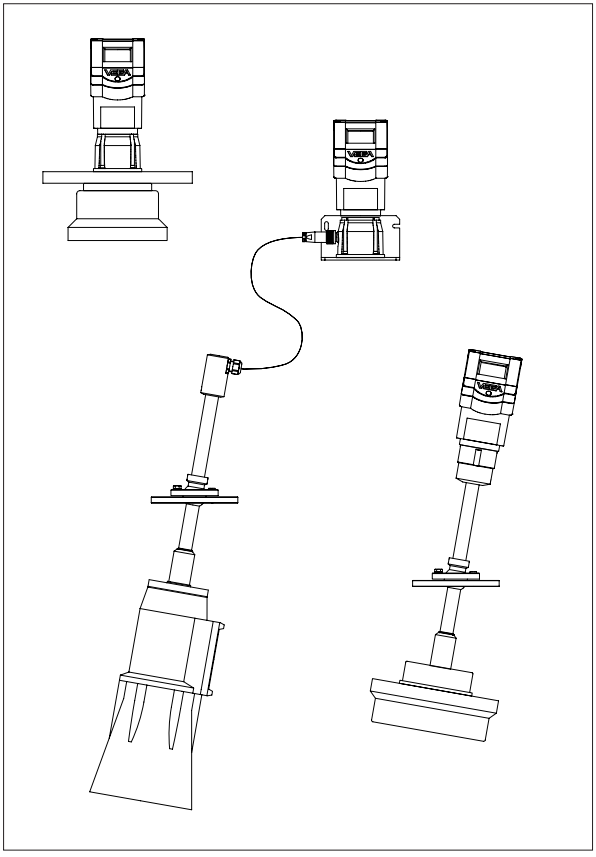
Level and Pressure

Operating Instructions

VEGASON 54P ... 56P (Profibus PA)



Contents

Safety information

Please read this manual carefully, and also take note of country-specific installation standards (e.g. the VDE regulations in Germany) as well as all prevailing safety regulations and accident prevention rules.
For safety and warranty reasons, any internal work on the instruments, apart from that involved in normal installation and electrical connection, must be carried out only by qualified VEGA personnel.

Note Ex area

Please note the attached safety instructions containing important information on installation and operation in Ex areas.
These safety instructions are part of the operating instructions and come with the Ex approved instruments.

1 Product description

1.1 Function

Continuous level measurement with ultrasonic sensors is based on the running time measurement of ultrasonic pulses.

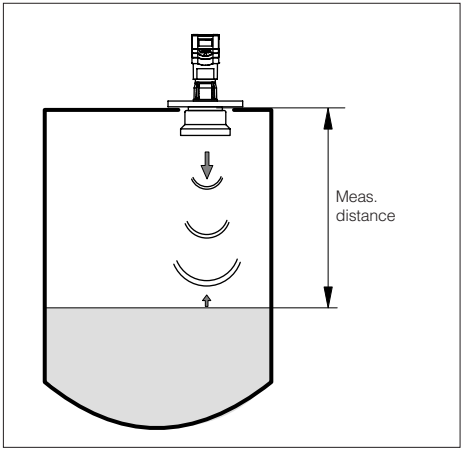
VEGASON 54 ... 56 sensors are a newly developed generation of extremely compact ultrasonic sensor for level measurement. They were developed for liquids and especially for solids and larger measuring distances. They are the right choice for applications in silos, bunkers and material dumps.

Due to small housing dimensions and process fittings, the compact sensors are an unobtrusive, and most of all, very cost-effective solution for your level measurement applications. With the integrated display and a special sensor intelligence in conjunction with large measuring ranges, they enable high-precision level measurement and can be used for applications in which the advantages of non-contact measurement could never before be realised.

The outputs generate a digital Profibus PA signal as output, i.e. measurement signal.

Measuring principle

High-performance piezoceramic transducers emit focused ultrasonic pulses which are reflected by the product surface. The measurement electronics prepares a precise image of the environment from the reflected ultrasonic pulses. The transducers work both as transmitter and receiver. As receiver, the transducers are high-sensitivity piezo microphones.



emission - reflection - reception

The measurement electronics precisely calculates the distance between transducer and medium from the speed of sound and the measured running time of the emitted sound impulse. The distance is then converted into a level-proportional signal and, in conjunction with the sensor parameter settings, made available as a precise, calibrated level value.

Since the speed of sound is subject to temperature influence, the transducer also continuously detects the ambient temperature, so that the level is precisely measured even in case of varying ambient temperature.

Output signal

The level-proportional Profibus PA measurement signal is processed and outputted completely digitally. Digital processing of the measurement signal ensures an accuracy which could be never reached by an analogue measurement signal, as the digital signal is always transmitted error-free right up to the last decimal position. Varying resistances or tiny leakage currents do not influence the accuracy of digital technology. The digital signal is always clear and unambiguous.

The digital signal, giving a faithful representation of the adjusted measuring range of the sensor, can be modified by various parameter settings.

Measured value display

As an option, the series 50 ultrasonic sensors can be equipped with an indicating instrument for direct, local level survey. The indicating instrument shows the precise level by means of the analogue bar graph and the digital number value. In addition to the indication in the sensor, you can have the level displayed with the VEGADIS 50 external indicating instrument at a distance of up to 25 m from the sensor. The external measured value display operates, like the integrated display, independently of the PA output signal and can be modified through individual parameter settings.

1.2 Application features

Two-wire technology
- Power supply and output signal on one two-wire cable.
- Output signal and signal processing completely digital, therefore maximum accuracy.
- Profibus profile 3 – sensor.

Applications
- Level measurement of solids, liquids and pastes.
- Gauge measurement, distance measurement, object monitoring and conveyor belt monitoring.

Rugged and precise
- Measurement unaffected by substance properties such as density, conductivity, dielectric constant…
- Suitable for corrosive substances.
- Measuring range 0.8 m … 70 m.

Adjustment options
- With adjustment software VEGA Visual Operating (VVO) on the PC.
- With detachable adjustment module MINICOM.

Measured value display
- Measured value display integrated in the sensor.
- Optional display separate from sensor.
- Adjustment module MINICOM in sensor.

Connection to any process
- G 1 A, DN 50, DN 80, DN 200, DN 250

Approvals
- CENELEC, ATEX, PTB

1.3 Profibus output signal

PROcess **FI**eld **BUS** (PROFIBUS) is the result of a joint project of thirteen companies and five universities. The companies Bosch, Klöckner-Möller and Siemens played a decisive role. The specifications of the bus are described in the protocol layers 1, 2 and 7 of the ISO/OSI reference model and are available from the PNO (Profibus user organisation). Layers 3 ... 5 have not yet been developed as a standard, leaving Profibus with far-reaching perspectives for the future.

Today approx. 600 companies make use of Profibus technology and belong to the PNO. Profibus **FMS** stands for Fieldbus Messaging Specification, Profibus **DP** for Decentralised Periphery and Profibus **PA** for Process Automation.

As a process automation bus, Profibus PA enables power supply over the bus. Up to 32 sensors can be operated on a shielded two-wire cable that carries both power supply and measurement signal. In Ex areas, up to ten sensors can be connected from the PA level to one two-wire cable (EEx ia).

Bus structure

The Profibus DP and PA network consists of up to 126 master and slave participants. Data are always exchanged from point to point, with the data traffic being exclusively controlled and checked by master devices. Communication is carried out according to the Token-Passing procedure. This means that the master holding the Token can contact the slaves, give instructions, enquire data and cause the slaves to receive and transmit data. After the work is done or after a predetermined time interval, the Token is passed on by the master to the next master.

Master-Class 1
is the actual automation system, i.e. the process control computer or the PLC that enquires and processes all measured values.

Master-Class 2
One or several Master-Class 2 can operate in a Profibus network. As a rule, Master-Class 2 devices are engineering, adjustment or visualisation stations. The VEGA adjustment software VVO (VEGA Visual Operating) operates as Master-Class 2 participant on the DP bus and can work on an engineering PC, on an adjustment PC or on the process control computer and can access any VEGA sensor on the PA level.

Instrument master file
A so-called GSD file is delivered with every VEGASON Profibus sensor. This file is necessary for integrating the sensor into the bus system. The GSD file (instrument master file) contains, beside the sensor name and the manufacturer, the sensor-specific communication parameters which are necessary for a stable integration of the sensor in the bus.

Load the GSD file belonging to the sensor into your bus configuration program. If the GSD file is not available, it can be loaded from the VEGA homepage: http://www.vega.com.

Do not confuse the GSD file with the EDD (Electronic Device Description), a file necessary for the PDM environment (this can be also found on the VEGA homepage).

1.4 Adjustment

Each measuring situation is unique. For that reason, every ultrasonic sensor needs some basic information on the application and the environment, e.g. which level means "empty" and which level "full". Beside this "empty and full adjustment", many other settings and adjustments are possible with VEGASON ultrasonic sensors. The output of echo curves or the calculation of vessel linearisation curves by means of vessel dimensions are only two examples.

Profibus adjustment scheme

In the Profibus environment, there are different adjustment concepts and adjustment tools which often differ considerably from manufacturer to manufacturer. From the user's point of view, a manufacturer-independent adjustment program which could be operated directly on the Profibus DP, as well as at any system node (e.g. the engineering station or the process control), would be ideal.

In the past, only the program "SIMATIC PDM", based on the HART® adjustment scheme, could fulfil this wish (though with the limitations common to HART®). As with HART®, the availability of an instrument-specific database for a comprehensive adjustment with PDM (Process Device Managing) is a requirement. Otherwise, only the basic instrument functions, such as adjustment, are available. In the PDM environment, this instrument-specific database is called EDD (Electronic Device Description), in perfect analogy to the HART® environment which also requires, except for the VEGA HART® instruments, a DD (Device Description) for each sensor.

We are aware of the disadvantages of the HART® environment: for each sensor/participant, an individual DD must be loaded, which in addition, must always be the latest and most up-to-date DD. Special adjustment options such as e.g., the output of an echo curve, are available neither with HART® nor with PDM. User-friendly adjustment is out of the question. With VEGA's adjustment program VVO, those restrictions belong to the past.

The legitimate wish of many Profibus users for a manufacturer-independent adjustment tool without EDD has been realised in the form of PACTware™ [1]. An association of a number of process technology companies developed PACTware™: a Process Automation Configuration Tool that can run different manufacturer software tools under a standardised user interface and adjustment scheme. Specialists call this technology Field Device Transcription. Just as different Windows printer drivers enable operation of completely different printers under a single user interface, PACTware™ enables operation of all field instruments under a single user interface. Instrument-specific databases (EDD), like those required for SIMATIC PDM, are not necessary.

As a result of this development, four adjustment media are available for VEGA Profibus sensors:

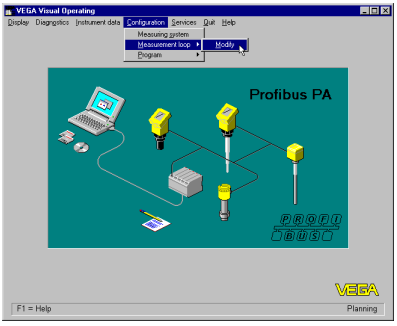
- adjustment with the PC and the adjustment program VVO (VEGA Visual Operating) as stand-alone tool, on the segment coupler or directly on the sensor.
- adjustment with the detachable adjustment module MINICOM in the sensor
- adjustment with the SIMATIC PDM adjustment program (requires EDD instrument databases) from the control room
- adjustment with the manufacturer-independent user interface PACTware™ on the sensor, from the control room or on the segment coupler.

Adjustment with the adjustment program VVO - VEGA Visual Operating

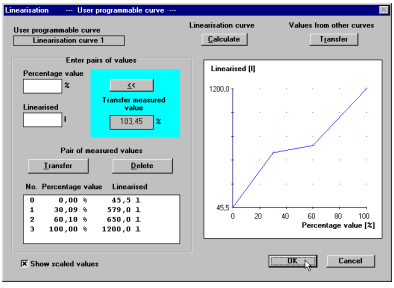
The setup and adjustment of the ultrasonic sensors is generally done on the PC with the adjustment program VEGA Visual Operating (VVO) under Windows®. The program leads quickly through adjustment and parameter setting by means of pictures, graphics and process visualisations.

Note:
The adjustment program VVO must be available in version 2.70 or higher.

The VEGA adjustment software VVO (VEGA Visual Operating) operates either as a subprogram of the host program PACTware™ acc. to the FDT concept (Field Device Tool) or as an independent adjustment program on any PC, engineering station or process control computer.

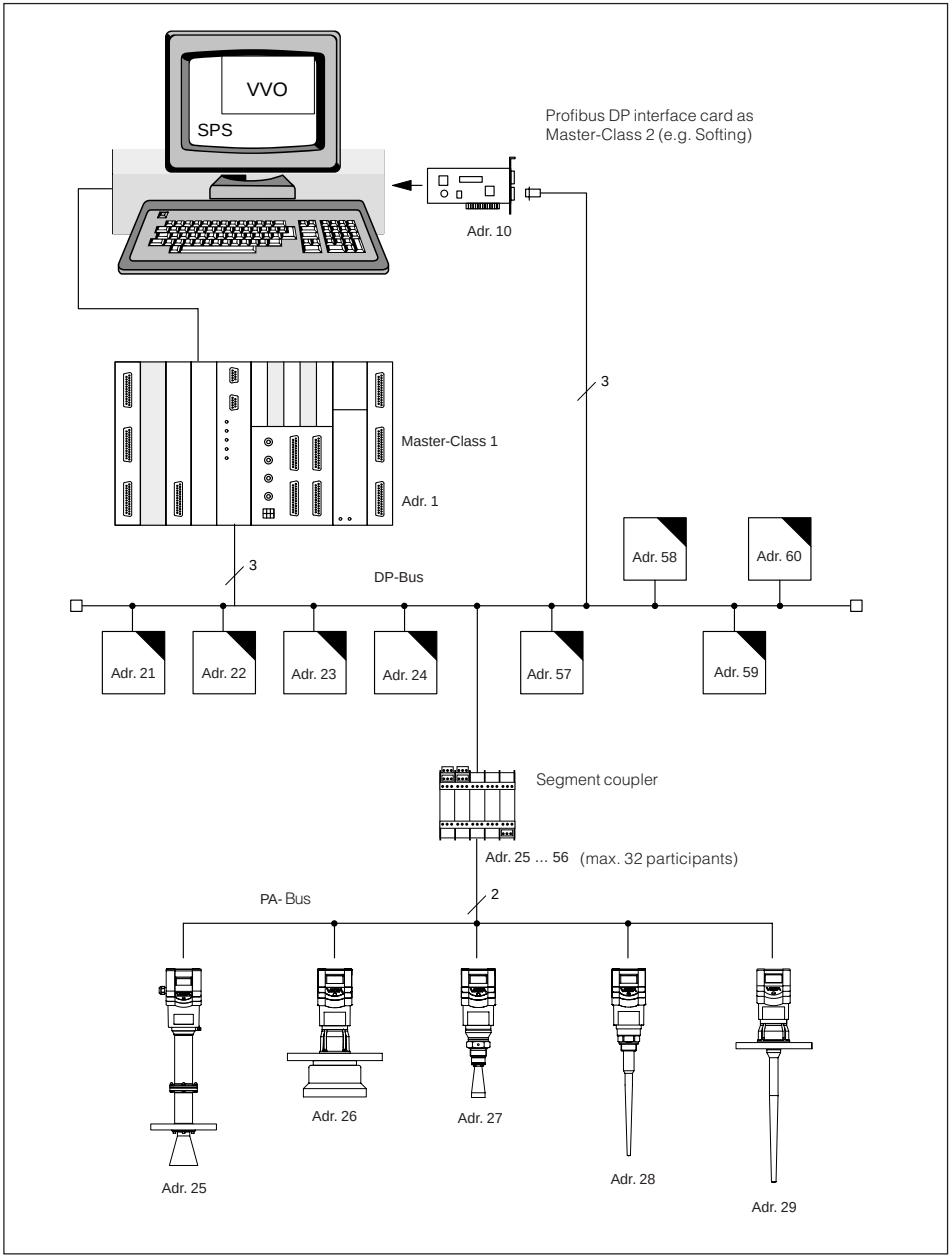


The adjustment program recognises the sensor type



Visualised input of a vessel linearisation curve in the adjustment program VVO

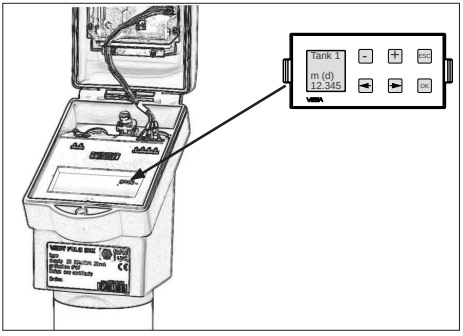
VEGA's adjustment program VVO can access the adjustment options of VEGA sensors in their entirety and, if necessary, can update the complete sensor software. For communication with Profibus sensors, the adjustment program either requires a Profibus-Master-Class2 interface card or the interface adapter VEGACONNECT 3.
The PC with the Profibus interface card can be connected directly to any point on the DP bus with the standard RS 485 Profibus cable. In conjunction with the adapter VEGACONNECT, the PC can be connected directly to the sensor. VEGACONNECT communicates via a small plug directly with the respective sensor.
The adjustment and parameter data can be saved at any time on the PC with the adjustment software and can be protected by passwords. If necessary, the adjustments can be transferred quickly to other sensors.
In practice, the adjustment program VVO is often installed as a tool on an engineering station or an operating station. VVO then accesses all VEGA sensors directly over the bus via the Profibus interface card (e.g. from Softing) as Master Class 2, from the DP level to the PA level (via segment coupler) right down to the individual sensor.
Beside the instrument master file (GSD), with which a sensor is logged into the Profibus system, the majority of all Profibus sensors requires for adjustment, beside the specific adjustment software, also a so-called EDD (Electronic Device Description) for each sensor, in order to access and adjust the sensor from the bus levels. This is not the case with VVO. The adjustment software VVO can communicate at any time with all VEGA sensors without the help of a special database. Of course, all other non-Profibus VEGA sensors can be adjusted with the adjustment software as well (4 … 20 mA sensors or VBUS sensors). With VEGA sensors, it is not necessary to go looking for the latest EDD. This is the essential requirement for a manufacturer-independent adjustment program, like PACTware™, anticipated by many users, see following pages.



Adjustment of the VEGASON ultrasonic sensors from process control via a Profibus interface card in the process control computer or in an additional PC. The adjustment software VEGA Visual Operating (VVO) accesses the sensors bidirectionally via the interface (interface card).

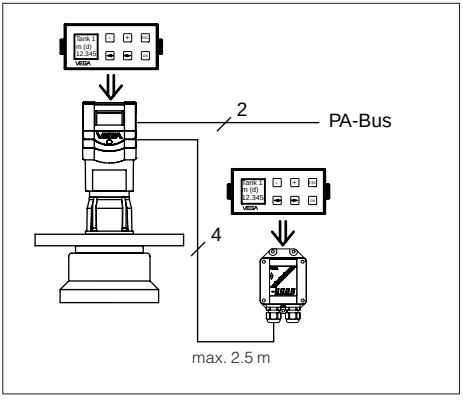
Adjustment with adjustment module MINICOM

With the small (3.2 cm x 6.7 cm) 6-key adjustment module with display, you carry out the adjustment in clear text dialogue. The adjustment module can be plugged into the ultrasonic sensor or into the optional, external indicating instrument.



Detachable adjustment module MINICOM

The adjustment module can be easily removed to prevent unauthorised sensor adjustment.



Adjustment with detachable adjustment module. The adjustment module can be plugged into the ultrasonic sensor or into the external indicating instrument VEGADIS 50.

Adjustment with the SIMATIC PDM adjustment program

To adjust all essential functions of the VEGA sensor with the adjustment station SIMATIC PDM from Siemens, a so-called EDD is required. Without this EDD, only the basic functions such as min./max. wet adjustment or integration time can be adjusted with the PDM adjustment program. Further important adjustment functions, such as input of the measuring environment or false echo storage, are not available without EDD. After integration of the EDD files in the Simatic PDM adjustment software, all important adjustment functions are accessible. If it is not at hand, the obligatory GSD (instrument master file) as well as the EDD (Electronic Device Description) necessary for PDM can be downloaded from the VEGA homepage (http://www.vega.com).

Adjustment with PACTware™

PACTware™ is a manufacturer-independent automation/configuration tool through which access to instruments of different manufacturers (Krohne, Pepperl + Fuchs, VEGA, WIKA-, Bürkert…) is possible. The VEGA adjustment software VVO works as a subprogram/menu. PACTware™ activates the required menu options for the sensor/instrument being accessed.

PACTware™ looks different than VVO and is designed with a tree structure. Operating instructions for PACTware™ can be found in the PACTware™ documentation. They are not described in this operating instructions manual.

1.5 Type survey

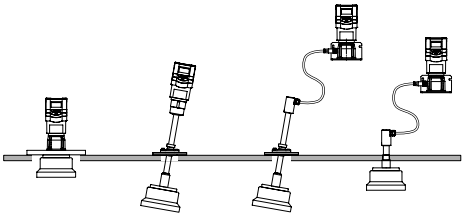
VEGASON 54 ... 56 sensors are a newly developed generation of very compact ultrasonic sensors for large measuring ranges. For shorter measuring ranges, VEGASON 51 ... 53 sensors are used.

Thanks to the small housing dimensions and process fittings, the compact sensors are a very cost-effective solution for your level measurement applications. Swivelling holders enable quick orientation of the transducers to the liquid or solid surface. Because the sensor electronics and transducer can be separated, installation is very simple. It is possible to separate the sensor electronics up to 300 m from the transducer. As a result, the transducer can handle ambient temperatures up to 150°C (VEGASON 56).

General features

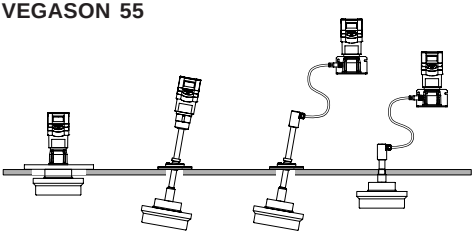
- Application in solids and liquids.
- Measuring range 0.8 m ... 70 m.
- Ex-approved in Zone 10 (IEC) or Zone 11 (ATEX) classification mark EEx ia [ia] IIC T6 or Zone 20/21/22, VEGASON 56 also Zone 1.
- Integrated measured value display in the sensor or in the external indicating instrument which can be mounted up to 25 m away from the sensor.

