Operating Instructions

Capacitive cable electrode for continuous level measurement

VEGACAL 66

Profibus PA

Document ID: 30037

Contents

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1 About this document

1.1 Function

This instruction provides all the information you need for mounting, connection and setup as well as important instructions for maintenance, fault rectification, the exchange of parts and the safety of the user. Please read this information before putting the instrument into operation and keep this manual accessible in the immediate vicinity of the device.

1.2 Target group

This operating instructions manual is directed to trained personnel. The contents of this manual must be made available to the qualified personnel and implemented.

1.3 Symbols used

Document ID
This symbol on the front page of this instruction refers to the Document ID. By entering the Document ID on www.vega.com you will reach the document download.

Information, note, tip: This symbol indicates helpful additional information and tips for successful work.

Note: This symbol indicates notes to prevent failures, malfunctions, damage to devices or plants.

Caution: Non-observance of the information marked with this symbol may result in personal injury.

Warning: Non-observance of the information marked with this symbol may result in serious or fatal personal injury.

Danger: Non-observance of the information marked with this symbol results in serious or fatal personal injury.

Ex applications
This symbol indicates special instructions for Ex applications.

List
The dot set in front indicates a list with no implied sequence.

1 Sequence of actions
Numbers set in front indicate successive steps in a procedure.

Disposal
This symbol indicates special instructions for disposal.

2 For your safety

2.1 Authorised personnel

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

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

2.2 Appropriate use

VEGACAL 66 is a sensor for continuous level measurement.

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

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

2.3 Warning about incorrect use

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

2.4 General safety instructions

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

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

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

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

2.5 Conformity

The device complies with the legal requirements of the applicable country-specific directives or technical regulations. We confirm conformity with the corresponding labelling.

The corresponding conformity declarations can be found on our homepage.

2.6 NAMUR recommendations

NAMUR is the automation technology user association in the process industry in Germany. The published NAMUR recommendations are accepted as the standard in field instrumentation.

The device fulfils the requirements of the following NAMUR recommendations:

- NE 21 – Electromagnetic compatibility of equipment
- NE 43 – Signal level for fault information from measuring transducers
- NE 53 – Compatibility of field devices and display/adjustment components

For further information see www.namur.de.

2.7 Installation and operation in the USA and Canada

This information is only valid for USA and Canada. Hence the following text is only available in the English language.

Installations in the US shall comply with the relevant requirements of the National Electrical Code (NEC - NFPA 70) (USA).

Installations in Canada shall comply with the relevant requirements of the Canadian Electrical Code (CEC Par I) (Canada).

2.8 Safety instructions for Ex areas

For applications in explosion-proof areas (Ex), only devices with corresponding Ex approval may be used. Observe the Ex-specific safety instructions. These are an integral part of the operating instructions and are enclosed with every device with Ex approval.

2.9 Environmental instructions

Protection of the environment is one of our most important duties. That is why we have introduced an environment management system with the goal of continuously improving company environmental protection. The environment management system is certified according to DIN EN ISO 14001.

Please help us fulfil this obligation by observing the environmental instructions in this manual:

- Chapter " *Packaging, transport and storage*"
- Chapter " *Disposal*"

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

● Level sensor VEGACAL 66

The further scope of delivery encompasses:

● Documentation
  – Operating instructions VEGACAL 66
  – Instructions for optional instrument features
  – Ex-specific " *Safety instructions*" (with Ex versions)
  – If necessary, further certificates

ℹ Information:
Optional instrument features are also described in this operating instructions manual. The respective scope of delivery results from the order specification.

Scope of this operating instructions

This operating instructions manual applies to the following instrument versions:

● Hardware from 1.0.0
● Software from 1.3.0
● Only for instrument versions without SIL qualification

Constituent parts

The VEGACAL 66 consists of the components:

● Process fitting with probe
● Housing with electronics
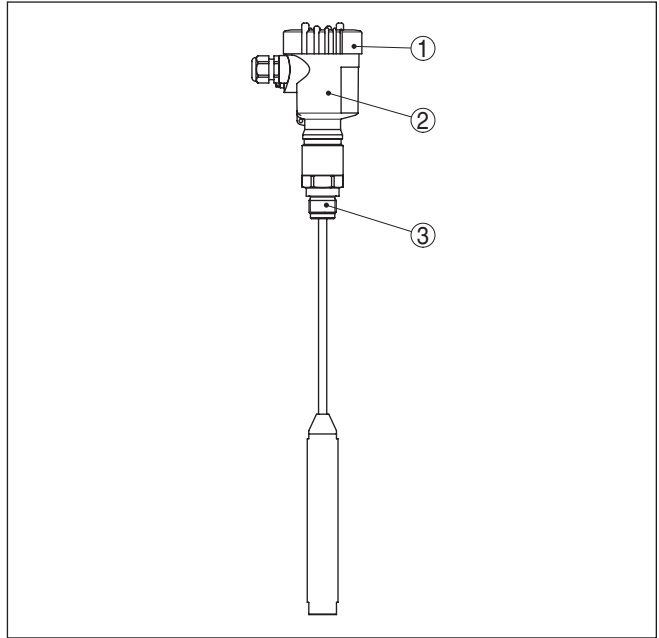● Housing cover, optionally available with display and adjustment module

Fig. 1: VEGACAL 66, cable version with plastic housing

1   Housing lid with integrated display and adjustment module (optional)
2   Housing with electronics
3   Process fitting

Type label

The type label contains the most important data for identification and use of the instrument:
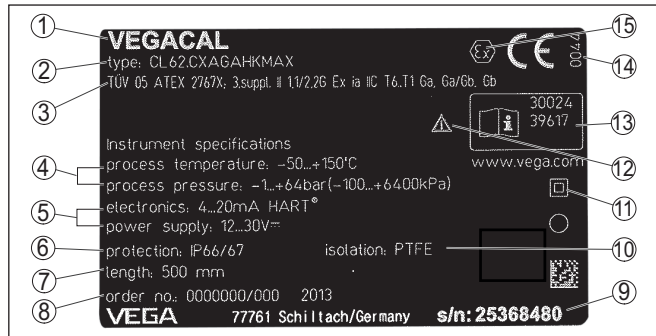
Fig. 2: Layout of the type label (example)

1 Instrument type
2 Product code
3 Approvals
4 Process and ambient temperature, process pressure
5 Power supply and signal output, electronics
6 Protection rating
7 Probe length
8 Order number
9 Serial number of the instrument
10 Material wetted parts
11 Symbol of the device protection class
12 Reminder to observe the instrument documentation
13 ID numbers, instrument documentation
14 Notified authority for CE marking
15 Approval directives

With the serial number, you can access the delivery data of the instrument via " www.vega.com", " *Search*". You can find the serial number on the inside of the instrument as well as on the type label on the outside.

Serial number - Instrument search

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

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

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

Alternatively, you can access the data via your smartphone:

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

3.2 Principle of operation

Application area

VEGACAL 66 is a level sensor for use in non-abrasive liquids and bulk solids.

The cable probe is fully insulated. The proven mechanical construction offers high functional safety.

Functional principle

Probe, measured product and vessel wall form an electrical capacitor. The capacitance is influenced by three main factors.
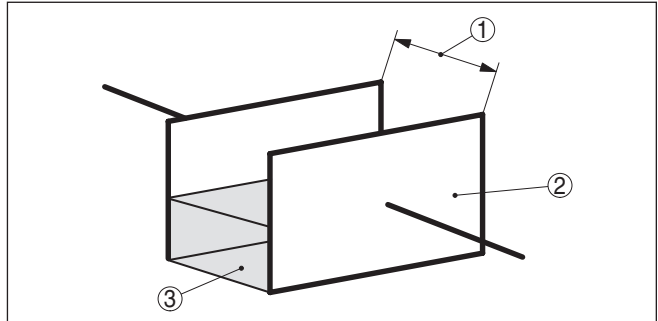

Fig. 3: Functional principle - Plate capacitor

1   Distance between the electrode surfaces
2   Size of the electrode surfaces
3   Type of dielectric between the electrodes

The probe and the vessel wall are the capacitor plates. The measured product and the insulation are the dielectric. Due to the higher dielectric constant of the insulation and the conductive product compared to air, the capacitance increases as the probe is gradually covered.

The capacitance as well as the resistance change are converted by the electronics module into a level-proportional signal.

Power supply and bus communication

Power supply via the Profibus DP/PA segment coupler or VEGALOG 571 EP cards. A two-wire cable according to Profibus specification serves as carrier of both power and digital data transmission for multiple sensors. The instrument profile of VEGACAL 66 corresponds to profile specification version 3.0.

The backlight of the display and adjustment module is powered by the sensor. Prerequisite is a certain level of operating voltage.

The data for power supply are specified in chapter " *Technical data*".

The optional heating requires its own operating voltage. You can find further details in the supplementary instructions manual " *Heating for display and adjustment module*".

This function is generally not available for approved instruments.

GSD/EDD

The GSD (instrument master files) and bitmap files necessary for planning your Profibus-DP-(PA) communication network are available from the download section on the VEGA homepage www.vega.com. There you can also find the appropriate certificates. In a PDM environment, an EDD (Electronic Device Description) is also required

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to enable the full range of sensor functions (also available as a download).A CD with the appropriate files can be ordered via e-mail under info@de.vega.com or by phone from one of the VEGA agencies under the order number "DRIVER.S".

3.3 Adjustment

The instrument can be adjusted with the following adjustment media:

● With the display and adjustment module
● with the suitable VEGA DTM in conjunction with an adjustment software according to the FDT/DTM standard, e.g. PACTware and PC
● with the adjustment program PDM

3.4 Packaging, transport and storage

Packaging

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test based on ISO 4180.

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions, PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Transport

Transport must be carried out in due consideration of the notes on the transport packaging. Nonobservance of these instructions can cause damage to the device.

Transport inspection

The delivery must be checked for completeness and possible transit damage immediately at receipt. Ascertained transit damage or concealed defects must be appropriately dealt with.

Storage

Up to the time of installation, the packages must be left closed and stored according to the orientation and storage markings on the outside.

Unless otherwise indicated, the packages must be stored only under the following conditions:

● Not in the open
● Dry and dust free
● Not exposed to corrosive media
● Protected against solar radiation
● Avoiding mechanical shock and vibration

Storage and transport temperature

● Storage and transport temperature see chapter " *Supplement - Technical data - Ambient conditions*"
● Relative moisture 20 … 85 %

Lifting and carrying

With instrument weights of more than 18 kg (39.68 lbs) suitable and approved equipment must be used for lifting and carrying.

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3.5 Accessories

The instructions for the listed accessories can be found in the download area on our homepage.

Display and adjustment module

The display and adjustment module is used for measured value indication, adjustment and diagnosis.

The integrated Bluetooth module (optional) enables wireless adjustment via standard adjustment devices.

VEGACONNECT

The interface adapter VEGACONNECT enables the connection of communication-capable instruments to the USB interface of a PC.

VEGADIS 81

The VEGADIS 81 is an external display and adjustment unit for VEGA plics® sensors.

VEGADIS 82

VEGADIS 82 is suitable for measured value indication and adjustment of sensors with HART protocol. It is looped into the 4 … 20 mA/HART signal cable.

PLICSMOBILE T81

The PLICSMOBILE T81 is an external GSM/GPRS/UMTS radio unit for transmission of measured values and for remote parameter adjustment of HART sensors.

External housing

If the standard sensor housing is too big or in case of strong vibrations, an external housing can be used.

Then the sensor housing is made of stainless steel. The electronics is located in the external housing which can be mounted in a distance of up to 10 m (32.8 ft) to the sensor by using a connection cable.

