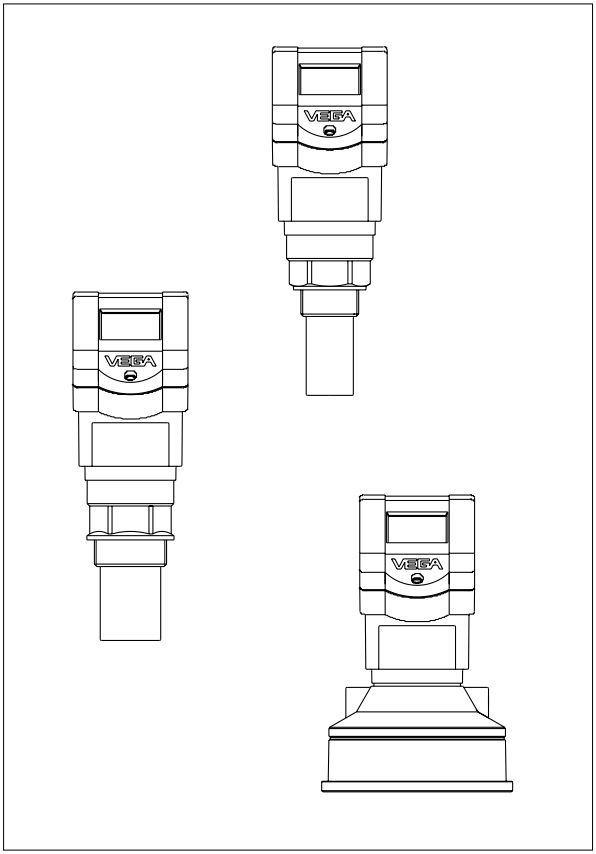
Level and Pressure

Operating Instructions

VEGASON 51K ... 53K



Contents

Safety information

The described module must only be installed and operated as described in these operating instructions. Please note that other action can cause damage for which VEGA does not take responsibility.

Ex-area

Please note the approval documents attached (yellow binder) and especially the included safety data sheet.

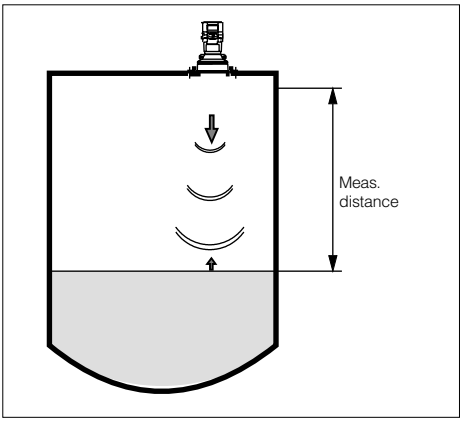
1 Product description

1.1 Function

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

Measuring principle

Piezoceramic high performance transducers emit focused ultrasonic pulses which are reflected by the surface of solids and liquids. The measuring electronics prepare a precise picture of the environment from the running time and the signal form of the reflected ultrasonic pulses. The transducers work as transmitter and receiver. As receiver the transducers are high sensitivity piezo-microphones.



emission - reflection - receipt

The measuring electronics precisely calculate the distance between transducer and medium from the speed of sound and the actually detected running time of the emitted sound impulse. The distance is then converted into a level proportional signal and provided according to the sensor parameter adjustment as precise scaled level.

In order to be prepared for the different measuring distances and requirements, the instruments operate with emitting frequencies of 34 kHz up to 70 kHz.

As the sound velocity is subjected to a temperature influence, the transducer also continuously detects the ambient temperature so that the level is precisely provided even in case of varying ambient temperature.

Output signals

The level proportional measuring signal is provided as 4 … 20 mA-output signal.

The parameter adjustment of the analogue 4 … 20 mA-signal is individually possible and reflects the measuring range or the adjusted adjustment range of the sensor.

Measured value indication

If desired, an indicating instrument for direct lobal survey can be mounted on to the series 50 ultrasonic sensors. The indicating instrument shows the precise level with the analogue bar-graph and with the digital figure. In addition to the indication in the sensor itself, you can have the level displayed with the external indicating instrument VEGADIS 50 up to 25 m away from the sensor.

The external measured value indication operates, like the integral indication, independent of the 4 … 20 mA-output signal, and individual parameter adjustment is possible.

1.2 Application features

Applications
- Level measurement of all liquids
- Level measurement of solids (only short measuring distances) such as e.g.: coal, ore, stones, stone dust, cement, gravel, crushed stones, sand, sugar, salt, cereals, flour, granules, powder, dusts, saw dust, wood chips
- Flow measurement on different flumes
- Gauge measurement, distance measurement, object monitoring and conveyor belt monitoring

Two-wire technology
- Supply and output signal on one two-wire line (Loop powered)
- 4 ... 20 mA-output signal

Rugged and precise
- Unaffected by product features such as density, conductivity, dielectric constant ...
- Suitable for aggressive substances
- Measuring ranges 0,25 m ... 15 m

Adjustment choice
- With adjustment software VEGA Visual Operating (VVO) on PC
- With detachable adjustment module MINICOM
- With the HART®-Handheld
- Measured value indication integrated in the sensor
- Optional indication separate from the sensor

Connection for each process
- G $1^1/_2$ A, $1^1/_2$" NPT
- G 2 A, 2" NPT
- Compression flange DN 100, ANSI 4"

Approvals
- CENELEC, ATEX, PTB, FM, CSA, ABS, LRS, GL, LR, FCC

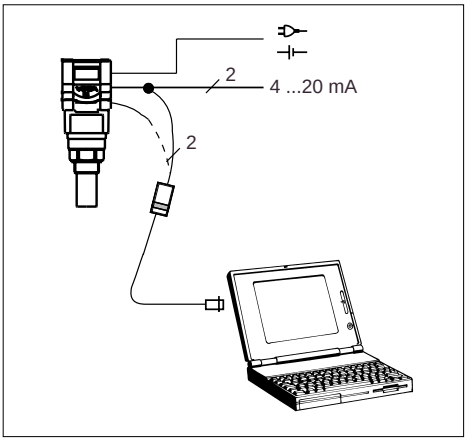
1.3 Adjustment

Each measuring distance is different, therefore each ultrasonic sensor must be given some basic information on the application and the environment, e.g. you need to inform the sensor which level means “empty“ and which level “full“. Apart from this “empty and full adjustment“, a number of other adjustments can also be carried out with VEGASON ultrasonic sensors.

The adjustment and parameter adjustment of the ultrasonic sensors are carried out with
- the PC
- the detachable adjustment module MINICOM
- the HART®-Handheld

Adjustment with PC

The set-up and adjustment of the ultrasonic sensors is generally made on the PC with the adjustment program **V**EGA **V**isual **O**perating (VVO) under Windows®.
The program leads quickly through the adjustment and parameter adjustment via pictures, graphics and process visualisations.

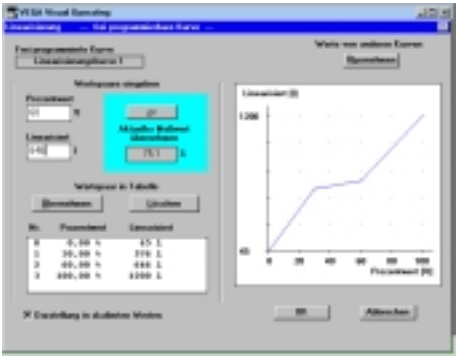


Adjustment with the PC on the analogue 4 ... 20 mA-signal and supply line or directly on the sensor (four-wire sensor)

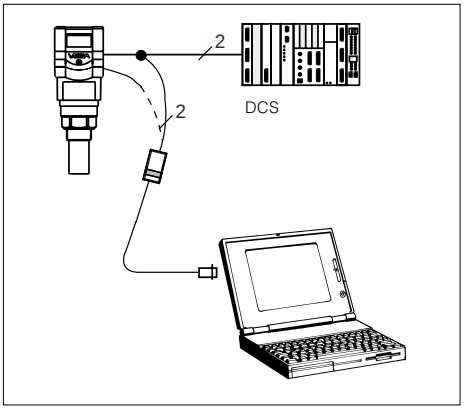
The PC can be connected to any individual position of the system or the signal line. It is thereby connected with the two-wire PC-interface converter VEGACONNECT 2 to the sensor or to the signal line.

The adjustment and parameter adjustment data can be saved with the adjustment software on the PC and protected with passwords. If required, the adjustment can be transmitted quickly to other sensors.

The adjustment program recognises the sensor type



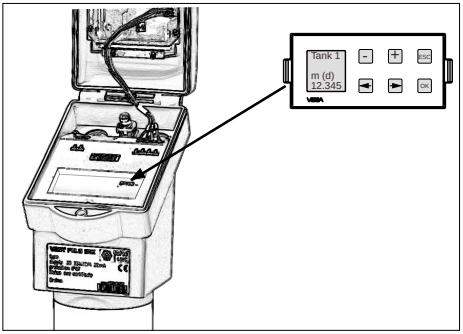
Visualised input of a vessel linearisation curve



Adjustment with the PC on the 4 … 20 mA signal and supply line to the DCS or directly on the sensor (in the figure a two-wire sensor)

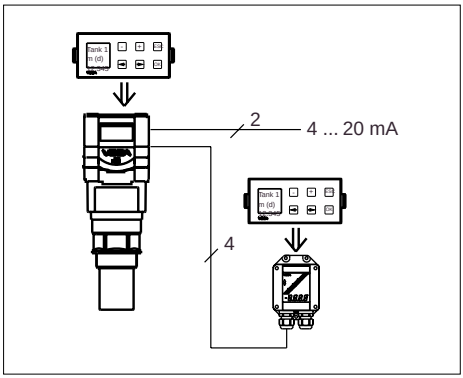
Adjustment with adjustment module MINICOM

With the (3,2 cm x 6,7 cm) 6-key adjustment module with display you can carry out the adjustment in clear text.
The adjustment module can be plugged into the ultrasonic sensor or into the optional external indicating instrument.



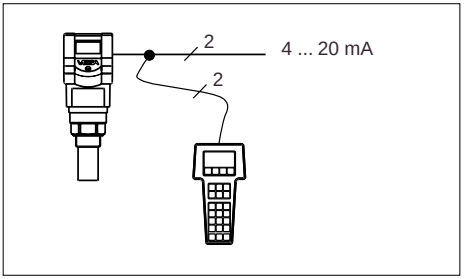
Detachable adjustment module MINICOM

By removing the adjustment module unauthorised adjustments are avoided.



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

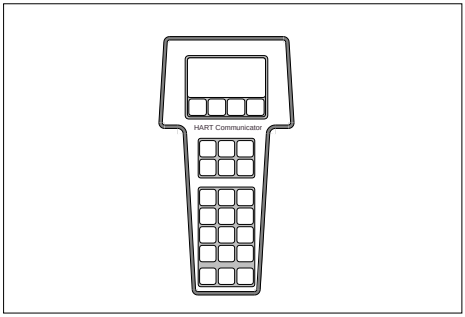
For adjustment, just connect the HART®-Handheld in any position of the 4 … 20 mA-output signal line or insert the two communication lines of the HART®-handheld into the adjustment sockets on the sensor.



HART®-handheld on the 4 … 20 mA-signal line

Adjustment with HART®-Handheld

Series 50 sensors with 4 … 20 mA output signal can also be adjusted with the HART®-Handheld. A special DDD (Data-Device-Description) is not necessary as the sensors can be adjusted with the HART®-standard menus of the handheld.



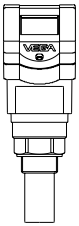
HART®-handheld

2 Types and versions

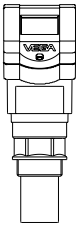
VEGASON series 50 sensors are a newly developed generation of very compact, small ultrasonic sensors. With very narrow space requirements, they are designed for short meas. distances (0 … 15 m) and for standard applications such as storage tanks, gauge measurement and buffer tanks.

Due to the small housing dimensions and process connections, the compact sensors monitor your levels very price favourably. With the integral indication and the many features of the “big brothers“ of VEGASON series 80, they offer the advantages of an ultrasonic level measurement for applications where the special advantages of a non-contact measurement are not applicable for price reasons.

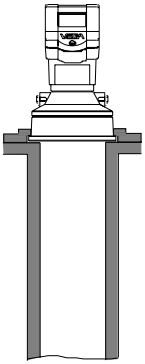
VEGASON 50 ultrasonic sensors control the two-wire technology perfectly. The supply voltage and the output signal are transmitted via a two-wire line. An analogue 4 ... 20 mA-output signal is available as output or measuring signal.



VEGASON 51
with 1 1/2“ thread



VEGASON 52
with 2“ thread



VEGASON 53
for mounting with holding strap or DN 100 compression flange (here on a standpipe)

2.1 Type survey

General features

- Application in solids and liquids
- Measuring range 0,25 … 15 m
- Ex-approved in Zone 1 (IEC) or Zone 1 (ATEX) classification EEx ia [ia] IIC T6
- Integral measured value indication

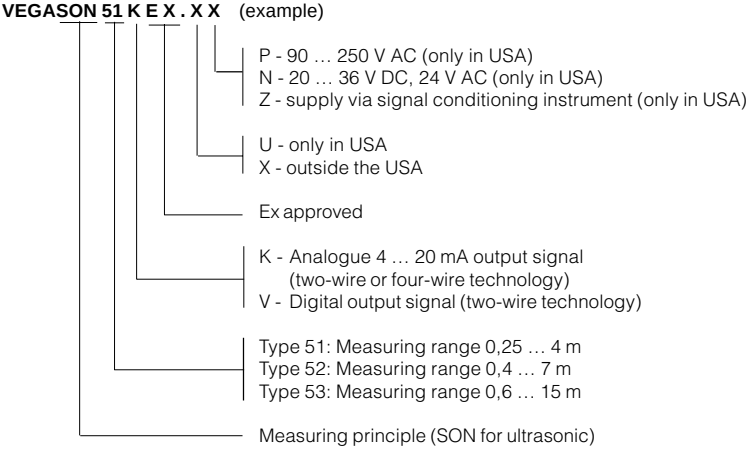
Survey	VEGASON … 51K	52K	53K
Signal output			
– active (4 … 20 mA)	•	•	•
– passive (4 … 20 mA)	•	•	–
Voltage supply			
– two-wire technology (voltage supply and signal output via a two-wire line)	•	•	–
– four-wire technology (voltage supply separated from the signal line)	•	•	•
Process connection			
– G1 1/2 A; 1 1/2" NPT	•	–	–
– G 2 A; 2" NPT	–	•	–
– DN 100 compression flange	–	–	•
Adjustment			
– PC	•	•	•
– adjustment module in the sensor	•	•	•
– adjustment module in external indicating instrument	•	•	•
– HART®-handheld	•	•	•
Measuring range in m			
– liquids	0,25 … 4	0,4 … 7	0,6 … 15
– solids	0,3 … 2	0,25…3,5	0,75 … 7

Type code

The second letter of the type designation e.g. VEGASON 5[1]… differentiates the instruments acc. to process connection and measuring range.

The letter e.g. VEGASON 51[K] characterises the output signal:
K stands for an analogue 4 … 20 mA output signal (compact instrument).

VEGASON 51 K E X . X X (example)



2.2 Configuration of meas. systems

A meas. system consists of a sensor with a 4 … 20 mA signal output and a unit evaluating or processing the level proportional current signal.

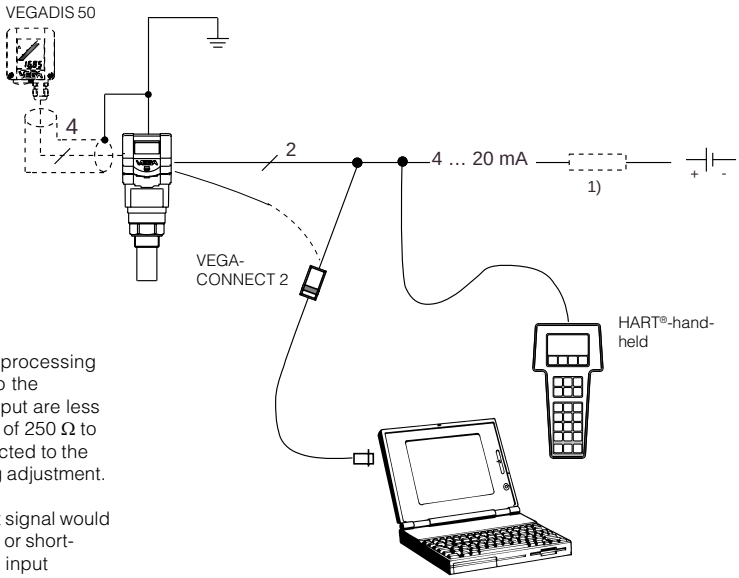
On the following pages you will see the instrument configurations called meas. system which are shown in the following partly with a signal processing.

Meas. systems in two-wire technology:
- 4 … 20 mA drawing without processing unit, (bottom)
- 4 … 20 mA on active DCS, (page 12)
- 4 … 20 mA on active DCS (Ex-area), (page 13)
- 4 … 20 mA on passive DCS, (page 14)
- 4 … 20 mA on indicating instrument VEGADIS 371 Ex, (page 15)

Meas. systems in four-wire technology:
- 4 … 20 mA drawing without signal conditioning instrument, (page 16)

Meas. systems with VEGASON 51K … 53K

- Two-wire technology (loop powered), supply and output signal via a two-wire line
- Output signal 4 … 20 mA (passive)
- Optional external indicating instrument with analogue and digital indication (can be mounted up to 25 m away from the sensor)
- Adjustment with PC, HART®-handheld or adjustment module MINICOM (can be plugged into the sensor or in the external indicating instrument VEGADIS 50)

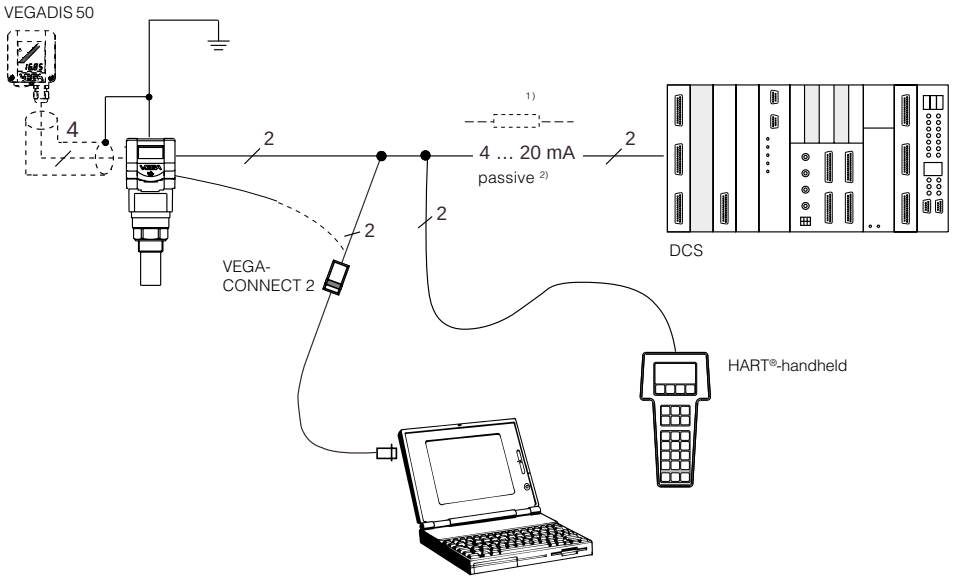


[1] If the resistors of the processing systems connected to the 4 … 20 mA-signal output are less than 200 Ω, a resistor of 250 Ω to 350 Ω must be connected to the connection line during adjustment.