VEGASON 54



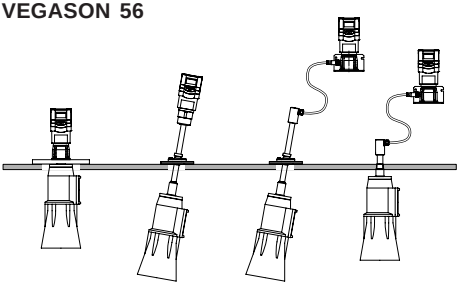
Version A Version B Version C Version D

VEGASON 55



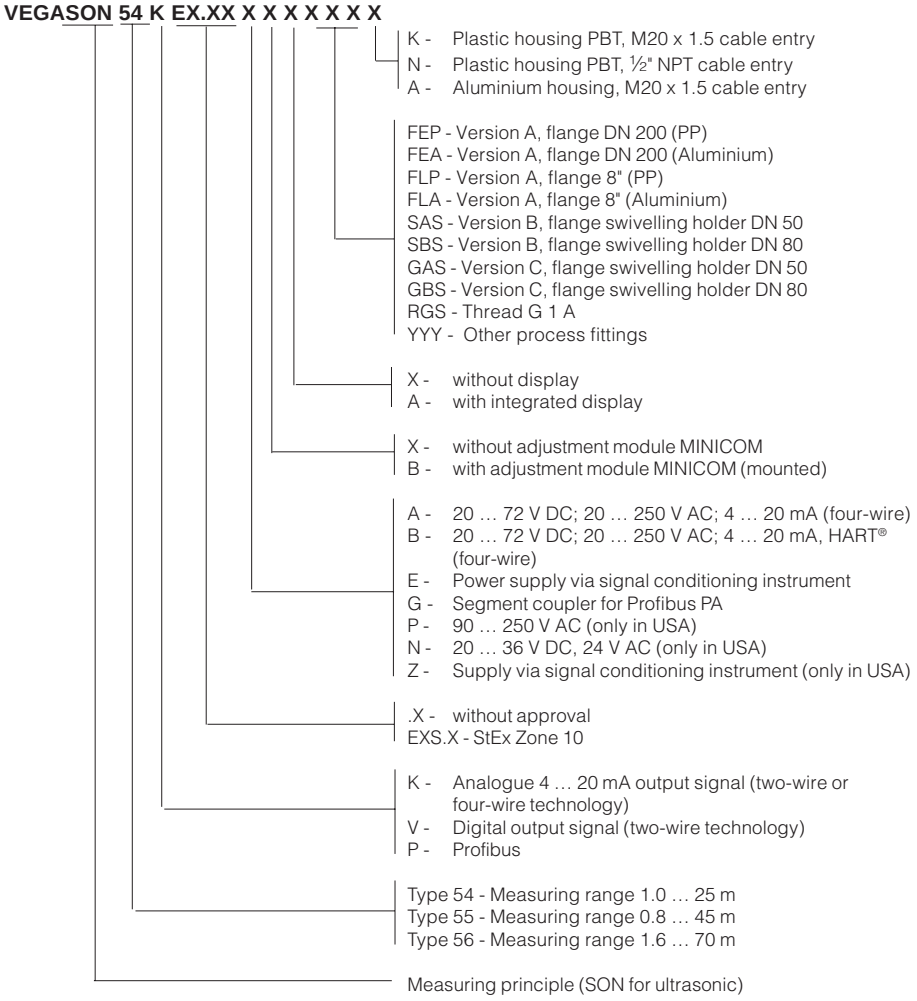
Version A Version B Version C Version D

VEGASON 56



Version A Version B Version C Version D

1.6 Type code


VEGASON 54 K EX.XX X X X X X X X
K - Plastic housing PBT, M20 x 1.5 cable entry
N - Plastic housing PBT, ½" NPT cable entry
A - Aluminium housing, M20 x 1.5 cable entry
FEP - Version A, flange DN 200 (PP)
FEA - Version A, flange DN 200 (Aluminium)
FLP - Version A, flange 8" (PP)
FLA - Version A, flange 8" (Aluminium)
SAS - Version B, flange swivelling holder DN 50
SBS - Version B, flange swivelling holder DN 80
GAS - Version C, flange swivelling holder DN 50
GBS - Version C, flange swivelling holder DN 80
RGS - Thread G 1 A
YYY - Other process fittings
X - without display
A - with integrated display
X - without adjustment module MINICOM
B - with adjustment module MINICOM (mounted)
A - 20 … 72 V DC; 20 … 250 V AC; 4 … 20 mA (four-wire)
B - 20 … 72 V DC; 20 … 250 V AC; 4 … 20 mA, HART® (four-wire)
E - Power supply via signal conditioning instrument
G - Segment coupler for Profibus PA
P - 90 … 250 V AC (only in USA)
N - 20 … 36 V DC, 24 V AC (only in USA)
Z - Supply via signal conditioning instrument (only in USA)
.X - without approval
EXS.X - StEx Zone 10
K - Analogue 4 … 20 mA output signal (two-wire or four-wire technology)
V - Digital output signal (two-wire technology)
P - Profibus
Type 54 - Measuring range 1.0 … 25 m
Type 55 - Measuring range 0.8 … 45 m
Type 56 - Measuring range 1.6 … 70 m
Measuring principle (SON for ultrasonic)

2 Mounting and installation

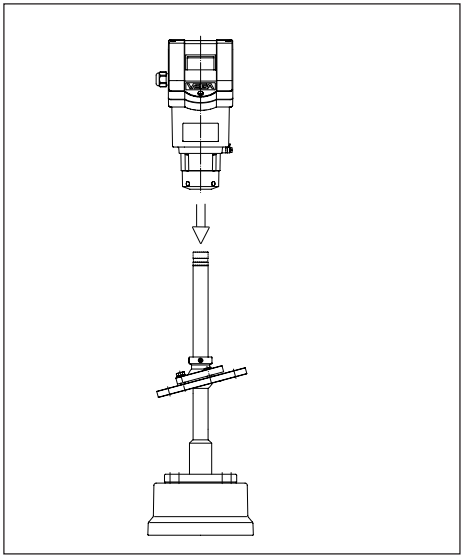
2.1 Mounting

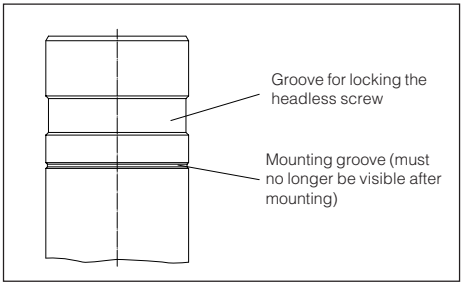
Version A

Sensors in version A (flange version) are supplied completely assembled and ready for operation. Immediately after mounting on the vessel and electrical connection, they are ready for operation.

Version B

Sensors in version B are supplied in two parts (transducer and sensor electronics). First of all, mount the transducer on the vessel or above the medium. There is a four-pole jack at the end of the transducer tube. The respective counterpart to the jack protrudes out of the lower side of the sensor electronics. Insert the plug of the sensor electronics (only possible in one position) into the jack of the transducer tube. Continue pushing the electronics housing onto the transducer tube, on which there is a wide and a narrow groove.

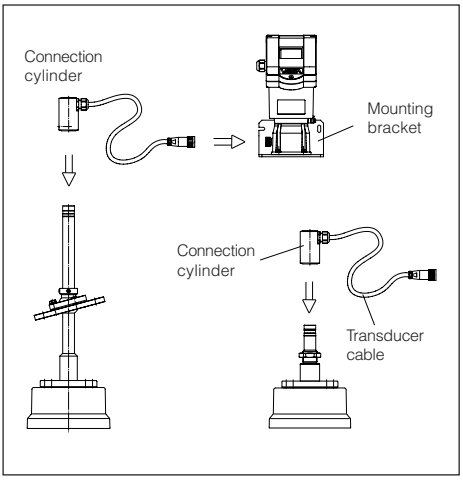




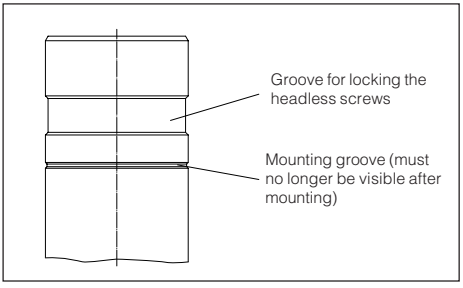
The wide groove is used for locking the headless screws. The narrow groove is an assembly mark. Move the electronics housing farther down over the transducer tube until the mounting groove is no longer visible. Fasten the housing with the headless screws to the transducer tube. Use a 5 mm hexagon screwdriver (or Allen wrench).

Version C and D

The sensors in version C and D are supplied in three parts (transducer, sensor electronics and transducer cable). First mount the transducer (see version B). There is a four-pole jack at the transducer tube end. A respective counterpart to the jack is provided in the connection cylinder of the transducer cable. Insert the connection cylinder plug into the jack of the transducer tube. S



On the end of the transducer tube you find a wide and a narrow groove. The wide groove is used for locking the cylinder with the headless screws. The narrow groove is the assembly mark.



Then push the connection cylinder onto the transducer tube (with a slight swivelling motion) until the assembly mark is no longer visible.

When the assembly mark is covered by the cylinder, fasten the cylinder with the two headless screws. Use a 5 mm hexagon screwdriver (or Allen wrench).

Now mount the sensor electronics at the requested location. The sensor electronics is fastened to a mounting bracket so that it can be mounted on a plain surface or on a wall. Make sure that the sensor electronics is mounted in such a way that there is enough space above the electronics to open the cover.

Now insert the plug at the other end of the transducer cable into the jack on the electronics housing.

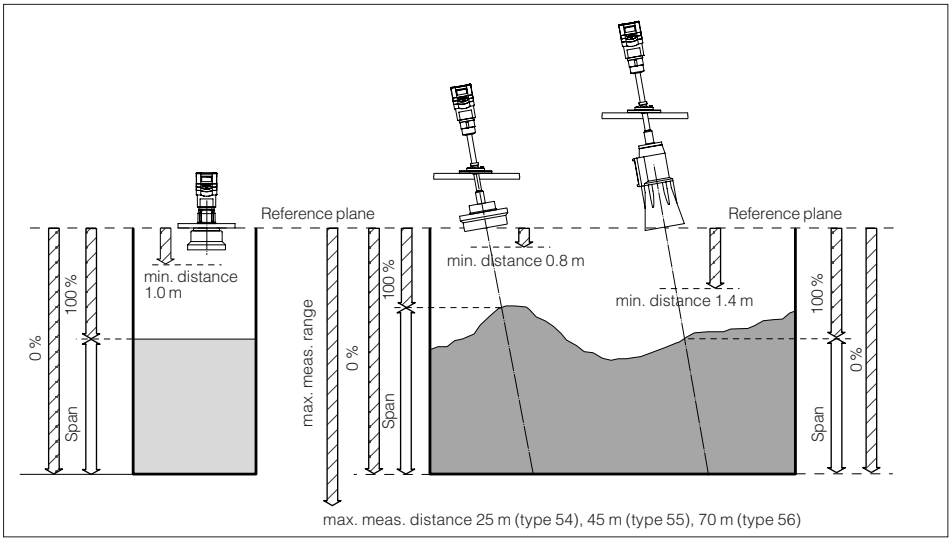
Note:
Avoid bending the transducer cable too sharply when laying it out. This is a special cable which could otherwise be damaged.

In addition, make sure that the cable cannot be damaged during operation. A signal with a voltage of approx. 1 kV is transmitted (which could be a danger in Ex areas if the cable is damaged) via the shielded cable cores.

2.2 General installation instructions

Measuring range

Beside other criteria, you select your instrument according to the required measuring range. The reference plane for the min. and max. distance to the liquid or solids is the transducer end, or for instruments in flange version, the instrument flange (version A). Please note the information on the reference planes in chapter "7.4 Dimensions". The max. filling depends on the required min. distance and the mounting location.



Min. distance, max. measuring range, span and reference plane

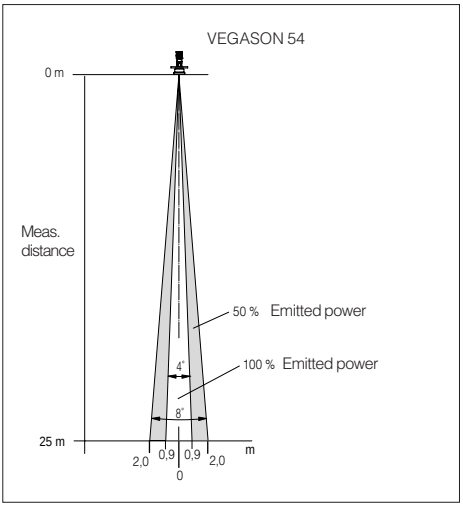
Beam angle and false echoes

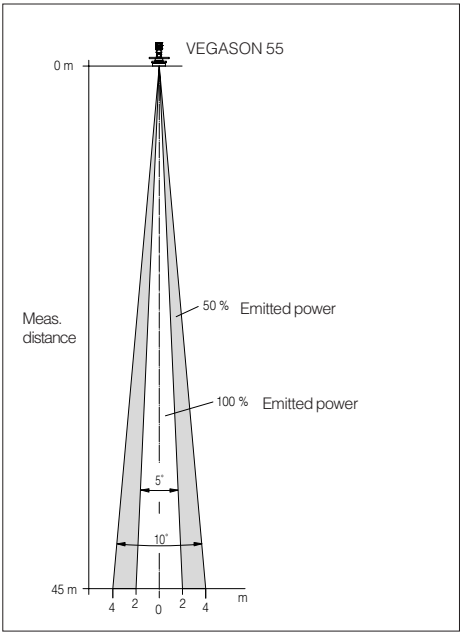
The ultrasonic impulses are focused by the transducers. The impulses leave the transducer in a conical form similar to the beam pattern of a spotlight. The beam angle is 4° (VEGASON 54), 5° (VEGASON 55) and 6° (VEGASON 56) at -3 dB emitted power. Any object, e.g. tubes or struts inside this emission cone will cause a large false echo. Especially within the first few meters of the emission cone, pipes, struts, or other installations can interfere with the measurement. At a distance of 6 m, the false echo of a strut has an amplitude nine times greater than at a distance of 18 m.

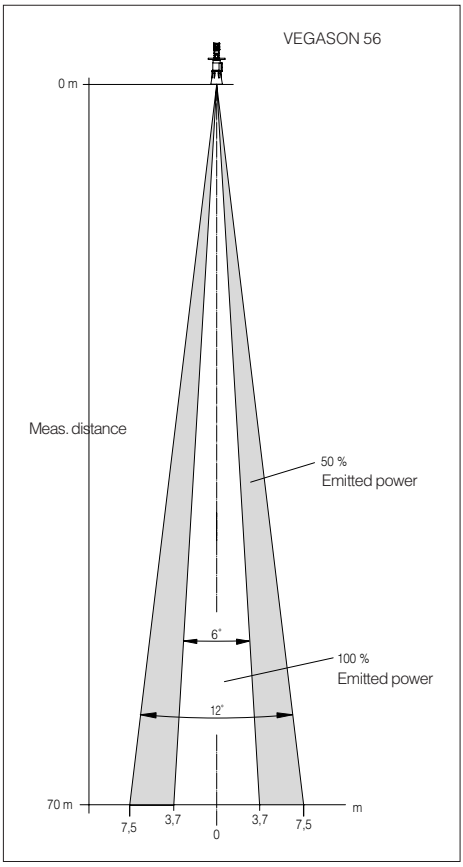
At greater distance, the energy of the ultrasonic impulses distributes over a large area, thus causing weaker echoes from obstructing surfaces. The interfering signals are therefore less critical than those at close range.

If possible, orient the sensor axis perpendicularly to the product surface and avoid vessel installations (e.g. pipes and struts) within the 100 % area of the emission cone.

The following illustration of the ultrasonic beams is simplified and represents only the main beam - a number of additional weaker beams exists.





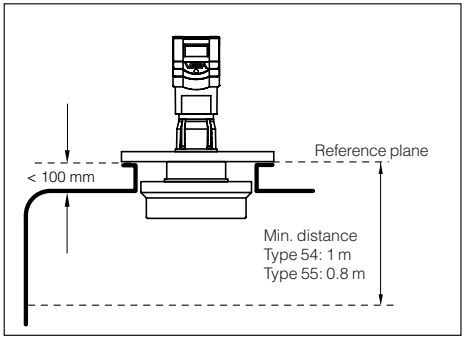


Therefore, in practical application, the transducer has to be oriented so that the lowest possible false echo signal strength is achieved. Only giving attention to the size of the useful echo is usually not adequate under difficult measuring conditions. In most cases, a low false echo level enables the sensor to reliably pick up the useful echo. With the adjustment software VVO on the PC, you can view the echo image (see manual VVO "Sensor optimisation".

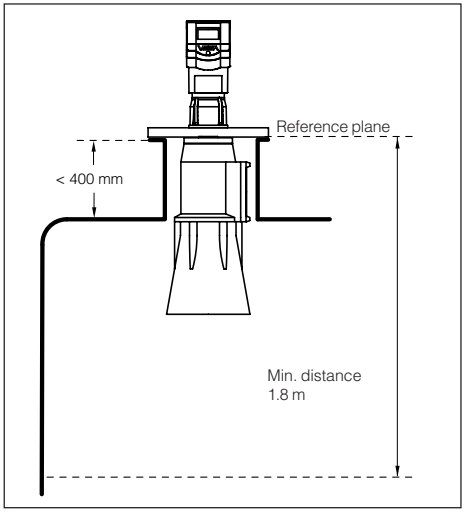
2.3 Measurement of liquids

Flat vessel top

On flat vessels, mounting is usually done on a very short DIN socket piece. The lower side of the flange is the reference plane. The transducer should protrude out of the flange pipe.

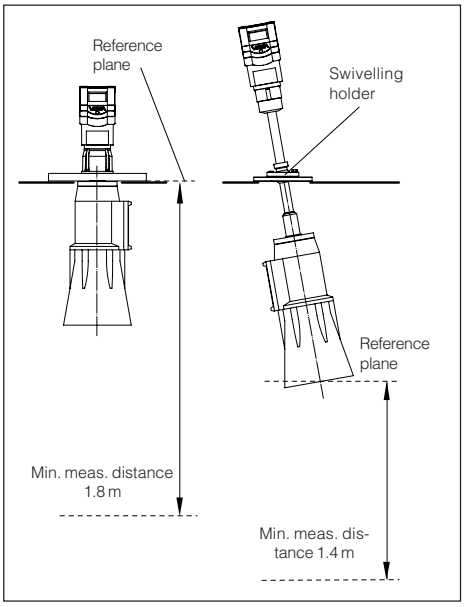


VEGASON 55 in flange version on short DIN socket piece



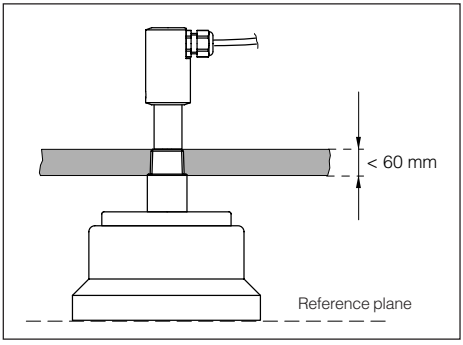
VEGASON 56 in flange version on short DIN socket piece

A mounting location directly on the vessel top is ideal. A round opening in the vessel top is sufficient to fasten the sensor with the flange or version B and C with the swivelling holder.



Flange version and swivelling holder on flat vessel top

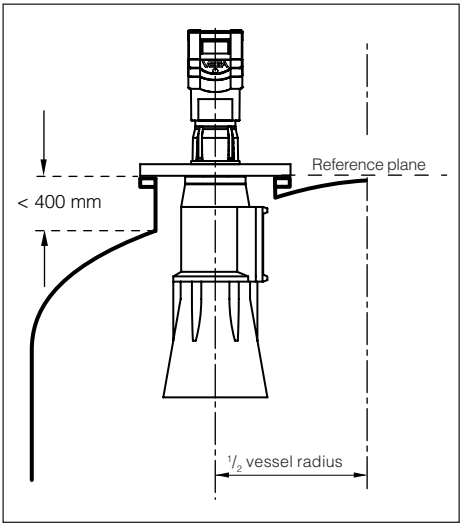
It is also possible to mount version C sensors in a 1" thread.



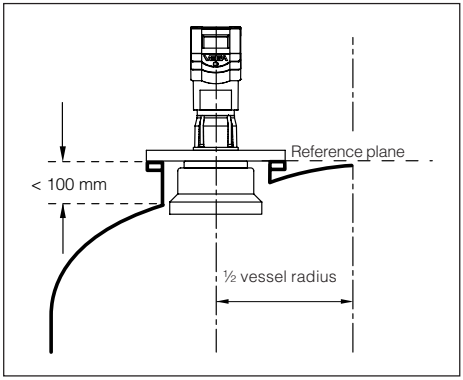
Mounting of the transducer in a 1" thread

Dished tank top

On dished tank tops, please do not mount the instrument in the centre or close to the vessel wall, but approx. ½ vessel radius from the centre. Dished tank ends can act as paraboloidal reflectors. If the transducer is placed in the focal point of the parabolic tank, the ultrasonic sensor receives amplified false echoes. The transducer should be mounted outside the focal point. Parabolically amplified echoes can be thereby avoided.



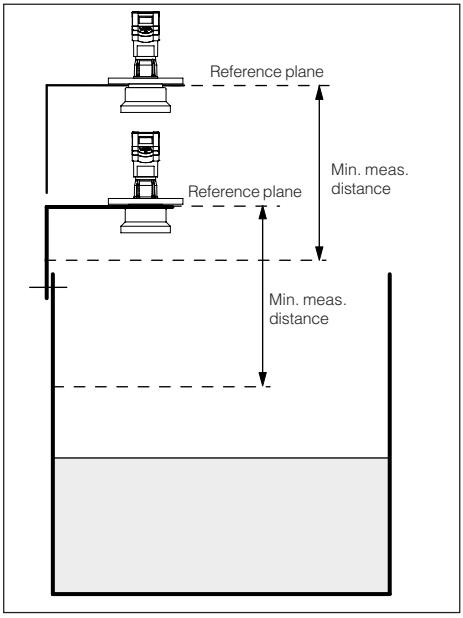
VEGASON 56 on dished tank top



VEGASON 54 on dished tank top; applies also to VEGASON 55

Open vessels

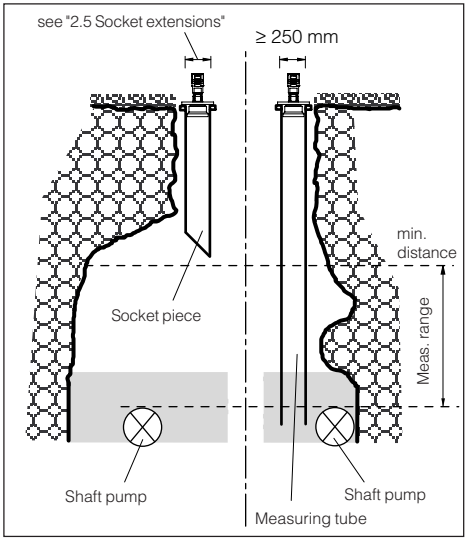
On open vessels, the sensors can be readily installed on extended mounting brackets. Mount the low-weight sensor onto such a bracket and ensure a sufficient distance from the vessel wall.



