Quick setup guide

Pressure transmitter with metallic measuring cell

VEGABAR 87

Secondary sensor for electronic differential pressure

With SIL qualification

Document ID: 48054

Contents

Information:
This quick setup guide enables quick setup and commissioning of your instrument.

You can find supplementary information in the corresponding, more detailed Operating Instructions Manual as well as the Safety Manual that comes with instruments with SIL qualification. These manuals are available on our homepage.

Operating instructions VEGABAR 87 - Secondary sensor for electronic differential pressure with SIL qualification: Document-ID 48049

Safety Manual VEGABAR series 80 - Two-wire 4 … 20 mA/HART with SIL qualification: Document-ID 48369

Editing status of the quick setup guide: 2021-03-31

48054-EN-210430

1 For your safety

1.1 Authorised personnel

All operations described in this documentation must be carried out only by trained, qualified personnel authorised by the plant operator.

During work on and with the device, the required personal protective equipment must always be worn.

1.2 Appropriate use

As Secondary Device, the VEGABAR 87 is part of an electronic differential pressure meaasurement.

You can find detailed information about the area of application in chapter "*Product description*".

Operational reliability is ensured only if the instrument is properly used according to the specifications in the operating instructions manual as well as possible supplementary instructions.

1.3 Warning about incorrect use

Inappropriate or incorrect use of this product can give rise to application-specific hazards, e.g. vessel overfill through incorrect mounting or adjustment. Damage to property and persons or environmental contamination can result. Also, the protective characteristics of the instrument can be impaired.

1.4 General safety instructions

This is a state-of-the-art instrument complying with all prevailing regulations and directives. The instrument must only be operated in a technically flawless and reliable condition. The operator is responsible for the trouble-free operation of the instrument. When measuring aggressive or corrosive media that can cause a dangerous situation if the instrument malfunctions, the operator has to implement suitable measures to make sure the instrument is functioning properly.

The safety instructions in this operating instructions manual, the national installation standards as well as the valid safety regulations and accident prevention rules must be observed by the user.

For safety and warranty reasons, any invasive work on the device beyond that described in the operating instructions manual may be carried out only by personnel authorised by the manufacturer. Arbitrary conversions or modifications are explicitly forbidden. For safety reasons, only the accessory specified by the manufacturer must be used.

To avoid any danger, the safety approval markings and safety tips on the device must also be observed.

1.5 EU conformity

The device fulfils the legal requirements of the applicable EU directives. By affixing the CE marking, we confirm the conformity of the instrument with these directives.

The EU conformity declaration can be found on our homepage.

1.6 SIL qualification according to IEC 61508

The Safety Integrity Level (SIL) of an electronic system is used to assess the reliability of integrated safety functions.

For detailed specification of the safety requirements, multiple SIL levels are specified according to safety standard IEC 61508. You can find detailed information in chapter "*Functional safety (SIL)*" of the operating instructions.

The instrument meets the specifications of IEC 61508: 2010 (Edition 2). It is qualified for single-channel operation up to SIL2. The instrument can be used homogeneously redundant up to SIL3 in multi-channel architecture with HFT 1.

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2 Product description

2.1 Configuration

Type label

The type label contains the most important data for identification and use of the instrument:

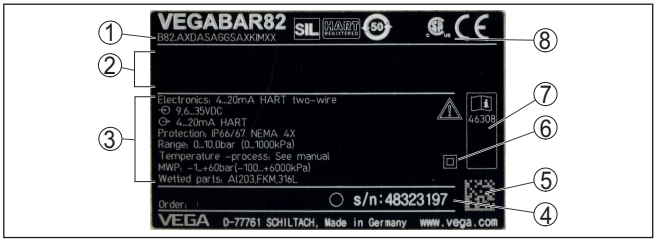

Fig. 1: Layout of the type label (example)

1 *Product code*
2 *Field for approvals*
3 *Technical data*
4 *Serial number of the instrument*
5 *QR code*
6 *Symbol of the device protection class*
7 *ID numbers, instrument documentation*
8 *SIL identification*

Serial number - Instrument search

The type label contains the serial number of the instrument. With it you can find the following instrument data on our homepage:

- Product code (HTML)
- Delivery date (HTML)
- Order-specific instrument features (HTML)
- Operating instructions, quick setup guide and Safety Manual at the time of shipment (PDF)
- Test certificate (PDF) - optional

Move to "www.vega.com" and enter in the search field the serial number of your instrument.

