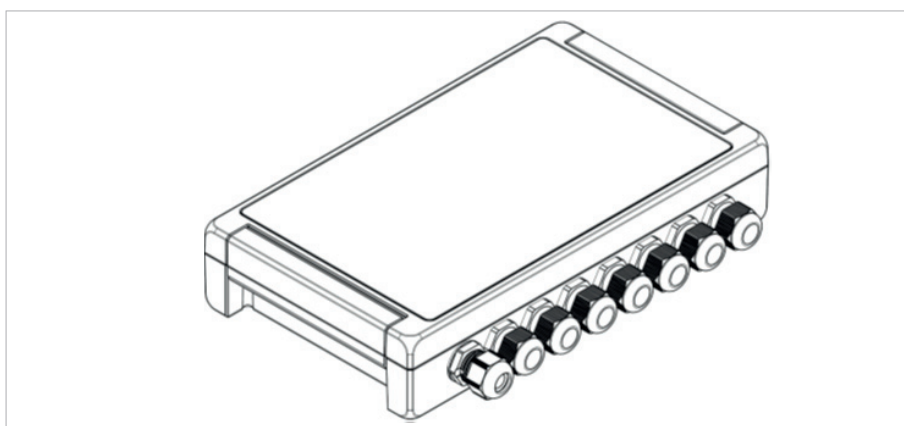


Figure 2-4: Housing for wall mounting with cable glands

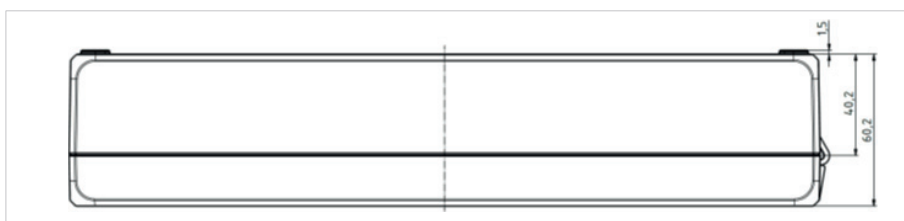


Figure 2-5: Top view

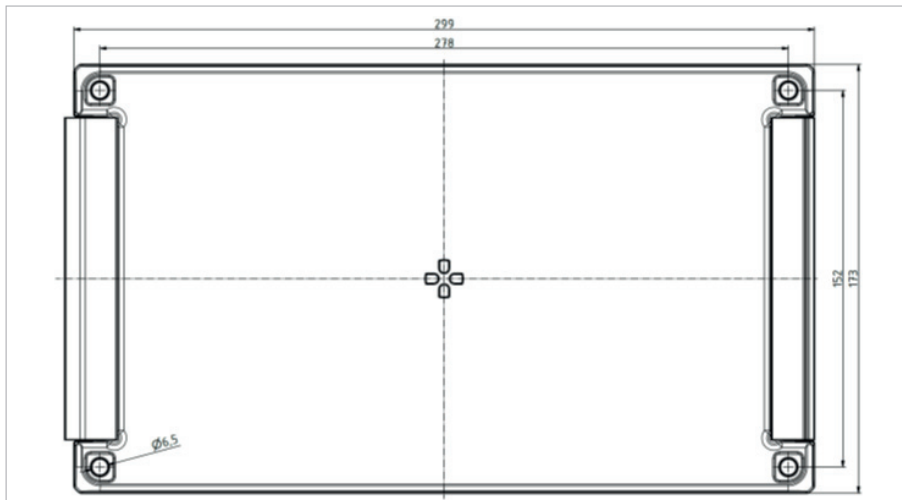


Figure 2-6: Bottom view with mounting holes

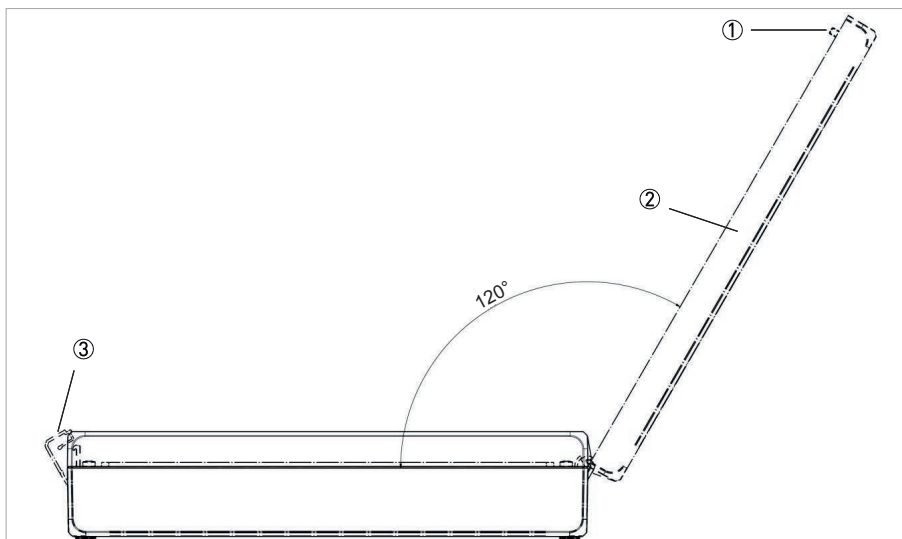


Figure 2-7: Housing with opened cover

- ① Locking screw
- ② Open cover
- ③ Open cover profile

3.1 General notes on installation

Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

Do a check of the packing list to make sure that you have all the elements given in the order.

*Look at the device nameplate to ensure that the device is delivered according to your order.
Check for the correct supply voltage printed on the nameplate.*

3.2 Ingress protection for housing

The housing of the device fulfills the requirements for ingress protection in accordance with IEC 60529. For further information refer to *Technical data* on page 6.

3.3 Packaging

Your device was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by test following ISO 22248. The packing of standard devices consists of environmentally friendly materials.

3.4 Storage

Observe the storage information found on the packaging. Labels on the original packaging must always remain legible and may not be damaged.

- Store the device in a dry, dust-free location.
- Avoid extended direct exposure to the sun.
- Store the device in the original packaging supplied.
- Do not expose to aggressive media.
- Avoid mechanical shocks.
- Storage temperature: -40...+85°C / -40...+185°F
- Relative air humidity: 0...95%; non-condensing

3.5 Transport

- Use original packaging for transport and ensure that the packaging does not get crushed or damaged by sharp objects or other boxes.
- Do not throw or drop the device.
- Avoid temperatures below -40°C / -40°F and above +85°C / +185°C.
- When transporting by ship, use seaworthy outer packing.

3.6 Installation specifications

Observe the relevant directives, ordinances, standards and accident prevention regulations (e.g. VDE/VDI 3512, DIN 19210, VBG, Elex V, etc.).

3.7 Mounting

- *Prior to installing the device, it is essential to verify whether the version of the device on hand completely fulfils the technical and safety requirements of the measuring point. This applies in particular to the temperature and operating voltage.*