Open vessel

Pump shaft

Narrow, uneven shafts, wells and vessel openings with very rough walls and shoulders make ultrasonic measurements extremely difficult due to strong false echoes. This problem can be overcome by using an extended socket piece or a complete measuring tube (see chapter "2.5 Socket extension").



Measuring tube socket or measuring tube in a shaft

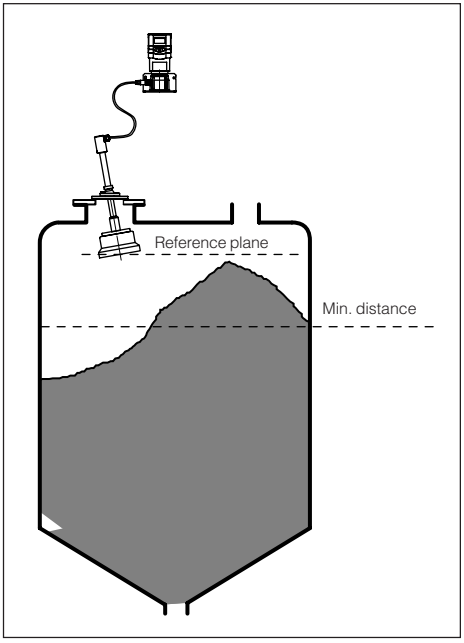
Shaft
Very good measuring results can be attained with a measuring tube in continuous narrow shafts, see illustration. The applied measuring tube must have smooth walls inside (e.g. PE sewage pipe) and a diameter ≥ 200 mm. This arrangement works well as long as the inside of the measuring tube collects no dirt or buildup (cleaning necessary). You might want to consider using hydrostatic pressure transmitters or capacitive measuring probes. The measuring tube should either be never immersed in the medium, or always immersed, making the measurement take place exclusively in the tube.

2.4 Measurement of solids

Flange mounting

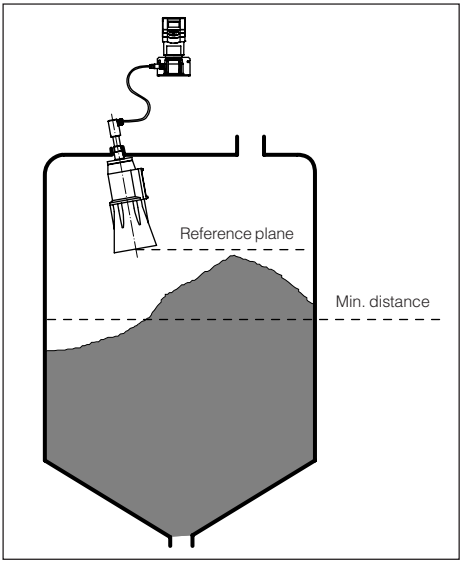
For containers with solids, as with applications for liquids, the instrument can be mounted on a short DIN socket piece. The transducer end should protrude out of the socket so that it does not interfere with ultrasonic signals. The swivelling holder enables not only correct orientation to the product surface but also minimisation of possible false echoes.

Different filling conditions often lead to a varying product surface orientation. This causes the useful echo to vary in quality. For this reason, the transducer should be mounted in such a way that, even in an empty vessel, the false echo intensity remains as low as possible. You can view the echo curve on the PC with the adjustment program VVO.



VEGASON 54C with adapter flange on a DN 200 vessel flange

Mounting boss

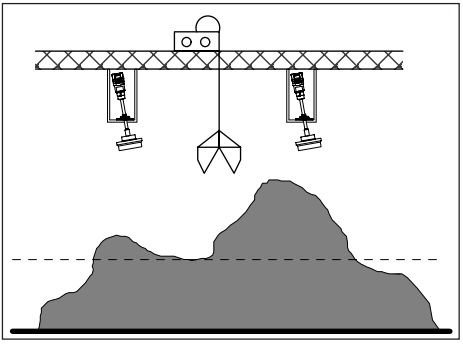


VEGASON 56 in 1" mounting boss.

The socket axis should be oriented to the product surface. More suitable is the use of a swivelling holder version (type B, C), as described on previous pages.

Material heaps

Large material heaps are usually measured with several instruments, which can be mounted on e.g. traverse cranes. If material cones form, we recommend orienting the sensors to the solid surface.



Transducer on traverse crane above a material heap

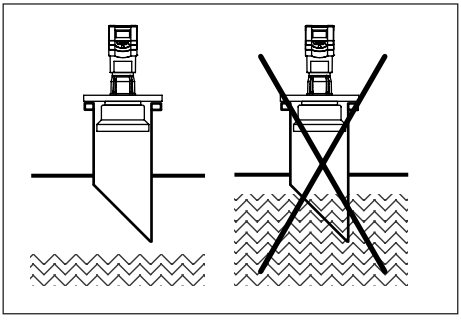
2.5 Socket extensions

Ultrasonic sensors require a min. distance to the liquid or solid. Take the min. distance into account in your planning. In some situations, it is possible to reach the required min. distance, and hence the desired filling height with a socket extension. However, the socket piece increases the noise level of the ultrasonic signal at the extension outlet and can interfere with the measurement. Only use a socket extension if all other possibilities have to be excluded. Carry out the extension as shown in the following illustration.

Socket extensions for liquids

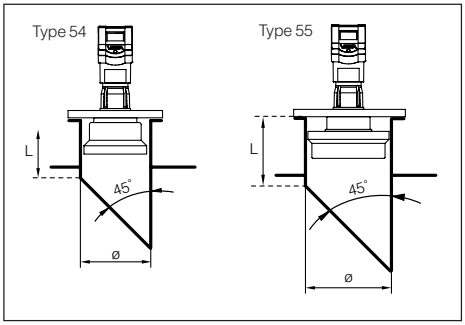
Chamfer and deburr the socket carefully and make sure that it has a smooth inner surface. The socket should not protrude into the measured product, in case buildup can form on the socket through dirt or product residues.

For non-adhesive measured products, a socket extension in the form of a measuring tube can be permanently submerged in the product. The ultrasonic measurement is then made exclusively in the measuring tube and works very well without interference from other vessel installations (see "Pump shaft").



Socket piece should not be immersed into adhesive products (figure: VEGASON 54)

The socket diameter should be as large and the socket length as small as possible. To minimise false echoes, make sure that the socket outlet is burr-free.

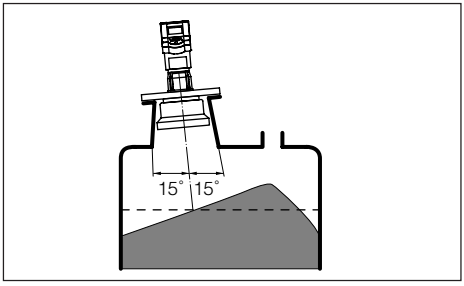


Socket extensions not immersed into the medium

Max. socket length in relation to socket diameter

ø in mm	L in mm Type 54	Type 55	Type 56
200	400	––	––
250	500	500	500
300	––	––	600

Socket extension in solids
For solids, use a conical socket extension with a taper of at least 15° ... 20°.



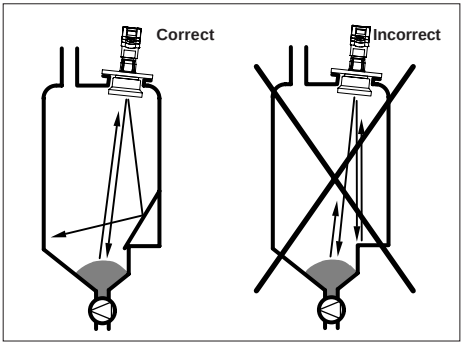
Socket extension in solids

2.6 False echoes

The mounting location of the ultrasonic sensor must be selected such that no installations or inflowing material are in the path of the ultrasonic impulses. The following examples and instructions show the most frequent measuring problems and how to avoid them.

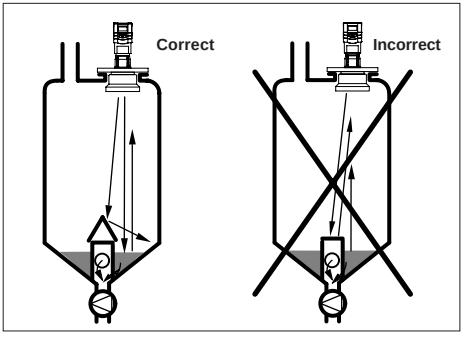
Vessel protrusions

Vessel forms with flat protrusions can, due to their strong false echoes, adversely effect the measurement. Shields above these flat protrusions scatter the false echoes and guarantee a reliable measurement.



Vessel protrusions (slope)

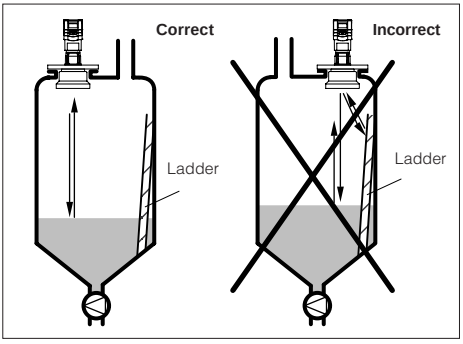
Intake pipes, e.g. for the mixing of materials, with a flat surface directed towards the sensor should be covered with a sloping shield. The shield will scatter the false echo.



Vessel protrusions (intake pipe)

Vessel installations

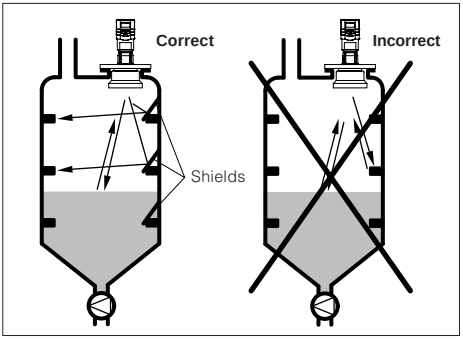
Vessel installations such as, for example, a ladder, often cause false echoes. Make sure when planning your measurement loop that the ultrasonic signals have free access to the measured product.



Vessel installations

Struts

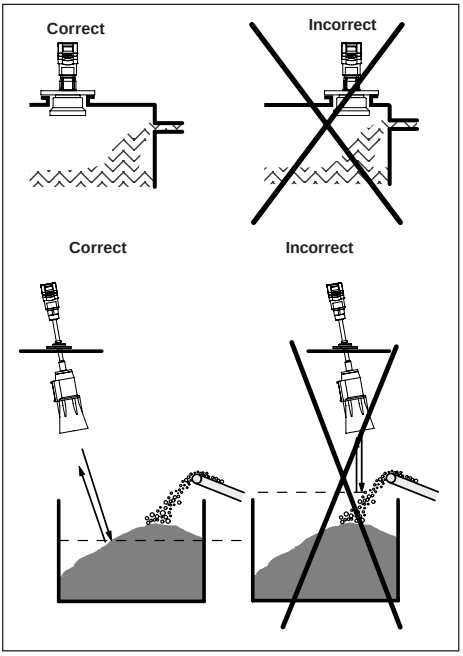
Struts, like other vessel installations, can cause strong false echoes that are superimposed over the useful echo signal. Small shields effectively hinder a direct false echo reflection. The false echoes are scattered and diffused in the area and are then filtered out as "echo noise" by the measuring electronics.



Struts

Inflowing material

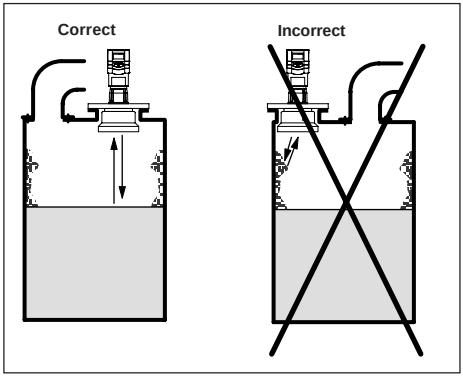
Do not mount the instrument in or above the filling stream. Ensure that you detect the product surface and not the inflowing material.



Inflowing material

Buildup

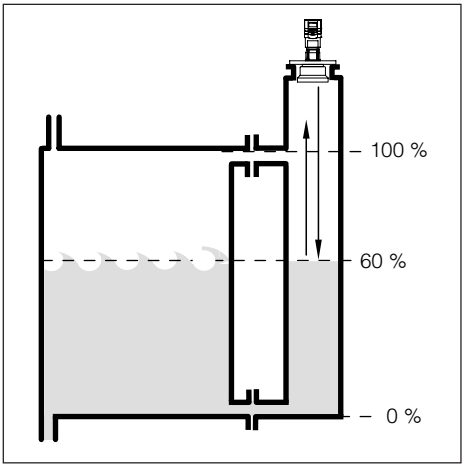
If the sensor is mounted too close to the vessel wall, residues or buildup of the measured product on the vessel wall can cause false echoes. Position the sensor at a sufficient distance from the vessel wall. Please also note chapter "2.2 General installation instructions".



Buildup

Strong product movements

Strong turbulence in the vessel, e.g. caused by powerful stirrers or intense chemical reactions, seriously interfere with the measurement. A surge or bypass tube of sufficient size (DN 200, DN 250) always allows, provided the product causes no buildup in the tube, a reliable measurement even with strong turbulence in the vessel.

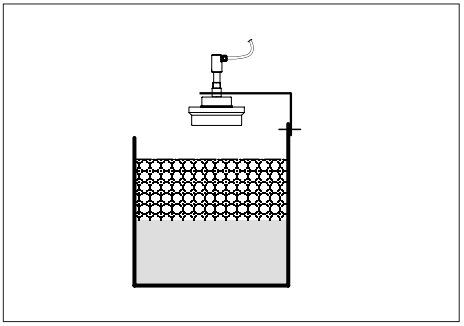


Strong turbulence

2.7 Installation mistakes

Foam generation

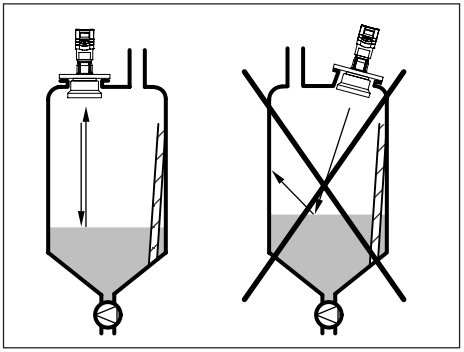
Thick foam on the product can cause incorrect measurements. Take measures to avoid foam, carry out the measurement in a bypass tube, or use a different measurement technology, e.g. capacitive probes or hydrostatic pressure transmitters.



Foam generation

Wrong orientation to the product

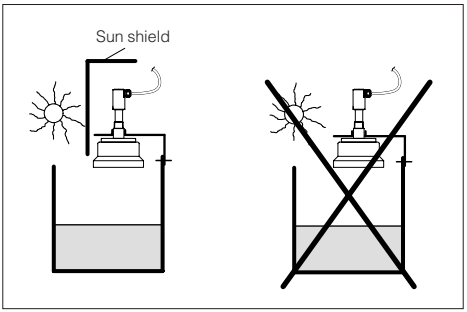
Weak measuring signals are the result if the sensor is not directly oriented to the product surface. Orient the sensor axis perpendicularly to the product surface to achieve optimum measuring results.



Orient the sensor perpendicularly to the product surface

Strong temperature fluctuations

Strong temperature fluctuations, e.g. caused by the sun, cause measuring errors. Please provide a sun shield.

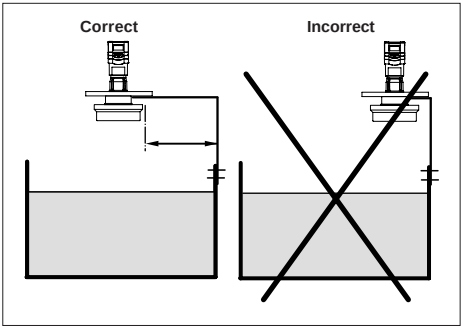


Strong heat fluctuations

Min. distance to the medium

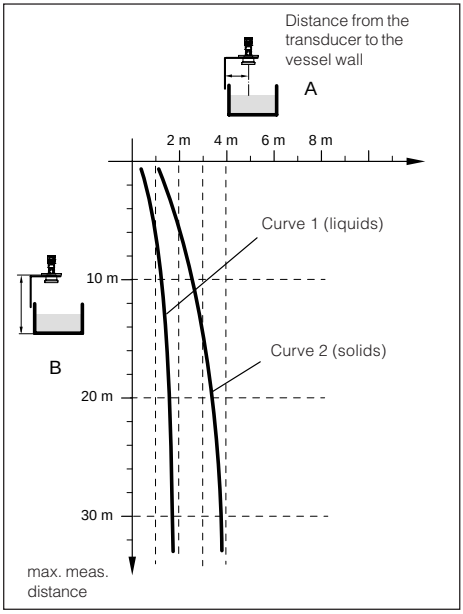
If the min. distance to the medium is not maintained, the instruments show wrong measured values. Mount the instrument at the required min. distance.

Sensor too close to vessel wall



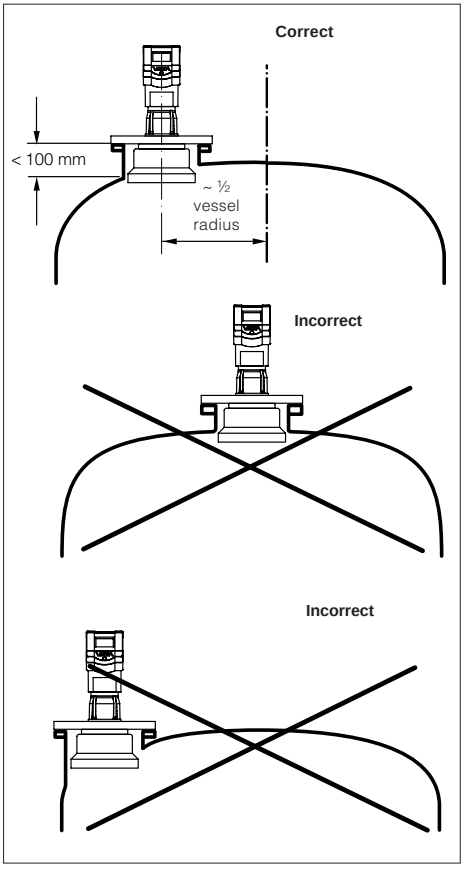
Sensor too close to the vessel wall

If the sensor is mounted too close to the vessel wall (dimension A in diagram), strong false echoes can be caused. Buildup, rivets, screws or weld joints on the vessel wall superimpose their echoes on the product, i.e. the useful echo. Please ensure a sufficient distance from the sensor to the vessel wall depending on the maximum measuring distance (dimension B in diagram). In case of good reflecting conditions (liquids, no vessel installations), we recommend determining the sensor distance according to **Diagram curve 1**. At a max. measuring distance of e.g. 10 m, the distance of the transducer (acc. to curve 1) should be approx. 1.5 m. In case of solids with poor reflective properties, determine the distance to the vessel wall according to **Diagram curve 2**. Under very bad measuring conditions (rough vessel walls, struts), it might be necessary to increase the distance to the vessel wall, or to also filter out the false echoes by storing them in memory, thereby adapting the sensor more precisely to the environment.



Parabolic effects of rounded or arched vessel tops

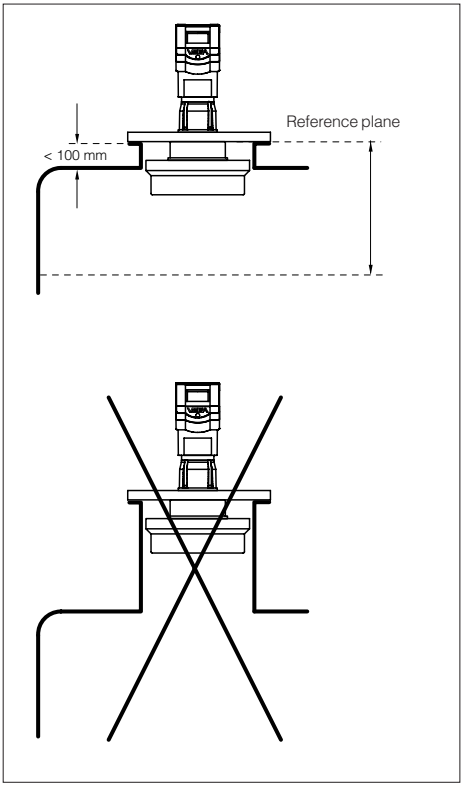
Round or parabolic tank tops act like a parabolic mirror on the signals. If the sensor is placed at the focal point of such a parabolic tank top, the sensor receives amplified false echoes. The optimum location is generally in the area of half the vessel radius from the centre.



Mounting on a vessel with parabolic tank top

Socket piece too long

If the sensor is mounted in a socket piece that is too long, strong false echoes are generated and measurement is made more difficult. Make sure that the transducer protrudes at least 30 mm out of the socket piece.



Correct and wrong length of socket piece

3 Electrical connection

3.1 Connection

Safety information – Qualified personnel

Instruments which are not operated with protective low voltage or DC voltage must only be connected by qualified personnel. This also applies to the configuration of measuring systems planned for Ex environment.

As a rule, do all connecting work in the complete absence of line voltage. Always switch off the power supply before you carry out connecting work on the ultrasonic sensors. Protect yourself and the instruments.

Note, important for connection to an EP card

If VEGASON 54P ... 56P sensors are operated on Profibus input cards (EP cards) in the VEGALOG 571 processing system, each card must be powered individually with an own power supply unit. For power supply of an EP card, use the power supply unit "ASI-Interface SLA 3.100" from Puls which is available from VEGA.

By this measure, the signal circuits are galvanically separated. This avoids possible crosstalks between the EP cards.

3.2 Connection cables and bus configuration

Note the Profibus specification. The connection cables must be specified for the expected operating temperatures in the plant and must have an outer diameter of 6 ... 12 mm, to ensure the seal effect of the cable entry on the sensor.

For power supply and bus communication, a two-wire cable acc. to the Profibus specification (up to max. 2.5 mm^2 cross-section area of conductor) is used. The electrical connection on the sensor is made by spring-loaded terminals.

In a laboratory setup, a Profibus system will also work with standard, unshielded two-wire cable. In practice however, an automation network and bus system can only be protected reliably against electromagnetic interference with screened cable. Acc. to the Profibus specification (IEC 1158-2), screened and twisted cables are prescribed.

All participants are connected in one line (serially). At the beginning and end of the bus segment, the bus is terminated by an active bus termination. On the DP bus level, most participants already have a bus termination implemented. With more than 32 participants on the DP level, a so-called repeater must be used to open and combine another DP level with a max. of 32 additional participants. On the PA bus branch of the segment coupler, the PA ultrasonic sensors also work with a maximum of 32 participants (Ex max. 10 participants).