Alternatively, you can access the data via your smartphone:

- Download the VEGA Tools app from the "*Apple App Store*" or the "*Google Play Store*"
- Scan the DataMatrix code on the type label of the instrument or
- Enter the serial number manually in the app

3 Mounting

3.1 General instructions for use of the instrument

Protection against moisture

Protect your instrument against moisture ingress through the following measures:

- Use a suitable connection cable (see chapter "*Connecting to power supply*")
- Tighten the cable gland or plug connector
- Lead the connection cable downward in front of the cable entry or plug connector

This applies mainly to outdoor installations, in areas where high humidity is expected (e.g. through cleaning processes) and on cooled or heated vessels.

Note:

Make sure that during installation or maintenance no moisture or dirt can get inside the instrument.

To maintain the housing protection, make sure that the housing lid is closed during operation and locked, if necessary.

3.2 Ventilation and pressure compensation

Filter element - Position

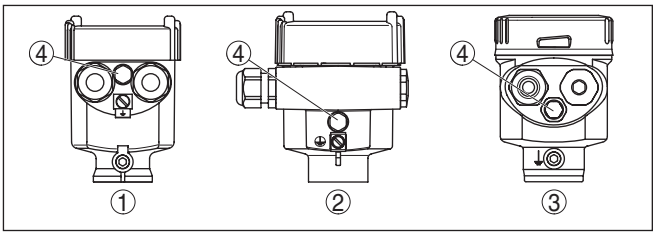

Fig. 2: Position of the filter element - non-Ex, Ex-ia version

1 Plastic, stainless steel housing (precision casting)
2 Aluminium housing
3 Stainless steel housing (electropolished)
4 Filter element

With the following instruments a blind plug is installed instead of the filter element:

- Instruments in protection IP66/IP68 (1 bar) - ventilation via capillaries in non-detachable cable
- Instruments with absolute pressure

3.3 Combination Primary/Secondary sensor

In principle, any sensor combination within the instrument series is allowed. The following requirements must be fulfilled:

- Configuration of the sensor suitable for electronic differential pressure
- Pressure type is identical for both sensors, i.e. relative pressure/relative pressure or absolute pressure/absolute pressure

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- Primary Device measures the higher pressure
- Measurement setup as shown in the following chapters

The measuring range of each sensor is selected such that it fits the measuring loop. For this, the max. recommended turn down must be noted. See chapter "*Technical data*". It is absolutely necessary the the measuring ranges of Primary and Secondary Device correspond.

Measurement result = Measured value of Primary (total pressure) - measured value of Secondary (static pressure)

Depending on the application, individual combinations can result, see following examples:

Example - large vessel

Data
Application: Level measurement

Medium: Water

Vessel height: 12 m, hydrostatic pressure = 12 m x 1000 kg/m³ x 9.81 m/s² = 117.7 kPa = 1.18 bar

Superimposed pressure: 1 bar

Total pressure: 1.18 bar + 1 bar = 2.18 bar

Instrument selection
Nominal measuring range Primary: 2.5 bar

Nominal measuring range Secondary: 1 bar

Turn Down: 2.5 bar/1.18 bar = 2.1 : 1

Example - small vessel

Data
Application: Level measurement

Medium: Water

Vessel height: 500 mm, hydrostatic pressure = 0.50 m x 1000 kg/m³ x 9.81 m/s² = 4.9 kPa = 0.049 bar