- *The device must not be heated by radiated heat (e.g. exposure to the sun) to an electronics housing surface temperature above the maximum permissible ambient temperature. If it is necessary to prevent damage from heat sources, a heat protection (e.g. sun shade) has to be installed.*

3.7.1 Panel mounting case

This version of the OPTIBAR FC 1000 is mounted by default in a panel cut-out.

For mounting the two brackets at the side must be removed (when installed) by pressing them forward. The unit is then inserted into the front of the control panel. Afterwards, reinstall the brackets and tighten the screw to fix the device in place. Ensure that the supplied gasket is firmly seated between the display and the control panel.

3.7.2 Wall mounting case

This version of the OPTIBAR FC 1000 is intended to be mounted on a wall by using the provided four mounting holes.

To open the housing for access to the mounting holes, open the cover profile on the left side of the device and loose the two locking screws. After that, the cover can be opened.

The protection class of the housing is only guaranteed if the locking screws are retightened after closing the cover.

4.1 Safety instructions

*All work on the electrical connections may only be carried out with the power disconnected.
Take note of the voltage data on the nameplate!*

Observe the national regulations for electrical installations!

*Observe without fail the local occupational health and safety regulations.
Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.*

*Look at the device nameplate to ensure that the device is delivered according to your order.
Check for the correct supply voltage printed on the nameplate.*

4.2 Notes for electrical cables

The device must be grounded to a spot in accordance with regulations in order to protect personnel against electric shocks.

Cables may only be connected when the power is switched off! Since the transmitter has no switch-off elements, overcurrent protection devices, lightning protection and/or energy isolating devices need to be provided by the customer.

4.3 Connections at the OPTIBAR FC 1000

The terminals / connections at the OPTIBAR FC 1000 can be divided into multiple areas. These are shown in the following figure.