Three different external sensor housings are available.
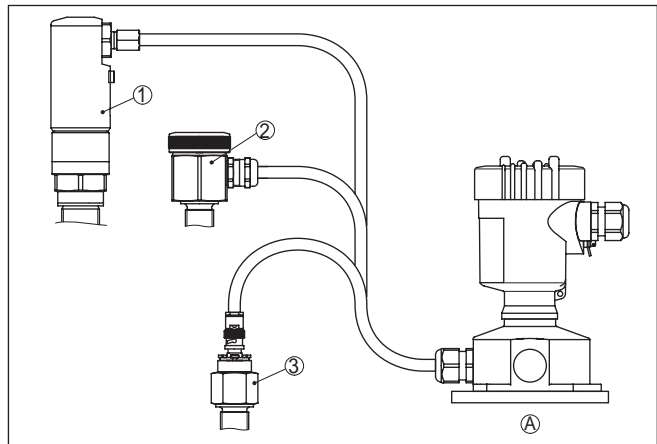
Fig. 4: External housing

A   Instrument housing
1   Sensor housing, stainless steel (316L), IP68 (10 bar)
2   Sensor housing, stainless steel (316L), IP67
3   Sensor housing, stainless steel (316L), BNC plug IP54

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Protective cover   The protective cover protects the sensor housing against soiling and
                              intense heat from solar radiation.

Flanges   Screwed flanges are available in different versions according to the
                              following standards: DIN 2501, EN 1092-1, BS 10, ASME B 16.5,
                              JIS B 2210-1984, GOST 12821-80.

4 Mounting

4.1 General instructions

Process conditions

Note:
For safety reasons, the instrument must only be operated within the permissible process conditions. You can find detailed information on the process conditions in chapter " *Technical data*" of the operating instructions or on the type label.

Hence make sure before mounting that all parts of the instrument exposed to the process are suitable for the existing process conditions.

These are mainly:

● Active measuring component
● Process fitting
● Process seal

Process conditions in particular are:

● Process pressure
● Process temperature
● Chemical properties of the medium
● Abrasion and mechanical influences

Installation position

Select an installation position you can easily reach for mounting and connecting as well as later retrofitting of a display and adjustment module. The housing can be rotated by 330° without the use of any tools. You can also install the display and adjustment module in four different positions (each displaced by 90°).

Screwing in

Devices with threaded fitting are screwed into the process fitting with a suitable wrench via the hexagon.

See chapter " *Dimensions*" for wrench size.

Warning:
The housing or the electrical connection may not be used for screwing in! Depending on the device version, tightening can cause damage, e. g. to the rotation mechanism of the housing.

Welding work

Before beginning the welding work, remove the electronics module from the sensor. By doing this, you avoid damage to the electronics through inductive coupling.

Ground the probe before welding directly on the rod or cable.

Handling

With threaded versions, the housing must not be used to screw in the instrument! Applying tightening forces on the housing can damage its internal parts.

Use the hexagon for screwing in.

Protection against moisture

Use the recommended cables (see chapter " *Connecting to power supply*") and tighten the cable gland.

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You can give your instrument additional protection against moisture penetration by leading the connection cable downward in front of the cable gland. Rain and condensation water can thus drain off. This applies mainly to outdoor mounting as well as installation in areas where high humidity is expected (e.g. through cleaning processes) or on cooled or heated vessels.

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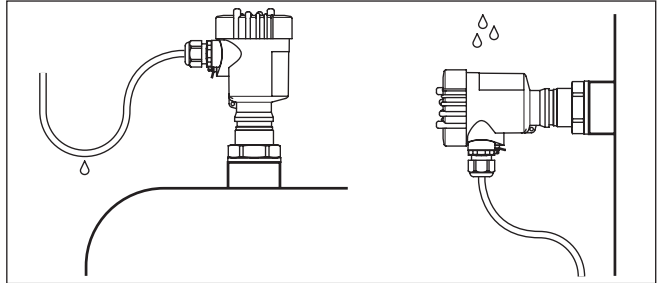

Fig. 5: Measures against moisture ingress

Pressure/Vacuum

The process fitting must be sealed if there is gauge or low pressure in the vessel. Before use, check if the sealing material is resistant against the measured product and the process temperature.

The max. permissible pressure is specified in chapter " *Technical data*" or on the type label of the sensor.

Insulating measures, such as e.g. covering the thread with teflon tape, can interrupt the necessary electrical connection with metal vessels. For this reason, ground the probe on the vessel or use a conductive seal material.

Vessel material

Metal vessel
Make sure that the mechanical connection of the probe to the vessel is electrically conductive to ensure sufficient grounding.

Use conductive seals, such as those made of copper or lead, etc. Insulating measures, such as covering the thread with Teflon tape, can interrupt the necessary electrical connection with metal vessels. For this reason, ground the probe on the vessel or use a conductive seal material.

Non-conductive vessels
In non-conductive vessels, e.g. plastic tanks, the second pole of the capacitor must be provided separately.

Vessel shapes

If possible, the capacitive probe should be mounted vertically or parallel to the counter electrode. This applies particularly to applications in non-conductive products.

In cylindrical tanks, spherical tanks or other asymmetrical tank forms, nonlinear level values are generated due to the varying distance to the vessel wall.

Use a concentric tube in non-conductive products or linearize the meas. signal.

Condensation

If condensate forms on the vessel top, the run-off liquid can cause bridging and hence measurement errors.

For this reason, use a screening tube . The length of the screening tube depends on the amount of condensate and the drain-off behaviour of the product.

Cable entries - NPT thread
Cable glands

Metric threads
In the case of instrument housings with metric thread, the cable glands are screwed in at the factory. They are sealed with plastic plugs as transport protection.

You have to remove these plugs before electrical connection.

NPT thread
In the case of instrument housings with self-sealing NPT threads, it is not possible to have the cable entries screwed in at the factory. The free openings for the cable glands are therefore covered with red dust protection caps as transport protection.

Prior to setup you have to replace these protective caps with approved cable glands or close the openings with suitable blind plugs.

4.2 Mounting instructions

Installation position

During operation, the probe must not touch any installations or the vessel wall. The measured value can also change if the distance to the vessel wall changes considerably. If necessary, secure the end of the probe (insulated).

Depending on the size of the process fitting there is either a thread (M12), e.g. for a ring bolt or a hole for the steel cable in the gravity weight. The gravity weight is isolated from the measuring cable.

Make sure that the probe cable is not completely taut. Avoid tensile loads on the cable.
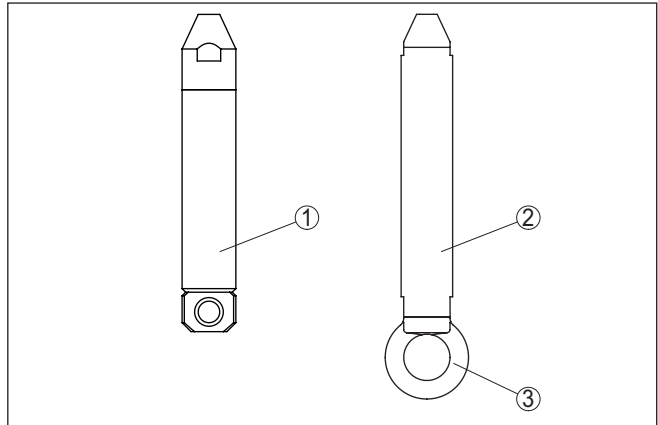
Fig. 6: Fasten the probe

1   Gravity weight - Process fitting thread ≤ 2", flange ≤ DN 50
2   Gravity weight - Process fitting thread > 2", flange > DN 50
3   Eyelet M12

In vessels with conical bottom it can be advantageous to mount the sensor in the centre of the vessel, as measurement is then possible down to the bottom.

Caution:
It is not possible to measure on the gravity weight. The measuring range of the probe ends at the upper edge of the gravity weight.

Inflowing medium

If the instrument is mounted in the filling stream, unwanted false measurement signals can be generated. For this reason, mount the instrument at a position in the vessel where no disturbances, e.g. from filling openings, agitators, etc., can occur.

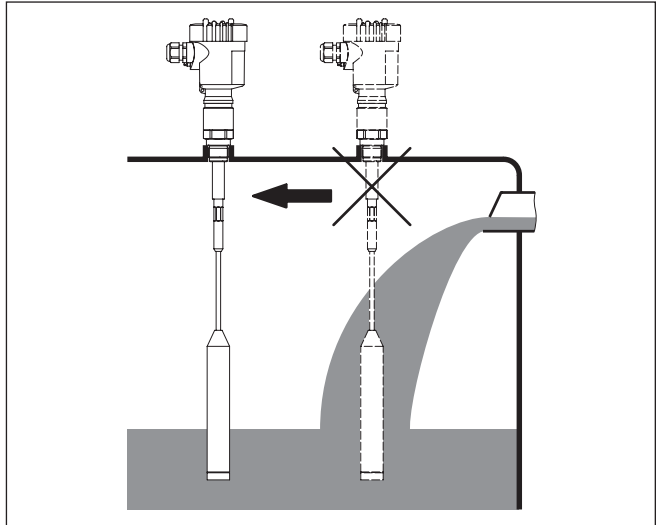This applies particularly to instrument versions with a longer probe.

Fig. 7: Inflowing medium

5   Connecting to power supply

5.1   Preparing the connection

Safety instructions   Always keep in mind the following safety instructions:

● Carry out electrical connection by trained, qualified personnel authorised by the plant operator
● If overvoltage surges are expected, overvoltage arresters should be installed

⚠ **Warning:**
Only connect or disconnect in de-energized state.

Voltage supply   The voltage supply is provided by a Profibus DP /PA segment coupler.

The voltage supply range can differ depending on the instrument version. You can find the data for voltage supply in chapter " *Technical data*".

Connection cable   Connection is made with shielded cable according to the Profibus specification. Power supply and digital bus signal are carried over the same two-wire connection cable.

Use cable with round cross section for instruments with housing and cable gland. To ensure the seal effect of the cable gland (IP protection rating), find out which cable outer diameter the cable gland is suitable for.

Use a cable gland fitting the cable diameter.

Make sure that the entire installation is carried out according to the Profibus specification. In particular, make sure that the bus is terminated with suitable terminating resistors.

You can find detailed information of the cable specification, installation and topology in the " *Profibus PA - User and Installation Guideline*" on www.profibus.com.

Cable glands   **Metric threads:**
In the case of instrument housings with metric thread, the cable glands are screwed in at the factory. They are sealed with plastic plugs as transport protection.

ⓘ **Note:**
You have to remove these plugs before electrical connection.

NPT thread:
In the case of instrument housings with self-sealing NPT threads, it is not possible to have the cable entries screwed in at the factory. The free openings for the cable glands are therefore covered with red dust protection caps as transport protection.

ⓘ **Note:**
Prior to setup you have to replace these protective caps with approved cable glands or close the openings with suitable blind plugs.

On plastic housings, the NPT cable gland or the Conduit steel tube must be screwed into the threaded insert without grease.

Max. torque for all housings, see chapter " *Technical data*".

Cable screening and grounding

Make sure that the cable screen and grounding are carried out according to Fieldbus specification. We recommend to connect the cable screening to ground potential on both ends.

In systems with potential equalisation, connect the cable screening directly to ground potential at the power supply unit, in the connection box and at the sensor. The screen in the sensor must be connected directly to the internal ground terminal. The ground terminal outside on the housing must be connected to the potential equalisation (low impedance).

5.2 Connection procedure

Proceed as follows:

1. Unscrew the housing lid
2. If a display and adjustment module is installed, remove it by turning it to the left
3. Loosen compression nut of the cable gland and remove blind plug
4. Remove approx. 10 cm (4 in) of the cable mantle, strip approx. 1 cm (0.4 in) of insulation from the ends of the individual wires
5. Insert the cable into the sensor through the cable entry
6. Lift the opening levers of the terminals with a screwdriver (see following illustration)
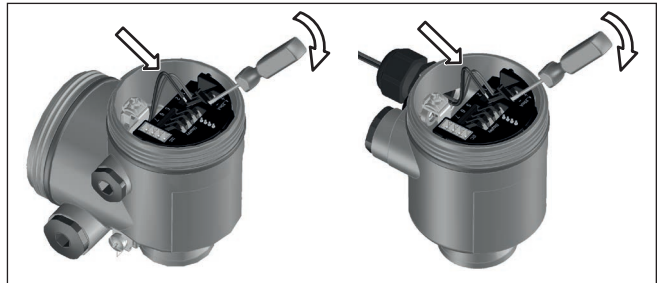7. Insert the wire ends into the open terminals according to the wiring plan

Fig. 8: Connection steps 6 and 7

8. Press down the opening levers of the terminals, you will hear the terminal spring closing
9. Check the hold of the wires in the terminals by lightly pulling on them
10. Connect the shielding to the internal ground terminal, connect the external ground terminal to potential equalisation

11. Tighten the compression nut of the cable entry gland. The seal ring must completely encircle the cable

12. Screw the housing lid back on

The electrical connection is finished.

