Installation & Maintenance Instructions

MINITRAC 31

4 … 20 mA/HART - four-wire

Radiation-based sensor for density measurement

VEGA

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Contents

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Safety instructions for Ex areas

Please note the Ex-specific safety information for installation and operation in Ex areas. These safety instructions are part of the operating instructions manual and come with the Ex-approved instruments.

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1 About this document

1.1 Function

This operating instructions manual provides all the information you need for mounting, connection and setup as well as important instructions for maintenance and fault rectification. 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 specialist personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3 Symbolism used

Information, tip, note
This symbol indicates helpful additional information.

Caution: If this warning is ignored, faults or malfunctions can result.

Warning: If this warning is ignored, injury to persons and/or serious damage to the instrument can result.

Danger: If this warning is ignored, serious injury to persons and/or destruction of the instrument can result.

Ex applications
This symbol indicates special instructions for Ex applications.

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

→ **Action**
This arrow indicates a single action.

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

Battery disposal
This symbol indicates special information about the disposal of batteries and accumulators.

40447-EN-130430

2 For your safety

2.1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained specialist 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

The MINITRAC 31 is a sensor for density measurement and level detection.

You can find detailed information on the application range 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 the instrument can give rise to application-specific hazards, e.g. vessel overfill or damage to system components through incorrect mounting or adjustment.

2.4 General safety instructions

This is a state-of-the-art instrument complying with all prevailing regulations and guidelines. 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.

During the entire duration of use, the user is obliged to determine the compliance of the necessary occupational safety measures with the current valid rules and regulations and also take note of new regulations.

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.

The safety approval markings and safety tips on the device must also be observed.

This measuring system uses gamma rays. Therefore take note of the instructions for radiation protection in chapter "*Product description*". All work on the source container may only be carried out under the supervision of a qualified radiation protection officer.

2.5 CE conformity

The device fulfills the legal requirements of the applicable EC guidelines. By affixing the CE marking, VEGA confirms successful testing of the product.

Only with class A instruments:
The device is a class A instrument designed for use in an industrial environment. When used in a different environment, e.g., in a living area, the electromagnetic compatibility must be ensured by the user. If necessary, suitable screening measures against conducted and emitted disturbances must be taken.

You can find the conformity certificate in the download section under www.vega.com.

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 fulfills the requirements of the following NAMUR recommendations:

- NE 21 – Electromagnetic compatibility of equipment
- NE 43 – Signal level for malfunction information from measuring transducers
- NE 53 – Compatibility of field devices and display/adjustment components
- NE 107 – Self-monitoring and diagnosis of field devices

For further information see www.namur.de.

2.7 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 fulfill this obligation by observing the environmental instructions in this manual:

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

3 Product description

3.1 Configuration

Type plate

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

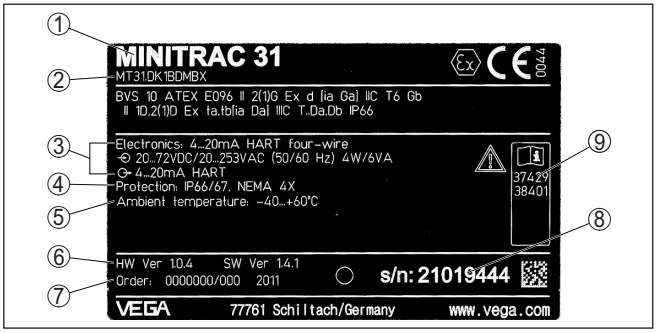


Fig. 1: Layout of the type label (example)

1 *Instrument version*
2 *Product code*
3 *Electronics*
4 *Protection rating*
5 *Ambient temperature*
6 *Hardware and software version*
7 *Order number*
8 *Serial number of the instrument*
9 *ID numbers, instrument documentation*

Serial number

With the serial number of the instrument on the type label you have access to the following data on our homepage:

- Article number of the instrument (HTML)
- Delivery date (HTML)
- Order-specific instrument features (HTML)
- Operating instructions at the time of shipment (PDF)
- Order-specific sensor data for an electronics exchange (XML)
- Test certificate "Measuring Accuracy" (PDF)

For this purpose, move to www.vega.com and "*VEGA Tools*".

As an alternative, you have access to these data via your Smartphone:

- Download the Smartphone-App "*VEGA Tools*" from the "*Apple App Store* " or the "*Google Play Store*"
- Scan the Data-Matrix-Code on the type label of the instrument or
- Enter the serial number manually into the App

Scope of this operating instructions manual

This operating instructions manual applies to the following instrument versions:

- Hardware from 1.0.4
- Software from 1.4.2
- Modification status, electronics as of -01

Electronics versions

The instrument is available in different electronics versions. Each version can be identified via the product code on the type label:

- Standard electronics type PT30E-XX

Scope of delivery

The scope of delivery encompasses:

- Radiation-based sensor
- Documentation
  - this operating instructions manual
  - Operating instructions manual "*Display and adjustment module*" (optional)
  - Ex-specific "*Safety instructions*" (with Ex versions)
  - if necessary, further certificates

3.2 Principle of operation

Application area

The instrument is suitable for applications in liquids and bulk solids in vessels under difficult process conditions. There are application possibilities in nearly all areas of industry.

The measured value is detected contactlessly right through the vessel wall. Neither a process fitting nor a vessel opening are required. The instrument is thus ideal for retro installation.

The instrument can be used for many different measuring tasks. Apart from the main applications such as density measurement and level detection, the MINITRAC 31 can also detect residues and the mass flow rate in conjunction with a flow meter.

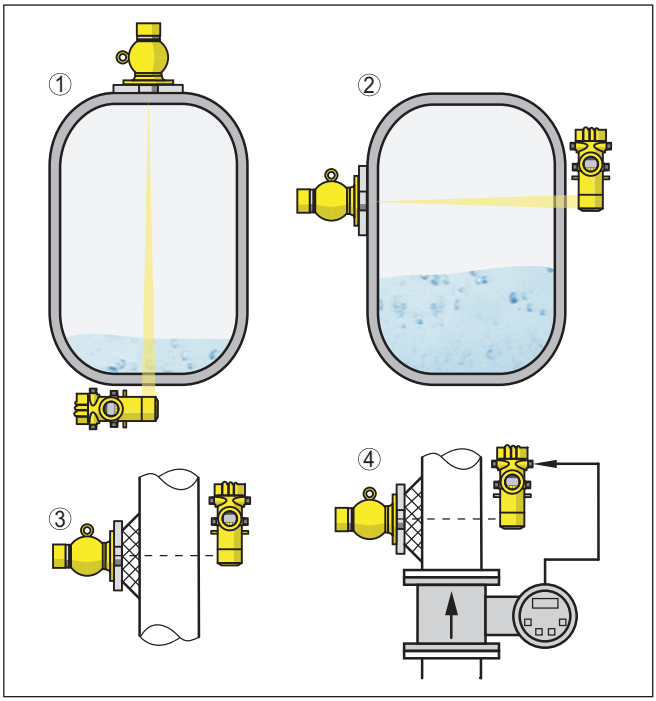


Fig. 2: MINITRAC 31 - Application possibilities

1 Level measurement - Residue detection
2 Point level detection
3 Density measurement
4 Mass flow measurement

Further application possibilities are also the use as X-ray alarm or real value correction.

