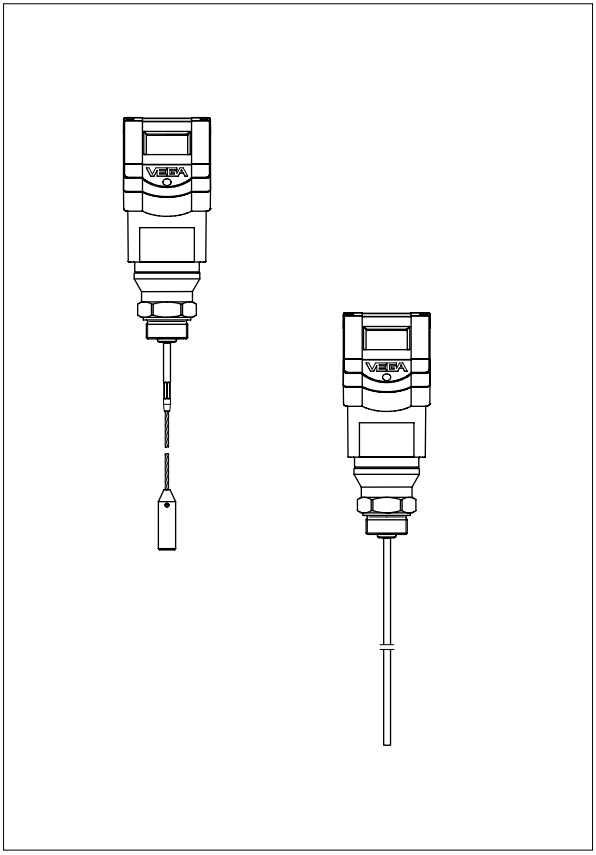
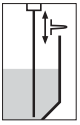
Level and Pressure

Operating Instructions

VEGAFLEX 54P (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

High frequency microwave impulses are guided along a steel rope or a rod.
The microwave impulses are reflected when they reach the product surface. The impulse running time is processed by the integrated electronics and outputted as level.

The sensors detect levels in all types of liquids. Density, conductivity and dielectric value of the product do not influence the measurement. Continuously changing properties of the medium also do not influence the measured value.

In many applications, VEGAFLEX microwave sensors are the solution to difficult technical problems. Even in products with varying or fluctuating dielectric constant, the level is reliably detected. In high, narrow vessels, where non-contact measurement technologies often deliver less than optimal results, VEGAFLEX carries out problem-free measurements. VEGAFLEX 54 is optionally equipped with a 4 mm diameter cable up to a length of 20 m, or an 8 mm diameter rod up to a length of 4 m.

- Adjustment without filling or emptying the vessel.
- Two-wire sensor, power supply and digital measuring signal via one two-wire cable (loop powered).
- Up to 32 sensors can be connected via one two-wire cable (Ex area: 8 sensors).
- Measuring range up to 20 m, very small minimum measuring distance.
- Unaffected by application conditions such as:
  - varying products
- Unaffected by the vessel material, e.g. metal, concrete, plastic etc.
- As an option, the display with adjustment functions can be mounted separate from the sensor.
- Low wiring costs through the use of two-wire technology.

1.2 Application features

Applications
- Level measurement of liquids.
- Measurement also in vacuum.
- All slightly conductive substances and all substances with a dielectric value $\varepsilon_r > 1.7$ can be measured.
- Measuring range 0 ... 20 m.

Two-wire technology
- Power supply, signal transmission and output signal on one two-wire cable.
- 4 … 20 mA output signal or digital output signal.

Rugged
- Highly resistant materials: PCTFE, 1.4435, Hastelloy C22.

Precise and reliable
- Resolution 1 mm.
- Unaffected by noise, steam, gas compositions and inert gas stratification.
- Unaffected by varying density.
- Measurements under pressure up to 40 bar and with product temperatures up to 150°C.

Communicative
- Integrated measured value display.
- As an option, display can be mounted separate from the sensor.
- Adjustment from the PLC level.

Approvals
- ATEX  II 1 G or II 1/2 G or II 2 G EEx ia II C T6
- ATEX  II 1/2 G or II 2 G EEx d ia II C T6

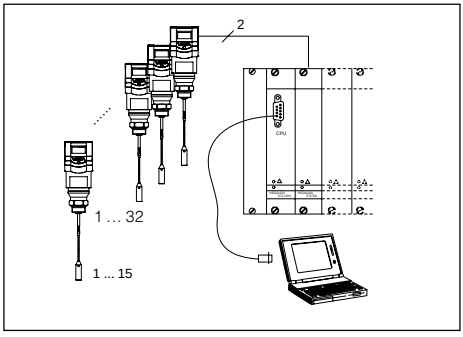
Adjustment with PC

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

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. To do this, the adjustment program must be installed on a PC which is equipped with a Profibus Master Class 2 interface card (Softing) (see illustration under "1.4 Profibus output signal").

The PC with the Profibus interface card can be connected directly to any position of the DP bus by using the standard RS 485 Profibus cable.

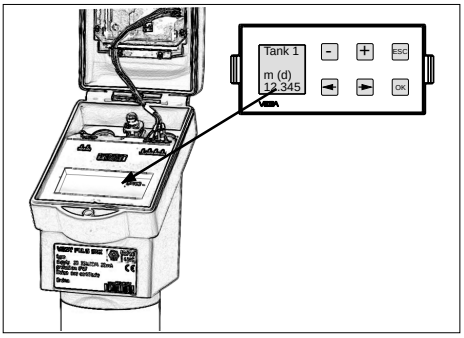
The adjustment and parameter data can be saved with the adjustment software on the PC and can be protected by passwords. On request, the adjustments can be quickly transferred to other sensors.



Adjustment with the PC and the standard cable RS 232 on the VEGALOG processing system

Adjustment with adjustment module MINICOM

With the small (3.2 cm x 6.7 cm) 6-key adjustment module MINICOM, the adjustment can be carried out in clear text dialogue.
The adjustment module can be plugged into VEGAFLEX or the external indicating instrument VEGADIS 50.
Thus, VEGAFLEX can also be adjusted from the external indicating instrument VEGADIS 50.



Pluggable adjustment module MINICOM

1.3 Types and versions

VEGAFLEX series 50 P

In general, all VEGAFLEX series 50 P sensors can be adjusted with the pluggable adjustment module MINICOM. With the software VEGA Visual Operating (VVO), it is also possible to adjust the sensor with a PC.

Profibus PA
Two-wire sensors with digital data transmission acc. to Profibus standard.

1.4 Profibus output signal

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 measuring signal. In Ex areas, up to ten sensors can be connected from the PA level to one two-wire cable (EEx ia).

Bus structure

A Profibus system with DP and PA segments 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.

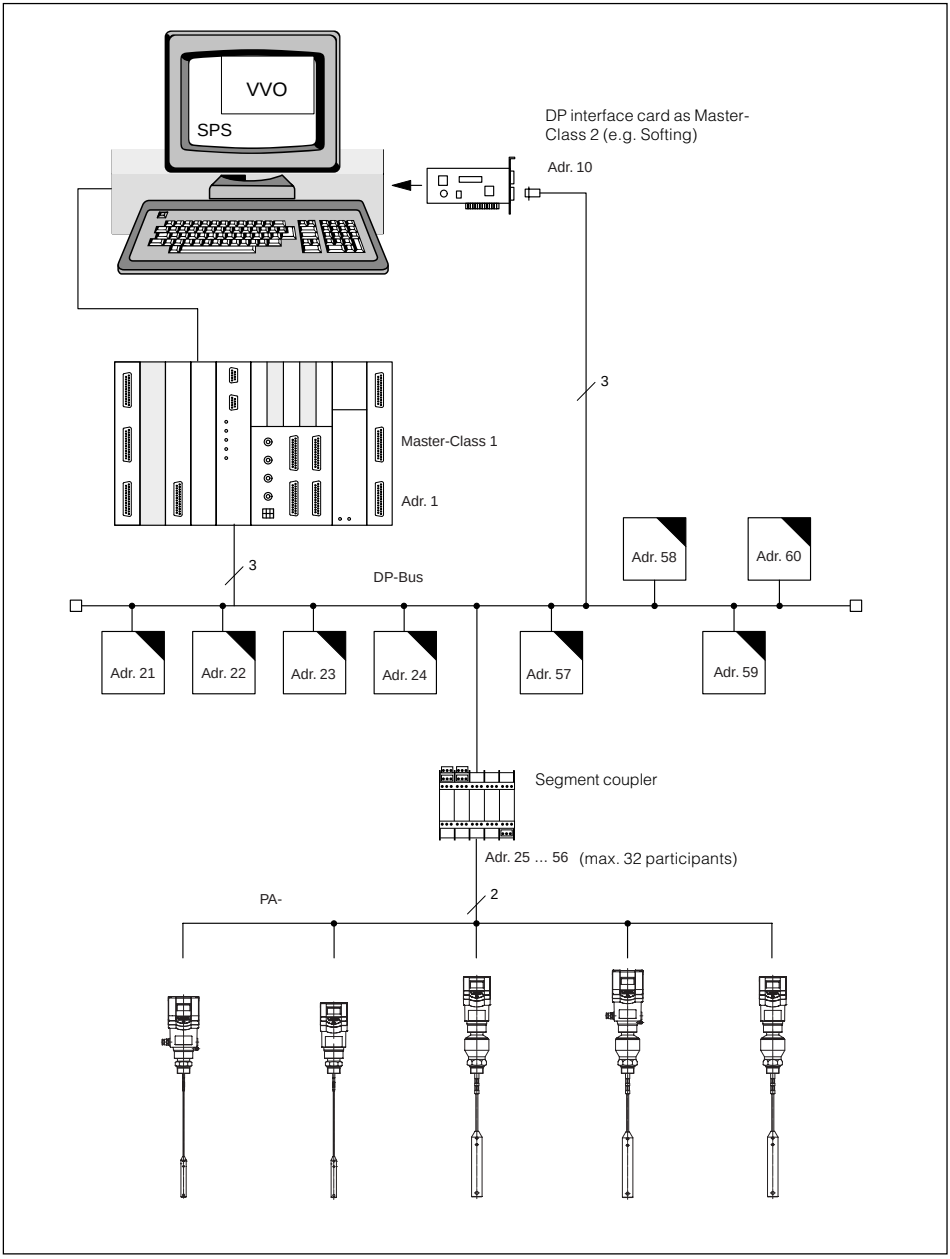
Master-Class 1
is the actual automation system, i.e. the process control computer or the PLC that enquires and processes all measured values.

Master-Class 2
One or several Master-Class 2 devices 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.

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.

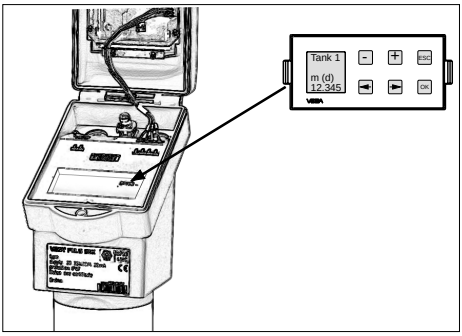
In the past, only the program "SIMATIC PDM", based on the HART® adjustment scheme, could fulfil this wish (though with the limitations common to HART®). As with HART®, the availability of an instrument-specific database for a comprehensive adjustment with PDM (Process Device Managing) is a requirement. 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.



Adjustment of the VEGAFLEX 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).

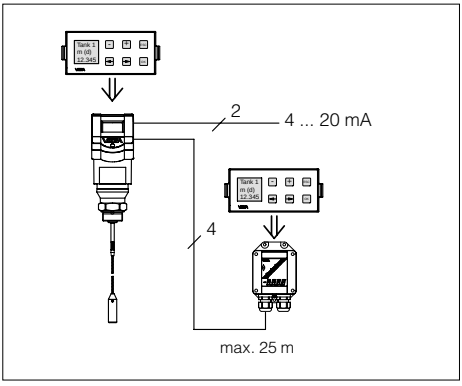
Adjustment with adjustment module MINICOM

With the small (3.2 cm x 6.7 cm) 6-key adjustment module with display, you can carry out the sensor-relevant adjustments directly in the sensor.