Superimposed pressure: 350 mbar = 0.35 bar

Total pressure: 0.049 bar + 0.35 bar = 0.399 bar

Instrument selection
Nominal measuring range Primary: 0.4 bar

Nominal measuring range Secondary: 0.4 bar

Turn Down: 0.4 bar /0.049 bar = 8.2 : 1

Example - orifice in pipeline

Data
Application: Differential pressure measurement

Medium: Gas

Static pressure: 0.8 bar

Differential pressure on orifice: 50 mbar = 0.050 bar

Total pressure: 0.8 bar + 0.05 bar = 0.85 bar

Instrument selection
Nominal measuring range Primary: 1 bar

Nominal measuring range Secondary: 1 bar

Turn Down: 1 bar/0.050 bar = 20 : 1

Output measured values

The measuring result (level, pressure difference) as well as measured value Secondary (static or superimposed pressure) are output by the sensor. Depending on the instrument version, output as 4 … 20 mA signal or digitally via HART, Profibus PA or Foundation Fieldbus.

4 Connecting to power supply

4.1 Connecting

Connection technology

The connection to the Primary Device is carried out through spring-loaded terminals in the respective housing. For this, use the supplied, confectioned cable. Solid cores as well as flexible cores with cable end sleeves are inserted directly into the terminal openings.

In case of flexible cores without end sleeves, press the terminal from above with a small screwdriver, the terminal opening is then free. When the screwdriver is released, the terminal closes again.

Information:
The terminal block is pluggable and can be removed from the electronics. To do this, lift the terminal block with a small screwdriver and pull it out. When reinserting the terminal block, you should hear it snap in.

You can find further information on the max. wire cross-section under "*Technical data - Electromechanical data*".

Connection procedure

Proceed as follows:

1. Unscrew the housing lid
2. Loosen compression nut of the cable gland and remove blind plug
3. Remove approx. 10 cm (4 in) of the cable mantle, strip approx. 1 cm (0.4 in) insulation from the individual wires or use supplied connection cable
4. Insert the cable into the sensor through the cable entry

Fig. 3: Connection steps 5 and 6

5. Insert the wire ends into the terminals according to the wiring plan
6. Check the hold of the wires in the terminals by lightly pulling on them

7. Connect the shielding to the internal ground terminal, connect the external ground terminal to potential equalisation
8. Tighten the compression nut of the cable entry gland. The seal ring must completely encircle the cable
9. Unscrew the blind plug on the Primary, screw in the supplied cable gland
10. Connection cable to Primary, see steps 3 to 8
11. Screw the housing lid back on

The electrical connection is finished.

4.2 Single chamber housing

The following illustration applies to the non-Ex, Ex-ia and Ex-d-ia version.

Electronics and connection compartment

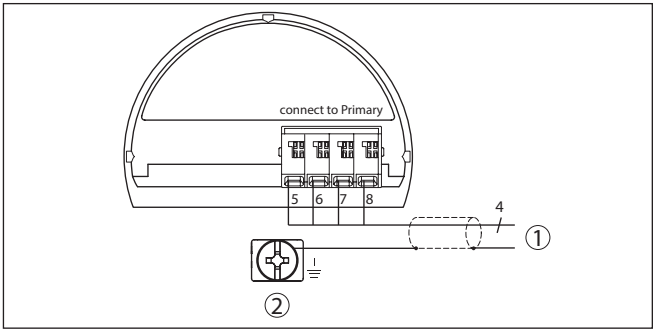


Fig. 4: Wiring plan VEGABAR 87 Secondary Device

1 To the Primary Device
2 Ground terminal for connection of the cable screening[1)]

4.3 Connection example

Connection example, electronic differential pressure

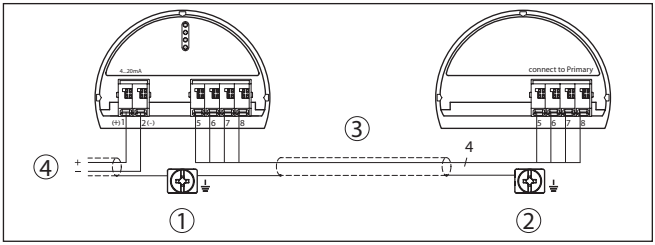


Fig. 5: Connection example, electronic differential pressure

1 Primary Device
2 Secondary Device
3 Connection cable
4 Supply and signal circuit Primary Device

[1)] Connect shielding here. Connect ground terminal on the outside of the housing to ground as prescribed. The two terminals are galvanically connected.