The terminals for the electrical connections are pluggable. The power supply terminal is additionally secured with screws.

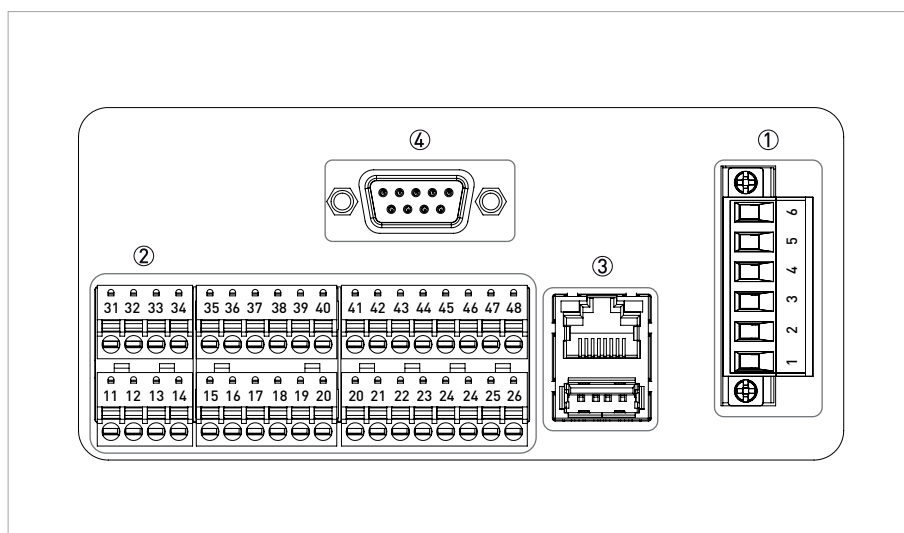


Figure 4-1: Connections at OPTIBAR FC 1000

- ① Power supply terminal with relay
- ② Main terminal strip
- ③ Ethernet connection / USB socket
- ④ D-sub connector (optional for panel mounting case, not available for wall mounting case)

4.4 Terminal assignment

4.4.1 Power supply terminal with relay

Pin	AC connection	DC connection
1	L	Unused
2	PE	GND
3	N	L+
4	Relay NC	Relay NC
5	Relay COM	Relay COM
6	RelayNO	Relay NO

Table 4-1: Pin assignment of power supply terminal and relay

The nameplate indicates whether it is an OPTIBAR FC 1000 for AC operation (AC voltage) or DC operation (DC voltage). Only the information on the nameplate of the device applies.

The auxiliary voltage is connected via the power supply terminl..

4.4.2 Connection of the Pt100/RTD

First Pt100/RTD		Second Pt100/RTD	
Pin	Description	Pin	Description
11	Port A	31	Port A
12	Port a	32	Port a
13	Port B	33	Port B
14	Port b (optional)	34	Port b (optional)

Table 4-2: Pin assignment of first and second Pt100/RTD

The Pt100 temperature resistors (RTDs) can be connected in 3- or 4-wire connection.

Both possibilities are illustrated in the figure below. The terminal assignments for the second Pt100/RTD are given in brackets.

If the temperature sensor is equipped with a transmitter, the connection is made as described in the next chapter.