5.3 Wiring plan - single chamber housing

The following illustrations apply to the non-Ex as well as to the Ex-ia version.
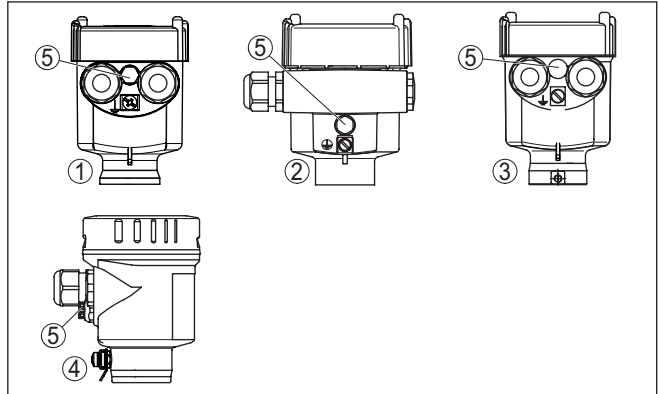
Housing overview

Fig. 9: Material versions, single chamber housing

1   Plastic
2   Aluminium
3   Stainless steel (precision casting)
4   Stainless steel (electro-polished)
5   Filter element for air pressure compensation of all material versions. Blind plug with version IP66/IP68 (1 bar) for Aluminium and stainless steel

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Electronics and connection compartment

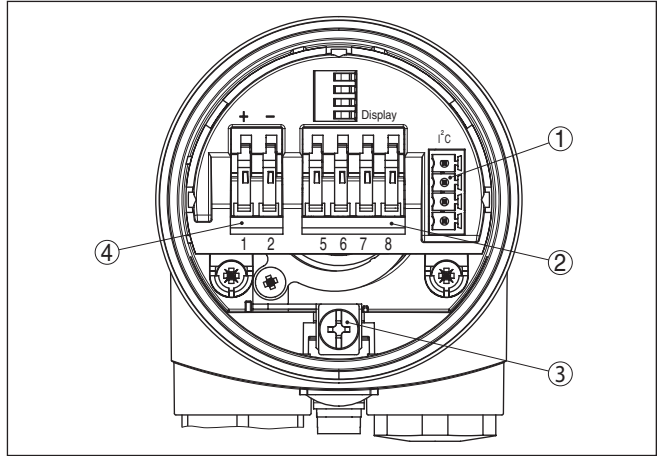*Fig. 10: Electronics and connection compartment - single chamber housing*

1   Plug connector for VEGACONNECT (I²C interface)
2   Spring-loaded terminals for connection of the external indication VEGADIS 81
3   Ground terminal for connection of the cable screening
4   Spring-loaded terminals for voltage supply
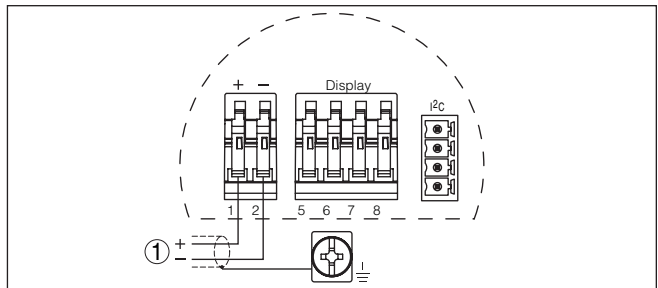
Wiring plan

Fig. 11: Wiring plan - single chamber housing
1   Voltage supply, signal output

5.4   Wiring plan - double chamber housing

The following illustrations apply to the non-Ex as well as to the Ex-ia version.

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Housing overview

Fig. 12: Double chamber housing

1 Housing cover - connection compartment
2 Blind plug or M12 x 1 connection plug VEGADIS 81 (optional)
3 Housing cover - electronics compartment
4 Filter element for air pressure compensation
5 Cable gland

Electronics compartment

Fig. 13: Electronics compartment - double chamber housing

1 Plug connector for VEGACONNECT (I²C interface)
2 Internal connection cable to the connection compartment
3 Terminals for VEGADIS 81

Connection compartment

Fig. 14: Connection compartment - double chamber housing

1 Spring-loaded terminals for voltage supply
2 Plug connector for service (I²C interface)
3 Ground terminal for connection of the cable screening

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Wiring plan

Fig. 15: Wiring plan - double chamber housing

1   Voltage supply, signal output

5.5   Wiring plan - Ex d double chamber housing
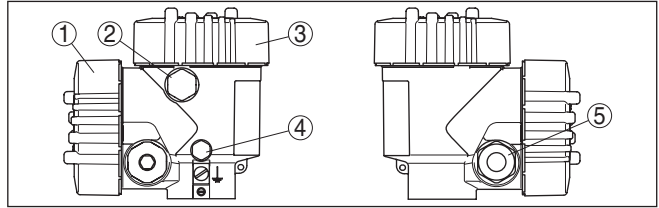
Housing overview
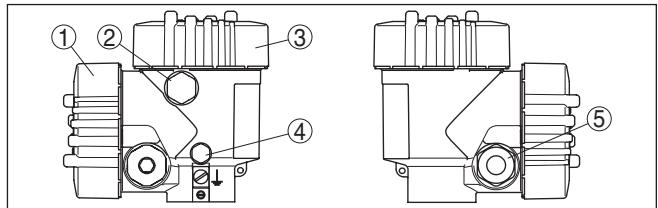
Fig. 16: Double chamber housing

1   Housing cover - connection compartment
2   Blind plug or M12 x 1 connection plug VEGADIS 81 (optional)
3   Housing cover - electronics compartment
4   Filter element for air pressure compensation
5   Cable gland

Electronics compartment
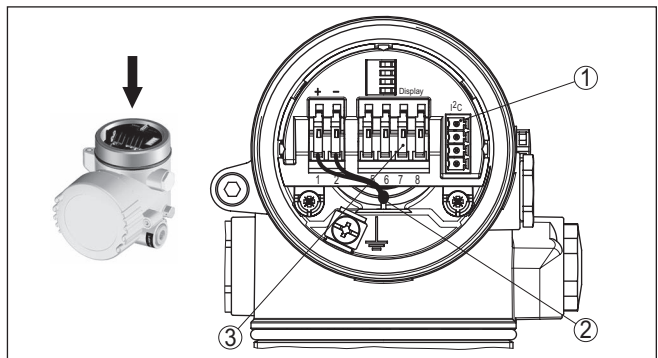
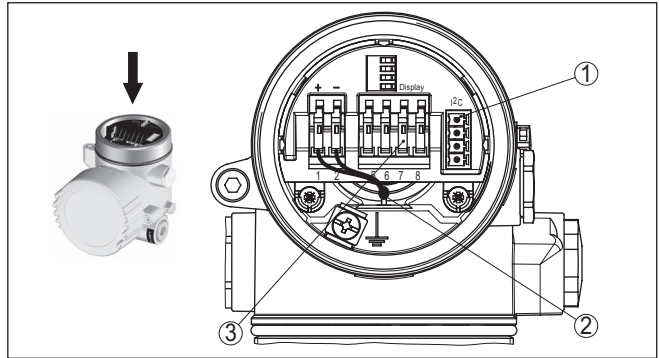*Fig. 17: Electronics compartment - double chamber housing*

1   Plug connector for VEGACONNECT (I²C interface)
2   Internal connection cable to the connection compartment
3   Terminals for VEGADIS 81

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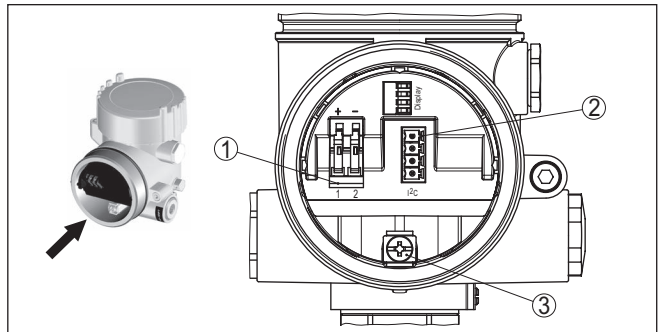
Connection compartment

Fig. 18: Connection compartment - Ex d ia double chamber housing

1   Spring-loaded terminals for power supply and cable screen
2   Ground terminal for connection of the cable screening

Wiring plan
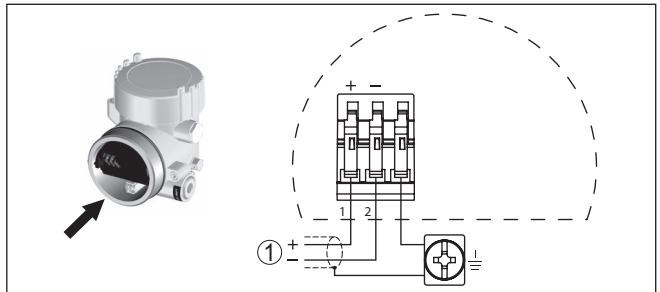
Fig. 19: Wiring plan - Ex d ia double chamber housing

1   Voltage supply, signal output

5.6   Wiring plan - version IP66/IP68 (1 bar)

Wire assignment, connection cable
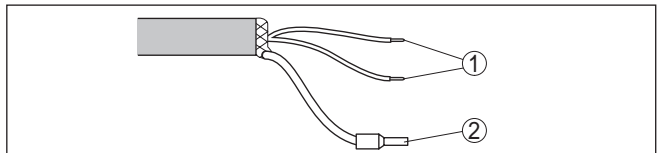
Fig. 20: Wire assignment, connection cable

1   Brown (+) and blue (-) to power supply or to the processing system
2   Shielding

6 Set up with the display and adjustment module PLICSCOM

6.1 Short description

Function/Configuration

The display and adjustment module is used for measured value display, adjustment and diagnosis. It can be mounted in the following housing versions and instruments:

● All sensors of the plics® instrument family, in the single as well as in the double chamber housing (optionally in the electronics or connection compartment)
● External display and adjustment unit VEGADIS 61

6.2 Insert display and adjustment module

Mount/dismount display and adjustment module

The display and adjustment module can be inserted into the sensor and removed again at any time. It is not necessary to interrupt the voltage supply.

Proceed as follows:

1. Unscrew the housing lid
2. Place the display and adjustment module in the desired position on the electronics (four positions in 90° offset can be selected) and turn to the right until it clicks into place.
3. Screw housing lid with inspection window tightly back on

Disassembly is carried out in reverse order.

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

Fig. 21: Insert display and adjustment module in the single chamber housing

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

6.3 Adjustment system
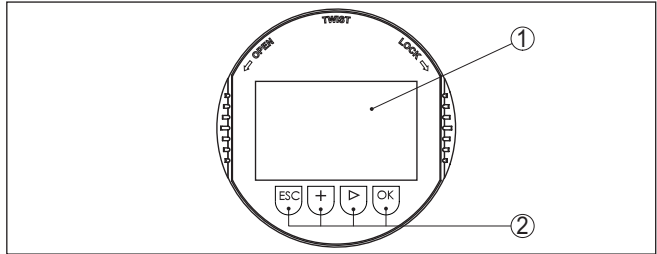
Fig. 22: Display and adjustment elements

1 LC display
2 Indication of the menu item number
3 Adjustment keys

Key functions

● **[OK]** key:
  – Move to the menu overview
  – Confirm selected menu
  – Edit parameter
  – Save value

● **[->]** key to select:
  – Menu change
  – Select list entry
  – Select editing position

● **[+]** key:
  – Change value of the parameter

● **[ESC]** key:
  – Interrupt input
  – Jump to next higher menu

Adjustment system

The instrument is operated via the four keys of the display and adjustment module. The individual menu items are shown on the LC display. You can find the function of the individual keys in the previous illustration.

Time functions

When the **[+]** and **[->]** keys are pressed quickly, the edited value, or the cursor, changes one value or position at a time. If the key is pressed longer than 1 s, the value or position changes continuously.

When the **[OK]** and **[ESC]** keys are pressed simultaneously for more than 5 s, the display returns to the main menu. The menu language is then switched over to " *English*".