The connection between Primary and Secondary Device is carried out acc. to the table:

Primary Device	Secondary Device
Terminal 5	Terminal 5
Terminal 6	Terminal 6
Terminal 7	Terminal 7
Terminal 8	Terminal 8

5 Set up with the display and adjustment module

5.1 Insert display and adjustment module

The display and adjustment module can be inserted into the sensor and removed again at any time. You can choose any one of four different positions - each displaced by 90°. It is not necessary to interrupt the power supply.

Proceed as follows:

1. Unscrew the housing lid
2. Place the display and adjustment module on the electronics in the desired position and turn it to the right until it snaps in.
3. Screw housing lid with inspection window tightly back on

Disassembly is carried out in reverse order.

The display and adjustment module is powered by the sensor, an additional connection is not necessary.

Fig. 6: Installing the display and adjustment module in the electronics compartment of the single chamber housing

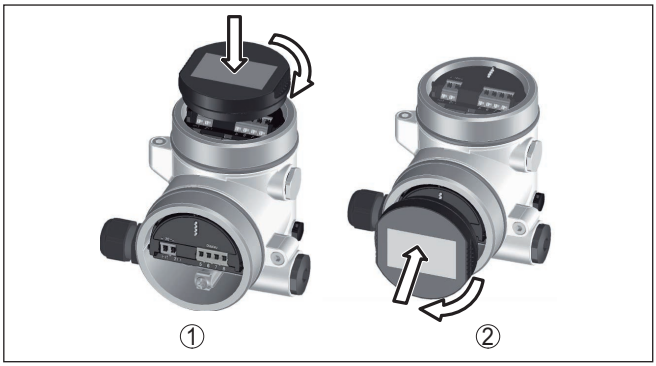


Fig. 7: Installing the display and adjustment module in the double chamber housing

1 In the electronics compartment
2 In the connection compartment

Note:
If you intend to retrofit the instrument with a display and adjustment module for continuous measured value indication, a higher lid with an inspection glass is required.

5.2 Parameter adjustment

Operating sequence

A parameter change with SIL qualified instruments must always be carried out as follows:

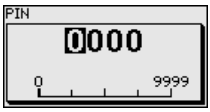
- Unlock adjustment
- Change parameters
- Lock adjustment and verify modified parameters

This ensures that all modified parameters have been deliberately changed.

Unlock adjustment
The instrument is shipped in locked condition.

To prevent unintentional or unauthorized adjustment, the instrument is protected (locked) against all parameter changes while in normal operating condition.

For each parameter change you have to enter the PIN of the instrument. In delivery status, the PIN is "0000".



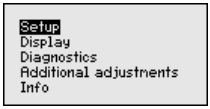
Change parameters
You can find a description below the respective parameter.

Lock adjustment and verify modified parameters

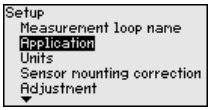
You can find a description below the parameter "*Setup - Lock adjustment*".

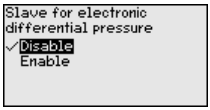
Change setup parameters

1. Go to the menu " *Setup*" via the display and adjustment module.

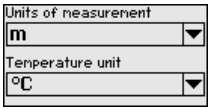


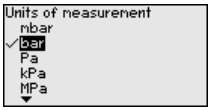
2. In this menu item you activate/deactivate the Secondary sensor for electronic differential pressure and select the application, e.g. level



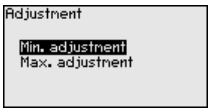


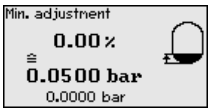
3. Select in the menu item " *Units*" the adjustment unit of the instrument, e.g. " *bar*".