Detachable adjustment module MINICOM

The adjustment module can be plugged into the sensor or into the optional, external indicating instrument.



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

With the adjustment module MINICOM, you can adjust the sensor and set the basic functions. Beside setting the measurement conditions and the simulation mode, it is also possible to assign the Profibus address and carry out a false echo storage, see "4.2 Adjustment with the adjustment module MINICOM".

Adjustment with the SIMATIC PDM adjustment program

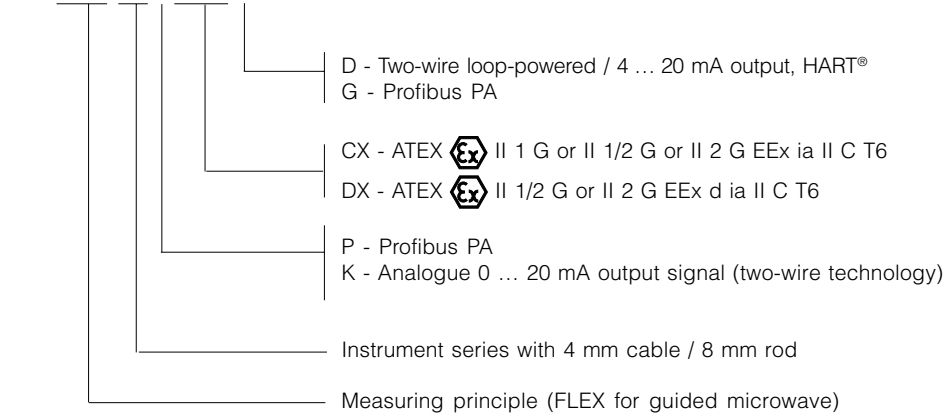
To adjust all essential functions of the VEGA sensor with the adjustment station SIMATIC PDM from Siemens, a so-called EDD is required. Without this EDD, only the basic functions such as min./max. wet adjustment or integration time can be adjusted with the PDM adjustment program. Further important adjustment functions, such as the input of the "*Meas. environment*" or a 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).

1.5 Type code

The second digit of the type name, e.g. VEGAFLEX 5[4]... distinguishes the instruments according to the type and version of the sensor component.

The letter, e.g. VEGAFLEX 54[P] characterises the output signal:
K stands for an analogue 4 ... 20 mA output signal (compact instrument)
P stands for a digital signal transmission for connection to Profibus PA

VEGAFLEX 54 P .CX D



1.6 Bus configuration

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

VEGAFLEX 54P 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 two pages, you will see schematic illustrations of the bus configuration.

The automation system as Master-Class 1 takes over bus control completely. It reads out all signals cyclically and, if necessary, gives instructions to the participants (e.g. sensors). Besides this, additional master systems (e.g. visualisation systems or adjustment tools) can 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 a minimum a screened two-wire cable. The DP bus can additionally have up to 8 cores (screened), of which some can be supply cables.

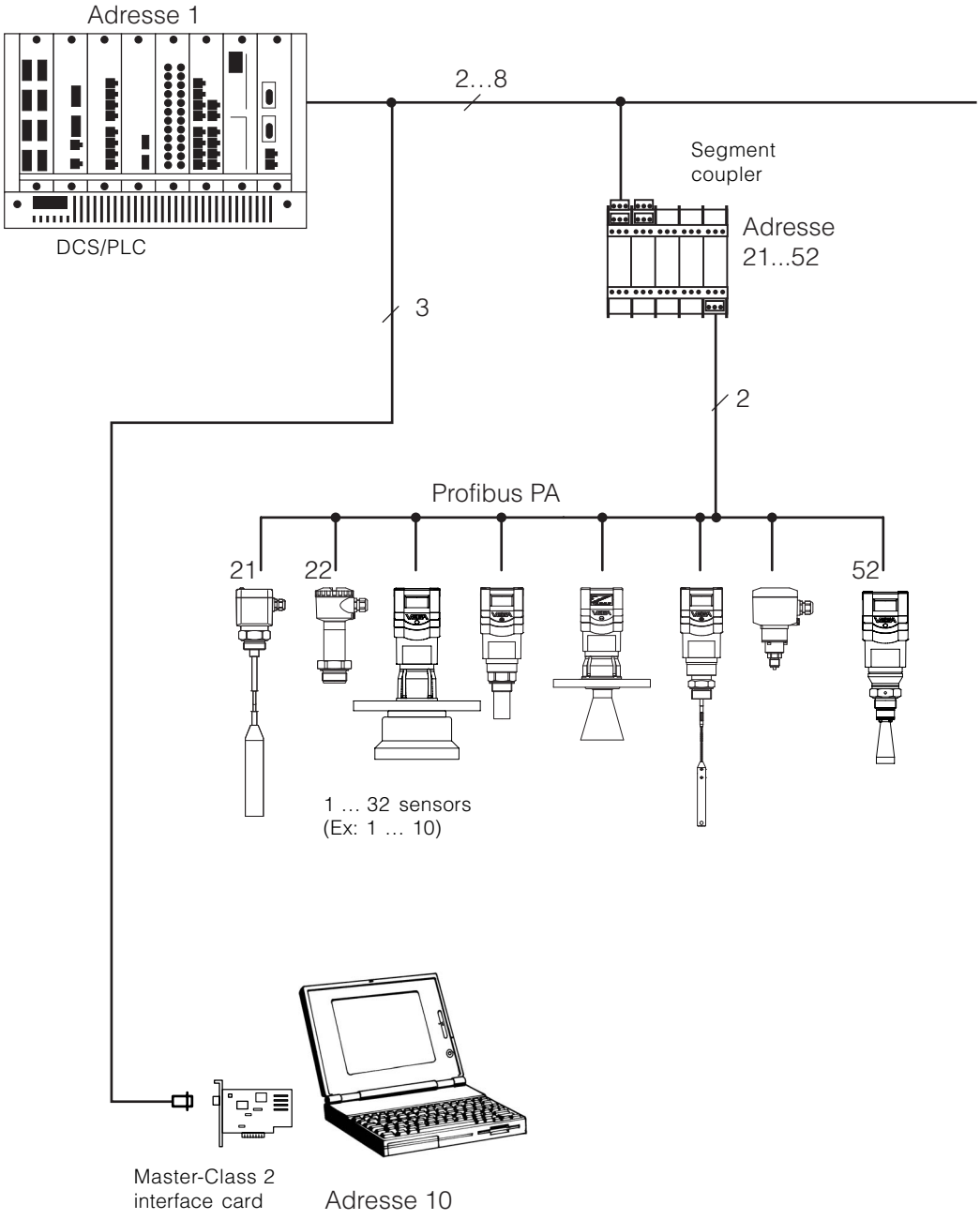
Each participant on the bus must have an unambiguous address. The addressing covers both bus levels. A Profibus DP network can have max. 126 participants, including all participants on the PA level. In practice, each Master-Class 1 computer gets address 1 and the Master-Class 2 computers address 10 …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

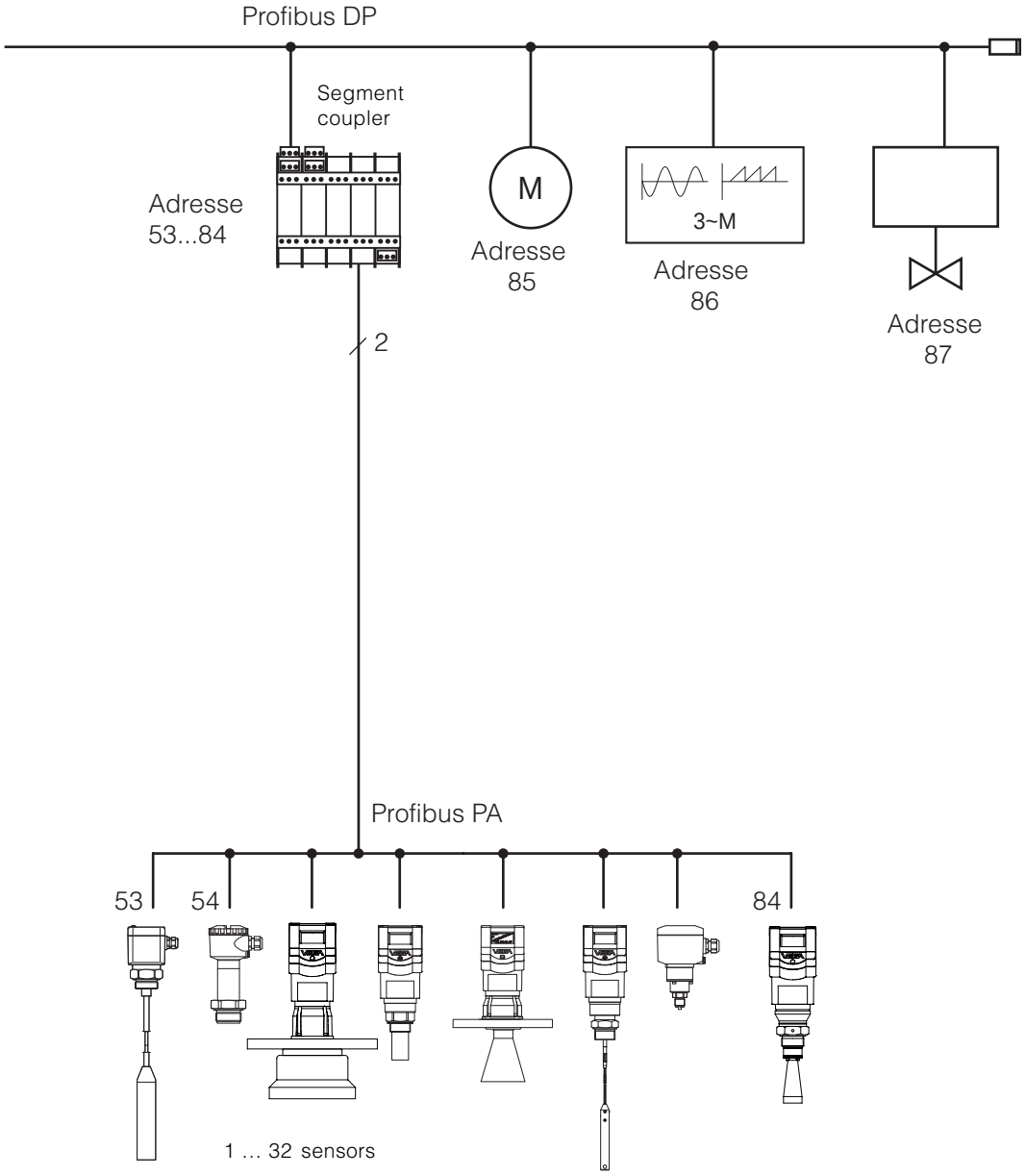
Ex environment

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)

The min. basic current has been set at 10 mA according to the Profibus specification. VEGA Profibus sensors constantly consume a basic current of 10 mA and operate without leakage current requirement, so that in Ex environment, up to max. ten VEGA sensors can be operated on one segment coupler.


Adresse 1
2...8
Segment coupler
Adresse 21...52
DCS/PLC
3
2
Profibus PA
21
22
52
1 ... 32 sensors
(Ex: 1 ... 10)
Master-Class 2 interface card
Adresse 10


Profibus DP
Segment coupler
Adresse 53...84
M
Adresse 85
3~M
Adresse 86
Adresse 87
2
Profibus PA
53
54
84
1 ... 32 sensors

1.7 Approvals

VEGAFLEX sensors are approved for StEx Zone 10.

Observe the attached approval documents when using a sensor in Ex environment.

1.8 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							

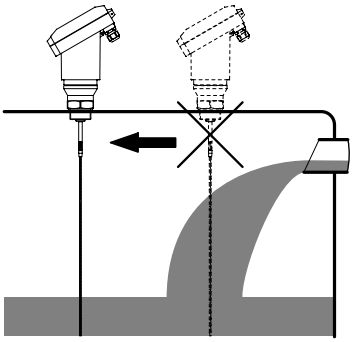
Formula: Measured value = $(-1)^{VZ} \bullet 2^{(Exponent - 127)} \bullet (1 + Mantissa)$

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

2 Mounting

2.1 Installation instructions

Lateral load
Make sure that the cable is not subjected to strong lateral forces. Mount VEGAFLEX at a location where no interference caused by, e.g., stirrers, filling inlets, etc. can occur.