The digital adjustment signal would be extremely damped or short-circuited via too small input resistors of the connected processing system which means that the digital communication with the PC could no longer be ensured.

Measuring system with VEGASON 51K … 53K on active DCS

- Two-wire technology, supply on active DCS.
- Output signal 4 … 20 mA (passive).
- Measured value indication integrated in the sensor.
- Optional external indicating instrument (can be mounted up to 25 m away from the sensor in Ex-area).
- Adjustment with PC, HART®-handheld or adjustment module (can be plugged in the sensor or in the external indicating instrument).

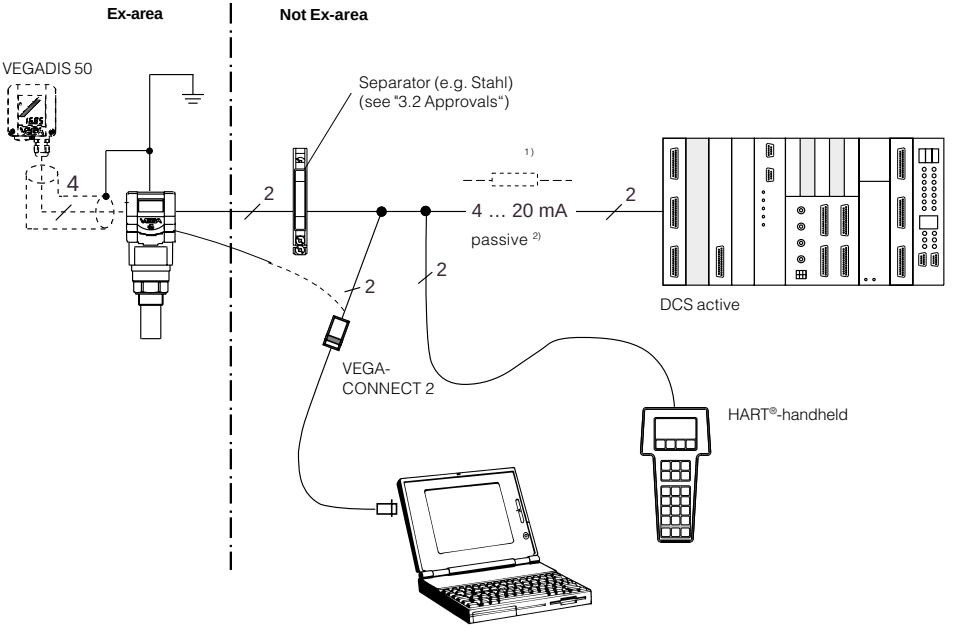


1) If the resistors of the processing systems connected to the 4 … 20 mA-signal output are less than 200 Ω, a resistor of 250 Ω to 350 Ω must be connected to the connection line during adjustment.
The digital adjustment signal would be extremely damped or short-circuited via too small input resistors of the connected processing system which means that the digital communication with the PC could no longer be ensured.

2) 4 … 20 mA passive means that the sensor takes, depending on the level a current of 4 … 20 mA. The sensor therefore reacts electrically like a resistor (consumer) on the DCS.

Measuring system with VEGASON 51K ... 53K via separator in Ex-area on active DCS

- Two-wire technology (loop powered), supply via the signal line on the DCS; output signal 4 … 20 mA (passive)
- Separator converts the not-intrinsically safe DCS-circuit into an intrinsically safe circuit, the sensor can therefore also be used in Ex-zone 1
- Optional external indicating instrument with analogue and digital indication (can be mounted up to 25 m away from the sensor)
- Adjustment with PC, HART®-handheld or adjustment module MINICOM (can be plugged in the sensor or in the external indicating instrument VEGADIS 50)

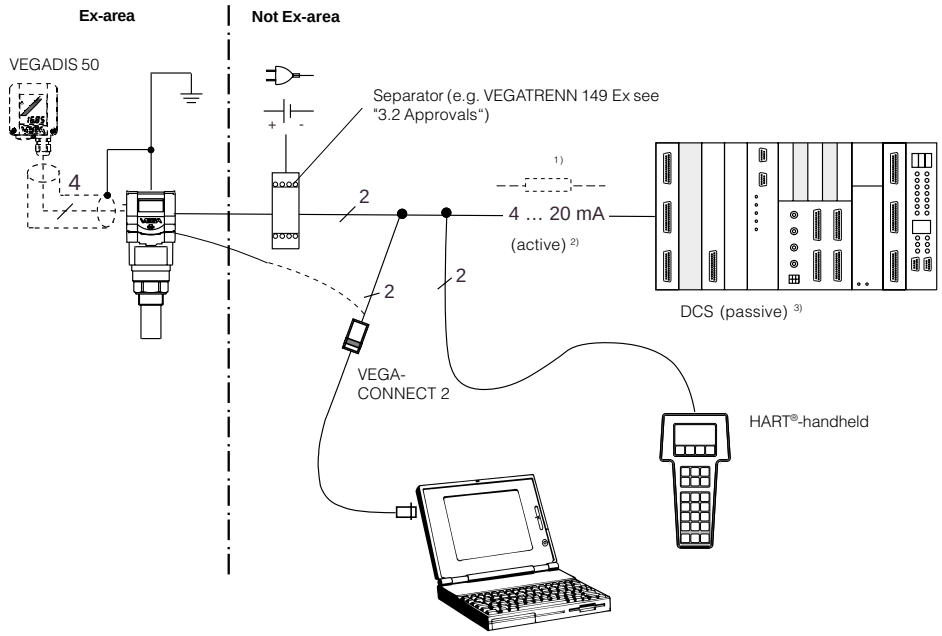


1) If the resistors of the processing systems connected to the 4 … 20 mA-signal output are less than 200 Ω, a resistor of 250 Ω to 350 Ω must be connected to the connection line during adjustment.
The digital adjustment signal would be extremely damped or short-circuited via too small input resistors of the connected processing system which means that the digital communication with the PC could no longer be ensured.

2) 4 … 20 mA passive means that the sensor takes a current of 4 … 20 mA depending on the level. The sensor, therefore, reacts electrically like a resistor (consumer) on the DCS. The DCS operates actively, i.e. as current or voltage supply.

Measuring system with VEGASON 51K … 53K vi a separator (Smart-Transmitter) on passive DCS

- Two-wire technology (loop powered), intrinsically ia-supply via the signal line from the separator for operation of the sensor in Ex-Zone 1
- Output signal sensor 4 … 20 mA passive
  Output signal separator 4 … 20 mA active
- Optional external indicating instrument with analogue and digital indication (can be mounted up to 25 m away from the sensor)
- Adjustment with PC, HART®-handheld or adjustment module MINICOM (can be plugged in the sensor or in the external indicating instrument VEGADIS 50)



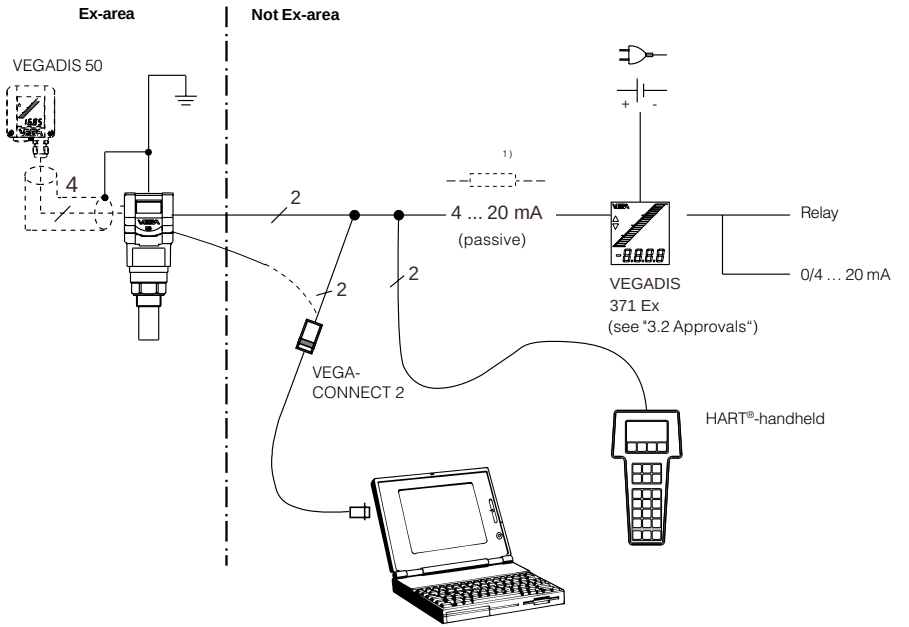
1) If the resistors of the processing systems connected to the 4 … 20 mA-signal output are less than 200 Ω, a resistor of 250 Ω to 350 Ω must be connected to the connection line during adjustment.
The digital adjustment signal would be extremely damped or short-circuited via too small input resistors of the connected processing system which means that the digital communication with the PC could no longer be ensured.

2) 4 … 20 mA active means that the separator delivers level dependent a current of 4 … 20 mA. The separator therefore reacts electrically against the DCS like a current source.

3) 4 … 20 mA passive means that the sensor takes, a current of 4 … 20 mA, depending on the level. The sensor therefore reacts electrically like a resistor (consumer) on the DCS.

Measuring system with VEGASON 51K … 53K on the indicating instrument VEGADIS 371 Ex with current and relay output

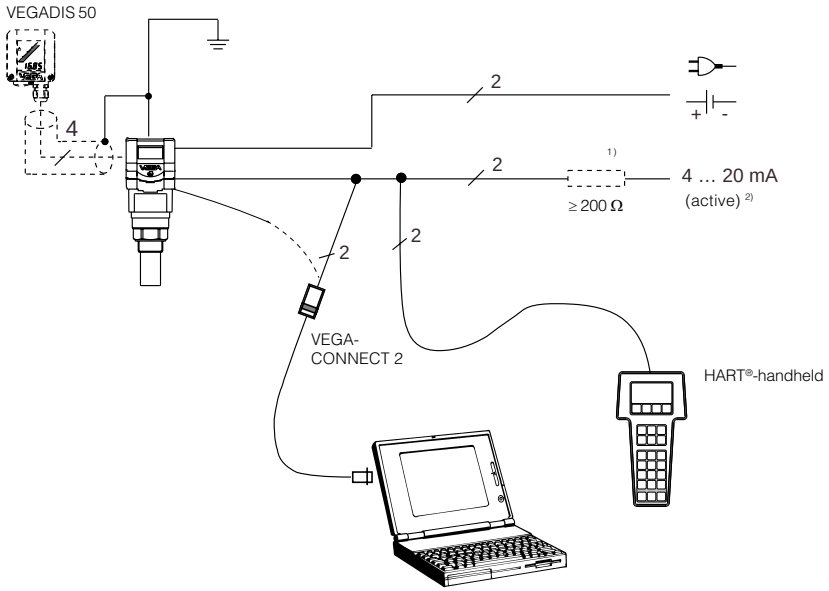
- Two-wire technology (loop powered), intrinsically safe ia-supply via the signal line from the indicating instrument VEGADIS 371 Ex for operation of the sensor in Ex-zone 1
- Optional external indicating instrument with analogue and digital indication (can be mounted up to 25 m away from the sensor)
- Adjustment with PC, HART®-handheld or adjustment module MINICOM (can be plugged in the sensor or in the external indicating instrument VEGADIS 50)



1) If the resistors of the processing systems connected to the 4 … 20 mA-signal output are less than 200 Ω, a resistor of 250 Ω to 350 Ω must be connected to the connection line during adjustment.
The digital adjustment signal would be extremely damped or short-circuited via too small input resistors of the connected processing system which means that the digital communication with the PC could no longer be ensured.

Measuring system with VEGASON 51K … 53K in four-wire technology

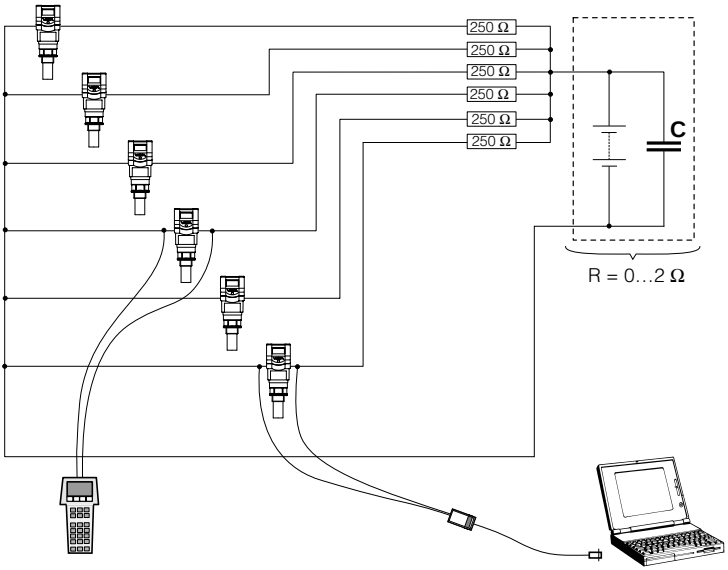
- Four-wire technology, supply and output signal via two separate two-wire lines
- Output signal 4 … 20 mA active
- Optional external indicating instrument with analogue and digital indication (can be mounted up to 25 m away from the sensor)
- Adjustment with PC, HART®-handheld or adjustment module MINICOM (can be plugged in the sensor or in the external indicating instrument VEGADIS 50)
- Max. resistance on the signal output (load) 500 Ω



1) If the resistors of the processing systems connected to the 4 … 20 mA-signal output are less than 200 Ω, a resistor of 250 Ω to 350 Ω must be connected to the connection line during adjustment.
The digital adjustment signal would be extremely damped or short-circuited via too small input resistors of the connected processing system which means that the digital communication with the PC could no longer be ensured.

2) 4 … 20 mA active means that the sensor delivers a current of 4 … 20 mA (source) depending on the level. The sensor, therefore, reacts electrically against a processing system (e.g. indication) like a current source.

Several sensors on a voltage source



All sensors are dispatched with the same communication address zero. If several sensors are operated on one voltage source, a communication on the signal line with the PC or with the HART®-handheld is no longer possible, as in this case all sensors are addressed digitally at the same time.

To avoid this, 250 Ω ... 350 Ω resistors must be connected directly on the voltage source in the sensor supply line. The inner resistance of the voltage source must be very small. The digital communication signal (PC or HART®-handheld) used on the sensor line, is then no longer transmitted to the other sensors. You can then communicate with the PC or HART®-handheld on the signal line of the appropriate sensor without the participation of all other sensors in the communication even though all sensors react to the address zero. The low inner resistor (alternating load resistor by filter capacitor) of the voltage source short-circuits the signals before they can cross over to the other sensor lines. The resistors avoid the adjustment signals of the actually operated sensor from also being short-circuited.

With the PC and the adjustment software VEGA Visual Operating (VVO) or with the HART®-handheld, the sensors can be adjusted from the address zero to the address 1 ... 15. If a sensor is adjusted to the address 1 ... 15, the sensor no longer delivers a 4 ... 20 mA-signal, but is frozen to 4 mA (power supply). Nevertheless, the sensor will continue to provide the measured value digitally. This mode is called multidrop operation.

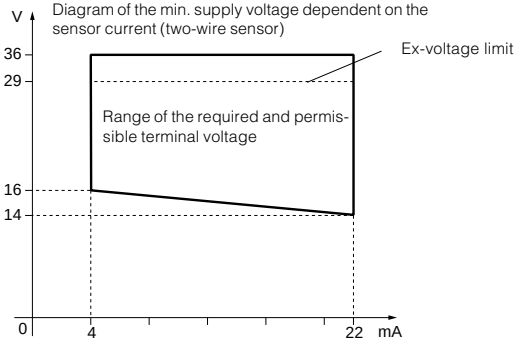
3 Technical data

3.1 Data

Power supply

Supply voltage

- two-wire sensor	24 V DC (16 … 36 V DC)
- four-wire sensor	230 V AC (20 … 250 V AC), 50/60 Hz 24 V DC (20 … 72 V DC) fuse 0,2 A TR



Current consumption

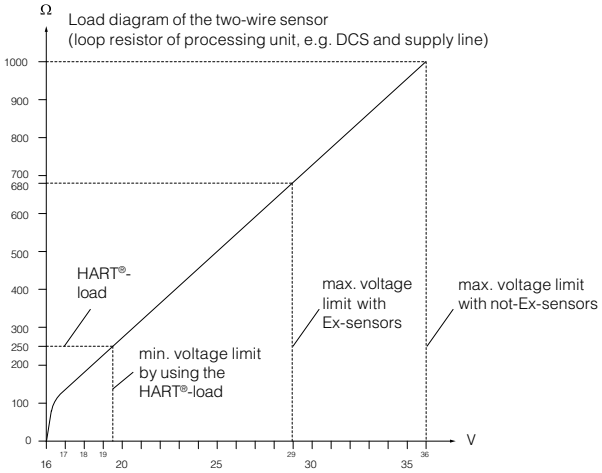
- two-wire sensor	max. 22,5 mA
- four-wire sensor	max. 140 mA

Power consumption

- two-wire sensor	max. 80 mW, 0,45 VA
- four-wire sensor	max. 1,2 W, 2,50 VA

Load

- two-wire sensor	see diagram
- four-wire sensor	max. 500 Ω



Type	51...	52...	53...
Measuring range (relating to the transducer surface)			
Liquid	0,25 ... 4 m	0,4 ... 7 m	0,6 ... 15 m
Solid	0,30 ... 2 m	0,5 ... 3,5 m	0,75 ... 7 m

Output signal

Analogue 4 ... 20 mA-current signal

Adjustment

- PC with adjustment software VEGA Visual Operating
- adjustment module MINICOM
- HART®-handheld

Accuracy (typical values under reference conditions) [1)]

Class accuracy (deviation in characteristics including repeatability and hysteresis acc. to the limit point method)	< 0,1 % relating to max. measuring range		
Temperature drift (relating to 20°C)	< 0,015 %/10 K of measuring range		
Accuracy of the 4 ... 20 mA-output signal	0,025 % (D/A-converter)		
Resolution	1 mm		

Characteristics

Min. span (between empty and full adjustment)	> 20 mm (recommended > 50 mm)		
Ultrasonic frequency	70 kHz	55 kHz	34 kHz
Intervals	1,0 s	1,0 s	1,0 s
Beam angle (at -3 dB emitted power)	5,5°	5,5°	3°
Response time [2)]	2 ... 20 s (dependent on the factory setting)		

Materials

Housing	PBT (Valox)
Transducer, process connection thread	PVDF
Compression flange	PP or 1.4571
Transducer diaphragm (type 53)	1.4571

Weights

Weight incl. transducer	
- VEGASON 51	1,2 kg
- VEGASON 52	1,6 kg
- VEGASON 53	2,3 kg

[1)] Reference conditions acc. to IEC 770, e.g.: Temperature 18°C ... 30°C etc.