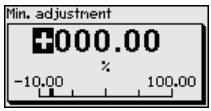




4. Depending on the application, carry out the adjustment e.g. in the menu items " *Min. adjustment*" and " *Max. adjustment*".







Parameterization example

VEGABAR 87 always measures pressure independently of the process variable selected in the menu item " *Application*". To output the selected process variable correctly, an allocation of the output signal to 0 % and 100 % must be carried out (adjustment).

For the application " *Interface*", the hydrostatic pressure e.g. with interface "Min." and interface "Max." is entered for the adjustment. The position of the interface is detected by the Secondary sensor. See following example:

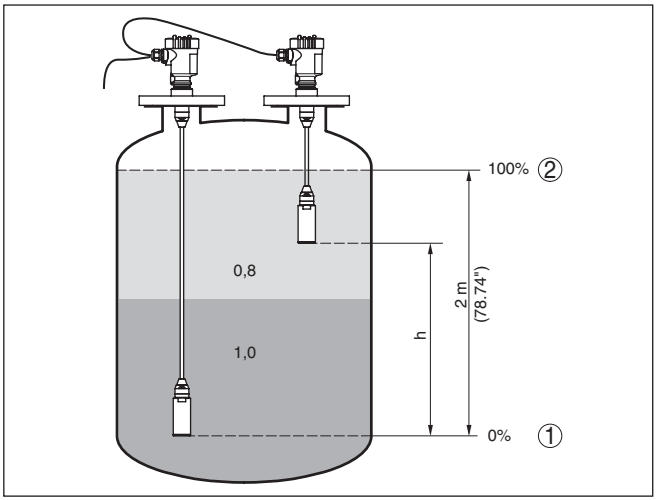


Fig. 8: Parameter adjustment example "Min./max. adjustment, interface measurement"

1 Min. interface = 0 % correspond to 0.0 mbar
2 Max. interface = 100 % correspond to 490.5 mbar
3 VEGABAR 87
4 VEGABAR 87 - Secondary sensor

If these values are not known, an adjustment with interface layers of for example 10 % and 90 % is also possible. By means of these settings, the layer of the actual interface is then calculated.

The real product level during the adjustment is not important, because the min./max. interface adjustment is always carried out without changing the product level. These settings can be made ahead of time without the instrument having to be installed.

Lock adjustment

With this menu item you safeguard the sensor parameters against unauthorized or unintentional modifications.

SIL To detect parameterization errors reliably, safety-relevant parameters must be verified before saving them into the instrument.

1. Enter PIN
In delivery status, the PIN is "0000".

2. Character string comparison
You then have to carry out the character string comparison. This is used to check the character presentation.

3. Serial number acknowledgement
Afterwards you confirm that the serial number of your instrument was carried over correctly. This is used to check device communication.

4. Verify parameters
Confirm the modified values one after the other.

If the described process of parameter adjustment was run through completely and correctly, the instrument will be locked and hence ready for operation.

5.3 Menu overview

The following tables show the adjustment menu of the instrument. Depending on the instrument version or application, all menu items may not be available or some may be differently assigned.

Note:
You can find further menu items in the operating instructions of the respective Primary Device.

Setup

Menu item	Parameter	Default setting
Measurement loop name	19 alphanumeric characters/special characters	Sensor
Application (SIL)	Level, process pressure	Level
	Secondary Device for electronic differential pressure[2)]	Deactivated
Units	Adjustment unit (m, bar, Pa, psi … user-defined)	mbar (with nominal measuring range ≤ 400 mbar) bar (with nominal measuring ranges ≥ 1 bar)
	Static pressure	bar
Position correction (SIL)		0.00 bar
Adjustment (SIL)	Distance (with density and interface)	1.00 m
	Zero/Min. adjustment	0.00 bar 0.00 %
	Span/Max. adjustment	Nominal measuring range in bar 100.00 %
Damping (SIL)	Integration time	0.0 s
Linearization (SIL)	Linear, cylindrical tank, … user-defined	Linear
Current output (SIL)	Current output - Mode	Output characteristics 4 … 20 mA Reaction when malfunctions occur ≤ 3.6 mA
	Current output - Min./Max.	3.8 mA 20.5 mA