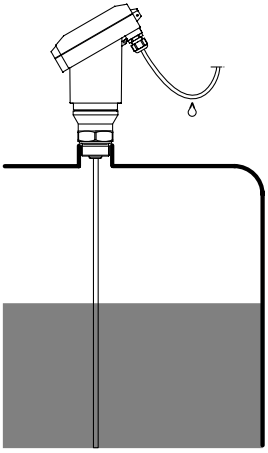
Lateral load

Pressure
In case of gauge or low pressure in the vessel, the mounting boss must be sealed on the thread. Make sure that the seal ring is resistant to the medium.

Cable entries
When mounting outdoors, on cooled vessels or in humid areas where cleaning is done, e.g. with steam or high pressure, the seal of the electrical cable entry is very important.

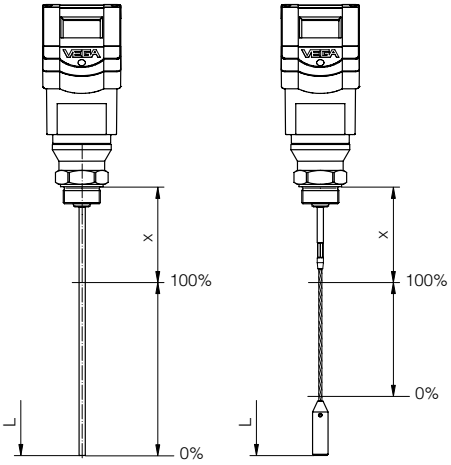
Use electrical cable with a round cross-section and tighten the cable entry firmly. The cable entry is suitable for cable diameters of 5 mm to 9 mm.

Moisture from outside
To avoid moisture ingress, the connection cable leading to the housing should be looped downward (directly in front of the cable entry), so that rain and condensation water can drain off. This mainly applies to outdoor mounting, to areas where moisture is expected (e.g. by cleaning processes) or to cooled or heated vessels.



Moisture

Measuring range
The electrode (rod / cable) cannot be used over its entire length.
Keep especially in mind that the cable length cannot be utilised down to the very tip. A measurement in the area of the gravity weight is not possible.
Rod 0.15 ... 4 m (with DK value > 4: 0.1 … 4 m)
Cable 0.15 … 20 m (with DK value < 4: 0.3 … 20 m)



Measuring range

Sockets
Avoid long sockets. Mount the sensor flush and use short sockets with small diameters. Note under "4.3 Adjustment with PC/Empty vessel profile".

If VEGAFLEX is mounted on a socket or mounting boss, the measurement at close range can be inaccurate. If your socket or mounting boss exceeds the following lengths, a storage of the empty vessel profile should be carried out.

Thread 1“, 1 1/2“	- Length > 50 mm
Flange DN 50	- Length > 50 mm
Flange DN 80	- Length > 80 mm
Flange ≥ DN 100	- Length > 100 mm

3 Electrical connection

3.1 Connection – Connection cable – Screening

Safety information – Qualified personnel

Instruments which are not operated with protective low voltage or DC voltage must be connected only 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 sensors. Protect yourself and the instruments.

Connection cables and bus configuration

"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.

We recommend the use of shielded cable. Shielding is also a good preventative measure against future sources of interference. Ground the shielding only on one sensor end (fig. 3.1 a). It is advantageous to ground the shielding on both ends. However, you must make sure that no earth equalisation currents flow through the cable shielding (fig. 3.1 b). Earth equalisation currents (when grounding at both ends) can be prevented by connecting the cable shielding on one end (e.g. in the switching cabinet) via a capacitor (e.g. 0.1 µF; 250 V AC) to the earth potential. Use a very low-resistance earth connection (foundation, plate or mains earth). In Ex applications, the shielding should be grounded only at one end. Potential transfer can occur if both ends are grounded.

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 in order to ensure the sealing 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. For this reason, screened and twisted cables are prescribed acc. to the Profibus specification (IEC 1158-2).

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, there can be also a maximum of 32 participants, i.e. PA sensors (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.

Grounding at one end (next to the sensor)

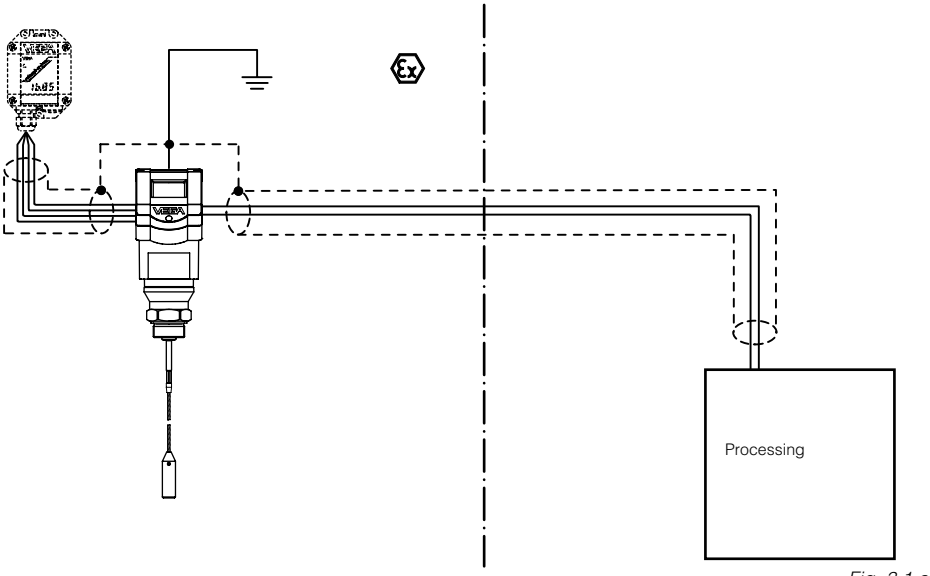


Fig. 3.1 a

Grounding at both ends (on the signal conditioning instrument via the potential separating capacitor)

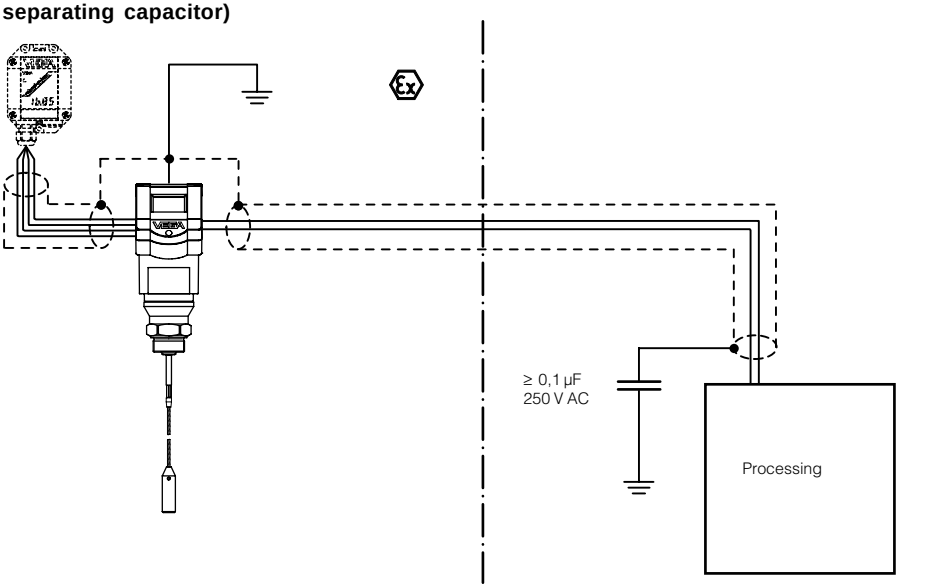


Fig. 3.1 b

Connection cable and 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 1158-2:
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 (VEGAFLEX 10 mA) or the voltage requirement (VEGAFLEX 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 the external ground terminal.

Screening

According to the Profibus specification, the screen should be grounded 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, grounding at both ends in non-Ex areas can be done by connecting the cable screen on one end (in the switching cabinet) via a capacitor (e.g. 0.1 µF; 250 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 participants and the bus cables with their electrical data have been determined, so that the linking of these components always meets Ex requirements. A more time-consuming Ex calculation is therefore not necessary. 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 losses, earthing on both ends without a potential equalisation system is prohibited 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.

Ex protection

If an instrument is used in dust-Ex areas, the necessary regulations as well as the StEx certificate of VEGAFLEX for systems in dust Ex areas must be taken into account.

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 830-5AH10 (Siemens)	44 Ω/km	2	0.75	100 Ω +/- 20 Ω	< 90	< 3 dB/km 39 kHz	Cu braiding
SINEC L26XV1 830-35H10 (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

3.2 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 will occur in the bus.

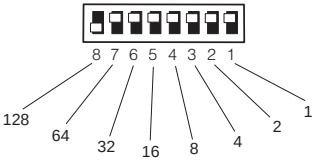
The address of a VEGAFLEX sensor can be set in three ways:
- with the adjustment software VVO (software addressing),
- with the DIP switch block in the sensor (hardware addressing) or
- with the adjustment module MINICOM.

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.

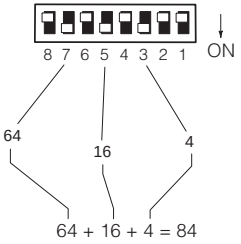
DIP switch 8 corresponds to the number 128, switch 1 corresponds to the number 1 and switch 3 corresponds to the decimal number 4.



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

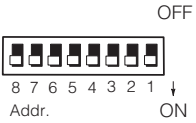
You want to set address 99
64 + 32 + 2 + 1 = 99

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

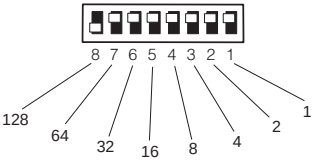
Software addressing

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).

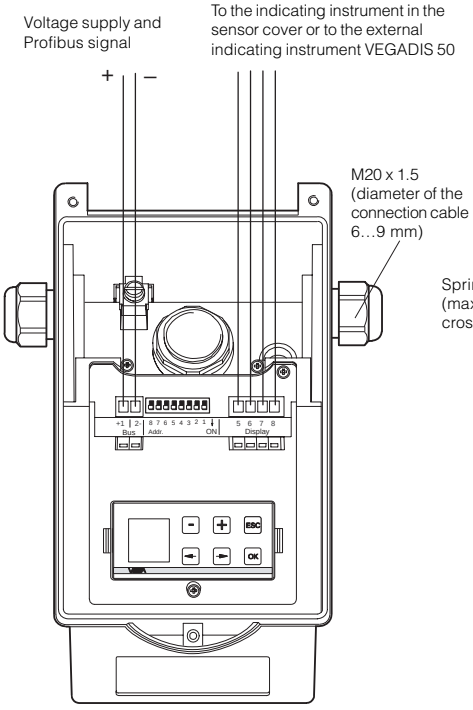
The adjustment of the address with software VVO is described in the operating instructions manual of the adjustment software VVO.

The address adjustment can also be carried out with the adjustment module MINICOM. Note the menu schematics of MINICOM.

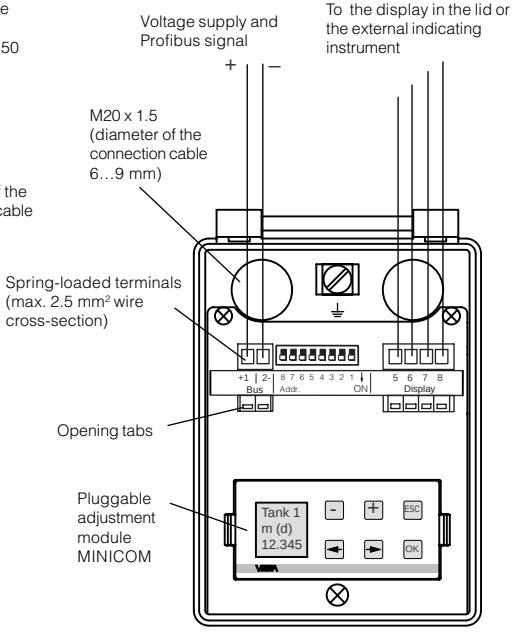
3.3 Connection of the sensor

- Loosen the closing screws on the upper side of the sensor.
- Open the sensor cover.
- Remove the sleeve nut from the cable fitting and slide it a short distance up the connection cable.
- Remove the rubber seal from the cable fitting and slide it also a short distance up the connection cable.
- Remove the outer insulation of the connection cable over a length of approx. 10 cm.
- Insert the cable through the cable fitting into the sensor.
- Connect the cables. Push the white tabs of the spring-loaded terminals 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 pulling lightly on them.
- Screw the sleeve nut back onto the cable fitting and screw it down tightly.