[2)] The response time is the time the sensor requires to provide the level correctly with a quick level change (with max. 10 % deviation).

Ambient conditions

Max. vessel pressure (gauge pressure)	
- VEGASON 51 and 52	3 bar
- VEGASON 53	1 bar
Ambient temperature	
- sensor (electronics)	-20°C ... +60°C
- process (transducer)	-40°C ... +80°C (StEx: -20°C ... +75°C)
- storage and transport temperature	-40°C ... +80°C
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	
- to sensor	45°C
- to transducer, process	55°C

Ex-technical data

Classification	ia intrinsically safe (in conjunction with a safety barrier or separator)
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	
- ATEX	Zone 1 (II 2 G)
- IEC, CENELEC, PTB	Zone 1 (II 2 G)
Classification mark	EEx ia IIC T6

Process connections

VEGASON 51	G $1^1/_2$ A, $1^1/_2$" NPT
VEGASON 52	G 2 A, 2" NPT
VEGASON 53	DN 100 compression flange

Connection lines

Two-wire sensors	supply and voltage via one two-wire line, load dependent on the supply voltage
Four-wire sensor	supply and signal separately, load of the 4 ... 20 mA-signal line max. 500 Ω
Cross-section area of conductor	generally 2,5 mm^2
Earth connection	max. 4 mm^2
Cable entry, Pg	2 x M20 x 1,5 (cable diameter 5 ... 9 mm)

CE-conformity CE

VEGASON series 50 ultrasonic sensors meet the protective regulations of EMVG (89/336/EWG) and NSR (73/23/EWG). The conformity has been judged acc. to the following standards:

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

Outputs and processings

Display indication

Indication	- optional integrated in the sensor, scalable analogue and digital meas. value indication - optional external meas. value indication, powered by the sensor and up to 25 m away from the sensor (also the adjustment module MINICOM can be inserted)

Signal output

Signal output	
- two-wire technology	4 … 20 mA (load dependent on supply voltage, see load diagram page 17)
- four-wire technology	4 … 20 mA (load max. 500 Ω)
Resolution of the 20 mA-signal	0,025 % of operating range
Failure of the 20 mA-signal	< 0,025 % of operating range

Two-wire technology:
The analogue 4 … 20 mA-output signal (measuring signal) is transmitted together with the power supply via a two-wire line.

Four-wire technology:
Separate power supply.
The analogue 4 … 20 mA-output signal (measuring signal) is looped by a line separated from the supply voltage.

3.2 Approvals

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

VEGASON 50 ultrasonic sensors are approved for Ex-zone 1. Please note the attached approval documents when using a sensor in Ex-area.

Test and approval authorities

VEGASON ultrasonic sensors are tested and approved by the following monitoring, test and approval authorities:

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

Ex-area zone 1

Series 50 senors require special safety barriers and separators for operation in Ex-area zone 1. The safety barriers and separators provide intrinsically safe (ia) circuits. The followes shows a choice of instruments with which the series 50 sensors work reliably. The signal line resistance must not exceed 15 Ω per wire.

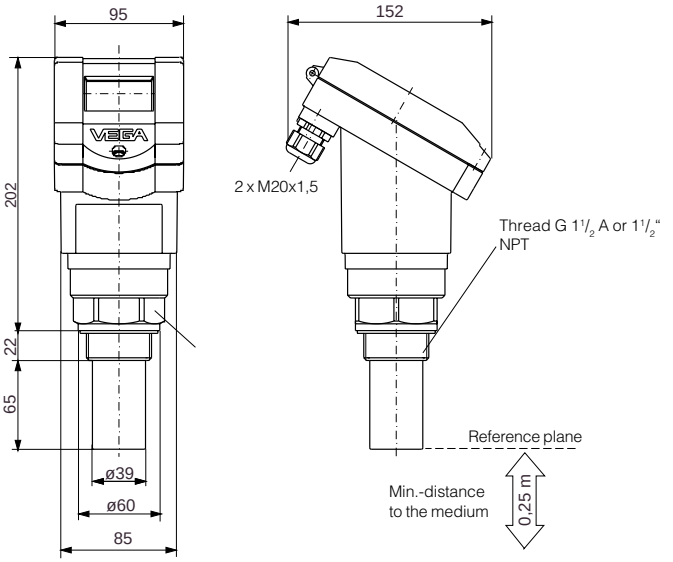
Separators and signal conditioning instrument:
- VEGADIS 371 Ex
- A puissance 3 PROFSI 37-24070A
- VEGAMET 614 Ex
- Apparatebau Hundsbach
  AH MS 271-B41EEC 010

Separators:
- VEGATRENN 149 Ex…
- Stahl 9303/15/22/11
- CEAG GHG 124 3111 C1206

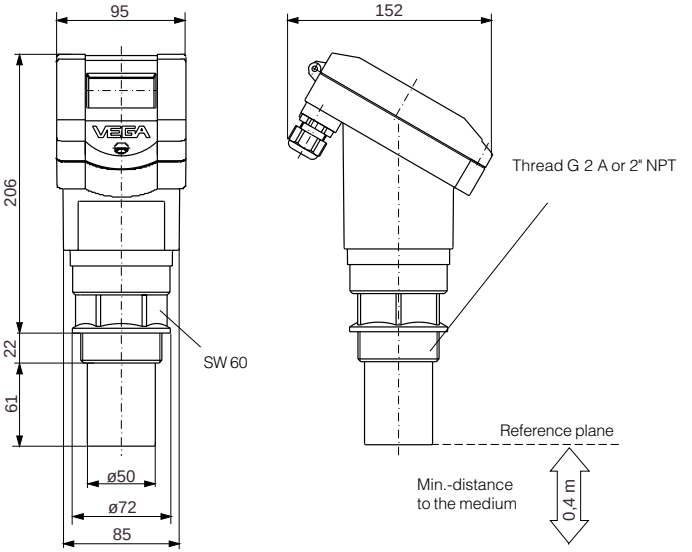
Separators, safety barriers:
- Stahl 9001/01/280/110/10
- CEAG GHG 11 1 9140 V0728
- Type 9130 (VEGA)
- Stahl 9001/51/280/110/14
- MTL 787 S+
- CEAG CS 3/420-106

3.3 Dimensions

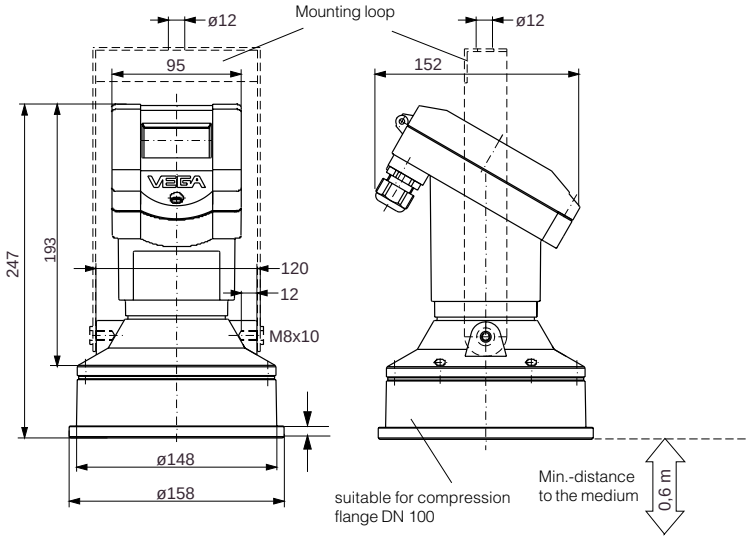
VEGASON 51



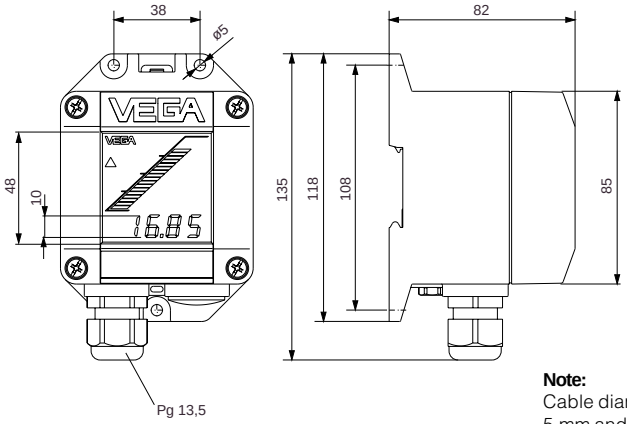
VEGASON 52



VEGASON 53



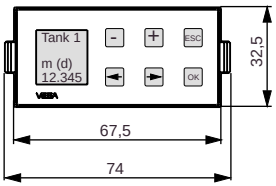
External indicating instrument VEGADIS 50



Carrier rail mounting 35 x 7,5 acc. to EN 50 022 or flat screwed

Note:
Cable diameter of the connection cable min. 5 mm and max. 9 mm.
Otherwise the seal effect of the cable entry is not ensured.

Adjustment module MINICOM



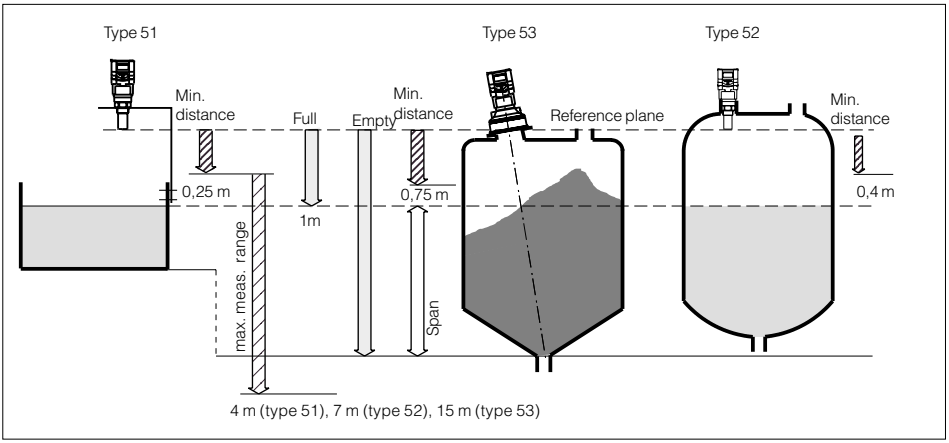
Adjustment module for insertion into VEGASON series 50 sensors or into the external indicating instrument VEGADIS 50

4 Mounting and installation

4.1 General installation instructions

Measuring range

You select your instrument according to the required measuring range, as well as other criteria. The reference planes for the min. and max. distance to the product or the solid is either the transducer surface (diaphragm) or, on instruments with flange version, the instrument flange. (Note the information for the reference planes in chapter "Dimensions"). The max. filling is dependent on the required min. distance of the instrument used (0,25 m to 1,4 m) and the installation place of the instrument or the transducer.



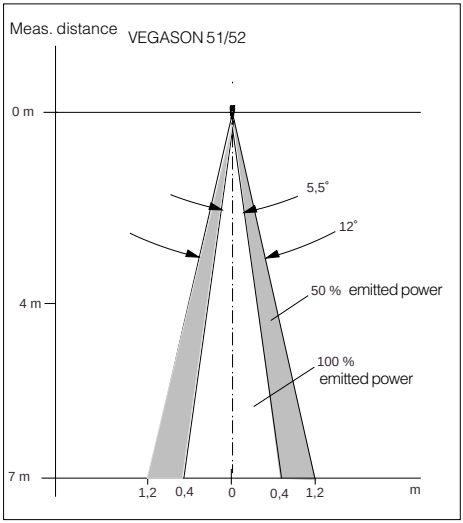
Min. distance, max. measuring range and span (example VEGASON 51, 52 and 53)

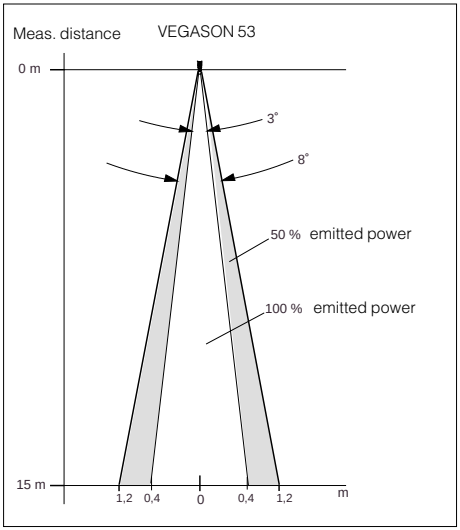
Beam angle and false echoes

The ultrasonic impulses are focussed by the transducer. The impulses leave the transducer in conical form similar to the beam pattern of a spotlight. The beam angle is 5,5° (VEGASON 51/52) or 3° (VEGASON 53) at -3 dB emitted power.

Any object in this beam angle causes a false echo. Within the first few metres of the beam angle, tubes, struts or other installations cause strong false echoes. At a distance of 6 m the false echo of a strut has 9-times more amplitude than at a distance of 18 m.

If possible, provide a vertical directing of the sensor axis to the product surface and avoid, if possible, struts within the 100 %-beam, e.g. by tubes and struts.

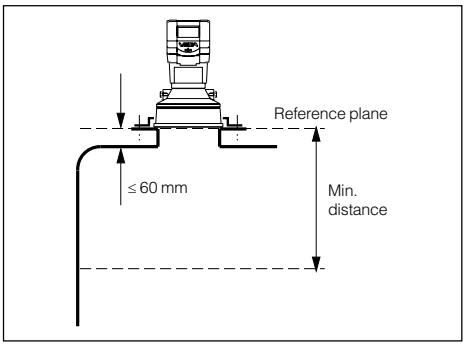




4.2 Measurement of liquids

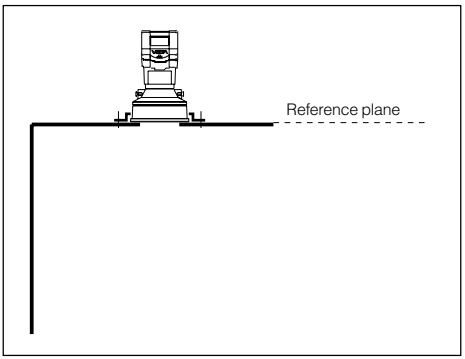
Flat vessel top

On flat vessels the mounting is mainly made on a very short DIN-socket piece. Reference plane on flange versions is the instrument flange. The transducer should protrude out of the flange pipe.



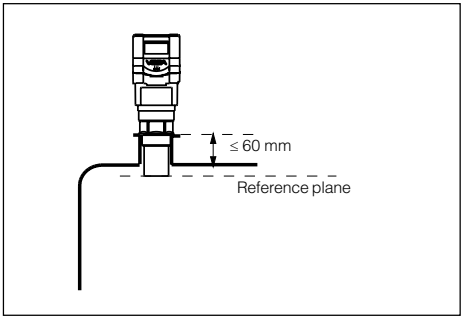
Flange version on very short DIN-socket piece

Ideal is the mounting directly on the vessel top. A round opening on the vessel is sufficient to fasten the VEGASON 53 sensor with a compression flange.

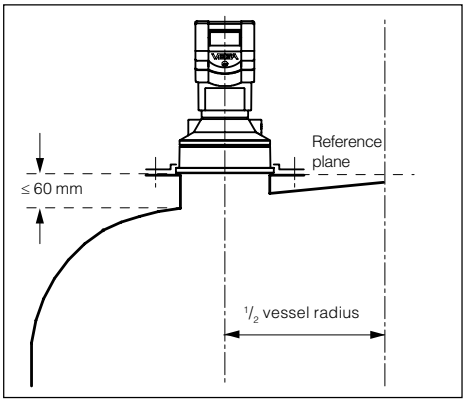


Flange version (compression flange) on flat vessel top

You can also mount the sensors with 1 1/2" or 2" thread to short socket pieces.



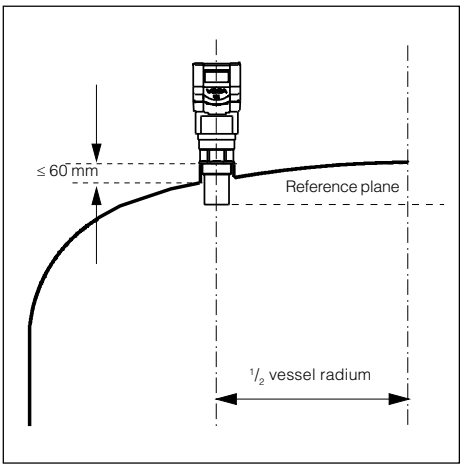
Mounting on short 1 1/2" or 2" socket piece



Flange on dished vessel ends

Dished tank ends

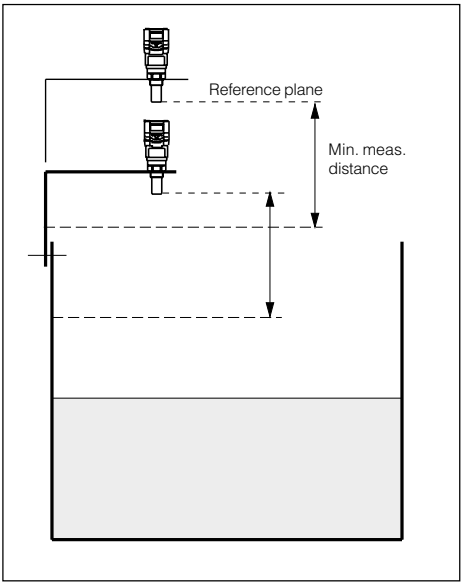
On dished tank ends, please do not mount the instrument in the centre but approx. 1/2 vessel radius from the centre. Dished tank ends can act as paraboloidal reflectors for the ultrasonic pulses. If the transducer is placed in the "focus" of the parabolic tank end, the transducer receives amplified false echoes. The transducer should be mounted outside the "focus". Parabolic amplified echoes are thereby avoided.



Mounting boss on dished tank ends

Open vessles

On open vessels the use of the instruments on a mounting lever is recommended. Mount the low-weight sensor to a mounting lever.