VEGA

Approx. 60 minutes after the last pressing of a key, an automatic reset to measured value indication is triggered. Any values not confirmed with *[OK]* will not be saved.

6.4 Setup steps

Switch-on phase

After VEGACAL 66 is connected to voltage supply or after voltage recurrence, the instrument carries out a self-check for approx. 30 seconds. The following steps are carried out:

● Internal check of the electronics
● Indication of the instrument type, the firmware as well as the sensor TAGs (sensor designation)
● Status byte goes briefly to fault value

Then the current measured value will be displayed and the corresponding digital output signal will be output to the cable. [1]

Basic adjustment - Sensor address

Level and pressure sensors operate as slaves on the Profibus PA. To be identified as a bus participant, each sensor must have a unique address. Each instrument is delivered with address 126. With this address, it can at first be connected to an existing bus. However, the address must be changed. This can be done in this menu item.

```
Sensor address


126
```
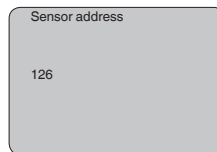
Parameter adjustment

VEGACAL 66 measures the capacitance of the respective product. To display the actual level of the product, an allocation of the measured capacitance to the percentage height must be carried out. For this adjustment, the capacitance is entered with emptied and filled vessel.

If the vessel cannot be emptied or filled completely, you can carry out the adjustment also with two known levels - for example with 10 % and 90 %. The difference between the empty and full adjustment values should be as large as possible.

The actual level can then be calculated on the basis of these settings.

VEGACAL 66 must be installed. A change of level is necessary for this adjustment.

In the main menu item " *Basic adjustment*", the individual submenu items should be selected one after the other and provided with the correct parameter values.

Tip:
If the display and adjustment module remains on the probe as a display, we recommend saving the sensor data in the display and adjustment module.

Use the function "Copy sensor data".

---

[1] The values correspond to the actual measured level as well as to the settings already carried out, e.g. default setting.

VEGACAL 66 • Profibus PA

Start your parameter adjustment with the following menu items of the basic adjustment:

Carry out min. adjustment   To be on the safe side, note the adjustment values for full and empty. If an adjustment procedure fails, it is not necessary to again carry out a level change.

These values can be helpful if the electronics has to be exchanged.

	%	Value
Empty adjustment		
Full adjustment		

Tab. 1: Adjustment protocol

> ● **Tip:**
> ▮ For min. adjustment the vessel should be as empty as possible, and for max. adjustment, as full as possible. If the vessel is already full, start with max. adjustment.

> ● **Note:**
> ▮ If possible, the vessel should be as empty as possible for min. adjustment.

Proceed as follows:

1. Move from the measured value display to the main menu by pushing *[OK]*.

> Basic adjustment
> Display
> Diagnostics
> Service
> Info
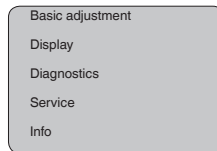
2. Select the menu item " *Basic adjustment*" with *[->]* and confirm with *[OK]*. Now the menu item " *Min. adjustment*" is displayed.
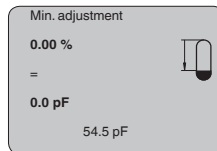
> Min. adjustment
> **0.00 %**
> =
> **0.0 pF**
>   54.5 pF

3. Prepare the adjustment value for editing with *[OK]*. Move to the selection window with *[OK]*.

> Min. adjustment
> Accept current measured value?
>
> **Accept?**
> **Edit?**
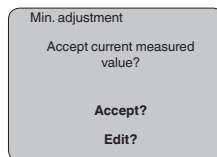
4. Accept the current measured value or move to the editing window with "Edit". To edit, set the cursor to the requested position with

[->]. Set the requested % value with *[+]* and save with *[OK]*. The cursor jumps to the capacitance value.

5. Enter the current capacitance value in pF (displayed below) for the empty vessel corresponding to the percentage value.

6. Save the settings with *[OK]* and move to "Max. adjustment" with *[->]*.

Carry out max. adjust-ment

Fill the vessel to the highest possible level.

ℹ **Note:**
For max. adjustment, the vessel should be as full as possible. This will make the calibration more accurate.

Proceed as follows:

```
Max. adjustment
100.00 %
=
1000 pF
          327.4 pF
```

1. Prepare the adjustment value for editing with *[OK]*. Move to the selection window with *[OK]*.

```
Min. adjustment
   Accept current measured
          value?

       Accept?

        Edit?
```
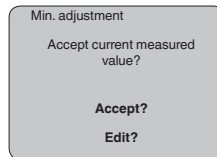
2. Accept the current measured value or move to the editing window with "Edit". To edit, set the cursor to the requested position with *[->]*. Set the requested % value with *[+]* and save with *[OK]*. The cursor jumps to the capacitance value.
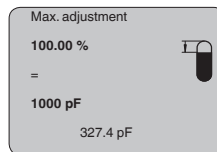
3. Enter the current capacitance value in pF (displayed below) for the full vessel corresponding to the percentage value.

4. Save the settings with *[OK]*.

Basic adjustment - Lin-earization curve

A linearization is necessary for all vessels in which the vessel volume does not increase linearly with the level - e.g. a horizontal cylindri-cal or spherical tank - and the indication or output of the volume is required. Corresponding linearization curves are preprogrammed for these vessels. They represent the correlation between the level percentage and vessel volume.

The linearisation applies to the measured value indication and the current output. By activating the appropriate curve, the volume per-centage of the vessel is displayed correctly. If the volume should not be displayed in percent but e.g. in l or kg, a scaling can be also set in the menu item " *Display*".
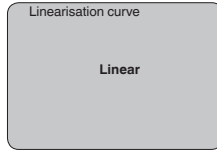
Linearisation curve

Linear

Enter the requested parameters via the appropriate keys, save your settings and jump to the next menu item with the *[->]* key.

⚠ **Caution:**
Note the following if the VEGACAL 66 with corresponding approval is used as part of an overfill protection system according to WHG (Water Resources Act):

If a linearisation curve is selected, the measuring signal is no longer necessarily linear to the filling height. This must be considered by the user especially when setting the switching point on the level switch.

Basic adjustment - Channel

The channel is the input selector switch for function block (FB) of the sensor. Within the function block, additional scalings (Out-Scale) are carried out. In this menu item, the value fir the function block is selected:

● SV1 (Secondary Value 1):
  – Percent with radar, guided microwave and ultrasonic sensors
  – Pressure or height with pressure transmitters
● SV2 (Secondary Value 2):
  – Distance with radar, guided microwave and ultrasonic sensors
  – Percent with pressure transmitters
● PV (Primary Value):
  – Linearised percentage value

Channel

PV lin. value
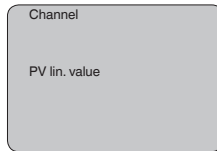
Basic adjustment - Damping

To suppress fluctuations in the measured value display, e. g. caused by an agitated medium surface, a damping can be set. This time can be between 0 and 999 seconds. Keep in mind that the reaction time of the entire measurement will then be longer and the sensor will react to measured value changes with a delay. In general, a period of a few seconds is sufficient to smooth the measured value display.
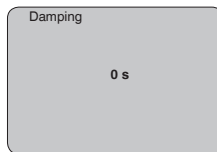
Damping

0 s

Enter the requested parameters via the appropriate keys, save your settings and jump to the next menu item with the *[->]* key.

Basic adjustment - Sensor TAG

In this menu item you can enter an unambiguous designation for the sensor, e.g. the measurement loop name or the tank or product designation. In digital systems and in the documentation of larger plants, a singular designation should be entered for exact identification of individual measuring points.

```
Sensor-TAG


        Sensor

```
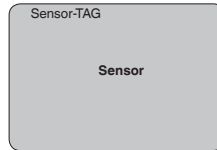
With this menu item, the Basic adjustment is finished and you can now jump to the main menu with the *[ESC]* key.

Menu section, display

Display - Indicated value

Radar, guided microwave and ultrasonic sensors deliver the following measured values:

● SV1 (Secondary Value 1): Percentage value after the adjustment
● SV2 (Secondary Value 2): Distance value before the adjustment
● PV (Primary Value): Linearised percentage value
● PA-Out (value after passing the function block): PA output

A pressure transmitter delivers the following measured values:

● SV1 (Secondary Value 1): Pressure or height value before adjustment
● SV2 (Secondary Value 2): Percentage value after the adjustment
● PV (Primary Value): Linearised percentage value
● PA-Out (value after passing the function block): PA output
● Temperature

In the menu item " *Display*" you can define which value should be indicated on the display.

```
Displayed value

PA-Out

```
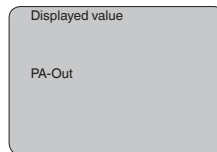
Display - Backlight

A background lighting integrated by default can be adjusted via the adjustment menu. The function depends on the height of the supply voltage. See " *Technical data/Voltage supply*".

To maintain the function of the device, the lighting is temporarily switched off if the power supply is insufficient.

```
Backlight

```

VEGACAL 66 • Profibus PA

In the default setting, the lightning is switched off.

Diagnosis - Peak indica-tor

The respective min. and max. measured values are saved in the sensor. The values are displayed in the menu item " *Peak indicator*".

● Min. and max. distance in m(d)
● Min. and max. temperature

```
Peak indicator
```
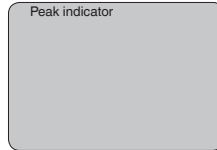
Diagnostics - Device status

The instrument status is displayed in this menu item. If no failure is detected by the sensor, " *OK*" will be displayed. If a failure is detected, there will be a sensor-specific flashing fault signal, for example " *E013*". The failure is also displayed in clear text, for example " *No measured value available*".

● **Information:**
The fault message as well as the clear text indication are also carried out in the measured value display.

```
Measurement reliability

Device status
```
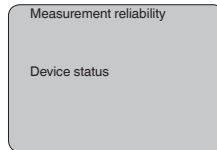
Trend recording

Up to 3000 measured values are recorded (depending on the sensor) when starting a " **Trend curve**". Then the values can be displayed on a time axis. The oldest measured values are always deleted.

The measured values displayed are in the unit pF.

```
Trend recording

Presentation of the trend
curve
```
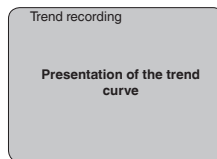
● **Information:**
The trend recording is not activated when being shipped. It must be started by the user via the menu item " *Start trend curve*".

Service - Additional PA value

Profibus transmits two values cyclically. The first value is determined in the menu item " *Channel*". The selection of the additional cyclical value is made in the menu item " *Additional PA value*".

The following values are available with radar, guided microwave and ultrasonic sensors:

● SV1 (Secondary Value 1): Percentage value after the adjustment

● SV2 (Secondary Value 2): Distance value before the adjustment
● PV (Primary Value): Linearised percentage value

With pressure transmitters the following values are available:

● SV1 (Secondary Value 1): Pressure or height value before adjustment
● SV2 (Secondary Value 2): Percentage value after the adjustment
● PV (Primary Value): Linearised percentage value

Additional PA value
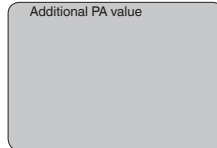
Service - Determine Out-Scale

Here, you determine the unit and scaling for PA-Out. These settings also apply to the values displayed on the display and adjustment module if in the menu item " *Displayed value*" PA-Out was selected.

The following displayed values are available in "Out-Scale unit":

● Pressure (only with pressure transmitters)
● Height
● Ground
● Flow
● Volume
● Others (no unit, %, mA)

In the menu item " *PV-Out-Scale*", the requested numerical value with decimal point is entered for 0 % and 100 % of the measured value.

Out-Scale-Unit

PV-Out-Scale
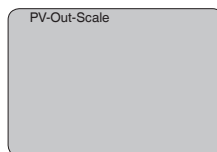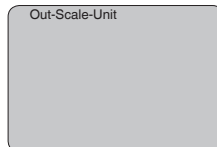
Service - Simulation

In this menu item you simulate a user-defined level or pressure value via the current output. This allows you to test the signal path, e.g. through connected indicating instruments or the input card of the control system.

The following simulation variables are available:

● Percent
● Current
● Pressure (with pressure transmitters)
● Distance (with radar and guided radar (GWR))

With Profibus PA sensors, the selection of the simulated value is made via the "Channel" in the menu " *Basic adjustments*".