Version with Aluminium housing

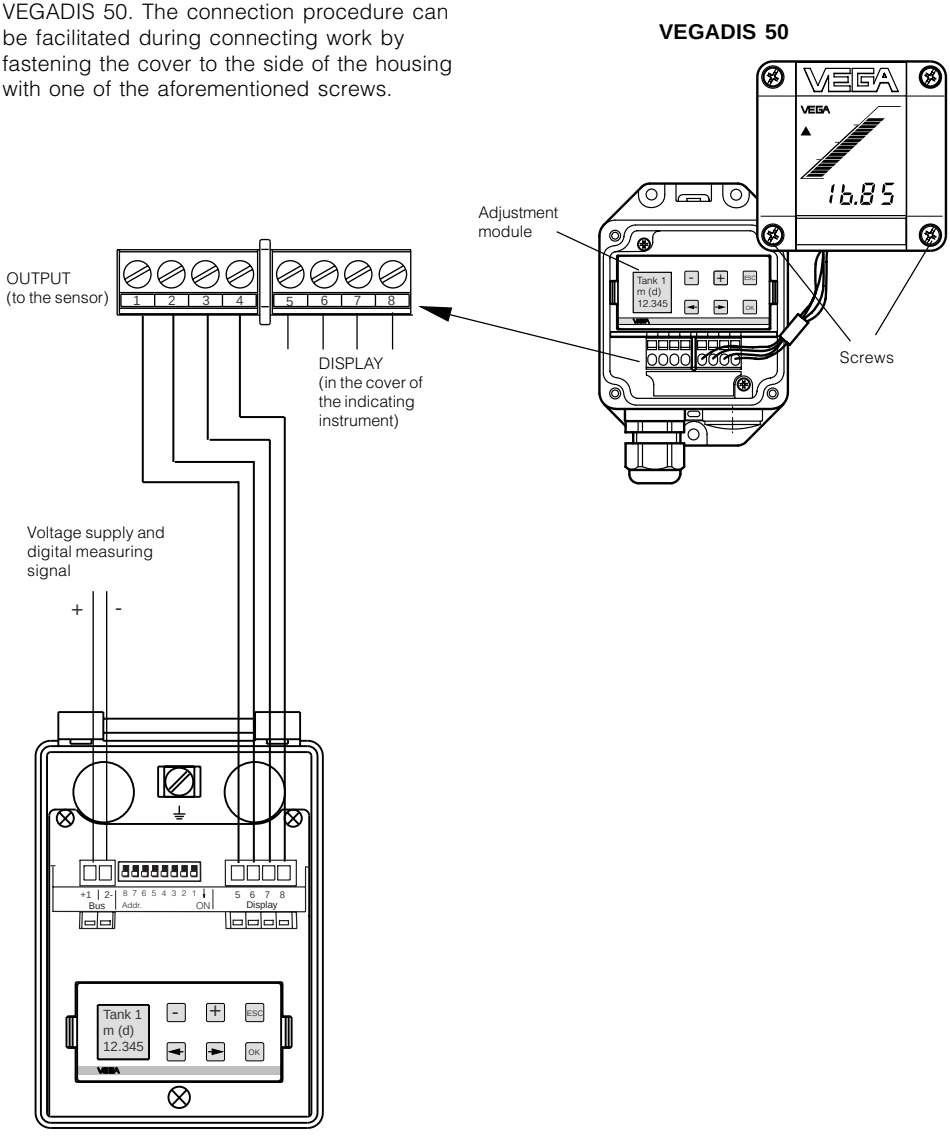


Version with plastic housing



3.4 Connection of the external indicating instrument

Loosen the 4 screws of the housing cover on VEGADIS 50. The connection procedure can be facilitated during connecting work by fastening the cover to the side of the housing with one of the aforementioned screws.



4 Setup

4.1 Adjustment media

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 of 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.

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. To do this, the adjustment program must be installed on a PC which is equipped with a Profibus Master Class 2 interface card (Softing) (see illustration on next page).

The PC with the Profibus interface card can be connected directly to any position of the DP bus by using the standard RS 485 Profibus cable.

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 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.

Device description (DD)
Beside the instrument master file (GSD), with which a sensor is logged into the Profibus system, the majority of all Profibus sensors also requires for adjustment, beside the specific adjustment software, a so-called EDD (Electronic Device Description) for each sensor. This enables sensor access and adjustment from the bus levels. VVO, however does not require this. 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. Expected by many users, this is the basic prerequisite for a manufacturer-independent adjustment program.

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

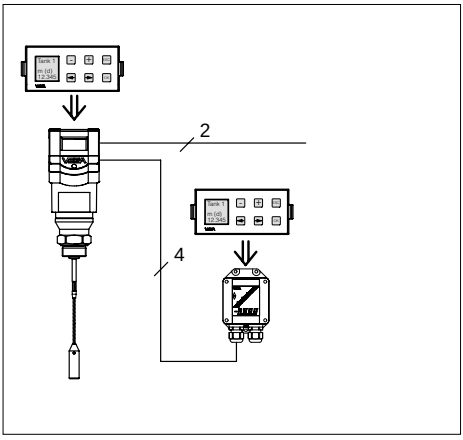
The sensors can be adjusted completely with PDM. However, some convenient functions and many special features, like e.g. display of an echo curve, are not available. In addition to the PDM software, an EDD (upon request available from VEGA) is required for each sensor type. The adjustment instructions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

Just as with 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).

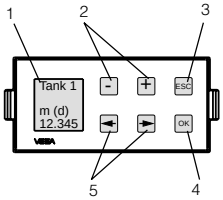


All the adjustment options provided by a PC with the adjustment program VVO are also available with the adjustment module MINICOM. You can carry out all adjustment steps with the 6 keys of the adjustment module. A small display shows you, apart from the measured value, a short message on the menu item or an entered numerical value.

However, not possible are parts of the adjustment relating to configuration and signal processing (e.g. linearisation curve). This is only possible with the PC.

Adjustment elements

The adjustment module MINICOM is menu-driven. The clear text indications on the display lead through the menu. The functions of the keys are described below.



"OK" key (4)
With the "OK" key you can confirm the settings.
When the symbol ▼ or ▼▼ is shown in the digital indication, you can switch to the next lower menu level with the "OK" key.
The symbol ▼▼ indicates there is no branching point below the menu item, but only a further menu item of the respective function.

"ESC" key (3)
With the "ESC" key (Escape) you can interrupt an adjustment or a current function or switch to the next higher menu level.
To reach e.g. the uppermost menu level, push the "ESC" key several times.

"+" and "–" key (2)
With the "+" and "–" keys, you can modify the values of the parameters or choose from a number of options.
After an initial push, the value to be adjusted flashes. Each additional push changes the value.

Arrow keys (5)
With the keys "–>" and "<–", you can move within the menu level from one menu item to the next.

Digital indication (1)
During operation, the digital display shows the actual measured value.
When adjusting the instrument, the clear text display shows the respective function.

▼ Branching point, from where you can move to the next lower menu.

▼▼ This symbol informs you of a subsequent safety enquiry.

Address
First of all, choose a free bus address (see chapter "3.2 Sensor address").

Adjustment steps

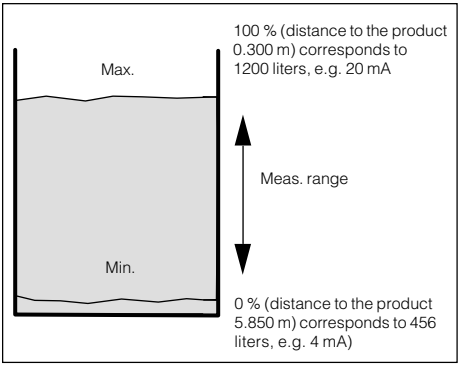
On the following pages, you will see the menu schematic of the adjustment module MINICOM.

Set up the sensor in the following sequence. The numbers correspond to the sequence of the setup. You will find the numbers with the respective menu items in the menu schematic on the following pages.

1. Adjustment
2. Conditioning
3. Outputs
4. Operating range
5. Measuring conditions
6. Indication of the useful signal and noise level

1. Adjustment

Under the menu item "*Adjustment*", you inform the sensor of the measuring range it should operate in.
The instruments are already adjusted to the respective probe length. You only have to carry out a max. adjustment and enter the max. level.

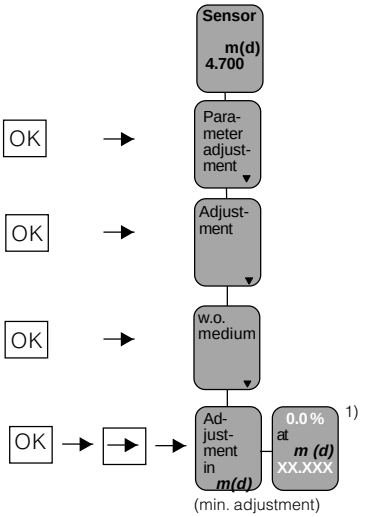


You can carry out the adjustment with or without medium. Generally, you will carry out the adjustment without medium, because you can adjust without having to fill the vessel.

Adjustment without medium

- Enter the distance from the sensor to the medium at 0 % (example: 5.850 m) with the "*+*" and "*–*" key.
  If you do not know the distance, you have to do a sounding.
- Enter the distance from the sensor to the medium at 100 % filling.

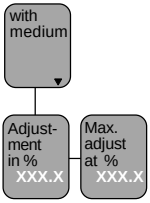
Key / Display indication



[1] If there are two values which can be modified, you can move with the "+" key to the second value (confirm with the "OK" key).

Adjustment with medium

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



2. Conditioning

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

- Enter in the menu window "*0 % correspond*" the value of the 0 % filling. This will be e.g. "80" for 80 liters.
- Confirm with "*OK*".
- With the arrow key, you switch to the 100 % menu. Enter here the value of your parameter corresponding to a 100 % filling. E.g. "1200" for 1200 liters.
- Confirm with "*OK*".
- If necessary, choose a decimal point. Note that max. 4 digits can be shown.
- In the menu "*prop. to*", you choose the parameter (mass, volume, distance…),
- In the menu "*Unit*", you choose the physical unit (kg, l, ft^3, gal, m^3 …).
- With the "ESC" key, you go back to the next higher menu level. With the arrow key, you choose the next menu item.
- In the menu *"Lin. curve",* you can choose between three standard linearisation curves.
  A linear correlation between the percentage value of the product distance and the percentage value of the filling volume has been preset.
  You can choose between linear, spherical and cylindrical tank. Entering a user-programmable curve is only possible with the PC and the adjustment program VVO.
- In the menu item *"Integration time",* you can set a delay period for the signal output.

3. Outputs

Under the menu "*Outputs*" you can scale the display and determine which parameter should be indicated on the sensor display.

4. Operating range

Without special adjustment, the operating range corresponds to the measuring range. The measuring range is automatically set with the min./max. adjustment. It is generally better to set a slightly wider span for operating range (approx. 5 %) than for the measuring range (meas. span).

Example:
Min./Max. adjustment: 0.300 … 5.850 m; set operating range to approx. 0.250 … actual cable length.

5. Meas. conditions

With these functions, you can enter the ambient conditions in the vessel (see menu schematic).