A PA sensor can work only in conjunction with a Profibus DP system, to which a Profibus PA subsystem is connected. A PA Profibus participant must consume min. 10 mA supply current.

Cable length

Connection cables must correspond to the Profibus specification and the FISCO model. The sensor cable must be in conformity with the values of the reference cable acc. to IEC 61158-2:
0.8 mm^2; $R_{DCmax.}$ = 44 Ω/km;
$Z_{31.25kHz}$ = 80 … 120 Ω; damping = 3 dB/km;
$C_{asymmetric}$ = 2 nF/km.

The max. cable length first of all depends on the transmission speed:
up to 32 kbit/s: 1900 m Profibus PA
up to 94 kbit/s: 1200 m Profibus DP
up to 188 kbit/s: 1000 m Profibus DP
up to 500 kbit/s: 500 m Profibus DP
up to 1500 kbit/s: 200 m Profibus DP
up to 12000 kbit/s: 100 m Profibus DP

The distributed resistance of the cable, in conjunction with the output voltage of the segment coupler and the current requirement (VEGASON 10 mA) or the voltage requirement (VEGASON 9 V) of the sensors, determines the max. length of the cable.

In a practical application of a PA bus branch, the max. length of the cable is also determined (beside the required supply voltage and max. current consumption of all participants on the PA bus branch) by the bus structure and the type of segment coupler used.

The cable length results from the sum of all cable sections and the length of all stubs. The length of the individual stubs must not exceed the following lengths:

1 … 12 stubs	120 m (Ex: 30 m)
13 … 18 stubs	60 m (Ex: 30 m)
19 … 24 stubs	30 m (Ex: 30 m)

More than 24 stubs are not permitted, whereby each branch longer than 1.2 m is counted as a stub. The total length of the cable must not exceed 1900 m (in Ex version 1000 m).

Ground terminal

The electronics housings of the sensors have a protective insulation. The ground terminal in the electronics is galvanically connected with the metallic process connection. For sensors with a plastic thread as process fitting, the sensor must be grounded by connecting a ground cable to its external ground terminal.

Screening

"Electromagnetic pollution" caused by electronic actuators, energy cables and transmitting systems has become so pervasive that shielding for normal two-wire bus cable is usually a necessity. According to the Profibus specification, the screening should be made on both ends. To avoid potential equalisation currents, a potential equalisation system must be provided in addition to the screening.

According to specification, we recommend the use of twisted and screened two-wire cable, e.g.: SINEC 6XV1 830-5AH10 (Siemens), SINEC L26XV1 830-35H10 (Siemens), 3079A (Belden).

Alternatively, when grounding at both ends in non-Ex areas, the cable shielding can be connected on one ground side (in the switching cabinet) via an Y_C-capacitor (e.g. 10 nF, 1500 V) to the ground potential. Make sure that the ground connection has the lowest possible resistance (foundation, plate or mains earth).

Profibus PA in Ex environment

When used in Ex area, a PA bus with all connected instruments must be carried out in intrinsically safe protection class "i". Four-wire instruments requiring separate supply must at least have an intrinsically safe PA connection. VEGA sensors for PA-Ex environment are generally "ia" two-wire instruments.

In the so-called Fieldbus Intrinsically Safe Concept (FISCO), the general conditions for an Ex safe bus configuration have been laid down. Therein, the electrical data of the participants and the bus cable have been determined, so that the linking of these components always meets Ex requirements. This makes the otherwise time-consuming Ex calculation unnecessary. You can build your Ex bus according to the IEC standard 1158-2.

The Ex segment coupler delivers a controlled power supply to the PA bus. It acts as source in the PA branch. All other components (field instruments and bus terminators) are only consumers. A field instrument must consume at least 10 mA. Ideally, an individual sensor should not consume more than 10 mA, so that the number of instruments can be as large as possible.

VEGA PA sensors, whether Ex or non Ex, consume a constant current of 10 mA. According to the Profibus specification, this is the minimum participant current. With VEGA sensors it is therefore possible to connect 10 sensors (also in Ex environment) even with a limited energy supply from the Ex segment couplers.

Watch out for potential losses

Due to potential transfer, earthing on both sides without a potential equalisation system is not allowed in Ex applications. If an instrument is used in hazardous areas, the required regulations, conformity and type approval certificates for systems in Ex areas must be noted (e.g. DIN 0165). Please also note the approval documents with the safety data sheet attached to the Ex sensors.

Electrical data of the cables

	R_{DC}	No. of cores	A in mm^2	$Z_{31.25kHz}$	C in nF/km	Damping	Screen
SINEC 6XV1 830-SEH10 (Siemens)	44 Ω/km	2	0.75	100 Ω +/- 20 Ω	< 90	< 3 dB/km 39 kHz	Cu braiding
SINEC L26XV1 830-SFH10 (Siemens)	44 Ω/km	2	0.75	100 Ω +/- 20 Ω	< 90	< 3 dB/km 39 kHz	Cu braiding
3079A (Belden)	105 Ω/km	2	0.32	150 Ω	29.5	< 3 dB/km 39 kHz	Foil

3.3 Sensor address

In a Profibus system composed of Profibus DP and Profibus PA subsystem, each participant must have a unique address. Each participant, whether master or slave, is accessed by means of its own address in the bus system. The address of a participant, whether on DP or PA level, should be assigned before connecting to the bus, because an address can be used only once. If an address is used twice, interference in the bus will be caused.

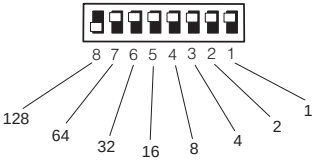
The address of an ultrasonic sensor can be set in two ways:
- with the adjustment software VVO (software addressing) or
- with the DIP switch block in the sensor (hardware addressing).

VEGA Profibus sensors are delivered with the address set at 126 (all DIP switches to "ON").
Remember, in a Profibus system there are max. 126 participants possible. When the DIP switch is set to address 126 (or higher), the address can be adjusted with the adjustment software VVO, the adjustment module MINICOM or another configuration tool (e.g. PDM). However, there can be only one sensor on the bus with address 126 (delivery status) during address assignment via software. For that reason, hardware addressing (DIP switch) before connection to the bus is recommended.

Hardware addressing

The DIP switches generate an address number in the binary system. This means that, from right to left (ascending), any switch represents a number twice as high as the previous switch on the right. The corresponding number in the decimal system results from the sum of all switches set to "ON". In the illustration, you see the decimal number that corresponds to each individual DIP switch.

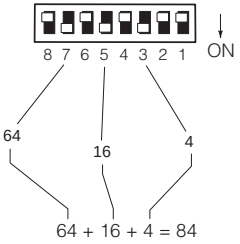
DIP switch 8 corresponds to the number 128, switch 1 corresponds to the number 1 and switch 3 corresponds to the decimal number 4.



Example 1

The switches 3, 5 and 7 are set to "ON". The address is then:
DIP switch 3 to "ON" means 4
DIP switch 5 to "ON" means 16
DIP switch 7 to "ON" means 64

The sum is:
4 + 16 + 64 = Address 84



Example 2

You want to set address 27.
16 + 8 + 2 + 1 = 27

You must set the DIP switches
5 = 16
4 = 8
2 = 2
1 = 1
to "ON".

Example 3

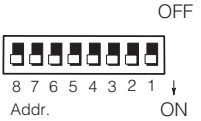
You want to set address 99
64 + 32 + 2 + 1 = 99

You must set the DIP switches
7 = 64
6 = 32
2 = 2
1 = 1
to "ON".

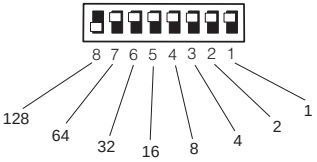
Software addressing

The DIP switches must be set to an address of 126 ... 255, i.e.

- either all DIP switches are set to "ON", corresponding to address 255 (delivery status)



- or only DIP switch 8 is set to "ON", corresponding to address 128.



Of course, software addressing is also possible, if the switches 7 ... 2 are set to "ON" (address 126).

The adjustment of the address with software VVO is described in chapter "6.2 Adjustment with VVO" under the heading "Software addressing" or in chapter "6.3 Sensor adjustment with the adjustment module MINICOM".

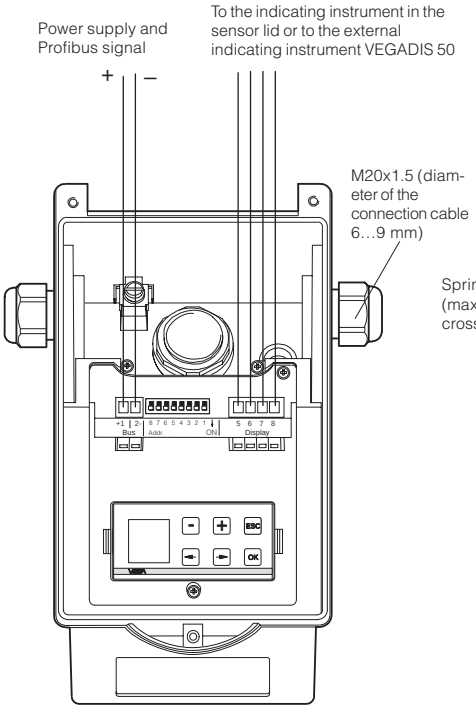
3.4 Connection of the sensor

After mounting the sensor at the measurement location according to the instructions in chapter "4 Mounting and installation", loosen the closing screws on top of the sensor. The sensor lid with the optional indication display can then be opened. Unscrew the sleeve nut and slip it over the connection cable (after removing about 10 cm of insulation). The sleeve nut of the cable entry has a self-locking ratchet that prevents it from opening on its own.

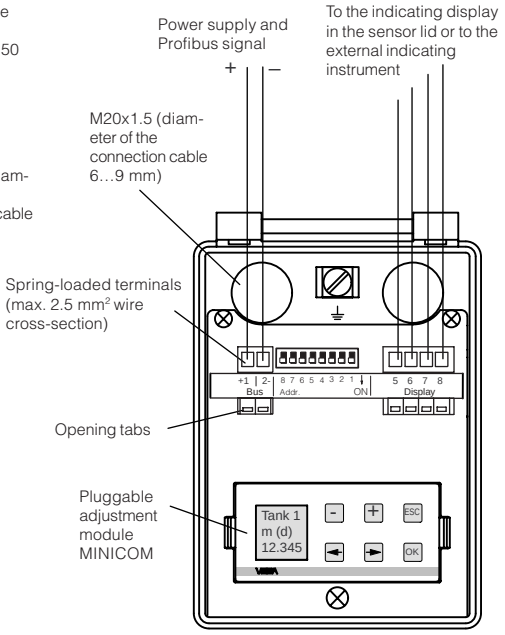
Now insert the cable through the cable entry into the sensor. Screw the sleeve nut back onto the cable entry and clamp the stripped wires of the cable into the proper terminal positions.

The terminals hold the wire without a screw (spring-loaded terminals). Press the white opening tabs with a small screwdriver and insert the copper core of the connection cable into the terminal opening. Check the hold of the individual wires in the terminals by lightly pulling on them.

Version with Aluminium housing

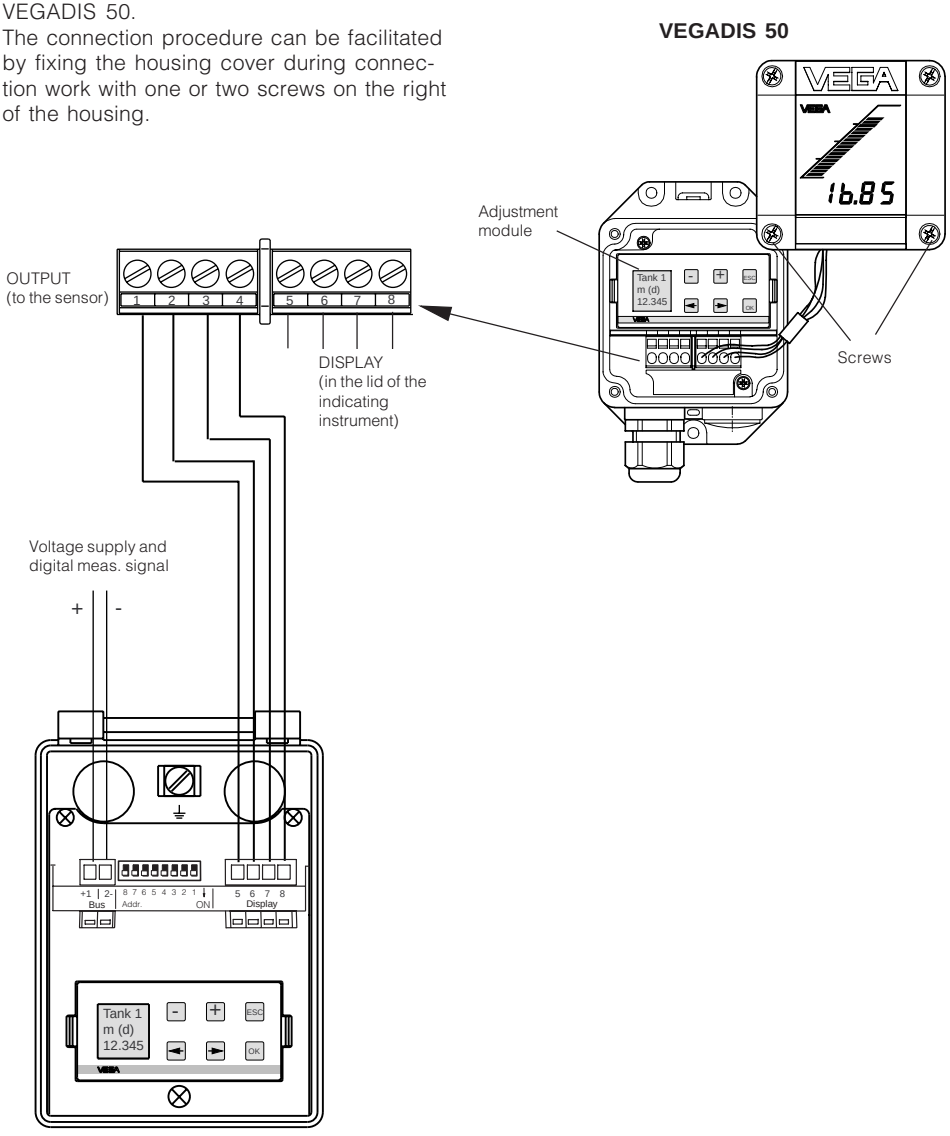


Version with plastic housing



3.5 Connection of the external indicating instrument

Loosen the four screws of the housing lid on VEGADIS 50.
The connection procedure can be facilitated by fixing the housing cover during connection work with one or two screws on the right of the housing.



3.6 Bus configuration

The type of ultrasonic sensor you use depends on the process requirements and mounting conditions, as well as on the requirements of your control, regulative, or process control system.

VEGASON 54 ... 56 Profibus sensors are sensors for use in Profibus PA environment. Profile 3 has been implemented in the sensors. A measuring system consists of one or several sensors, one or several segment couplers and one DP master computer, such as e.g. a S7 PLC with Profibus interface or a process control system with Profibus DP-Master-Slot. The processing unit, e.g. the PLC, evaluates the level-proportional, digital measuring signals in a number of evaluation routines and puts them to use process-specifically.

On the following four pages you will see schematic illustrations of the bus configuration.

The automation system as Master-Class 1 takes over the complete bus control. It reads out all signals cyclically and, if necessary, gives instructions to the participants (e.g. sensors). Additional master systems (e.g. visualisation systems or adjustment tools) can also be connected to the DP bus. These systems operate as so-called Master-Class 2 participants. Like the Master-Class 1 system, they can read out signals, give instructions and operate in the acyclical mode.

A DP bus does not allow power supply via signal cable, whereas the PA bus does. Both, DP and PA, require at least one screened two-wire cable. The DP bus can additionally have up to 8 cores (screened), some of which can be supply cables (see also "Installation Guides PA + DP" of the Profibus User Organisation (PNO).

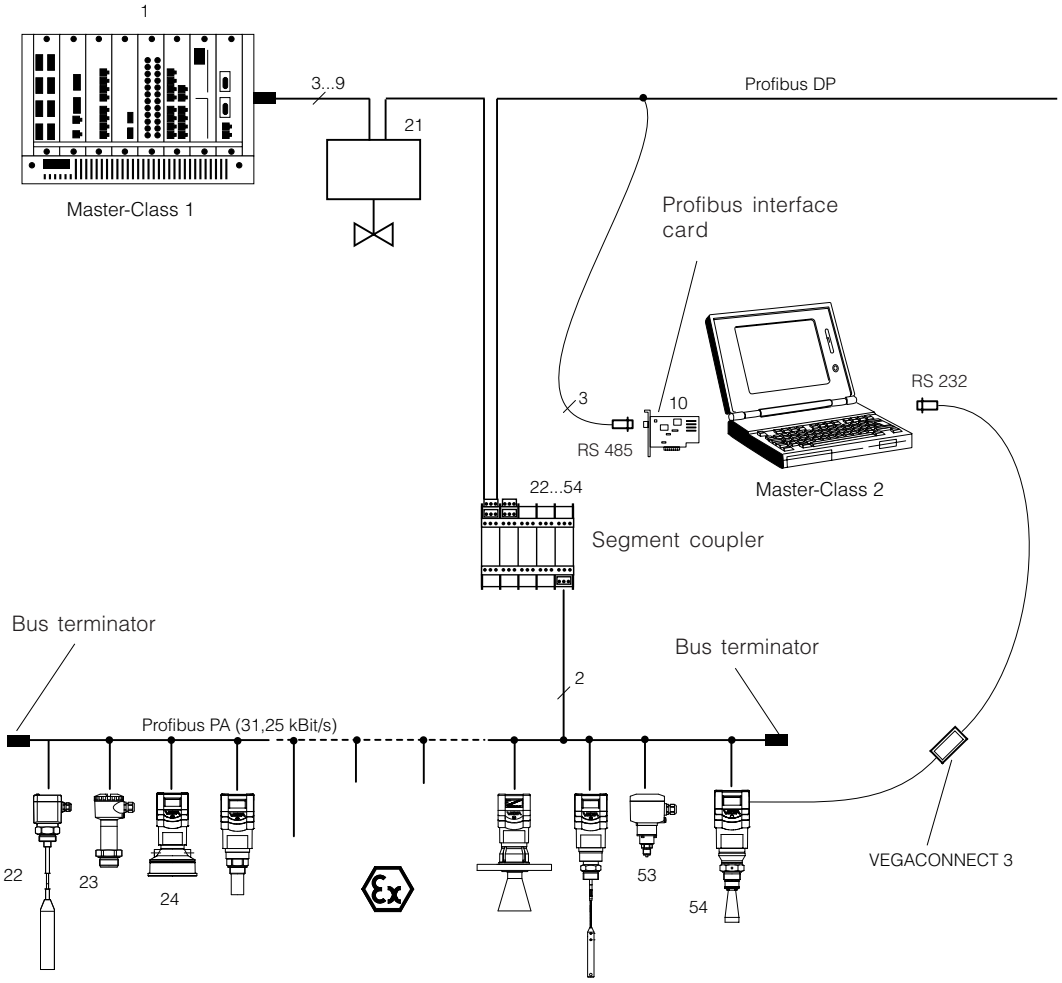
Each participant on the bus must have an unambiguous address. The addressing covers both bus levels. A Profibus DP network can have max. 126 participants, including all participants on the PA level. In practice, each Master-Class 1 computer gets address 1 and the Master-Class 2 computers address 10 ... 20. As a rule, the slaves or participants get the addresses 21 ... 126. On the Profibus PA network segment, a max. of 32 sensors can be connected on one PA segment coupler.