How to start the simulation:

1. Push *[OK]*
2. Select the requested simulation variable with *[->]* and confirm with *[OK]*.
3. Set the requested numerical value with *[+]* and *[->]*.
4. Push *[OK]*

The simulation is now running, with 4 … 20 mA/HART a current is output and with Profibus PA or Foundation Fieldbus a digital value.

How to interrupt the simulation:

→ Push *[ESC]*

Information:
The simulation is automatically terminated 10 minutes after the last pressing of a key.

> Simulation
>
> Start simulation?
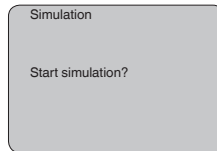
Reset

Basic adjustment
If the function " *Reset*" is carried out, the sensor resets all settings to default.

The following values will be reset:

Function	Reset value
Max. adjustment	3000 pF
Min. adjustment	0 pF
Damping ti	0 s
Linearisation	Linear
Sensor-TAG	Sensor
Display	PA-Out 1
Channel (PV)	lin %
Additional PA value (PV)	lin %
Out-Scale-Unit	%
PV Out-Scale	0.00 lin-% = 0.0 % 100.0 lin-% = 100 %

Information:
All additional settings are reset to the standard values of the Profibus PA specification.

Special parameters
All special parameters are reset to delivery status.

Peak indicator
The min. and max. values are reset to the actual value.

Service - Language   The sensor is already set to the ordered national language. In this menu item you can change the language. The following languages are available as of software version 3.50:

• Deutsch
• English
• Français
• Espanõl
• Pycckuu
• Italiano
• Netherlands
• Japanese
• Chinese

```
Language

German
```
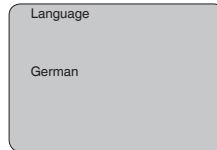
Copy sensor data   With this function

• Load parameter adjustment data from the sensor into the display and adjustment module
• Write parameter adjustment data from the display and adjustment module into the sensor

The data are permanently saved in an EEPROM memory in the display and adjustment module and remain there even in case of power failure. From there, they can be written into one or several sensors or kept as backup for a possible sensor exchange.

The type and the volume of the copied data depend on the respective sensor.

> **Information:**
> Before data are written into the sensor, a check is carried out to determine whether the data fit the sensor. If the data do not fit, a fault signal is triggered or the function is blocked. When writing data into the sensor, you will see which instrument type the data originate from and which TAG number this sensor had.

The following items are checked:

• Software version
• WHG approval
• SIL activated
• Measuring principle
• Signal output

> Copy sensor data
>
> Copy sensor data?
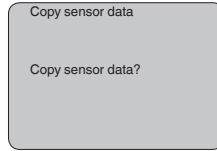
Service - PIN   In this menu item, the PIN is activated/deactivated permanently.
Entering a 4-digit PIN protects the sensor data against unauthorized
access and unintentional modifications. If the PIN is activated perma-
nently, it can be deactivated temporarily (i.e. for approx. 60 min.) in
any menu item. The instrument is delivered with the PIN set to 0000.

> PIN
>
> Activate permanently?
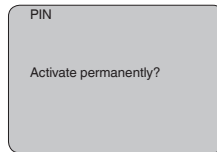
Only the following functions are permitted with activated PIN:

● Select menu items and show data
● Read data from the sensor into the display and adjustment module

Info   In this menu item the most important sensor information can be
displayed:

● Instrument type
● Serial number: 8-digit number, e.g. 12345678

> Instrument type
>
> Serial number
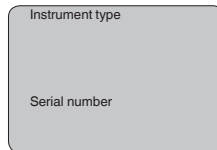
● Date of manufacture: Date of the factory calibration
● Software version: Edition of the sensor software

> Date of manufacture
>
> Software version
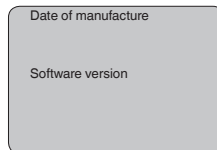
● Date of last change using PC: Date of the last change of sensor
  parameters via PC

> Last change using PC
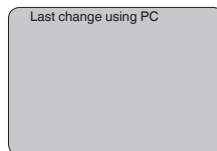
- Sensor details, e.g. approval, process fitting, seal, measuring cell, measuring range, electronics, housing, cable entry, plug, cable length etc.

```
Sensor characteristics


      Display now?
```
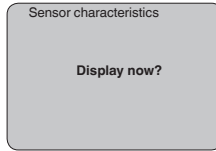
6.5 Menu schematic

Basic adjustment

```
Basic adjustment     1
Display
Diagnostics
Service
Info
```

```
Sensor address     1.1


      000
```

```
Min. adjustment     1.2
0.00 %
=
0.0 pF
82.5 pF
```

```
Max. adjustment     1.3
100.00 %
=
1000.0 pF
327.4 pF
```

```
Linearisation curve     1.4


      linear
```

```
Channel     1.5


  PV (lin. perc.)
```

```
Damping     1.6


      0 s
```

```
Sensor-TAG     1.7


      Sensor
```

Display

```
Basic adjustment     2
Display
Diagnostics
Service
Info
```

```
Displayed value     2.1

PV (lin. perc.)
```

```
Backlight     2.4

Switched on ►
```

Diagnostics

Basic adjustment	3
Display	
Diagnostics	
Service	
Info	

Peak indicator	3.1
Capacit. min.: 65.7 pF	
Capacit. max.: 782.4 pF	

Device status	3.2
OK	

Trend recording	3.3
Presentation of the trend curve	

Service

Basic adjustment	4
Display	
Diagnostics	
Service	
Info	

Additional PA value	4.1
SV 1 (percent)	

Out-Scale-Unit	4.2
Volume	
hl	

PV-Out-Scale Min.	4.3
0 % = 5.0 hl	
100 % = 5000.0 hl	

Simulation	4.4
Start simulation?	

Reset	4.5
Select reset?	

Language	4.6
German	

Copy sensor data	4.7
Copy sensor data?	

PIN	4.8
Enable?	

Info

Basic adjustment	5
Display	
Diagnostics	
Service	
Info	

Instrument type	5.1
VEGACAL 6x	
Serial number	
12345678	

Date of manufacture	5.2
06. February 2019	
Software version	
1.40	

Last change using PC	5.3
12. May 2020	

Sensor characteristics	5.4
Display now?	

VEGA

6.6 Saving the parameterisation data

On paper

We recommended writing down the adjustment data, e.g. in this operating instructions manual, and archiving them afterwards. They are thus available for multiple use or service purposes.

In the display and adjustment module

If the instrument is equipped with a display and adjustment module, the parameter adjustment data can be saved in it. The data remain permanently stored there even if the sensor supply fails. The procedure is described in menu item " *Copy sensor data*".

7 Set up with PACTware and other adjustment programs

7.1 Connect the PC

VEGACONNECT directly on the sensor
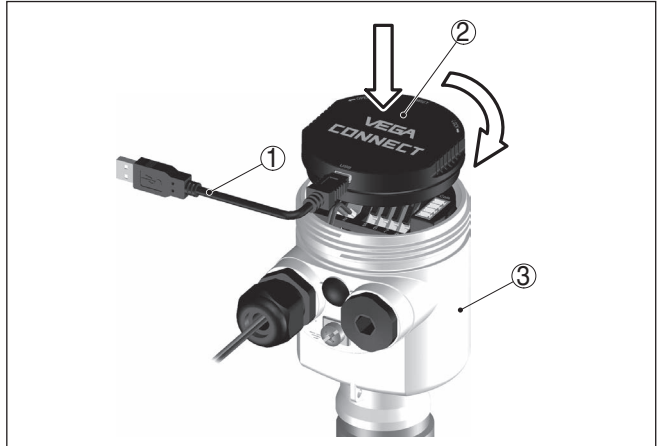
Fig. 23: Connection of the PC directly to the sensor via the interface adapter VEGACONNECT

1   USB cable to the PC
2   Interface adapter VEGACONNECT
3   Sensor

VEGACONNECT externally

Fig. 24: Connection via interface adapter VEGACONNECT external

1   I²C bus (com.) interface on the sensor
2   I²C connection cable of VEGACONNECT
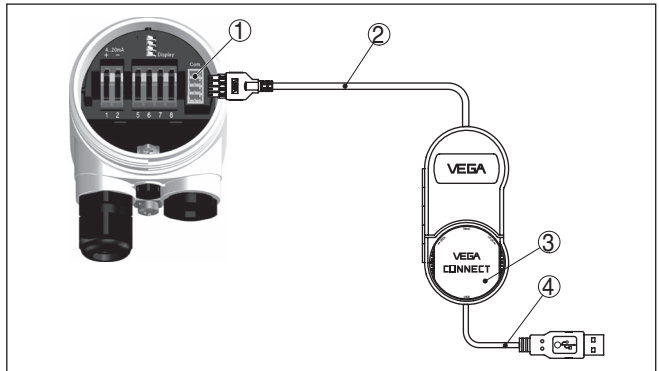*3   Interface adapter VEGACONNECT*
4   USB cable to the PC

Necessary components:

● VEGACAL 66

- PC with PACTware and suitable VEGA DTM
- VEGACONNECT
- Power supply unit or processing system

7.2 Parameter adjustment with PACTware

Prerequisites

For parameter adjustment of the instrument via a Windows PC, the configuration software PACTware and a suitable instrument driver (DTM) according to FDT standard are required. The latest PACTware version as well as all available DTMs are compiled in a DTM Collection. The DTMs can also be integrated into other frame applications according to FDT standard.

> **Note:**
> To ensure that all instrument functions are supported, you should always use the latest DTM Collection. Furthermore, not all described functions are included in older firmware versions. You can download the latest instrument software from our homepage. A description of the update procedure is also available in the Internet.

Further setup steps are described in the operating instructions manual " *DTM Collection/PACTware*" attached to each DTM Collection and which can also be downloaded from the Internet. Detailed descriptions are available in the online help of PACTware and the DTMs.
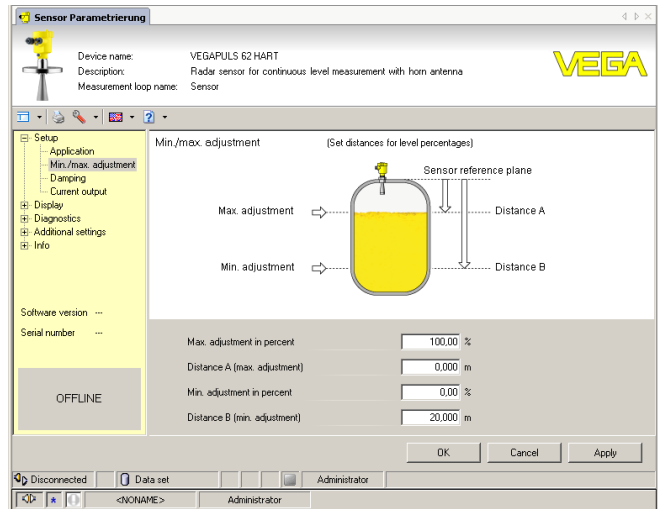
Fig. 25: Example of a DTM view

Standard/Full version

All device DTMs are available as a free-of-charge standard version and as a full version that must be purchased. In the standard version, all functions for complete setup are already included. An assistant for simple project configuration simplifies the adjustment considerably. Saving/printing the project as well as import/export functions are also part of the standard version.

In the full version there is also an extended print function for complete project documentation as well as a save function for measured value and echo curves. In addition, there is a tank calculation program as well as a multiviewer for display and analysis of the saved measured value and echo curves.

The standard version is available as a download under www.vega.com/downloads. The full version is available on CD from the agency serving you.

7.3 Parameter adjustment with AMS™ and PDM

For VEGA sensors, instrument descriptions for the adjustment programs AMS™ and PDM are available as DD or EDD. The instrument descriptions are already implemented in the current versions of AMS™ and PDM.

For older versions of AMS™ and PDM, a free-of-charge download is available via Internet. Move to www.vega.com.

7.4 Saving the parameterisation data

It is recommended to document or save the parameter adjustment data. That way they are available for multiple use or service purposes.

The VEGA DTM Collection and PACTware in the licensed, professional version provide suitable tools for systematic project documentation and storage.