6. Useful level and noise level

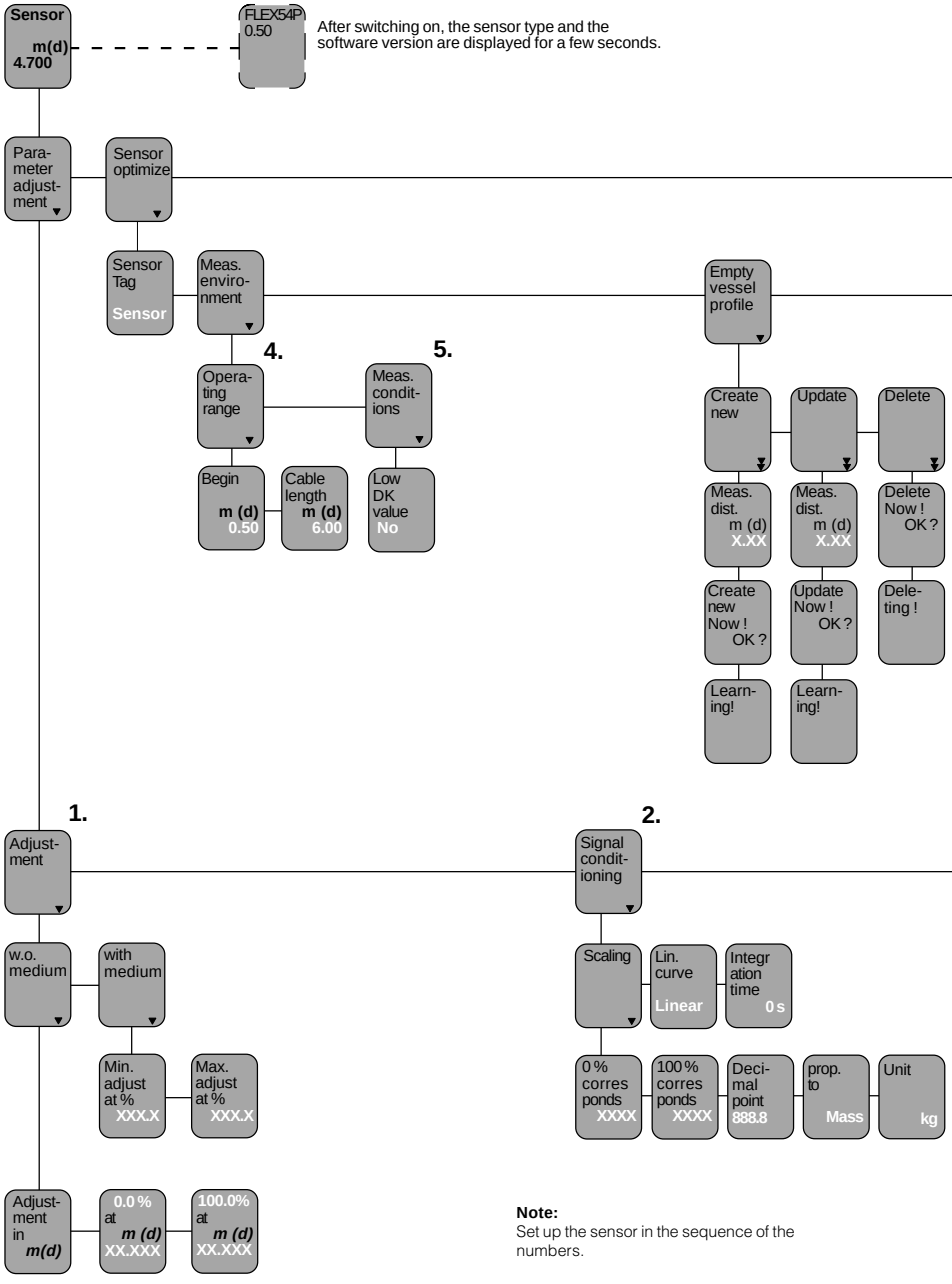
In the menu *"Info",* you get important information on the signal quality of the product echo. The higher the "*S-N*" value, the more reliable the measurement.

Ampl.: Means amplitude of the product echo in dB (useful signal level)
S-N: Means Signal-Noise (useful signal level minus noise level)

The higher the S-N value (useful signal level minus noise level), the higher the reliability:

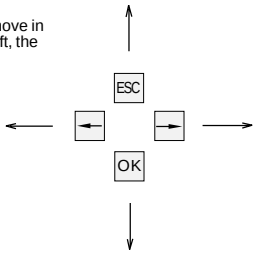
> 30 dB	Measurement good
10 … 30 dB	Measurement satisfactory
< 10 dB	Measurement bad

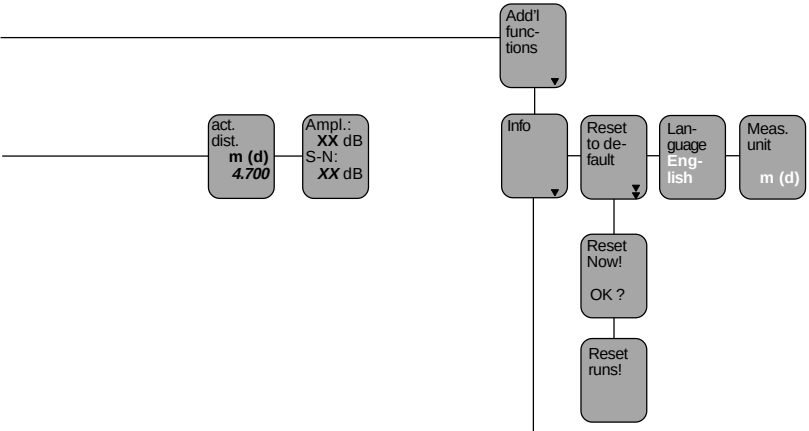
Menu schematic of the adjustment module MINICOM



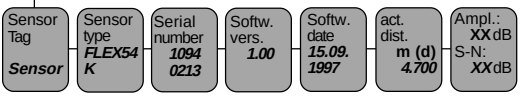
Note:
Set up the sensor in the sequence of the numbers.

With these keys you move in the menu field to the left, the right, top and bottom.

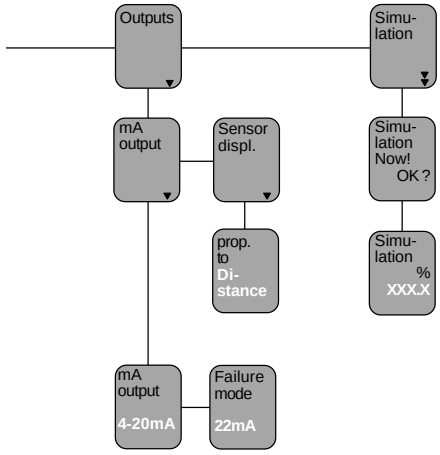


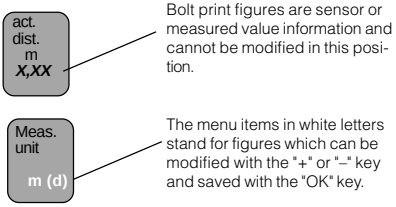


6.



3.





4.3 Adjustment with the PC

The adjustment with the PC and the adjustment program VVO is not described in this operating instructions manual, but in the manual "VEGA Visual Operating (VVO)". Beside the adjustment of VEGAFLEX, you will find in the manual VEGA Visual Operating further information on the scope of the adjustment options with the PC.

If you operate a sensor in conjunction with a VEGA signal conditioning instrument, please use an additional communication resistor acc. to the following table:

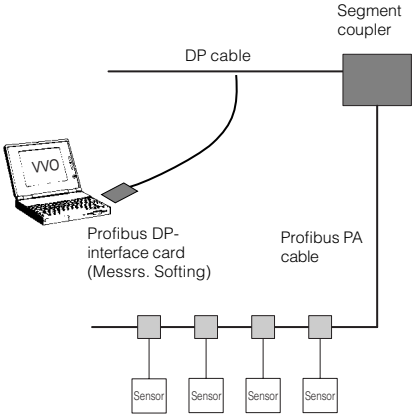
VEGA signal condit. instrument	Rx
VEGAMET 513, 514, 515, 602	50 … 100 Ohm
VEGAMET 614 VEGADIS 371	no additional resistance necessary
VEGAMET 601	200 … 250 Ohm
VEGASEL 643	150 … 200 Ohm
VEGAMET 513 S4, 514 S4 515 S4, VEGALOG EA card	100 … 150 Ohm

Before you can set up the sensors with the adjustment program VVO (VEGA Visual Operating), they have to be integrated into the Profibus system. First of all, address the sensors and connect them to your PA segment. With the attached GSD file, you integrate the sensors into your system.

To set up VEGA sensors with the adjustment software VVO, the PC or the adjustment station on which VVO is installed must be equipped with a Profibus DP interface card (e.g. from Softing). The PC or adjustment station then communicates as Master-Class 2 participant on the DP bus with the VEGA sensors on the PA bus segment.

To connect the PC to the DP bus a standard RS 485-DTE interface cable (Data Terminal equipment) is required. With the cable, you connect the DP interface card to the bus or the segment coupler.

PC		BUS		
Screen	1	1	Screen	
– –	2	2	M24	
RxD/TxD-P	**3**	**3**	**RxD/TxD-P**	(40)
– –	4	4	CNTR-P	
GND	**5**	**5**	**GND**	(55)
– –	6	6	VP	
– –	7	7	P24	
RxD/TxD-N	**8**	**8**	**RxD/TxD-N**	(41)
– –	9	9	CNTR-P	
Profibus-DP interface card		DP bus (in brackets the PIN number of the P+F segment couplers)		



After having connected the computer to the Profibus DP cable, VVO can be started.

5 Diagnosis

5.1 Simulation

To simulate a certain filling, you can call up the function "Simulation" on the adjustment module MINICOM, in the adjustment program VVO or in the HART® handheld. With this function, you simulate a certain current. Please note that connected instruments, such as e.g. a PLC, react according to their adjustments and will probably activate alarms or system functions.

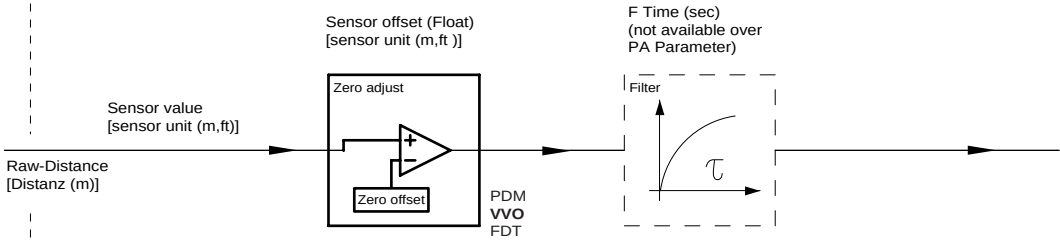
Simulation with VVO
If you start the simulation mode with the adjustment program VVO on the PC, the simulated level is outputted until you quit the simulation mode.

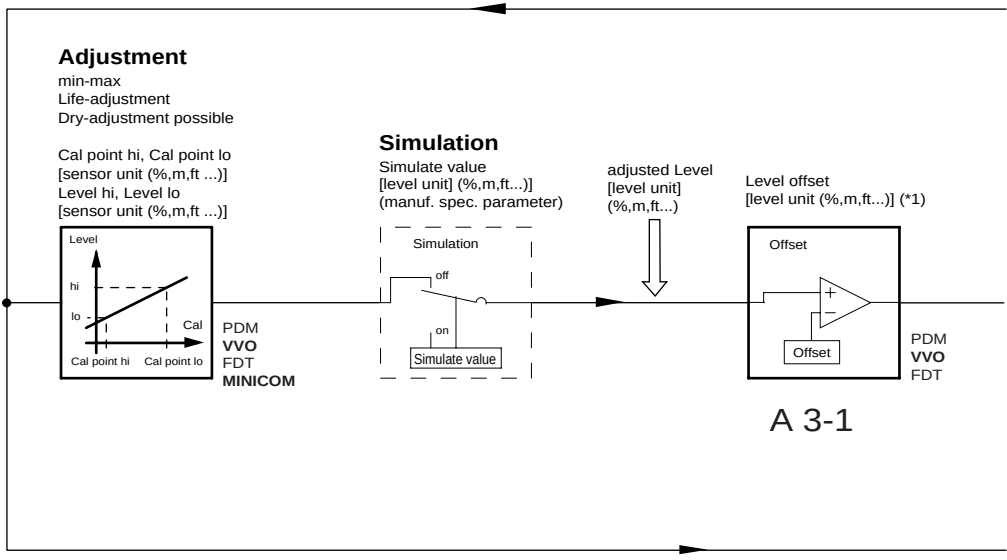
Simulation with MINICOM
If you start the simulation mode on the adjustment module MINICOM, the sensor returns to standard operating mode after one hour.