Ex environment

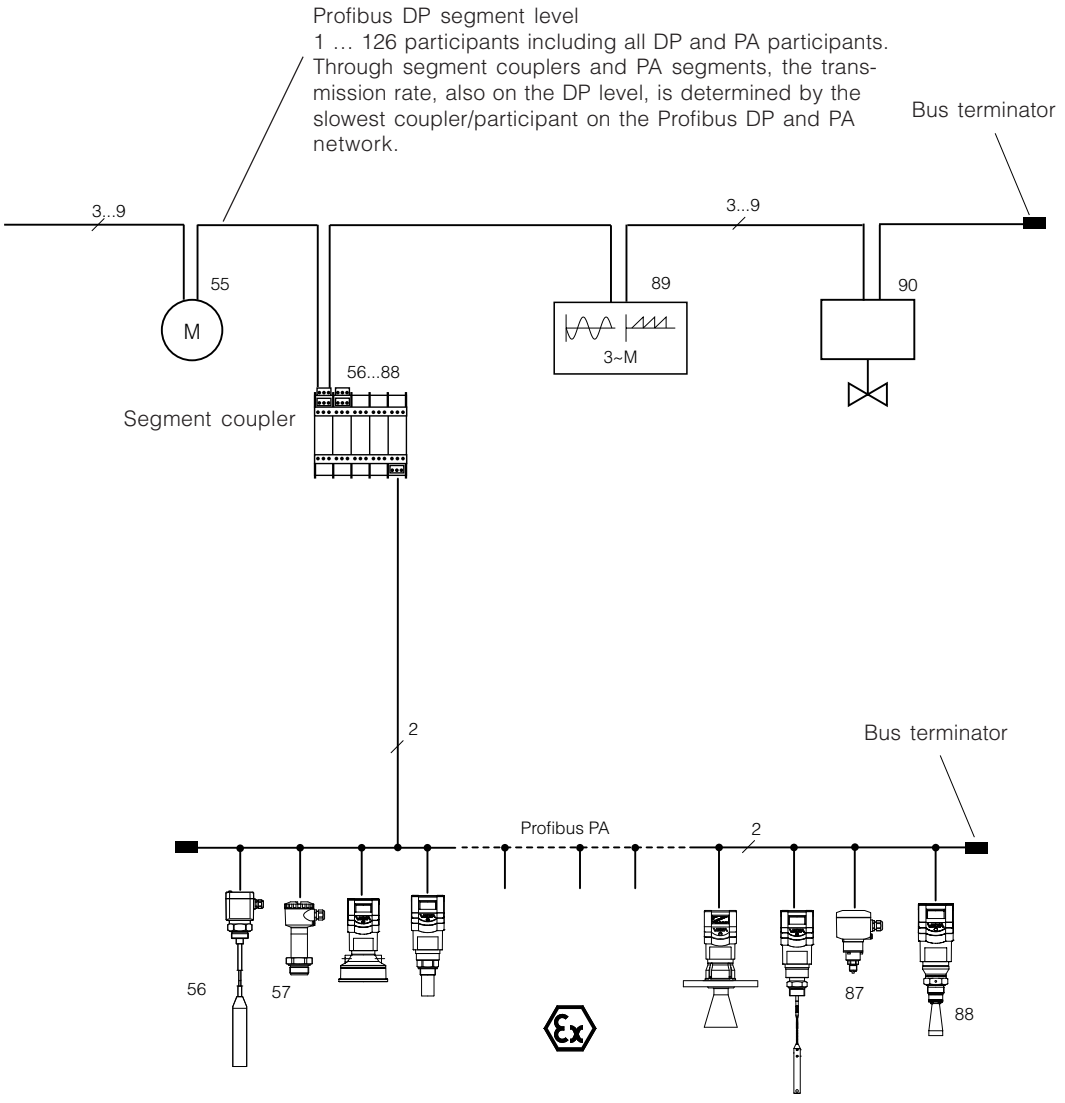
In Ex environment, intrinsically safe (EEx ia) PA sensors are used with Ex segment couplers. Generally, the number of PA sensors on a segment coupler (Ex or non Ex) depends on the current requirement of the sensors and on the current supplied by the segment coupler. Segment couplers for EEx ia environment provide 90 ... 110 mA. The number of sensors results from the sum of:

- the basic current intake of all sensors
- plus 9 mA communication signal
- plus the leakage currents of all sensors
- plus a recommended current reserve (approx. 10 mA)

Profibus PA sensors on the Profibus network

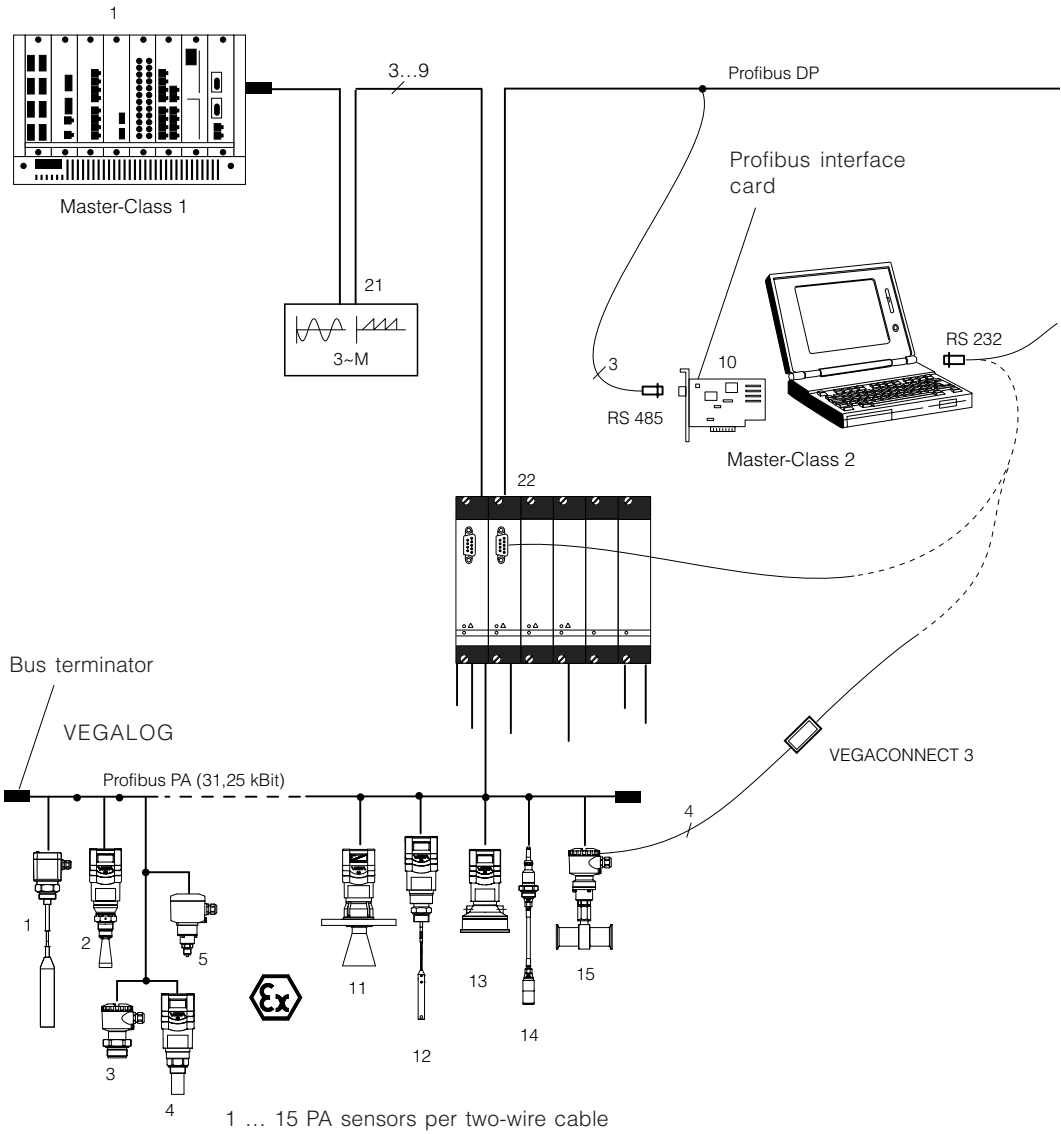


PA segment on segment coupler:
1 ... 32 sensors on one two-wire cable
(Ex: 10 sensors)

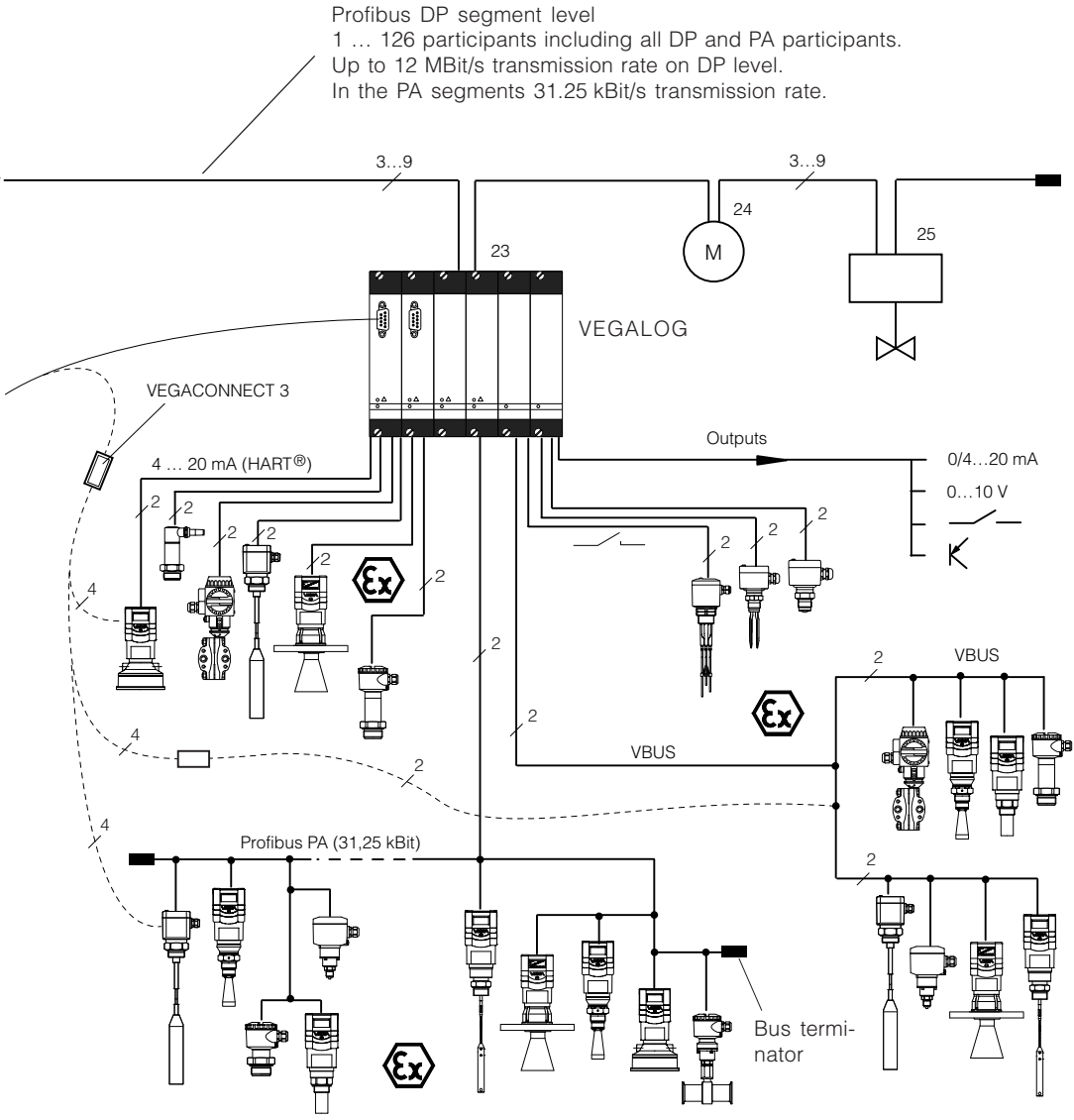


PA segment:
1 ... 32 sensors on one two-wire cable
(Ex: 10 sensors)

Profibus PA sensors with 4 … 20 mA sensors on the Profibus network



1 … 15 PA sensors per two-wire cable with independent address zone (Ex: 10 sensors)



Profibus PA:
1 … 15 sensors per two-wire cable
(Ex: 10 sensors) with independent address zone

VBUS:
1 … 15 sensors per two-wire cable
Exd: also 15
Ex ia: 5 sensors

4 Setup

4.1 Adjustment media

In chapter "1.4 Adjustment" the Profibus adjustment scheme was briefly explained and the adjustment media for VEGA Profibus sensors were shown. All VEGA Profibus sensors operate in profile 3 and can be adjusted with:

- the adjustment program VVO on a PC with Profibus card
- the adjustment program PACTware™, under which VVO runs as a subprogram
- the Siemens software PDM in conjunction with an EDD (Electronic-Device-Description)
- the adjustment module MINICOM in the sensor.

Adjustment with VVO on the PC

The adjustment program VVO enables user-friendly adjustment of VEGA Profibus PA sensors. All functions and options relating to the sensor adjustment are accessible. The program runs under Windows® on a PC with a Profibus-Master-Class 2 interface card on Profibus DP level as Master-Class 2 tool. The VVO program accesses the VEGA PA sensors via the DP bus, the segment coupler and the PA bus.

Note:
Please note that for adjustment with VVO, version 2.70 or higher is required.

Adjustment with PACTware™

The adjustment with PACTware™ corresponds to VVO adjustment. In this case, VVO runs as a subprogram of PACTware™. The adjustment instructions can be found in the documentation of PACTware™.

Adjustment with PDM

The sensors can be adjusted completely with PDM. However, some convenient functions and many special features, like e.g. display of an echo curve, are not available. In addition to the PDM software, an EDD (available upon request from VEGA) is required for each sensor type. The adjustment instructions for PDM are described in the PDM documentation.

Adjustment with the adjustment module MINICOM

With the adjustment module MINICOM, you adjust the individual sensor directly in the sensor or in the external indicating instrument VEGADIS 50. The adjustment module MINICOM enables (with the 6-key adjustment field with text display) all essential functions of parameter setting and adjustment.

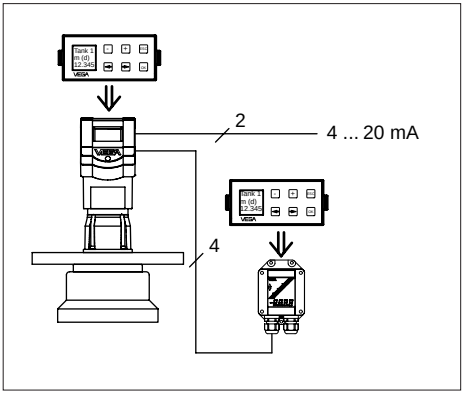
4.2 Adjustment with the PC

The instructions for the adjustment with the PC and the adjustment program VVO can be found in the manual "VEGA Visual Operating (VVO)" which is supplied with the latest adjustment software.

Beside the adjustment of ultrasonic sensors, the manual "VEGA Visual Operating (VVO)" also describes the setup of all other VEGA sensors with the PC.

4.3 Adjustment with the adjustment module MINICOM

In addition to the PC, you can adjust the sensor with the small, detachable adjustment module MINICOM. The adjustment module is plugged into the sensor or into the external indicating instrument (optional).



All sensor versions (adjustment options) provided by a PC with the adjustment program VVO are also available with the adjustment module MINICOM. However, the adjustment with MINICOM looks different.

You can carry out all adjustment steps with the 6 keys of the adjustment module. A small display shows you, apart from the measured value, a short message on the menu item or an entered numerical value.

Although the volume of information of the small display cannot be compared with that of the adjustment program VVO, you will be able to carry out your settings quickly and efficiently with the small MINICOM.

Error codes:

E013 No valid measured value
- sensor in the warm-up phase
- loss of the useful echo

E017 Adjustment span too small

E036 Sensor program not operating
- sensor must be reprogrammed (service)
- fault signal also appears during programming

E040 Hardware failure, electronics defective

E113 Hardware failure

Adjustment steps

On the following pages, you will find the complete menu schematic of the adjustment module MINICOM.

Set up the sensor in the numbered sequence:

1. Address
2. Measurement in gases
3. Operating range
4. Adjustment
5. Conditioning
6. Meas. conditions
7. False echo storage (only required if errors occur during operation).
8. Indication of the useful level and noise level
9. Outputs

Below you will find short explanations to setup steps 1 … 9.

1. Address

Choose a free bus address with the DIP switch (see chapter "4.2 Sensor address").

2. Measurement in gases

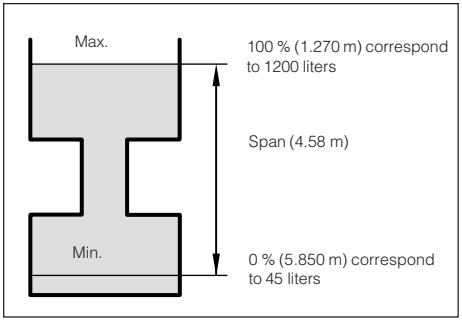
Adjustment is only necessary if the measurement is made in gases other than air (CO_2, He, etc.). When measuring in gases, sound the distance from the sensor to the product surface and enter this in the menu item "*Measurement in gases*". The sensor can then take the altered (compared to air) sonic velocity into account and output correct levels.

3. Operating range

Without special adjustment, the operating range corresponds to the measuring range. The measuring range was already entered with the min./max. adjustment. Generally, it is useful to choose a slightly wider range (approx. 5 %) for the operating range than for the measuring range.

Example:
Min./Max. adjustment: 0.300 … 5.850 m;
adjust operating range to approx.
0.250 … 6.000 m.

4. Adjustment

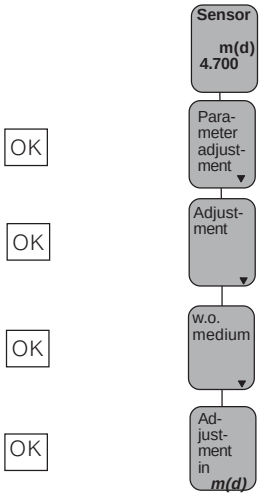


Under the menu item "*Adjustment*", you inform the sensor of the measuring range.

You can carry out the adjustment with or without medium. Generally, you will carry out the adjustment without medium, as you can then adjust without a filling/emptying cycle.

Adjustment without medium
(adjustment independent of the actual level)

Key | Display indication

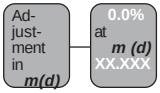


(min. adjustment)

[+] The distance indication flashes and you can choose "feet" and "m".

[OK] Confirm the setting with "*OK*".

[→]



[+] or [–] With "*+*" and "–" you set the percentage value for the min. value or the lower level (example 0.0 %).

[OK] The entered percentage value is written in the sensor and the distance corresponding to the percentage value begins flashing.

[+] or [–] With the "*+*" or "–" key you can assign a level distance (example 5.85 m) to the previously adjusted percentage value. If you do not know the distance, you have to measure it by sounding.

[OK] The entered product distance is written in the sensor and the display stops flashing.

You thereby adjusted the lower product distance as well as the percentage filling value corresponding to the lower product distance.

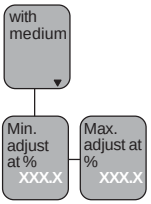
[→]

(max. adjustment)

Enter the max. adjustment (upper product distance) in the same manner (example: 100 % and 1.270 m).

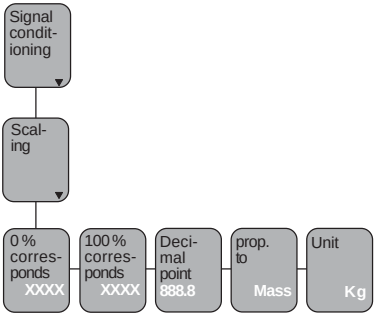
Note:
The difference between the adjustment values of the lower product distance and the upper product distance should be as big as possible, preferably at 0 % and 100 %. If the values are very close together, e.g. lower product distance adjustment at 40 % (3.102 m) and upper product distance adjustment at 45 % (3.331 m), the measurement will be inaccurate. A characteristics curve is generated from the two points. Even the smallest deviations between actual product distance and entered product distance will considerably influence the slope of the characteristics curve. If the adjustment points are too close together, small errors inflate to considerably larger ones when the 100 % or the 0 % value is outputted.

Adjustment with medium



Fill the vessel e.g. to 10 % and enter 10 % in the menu "*Min. adjust*" with the "*+*" and "–" keys. Then fill the vessel, e.g. to 80 % or 100 % and enter 100 % in the menu "*Max. adjust*" with the "*+*" and "–" keys.

5. Conditioning



Under the menu item "*Conditioning*", you assign a product distance at 0 % and at 100 % filling. Then you enter the physical quantity and the physical unit as well as the decimal point.

Enter in the menu window "*0 % corresponds*" the numerical value of the 0 % filling. In the example of the adjustment with the PC and the adjustment software VVO, this would be 45 for 45 liters.

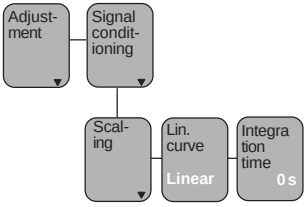
- Confirm with "*OK*".

With the "—>" key you change to the 100 % menu. Enter here the numerical value of your parameter corresponding to a 100 % filling. In the example 1200 for 1200 liters.

- Confirm with "*OK*".

If necessary, choose a decimal point. However, note that only max. 4 digits can be displayed. In the menu "*prop. to*", you choose the physical quantity (mass, volume, distance…) and in the menu "*Unit*" the physical unit (kg, l, ft^3, gal, m^3 …).

Linearisation:



A linear correlation between the percentage value of the product distance and percentage value of the filling volume is preset. With the menu "Lin. curve" you can choose between linear, spherical tank and cylindrical tank. The generation of a customised linearisation curve is only possible with the PC and the adjustment program VVO.

6. Meas. conditions

(see menu schematic)

7. False echo storage

A false echo storage is always useful when unavoidable false echo sources (e.g. struts) must be minimised. By creating a false echo storage, you authorise the sensor electronics to record the false echoes and save them in an internal database. The sensor electronics treats these (false) echoes differently from the useful echoes and filters them out.

8. Signal and noise level

In the menu 

you get important information on the signal quality of the product echo. The higher the "S-N" value, the more reliable the measurement (menu schematic MINICOM).

Ampl.: means amplitude of the level echo in dB (useful level)
S-N: means Signal-Noise, i.e. the useful level minus the level of the background noise

The bigger the "S-N" value (difference between the amplitudes of the useful signal level and the noise level), the better the measurement:

> 50 dB	Measurement excellent
40 … 50 dB	Measurement very good
20 … 40 dB	Measurement good
10 … 20 dB	Measurement satisfactory
5 … 10 dB	Measurement sufficient
< 5 dB	Measurement poor