VEGA

8 Set up with smartphone/tablet/PC/notebook via Bluetooth

8.1 Preparations

Make sure that the Bluetooth function of the display and adjustment module is activated. For this, the switch on the bottom side must be set to " *On*".
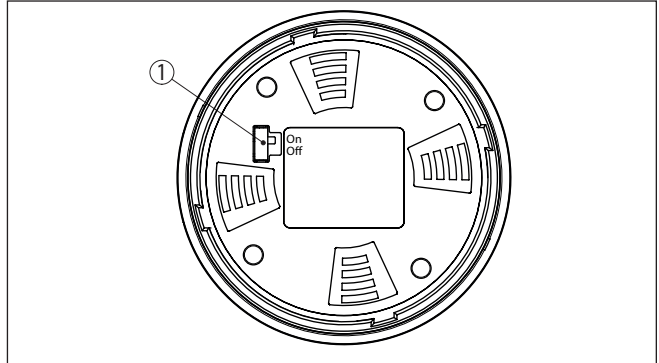
Fig. 26: Activate Bluetooth

1 Bluetooth switch
On Bluetooth active
Off Bluetooth not active

Change sensor PIN

The security concept of Bluetooth operation absolutely requires that the default setting of the sensor PIN be changed. This prevents unauthorized access to the sensor.

The default setting of the sensor PIN is " **0000**". First of all you have to change the sensor PIN in the adjustment menu of the respective sensor, e.g. to " **1111**".

Use " *OK*" to switch to the input menu.

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```
PIN

      0000
```

Change the PIN, e.g. to " **1111**".

```
PIN

      1111
```

```
PIN

      Deactivated
```
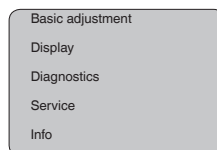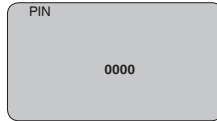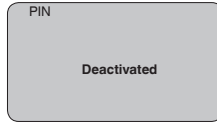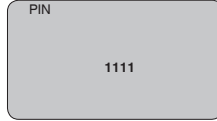
This permanently deactivates the PIN.

The display immediately changes to PIN activation.

Press " *ESC*" to cancel the activation of the PIN.

With " *OK*" you can enter and activate a PIN.