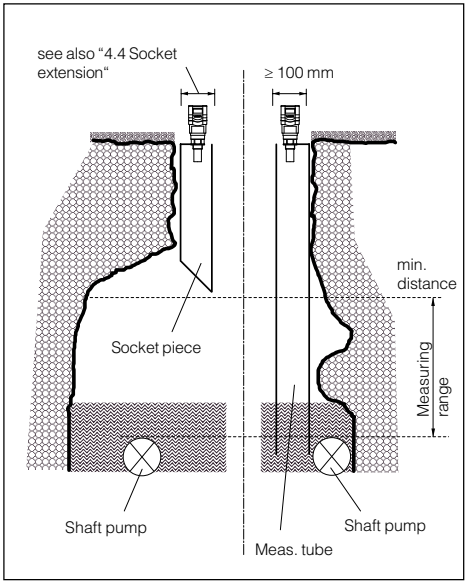


Open vessels

Pump shaft

Narrow shafts and shaft openings (vessel openings) with very rough walls and shoulders aggravate an ultrasonic measurement due to strong false echoes.

Shaft and vessel openings
Narrow, very rough shaft, well and vessel openings can be overcome by a socket piece as described under "4.4 Socket extensions“ (left lower half of the figure).



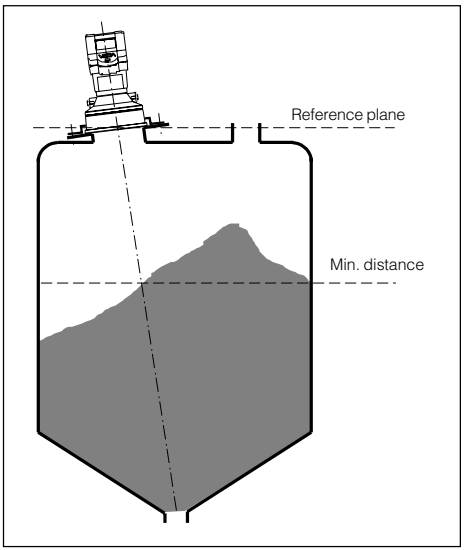
Socket piece or meas. tube on the example of a shaft

Shaft
You can realise very good meas. results with a meas. pipe in continous narrow shafts, see figure. The meas. pipe used must have smooth walls inside (e.g. PE-sewage pipe) and a diameter of ≥100 mm. This coordination works without problems as long as the inside of the meas. pipe has no build-up (cleaning). Also check the use of hydrostatic pressure transmitters or capacitive electrodes.

4.3 Measurement of solids

Flange mounting

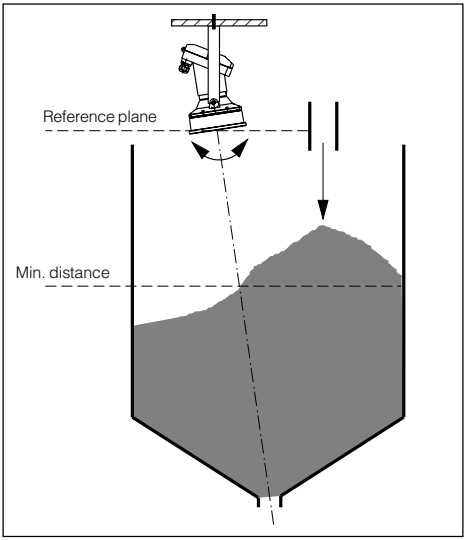
As with liquids, the instrument can also be mounted on a short DIN-socket piece in solid vessels. The socket axis must point to the vessel outlet or should be directed vertically to the product surface and must be very short (< 100 mm).



VEGASON 53 on vessel flange

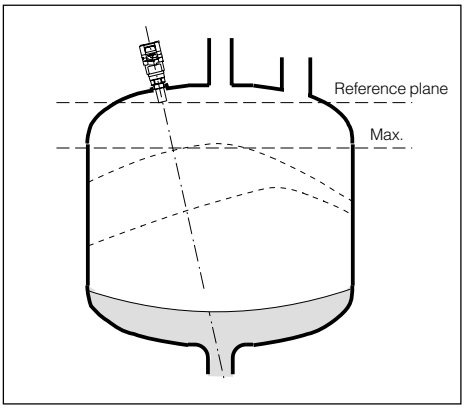
Swivelling holder

The accessory programme offers a swivelling holder (mounting loop) for mounting of the VEGASON 53. This facilitates the directing of the sensor to the product surface.

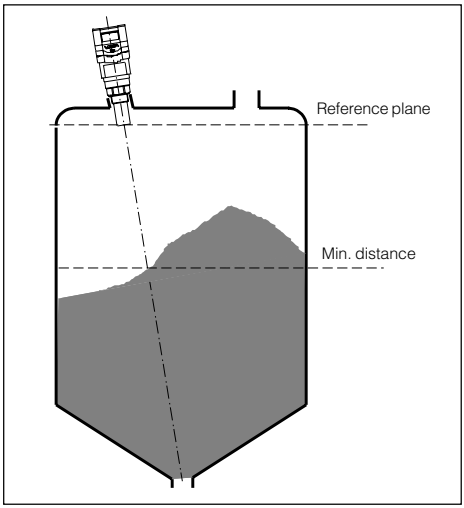


VEGASON 53 on swivelling holder

Mounting boss



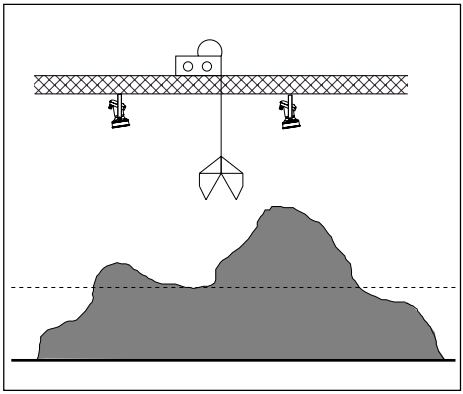
VEGASON 52 on mounting boss



VEGASON 51 or 52 on the mounting boss. The socket axis should point to the product surface

Material cones

Large material cones are detected with several instruments which can be fastened on lifting beams.

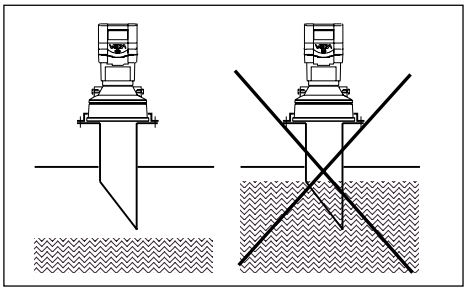


Transducer on lifting beam above material cone

4.4 Socket extensions

The ultrasonic sensor requires a min. distance to the product or solid. Note this min. distance in your planning.
In exceptions it is possible to reach the required min. distance and hence the desired filling height with a socket piece. However, the socket piece increases the noise level of the ultrasonic signal and can interfere with the measurement. Only provide the socket extension when there is no other possibility, and carry out the extension as shown in the following figure.

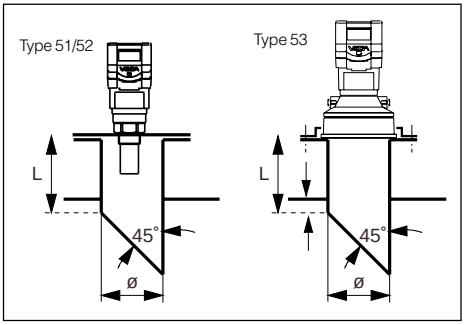
Socket extension with liquids
Chamfer the socket carefully and ensure a smooth inner side of the socket. The socket should not protrude into the measured product when pollution or measured product could stick to the socket.



Socket piece should not be submerged into the adhesive product (figure: VEGASON 53)

Choose as large a socket diameter as possible and as small a socket length as possible. Ensure that the socket opening is burr free to minimise false echoes.

For measurements in products which do not cause any build-up, the socket extension, in form of a meas. pipe, can be permanently submerged into the measured product. The ultrasonic mesurement is then only carried out in the meas. pipe without being interfered with by vessel installations (see page 28 "Pump shaft").

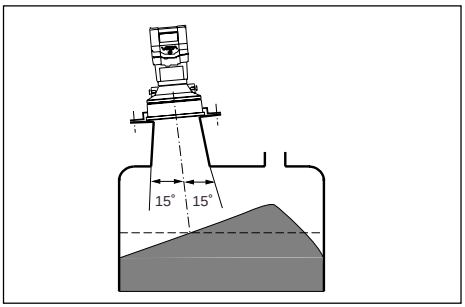


Socket extension with liquids

Max. socket length dependent on the socket diameter

ø	L in mm		
in mm	Type 51	Type 52	Type 53
100	200	300	300
150	300	400	400
200	–	500	500
250	–	–	600

Socket extension with solids
For solids provide a conical socket extension with an angle of at least 15° … 20°.



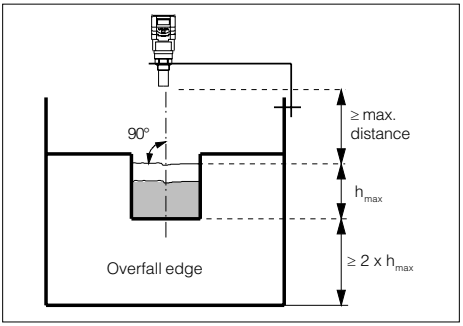
Socket extension with solids

4.5 Flow measurement

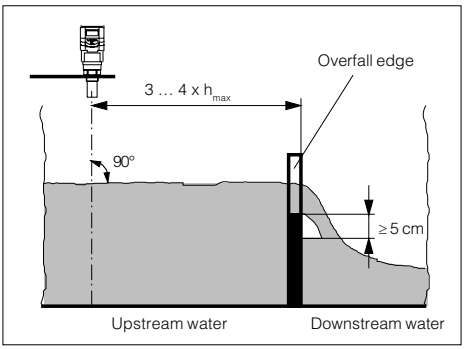
The short examples on this page only give introductory information for your flow measurement. Planning information is given by the flume manufacturers and in special literature.

Rectangular flume

- Installation of the sensor on the upstream side
- Note distance to the overfall edge (3 … 4 x h_{max})
- Installation centered to the flume
- Edge opening ≥ 2 x h_{max} from ground
- Installation perpendicular to the liquid surface
- Keep min. distance relating to h_{max}
- Min. distance of the edge opening of downstream water ≥ 50 mm



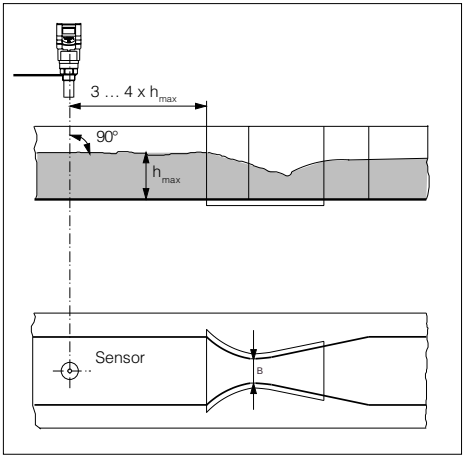
Flow measurement on open flumes



Flow measurement on open flumes

Khafagi-Venturi flume

- Installation of the sensor on the inlet side
- Note distance to the Khafagi-Venturi flume (3 … 4 x h_{max})
- Installation perpendicular to the liquid surface
- Keep min. distance relating to the height of damming h_{max}



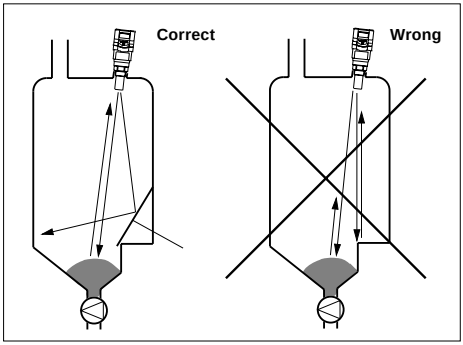
Khafagi-Venturi flume

4.6 False echoes

The placing of the ultrasonic senor must be chosen so as to ensure that no mountings or in-flowing filling material crosses with the ultrasonic impulses. The following examples and instructions show the most frequent measuring problems and how to avoid them.

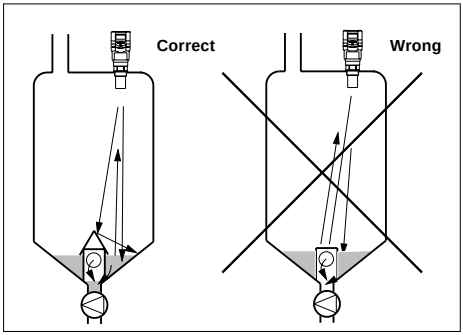
Vessel protrusions

Vessel forms with flat protrusions can, due to their strong false echoes, greatly effect the measurement. The placing of shields over these flat protrusions scatter the false echoes and guarantee a definite measurement.



Vessel protrusions (slope)

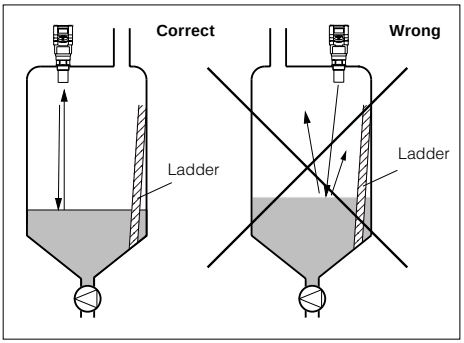
Intake pipes, i.e. for the mixing of materials - with the flat top turned towards the sensor - should be covered with an angular shield with which the false echoes are then scattered.



Vessel protrusions (intake pipe)

Vessel mountings

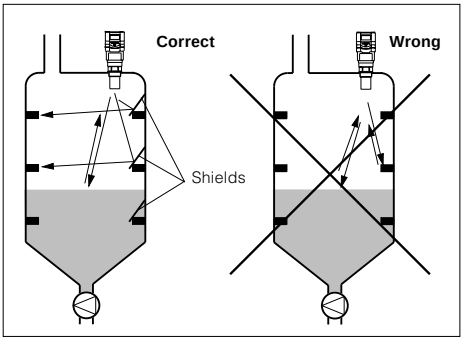
Vessel mountings such as, for example, a ladder often cause false echoes. When projecting the measuring point, please ensure the free access of the ultrasonic signals to the medium.



Vessel mountings

Vessel struts

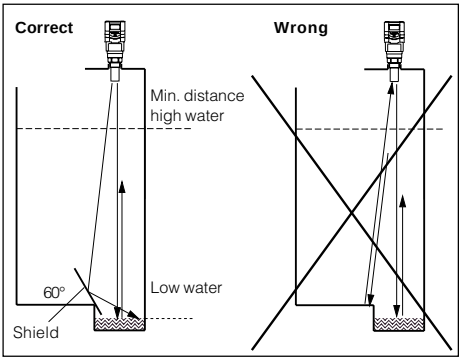
Vessel struts, as with other vessel mountings, can cause strong false echoes which superimpose the useful echoes. Small shields effectively hinder a direct false echo reflection. The false echoes are scattered and diffused in the area and are then filtered out as "echo noise" by the measuring electronics.



Vessel struts

Flood basin

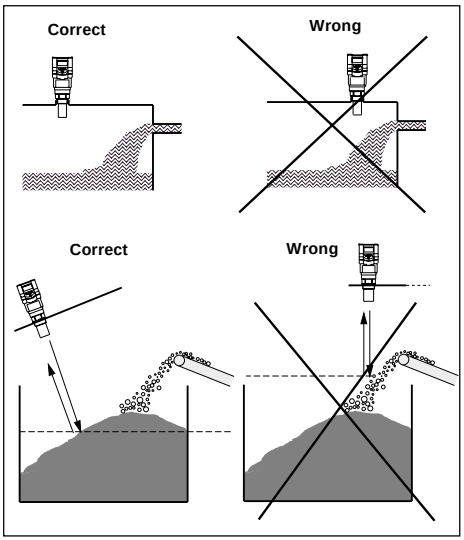
The max. height of water to be expected determines the installation height to keep the min. distance of the transducer even with highest high water. The low water edge should be covered with a shield in the transducer range.



Gating out of an echo

Inflowing material

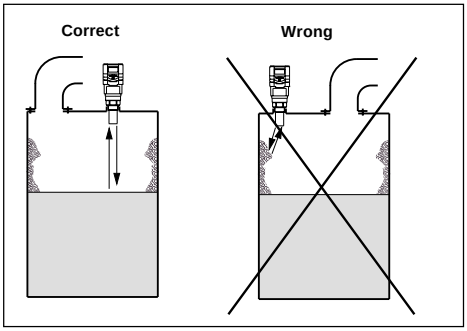
Do not mount the instrument in or above the filling stream. Ensure that you detect the product surface and note the inflowing material.



Inflowing material

Mounting on the vessel

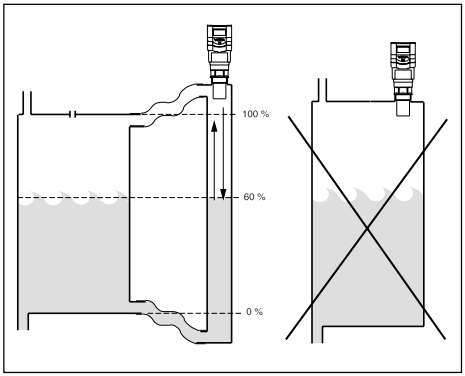
If the sensor is mounted too close to the vessel wall, build-up and adhesion of the filling material to the vessel wall cause false echoes. Please position the sensor at a sufficient distance from the vessel wall. Please also note chapter "4.1 General installation instructions".



Build-up

Strong product movements

Heavy turbulences in the vessel, e.g. by strong stirrers or strong chemical reactions, aggravate the measurement. A surge or bypass pipe (figure) of sufficient size always allows, provided that the product causes no build-up in the pipe, a reliable measurement even with strong turbulences in the vessel.

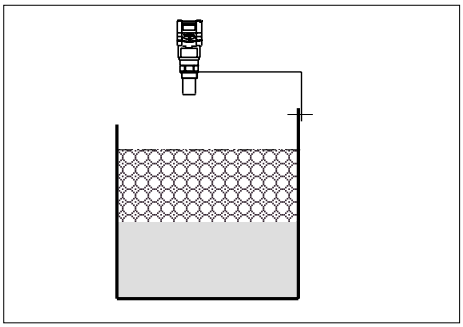


Strong product movements

4.7 Installation error

Foam generation

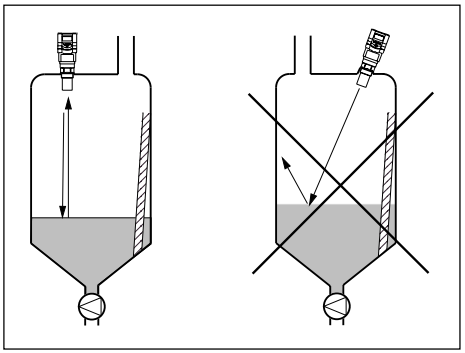
Strong foam on the product can cause faulty measurements. Provide measures to avoid foam, measure in a bypass pipe or use another meas. principle, e.g. capacitive electrodes or hydrostatic pressure transmitters.