Example:
Ampl. = 68 dB
S-N = 53 dB

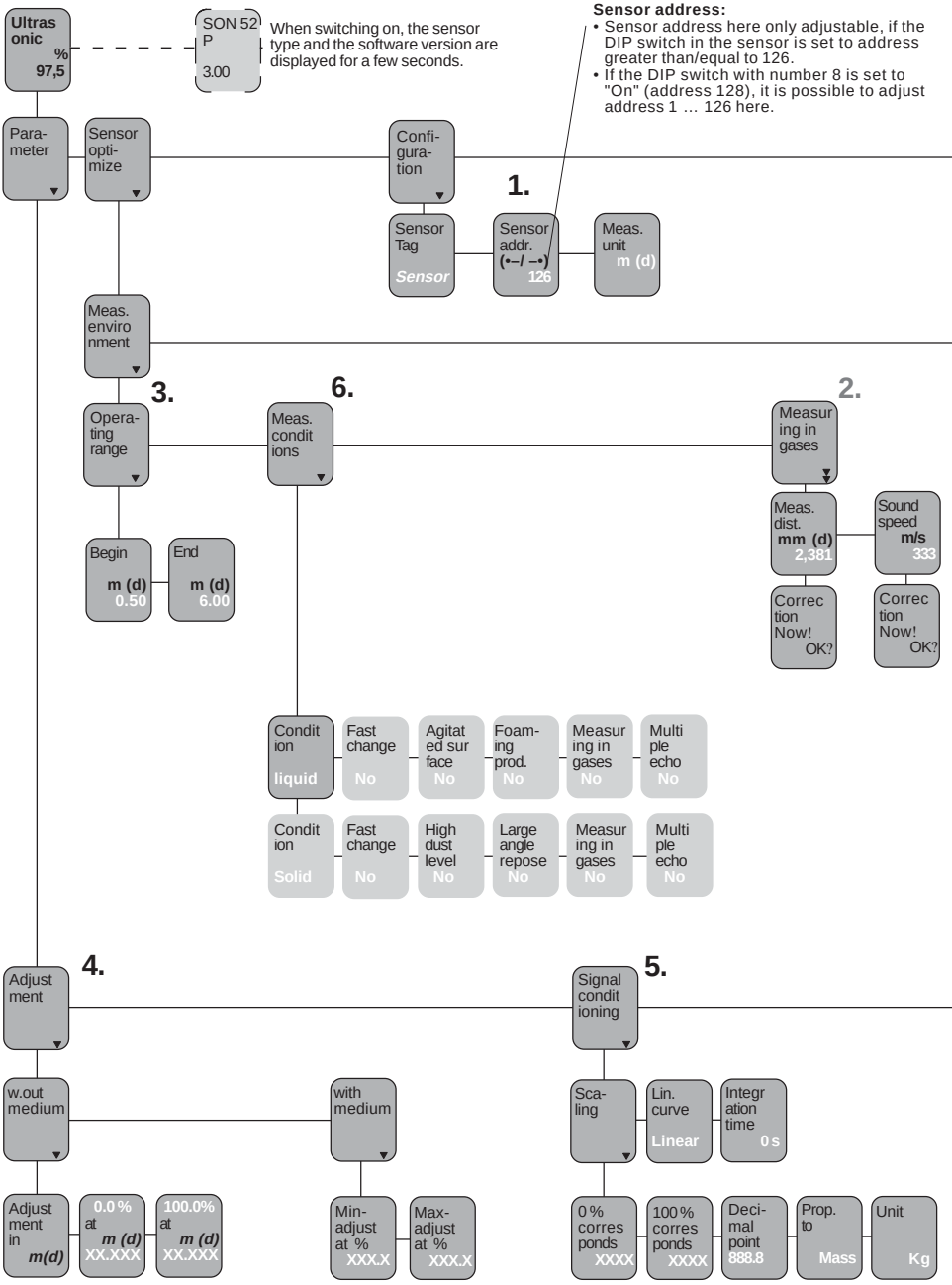
68 dB – 53 dB = 15 dB noise level

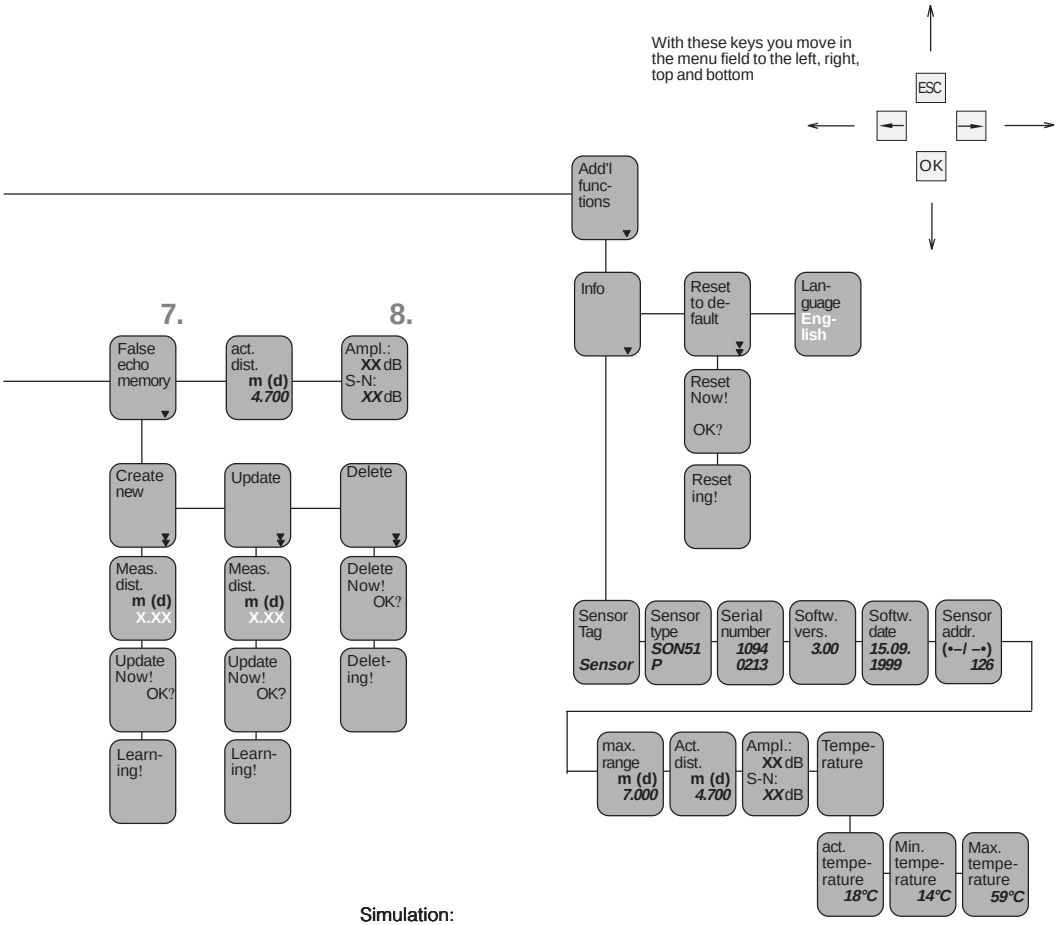
A signal distance of 53 dB means a very high degree of measurement reliability.

9. Outputs

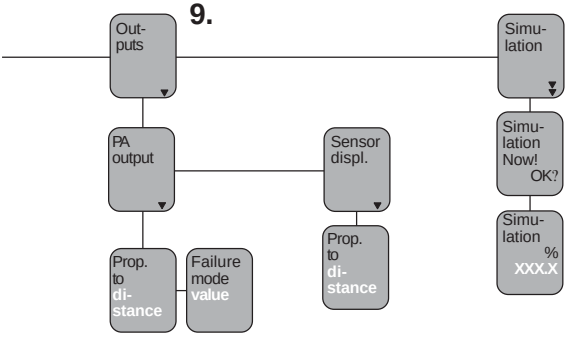
Under the menu "Outputs" you determine, for example, if the current output should be inverted, or which unit of measurement should be shown on the sensor display.

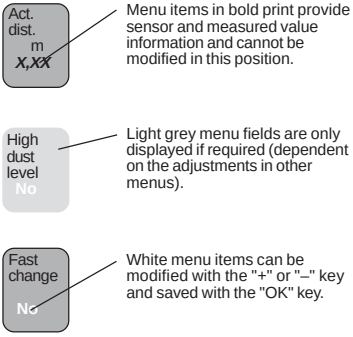
Menu schematic for the adjustment module MINICOM





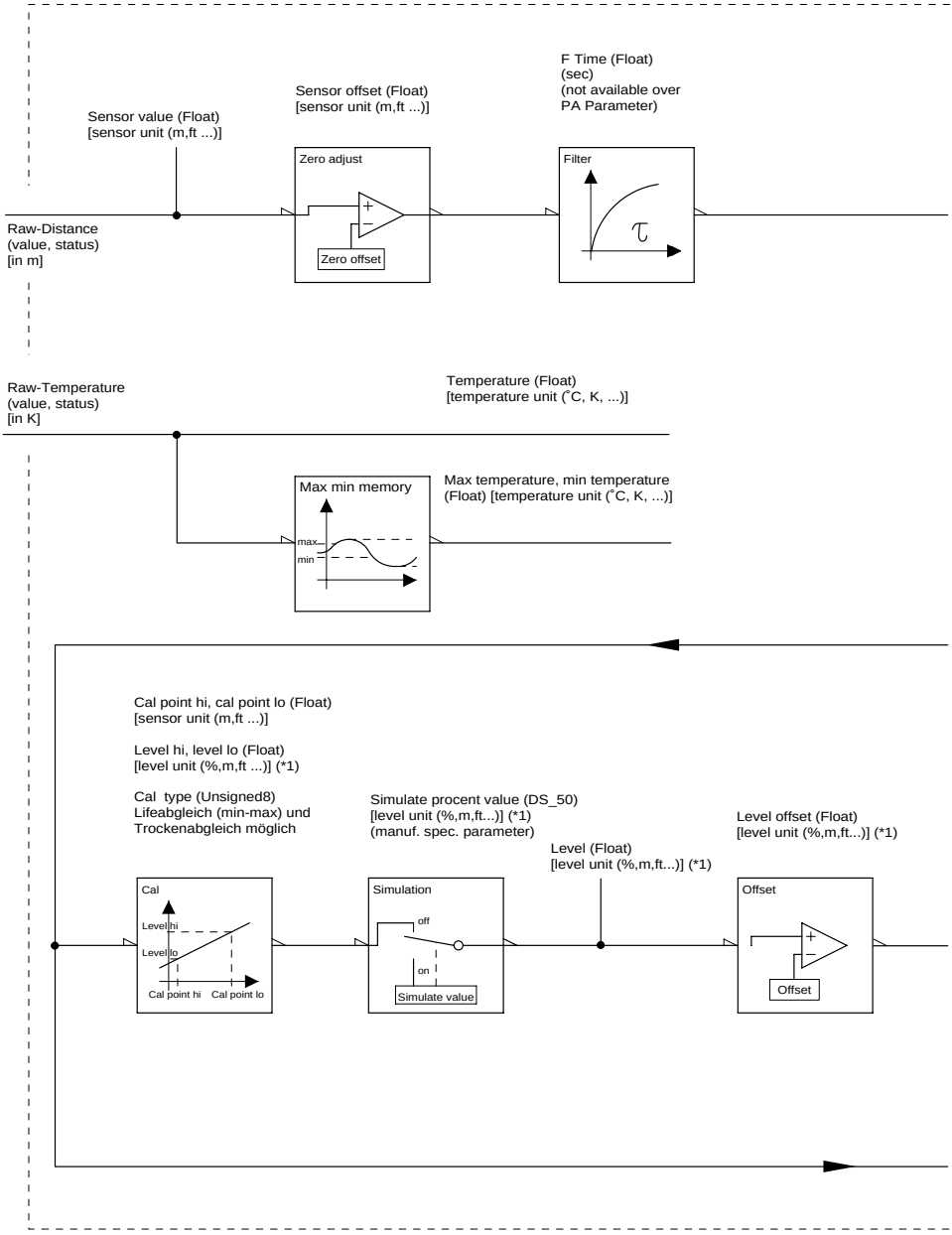
Simulation:
One hour after the last simulation adjustment, the sensor returns automatically to normal operating mode

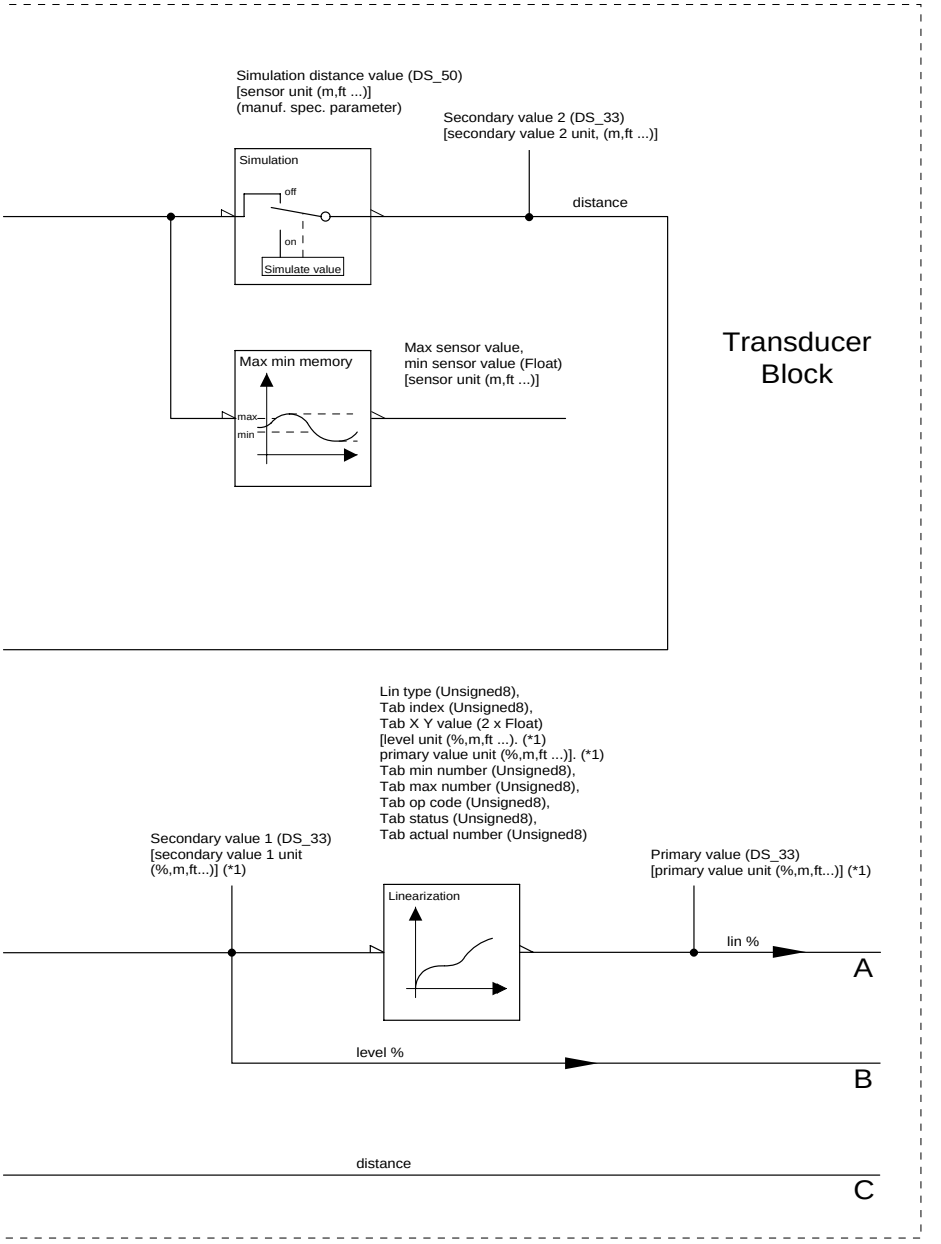


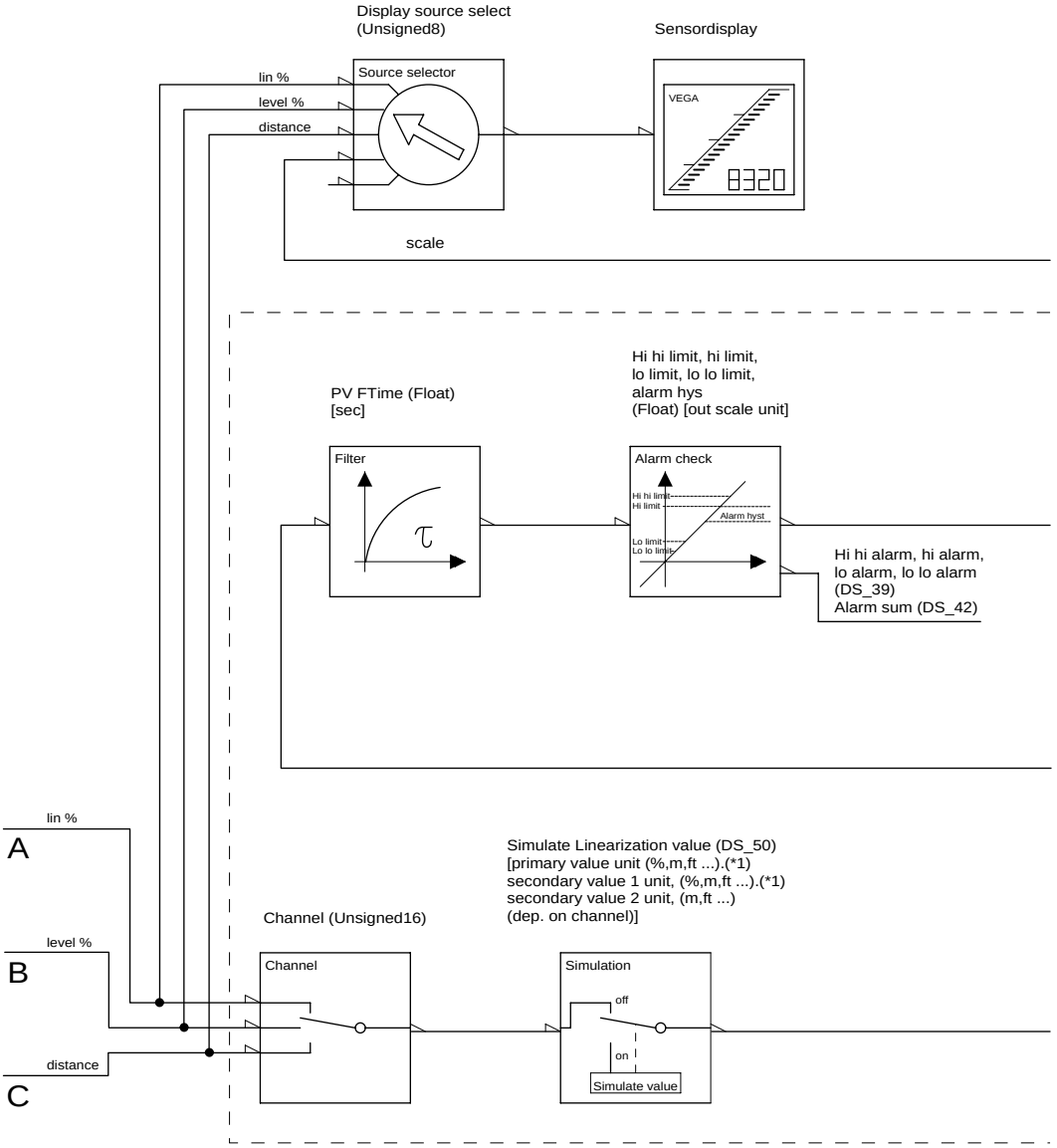


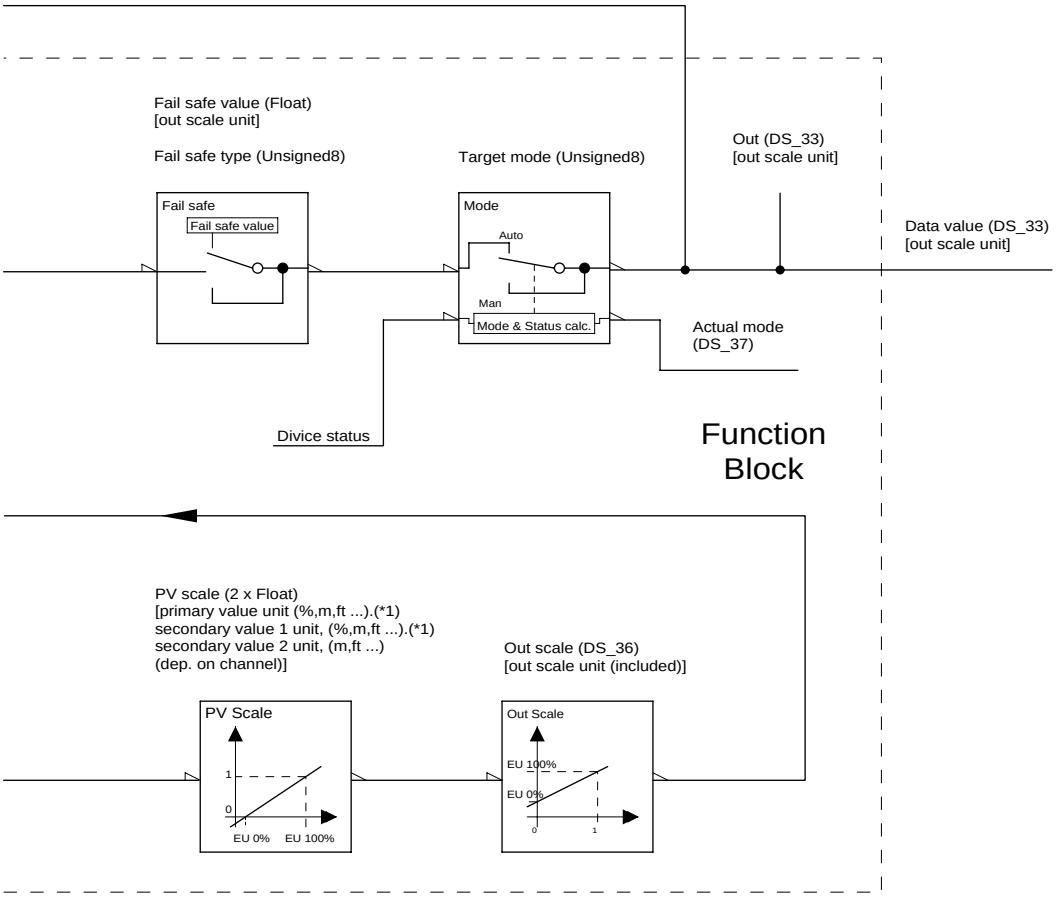
5 PA function diagram and parameters

5.1 PA function diagram




Simulation distance value (DS_50)
[sensor unit (m,ft ...)]
(manuf. spec. parameter)
Secondary value 2 (DS_33)
[secondary value 2 unit, (m,ft ...)]
Simulation
off
on
Simulate value
distance
Max min memory
max
min
Max sensor value,
min sensor value (Float)
[sensor unit (m,ft ...)]
Transducer Block
Lin type (Unsigned8),
Tab index (Unsigned8),
Tab X Y value (2 x Float)
[level unit (%,m,ft ...). (*1)
primary value unit (%,m,ft ...)]. (*1)
Tab min number (Unsigned8),
Tab max number (Unsigned8),
Tab op code (Unsigned8),
Tab status (Unsigned8),
Tab actual number (Unsigned8)
Secondary value 1 (DS_33)
[secondary value 1 unit
(%,m,ft...)] (*1)
Primary value (DS_33)
[primary value unit (%,m,ft...)] (*1)
Linearization
lin %
A
level %
B
distance
C


Display source select
(Unsigned8)
Sensordisplay
Source selector
lin %
level %
distance
VEGA
scale
PV FTime (Float)
[sec]
Hi hi limit, hi limit,
lo limit, lo lo limit,
alarm hys
(Float) [out scale unit]
Filter
Alarm check
Hi hi limit
Hi limit
Alarm hyst
Lo limit
Lo lo limit
Hi hi alarm, hi alarm,
lo alarm, lo lo alarm
(DS_39)
Alarm sum (DS_42)
lin %
A
level %
B
distance
C
Channel (Unsigned16)
Simulate Linearization value (DS_50)
[primary value unit (%,m,ft ...).(*1)
secondary value 1 unit, (%,m,ft ...).(*1)
secondary value 2 unit, (m,ft ...)
(dep. on channel)]
Channel
Simulation
off
on
Simulate value


Fail safe value (Float)
[out scale unit]
Fail safe type (Unsigned8)
Target mode (Unsigned8)
Out (DS_33)
[out scale unit]
Fail safe
Fail safe value
Mode
Auto
Man
Mode & Status calc.
Data value (DS_33)
[out scale unit]
Actual mode
(DS_37)
Divice status
Function
Block
PV scale (2 x Float)
[primary value unit (%,m,ft ...).(*1)
secondary value 1 unit, (%,m,ft ...).(*1)
secondary value 2 unit, (m,ft ...)
(dep. on channel)]
Out scale (DS_36)
[out scale unit (included)]
PV Scale
1
0
EU 0%
EU 100%
Out Scale
EU 100%
EU 0%
0
1

5.2 Status bytes

Coding of the status byte on the PA output value

Status code	Descr. acc. to Profibus standard	Probable causes in the VEGA sensor
0x00	bad – non-specific	- Flash-Update active
0x04	bad – configuration error	- Adjustment error - Configuration error with PV-Scale (PV-Span too small) - Differences in meas. unit - Error in the linearisation table
0x0c	bad – device failure	- Hardware error - Converter error - Leakage pulse error - Trigger error
0x10	bad – sensor failure	- Meas. value error - Temperature error
0x1f	bad – out of service - constant	- "Out of Service" mode switched on
0x44	uncertain – last unusable value	- Failsafe useable value (Failsafe-Mode = "Last valid value" and already valid meas. value since switching on)
0x48	uncertain – substitute set	- Simulation switched on - Failsafe substitute value (Failsafe-Mode = "Fsafe value")
0x4c	uncertain – initial value	- Failsafe substitute value (Failsafe-Mode = "Last valid value" and no valid meas. value since switching on)
0x51	uncertain – sensor conversion not accurate – low limited	- Sensor value < lower limit
0x52	uncertain – sensor conversion not accurate – high limited	- Sensor value > upper limit
0x80	good (non-cascade) - ok	- ok
0x84	good (non-cascade) – active block alarm	- Static revision (FB, TB) changed (active for 10 sec., after parameter was written in static category)
0x89	good (non-cascade) – active advisory alarm – low limited	- Lo-Alarm
0x8a	good (non-cascade) – active advisory alarm – high limited	- Hi-Alarm
0x8d	good (non-cascade) – active critical alarm – low limited	- Lo-Lo-Alarm
0x8c	good (non-cascade) – active critical alarm – high limited	- Hi-Hi-Alarm

Note:
All 256 possible status byte values can also be generated by simulation. For this reason, the Failsafe-Mode should be set to "Wrong calculated value", so that the simulated status will not be modified by the Failsafe calculation.