If X-ray alarm is selected, the instrument detects radiation from external sources. Possible external radiation sources can be, for example, a weld joint test in a neighbouring facility or other radiation-based instruments.

When the instrument operates as real value correction it transmits the real value to correct another radiation-based sensor. The measurement can thus be adapted perfectly to the situation in the vessel.

Functional principle

In radiation-based measurement, a Caesium-137 or Cobalt-60 isotope emits focussed gamma rays that are attenuated when penetrating the tube wall and the medium. The NaI detector on the opposite side, on a pipeline for example, receives the radiation. The intensity of the radiation is dependent on the density of the measured media. The measuring principle has proven to be very reliable in conjunction with extreme process conditions because it measures contactlessly from outside through the tube wall. The measuring system ensures

maximum safety, reliability and plant availability independent of the medium and its properties.

3.3 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 under 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 humidity 20 … 85 %

3.4 Accessories and replacement parts

PLICSCOM

The display and adjustment module PLICSCOM is used for measured value indication, adjustment and diagnosis. It can be inserted into the sensor or the external display and adjustment unit and removed at any time.

You can find further information in the operating instructions "*Display and adjustment module PLICSCOM*" (Document-ID 27835).

VEGACONNECT

The interface adapter VEGACONNECT enables the connection of communication-capable instruments to the USB interface of a PC. For parameter adjustment of these instruments, an adjustment software such as PACTware with VEGA-DTM is required.

You can find further information in the operating instructions "*Interface adapter VEGACONNECT*" (Document-ID 32628).

VEGADIS 81

VEGADIS 81 is an external display and adjustment unit for sensors with single or double chamber housing.

For the double chamber housing there is also an interface adapter for VEGADIS 81 required.

You can find further information in the operating instructions "*VEGADIS 81*" (Document-ID 43814).

External indicating unit

The VEGADIS 62 is suitable for measured value indication of sensors. It is looped into the 4 … 20 mA/HART signal cable.

You can find further information in the operating instructions "*VEGADIS 62*" (Document-ID 36469).

Electronics module

The electronics module PT30E.XX is a replacement part for radiation-based sensors MINITRAC 31.

The electronics module can only be exchanged by VEGA service technician.

3.5 Corresponding source container

A radioactive isotope in a suitable source holder is the prerequisite for a radiation-based measurement setup.

The handling of radioactive material is regulated by law. The radiation protection rules of the country in which the system is operated apply first and foremost.

In Germany, for example, the current radiation protection ordinance (StrlSchV) based on the Atomic Energy Law (AtG) applies.

The following points are important for measurement with radiation-based methods:

Handling permit

A handling permit is required for operation of a system using gamma rays. This permit is issued by the respective government office or the responsible authority (in Germany, for example, offices for environmental protection, trade supervisory boards, etc.)

You can find further instructions in the operating instructions manual of the source container.

General instructions for radiation protection

When handling a radioactive source, unnecessary radiation exposure must be avoided. An unavoidable radiation exposure must be kept as low as possible. Take note of the following three important measures:

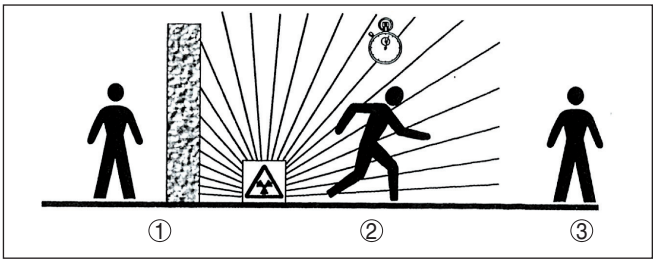


Fig. 3: Measures for protection against radioactive radiation

1 Shielding
2 Time
3 Distance

Shielding - Provide good shielding between the radioactive source and yourself as well as all other persons. Special source containers (e.g. VEGASOURCE) as well as all materials with high density (e.g. lead, iron, concrete, etc.) provide effective shielding.

Time: Stay as short a time as possible in radiation exposed areas.

Source: Your distance to the source should be as large as possible. The local dose rate of the radiation decreases in proportion to the square of the distance to the radiation source.

Radiation safety officer

The plant operator must appoint a radiation safety officer with the necessary expert knowledge. He is responsible that the radiation protection ordinance is maintained and that all radiation protection measures are implemented.

Control area

Control areas are areas in which the local dose rate exceeds a certain value. Only persons who undergo official dose monitoring are allowed into these control areas. You can find the respectively valid limit values for control areas in the guideline of the respective authority (in Germany, for example, the radiation protection ordinance).

We are at your disposal for further information concerning radiation protection and regulations in other countries.

4 Mounting

4.1 General instructions

Switch off source

The source container is part of the measuring system. In case the source container is already equipped with an active isotope, the source container must be locked before mounting.

Danger:
Before mounting; make sure that the source is securely closed. Use a padlock to secure the source container in the closed condition and prevent it from being inadvertently opened.

Protection against moisture

Protect your instrument through the following measures against moisture penetration:

- Use the recommended cable (see chapter "*Connecting to power supply*")
- Tighten the cable gland
- Loop the connection cable downward in front of the cable gland

This applies particularly to:

- outdoor mounting
- installations in areas where high humidity is expected (e.g. through cleaning processes)
- installations on cooled or heated vessels

Suitability for the process conditions

Make sure 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 are particularly:

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

You can find the specifications in chapter "*Technical data*" and on the nameplate.

Protective caps

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 openings for the cable glands are therefore covered with red protective 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.

The suitable cable glands and blind plugs come with the instrument.

4.2 Mounting instructions

Installation position

Note:
During the planning stage, our specialists will analyse the conditions of the measuring point and dimension the source (isotope) accordingly.

You get a "Source Sizing" document specifying the required source activity and containing all relevant mounting information for your measuring point.

You must follow the instructions of this "Source Sizing" document in addition to the following mounting instructions.

The following mounting information is applicable as long as there is nothing else specified in the "Source Sizing" document.

You can find information on protective barriers and the mounting of the corresponding source container in the operating instructions manual of the source container, e.g. VEGASOURCE.

You can mount the MINITRAC 31 in any position. If you have ordered your instrument with a lead cover as a protection against ambient radiation (optionally), the the sensor is shielded laterally against X-ray radiation. In this case, the radiation can only penetrate frontally.

Fasten the sensors in such a way that they cannot fall out of the holder.

Direct the exit angle of the source container to the MINITRAC 31.

Mount the source container as close as possible to the vessel. If there are gaps, secure the area with a safety fence and protective grating so that no one can reach into the dangerous area.