Foam generation

Wrong directing to the product

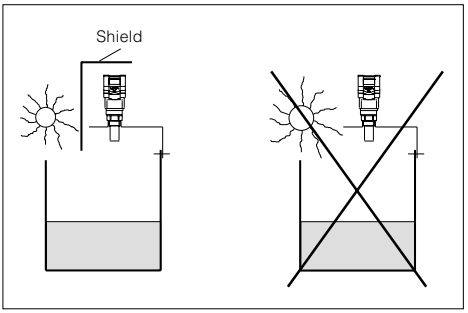
Weak measuring signals are caused if the sensor is not directed to the product surface. Direct the sensor axis vertically to the product surface to achieve optimum measuring results.



Direct sensor vertically to the product surface

Strong heat fluctuations

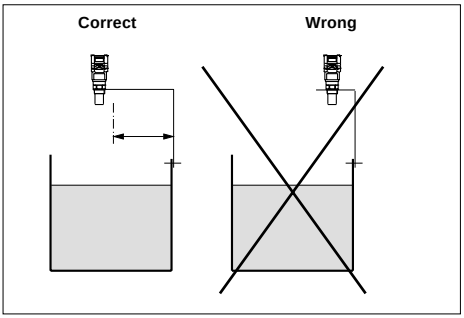
Strong heat fluctuations, e.g. due to the sun cause measuring errors. Provide a shield.



Strong heat fluctuations

Min. distance to the medium

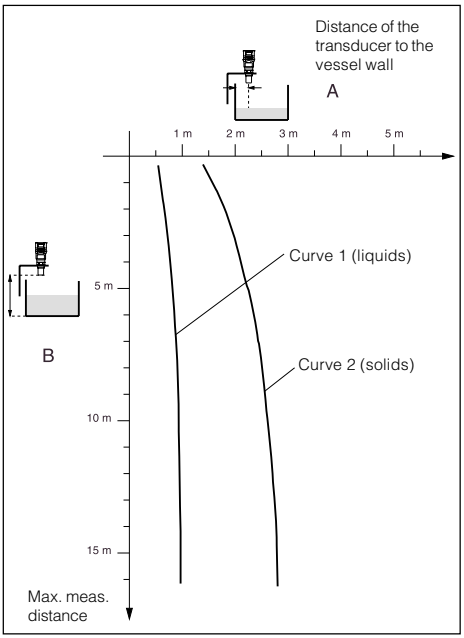
When the min. distance to the medium is not maintained, the instruments show wrong measured values. Mount the instruments with the required min. distance.



Sensor too close to the vessel wall

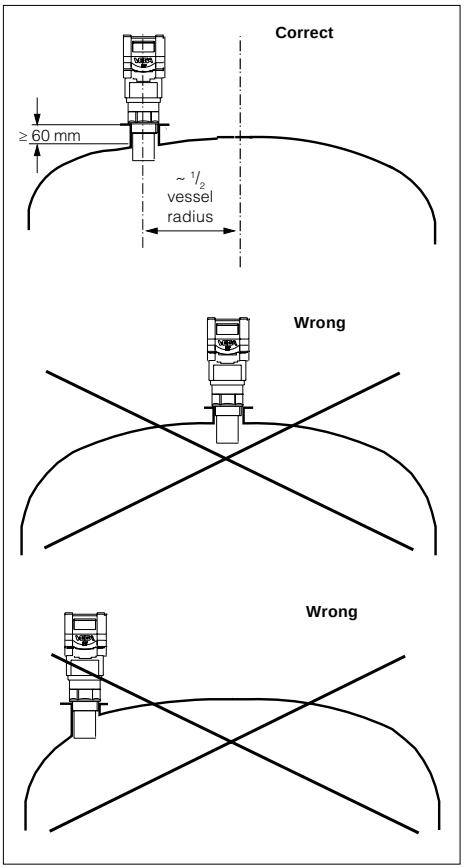
Sensor too close to the vessel wall

if the sensor is mounted too close to the vessel wall (dimension A in diagram) strong false echoes can be caused. Build-up, rivets, screws and weld joints superimpose their echoes on the product echo or useful echo. Please ensure the sufficient distance of the sensor to the vessel wall depending on the maximum measuring distance (dimension B in diagram). In case of good reflection conditions (liquids, no vessel installation) we recommend the provision of the sensor distance according to **diagram curve 1**. At a max. meas. distance of, for example 10 m the distance of the transducer, according to curve 1, should be approx. 1 m. In case of solids with bad reflection conditions provide a distance to the vessel wall according to **diagram curve 2**. With very bad meas. conditions it could be necessary to increase the distance to the vessel wall or to gate out the false echoes additionally by a false echo storage and thereby adapt the sensor more precisely to the environment.



Parabolic effects on dished boiler head or basket arch vessels

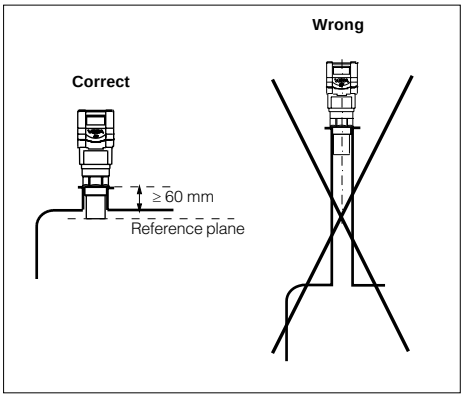
Round or parabolic tank tops act like a parabolic mirror for the signals. If the sensor is placed to the focus of such a parabolic tank top the sensor receives amplified false echoes. The optimum mounting is generally in the range of half the vessel radius from the centre.



Mounting on a vessel with parabolic tank top

Socket piece too long

When mounting the sensor in a socket piece which is too long, strong false echoes are caused, aggravating the measurement. Please ensure that the transducer protrudes at least 30 mm out of the socket piece.



Correct and wrong length of socket piece

5 Electrical connection

5.1 Connection and connection cable

Safety information

Ensure that the instrument is unpressurised before you start work. Always switch off the power supply before you carry out clamping work on the ultrasonic sensors. Protect yourself and the instruments, especially when using sensors which do not operarate with low voltage.

Skilled staff
Instruments which are not operated with protective low voltage or DC voltage must only be connected by skilled staff.

Connection

A standard two or four-wire cable (sensors with separate supply) with max. 2,5 mm^2 can be used as connection. Very often the "electromagnetic pollution“ by electronic actuators, energy lines and transmitting stations is so considerable that the two-wire line or four-wire line should be screened.

We recommend the use of screening. This screening prevents future interferences. Only earth the cable screens on both ends (on the sensor and on the processing system) when you have determined, by measurement, that no or only lowest earth compensating currents flow via the screens. Use a very low impedance earth connection (foundation, plate or mains earth).

Ex-protection

If an instrument is used in hazardous areas, the necessary regulations, conformity and type approvals for systems in Ex-areas must be noted (e.g. DIN 0165).

Intrinsically safe circuits with more than one active instrument (instrument delivering electrical energy) must not be connected. Please note the special installation conditions (DIN 0165).

Connection cable

Note that the connection cables are specified for the expected operating temperatures in your systems. The cable must have an outer diameter of 5 … 9 mm to ensure the seal effect of the cable entry. Cables for intrinsically safe circuits must be marked blue and must not be used for other circuits.

Earth conductor terminal

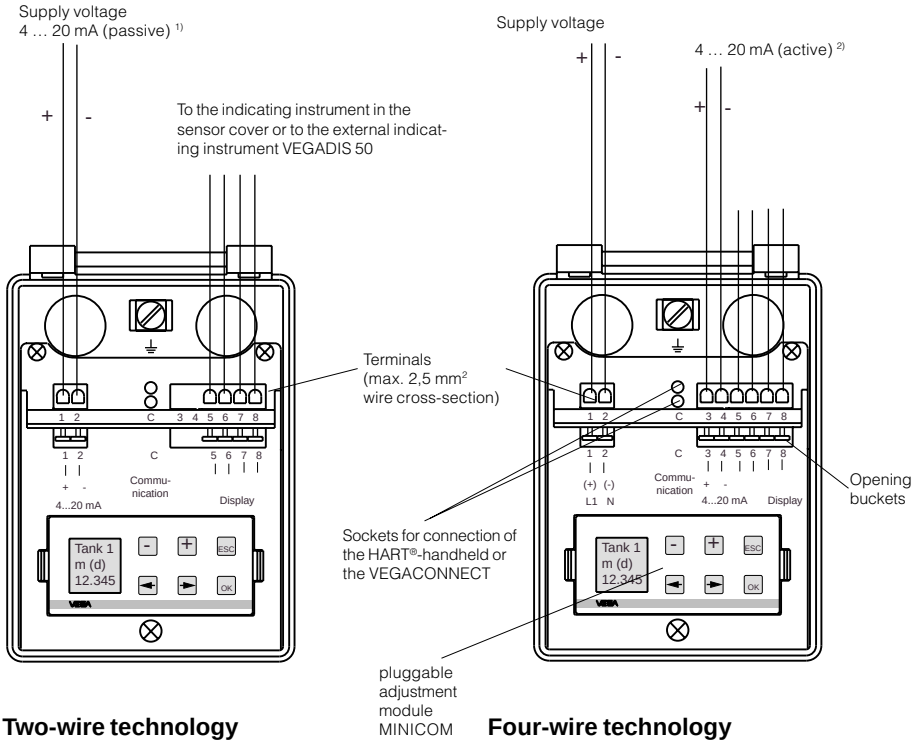
On VEGASON 51/52 sensors the earth conductor terminal is galvanically isolated. The sensors are shockproof. On the VEGASON 53 sensor the earth conductor terminal is galvanically connected to the metal transducer diaphragm.

5.2 Connection of the sensor

After having mounted the sensor in the meas. position according to the instructions in chapter 4 "Mounting and installation", loosen the closing screw on the top of the sensor. The sensor cover with the optional indication display can then be opened. Unscrew the compression screw and shift the screw over the approx. 10 cm dismantled connection cable. The compression screw of the cable entry is protected with a safety lock-in position against automatic loosening.

Now loop the cable through the cable entry into the sensor. Screw the compression screw on the cable entry and clamp the dismantled wires of the cable to the appropriate terminal positions.

The terminals operate without terminal screw. Press the white opening buckets with a small screwdriver and insert the copper core of the connection line into the terminal opening. Check the position of the lines in the terminal position by slightly pulling on the connection lines.



Two-wire technology
(loop powered)

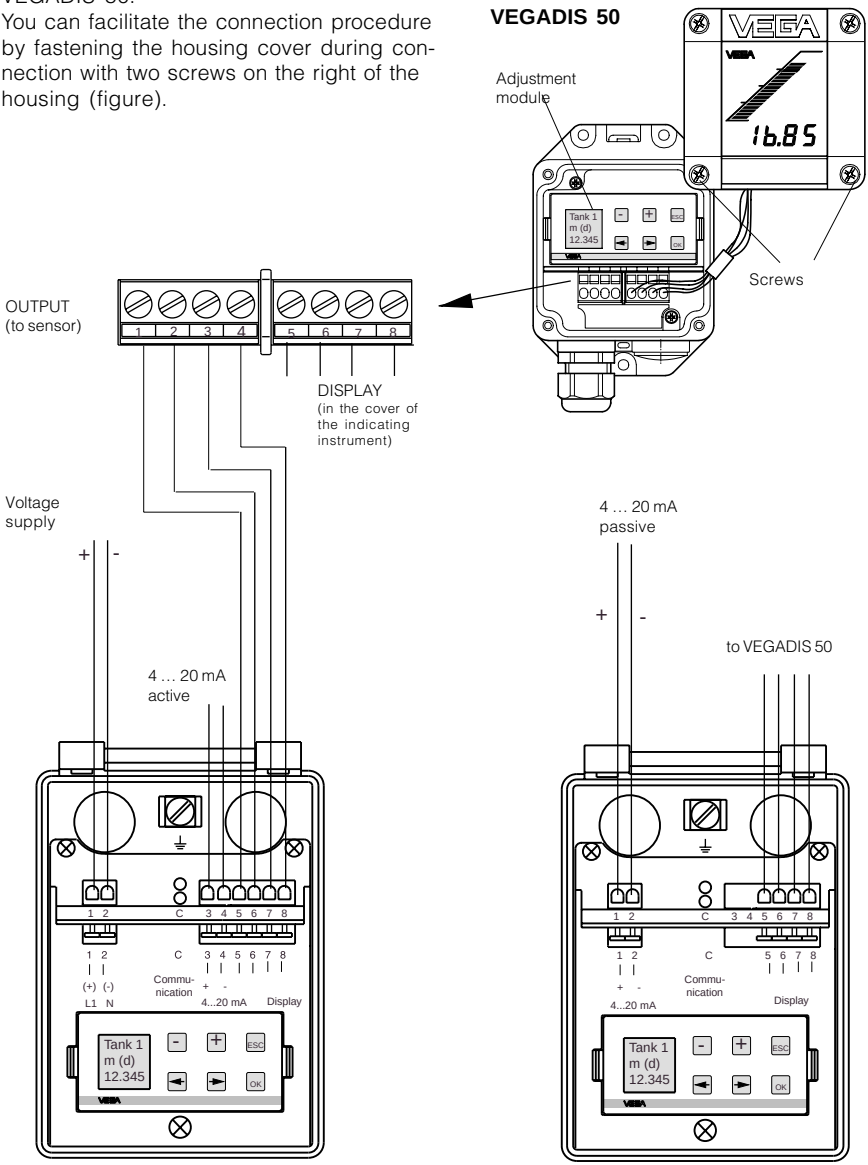
Four-wire technology
(separate supply)

1) 4 … 20 mA passive means that the sensor takes a current of 4 … 20 mA (consumer), depending on the level.

2) 4 … 20 mA active means that the sensor provides a current of 4 … 20 mA (current source), depending on the level.

5.3 Connection of the external indicating instrument VEGADIS 50

Loosen the 4 screws of the housing cover on VEGADIS 50.
You can facilitate the connection procedure by fastening the housing cover during connection with two screws on the right of the housing (figure).



Four-wire sensor
(separate supply)

Two-wire sensor
(loop powered)

6 Set-up

6.1 Adjustment structure

Series 50 ultrasonic sensors can be adjusted with
- PC (adjustment program VVO)
- with the detachable adjustment module MINICOM
- with the HART®-handheld.

The adjustment must only be carried out with one adjustment medium. If, for example you try the parameter adjustment with the MINICOM and the HART®-handheld, the adjustment will not be successful.

Adjustment program VVO
With the adjustment program VVO (VEGA Visual Operating System) on the PC you can adjust the ultrasonic sensors very comfortably. The PC communicates via the interface adapter VEGACONNECT 2 with the sensor. A digital adjustment signal is therefore superimposed on the signal and supply line. The adjustment can be carried out directly on the sensor or on any individual position of the signal line.

Adjustment module MINICOM
With the adjustment module MINICOM you adjust in the sensor or in the external indicating instrument VEGADIS 50. The adjustment module enables via the text display with 6-key field the adjustment in the same functions volume as with the adjustment program VVO.

HART®-handheld
VEGASON 50 K ultrasonic sensors, like other HART®-protocol capable instruments, can be adjusted with the HART®-handheld. A manufacturer specific DDD (Data-Device-Description) is not required. The ultrasonic sensors are adjusted with the HART®-standard menus. All main functions are, therefore, accessible.
Some functions which are rarely used such as, for example the scaling of the A/D-converter for the signal output, or the adjustment with medium, are not possible or are blocked by the HART®-handheld. These functions must be carried out with the PC or the MINICOM.

6.2 Adjustment with PC

Connection

In chapter 2.2 "Configuration of meas. systems" different possibilities for connection of the PC are shown. The PC with the adjustment program VVO (VEGA Visual Operating) can be connected
- to the sensor
- to the signal line.

PC on the sensor
For connection of the PC to the sensor you need the interface adapter VEGACONNECT 2. Insert VEGACONNECT 2 into the CONNECT-socket provided in the sensor.

PC on the signal line
Connect the two-wire line of VEGACONNECT 2 to the signal or supply line of the sensor. When the resistors of the systems (DCS, current source etc.,) connected to the signal/supply line are less than 250 Ω, a resistor of 250 … 350 Ω must be connected to the signal/supply line during adjustment. The digital signals modulated to the signal line would be considerably damped via the small system resistors or "shortcircuited" which means that the communication with the PC would be interfered with.

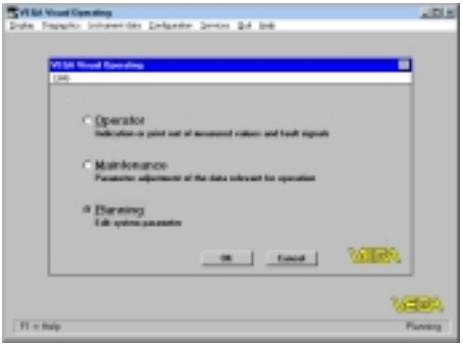
Adjustment
The individual adjustment steps are marked in the following with a dot.
Example:
- Choose …
- Start …

You have connected the PC with the adjustment software VVO to your measuring system.

- First of all siwtch on the power supply of the connected sensor.

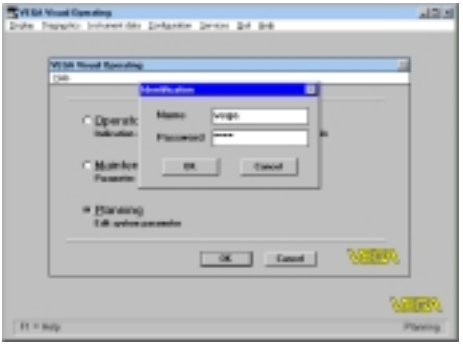
In the first 10 … 15 seconds the sensor starts to take a current of approx. 22 mA (self-check) and then takes a level proportional or distance proportional current of 4 … 20 mA.

- Switch on the PC and start the adjustment software VVO.



- Choose the point "Planning“ on the entrance screen with the arrow keys or the mouse an click on "OK“.

You are asked for the user identification.



- Enter under name "VEGA“.
- Also enter under password "VEGA“.

The adjustment program VEGA Visual Operating (VVO), called in the following VVO gets into contact with the connected sensor …

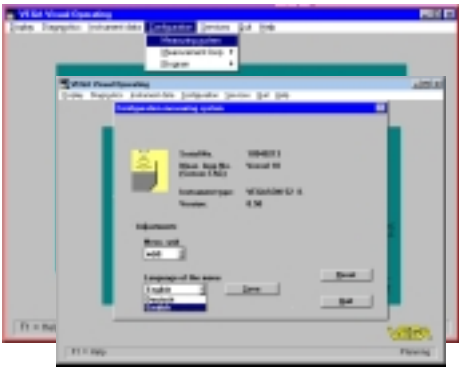
… and indicates after a few seconds if and with which sensor a connection exists.

The preadjusted user identification can be modified later in the menu "User access“.