5.2 Function diagram

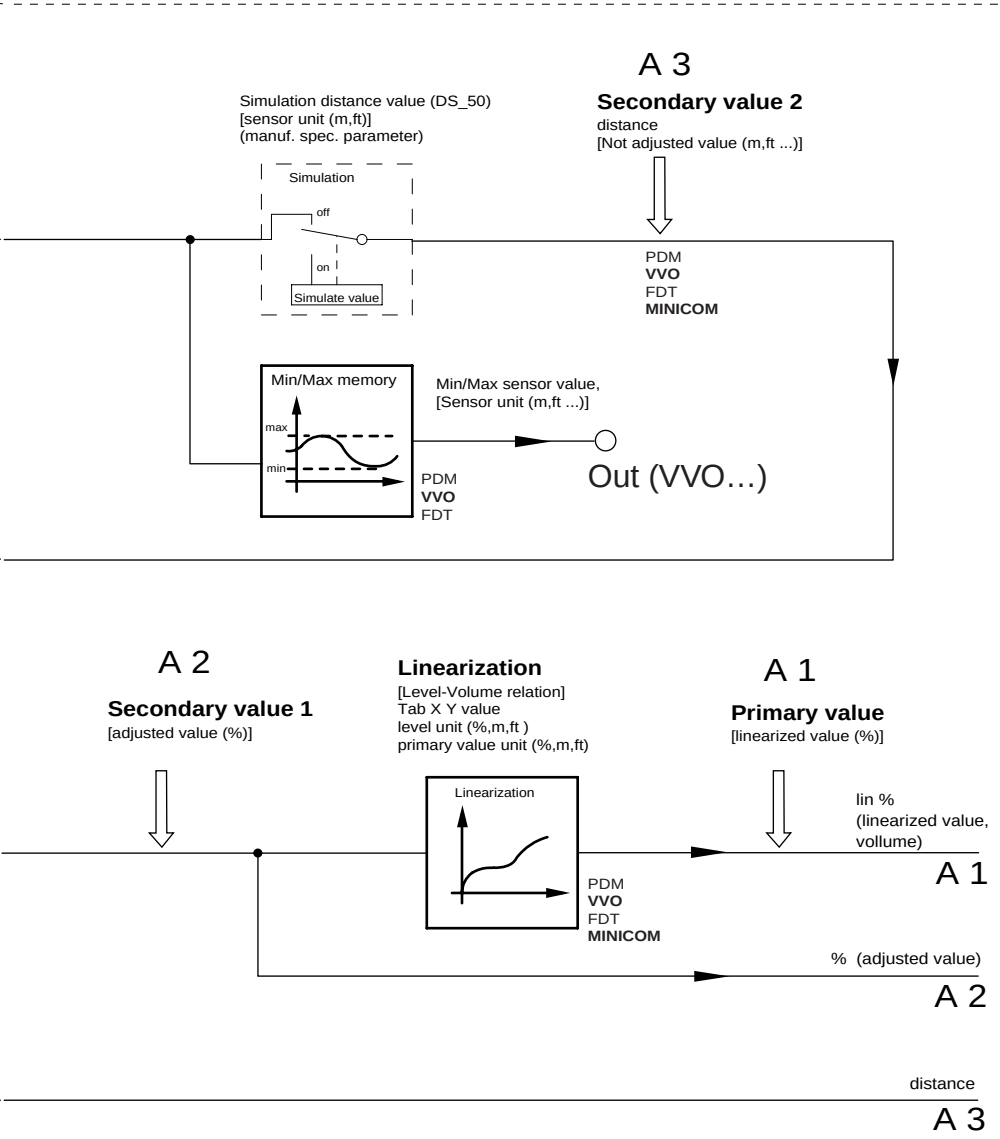
The following function diagram is used for setup with the automation system, if no adjustment software is available. Keep in mind that all VEGA sensors are profile 3 sensors. You will more likely carry out the setup of the sensors with the user-friendly VEGA adjustment software VVO or with the adjustment module MINICOM in the sensor.

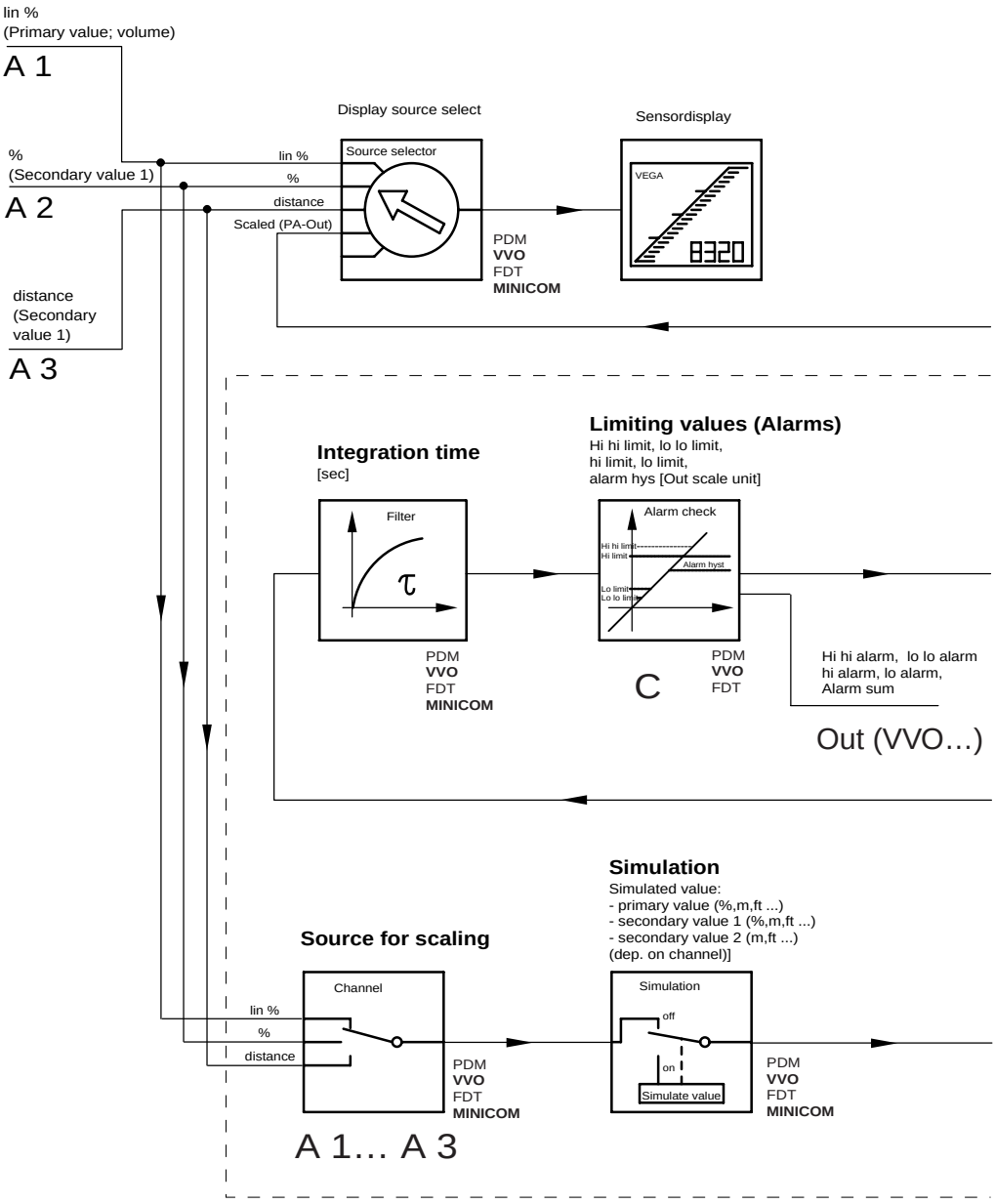
Normally, the function diagram is not required for setup and only serves to deepen the knowledge of the interested user and enable him to read meas. values from the sensor into the processing system (also without adjustment tool).

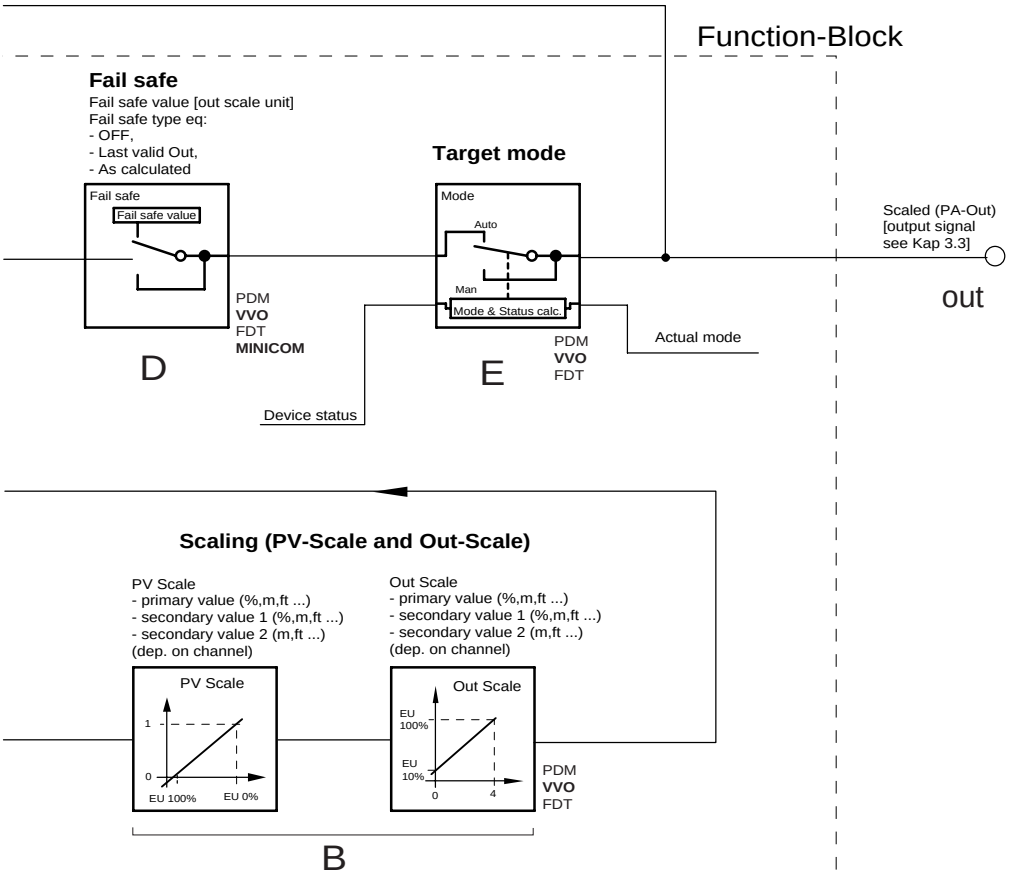

Sensor offset (Float)
[sensor unit (m,ft)]
F Time (sec)
(not available over
PA Parameter)
Zero adjust
Filter
Sensor value
[sensor unit (m,ft)]
Raw-Distance
[Distanz (m)]
Zero offset
PDM
VVO
FDT


Adjustment
min-max
Life-adjustment
Dry-adjustment possible
Cal point hi, Cal point lo
[sensor unit (%,m,ft ...)]
Level hi, Level lo
[sensor unit (%,m,ft ...)]
Level
hi
lo
Cal
Cal point hi
Cal point lo
PDM
VVO
FDT
MINICOM
Simulation
Simulate value
[level unit] (%,m,ft...)]
(manuf. spec. parameter)
Simulation
off
on
Simulate value
adjusted Level
[level unit]
(%,m,ft...)
Level offset
[level unit (%,m,ft...)] (*1)
Offset
Offset
PDM
VVO
FDT
A 3-1