Caution:
Make sure that the tube is always completely filled. Mainly in horizontally arranged tube measuring distances, air bubbles or buildup in the tube can influence the measuring result. Measurement should be preferably through the centre of the tube.

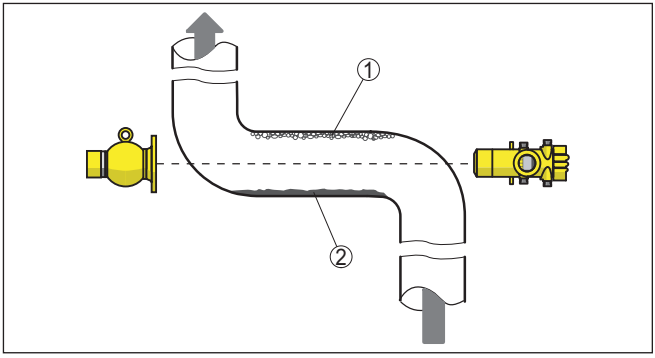


Fig. 4: Installation on a horizontal pipeline

1 Air bubbles
2 Buildup

Density measurement

A density and concentration measurement is possible on pipelines and vessels. The accuracy of the measurement increases in proportion to the radiated length (L) of medium. This is particularly important in the case of products with low density or small tube diameters. There are different ways to increase the radiated length (L) of the medium.

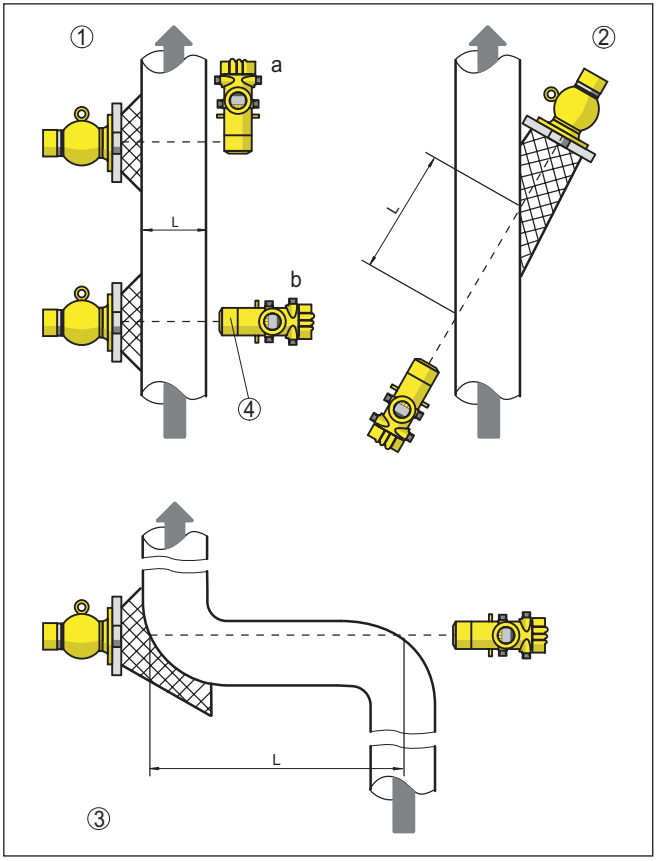


Fig. 5: Installation possibilities - Density measurement or concentration measurement

1a Direct radiation - Horizontal mounting
1b Direct radiation - Vertical mouting or when the lead cover is used as protection against ambient radiation
2 Inclined radiation for extention of the radiated length (L)
3 Extension of the radiated length (L) by adding a tube angle piece as measuring distance
4 Integrated lead cover as protection against ambient radiation - the instrument is hence shielded laterally

With density measurement, the radiation difference with differing density is very low. Especially with small tube diameters, the change is negligible.

Therefore it is important to shield from interfering X-ray radiation. To protect the instrument against X-ray radiation, it can be be equipped with an optional lead ring. A later retrofitting of the lead ring is not possible.

Mass flow rate

The mass flow rate can be determined with the MINITRAC 31 in conjunction with a flow meter.

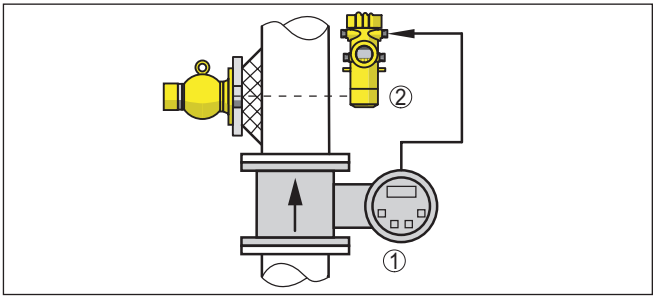


Fig. 6: Mass flow rate measurement

1 Flow meter
2 MINITRAC 31

Point level detection

For level detection, the sensor is generally mounted horizontally at the height of the requested limit level. Make sure that there are no struts or reinforcements at this position in the vessel.

Direct the exit beam of the source container exactly towards the measuring range of MINITRAC 31.

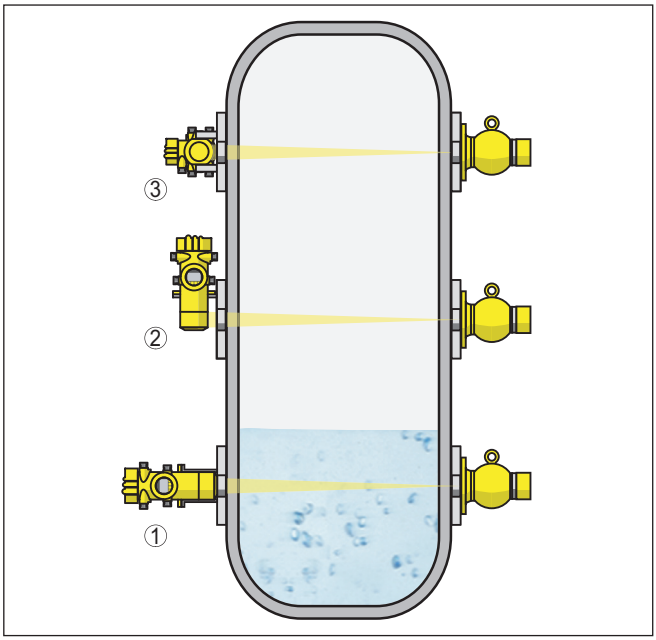


Fig. 7: Mounting position - level detection

1 Mounting horizontal
2 Mounting vertical
3 Mounting horizontally, at right angles to container

Level measurement - Residue detection

The MINITRAC 31 can be used for residue detection, e.g. in storage tanks for high-cost liquids. For this purpose, the instrument must be mounted at the lowest point of the vessel.