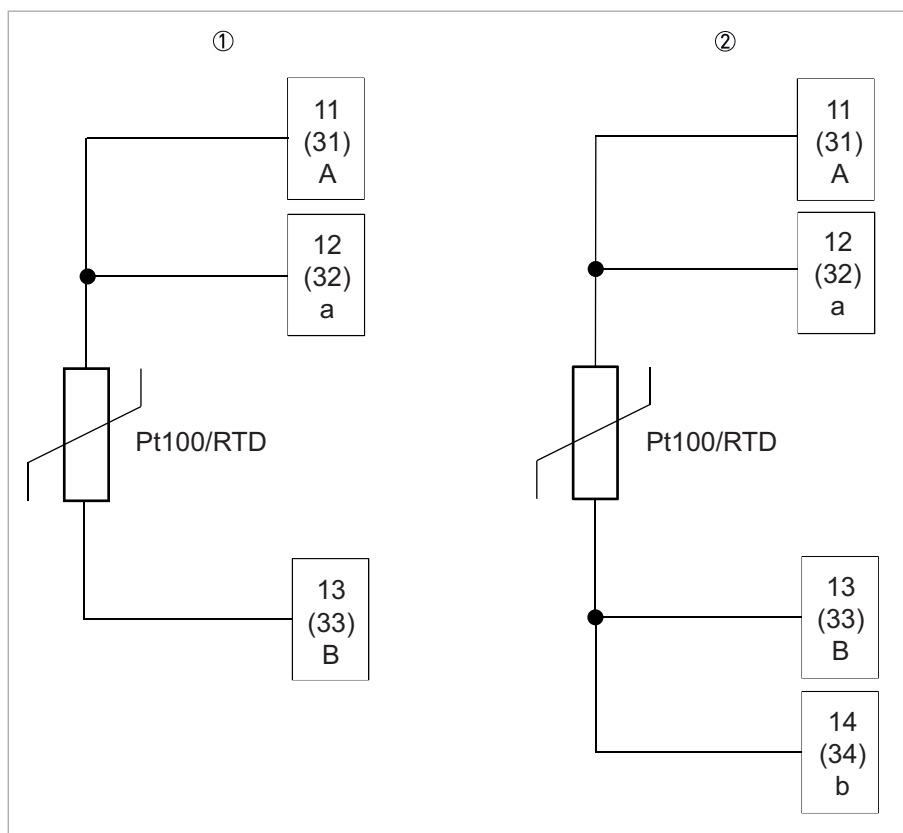


Figure 4-2: 3- and 4-wire connection of Pt100/RTD

- ① 3-wire connection of Pt100/RTD
- ② 4-wire connection of Pt100/RTD

4.4.3 Transmitters at the analog inputs

Passive transmitters are wired with their plus terminal to the signal input contact of the respective analog input. The minus terminal is connected to the respective GND contact. The following figure shows an example of a pressure transmitter at the third analog input. "AE" stands for the auxiliary energy with which the transmitter is supplied.

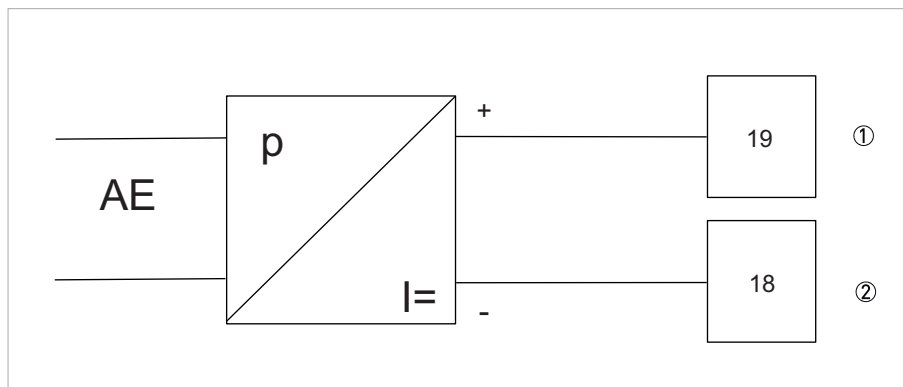


Figure 4-3: Connection of an passive transmitter

- ① Signal input
- ② GND

Active transmitters are wired with their plus terminal to the +24 V supply output of the respective analog input. The minus terminal is connected to the respective signal input. The following figure shows an example of a differential pressure transmitter at the first analog input.

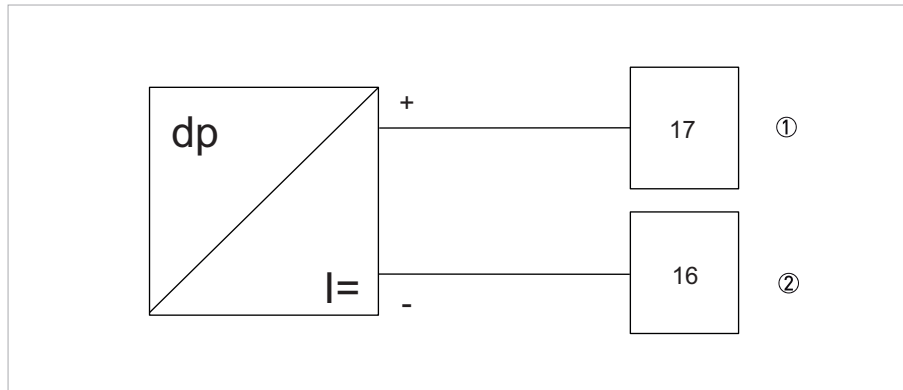


Figure 4-4: Connection of an active transmitter

- ① +24 V
② Signal input

Pins of 1. - 4. analog input (Ain1 / 2 / 3 / 4); HART capable	Description
15 / 18 / 35 / 38	Transmitter GND (VDC-)
16 / 19 / 36 / 39	for passive Transmitter Signal (VDC +)
17 / 20 / 37 / 40	for active Transmitter Signal (24 VDC + Supply)

Table 4-3: Pin assignment for 1. - 4. analog input

If the temperature is determined with a Pt100 (without transmitter), the connection is made according to the chapter before.