```
PIN

      Enable?
```

```
PIN

      Activated
```
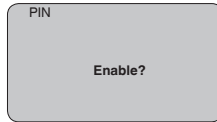
After the sensor PIN has been changed, sensor adjustment can be enabled again. For access (authentication) with Bluetooth, the modified PIN is still effective.

> **Information:**
> Bluetooth communication functions only if the actual sensor PIN differs from the default setting " **0000**".

8.2 Connecting

Preparations

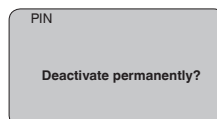**Smartphone/Tablet**
Start the adjustment app and select the function "Setup". The smartphone/tablet searches automatically for Bluetooth-capable instruments in the area.

PC/Notebook
Start PACTware and the VEGA project assistant. Select the device search via Bluetooth and start the search function. The device automatically searches for Bluetooth-capable devices in the vicinity.

Connecting

The message " *Searching …* " is displayed.

All found instruments will be listed in the adjustment window. The search is continued automatically.

Select the requested instrument in the device list.

The message " *Connecting …* " is displayed.

Authenticate

For the first connection, the operating device and the sensor must authenticate each other. After successful authentication, the next connection functions without authentication.

For authentication, enter in the next menu window the 4-digit sensor PIN.

8.3 Sensor parameter adjustment

The sensor parameterization is carried out via the adjustment app on the smartphone/tablet or the DTM on the PC/notebook.

App view

Fig. 27: Example of an app view - Setup sensor adjustment

9 Diagnostics and servicing

9.1 Maintenance

Maintenance

If the device is used properly, no special maintenance is required in normal operation.

Cleaning

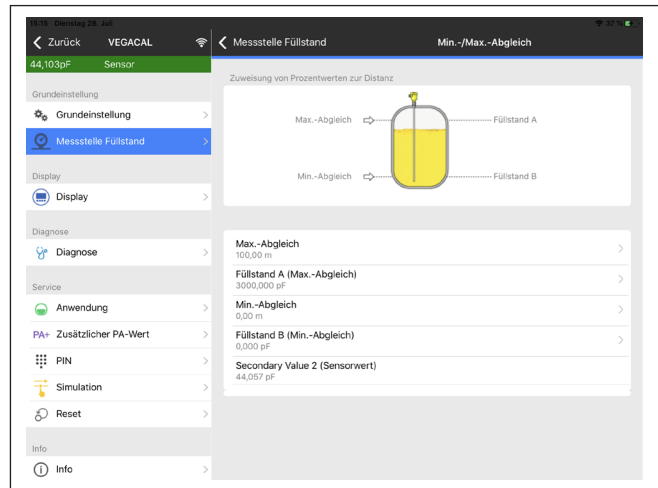The cleaning helps that the type label and markings on the instrument are visible.

Take note of the following:

● Use only cleaning agents which do not corrode the housings, type label and seals
● Use only cleaning methods corresponding to the housing protection rating

9.2 Rectify faults

Reaction when malfunction occurs

The operator of the system is responsible for taking suitable measures to rectify faults.

Causes of malfunction

The device offers maximum reliability. Nevertheless, faults can occur during operation. These may be caused by the following, e.g.:

● Sensor
● Process
● Voltage supply
● Signal processing

Fault rectification

The first measures to be taken are to check the output signals as well as to evaluate the error messages via the display and adjustment module. The procedure is described below. Further comprehensive diagnostics can be carried out on a PC with the software PACTware and the suitable DTM. In many cases, the causes can be determined and the faults rectified this way.

Reaction after fault rectification

Depending on the reason for the fault and the measures taken, the steps described in chapter "*Setup*" must be carried out again or must be checked for plausibility and completeness.

24 hour service hotline

Should these measures not be successful, please call in urgent cases the VEGA service hotline under the phone no. **+49 1805 858550**.

The hotline is also available outside normal working hours, seven days a week around the clock.

Since we offer this service worldwide, the support is provided in English. The service itself is free of charge, the only costs involved are the normal call charges.

Checking Profibus PA

The following table describes possible errors and helps to remove them:

Error	Cause	Rectification
When an additional instrument is connected, the segment fails.	Max. supply current of the segment coupler exceeded	Measure the current consumption, reduce size of segment
Wrong presentation of the measured value in Simatic S5	Simatic S5 cannot interpret the number format IEEE of the measured value	Insert converting component from Siemens
In Simatic S7 the measured value is always presented as 0	Only four bytes are consistently loaded in the PLC	Use function component SFC 14 to load 5 bytes consistently
Measured value on the display and adjustment module does not correspond to the value in the PLC	The menu item " *Display - Display value*" is not set to " *PA-Out*"	Check values and correct, if necessary
No connection between PLC and PA network	Incorrect adjustment of the bus parameter and the segment coupler-dependent baud rate	Check data and correct, if necessary
Instrument does not appear during connection setup	Profibus DP cable pole-reversed	Check cable and correct, if necessary
	Incorrect termination	Check termination at the beginning and end points of the bus and terminate, if necessary, according to the specification
	Instrument not connected to the segment, double assignment of an address	Check and correct, if necessary

In Ex applications, the regulations for the wiring of intrinsically safe circuits must be observed.

Error messages via the display and adjustment module

Error	Cause	Rectification
E013	no measured value available	● Short-circuit due to bridging by conductive buildup between process fitting and electrode ● Remove buildup, if necessary, mount a protective tube
	Shortcircuit in the probe, e.g. because of moisture in the housing	● Remove the electronics module out of the probe and check the resistor between the two marked plug connections according to the figure in paragraph " *Check the resistance in the probe*". ● There should be no contact between any of the connections (high resistance) ● If there is still a connection, exchange the instrument or return it for repair
E017	Adjustment span too small	Carry out a fresh adjustment and increase the distance between min. and max. adjustment
E036	no operable sensor software	Carry out a software update or send instrument for repair
E113	Communication conflict	Exchange the instrument or send it in for repair

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9.3 Exchanging the electronics module

If the electronics module is defective, it can be replaced by the user.

In Ex applications, only instruments and electronics modules with appropriate Ex approval may be used.

If there is no electronics module available on site, the electronics module can be ordered through the agency serving you. The electronics modules are adapted to the respective sensor and differ in signal output or voltage supply.

The new electronics module must be loaded with the default settings of the sensor. These are the options:

● In the factory
● Or on site by the user

In both cases, the serial number of the sensor is needed. The serial numbers are stated on the type label of the instrument, on the inside of the housing as well as on the delivery note.

When loading on site, the order data must first be downloaded from the Internet (see operating instructions " *Electronics module*").

Information:

All application-specific settings must be entered again. That's why you have to carry out a fresh setup after exchanging the electronics.

If you saved the parameter settings during the first setup of the sensor, you can transfer them to the replacement electronics module. A fresh setup is then not necessary.

9.4 How to proceed if a repair is necessary

You can find an instrument return form as well as detailed information about the procedure in the download area of our homepage. By doing this you help us carry out the repair quickly and without having to call back for needed information.

Proceed as follows in case of repair:

● Print and fill out one form per instrument
● Clean the instrument and pack it damage-proof
● Attach the completed form and, if need be, also a safety data sheet outside on the packaging
● Ask the agency serving you to get the address for the return shipment. You can find the agency on our homepage.

10 Dismount

10.1 Dismounting steps

Warning:
Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel or pipeline, high temperatures, corrosive or toxic media etc.

Take note of chapters " *Mounting*" and " *Connecting to voltage supply*" and carry out the listed steps in reverse order.

10.2 Disposal

Pass the instrument on to a specialised recycling company and do not use the municipal collecting points.

Remove any batteries in advance, if they can be removed from the device, and dispose of them separately.

If personal data is stored on the old device to be disposed of, delete it before disposal.

If you have no way to dispose of the old instrument properly, please contact us concerning return and disposal.

11   Supplement

11.1   Technical data

Note for approved instruments

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

All approval documents can be downloaded from our homepage.

General data

Material 316L corresponds to 1.4404 or 1.4435

Materials, wetted parts

− Process fitting - thread	316L, steel C22.8 (1.0460)
− Process fitting - flange	316L
− Process seal	Klingersil C-4400 (instruments with threaded fitting)
− Insulation (fully insulated)	PTFE
− Gravity weight	316L
− Screening tube	316L

Materials, non-wetted parts

− Probe (cable fully PTFE insulated: ø 8 mm/0.315 in)	316L
− Plastic housing	Plastic PBT (Polyester)
− Aluminium die-cast housing	Aluminium die-casting AlSi10Mg, powder-coated (Basis: Polyester)
− Stainless steel housing (precision casting)	316L
− Stainless steel housing (electropolished)	316L
− Seal between housing and housing lid	Silicone
− Inspection window in housing cover (optional)	Plastic housing: Polycarbonate (UL746-C listed) Metal housing: Glass [2]
− Ground terminal	316L
− Cable gland	PA, stainless steel, brass
− Sealing, cable gland	NBR
− Blind plug, cable gland	PA

Process fittings

− Pipe thread, cylindrical (DIN 3852-A)	G1, G1½
− Pipe thread, conical (ASME B1.20.1)	1 NPT, 1½ NPT
− Flanges	DIN from DN 40, ASME from 2"

Weight

− Instrument weight (depending on process fitting)	0.8 … 4 kg (0.18 … 8.82 lbs)

[2] Aluminium, stainless steel (precision casting) and Ex d housing

‒ Gravity weight	900 g (32 oz)
‒ Cable weight: ø 8 mm (0.315 in)	180 g/m (1.9 oz/ft)
Sensor length (L)	0.4 … 35 m (1.312 … 114.8 ft)
Max. tensile load (cable)	
‒ PTFE fully insulated: ø 8 mm (0.315 in)	10 KN (2248 lbf)
Max. torque (process fitting - thread)	100 Nm (74 lbf ft)
Torque for NPT cable glands and Conduit tubes	
‒ Plastic housing	max. 10 Nm (7.376 lbf ft)
‒ Aluminium/Stainless steel housing	max. 50 Nm (36.88 lbf ft)

Output variable

Output signal	digital output signal, format according to IEEE-754
Sensor address	126 (default setting)
Current value	10 mA, ±0.5 mA
Damping (63 % of the input variable)	0 … 999 s (adjustable)

Input variable

Measured variable	Level of conductive liquids and solids
Measuring principle	phase-selective admittance processing (PSA)
Measuring range	0 … 3000 pF
Measuring frequency	270 kHz

Measurement accuracy (according to DIN EN 60770-1)

Reference conditions according to DIN EN 61298-1	
‒ Temperature	+18 … +30 °C (+64 … +86 °F)