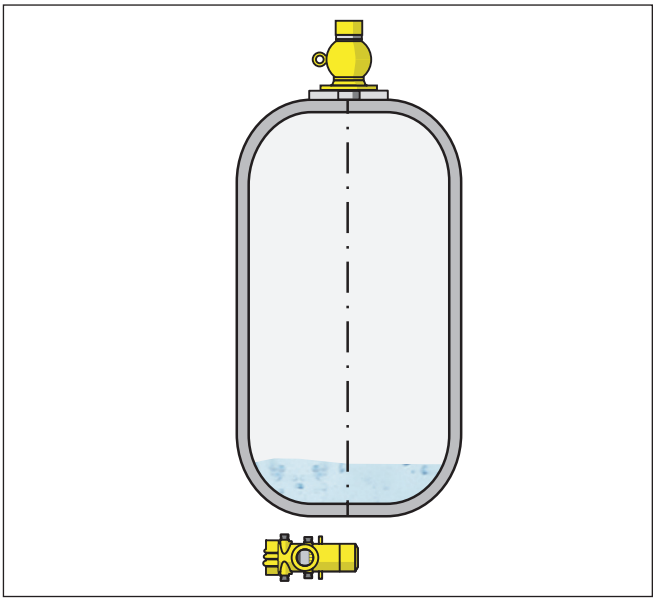


Fig. 8: Level measurement - Residue detection on a storage tank

Protection against heat

If the max. ambient temperature is exceeded, you must take suitable measures to protect the instrument against overheating.

You can protect the instrument by providing a suitable insulation against the heat or mounting the instrument further away from the heat source.

Make sure these measures are taken into account already in the planning stage. If you want to carry out such measures later on, contact our specialists to ensure that the accuracy of the application is not impaired.

If these measures are not sufficient to maintain the max. ambient temperature, you could consider using the water cooling system we offer for MINITRAC 31.

The water cooling must also be included in the calculations for the measuring point. Contact our specialists regarding the dimensioning of the water cooling.

5 Connecting to power supply

5.1 Preparing the connection

Safety instructions

Always keep in mind the following safety instructions:

- Connect only in the complete absence of line voltage
- If overvoltage surges are expected, overvoltage arresters should be installed

Voltage supply via mains voltage

In this case, the instrument is designed in protection class II. To maintain this protection class, it is absolutely necessary that the ground conductor be connected to the internal ground terminal. Take note of the general installation regulations.

Supply voltage and current signal are carried on separate connection cables if reliable separation is required. The supply voltage range can differ depending on the instrument version.

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

Select connection cable

For power supply, an approved installation cable with PE conductor is required.

The 4 … 20 mA current output is connected with standard two-wire cable without screen. If electromagnetic interference is expected which is above the test values of EN 61326-1 for industrial areas, screened cable should be used.

Use cable with a round wire cross section. An outer cable diameter of 6 … 12 mm (0.24 … 0.47 in) ensures the seal effect of the cable entry. If cable with a different diameter or wire cross section is used, exchange the seal or use an appropriate cable connection. Free cable glands have n sufficient protection against moisture and must be replaced by blind stoppers.

Cable entry

Generally provide all unused cable entries with suitable blind plugs. The thin foam rubber wahsers int he cable glands are only used as dust cover during trasport.

Cable gland ½ NPT

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

You have to replace these protective caps with approved cable glands before setup or cover them with suitable filler plugs. Unused cable glands do not provide sufficient protection against moisture and must be replaced with filler plugs.

The suitable cable glands and blind plugs come with the instrument.

Cable screening and grounding

If screened cable is necessary, connect the cable screen on both ends to ground potential. In the sensor, the screen must be connected directly to the internal ground terminal. The ground terminal on the outside of the housing must be connected to the potential equalisation (low impedance).

If potential equalisation currents are expected, the connection on the processing side must be made via a ceramic capacitor (e. g. 1 nF, 1500 V). The low-frequency potential equalisation currents are thus suppressed, but the protective effect against high frequency interference signals remains.

Warning:
Significant potential differences exist inside galvanization plants as well as on vessels with cathodic corrosion protection. Considerable equalisation currents can flow over the cable screen if the screen is grounded on both ends.

To avoid this in such applications, the cable screen must be connected to ground potential only at one end (in the switching cabinet). The cable screen must **not** be connected to the internal ground terminal in the sensor and the outer ground terminal on the housing must **not** be connected to the potential equalisation!

Information:
The metal parts of the instrument are conductively connected with the inner and outer ground terminal on the housing. This connection is either a direct metallic connection or, in case of instruments with external electronics, a connection via the screen of the special connection cable.

You can find specifications on the potential connections inside the instrument in chapter "*Technical data*".

Connection technology

The voltage supply and signal output are connected via the spring-loaded terminals in the housing.

The connection to the display and adjustment module or to the interface adapter is carried out via contact pins in the housing.

Connection procedure

Proceed as follows:

The procedure applies to instruments without explosion protection.

1. Unscrew the big housing cover
2. Loosen compression nut of the cable entry
3. 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
4. Insert the cable into the sensor through the cable entry

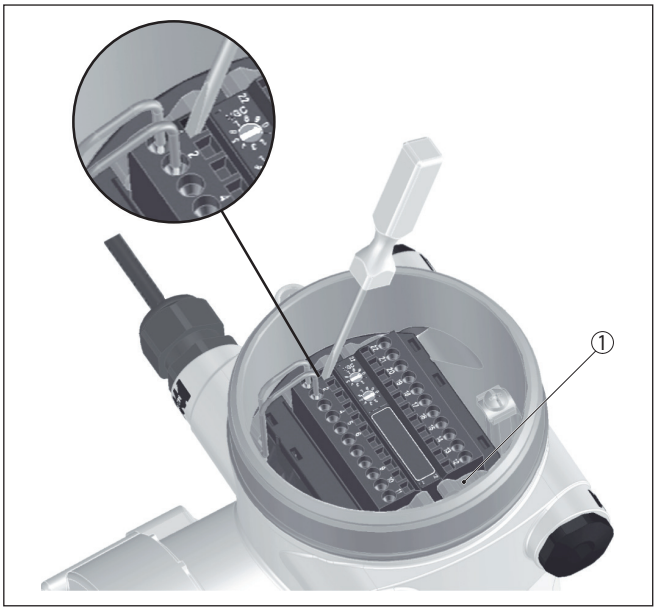


Fig. 9: Connection steps 4 and 5

1 Locking of the terminal blocks

5. Insert a small slotted screwdriver firmly into the rectangular lock openings of the respective connection terminal
6. Insert the wire ends into the round openings of the terminals according to the wiring plan

Information:
Solid cores as well as flexible cores with cable end sleeves are inserted directly into the terminal openings. In case of flexible cores without end sleeves, press the rectangular lock opening with a small screwdriver; the terminal opening is freed. When the screwdriver is released, the terminal opening closes again.

7. Check the hold of the wires in the terminals by lightly pulling on them

   To loosen a line, insert a small slotted screwdriver firmly into the rectangular locking opening according to the illustration
8. Connect the screen to the internal ground terminal, connect the outer ground terminal to potential equalisation
9. Tighten the compression nut of the cable entry. The seal ring must completely encircle the cable
10. Screw the housing cover back on

The electrical connection is hence finished.