Transducer Block




lin %
(Primary value; volume)
A 1
%
(Secondary value 1)
A 2
distance
(Secondary
value 1)
A 3
Display source select
Source selector
lin %
%
distance
Scaled (PA-Out)
PDM
VVO
FDT
MINICOM
Sensordisplay
VEGA
8320
Integration time
[sec]
Filter
τ
PDM
VVO
FDT
MINICOM
Limiting values (Alarms)
Hi hi limit, lo lo limit,
hi limit, lo limit,
alarm hys [Out scale unit]
Alarm check
Hi hi limit
Hi limit
Alarm hyst
Lo limit
Lo lo limit
C
PDM
VVO
FDT
Hi hi alarm, lo lo alarm
hi alarm, lo alarm,
Alarm sum
Out (VVO…)
Simulation
Simulated value:
- primary value (%,m,ft ...)
- secondary value 1 (%,m,ft ...)
- secondary value 2 (m,ft ...)
(dep. on channel)]
Source for scaling
Channel
lin %
%
distance
PDM
VVO
FDT
MINICOM
Simulation
off
on
Simulate value
PDM
VVO
FDT
MINICOM
A 1... A 3


Function-Block
Fail safe
Fail safe value [out scale unit]
Fail safe type eq:
- OFF,
- Last valid Out,
- As calculated
Fail safe
Fail safe value
PDM
VVO
FDT
MINICOM
D
Target mode
Mode
Auto
Man
Mode & Status calc
PDM
VVO
FDT
E
Device status
Actual mode
Scaled (PA-Out)
[output signal
see Kap 3.3]
out
Scaling (PV-Scale and Out-Scale)
PV Scale
- primary value (%,m,ft ...)
- secondary value 1 (%,m,ft ...)
- secondary value 2 (m,ft ...)
(dep. on channel)
PV Scale
1
0
EU 100%
EU 0%
Out Scale
- primary value (%,m,ft ...)
- secondary value 1 (%,m,ft ...)
- secondary value 2 (m,ft ...)
(dep. on channel)
Out Scale
EU
100%
EU
10%
0
4
PDM
VVO
FDT
B

5.3 Failure rectification

Error		Corrective measure
E 013	Sensor does not find a level echo	- Message is displayed during the warm-up phase. - If the message remains, the DK value of the medium might be too low. Check the useful level and noise level. See "4.2 Adjustment with adjustment module MINICOM; 6. Useful level and noise level". If the message still remains, carry out a new adjustment.
E 017	Adjustment span too small	Carry out the adjustment again. Make sure that the difference between min. and max. adjustment is at least 10 mm.
E 036	Software update incorrect	Return the instrument for repair. - Sensor requires programming (service). - Failure message appears also during programming.
E 040	Hardware failure/ Electronics defective	Check all connection cables. Contact our service department.

5.4 PA parameters

The following parameter listing and function diagram is used for setup with the automation system if there is no adjustment software available. The listing represents parameters of the function block and transducer block and should only be used by experienced Profibus technicians. Keep in mind that all VEGA sensors are profile 3 sensors. You will more likely carry out the setup of the sensors with the user-friendly VEGA adjustment software VVO or with the adjustment module MINICOM in the sensor.

PA parameters and function diagram are normally not necessary for setup.

Index	Parameter	Object	Read	Write	Type	Size	Store	Unit	Optional mandatory
0	Directory object header	DM	Yes	No	Array of Unsigned16	12	C		m
1	Composite list directory entries	DM	Yes	No	Array of Unsigned16	24	C		m
16	Block object	FB_Primary_Value	Yes	No	DS-32	20	C		m
17	St rev	FB_Primary_Value	Yes	No	Unsigned16	2	N		m
18	Tag desc	FB_Primary_Value	Yes	Yes	OctetString	32	S		m
19	Strategy	FB_Primary_Value	Yes	Yes	Unsigned16	2	S		m
20	Alert key	FB_Primary_Value	Yes	Yes	Unsigned8	1	S		m
21	Target mode	FB_Primary_Value	Yes	Yes	Unsigned8	1	S		m
22	Mode blk	FB_Primary_Value	Yes	No	DS-37	3	D		m
23	Alarm sum	FB_Primary_Value	Yes	No	DS-42	8	D		m
24	Batch	FB_Primary_Value	Yes	Yes	DS-67	10	S		m
26	Out	FB_Primary_Value	Yes	Yes (*1)	DS-33	5	D	[out scale unit]	m
27	PV scale	FB_Primary_Value	Yes	Yes	2 * Float	8	S	[prim, sec1, sec2 value unit (dep. on channel)	m
28	Out scale	FB_Primary_Value	Yes	Yes	DS-36	11	S	includes out scale unit	m
29	Lin type	FB_Primary_Value	Yes	Yes (*1)	Unsigned8	1	S		m
30	Channel	FB_Primary_Value	Yes	Yes	Unsigned16	2	S		m
32	PV FTime	FB_Primary_Value	Yes	Yes	Float	4	N	sec	m
33	Fsafe type	FB_Primary_Value	Yes	Yes	Unsigned8	1	S		o
34	Fsafe value	FB_Primary_Value	Yes	Yes	Float	4	S	[out scale unit]	o
35	Alarm hys	FB_Primary_Value	Yes	Yes	Float	4	S	[out scale unit]	m
37	HI HI Lim	FB_Primary_Value	Yes	Yes	Float	4	S	[out scale unit]	m
39	HI Lim	FB_Primary_Value	Yes	Yes	Float	4	S	[out scale unit]	m
41	LO Lim	FB_Primary_Value	Yes	Yes	Float	4	S	[out scale unit]	m
43	LO LO Lim	FB_Primary_Value	Yes	Yes	Float	4	S	[out scale unit]	m
46	HI HI Alm	FB_Primary_Value	Yes	No	DS-39	16	D		o
47	HI Alm	FB_Primary_Value	Yes	No	DS-39	16	D		o
48	LO Alm	FB_Primary_Value	Yes	No	DS-39	16	D		o
49	LO LO Alm	FB_Primary_Value	Yes	No	DS-39	16	D		o
50	Simulate	FB_Primary_Value	Yes	Yes	DS-50	6	N	[prim, sec1, sec2 value unit (dep. on channel)	m
61	View object FB_Primary_Value	FB_Primary_Value	Yes	No	OctetString	18	D		m

Index	Parameter	Object	Read	Write	Type	Size	Store	Unit	Optional mandatory
66	Block object	PB	Yes	No	DS-32	20	C		m
67	St rev	PB	Yes	No	Unsigned16	2	N		m
68	Tag desc	PB	Yes	Yes	OctetString	32	S		m
69	Strategy	PB	Yes	Yes	Unsigned16	2	S		m
70	Alert key	PB	Yes	Yes	Unsigned8	1	S		m
71	Target mode	PB	Yes	Yes (*1)	Unsigned8	1	S		m
72	Mode blk	PB	Yes	No	DS-37	3	(D)		m
73	Alarm sum	PB	Yes	No	DS-42	8	D		m
74	Software revision	PB	Yes	No	OctetString	16	C		m
75	Hardware revision	PB	Yes	No	OctetString	16	C		m
76	Device man ID	PB	Yes	No	Unsigned16	2	C		m
77	Device ID	PB	Yes	No	OctetString	16	C		m
78	Device ser num	PB	Yes	No	OctetString	16	C		m
79	Diagnosis	PB	Yes	No	OctetString	4	D		m
81	Diagnosis mask	PB	Yes	No	OctetString	4	C		m
83	Device certification	PB	Yes	No	OctetString	32	C		o
84	Write locking	PB	Yes	Yes	Unsigned16	2	N		o
85	Factory reset	PB	Yes	Yes	Unsigned16	2	S		o
86	Decriptor	PB	Yes	Yes	OctetString	32	S		o
87	Device message	PB	Yes	Yes	OctetString	32	S		o
88	Device install date	PB	Yes	Yes	OctetString	16	S		o
90	Ident number select	PB	Yes	Yes	Unsigned8	1	S		m
91	HW write protection	PB	Yes	No	Unsigned8	1	D		o
99	VVO	PB	Yes	Yes	OctetString	32			o
100	View object PB	PB	Yes	No	OctetString	17	D		m
180	Display source select	TB	Yes	Yes	Unsigned8	1	N		o
120	Block object	TB_Level	Yes	No	DS-32	20	C		m

Index	Parameter	Object	Read	Write	Type	Size	Store	Unit	Optional mandatory
121	St rev	TB_Level	Yes	No	Unsigned16	2	N		m
122	Tag desc	TB_Level	Yes	Yes	OctetString	32	S		m
123	Strategy	TB_Level	Yes	Yes	Unsigned16	2	S		m
124	Alert key	TB_Level	Yes	Yes	Unsigned8	1	S		m
125	Target mode	TB_Level	Yes	Yes (*1)	Unsigned8	1	S		m
126	Mode blk	TB_Level	Yes	No	DS-37	3	(D)		m
127	Alarm sum	TB_Level	Yes	No	DS-42	8	D		m
128	Primary value	TB_Level	Yes	No	DS-33	5	D	[primary value unit]	m
129	Primary value unit	TB_Level	Yes	Yes	Unsigned16	2	S		m
130	Level	TB_Level	Yes	No	Float	4	D	[level unit]	m
131	Level unit	TB_Level	Yes	Yes	Unsigned16	2	S		m
132	Sensor value	TB_Level	Yes	No	Float	4	D	[sensor unit]	m
133	Sensor unit	TB_Level	Yes	Yes	Unsigned16	2	S		m
134	Secondary value 1	TB_Level	Yes	No	DS-33	5	D	[secondary value 1 unit]	o
135	Secondary value 1unit	TB_Level	Yes	Yes	Unsigned16	2	S		o
136	Secondary value 2	TB_Level	Yes	No	DS-33	5	D	[secondary value 2 unit]	o
137	Secondary value 2 unit	TB_Level	Yes	Yes	Unsigned16	2	S		o
138	Sensor offset	TB_Level	Yes	Yes	Float	4	S	[sensor unit]	m
139	Cal type	TB_Level	Yes	Yes	Unsigned8	1	S		m
140	Cal point lo	TB_Level	Yes	Yes	Float	4	S	[sensor unit]	m
141	Cal point hi	TB_Level	Yes	Yes	Float	4	S	[sensor unit]	m
142	Level lo	TB_Level	Yes	Yes	Float	4	S	[level unit]	m
143	Level hi	TB_Level	Yes	Yes	Float	4	S	[level unit]	m
144	Level offset	TB_Level	Yes	Yes	Float	4	S	[level unit]	m
145	Lin type	TB_Level	Yes	Yes	Unsigned8	1	S		m
148	Sensor high limit	TB_Level	Yes	No	Float	4	C	[sensor unit]	o
149	Sensor low limit	TB_Level	Yes	No	Float	4	C	[sensor unit]	o
150	Max sensor value	TB_Level	Yes	Yes	Float	4	N	[sensor unit]	o
151	Min sensor value	TB_Level	Yes	Yes	Float	4	N	[sensor unit]	o
156	Tab index	TB_Level	Yes	Yes	Unsigned8	1	D		o