4.4.4 Switching and frequency inputs

Pins of 1. and 2. switch / frequency input	Description
21 / 41	Connection +
22 / 42	Connection -

Table 4-4: Pin assignment for switching and frequency inputs

These inputs are used, for example, to connect a volumetric flow sensor if it has a frequency output or an AGA-7 sensor . They are also used when connecting functional extensions.

4.4.5 Connection of analog outputs

Pins of 1. and 2. analog output	Description
23 / 43	Connection +
24 / 44	Connection -

Table 4-5: Pin assignment for analog outputs

Process variables can be output as 0/4...20 mA signals via the analog outputs.

4.4.6 Electronic relays

Pins of 1. (NO) and 2. (NC) electronic relay	Description
25 / 27	Connection + (COM)
26 / 28	Connection - (NC)

Table 4-6: Pin assignment for electronic relays

The OPTIBAR FC 1000 offers two electronic relays/switches. These are used, for example, for the output of status signals or as frequency/pulse outputs. For the parameterization of the electronic relays the figure below shows a connection recommendation for the first electronic relay. The resistance R should be 5 to 10 k Ω . The second electronic relay is connected in the same way.

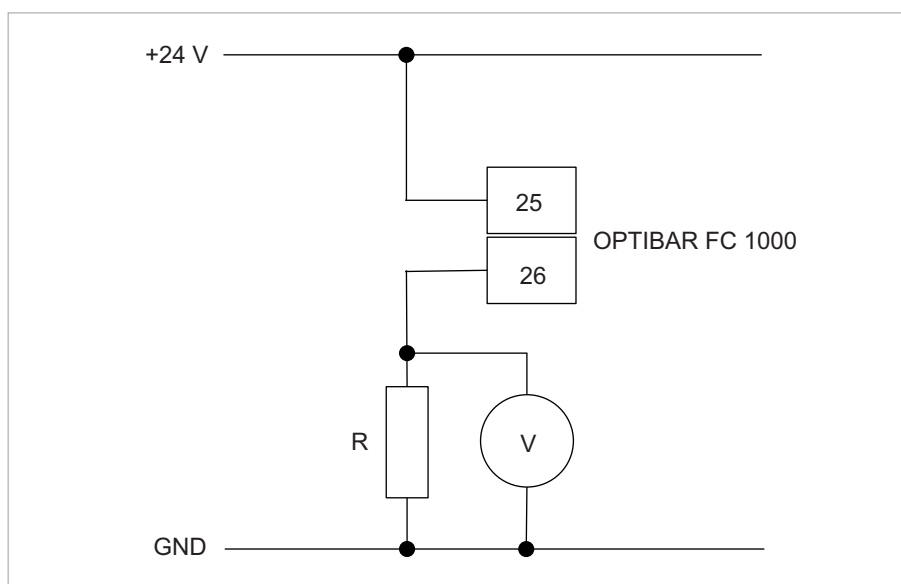


Figure 4-5: Connection recommendation first relay

4.4.7 Modbus / M-bus (serial 1)

Pin	Description
45	Connection +
46	Connection -
47	GND connection

Table 4-7: Pin assignment for electronic relays

The OPTIBAR FC 1000 offers an interface for Modbus/M-Bus. The interface assignment must be selected when ordering ("first Interface", refer to *Order information* on page 22).

4.4.8 Ethernet interface

The OPTIBAR FC 1000 offers an Ethernet interface. This allows access to the web server of the OPTIBAR FC 1000 and provides Modbus TCP. A standard Ethernet cable is required for the connection.

4.4.9 D-Sub connector

Pin (at D-sub connector)	Description
5	GND connection
8	Connection + (COM)
9	Connection - (NC)

Table 4-8: Pin assignment for D-sub connector

A standard serial cable with 1:1 wiring is required for the optional D-Sub connection ("second Interface", refer to *Order information* on page 22).