Information:
The terminal blocks are pluggable and can be detached from the electronics. For this purpose loosen the two lateral locking levers of

the terminal block with a small screwdriver. When loosening the locking, the terminal block is automatically squeezed out. It must snap in place when re-inserted.

5.2 Connection - Density, mass flow rate measurement

Non-Ex instruments and instruments with non-intrinsically safe current output

Electronics and connection compartment - Non-Ex instruments and instruments with non-intrinsically safe current output

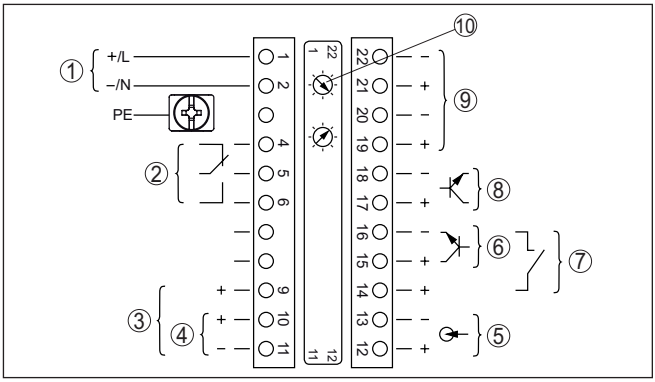


Fig. 10: Electronics and connection compartment with non-Ex instruments and instruments with non-intrinsically safe current output

1 *Voltage supply*
2 *Relay output*
3 *Signal output 4 … 20 mA/HART active*
4 *Signal output 4 … 20 mA/HART passive*
5 *Signal input 4 … 20 mA (active sensor)*
6 *Switching input for NPN transistor*
7 *Switching input floating*
8 *Transistor output*
9 *Interface for sensor-sensor communication (MGC)*
10 *Setting the bus address for sensor-sensor communication (MGC)*[1)]

Adjustment and connection compartment - Non-Ex instruments and instruments with non-intrinsically safe current output

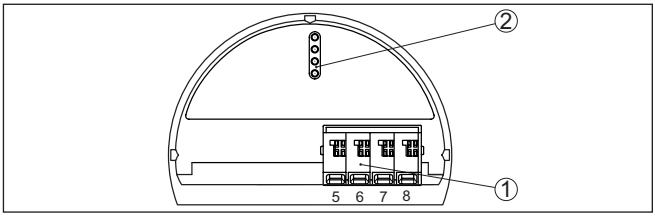


Fig. 11: Adjustment and connection compartment with non-Ex instruments and instruments with non-intrinsically safe current output

1 *Terminals for the external display and adjustment unit*
2 *Contact pins for the display and adjustment module or interface adapter*

1) MGC = Multi Gauge Communication

Instruments with intrinsically safe current output

You can find detailed information on the explosion-protected versions (Ex-ia, Ex-d) in the Ex-specific safety instructions. These safety instructions are part of the scope of delivery and come with the Ex-approved instruments.

Electronics and connection compartment - Instruments with intrinsically safe current output

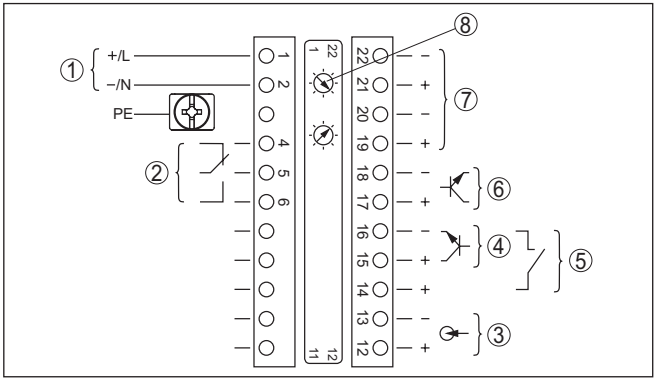


Fig. 12: Electronics and connection compartment (Ex-d) with instruments with intrinsically safe current output

1 *Voltage supply*
2 *Relay output*
3 *Signal input 4 … 20 mA (active sensor)*
4 *Switching input for NPN transistor*
5 *Switching input floating*
6 *Transistor output*
7 *Interface for sensor-sensor communication (MGC)*
8 *Setting the bus address for sensor-sensor communication (MGC)*[2)]

Adjustment and connection compartment - Instruments with intrinsically safe current output

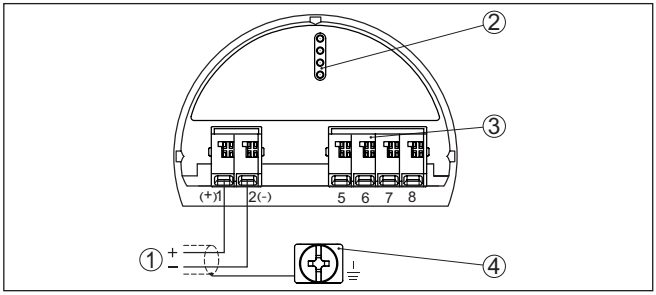


Fig. 13: Adjustment and connection compartment (Ex-ia) with instruments with intrinsically safe current output

1 *Terminals for intrinsically safe signal output 4 … 20 mA/HART active (not with versions with Ex-d approval)*
2 *Contact pins for the display and adjustment module or interface adapter*
3 *Terminals for the external display and adjustment unit*
4 *Ground terminal*

[2)] MGC = Multi Gauge Communication

5.3 Connection - Level detection

Non-Ex instruments and instruments with non-intrinsically safe current output

Electronics and connection compartment - Non-Ex instruments and instruments with non-intrinsically safe current output

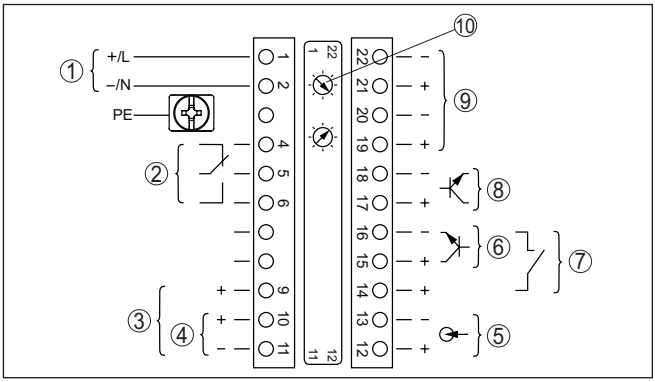


Fig. 14: Electronics and connection compartment with non-Ex instruments and instruments with non-intrinsically safe current output

1 *Voltage supply*
2 *Relay output*
3 *Signal output 8/16 mA/HART active*
4 *Signal output 8/16 mA/HART Multidrop passive*
5 *Signal input 4 … 20 mA*
6 *Switching input for NPN transistor*
7 *Switching input floating*
8 *Transistor output*
9 *Interface for sensor-sensor communication (MGC)*
10 *Setting the bus address for sensor-sensor communication (MGC)*[3)]