Hinweis:
When connecting the adjustment software (VVO) to a sensor from which data has already been saved, you are asked if the saved data should be transferred to the sensor or if you want to transfer the sensor data to the database of VVO (and overwrite).

If you get no sensor connection, check the following:
- is the sensor powered with supply voltage (min. 19 V)!
- when VEGACONNECT 2 is connected to the signal line, is the load resistor 250 … 350 Ω!
- did you erroneously use a VEGACONNECT instead of the new VEGACONNECT 2!
- have you connected VEGACONNECT 2 to COM1 on the PC?

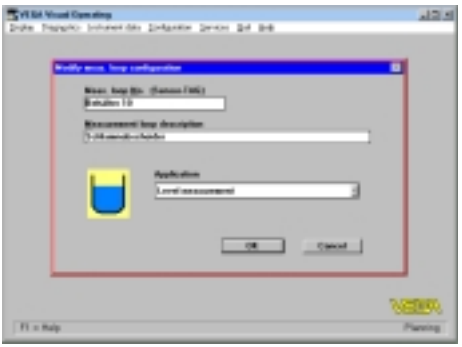
Configuration



- Choose the menu "Configuration/Measurement loop“ to get further information on the sensor type, the software version of the sensor, the meas. unit, the measurement loop designation etc.
- Click on "Quit“.
- Click on the menu "Configuration/Measurement loop/Modify“. This is the first step to set-up the sensor.

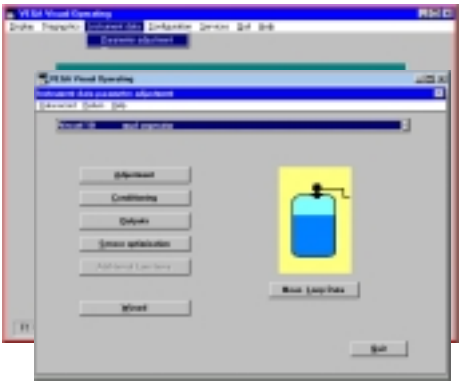
In the menu "Modify meas. loop configuration“ you can give a name to the measurement loop (e.g. vessel 10) and co-ordinate a measurement loop description (e.g. sludge separator).

- Now enter in this menu whether a level, a distance or a gauge should be measured and click on "OK“.



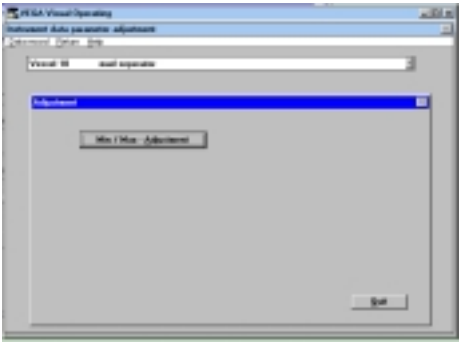
Parameter adjustment/Adjustment

- Now choose the menu "Parameter adjustment“.

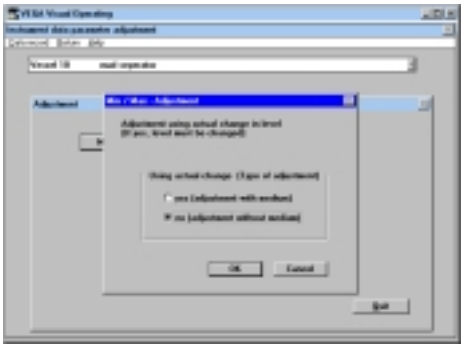


In the menu "Instrument data/Parameter adjustment“ you now carry out all important sensor adjustments. In the heading you now see the previously entered measurement loop name and the measurement loop description.

- First choose "Adjustment“.

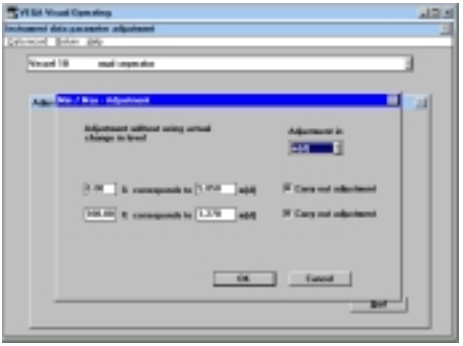


- Click on "Min/Max-adjustment“.



You can carry out the Min/Max-adjustment with medium or without medium. Generally you will carry out the adjustment without medium. When you want to carry out the adjustment with medium, you have to carry out the min.-adjustment with emptied vessel and the max.-adjustment with filled vessel.

It is convenient and quick to carry out the adjustment without medium as shown in the example.



- Choose whether you want to make the adjustment in m or in ft.
- Enter a distance for the upper and lower level and the filling degree in % corresponding to the distance.

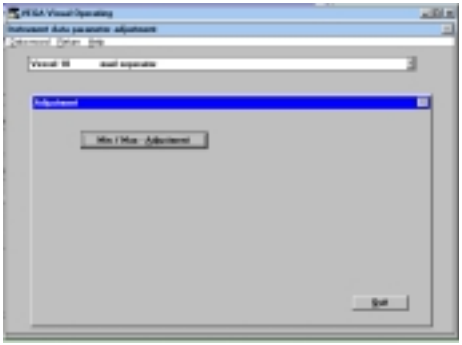
In the example the 0 % filling is at a product distance of 5,850 m and the 100 % filling at a product distance of 1,270 m.

- Confirm with "OK".

You are again in the menu "Adjustment". The sensor electronics has two characteristic points from which a linear proportionality between product distance and the percentage filling of a vessel is generated.

Naturally the characteristics points must not be at 0 % and 100 %, however , the distance should be as big as possible (e.g. at 20 % and at 80 %). The difference between the characteristics point for min./max. adjustment should be at least 50 mm product distance. When the characteristics points are too close together, the possible meas. error increases. Ideal would be to carry out the adjustment at 0 % and 100 %.

In the menu "Instrument data/Parameter adjustment/Conditionig/Linearisation" you can later enter, if necessary, a linear dependence between the product distance and the percentage filling degree.



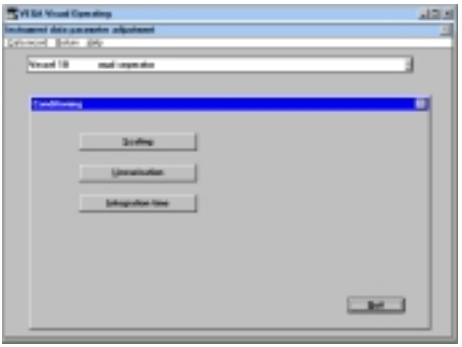
- Click in the menu "Adjustment" on "Quit".

You are again in the menu window "Instrument data parameter adjustment".

Conditioning

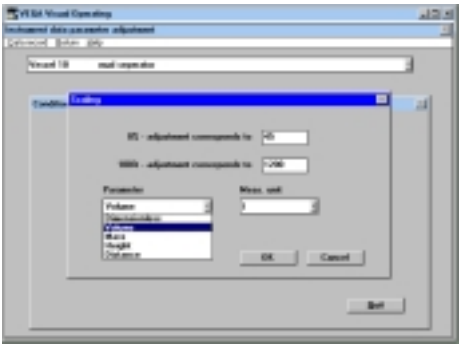
- Click on "Conditioning".

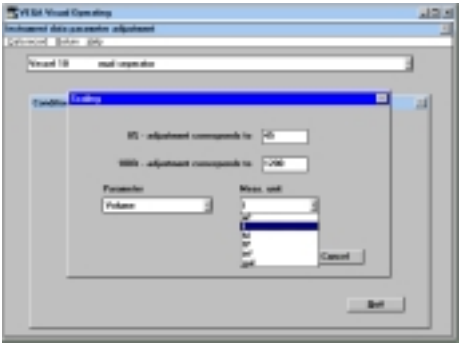
The menu window "Conditioning" opens.



- Click on "Scaling".

In the menu "Scaling" you enter the actual 0 % and 100 %-values of the parameter and the appropriate unit. You therevy inform the sensor, for example that at 0 % filling there are 45 l and at 100 % filling 1200 l in the vessel. The sensor indication then shows with empty vessel (0 %) 45 l and with full vessel (100 %) 1200 l.





As parameter you can choose "dimensionless (figures), volume, mass, height and distance“ and co-ordinate an appropriate meas. unit (e.g. l, hl) to the parameter. The sensor indication then shows the figure in the selected parameter and unit.

- Save the adjustments in the menu "Scaling“ by clicking on"OK“.

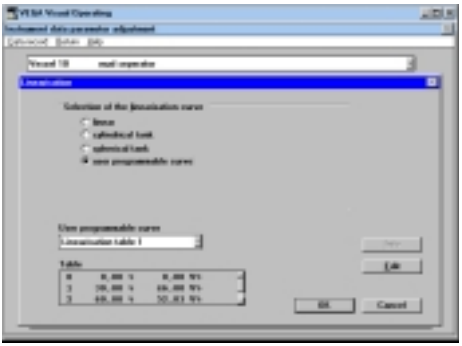
The adjustments are now transferred to the sensor.

Linearisation

When there is other than a linear dependence between product distance and the %-value of the filling in your vessel, choose the menu point "Linearisation“ in the menu window "Conditioning“.

- Click on "Linearisation“.

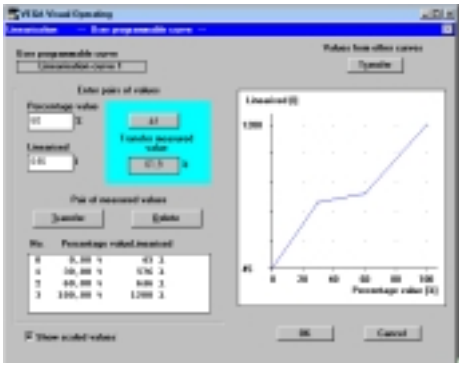
The menu window "Linearisation“ opens.



A linear dependence between the percentage value of the filling is preadjusted. As well as the two programmed linearisation curves "Cylindrical tank“ and "Spherical tank“ you can also enter "user programmable curves“.

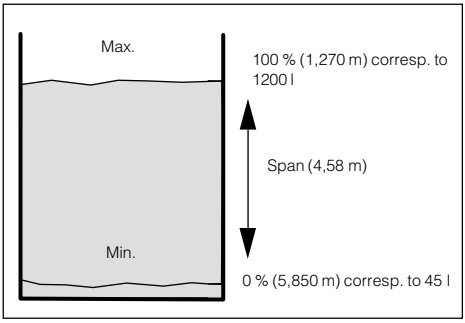
User programmable linearisation curves

- Click on the point "User programmable curve“ to enter an own vessel geometry or a user programmable filling curve.
- Click on "Edit“.



In the field "Transfer measured value“ the actual product distance in percent of the adjusted measuring range/measuring window is displayed. You have adjusted the measuring window or the span with the min./max. adjustment. In our example, the measuring window is in the range of 1,270 m … 5,85 m.
The user programmable linearisation curve is generated by index markers consisting of the value pairs "Linearised“ (product distance or adjusted unit) and "Percentage value“ (percentage value of the filling).
If the index markers or value pairs of your vessel are not known to you, you have to gauge the vessel by litres.

Gauging by litres
In the characteristics of the example you see four linearisation points or value pairs. There is always a linear interpolation between the linearisation points.
Click on "Indication in scaled values“, to have the adjusted measuring unit indicated on the y-axis (left bottom part in the menu window).
Linearisation point 1 is at 0 % filling (percentage value [%]) corresponding in the example to an actual distance to the product surface of 5,850 m (empty vessel). The volume value is, therefore, 45 l (rest filling of the vessel).
Linearisation point 2 is at a level of 30 % (30 % of the measuring distance of 1,270 m … 5,850 m). In our example there are 576 l at 30 % filling level in the vessel.
Linearisation point 3 is at a filling level of 60 %. At this filling level there are 646 l in the vessel.
Linearisation point 4 is at a filling level of 100 % (product distance 1,270 m) where 1200 l are in the vessel.



You can enter max. 32 linearisation points per linearisation curve (value pairs).

- Quit the menu with "OK“.
- Confirm the message with "OK“ and your individual linearisation curve will be saved in the sensor.

Again in the menu window "Conditioning“ you can enter a measured value integration with the menu point "Integration time“. This is useful for fluctuating product surfaces to avoid the measured value indication and output changing permanently.
As a standard feature, an integration time of 0 seconds is adjusted.

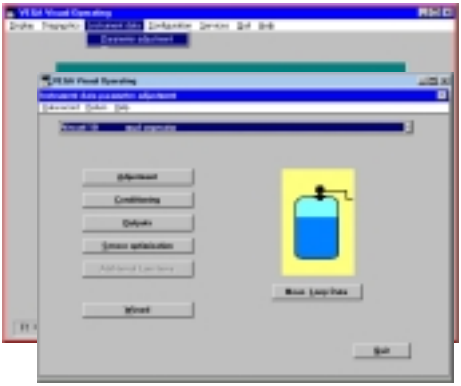
- Quit the menu with "OK“.

You are in the menu window "Instrument data parameter adjustment" again.

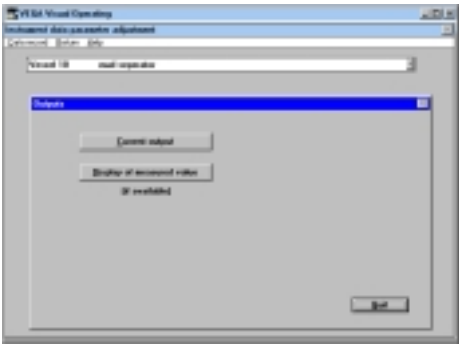
- Quit the menu window with "OK“.

Outputs

- Choose "Instrument data parameter adjustment“.



- Choose the menu point "Outputs“ in the menu window "Instrument data parameter adjustment“.



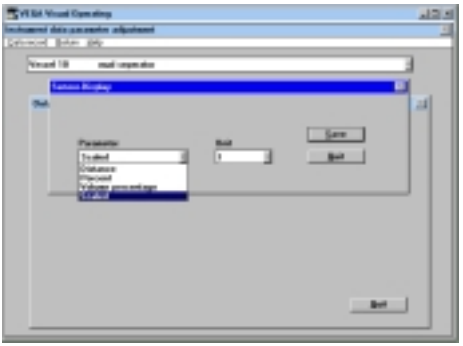
You are in the menu window "Outputs“.

Current output
With the menu point "Current output“ you choose the menu window "Current output“. Here you can adjust the signal condition of the 4 ... 20 mA output signal.

- If you have carried out adjustments in this menu window, click on"Save“.
- If you want to keep the adjustments without modifications, click on"Quit“.

You are in the menu window "Outputs“ again.

Display of measured value
- Click in the menu window "Outputs“ onthe menu point "Display of measured value“.



The menu window "Sensor-Display“ opens. Here you can once again adjust the sensor display.

- Choose "scaled“ when the display should show your previous adjustments. In the example, a level of 45 … 1200 l would be displayed.
- Choose "Volume percent“ when you want to have the level of 45 … 1200 l displayed as percentage value of 0 … 100 %.
- Choose "Distance“ to have the actual distance to the product surface displayed (in m).
- Choose "Percent“ when you want to have the product distance of 1,270 to 5,850 m displayed as a percentage value of 0 … 100 %.

With "Save“ the adjustment is transferred to the sensor.

- Click on "Quit“ in the window "Sensor-Display“.
- Click on "Quit“ in the window "Outputs“.

You are in the output menu window "Instrument data parameter adjustment“ again.

Sensor optimisation

In the menu "Sensor optimisation“ you can carry out special optimising adjustments.

Meas. environment

- Choose the menu point "Sensor optimisation“ in the menu window "Instrument data parameter adjustment“.

- First click on "Meas. environment“.

With the menu point "Operating range“ you can define the operating range of the sensor deviating from the "Min/Max-adjustment“. As a standard feature the operating range otherwise corresponds to the min./max. adjustment.

Generally it is better to choose the operating range approx. 5 % bigger than the measuring range (span) determined by the min./max.-adjustment.
In the example:
- min. adjustment to 1,270 m,
- max. adjustment to 5,85 m.

In the example you would have adjusted the operating range to 1 m up to 6 m.

- Save the adjustments and quit the menu window "Limitation of the operating range“ again.
- Click on "Measuring condition“.
- In the menu window "Measuring condition“ you click on the options corresponding to your application.

- Confirm with "OK“.

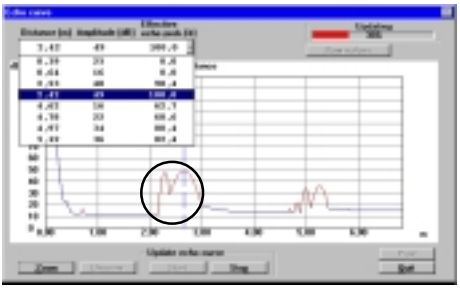
After a few seconds of saving during which the adjustments are permanently saved in the sensor, you are in the window "Meas. environment“ again.

- Click in the menu window "Meas. environment“ on "Quit“.

You are in the menu window "Sensor optimisation“ again.

Echo curve

With the menu point "Echo curve“ in the menu window "Sensor optimisation“ you can see the course and the strength of the detected ultrasonic echo. If, due to vessel installations, you have to expect strong false echoes, a correction of the installation position (if possible) can help, by monitoring the echo curve, to localise and reduce the size of the false echoes. In the following figure you see the echo curve before the correction of the installation angle (directing to the product surface) with a false echo with nearly the same size as the product echo.



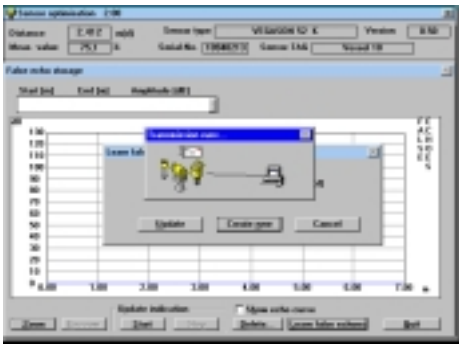
In the next figure you then see the echo curve after optimum directing of the sensor to the product surface (sensor axis vertical to the product surface). The false echo, e.g. caused by a strut, is now reduced by more than 10 dB and will no longer influence the measurement.

- Quit the menu window "Echo curve“ with "Quit“.

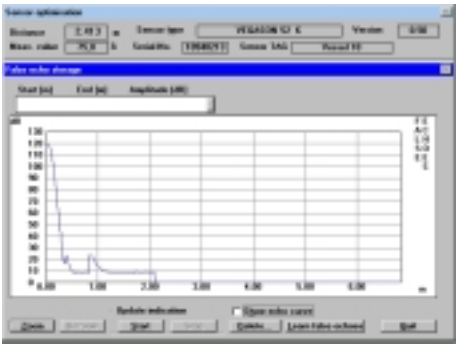
With the menu point "False echo storage“ in the menu window "Sensor optimisation“ you can authorise the sensor to save false echoes. The sensor electronics save the false echoes in an internal database and treat the false echoes at an appropriately lower level than the useful echo.