5.3 Parameter listing

The following parameter listing and function diagram is used for setup with the automation system if there is no adjustment software available. The listing reflects the parameters of the function block and the transducer block and should only be used by experienced Profibus technicians. Please make sure that all VEGA sensors are Profile 3 sensors. As a rule, however, you will carry out the sensor setup more conveniently with the VEGA adjustment software VVO or with the adjustment module MINICOM in the sensor.

The PA parameters and the function diagram are normally not required for setup and serve only to deepen the knowledge of the interested user and enable him to read in the sensor measured values into the processing system without an adjustment tool.

Slot	Index	Parameter	Object	Read	Write	Type	Size	Reset value	Store	Unit	Optional mandatory
0	16	Block object	PB	Yes	No	DS-32	20		C		m
0	17	St rev	PB	Yes	No	Unsigned16	2	0	N		m
0	18	Tag desc	PB	Yes	Yes	Octet String	32	32 * ' '	S		m
0	19	Strat egy	PB	Yes	Yes	Unsigned16	2	0	S		m
0	20	Alert key	PB	Yes	Yes	Unsigned8	1	0	S		m
0	21	Target mode	PB	Yes	Yes(*1)	Unsigned8	1		S		m
0	22	Mode blk	PB	Yes	No	DS-37	3		(D)		m
0	23	Alarm sum	PB	Yes	No	DS-42	8		D		m
0	24	Software revision	PB	Yes	No	Octet String	16		C		m
0	25	Hardware revision	PB	Yes	No	Octet String	16		C		m
0	26	Device man ID	PB	Yes	No	Unsigned16	2		C		m
0	27	Device ID	PB	Yes	No	Octet String	16		C		m
0	28	Device ser num	PB	Yes	No	Octet String	16		C		m
0	29	Diagnosis	PB	Yes	No	Octet String	4	-	D		m
0	31	Diagnosis mask	PB	Yes	No	Octet String	4		C		m
0	33	Device certification	PB	Yes	No	Octet String	32		C		o
0	34	Write locking	PB	Yes	Yes	Unsigned16	2	-	N		o
0	35	Factory reset	PB	Yes	Yes	Unsigned16	2	-	S		o
0	36	Decript or	PB	Yes	Yes	Octet String	32	-	S		o
0	37	Device message	PB	Yes	Yes	Octet String	32	-	S		o

Slot	Index	Parameter	Object	Read	Write	Type	Size	Reset value	Store	Unit	Optional mandatory
0	38	Device install date	PB	Yes	Yes	Octet String	16	-	S		o
0	40	Ident number select	PB	Yes	Yes	Unsigned8	1	-	S		m
0	41	HW write protection	PB	Yes	No	Unsigned8	1		D		o
0	49	VVO	PB	Yes	Yes	Octet String	32				o
0	50	View object PB	PB	Yes	No	Octet String	17		D		m
1	0	Directory object header	DM	Yes	No	Array of Unsigned16	12		C		m
1	1	Composite list directory entries	DM	Yes	No	Array of Unsigned16	24		C		m
1	16	Block object	FB_Primary_Value	Yes	No	DS-32	20		C		m
1	17	St rev	FB_Primary_Value	Yes	No	Unsigned16	2	0	N		m
1	18	Tag desc	FB_Primary_Value	Yes	Yes	Octet String	32	32*' '	S		m
1	19	Strategy	FB_Primary_Value	Yes	Yes	Unsigned16	2	0	S		m
1	20	Alert key	FB_Primary_Value	Yes	Yes	Unsigned8	1	0	S		m
1	21	Target mode	FB_Primary_Value	Yes	Yes	Unsigned8	1	8	S		m
1	22	Mode blk	FB_Primary_Value	Yes	No	DS-37	3		D		m
1	23	Alarm sum	FB_Primary_Value	Yes	No	DS-42	8		D		m
1	24	Batch	FB_Primary_Value	Yes	Yes	DS-67	10	0,0,0,0	S		m
1	26	Out	FB_Primary_Value	Yes	Yes(*1)	DS-33	5		D	out scale unit	m
1	27	PV scale	FB_Primary_Value	Yes	Yes	2*Float	8	0,100	S	prim, sec1, sec2 value unit (dep. on channel)	m
1	28	Out scale	FB_Primary_Value	Yes	Yes	DS-36	11	0,100,-,-	S	includes out scale unit	m
1	29	Lin type	FB_Primary_Value	Yes	Yes(*1)	Unsigned8	1	0	S		m
1	30	Channel	FB_Primary_Value	Yes	Yes	Unsigned16	2	-	S		m
1	32	PV FTime	FB_Primary_Value	Yes	Yes	Float	4	0	N	sec	m
1	33	Fsafe type	FB_Primary_Value	Yes	Yes	Unsigned8	1	1	S		o
1	34	Fsafe value	FB_Primary_Value	Yes	Yes	Float	4	-	S	out scale unit	o
1	35	Alarm hys	FB_Primary_Value	Yes	Yes	Float	4	0.5% of range	S	out scale unit	m
1	37	HI HI Lim	FB_Primary_Value	Yes	Yes	Float	4	max value	S	out scale unit	m
1	39	HI Lim	FB_Primary_Value	Yes	Yes	Float	4	max value	S	out scale unit	m
1	41	LO Lim	FB_Primary_Value	Yes	Yes	Float	4	min value	S	out scale unit	m
1	43	LOLO Lim	FB_Primary_Value	Yes	Yes	Float	4	min value	S	out scale unit	m
1	46	HI HI Alm	FB_Primary_Value	Yes	No	DS-39	16	0	D		o
1	47	HI Alm	FB_Primary_Value	Yes	No	DS-39	16	0	D		o
1	48	LO Alm	FB_Primary_Value	Yes	No	DS-39	16	0	D		o
1	49	LOLO Alm	FB_Primary_Value	Yes	No	DS-39	16	0	D		o
1	50	Simulate	FB_Primary_Value	Yes	Yes	DS-50	6	disable	N	prim, sec1, sec2 value unit (dep. on channel)	m
1	61	View object FB_Primary_Value	FB_Primary_Value	Yes	No	Octet String	18		D		m
1	180	Display source select	TB	Yes	Yes	Unsigned8	1	?	N		o

Slot	Index	Parameter	Object	Read	Write	Type	Size	Reset value	Store	Unit	Optional mandatory
1	120	Block object	TB_Level	Yes	No	DS-32	20		C		m
1	121	St rev	TB_Level	Yes	No	Unsigned16	2	0	N		m
1	122	Tag desc	TB_Level	Yes	Yes	Oct et String	32	32*' '	S		m
1	123	Strategy	TB_Level	Yes	Yes	Unsigned16	2	0	S		m
1	124	Alert key	TB_Level	Yes	Yes	Unsigned8	1	0	S		m
1	125	Target mode	TB_Level	Yes	Yes (*1)	Unsigned8	1		S		m
1	126	Mode blk	TB_Level	Yes	No	DS-37	3		(D)		m
1	127	Alarm sum	TB_Level	Yes	No	DS-42	8		D		m
1	128	Primary value	TB_Level	Yes	No	DS-33	5		D	primary value unit	m
1	129	Primary value unit	TB_Level	Yes	Yes	Unsigned16	2	%	S		m
1	130	Level	TB_Level	Yes	No	Float	4		D	level unit	m
1	131	Level unit	TB_Level	Yes	Yes	Unsigned16	2	%	S		m
1	132	Sensor value	TB_Level	Yes	No	Float	4		D	sensor unit	m
1	133	Sensor unit	TB_Level	Yes	Yes	Unsigned16	2		S		m
1	134	Secondary value 1	TB_Level	Yes	No	DS-33	5		D	secondary value 1unit	o
1	135	Secondary value 1unit	TB_Level	Yes	Yes	Unsigned16	2		S		o
1	136	Secondary value 2	TB_Level	Yes	No	DS-33	5		D	secondary value 2 unit	o
1	137	Secondary value 2 unit	TB_Level	Yes	Yes	Unsigned16	2		S		o
1	138	Sensor offset	TB_Level	Yes	Yes	Float	4	0	S	sensor unit	m
1	139	Cal type	TB_Level	Yes	Yes	Unsigned8	1	oder Lifeabgleich	S		m
1	140	Cal point lo	TB_Level	Yes	Yes	Float	4		S	[sensor unit]	m
1	141	Cal point hi	TB_Level	Yes	Yes	Float	4		S	sensor unit	m
1	142	Level lo	TB_Level	Yes	Yes	Float	4	0	S	level unit	m
1	143	Level hi	TB_Level	Yes	Yes	Float	4	100	S	level unit	m
1	144	Level offset	TB_Level	Yes	Yes	Float	4	0	S	level unit	m
1	145	Lin type	TB_Level	Yes	Yes	Unsigned8	1	0 (=linear)	S		m
1	148	Sensor high limit	TB_Level	Yes	No	Float	4		C	sensor unit	o
1	149	Sensor low limit	TB_Level	Yes	No	Float	4		C	sensor unit	o
1	150	Max sensor value	TB_Level	Yes	Yes	Float	4	oder akt. Wert	N	sensor unit	o
1	151	Min sensor value	TB_Level	Yes	Yes	Float	4	oder akt. Wert	N	sensor unit	o
1	152	Temperature	TB_Level	Yes	No	Float	4		D	temperature unit	o
1	153	Temperature unit	TB_Level	Yes	Yes	Unsigned16	2	°C	S		o
1	154	Max temperature	TB_Level	Yes	Yes	Float	4	oder akt. Wert	N	temperature unit	o
1	155	Min temperature	TB_Level	Yes	Yes	Float	4	oder akt. Wert	N	temperature unit	o
1	156	Tab index	TB_Level	Yes	Yes	Unsigned8	1	1	D		o

Slot	Index	Parameter	Object	Read	Write	Type	Size	Reset value	Store	Unit	Optional/mandatory
1	157	Tab XY value	TB_Level	Yes	Yes	2*Float	8		N	secondary value 1 unit, primary value unit	o
1	158	Tab min number	TB_Level	Yes	No	Unsigned8	1		C		o
1	159	Tab max number	TB_Level	Yes	No	Unsigned8	1		C		o
1	160	Tab op code	TB_Level	Yes	Yes	Unsigned8	1		D		o
1	161	Tab status	TB_Level	Yes	No	Unsigned8	1		D		o
1	162	Tab actual number	TB_Level	Yes	No	Unsigned8	1		D		o
1	190	Simulate sensor value	TB_Level	Yes	Yes	DS-50	6	disable	N	sensor unit	o
1	191	Simulate level	TB_Level	Yes	Yes	DS-50	6	disable	N	level unit	o
1	192	Füllguttyp	TB_Level	Yes	Yes	Unsigned8	1		N		o
1	193	Echo quality	TB_Level	Yes	No	Unsigned8	1		D	dB	o
1	194	First echo factor	TB_Level	Yes	Yes	Unsigned8	1	aus	N		o
1	195	Sound velocity	TB_Level	Yes	Yes	Float	4	ca. 331.6 (VEGA-Wert)	N	m/s	o
1	196	Lerndistanz	TB_Level	Yes	Yes	Float	4		D	sensor unit	o
1	197	Störechospeicher-Aktion	TB_Level	Yes	Yes	Unsigned8	1		D		o
1	198	Arbeitsbereich Ende	TB_Level	Yes	Yes	Float	4		N	sensor unit	o
1	199	Arbeitsbereich Anfang	TB_Level	Yes	Yes	Float	4		N	sensor unit	o
1	200	schnelle Meßwertänderung	TB_Level	Yes	Yes	Unsigned8	1		N		o
1	201	unruhige Füllgutoberfläche	TB_Level	Yes	Yes	Unsigned8	1		N		o
1	202	Schaumbildung	TB_Level	Yes	Yes	Unsigned8	1		N		o
1	203	starke Staubentwicklung	TB_Level	Yes	Yes	Unsigned8	1		N		o
1	204	Bodenreflexion; großer Schüttwinkel	TB_Level	Yes	Yes	Unsigned8	1		N		o
1	210	Korrekturfaktor Ausbr.geschw.	TB_Level	Yes	Yes	Float	4		N	%	o
1	211	Korrekturfaktor der Ausbr.geschw. per Distanzeingabe berechnen	TB_Level	No	Yes	Float	4		N	sensor unit	o
2	16	Block object	FB_Temperature	Yes	No	DS-32	20		C		m
2	17	St rev	FB_Temperature	Yes	No	Unsigned16	2	0	N		m
2	18	Tag desc	FB_Temperature	Yes	Yes	Octet String	32	32*' '	S		m
2	19	Strategy	FB_Temperature	Yes	Yes	Unsigned16	2	0	S		m
2	20	Alert key	FB_Temperature	Yes	Yes	Unsigned8	1	0	S		m
2	21	Target mode	FB_Temperature	Yes	Yes	Unsigned8	1	8	S		m

Slot	Index	Parameter	Object	Read	Write	Type	Size	Reset value	Store	Unit	Optional mandatory
2	22	Mode blk	FB_Temperature	Yes	No	DS-37	3		D		m
2	23	Alarm sum	FB_Temperature	Yes	No	DS-42	8		D		m
2	24	Batch	FB_Temperature	Yes	Yes	DS-67	10	0,0,0,0	S		m
2	26	Out	FB_Temperature	Yes	Yes(*1)	DS-33	5		D	temp out scale unit	m
2	27	PV scale	FB_Temperature	Yes	Yes	2*Float	8	0,100	S	temperature unit	m
2	28	Out scale	FB_Temperature	Yes	Yes	DS-36	11	0,100,-,-	S	includes temp out scale unit	m
2	29	Lin type	FB_Temperature	Yes	Yes(*1)	Unsigned8	1	0	S		m
2	30	Channel	FB_Temperature	Yes	Yes(*1)	Unsigned16	2	-	S		m
2	32	PV FTime	FB_Temperature	Yes	Yes	Float	4	0	N	sec	m
2	33	Fsafe type	FB_Temperature	Yes	Yes	Unsigned8	1	1	S		o
2	34	Fsafe value	FB_Temperature	Yes	Yes	Float	4	-	S	temp out scale unit	o
2	35	Alarm hys	FB_Temperature	Yes	Yes	Float	4	1K	S	temp out scale unit	m
2	37	HI HI Lim	FB_Temperature	Yes	Yes	Float	4	max value	S	temp out scale unit	m
2	39	HI Lim	FB_Temperature	Yes	Yes	Float	4	max value	S	temp out scale unit	m
2	41	LO Lim	FB_Temperature	Yes	Yes	Float	4	min value	S	temp out scale unit	m
2	43	LO LO Lim	FB_Temperature	Yes	Yes	Float	4	min value	S	temp out scale unit	m
2	46	HI HI Alm	FB_Temperature	Yes	No	DS-39	16	0	D		o
2	47	HI Alm	FB_Temperature	Yes	No	DS-39	16	0	D		o
2	48	LO Alm	FB_Temperature	Yes	No	DS-39	16	0	D		o
2	49	LO LO Alm	FB_Temperature	Yes	No	DS-39	16	0	D		o
2	50	Simulate	FB_Temperature	Yes	Yes	DS-50	6	disable	N	temperature unit	m
2	61	View object FB_Temperature	FB_Temperature	Yes	No	Octet String	18		D		m

6 Diagnosis

6.1 Simulation

To simulate a certain filling, you can call up the function "Simulation" on the adjustment module MINICOM or in the software program VVO.

With this function, you simulate a real vessel filling level. Please note that connected instruments, such as e.g. a PLC, react according to their adjustments and will probably activate alarms or system functions.

Simulation with VVO
If you start the simulation mode with the adjustment program VVO on the PC, the simulated level is outputted until you quit the simulation mode.

Simulation with MINICOM
If you start the simulation mode on the adjustment module MINICOM, the sensor returns to standard operating mode after one hour.

6.2 Error codes

Error codes		Corrective measure
E013	No valid measured value - Sensor in the warm-up phase - Loss of the useful echo	Message is displayed during the warm-up phase If the message remains, a false echo storage (with the adjustment software on the PC - see "Echo curve" under "Sensor optimisation") must be carried out together with a modification of mounting location and orientation to achieve the lowest possible false echo background.
E017	Adjustment span too small	Carry out a readjustment. Make sure that the difference between min. and max. adjustment is at least 10 mm .
E036	Sensor software does not run	Sensor requires a software update (service). Message appears during a software update.
E040	Hardware failure/Electronics defective	Check all connection cables. Transducer defective. Contact our service department.

7 Technical data

7.1 Data

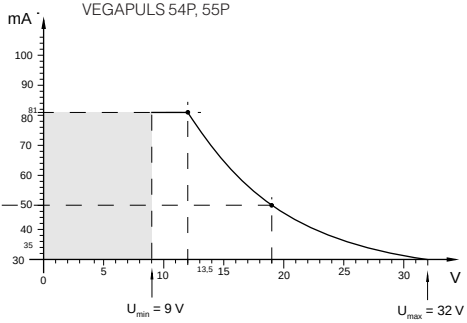
Power supply

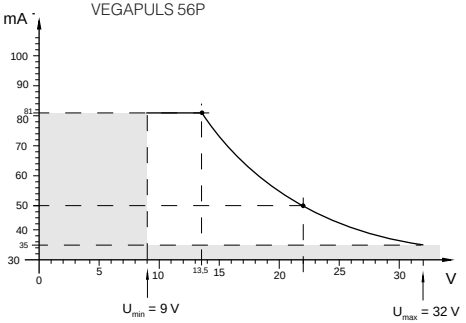
Supply voltage 9 … 32 V DC

Note:

If VEGASON 54P … 56P sensors are operated on Profibus input cards (EP cards) in the VEGALOG 571 processing system each card must be powered individually with own power supply unit. For power supply of an EP card, use the power supply unit (ASI-Interface SLA 3.100) from Puls which is available from VEGA.

Current consumption max. 81 mA, depending on the output voltage U_O (PA voltage) of the segment coupler used, see diagrams.





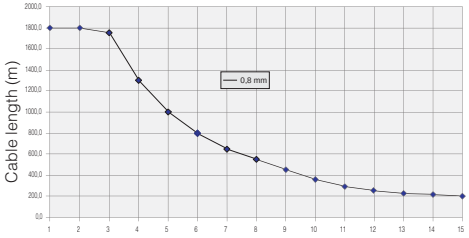
Power consumption

- VEGASON 54 and 55 max. 0.9 W
- VEGASON 56 max. 1.1 W

Resistance of the signal cable depending on the output voltage U_O (PA voltage) of the segment coupler used

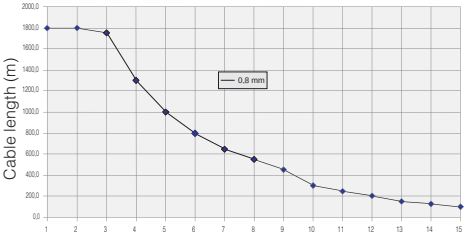
Number of sensors on a two-wire cable depending on the output voltage U_O of the segment coupler used and the voltage losses of the signal cable, see cable specification.
Number of sensors when being operated on an EP card in a VEGALOG, see diagrams:

VEGAPULS 54P, 55P on EP card



No. of sensors VEGAPULS 54P, 55 P

VEGAPULS 56P on EP card



No. of sensors VEGAPULS 56P

Measuring range
(with sensor version B ... D, the transducer end is the reference plane. With sensor version A the lower side of the flange is the reference plane)

VEGASON 54	1.0 … 25 m (solids 1.0 … 15 m)
VEGASON 55	0.8 … 45 m (solids 0.8 … 30 m)
VEGASON 56	
- Version A	1.8 … 70 m (solids 1.8 … 45 m)
- Version B … D	1.4 … 70 m (solids 1.8 … 45 m)

Output signal

digital (Profibus)	the digital output signal (meas. signal) is modulated onto the power supply and further processed in the PLC or process control system.
Integration time	0 … 999 seconds

Measured value display (optional)

Liquid-crystal indication	
- in the sensor	scalable output of meas. value as graph and number value.
- powered externally by the sensor	scalable output of meas. value as graph and number value. Measured value display can be mounted up to 25 m away from the sensor.

Adjustment

- adjustment software VEGA Visual Operating on Master-Class 2 PC
- adjustment module MINICOM in the sensor or in external indicating instrument (optional)
- process adjustment interface PACTware™ (VVO runs as a subprogram)
- SIMATIC PDM in conjunction with Electronic Device Description (EDD)

Process fitting

VEGASON 54	G 1 A, 1-11.5 NPT, DN 50, DN 80, DN 200
VEGASON 55	G 1 A, 1-11.5 NPT, DN 50, DN 80, DN 250
VEGASON 56	G 1 A, 1-11.5 NPT, DN 50, DN 80, DN 200

Note:
For G 1 A, 1-11.5 NPT, DN 50 and DN 80, an adapter flange is normally required.