Index	Parameter	Object	Read	Write	Type	Size	Store	Unit	Optional mandatory
157	Tab X Y value	TB_Level	Yes	Yes	2 * Float	8	N	[secondary value 1unit, primary value unit]	o
158	Tab min number	TB_Level	Yes	No	Unsigned8	1	C		o
159	Tab max number	TB_Level	Yes	No	Unsigned8	1	C		o
160	Tab op code	TB_Level	Yes	Yes	Unsigned8	1	D		o
161	Tab status	TB_Level	Yes	No	Unsigned8	1	D		o
162	Tab actual number	TB_Level	Yes	No	Unsigned8	1	D		o
190	Simulate sensor value	TB_Level	Yes	Yes	DS-50	6	N	[sensor unit]	o
191	Simulate level	TB_Level	Yes	Yes	DS-50	6	N	[level unit]	o
192	Füllguttyp	TB_Level	Yes	Yes	Unsigned8	1	N		o
193	Echo quality	TB_Level	Yes	No	Unsigned8	1	D	dB	o
194	First echo factor	TB_Level	Yes	Yes	Unsigned8	1	N		o
196	Lerndistanz	TB_Level	Yes	Yes	Float	4	D	[sensor unit]	o
197	Störechospeicher-Aktion	TB_Level	Yes	Yes	Unsigned8	1	D		o
198	Arbeitsbereich Ende	TB_Level	Yes	Yes	Float	4	N	[sensor unit]	o
199	Arbeitsbereich Anfang	TB_Level	Yes	Yes	Float	4	N	[sensor unit]	o
200	schnelle Meßwertänderung	TB_Level	Yes	Yes	Unsigned8	1	N		o
201	unruhige Füllgutoberfläche	TB_Level	Yes	Yes	Unsigned8	1	N		o
202	Schaumbildung	TB_Level	Yes	Yes	Unsigned8	1	N		o
203	starke Staubentwicklung	TB_Level	Yes	Yes	Unsigned8	1	N		o
204	Bodenreflexion / großer Schüttwinkel	TB_Level	Yes	Yes	Unsigned8	1	N		o
205	kleiner DK-Wert	TB_Level	Yes	Yes	Unsigned8	1	N		o
210	Korrektur-faktor Ausbr.-geschw.	TB_Level	Yes	Yes	Float	4	N	%	o
211	Berechn. Korr.fak. Ausbr.	TB_Level	No	Yes	Float	4	N	[sensor unit]	o
212	Rohrdurchmesser	TB_Level	Yes	Yes	Float	4	N	[sensor unit]	o
250	View object TB_Level	TB_Level	Yes	No	OctetString	22	D		m

6 Technical data

6.1 Technical data

Power supply

Supply voltage (output voltage U_O of the segment coupler)	9 … 32 V DC (depending on segment coupler used) see PA specification, e.g.
- non-Ex	22 V DC (nominal voltage of the segment coupler) max. 32 sensors on one two-wire cable
- Ex	13.5 V DC (nominal voltage of the segment coupler) max. 10 sensors on one two-wire cable (typically 8 sensors)
Current consumption	constantly 10 mA (no leakage current output)
Load	depending on segment coupler, see technical data of the segment couplers and Profibus specification

Measuring range

VEGAFLEX 54	rod 0.15 ... 4 m (with DK value > 4: 0.1 … 4 m) cable 0.15 … 20 m (with DK value < 4: 0.3 … 20 m)

Output signal

digital (Profibus)	Two-wire technology: The digital output signal (measuring signal) is modulated onto the power supply and further processed in the PLC or process control room .
Integration time	0 … 999 seconds (adjustable)

Adjustment

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

Accuracy [1)]
(under reference conditions acc. to IEC 770 - relating to the max. measuring range)

Linearity error	< 0.1 %
Temperature drift	0.015 %/10 K
Characteristics	linear
Deviation in characteristics incl. linearity, reproducibility and hysteresis (limit point method)	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	0.005 % or 1 mm

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

Characteristics

Min. span between full and empty adjustment	
- digital output signal	10 mm
Adjustment time [1]	> 1 s (depending on parameter setting)

Ambient conditions

Vessel pressure	-1 ... 40 bar
Ambient temperature on the housing	-40°C ... +60°C
Process temperature	-40°C ... +150°C
Storage and transport temperature	-40°C ... +80°C
Protection	IP 66/IP 67 (meets both protection classes)
Protection class	
- two-wire sensor	II
- four-wire sensor	I
Overvoltage category	III
Max. tensile load	cable ø 4 mm: 1 KN rod ø 8 mm: 1 KN
Min. dielectric constant	$\varepsilon_r > 1.7$

Process fittings

VEGAFLEX 54	G1 A, 1“ NPT, G $1^1/_2$ A, $1^1/_2$“ NPT of 1.4435 (stst; 316L) or Hastelloy C22 plated

Ex-technical data

Ex-Zone 0 acc. to ATEX II 1 G or II 1/2 G or II 2 G EEx ia II C T6, ATEX II 1/2 G or II 2 G EEx d ia II C T6 and ATEX II 1/2 G

The permissible operating data of VEGAFLEX sensors for Ex areas are stated in the certificate.

Materials

Housing	PBT (Valox) or Aluminium (powder coated)
Rod	1.4435 (stst; 316L) or Hastelloy
Cable	1.4401 (stst; 316L) gravity weight 1.4435

[2] The adjustment time (also actuating, response time or adjustment period) is the time required by the sensor to output the level correctly (with max. 10 % deviation) after a sudden level change.

Connection cables

Two-wire sensor
- power supply and signal via one two-wire cable.
  The line resistance depends on the supply voltage (see diagram).

Cross-section area of conductor	general 2.5 mm^2
Ground connection	max. 4 mm^2
Cable entry	2 x M20 x 1.5 (cable diameter 5 … 9 mm) 2 x $^1/_2$" NPT with ExD housing

CE conformity CE

VEGAFLEX sensors meet the protective regulations of EMC (89/336/EWG) and NSR (73/23/EWG). Conformity has been judged acc. to the following standards:

EMC	Emission	EN 50 081 - 1: 1992
	Susceptibility	EN 50 082 - 2: 1995
NSR		EN 61 010 - 1: 1993

Display

Indication	scalable analogue and digital measured value display (option).

An external measured value display powered by the sensor can be mounted up to 25 m away from the sensor.

Signal output

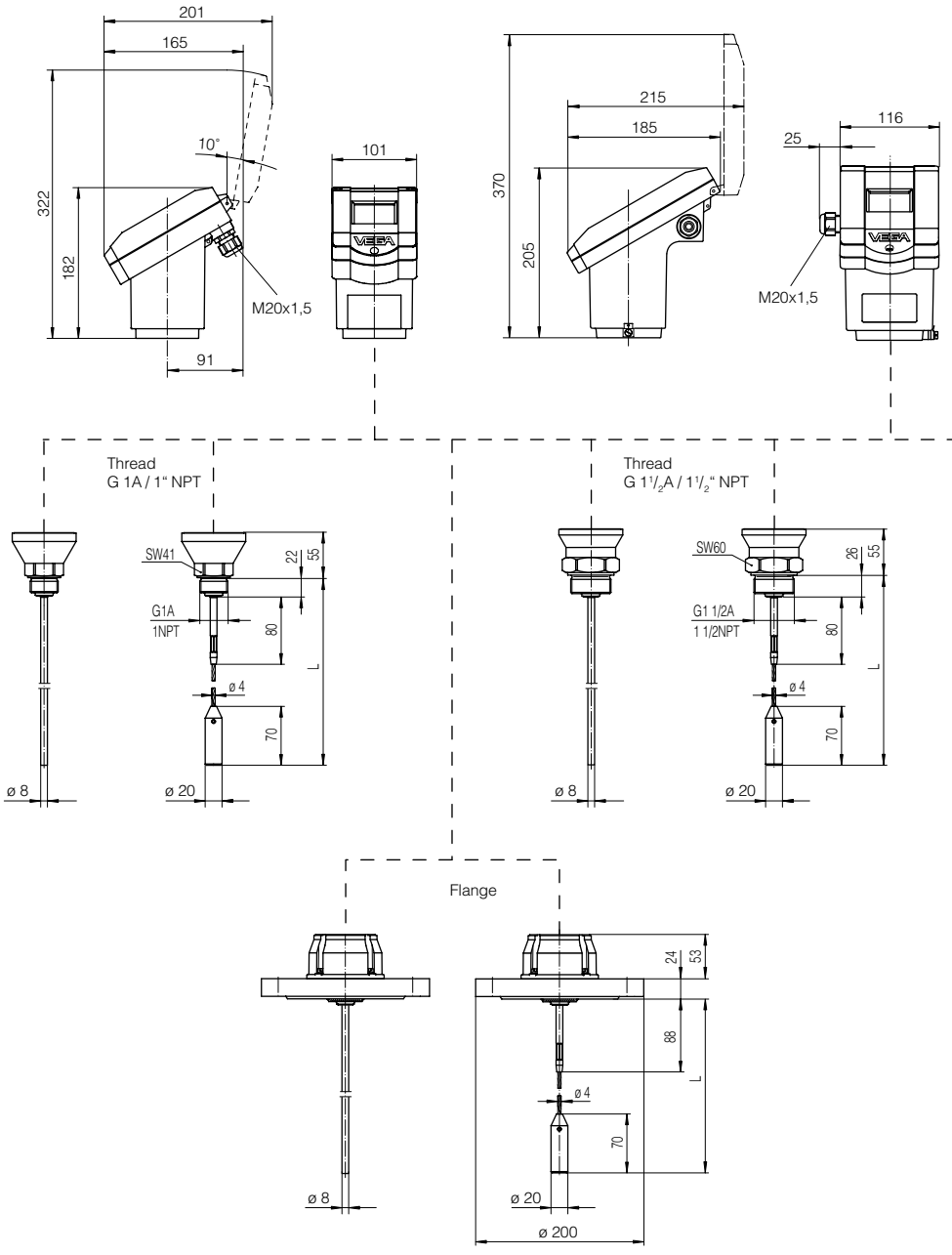
Signal output	digital output signal in two-wire technology (Profibus)

Two-wire technology:
The digital Profibus output signal (measuring signal) is modulated onto the power supply and is further processed in the signal conditioning instrument or in the processing system.

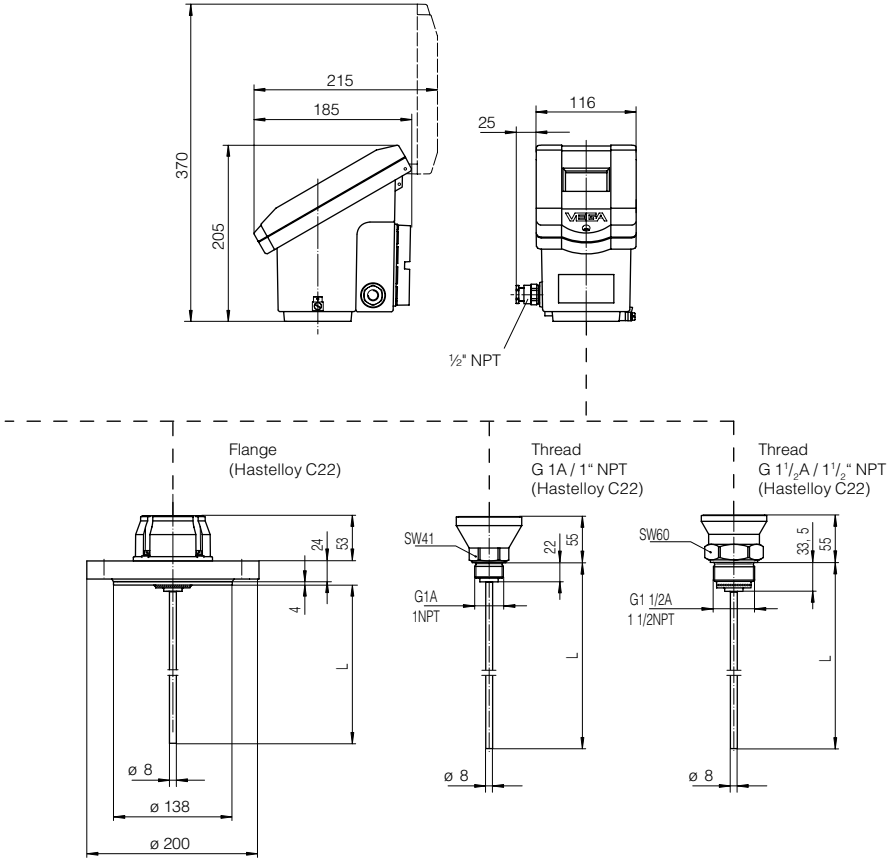
6.2 Dimensions

Plastic housing

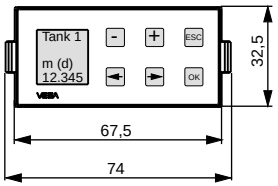
Aluminium housing



Aluminium housing with ExD terminal compartment



Adjustment module MINICOM



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

VEGA

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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 to subject to alterations