Adjustment and connection compartment - Non-Ex instruments and instruments with non-intrinsically safe current output

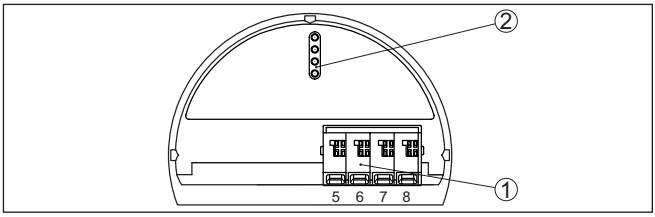


Fig. 15: Adjustment and connection compartment with non-Ex instruments and instruments with non-intrinsically safe current output

1 *Terminals for the external display and adjustment unit*
2 *Contact pins for the display and adjustment module or interface adapter*

Instruments with intrinsically safe current output

You can find detailed information on the explosion-protected versions (Ex-ia, Ex-d) in the Ex-specific safety instructions. These safety instructions are part of the scope of delivery and come with the Ex-approved instruments.

[3)] MGC = Multi Gauge Communication

Electronics and connection compartment - Instruments with intrinsically safe current output

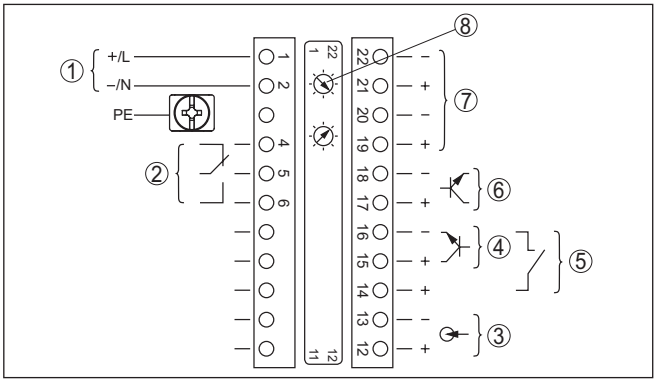


Fig. 16: Electronics and connection compartment (Ex-d) with instruments with intrinsically safe current output

1 *Voltage supply*
2 *Relay output*
3 *Signal input 4 … 20 mA*
4 *Switching input for NPN transistor*
5 *Switching input floating*
6 *Transistor output*
7 *Interface for sensor-sensor communication (MGC)*
8 *Setting the bus address for sensor-sensor communication (MGC)*[4)]

Adjustment and connection compartment - Instruments with intrinsically safe current output

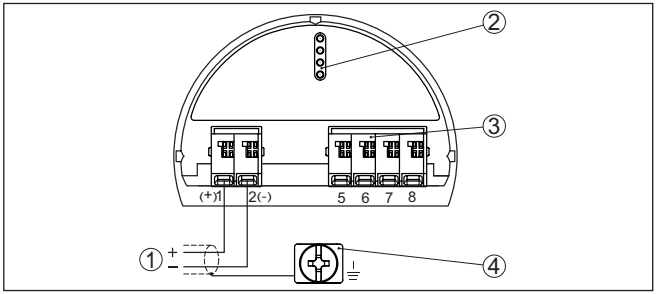


Fig. 17: Adjustment and connection compartment (Ex-ia) with instruments with intrinsically safe current output

1 *Terminals for intrinsically safe signal output 8/16 mA/HART (Multidrop) active (not with versions with Ex-d approval)*
2 *Contact pins for the display and adjustment module or interface adapter*
3 *Terminals for the external display and adjustment unit*
4 *Ground terminal*

4) MGC = Multi Gauge Communication

6 Set up with the display and adjustment module

6.1 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 power supply.

Proceed as follows:

1. Unscrew the small housing cover
2. Place the display and adjustment module in the desired position on the electronics (you can choose any one of four different positions - each displaced by 90°)
3. Press the display and adjustment module onto the electronics and turn it to the right until it snaps in.
4. Screw housing cover with inspection window tightly back on

Removal is carried out in reverse order.

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

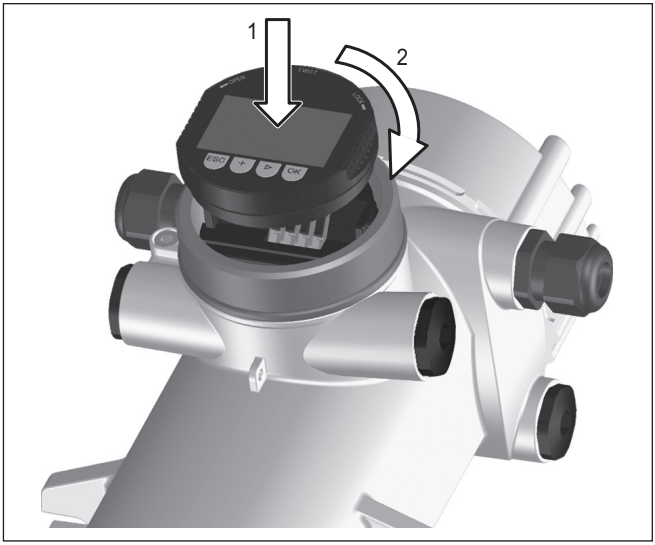


Fig. 18: Insert display and adjustment module

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

6.2 Adjustment system

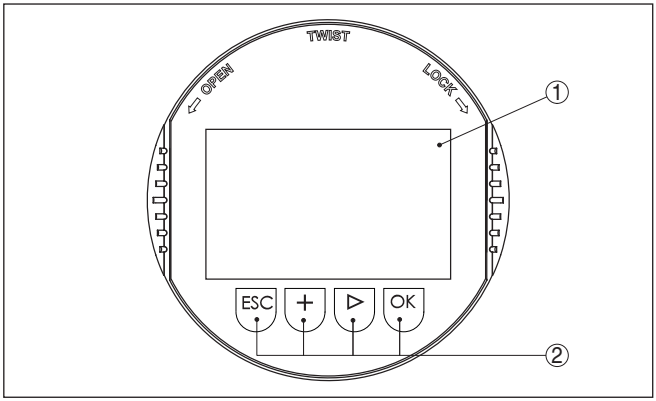


Fig. 19: Display and adjustment elements

1 LC display
2 Adjustment keys

Key functions

- ***[OK]*** key:
  - Move to the menu overview
  - Confirm selected menu
  - Edit parameter
  - Save value
- ***[->]*** key:
  - Presentation, change measured value
  - Select list entry
  - Select editing position
- ***[+]*** key:
  - Change value of the parameter
- ***[ESC]*** key:
  - Interrupt input
  - Jump to next higher menu

Adjustment system

The sensor is adjusted via the four keys of the display and adjustment module. The LC display indicates the individual menu items. The functions of the individual keys are shown in the above illustration. 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.

6.3 Parameter adjustment - Level measurement

Through the parameter adjustment the instrument is adapted to the application conditions. The parameter adjustment is carried out via an adjustment menu.