4.4.10 Interface converter for Profibus / Profinet

An interface converter for the first or second serial interface of the OPTIBAR FC 1000 is used for communication via Profibus DP Slave or Profinet.

When using the first serial interface (option P/S for "Interface (Terminals)", refer to *Order information* on page 22), a corresponding D-Sub connector with screw terminals is supplied to create a connecting cable.

When using the second serial interface (option P/S for "Interface (Sub-D)" refer to *Order information* on page 22), a corresponding connecting cable (length approx. 2 m) is supplied.

Technical Data of the interface converter

Technical specification	
Power supply	24 V DC $\pm 10\%$
Current consumption	max. 300 mA, typical 100 mA
Dimensions (mm)	27 W $\times$ 120 H $\times$ 75 D
Degree of protection	IP20
Mounting	DIN rail TH 35 (Top hat rail IEC/EN 60715 35 $\times$ 7.5 mm ²)
Operating temperature	0 ... 55 °C
Storage temperature	-40 ... 85 °C
Relative air humidity	0 ... 95 %; non-condensing
Installation altitude	up to 2000 m

Table 4-9: Technical data interface converter

Electrical connection of the interface converter

The interface converter is connected to the power supply and the OPTIBAR FC 1000. See the following figure.

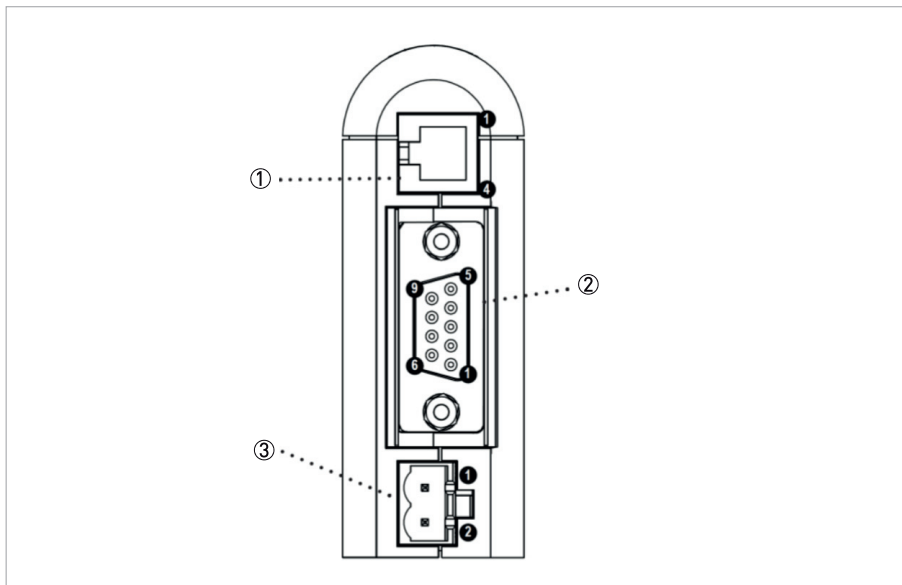


Figure 4-6: Electrical connection interface converter

- ① Maintenance connection (unused)
- ② D-Sub socket for connection to the OPTIBAR FC 1000 (via the supplied connecting cable or the D-Sub connector)
Pin assignment: 5 = GND connection; 8 = Connection +; 9 = Connection -
- ③ Power supply terminal
Pin assignment: 1 = +24 V DC; 2 = GND

The connection between the interface converter and the control station is made via the socket located on the front: D-Sub socket for the Profibus version and RJ45 socket for the Profinet version.

4.4.11 Automatic purging unit (APU)

General wiring

For the connection of the optional air purging unit (APU), the connection is as shown in the figure below. The remaining electrical connections are the same as in the previous sections.

The general wiring shown here is only an example. The order documentation of the purging unit (APU) usually includes a wiring diagram which represents the complete system. This wiring diagram then has sole validity.