[2)] Parameter active, when Secondary Device is connected

Menu item	Parameter	Default setting
Lock adjustment (SIL)	Blocked, released	Last setting

Display

Menu item	Default setting
Menu language	Order-specific
Displayed value 1	Current output in %
Displayed value 2	Ceramic measuring cell: Measuring cell temperature in °C Metallic measuring cell: Electronics temperature in °C
Display format 1 and 2	Number of positions after the decimal point, automatically
Backlight	Switched on

Diagnostics

Menu item	Parameter	Default setting
Device status		-
Peak value indicator	Pressure	Current pressure measured value
Pointer function temp.	Temperature	Actual measuring cell and electronic temperature
Simulation		-

Additional adjustments

Menu item	Parameter	Default setting
PIN		0000
Date/Time		Actual date/Actual time
Copy instrument settings		-
Special parameters		No reset
Scaling	Scaling size	Volume in l
	Scaling format	0 % corresponds to 0 l 100 % corresponds to 0 l
Current output	Current output - Meas. variable	Lin. percent - Level
	Current output - Adjustment	0 … 100 % correspond to 4 … 20 mA
HART mode		Address 0
DP flow element	Unit	m^3/s
	Adjustment	0.00 % correspond to 0.00 m^3/s 100.00 %, 1 m^3/s

Info

Menu item	Parameter
Device name	VEGABAR 87
Instrument version	Hardware and software version
Factory calibration date	Date
Sensor characteristics	Order-specific characteristics

6 Supplement

6.1 Technical data

Note for approved instruments

The technical data in the respective safety instructions which are included in delivery are valid for approved instruments (e.g. with Ex approval). These data can differ from the data listed herein, for example regarding the process conditions or the voltage supply.

All approval documents can be downloaded from our homepage.

Electromechanical data - version IP66/IP67 and IP66/IP68 (0.2 bar)[3)]

Options of the cable entry

- Cable entry: M20 x 1.5; ½ NPT
- Cable gland: M20 x 1.5, ½ NPT (cable ø see below table)
- Blind plug: M20 x 1.5; ½ NPT
- Closing cap: ½ NPT

Material cable gland/Seal insert	Cable diameter			
	5 … 9 mm	6 … 12 mm	7 … 12 mm	10 … 14 mm
PA/NBR	●	●	–	●
Brass, nickel-plated/NBR	●	●	–	–
Stainless steel/NBR	–	–	●	–

Wire cross-section (spring-loaded terminals)

- Massive wire, stranded wire: 0.2 … 2.5 mm² (AWG 24 … 14)
- Stranded wire with end sleeve: 0.2 … 1.5 mm² (AWG 24 … 16)

Interface to the Primary Device

Data transmission: Digital (I^2C-Bus)

Connection cable Secondary - Primary, mechanical data

- Configuration: Cores, strain relief, braided, metal foil, jacket
- Standard length: 5 m (16.40 ft)
- Max. length: 25 m (82.02 ft)
- Min. bending radius (at 25 °C/77 °F): 25 mm (0.985 in)
- Diameter: approx. 8 mm (0.315 in), approx. 6 mm (0.236 in)
- Material: PE, PUR
- Colour: Black

Connection cable Secondary - Primary, electrical data

- Wire cross-section: 0.34 mm² (AWG 22)
- Wire resistance: < 0.05 Ω/m (0.015 Ω/ft)

[3)] IP66/IP68 (0.2 bar), only with absolute pressure.

Voltage supply for the complete system through Primary Device

Operating voltage

– $U_{B\,min}$	12 V DC
– $U_{B\,min}$ with lighting switched on	16 V DC
– $U_{B\,max}$	Depending on the signal output and version of the Primary Device

Printing date:

All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the information available at the time of printing.
Subject to change without prior notice

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