Information:
In this operating instructions manual, the instrument-specific parameters are described. Further general parameters are described in the operating instructions manual "*Display and adjustment module*".

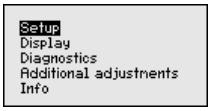
Instrument start

Caution:
During the first setup or after an instrument reset the instrument starts with preset standard values. These value are not suitable for your application and must be replaced by real values.

Carry out a setup in the sequence described in the following.

Main menu

The main menu is divided into five sections with the following functions:



Setup: Settings, e.g. for measurement loop name, isotope, application, background radiation, adjustment, signal output

Display: Settings, for example language, measured value display

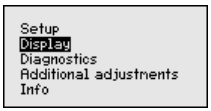
Diagnosis: Information, for example, of device status, peak value, simulation

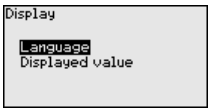
Additional adjustments: Instrument unit, reset, date/time, copying function

Info: Instrument name, hardware and software version, date of manufacture, instrument features

Proceeding

Check if the correct language is already set for the display. If not, you can change the language in the menu item "*Display/Language*".





Start with the setup of MINITRAC 31.

In the main menu point "*Setup*", the individual submenu points should be selected subsequently and provided with the correct parameters to ensure the optimum adjustment of the measurement. The procedure is described in the following.

Possibly keep the sequence of the menu items.

Adjustment

Setup - Measurement loop name

In this menu item you can assign an unambiguous name to the sensor or the measurement loop.

This parameter is described in the operating instructions manual "*Display and adjustment module*".

Setup/Isotope

In this menu item you can adjust the MINITRAC 31 to the integrated isotope in the source container.

For this purpose, check which isotope is integrated in the source container. You can find this information on the type label of the source container.

Setup - Application

Enter here, the respective application.

This menu item enables adaptation of the sensor to the requested application. You can choose between the following applications: "*Level*", "*Density*", "*Limit level*", "*X-ray alarm*" or "*Real value correction*".

Setup/Background radiation

The natural radiation on earth influences the accuracy of the measurement.

With this menu item the natural background radiation can be faded out.

For this purpose, the MINITRAC 31 measures the natural background radiation and sets the pulse rate to zero.

In the future, the pulse rate from this background radiation will be automatically deducted from the total pulse rate. This means: only the component of the pulse rate originating from the source will be displayed.

The source container must be closed for this setting.

Setup - Units

In this menu item you can select the units of the process value and the temperature.

Setup - Adjustment

In this menu item you can enter the measuring range (min. and max. process value) of the sensor.

These settings influence the current output of the sensor.

Enter in the menu window "*Max. process value*" the max. level (full), for example in "*m*". This corresponds to an output current of 20 mA.

Enter in the menu window "*Min. process value*" the min. level (empty), for example in "*m*". This corresponds to an output current of 4 mA.

Setup - Linearization

In this menu item you can carry out the adjustment of the sensor.

Due to the measuring principle, there is no linear relationship between pulse rate and level. Hence, this adjustment (i.e. linearization) must in any case be carried out.

Note:
If you cannot fill the vessel with the original medium, it is also possible to carry out the adjustment with water.

Prerequisites:

The radiation is switched on - source container is set to "On"

The vessel is either completely filled (100 %) or completely emptied (0 %).

Depending on the fact if the vessel is filled or emptied, you can carried out first the full or the empty adjustment. The MINITRAC 31 sorts the points automatically according to their level.

Select "*Show table*" to display and edit the linearization points.

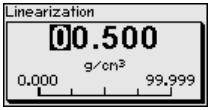
Select "*Linearization - New*" to enter the first point.

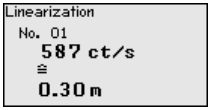
Select "*Determine count rate*" to enter the first point.

The determination of the actual count rate lasts 2 minutes. After the count rate has been determined, you can accept the value (ct/s).

Enter now the corresponding level (m).

By doing so, you assign a respective level to the actual count rate.





Accept the value pair with "*OK*".

Depending if you have started with full or empty vessel, you have to continue emptying or filling the vessel.

Also carry out such a linearization with several different filling heights if you have a linear vessel.

A maximum of 32 linearization points is possible.

Setup - Damping

In this menu item you can adjust the damping of the sensor. With it you can suppress fluctuations in the measured value indication, caused e.g. by an agitated product surface. This time can be between 1 and 1200 seconds. Keep in mind that also the reaction time increases and the instrument reacts to quick level changes with a delay. Generally a time of approximately 60 seconds is sufficient to smooth the measured value indication.

Setup/External radiation alarm

Radiation from external sources can influence the measuring result of the sensor.

Possible external radiation sources can be, for example, a weld joint test on a neighbouring facility or other radiation-based instruments.

An X-ray alarm is triggered if the impulses (ct/s) are more than 25 % above the max. value from the linearization table.

This fault message is only outputted for the period of the increased X-ray radiation. Then the fault message is automatically reset.

In this menu item you can determine the behaviour of the sensor when external radiation sources appear.

Setup/Relay

In this menu item you can activate the relay output and determine its function as well as the switching points.

When the output of the process values is set, you can choose between overfill and dry run protection.

The relay outputs of the sensor react accordingly.

You can choose "no" reference value. In this case, the relay output operates as fail safe relay.

Caution:
Independent of the selected reference value, the relay will deenergize in case of failure.

Additional settings

Additional adjustments - Reset

The following reset functions are available:

Basic adjustments: Resetting of the parameter adjustmetns to default values at the time of shipment. Order-specific settings will be deleted.

Default settings: Resetting of the parameter adjustment like under "*Basic adjustment*". In addition, special parameters will be reset to default values. Order-specific settings will not be deleted.

Peak values measured value: Resetting of the parameter adjustments in the menu item "*Setup*" to the default values of the respective instrument. Order-specific settings remain but are not taken over into the current parameters.

Peak values temperature: Resetting of the measured min. and max. temperatures to the actual measured value.

The following table shows the default values of the instrument. The values apply for the application "*Level*". First of all you have to select the application.

Depending on the instrument version, not all menu items may be available or they may be differently assigned:

Menu	Menu item	Default value
Adjustment	Measurement loop name	Sensor
	Isotope	Cs-137
	Applications	Level
	Background radiation	0 ct/s
	Unit of the process value	m
	Temperature unit	° C
	Damping	60 s
	Real value correction	0
	Current output mode	4 … 20 mA, < 3.6 mA
	Current output Min./Max.	Min. current 3.8 mA, max. current 20.5 mA
	X-ray alarm	Modulated measuring current
	Reference value - Relay	None
	Block operation	Released
Display	Language	Selected language
	Displayed value	Pulse rate
	Display unit	ct/s
Additional settings	Temperature unit	°C
	Linearization curve	Empty
	HART mode	Standard Address 0

6.4 Parameter adjustment - Density measurement

Through the parameter adjustment the instrument is adapted to the application conditions. The parameter adjustment is carried out via an adjustment menu.