Accuracy [1)]
(typical values under reference conditions, all statements relate to the nominal measuring range)

Characteristics	linear
Deviation in characteristics incl. linearity, reproducibility and hysteresis (determined acc. to the limit point method)	< 0.1 %
Linearity	better than 0.05 %
Average temperature coefficient of the zero signal	0.06 %/10 K
General resolution	max. 1 mm
Resolution of the output signal	0.01 % or 1 mm

Characteristics [1]

(typical values under reference conditions, all statements relate to the nominal measuring range)

Min. span	
(between empty and full adjustment)	> 20 mm (recommended > 50 mm)
Ultrasonic frequency (at 20°C)	
- VEGASON 54	30 kHz
- VEGASON 55	18 kHz
- VEGASON 56	10 kHz
Intervals	
- VEGASON 54	1.0 s
- VEGASON 55	1.5 s
- VEGASON 56	2.0 s
Beam angle at -3 dB emitted power	
- VEGASON 54	4°
- VEGASON 55	5°
- VEGASON 56	6°
Influence of the process temperature	negligible, is compensated by a dynamic temperature detection system integrated in the transducer. Without temperature compensation, the ambient temperature error will be 0.18 %/K
Influence of the process pressure	negligible within the approved sensor pressures
Adjustment time [2]	
- VEGASON 54	> 2 s (depending on parameter setting)
- VEGASON 55, 56	> 4 s (depending on parameter setting)

Ex technical data

Classification	m (encapsulation of the transducer)
Temperature class (permissible ambient temperature on the transducer when used in Ex areas)	
- T6	42°C
- T5	58°C
- T4	60°C
- T3	60°C
Ex approved in category or Zone	
- VEGASON 56	
ATEX	Zone 1 (II 2G)
IEC, CENELEC, PTB	Zone 1
- VEGASON 54 … 56	
ATEX	Zone 21/22 (II 2D/3D)
IEC, CENELEC, DMT	Zone 10/11

[1] Similar to DIN 16 086, reference conditions acc. to IEC 770; temperature 15°C … 35°C; moisture 45 % … 75 %; pressure 860 mbar … 1060 mbar.

[2] The adjustment time is the time required by the sensor to output a correct level (with max. 10 % deviation) after a sudden level change.

Ambient conditions

Ambient temperature (housing)	-20°C … +60°C
Process temperature (transducer)	
- VEGASON 54, 55	-40°C … +80°C (StEx: -20°C … +75°C)
- VEGASON 56	-40°C … +150°C
- storage and transport temperature	-40°C … +80°C
Vessel pressure max. (gauge pressure)	
- VEGASON 54	
Version A	1.5 bar (flange version)
Version B … C	0.5 bar
Version D	3 bar
- VEGASON 55	
Version A	1.5 bar (flange version)
Version B … C	0.5 bar
Version D	3 bar
- VEGASON 56	
Version A	3 bar (flange version)
Version B … C	0.5 bar
Version D	3 bar
Protection	
- sensor	IP 67
- transducer, process	IP 68
Protection class	
- two-wire sensor	II
- four-wire sensor	I
Overvoltage category	III
Self-heating	
at 40°C ambient temperature	
- sensor	45°C
- transducer, process	55°C

Connection cables

Power supply	power supply and signal via one two-wire cable from the segment coupler
Electrical connection	spring-loaded terminals, cross-section area of conductor generally 2.5 mm^2
- option	screwed plug connection
Ground connection	max. 4 mm^2
Transducer cable	
- VEGASON 54, 55	5 … 300 m (cable diameter 7.2 … 7.6 mm)
- VEGASON 56	5 … 300 m (cable diameter 9.5 … 9.9 mm)
Cable entry for the signal and supply cable with spring-loaded terminals	
- plastic housing (PBT)	2 x M20 x 1.5 (cable diameter 5 … 9 mm) or 2 x $^1/_2$" NPT (cable diameter 3.1 … 8.7 mm or 0.12 … 0.34 inch)
- Aluminium housing and Ex d terminal compartment	2 x $^1/_2$" NPT (cable diameter 3.1 … 8.7 mm or 0.12 … 0.34 inch)

Materials

Housing	PBT (Valox) or Aluminium
Process connection	
- flange version	Alu or PP
- swivelling holder and thread	galvanized steel
Transducer	
- VEGASON 54	PA (1.4301 with StEx)
- VEGASON 55, 56	UP
Transducer diaphragm	
- VEGASON 54	1.4571
- VEGASON 55	Alu/PE foam
- VEGASON 56	Alu/PTFE non-stick coating
Transducer cable (cable cover)	
- VEGASON 54, 55	PUR (1.1082)
- VEGASON 56	silicone (1.1083)

Weight (depending on the housing materials used)

VEGASON 54	
- Version A	5.6 ... 10.7 kg
- Version B	6.9 ... 9.7 kg
- Version C	7.5 ... 10.5 kg
- Version D	4.7 ... 6.9 kg
VEGASON 55	
- Version A	8.0 ... 13.3 kg
- Version B	8.7 ... 10.3 kg
- Version C	9.2 ... 11.1 kg
- Version D	6.5 ... 7.5 kg
VEGASON 56	
- Version A	7.3 ... 11.3 kg
- Version B	8.7 ... 10.3 kg
- Version C	9.3 ... 11.1 kg
- Version D	6.5 ... 7.5 kg

CE conformity CE

VEGASON series 50 ultrasonic sensors meet the protective regulations of EMC (89/336/EWG), NSR (73/23/EWG) and R & TTE directive (1999/5/EC).
Conformity has been judged acc. to the following standardst:

		EN 300 683 - 1: 1997 EN 300 440 - 1: 1995 I-ETS 300-440 Expert opinion No. 0043052-01/SEE, Notified Body No. 0499
EMC	Emission/Susceptibility	EN 61 326: 1997/A1: 1998
ATEX		EN 50 020: 1994 EN 50 018: 1994 EN 50 014: 1997
NSR		EN 61 010 - 1: 1993

7.2 Data format of the output signal

Byte4	Byte3	Byte2	Byte1	Byte0
Status	Measured value (IEEE-754 Format, see below)			

Status byte:
The status byte corresponds to profile 3,0 "Profibus PA Profile for Process Control Devices" coded. The status "Measured value OK" is coded as 80 (hex) (Bit7 = 1, Bit 6 ... 0 = 0).

Measured value:
The measured value is transmitted as a 32 Bit floating point number in IEEE-754 format.

Byte n								Byte n+1							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
VZ	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}	2^{-7}
Sign	Exponent							Mantissa							

Byte n+2								Byte n+3							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2^{-8}	2^{-9}	2^{-10}	2^{-11}	2^{-12}	2^{-13}	2^{-14}	2^{-15}	2^{-16}	2^{-17}	2^{-18}	2^{-19}	2^{-20}	2^{-21}	2^{-22}	2^{-23}
Mantissa								Mantissa							

Formula: Measured value = $(-1)^{VZ} \bullet 2^{(Exponent - 127)} \bullet (1 + Mantissa)$

Examples: 41 70 00 00 (hex) = 0100 0001 0111 0000 0000 0000 0000 0000 (bin)
Meas. value $= (-1)^{0} \bullet 2^{(130 - 127)} \bullet (1 + 2^{-1} + 2^{-2} + 2^{-3})$
$= 1 \bullet 2^{3} \bullet (1 + 0.5 + 0.25 + 0.125)$
$= 1 \bullet 8 \bullet 1.875$
$= 15.0$

7.3 Approvals

When using ultrasonic sensors in Ex areas or on ships, the instruments must be suitable and approved for the explosion zones and applications.
The suitability is checked by the approval authorities and is certified in approval documents.

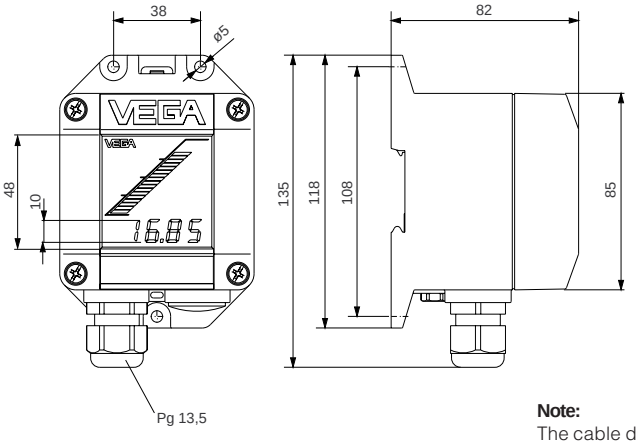
Please note the attached approval documents when using a sensor in Ex area.

Test and approval authorities

- **PTB**
  (Physikalisch Technische Bundesanstalt - Physical Technical Approval Authority)
- **FM**
  (Factory Mutual Research)
- **ABS**
  (American Bureau of Shipping)
- **LRS**
  (Lloyds Register of Shipping)
- **GL**
  (German Lloyd)
- **CSA**
  (Canadian Standards Association)

7.4 Dimensions

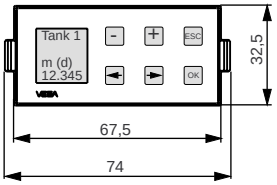
External indicating instrument VEGADIS 50



Mounting on carrier rail 35 x 7.5 acc. to EN 50 022 or screwed to a flat surface

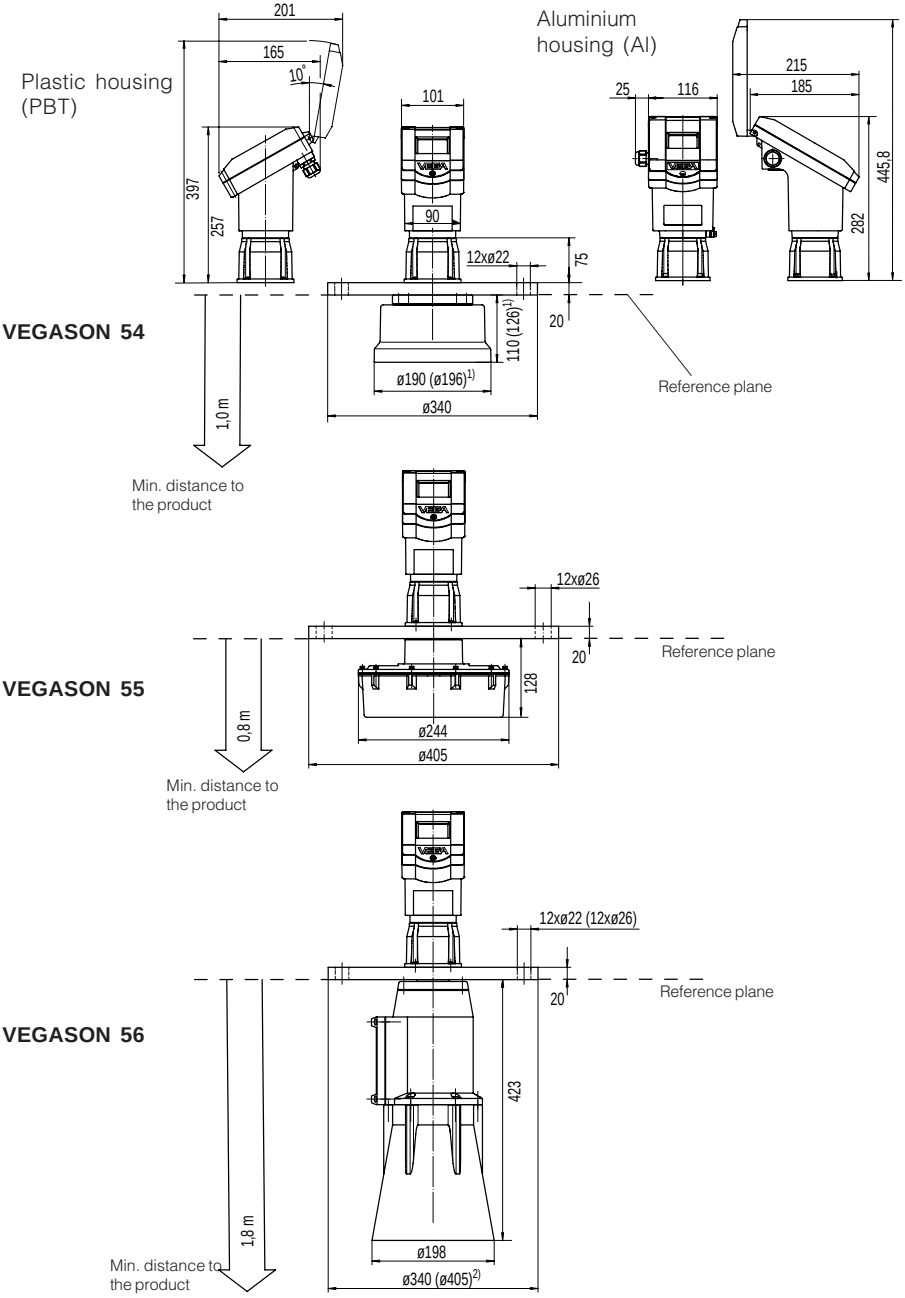
Note:
The cable diameter of the connection cable should be min. 5 mm and max. 9 mm. Otherwise, the seal effect of the cable entry would not be ensured.

Adjustment module MINICOM

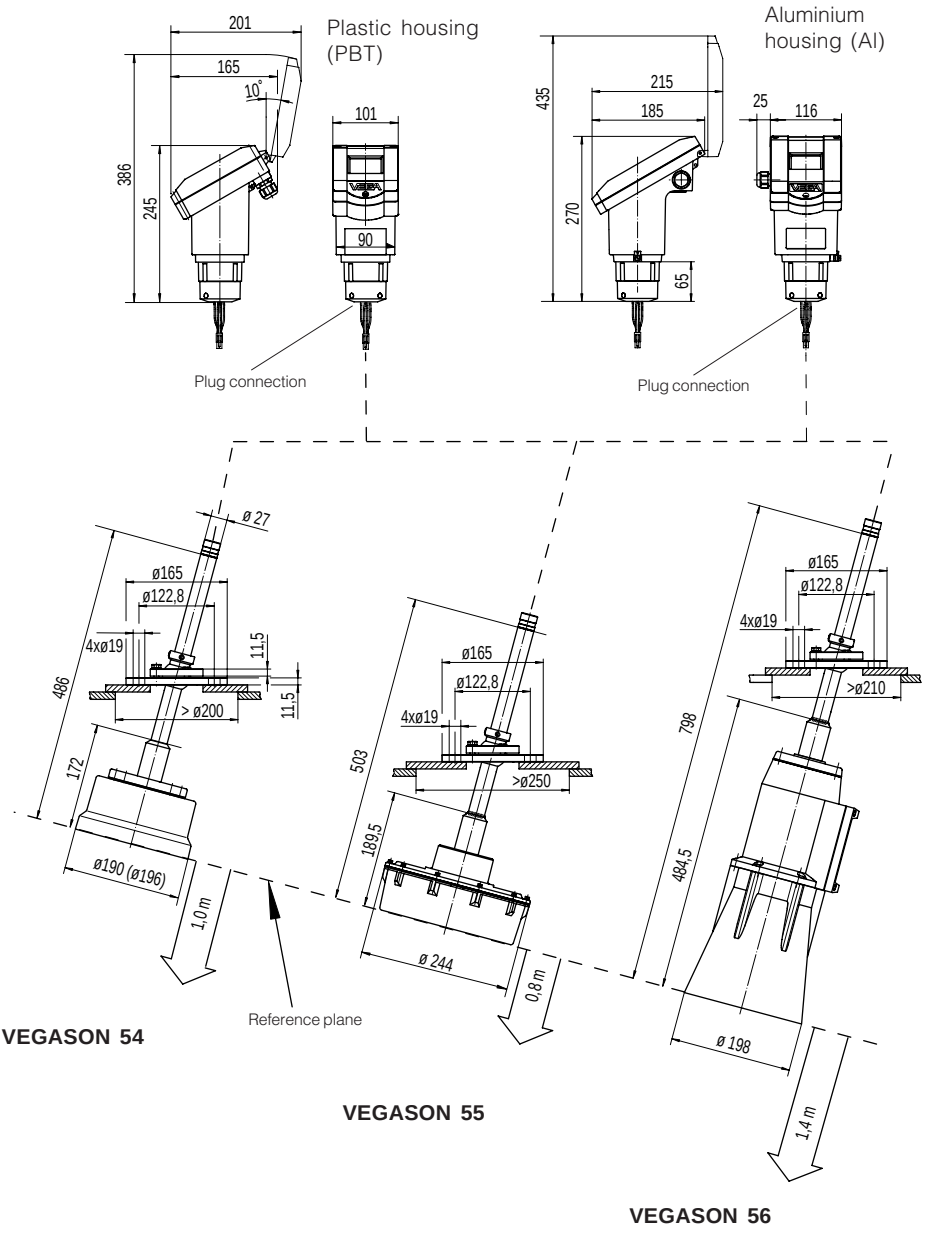


Adjustment module for insertion into VEGASON series 50 sensors or into the external indicating instrument VEGADIS 50

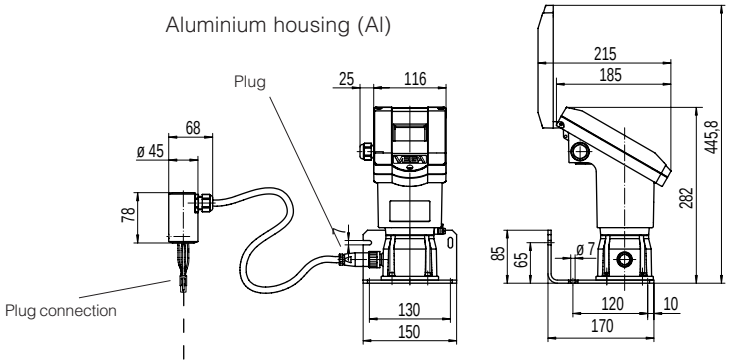
VEGASON 54 … 56 in Version A

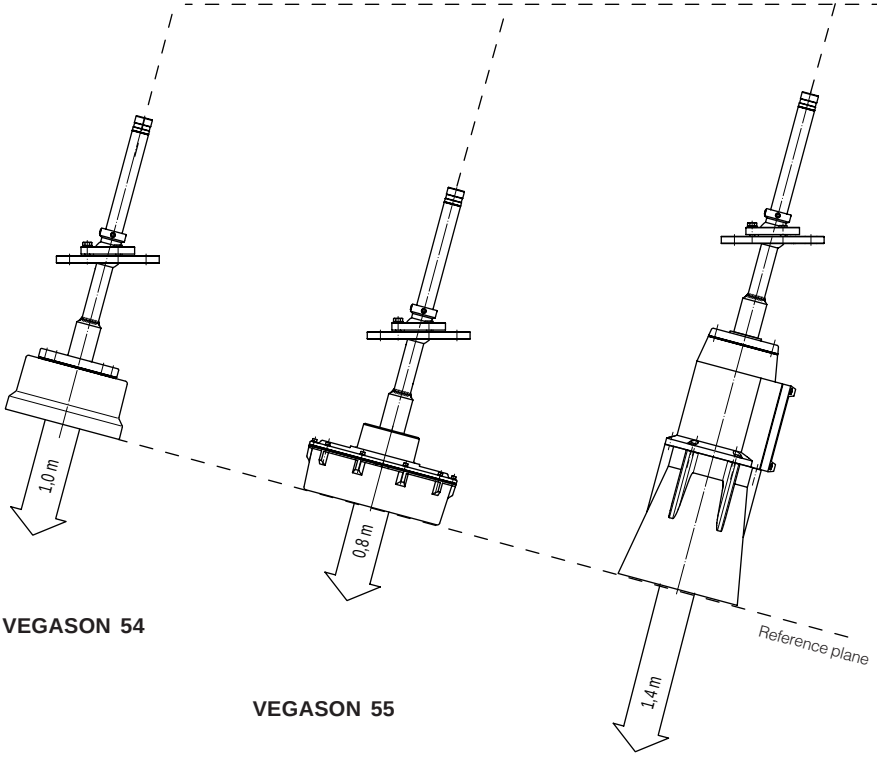


VEGASON 54 ... 56 in version B



VEGASON 54 … 56 in version C



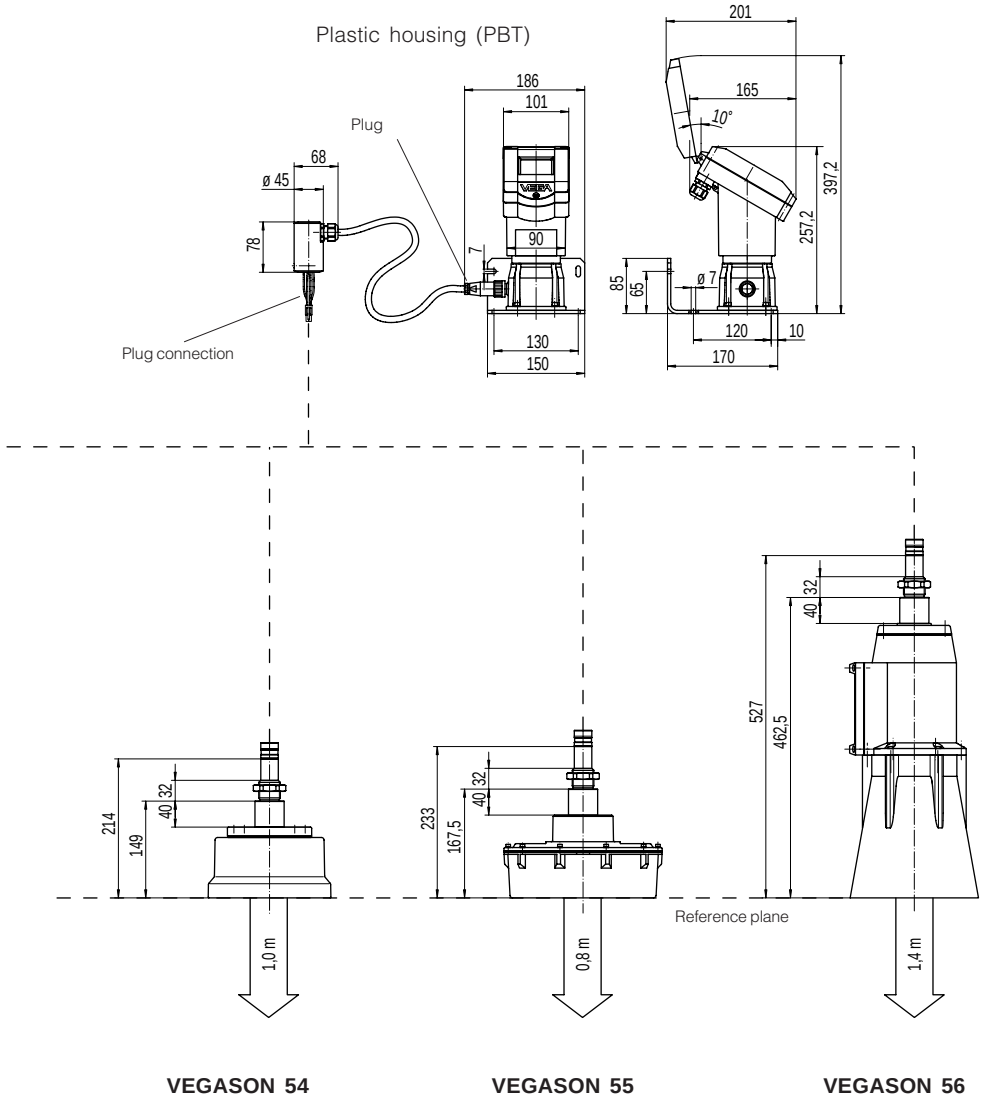


VEGASON 54

VEGASON 55

VEGASON 56

VEGASON 54 ... 56 in version D



VEGASON 54 **VEGASON 55** **VEGASON 56**

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All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the latest information at the time of printing.

Technical data subject to alterations