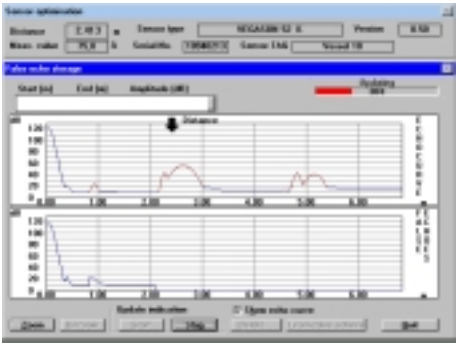
- Click in the menu window "Sensor optimisation“ on the menu point "False echo storage“. A small window opens.
- Now click in the opening window "False echo storage“ on "Learn false echoes“. The small window "Learn false echoes“ opens.
- Enter here the checked product distance and click on "Create new“.

You hereby authorise the sensor to mark all echoes before the product echo as false echoes. This avoids the sensor erroneously detecting a false echo as a level echo.



- Click on "Show echo curve“.





The echo curve and the false echo marking are shown.

- Quit the menu with "Quit“.

You are in the menu window "Sensor optimisation“ again.

With the menu point "Reset“, you reset all options from the menu "Sensor optimisation“ back to the basic adjustment.

- Quit the menu window "Sensor optimisation“ with "Quit“.

You are then in the initial menu window "Instrument data parameter adjustment“ again.

- Click on the menu point "Meas. Loop Data“.

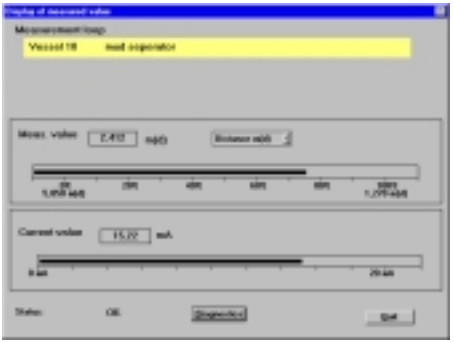
In the window "measurement loop data" all sensor charcateristics data are shown.

Parameter adjustment of interfaces

See "VEGA Visual Operating“ manual.

Display of measured value

- Click in the main menu window on the menu "Display“ and then on "Display of measured value“.



In the menu window "Display of measured value“:
- the measured value (actual meas. distance) in m
- the percentage filling degree with the limits adjusted in the min./max. adjustment (in the example 5,850 m at 0 % and 1,270 m at 100 %)
- the actual signal current in the 4 ... 20 mA signal line

are shown.

Simulation

- Click on the menu "Diagnostics/Simulation“.

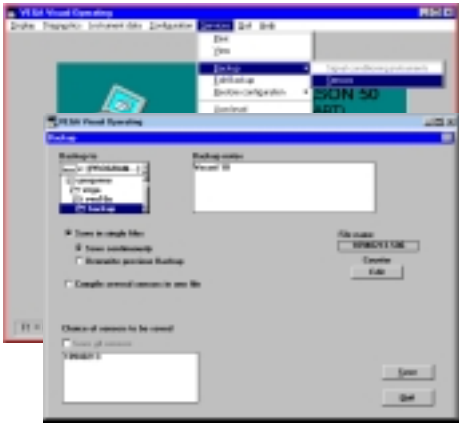
The menu window "Display of measured value“, which is similar to the previous menu window, opens. In this menu window you can however, adjust the filling of the vessel or the signal current and the indication to an individual value (simulation of measured value).

First of all the actual measured value and the signal current are displayed.

- Click on "Start" in the turquoise window segment.

The grey scrollbar becomes active. With this scrollbar you can modify the measured value in the range of -10 % ... 110 % and whereby simulate the filling or emptying of your vessel. In the field with the figures in the turquoise window cut-out you can also enter an individual %-value for the filling degree.

Note:
The sensor automatically returns to standard operating condition 1 hour after the last simulation adjustment.

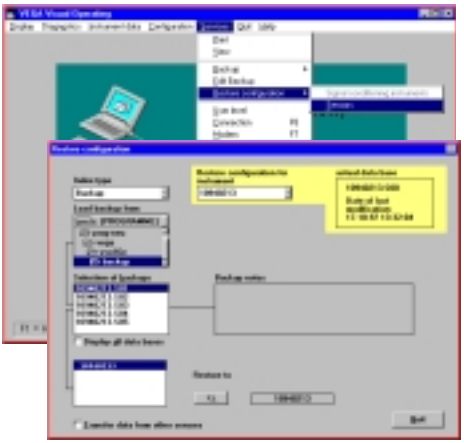


Backup

In the menu window "Backup" the sensor with the serial number is shown. You can save the sensor on your PC in a directory of your choice either individually, or in groups, with all adjustments. In addition, you can add a short note to each backup.

Saved sensor data can be transferred to other sensors later. If you have, for example a system with several storage vessels and identical sensors, it is sufficient to configure one sensor and then transfer to the other sensors.

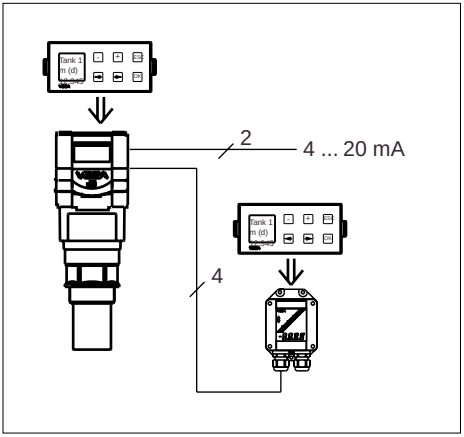
- Choose the menu "Services/Restore configuration/Sensors"



In this menu window the actual adjustment (database) with date and time of the last system configuration is displayed in the yellow window cut-out. When you click on the serial number of the sensor from which you want to take over the adjustments, you transfer these sensor adjustments to the actually connected sensor with "Restore to".

6.3 Adjustment with the adjustment module MINICOM

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



For the adjustment with the adjustment module all sensor versions (adjustment options) as with the PC and the adjustment program VVO are available. The adjustment with MINICOM, however, is different.

You 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 point or on the figure of a menu adjustment.

The information volume of the small display however cannot be compared with that of the adjustment program VVO, but you will soon get used to it and will be able to carry out your adjustments quickly and directly with the small MINICOM.

Error codes:

E Hardware failure, electronics defect
E013 No valid measured value
- Sensor in the feeding phase
- Loss of the useful echo

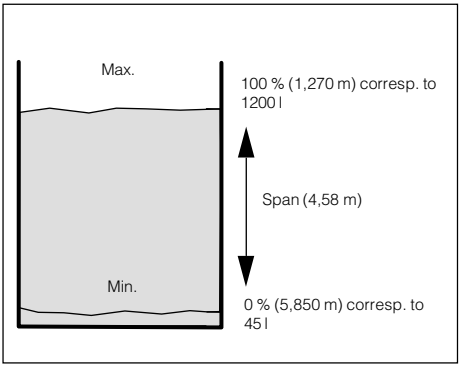
E017 Adjustment span too small
E036 Sensor program not operating
- Sensor must have a new programming (service)
- Fault signal also appears during programming

Adjustment steps

On pages 56 and 57 you can find the complete menu plan of the adjustment module MINICOM.
Set-up the sensor in the numbered sequence:
1. Adjustment
2. Conditioning
3. Outputs
4. Operating range
5. Meas. conditions
6. Carry out measurement in a pipe only when measuring in a standpipe.
7. False echo memory (only required when meas. errors occur during operation).
8. Indication of the useful and noise level

Short explanations to the set-up steps 1 … 8 follow:

1. Adjustment

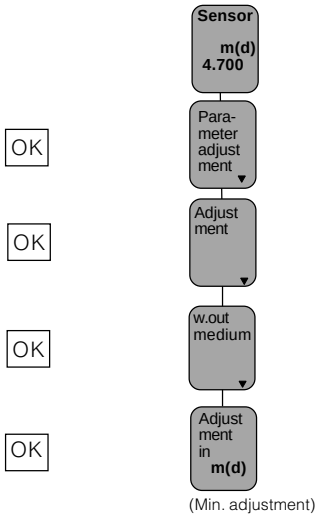


Under the menu point "Adjustment“ you inform the sensor with which meas. range it should operate.

You can carry out the adjustment without and with medium. Generally you will carry out the adjustment without medium as you can then adjust without filling cycle.

Adjustment without medium
(adjustment independent of the actual level)

Key Display

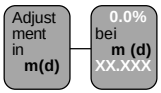


(Min. adjustment)

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

[OK] Confirm the adjustment with "OK“.

[→]



[+] or [–] With "+“ and "–“ you adjust the percentage value for the min. value or the lower level l (example 0,0 %).

[OK] The adjusted percentage value is written in the sensor and the distance corresponding to the percentage value flashes.

[+] or [–] With the "+“ or "–“-key you can co-ordinate a product distance (example 5,85 m) to the previously adjusted percentage value. When you do not know the distance, you have to sound.

[OK] The adjusted product distance is written in the sensor and the indication stops flashing.

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

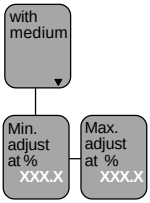
[→]

(Max-adjustment)

The max. adjustment (upper product distance) is made in the same way (example: 100 % and 1,270 m).

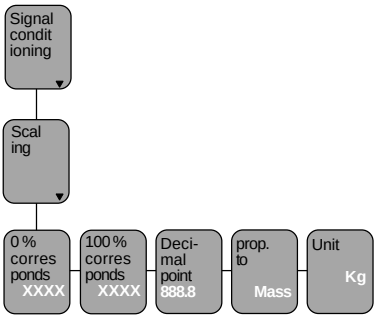
Note:
The difference between the adjustment values of the lower product distance and the upper product distance should be as big as possible, preferably at 0 % and 100 %. If the values are very close together, e.g. lower product distance at 40 % (3,102 m) and upper product distance at 45 % (3,331 m), the measurement will be inaccurate. A level characteristic is generated from the two points. Even with smallest deviations between actual product distance and adjusted product distance, the slope of the characteristics will be considerably influenced. Thereby small failures multiply with the adjustment when the adjustment points are too close together to more considerable errors at the output of the 100 %-value or the 0 %-value.

Adjustment with medium



Fill the vessel, for example 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 80 % or 100 % in the menu "Max. adjust" with the "+" and "–" keys.

2. Conditioning



Under the menu point "Signal conditioning" you choose the product distance at 0 % and at 100 % filling. Then you enter the parameter and the physical unit as well as the decimal point.

Enter in the menu window "0 % corresponds" the 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 l.

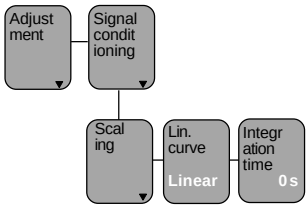
- Confirm with "OK".

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

- 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 parameter (mass, volume, distance...) and in the menu "Unit" the physical unit (kg, l, ft^3, gal, m^3 ...).

Linearisation:



A linear dependence between percentage value of the product distance and the percentage value of the filling volume is preadjusted. With the menu "Lin.curve" you can choose between linear, spherical tank and cylindrical tank. The adjustment of one's own linearisation curve is only possible with the PC and the adjustment program VVO.

3. Outputs

Under the menu "Outputs" you determine if, for example the current output should be inverted or which parameter should be provided by the sensor display.

4. Operating range

Without special adjustment, the operating range corresponds to the measuring range. The measuring range has already been adjusted with the min./max. adjustment. Generally it is useful to choose a slightly bigger (approx. 5 %) operating range than the measuring range.

Example:
Set min./max. adjustment to: 0,300 … 5,850 m; operating range to approx. 0,250 … 6,000 m.

5. Meas. conditions

(see menu plan no. 5)

6. Measurement in gases

Adjustment is only necessary when the measurement is made in gases (Co_2, He, etc.) deviating from air. In case of measurement in gases sound the distance of the sensor to the product surface and enter in the menu point "Measurement in gases". The sensor can then consider the modified sound velocity in gases as opposed to air and provide correct levels.

7. False echo storage

A false echo storage is always useful when false echo sources such as struts must be reduced. With the creating of a false echo storage, you authorise the sensor electronics to note the false echoes and save them in an internal database. The sensor electronics treat these (false) echoes differently from the useful echo and gates them out.

8. Useful and noise level

In the menu

you get important information on the signal quality of the level echo. The higher the "S-N"-value, the more reliable the measurement (menu plan 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 higher the "S-N"-value (distance of the amplitude useful level to 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

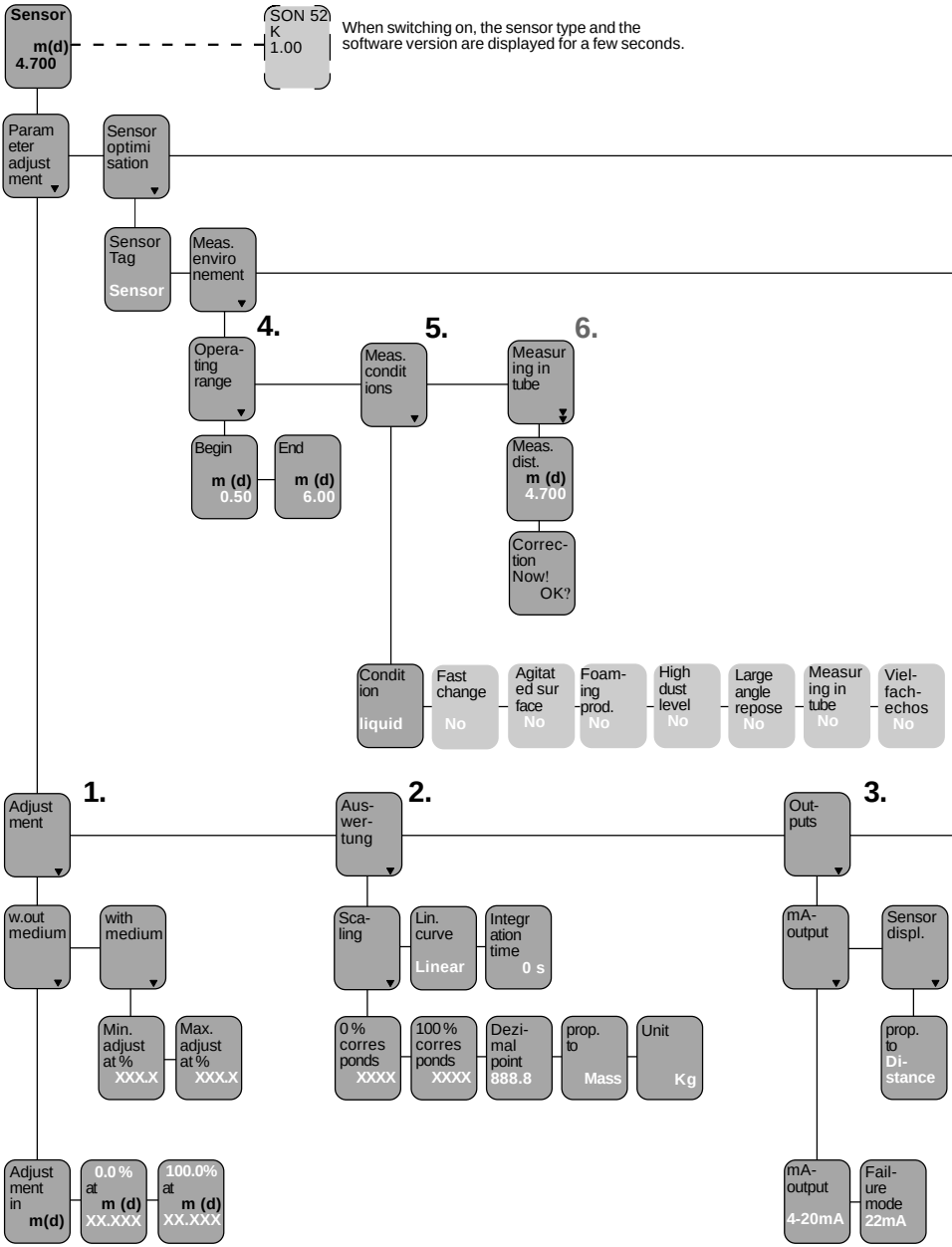
Example:
Ampl. = 68 dB
S-N = 53 dB

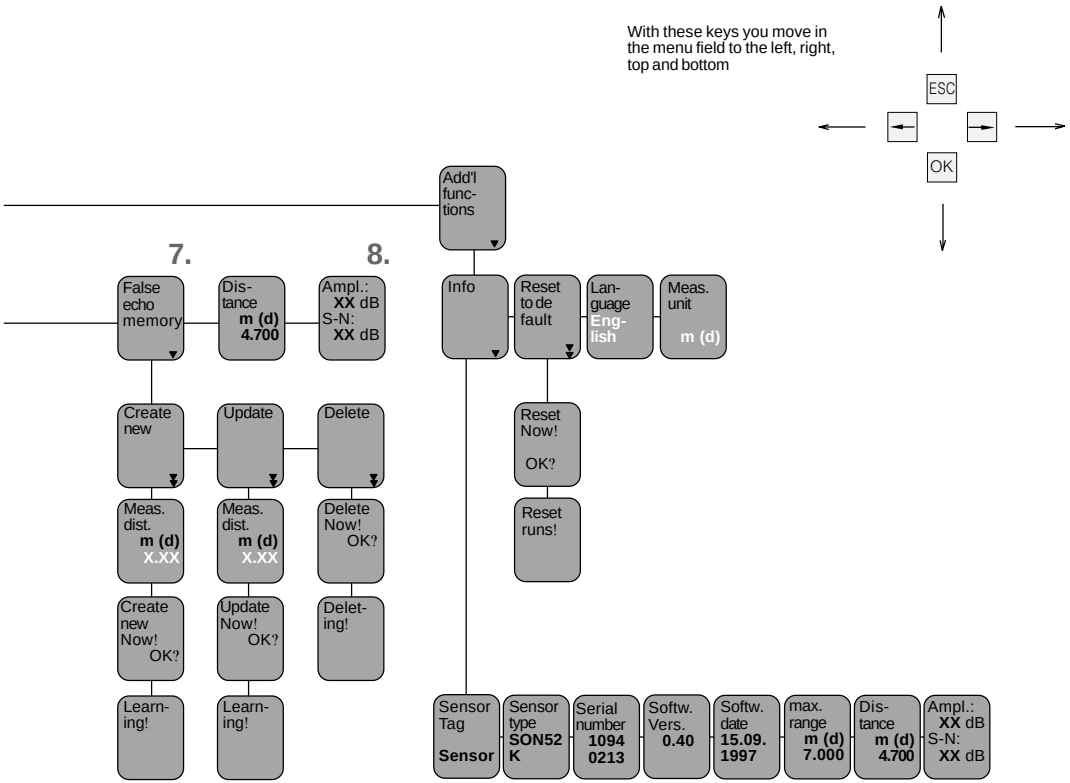
68 dB – 53 dB = 15 dB

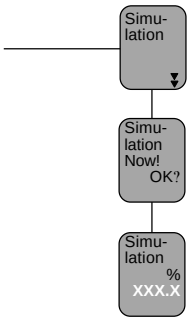
53 dB signal distance means very good reliability.