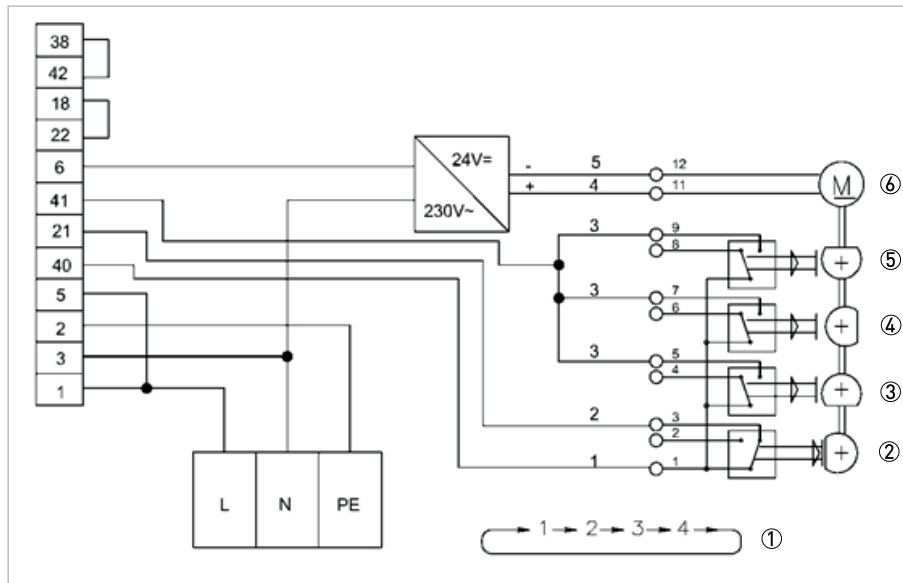


Figure 4-7: Connections of air purging unit

- ① Sequence of positions reached by the multiway valve
- ② Normal mode
- ③ Zero point control
- ④ Purging chamber 1
- ⑤ Purging chamber 2
- ⑥ Drive with endswitches for multiway valve

External triggering

If an external triggering of the purging cycle is desired, the connection for this is realized as shown in the figure below. The resistor R must be between 5 and 10 kΩ.

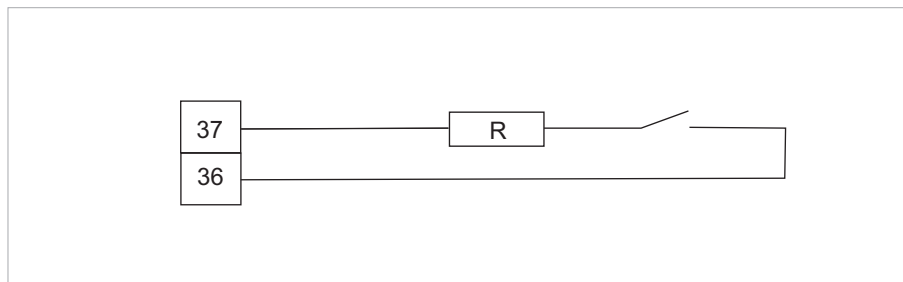


Figure 4-8: Connection external triggering of purging cycle

The two terminals 36 and 37 are used as standard. The triggering is then parameterized for the second analog input Ain2. Alternatively, another analog input can also be used. The terminals for transmitter supply and signal input of the respective analog input must then be used (refer to *Transmitters at the analog inputs* on page 16) and the parameterization must be changed .

4.5 Connection of an automatic zero point correction (functional extension)

The connection of the optional automatic zero-point correction device is described in the corresponding mounting instruction of the automatic zero-correction unit.

5.1 Order code

Instrument code		Type									
VGKM	4	Housing									
		S	Panel mounting; 4.3"-TFT-Touchdisplay								
		B	Wall mounting; 4.3"-TFT-Touchdisplay								
		Operation mode									
		W	Heat flow computer for steam, water, heat transfer fluid and ideal gas								
		G	additional to W: technical gases (real gas calculation)								
		E	additional to G: natural gas (SGERG-88, AGA8 (DC92/G1/G2), NX-19, ISO 20765-1)								
		Power supply									
		A	100-250 VAC (50-60 Hz)								
		D	18-30 VDC								
		Extensions									
		0	Without								
		Interface (Terminals)									
		M	Modbus Slave RTU								
		B	M-bus								
		P	Profibus DP Slave								
		N	Profinet Slave								
		Interface (Sub-D)									
		0	Without								
		M	Modbus Slave RTU								
		B	Modbus master RTU								
		P	Profibus DP Slave								
		N	Profinet Slave								
		Device parameterization									
		X	without; factory setting								
		C	with parameterization acc. application data								
		D	like X; additional 5-point factory calibration certificate								
		E	like C; additional 5-point factory calibration certificate								
		Marking									
		0	Tag on the display								
		T	Tag plate (30 x 19mm)								
VGKM	4										

Certain options can be enabled via the "Activation" menu.



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