‒ Relative humidity	45 … 75 %
‒ Air pressure	+860 … +1060 mbar/+86 … +106 kPa (+12.5 … +15.4 psig)
Temperature error	
‒ < 120 pF	< 1 pF
‒ > 120 pF	1 % of the current measured value
Linearity error	< 0.25 % of the complete measuring range

Ambient conditions

Ambient, storage and transport temperature	-40 … +80 °C (-40 … +176 °F)

Process conditions

For the process conditions, please also note the specifications on the type label. The lowest value always applies.

Process pressure	-1 … 40 bar/-100 … 4000 kPa (-14.5 … 580 psig)
Process temperature VEGACAL 66 of 316L	-50 … +150 °C (-58 … +302 °F)

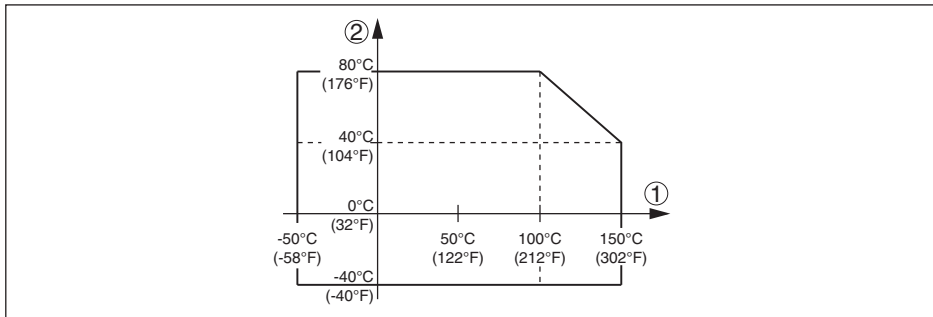Process temperature VEGACAL 66 of St   -20 … +150 °C (-4 … +302 °F)
C22.8

Fig. 28: Ambient temperature - Process temperature

1   Process temperature
2   Ambient temperature

Dielectric constant   ≥ 1.5

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

Options of the cable entry

– Cable entry	M20 x 1.5; ½ NPT
– Cable gland	M20 x 1.5; ½ NPT
– Blind plug	M20 x 1.5; ½ NPT
– Closing cap	½ NPT

Wire cross-section (spring-loaded terminals)

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

Electromechanical data - version IP66/IP68 (1 bar)

Options of the cable entry

– Cable gland with integrated connection cable	M20 x 1.5 (cable: ø 5 … 9 mm)
– Cable entry	½ NPT
– Blind plug	M20 x 1.5; ½ NPT

Connection cable

– Wire cross-section	0.5 mm² (AWG 20)
– Wire resistance	< 0.036 Ω/m
– Tensile strength	< 1200 N (270 lbf)
– Standard length	5 m (16.4 ft)
– Max. length	180 m (590.6 ft)
– Min. bending radius	25 mm (0.984 in) with 25 °C (77 °F)
– Diameter	approx. 8 mm (0.315 in)
– Colour - Non-Ex version	Black

– Colour - Ex-version	Blue

Display and adjustment module

Voltage supply and data transmission	through the sensor
Indication	LC display in dot matrix
Adjustment elements	4 keys
Protection rating	
– unassembled	IP20
– Mounted into the sensor without cover	IP40
Ambient temperature - Display and adjustment module	-20 … +70 °C (-4 … +158 °F)
Material	
– Housing	ABS
– Inspection window	Polyester foil

Voltage supply

Operating voltage	9 … 32 V DC
Operating voltage U_B with lighting switched on	12 … 32 V DC
Power supply by	DP/PA segment coupler
Max. number of sensors	32

Potential connections and electrical separating measures in the instrument

Electronics	Non-floating
Galvanic separation	
– between electronics and metallic parts of the device	Reference voltage 500 V AC
Conductive connection	Between ground terminal and metallic process fitting

Electrical protective measures

Protection rating

Housing material	Version	IP-protection class	NEMA protection
Plastic	Single chamber	IP66/IP67	Type 4X
	Double chamber	IP66/IP67	Type 4X
Aluminium	Single chamber	IP66/IP68 (0.2 bar)	Type 6P
		IP68 (1 bar)	Type 6P
	Double chamber	IP66/IP67	Type 4X
		IP66/IP68 (0.2 bar)	Type 6P
		IP68 (1 bar)	Type 6P
Stainless steel (electro-polished)	Single chamber	IP66/IP68 (0.2 bar)	Type 6P

Housing material	Version	IP-protection class	NEMA protection
Stainless steel (precision casting)	Single chamber	IP66/IP68 (0.2 bar)	Type 6P
		IP68 (1 bar)	Type 6P
	Double chamber	IP66/IP67	Type 4X
		IP66/IP68 (0.2 bar)	Type 6P
		IP68 (1 bar)	Type 6P

Connection of the feeding power supply unit	Networks of overvoltage category III
Altitude above sea level	
– by default	up to 2000 m (6562 ft)
– with connected overvoltage protection	up to 5000 m (16404 ft)
Pollution degree [3]	4
Protection class	II (IEC 61010-1)

Approvals

Instruments with approvals can have different technical specifications depending on the version.

For that reason the associated approval documents of these instruments have to be carefully noted. They are part of the delivery or can be downloaded by entering the serial number of your instrument into the search field under www.vega.com as well as in the general download area.

11.2 Device communication Profibus PA

In the following, the necessary device-specific details are shown. You can find further information of Profibus PA on www.profibus.com.

Instrument master file

The instrument master file (GSD) contains the characteristic data of the Profibus PA instrument. These data are, e.g. the permissible transmission rates as well as information on diagnostics values and the format of the measured value output by the PA instrument.

A bitmap file is also provided for the Profibus network planning tool. This file is installed automatically when the GSD file is integrated. The bitmap file is used for symbolic indication of the PA instrument in the configuration tool.

Ident number

Each Profibus instrument gets an unambiguous ident number (ID number) from the Profibus user organisation (PNO). This ID number is also included in the name of the GSD file. For VEGACAL 66 the ID number is **0x076E(hex)** and the GSD file **CL__076E.GSD**. Optionally to this manufacturer-specific GSD file, PNO provides also a general so-called profile-specific GSD file. For VEGACAL 66 you have to use the general GSD file **PA139700.GSD**. If the general GSD file is used, the sensor must be set to the profile-specific ident number via the DTM software. By default, the sensor operates with the manufacturer-specific ID number.

Cyclical data traffic

The Primary class 1 (e.g. PLC) cyclically reads out measured values from the sensor during operation. The below block diagram below shows which data can be accessed by the PLC.

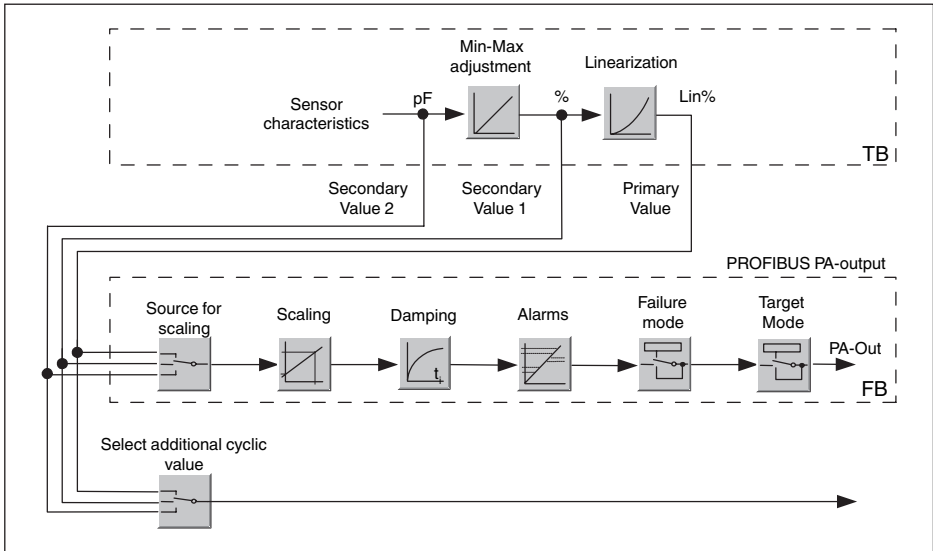[3] When used with fulfilled housing protection

Fig. 29: VEGACAL 66: Block diagram with AI (PA-OUT) value and additional cyclical value

TB   Transducer Block
FB   Function Block

Module of the PA sensors

For the cyclic data traffic, VEGACAL 66 provides the following modules:

● AI (PA-OUT)
  – PA-OUT value of the FB1 after scaling
● Additional Cyclic Value
  – Additional cyclical value (depending on the source)
● Free Place
  – This module must be used if a value should not be used in the data telegram of the cyclical data traffic (e.g. replacement of the Additional Cyclic Value)

A maximum of three modules can be active. By means of the configuration software of the Profibus master you can determine the configuration of the cyclical data telegram with these modules. The procedure depends on the respective configuration software.

> **Note:**
> The modules are available in two versions:

● Short for Profibus master supporting only one "Identifier Format" byte, e.g. Allen Bradley
● Long for Profibus master only supporting the "Identifier Format" byte, e.g. Siemens S7-300/400

Examples of telegram configuration

In the following you will see how the modules can be combined and how the appendant data telegram is structured.

Example 1 (standard setting) with distance value and additional cyclical value:

● AI (PA-OUT)

● Additional Cyclic Value

Byte-No.	1	2	3	4	5	6	7	8	9	10
Format	IEEE-754- Floating point value				Status	IEEE-754- Floating point value				Status
Value	PA-OUT (FB1)				Status (FB1)	Additional Cyclic Value				Status

Example 2 with distance value without additional cyclical value:

● AI (PA-OUT)
● Free Place

Byte-No.	1	2	3	4	5
Format	IEEE-754- Floating point value				Status
Value	PA-OUT (FB1)				Status (FB1)

Data format of the output signal

Byte4	Byte3	Byte2	Byte1	Byte0
Status	Value (IEEE-754)			

Fig. 30: Data format of the output signal

The status byte corresponds to profile 3.0 "Profibus PA Profile for Process Control Devices" coded. The status "Measured value OK" is coded as 80 (hex) (Bit7 = 1, Bit6 … 0 = 0).

The measured value is transferred as a 32 bit floating point number in the IEEE-754 format.

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

Value = $(-1)^{VZ}$ • $2^{(Exponent - 127)}$ • $(1 + Significant)$

Fig. 31: Data format of the measured value

Coding of the status byte associated with the PA output value

Status code	Description according to Profibus standard	Possible cause
0x00	bad - non-specific	Flash-Update active
0x04	bad - configuration error	● Adjustment error ● Configuration error with PV-Scale (PV-Span too small) ● Unit irregularity ● Error in the linearization table
0x0C	bad - sensor failure	● Hardware error ● Converter error ● Leakage pulse error ● Trigger error
0x10	bad - sensor failure	● Measured value generation error

Status code	Description according to Profibus standard	Possible cause
0x1f	bad - out of service constant	"Out of Service" mode switched on
0x44	uncertain - last unstable value	Failsafe replacement value (Failsafe-Mode = "Last value" and already valid measured value since switching on)
0x48	uncertain substitute set	● Switch on simulation ● Failsafe replacement value (Failsafe-Mode = "Fsafe value")
0x4c	uncertain - initial value	Failsafe replacement value (Failsafe-Mode = "Last valid value" and no valid measured value since switching on)
0x51	uncertain - sensor; conversion not accurate - low limited	Sensor value < lower limit
0x52	uncertain - sensor; conversion not accurate - high limited	Sensor value > upper limit
0x80	good (non-cascade) - OK	OK
0x84	good (non-cascade) - active block alarm	Static revision (FB, TB) changed (10 sec. active, after the parameter of the static category has been written)
0x89	good (non-cascade) - active advisory alarm - low limited	Lo-Alarm
0x8a	good (non-cascade) - active advisory alarm - high limited	Hi-Alarm
0x8d	good (non-cascade) - active critical alarm - low limited	Lo-Lo-Alarm
0x8e	good (non-cascade) - active critical alarm - high limited	Hi-Hi-Alarm

11.3 Dimensions

The following dimensional drawings represent only an extract of all possible versions. Detailed dimensional drawings can be downloaded at www.vega.com/downloads under " *Drawings*".
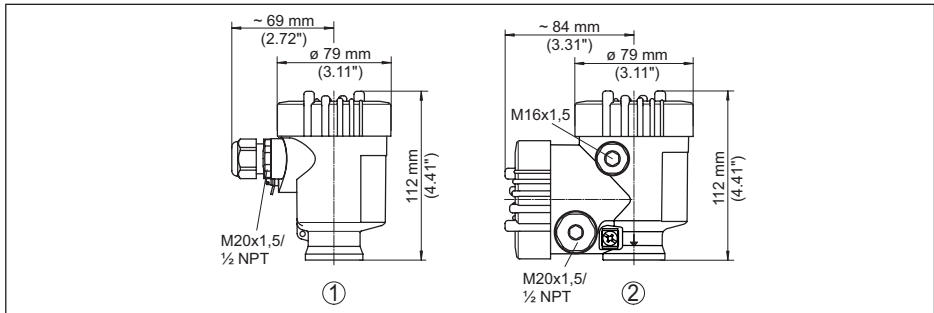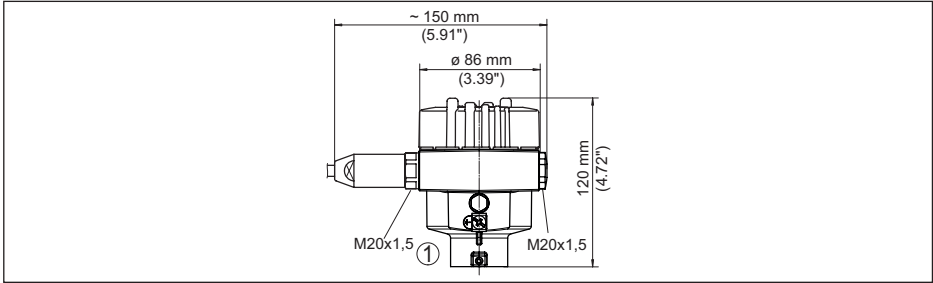
Plastic housing

Fig. 32: Housing versions in protection IP66/IP67 (with integrated display and adjustment module the housing is 9 mm/0.35 in higher)

1   Plastic single chamber
2   Plastic double chamber

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Aluminium housing with protection rating IP66/IP68 (1 bar)

Fig. 33: Housing version with protection rating IP66/IP68 (1 bar), (with integrated display and adjustment module the housing is 18 mm/0.71 in higher)
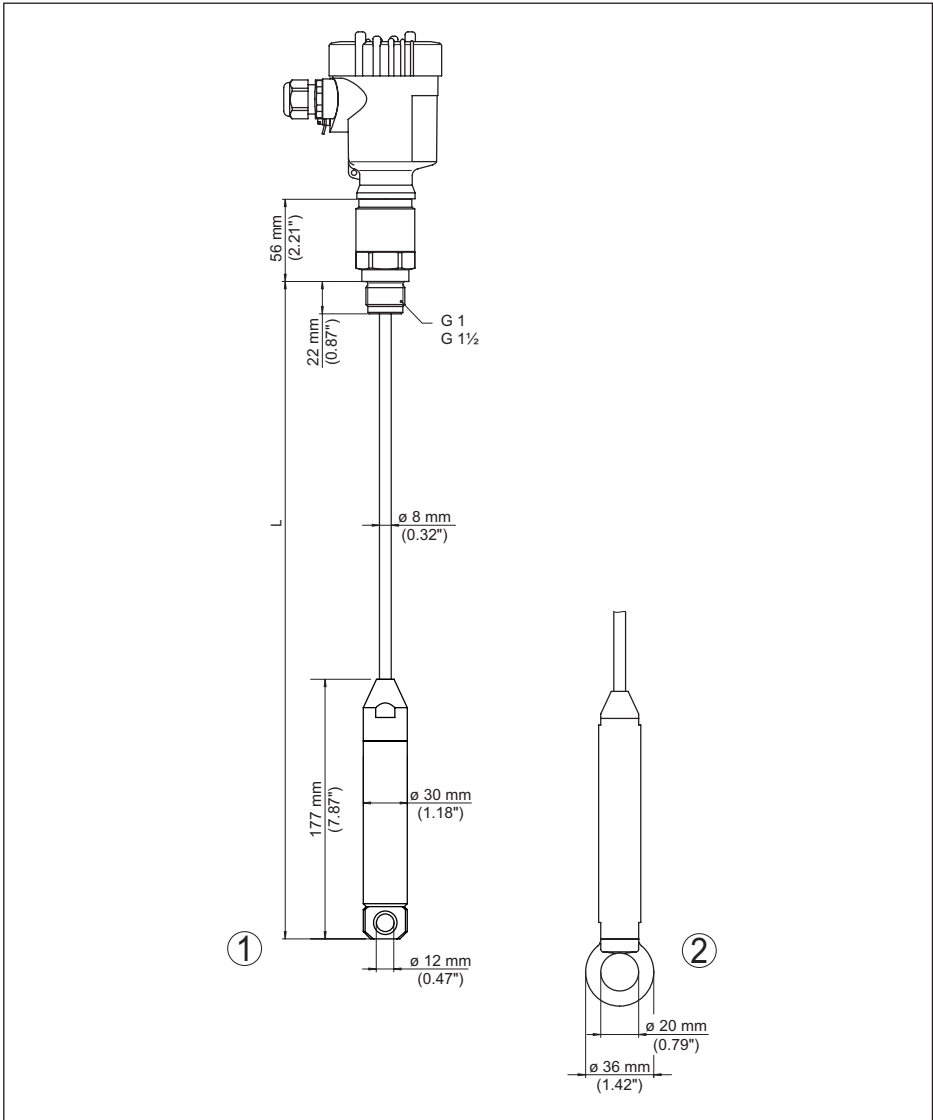
1   Aluminium - single chamber

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Fig. 34: VEGACAL 66, threaded version G1 (ISO 228 T1)

L   Sensor length, see chapter " Technical data"
1   Gravity weight - Process fitting thread ≤ 2", flange ≤ DN 50
2   Gravity weight - Process fitting thread > 2", flange > DN 50
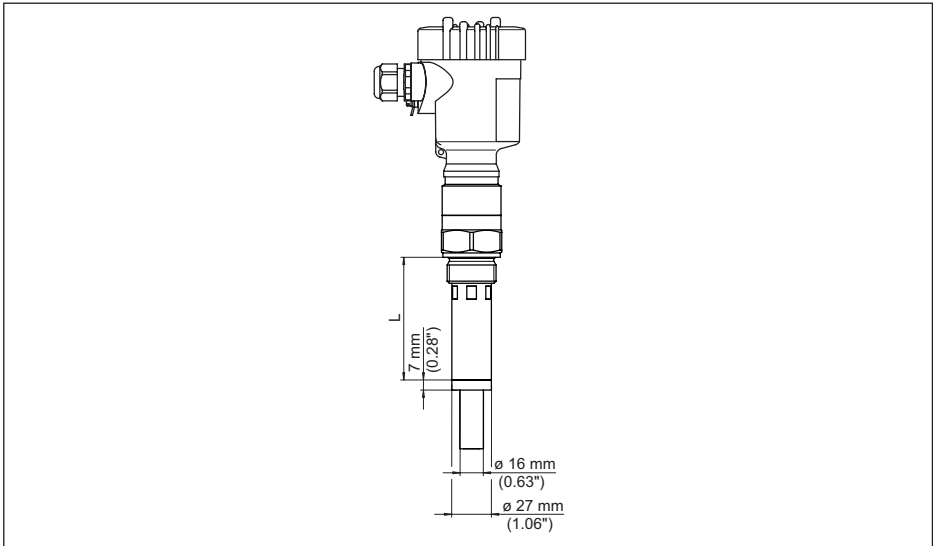
Fig. 35: VEGACAL 66, screening tube, for example against strong condensation

L   Length of the screening tube, see chapter " Technical data"

VEGA

11.4 Industrial property rights

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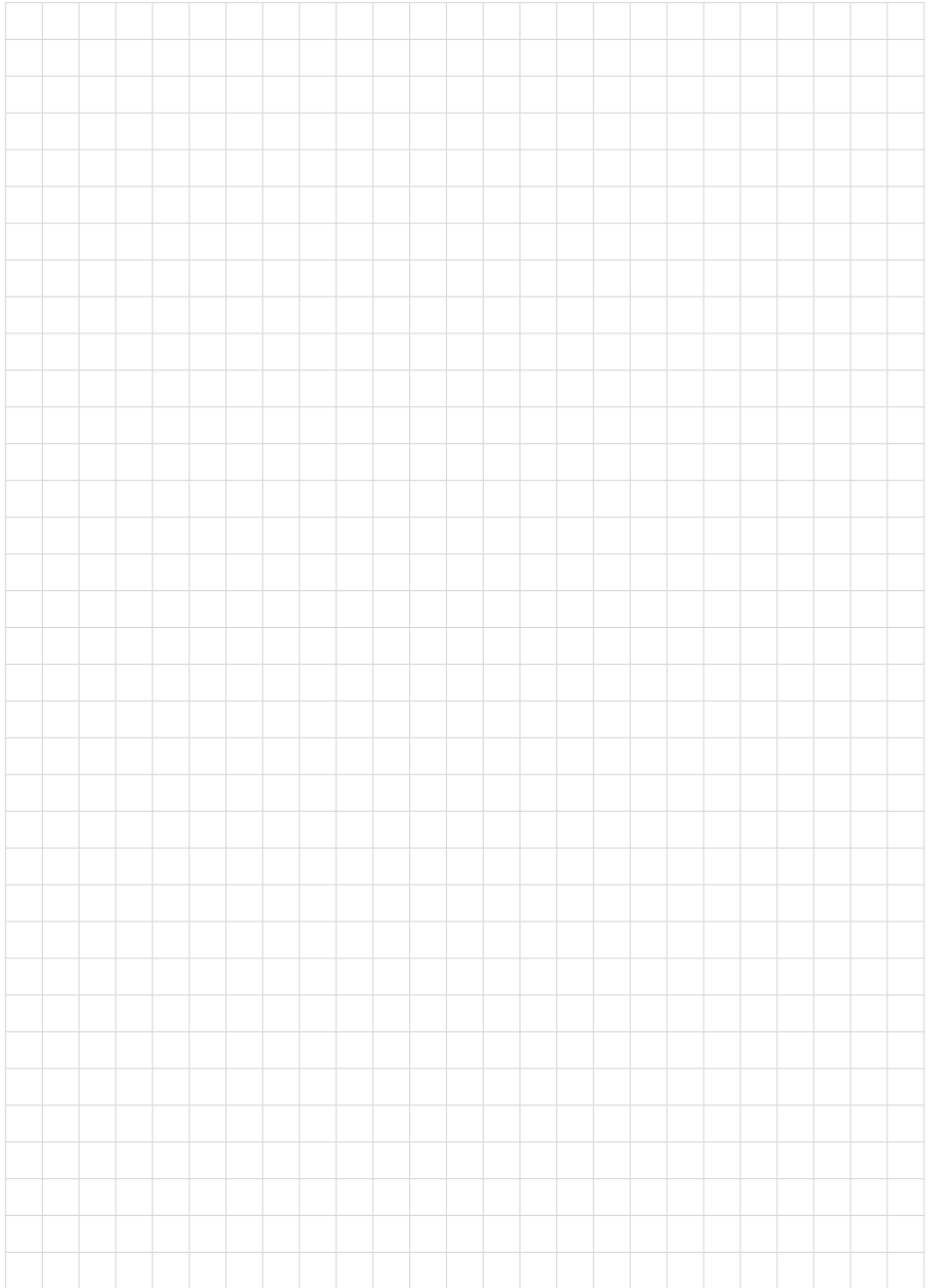
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