This means that the noise level is only 68 dB – 53 dB = 15 dB.

Menu plan of the adjustment module MINICOM



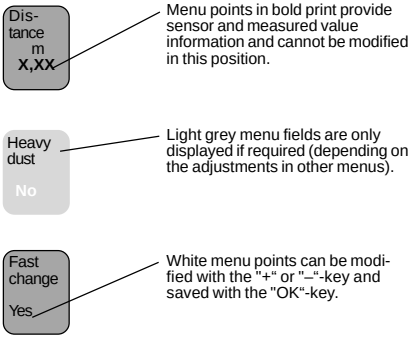




Simulation:
One hour after the last simulation adjustment the sensor returns automatically to normal operating condition.

Error codes:

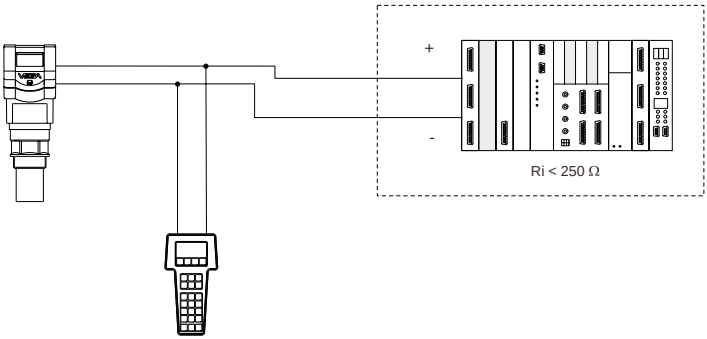
E	Hardware failure
E013	No valid measured value - Sensor in feeding phase - Loss of the useful echo
E017	Adjustment span too small
E036	No operating sensor program - Sensor must have a new programming (service) - Fault signal also appears during programming



6.4 Adjustment with the HART®-handheld

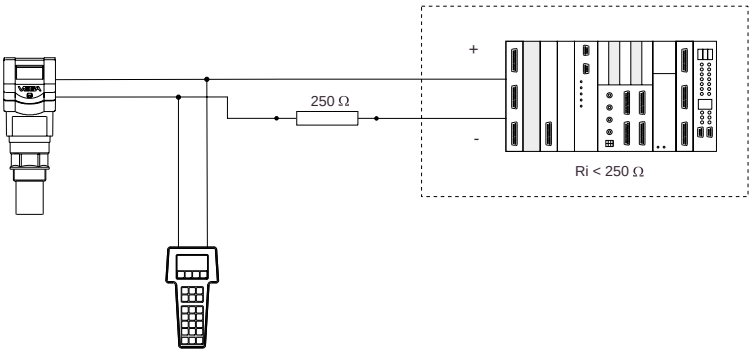
With each HART®-handheld you can set-up the VEGASON series 50K ultrasonic sensors like all other HART®-capable sensors. A special DDD (Data Device Description) is not necessary.

Just connect the HART®-handheld to the signal line, after having connected the sensor to power supply.



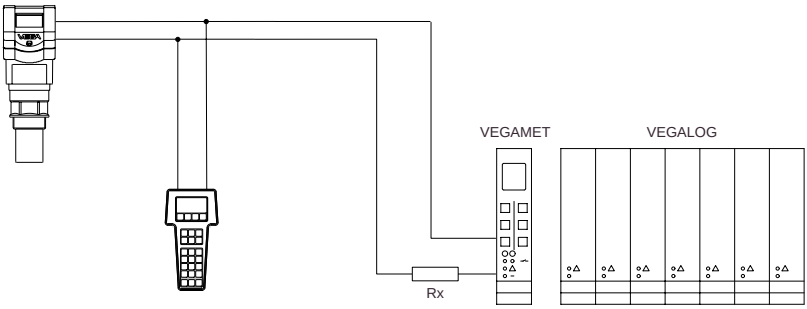
Note:
If the resistor of the power supply is less than 250 Ohm, a resistor must be looped into the signal/connection line during adjustment.

The digital adjustment and communication signals would be short-circuited via too small resistors of the supply current source of the processing system which means that the sensor communication could not be ensured.



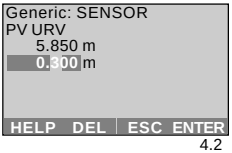
Connection to a VEGA-signal conditioning instrument
When you operate a HART®-capable sensor on a VEGA-signal conditioning instrument, you have to connect the sensor via a resistor according to the following table during the HART®-adjustment, to reach together with the inner resistor of the instruments the value of 250 Ohm required for the HART®-instrument.

VEGA-signal conditioning instr.	Rx
VEGAMET 513, 514, 515, 602	50 … 100 Ohm
VEGAMET 614 VEGADIS 371	no additional resistor required
VEGAMET 601	200 … 250 Ohm
VEGASEL 643	150 … 200 Ohm
VEGAMET 513 S4, 514 S4 515 S4, VEGALOG EA-card	100 … 150 Ohm



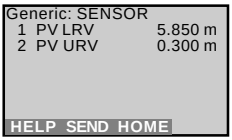
The most important adjustment steps

On the following pages you see a menu plan for the HART®-handheld in conjunction with VEGASON 51K ... 53K sensors. The most important adjustment steps are marked in the menu plan with the letters A ... E. When entering parameters first of all the key "ENTER" must be pressed. The adjustment is thereby saved in the handheld, but not in the sensor itself.

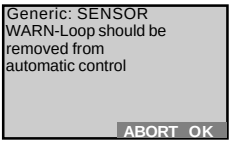


4.2
(5.2)

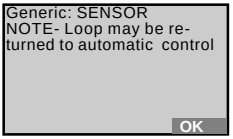
After having pressed "ENTER", press "SEND" (here in the example for the min.-adjustment).



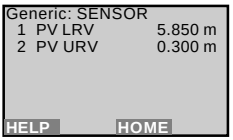
After pressing "SEND", a warning is displayed, which informs you that you are about to modify the configuration and for that, safety reasons, you should switch your system over to manual operation.



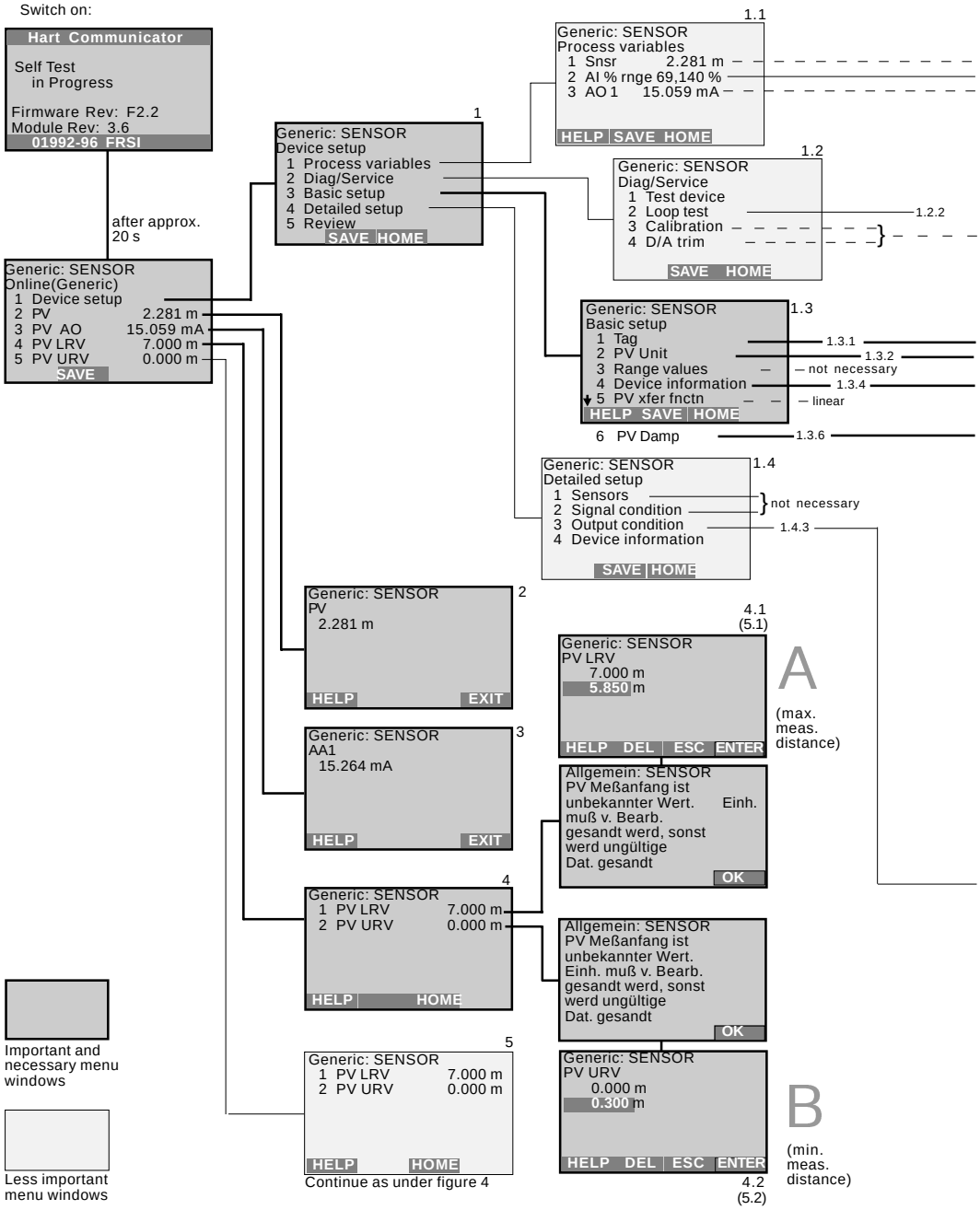
Press "OK" and the adjustment will now be transferred to the sensor. After a short time you are asked to switch you system over from manual to automatic operation. Confirm with "OK".

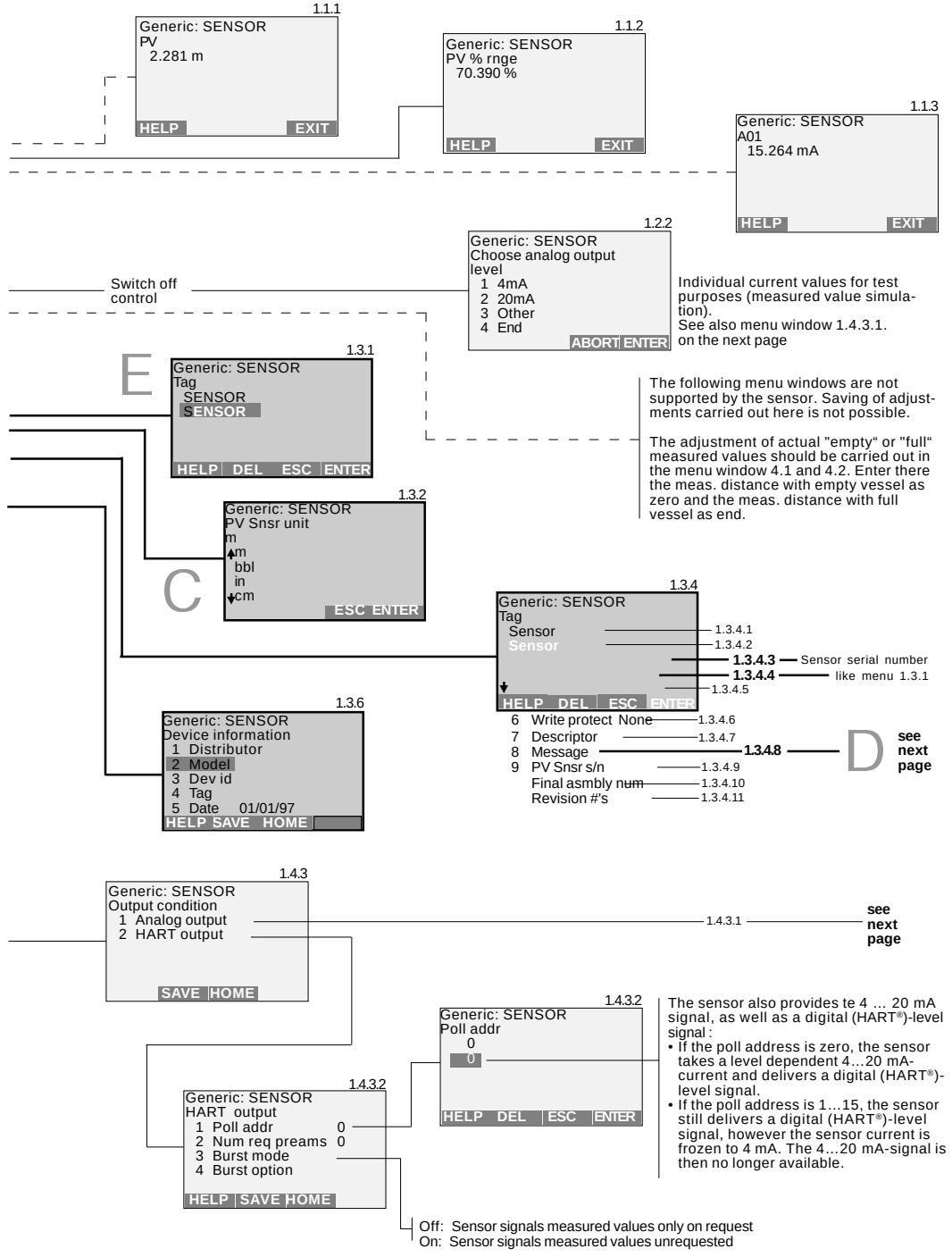


You see the actual carried out adjustment.



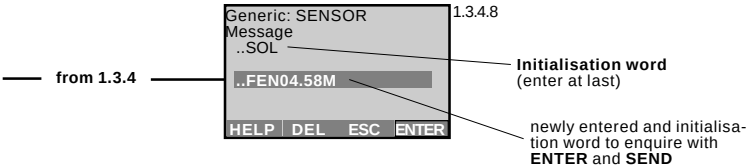
HART®-menu plan VEGASON 51K… 53K




1.1.1
Generic: SENSOR
PV
2.281 m
HELP
EXIT
1.1.2
Generic: SENSOR
PV % rnge
70.390 %
HELP
EXIT
1.1.3
Generic: SENSOR
A01
15.264 mA
HELP
EXIT
1.2.2
Generic: SENSOR
Choose analog output level
1 4mA
2 20mA
3 Other
4 End
ABORT ENTER
Switch off control
Individual current values for test purposes (measured value simulation).
See also menu window 1.4.3.1. on the next page
E
1.3.1
Generic: SENSOR
Tag
SENSOR
SENSOR
HELP DEL ESC ENTER
The following menu windows are not supported by the sensor. Saving of adjustments carried out here is not possible.
The adjustment of actual "empty" or "full" measured values should be carried out in the menu window 4.1 and 4.2. Enter there the meas. distance with empty vessel as zero and the meas. distance with full vessel as end.
1.3.2
Generic: SENSOR
PV Snsr unit
m
m
bbl
in
cm
ESC ENTER
C
1.3.4
Generic: SENSOR
Tag
Sensor
Sensor
1.3.4.1
1.3.4.2
1.3.4.3
Sensor serial number
1.3.4.4
like menu 1.3.1
1.3.4.5
HELP DEL ESC ENTER
1.3.6
Generic: SENSOR
Device information
1 Distributor
2 Model
3 Dev id
4 Tag
5 Date 01/01/97
HELP SAVE HOME
6 Write protect None
1.3.4.6
7 Descriptor
1.3.4.7
8 Message
1.3.4.8
9 PV Snsr s/n
1.3.4.9
Final asmbly num
1.3.4.10
Revision #'s
1.3.4.11
D
see next page
1.4.3
Generic: SENSOR
Output condition
1 Analog output
2 HART output
SAVE HOME
1.4.3.1
see next page
1.4.3.2
Generic: SENSOR
Poll addr
0
0
HELP DEL ESC ENTER
The sensor also provides te 4 ... 20 mA signal, as well as a digital (HART®)-level signal :
• If the poll address is zero, the sensor takes a level dependent 4...20 mA-current and delivers a digital (HART®)-level signal.
• If the poll address is 1...15, the sensor still delivers a digital (HART®)-level signal, however the sensor current is frozen to 4 mA. The 4...20 mA-signal is then no longer available.
1.4.3.2
Generic: SENSOR
HART output
1 Poll addr 0
2 Num req preams 0
3 Burst mode
4 Burst option
HELP SAVE HOME
Off: Sensor signals measured values only on request
On: Sensor signals measured values unrequested

Continuation HART®-menu plan – VEGASON 51K…53K

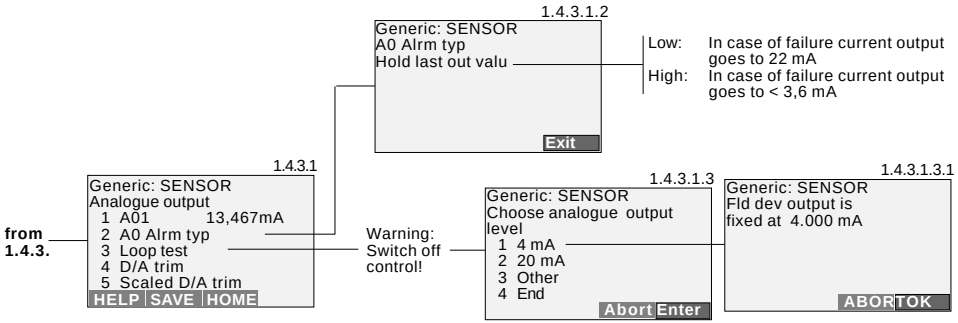
D



Available initialisation words:

..SOL	Meas. condition solid
..LIQ	Meas. condition liquid
..FED	Delete false echo memory
..FEN04.58M	False echo e.g. at 4.58 m create new
..FEN48.67FT	False echo e.g. at 48.67 ft create new
..FEU03.68M	Extend false echo memory: add a new false echo to the false echo memory at 3.68 m
..FEU36.05FT	add a new false echo to the false echo memory at 36.05 ft

Note:
After the adjustment of the initialisation word, press "ENTER" and then "SEND".
Confirm the message to change over to manual operation with "OK" and the message to switch over to automatic operation again with "OK".
Only then is the adjustment written in the sensor and effective.



VEGA

VEGA Grieshaber KG
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The statements on types, application, use and operating conditions of the sensors and processing systems correspond to the actual knowledge at the date of printing.

Technical data subject to alteration.

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