Information:
In this operating instructions manual, the instrument-specific parameters are described. Further general parameters are described in the operating instructions manual "*Display and adjustment module*".

Prerequisites
The following requirements must be fulfilled for reliable and safe operation:

- The tube must be filled. There must be no air bubbles in the tube
- The source container is switched on
- A sample point is close to the measuring point

Warning:
When the source container is switched on, the tube must always be filled. If the tube is empty, there can be an increased local dose rate. Make sure that the tube is filled even in case of plant downtime, or switch the source container off.

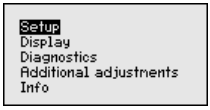
Instrument start

Carry out a setup in the sequence described in the following.

Caution:
During the first setup or after an instrument reset the instrument starts with preset standard values. These value are not suitable for your application and must be replaced by real values.

Main menu

The main menu is divided into five sections with the following functions:



Setup: Settings, e.g. for measurement loop name, isotope, application, background radiation, adjustment, signal output

Display: Settings, for example language, measured value display

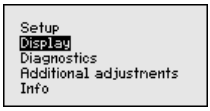
Diagnosis: Information, for example, of device status, peak value, simulation

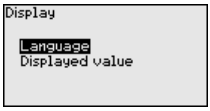
Additional adjustments: Instrument unit, reset, date/time, copying function

Info: Instrument name, hardware and software version, date of manufacture, instrument features

Proceeding

Check if the correct language is already set for the display. If not, you can change the language in the menu item "*Display/Language*".





Start with the setup of MINITRAC 31.

In the main menu point "*Setup*", the individual submenu points should be selected subsequently and provided with the correct parameters to ensure the optimum adjustment of the measurement. The procedure is described in the following.

Possibly keep the sequence of the menu items.

Adjustment

Setup - Measurement loop name

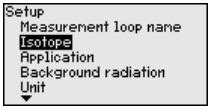
In this menu item you can assign an unambiguous name to the sensor or the measurement loop.

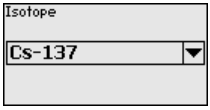
This parameter is described in the operating instructions manual "*Display and adjustment module*".

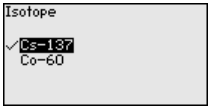
Setup/Isotope

In this menu item you can adjust the MINITRAC 31 to the integrated isotope in the source container.

For this purpose, check which isotope is integrated in the source container. You can find this information on the type label of the source container.







Through this selection, the sensitivity of the sensor is adapted perfectly to the isotope. The normal reduction of the emitter activity is hence considered through the radioactive decay.

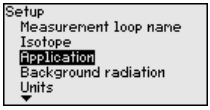
The MINITRAC 31 requires this information of the automatic decay compensation. This ensures an interference-free measurement over the complete life time of the gamma emitter - an annual recalibration is not necessary.

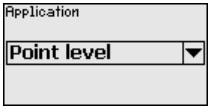
Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

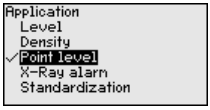
Setup/Application

Enter here, the respective application.

This menu item enables adaptation of the sensor to the requested application. You can choose between the following applications: "*Level*", "*Density*", "*Limit level*", "*X-ray alarm*" or "*Real value correction*".







Setup/Background radiation

The natural radiation on earth influences the accuracy of the measurement.

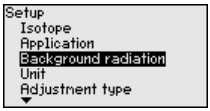
With this menu item the natural background radiation can be faded out.

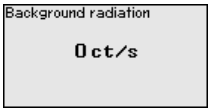
Note:
Make sure that some products have a self-radiation. This is for example the case with oil or potash salt lye. Therefore the tube must be filled to determine the background radiation.

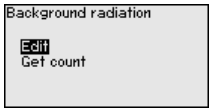
For this purpose, the MINITRAC 31 measures the natural background radiation and sets the pulse rate to zero.

In the future, the pulse rate from this background radiation will be automatically deducted from the total pulse rate. This means: only the component of the pulse rate originating from the source will be displayed.

The source container must be closed for this setting (OFF).

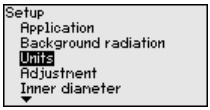


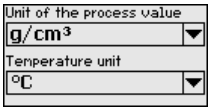


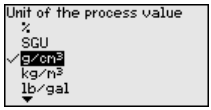


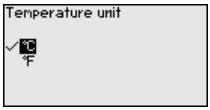
Setup/Units

In this menu item you can select the units of the process value and the temperature.





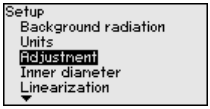


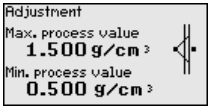


Setup/Adjustment

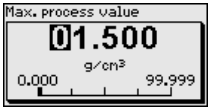
In this menu item you can enter the measuring range (min. and max. process value) of the sensor.

These settings influence the current output of the sensor.





Enter in the menu window "*Max. process value*" the max. density value, for example in "*g/cm³*". This corresponds to an output current of 20 mA.

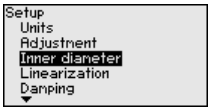


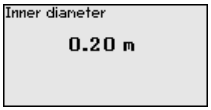
Enter in the menu window "*Min. process value*" the min. density value, for example in "*g/cm³*". This corresponds to an output current of 4 mA.

Setup/Inside diameter

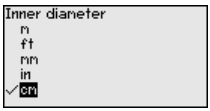
In this menu item you can enter the inside diameter of the tube or the radiated length (L).

This setting influences the accuracy of the sensor.





First of all, select the unit of the inside diameter.



Enter in the menu window "*Inside diameter*" the inside diamter of the tube, for example in "*cm*".

If the tube is not radiated with 90°, then you have to enter the radiated length (L) instead of the tube inside diameter.

Enter also here the radiated length without the wall thickness of the tube.

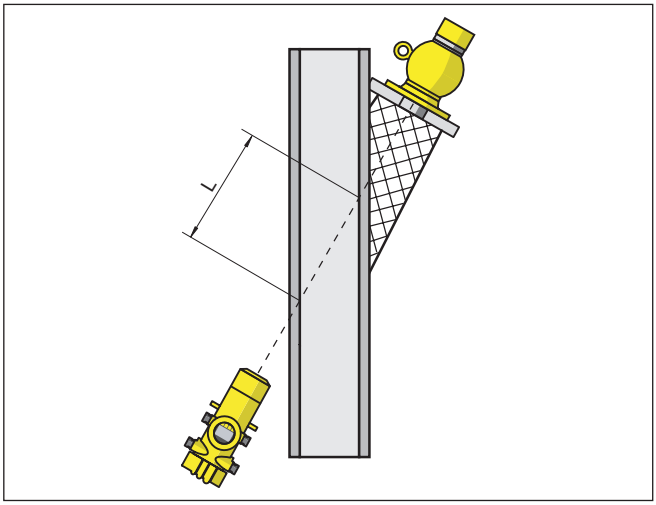
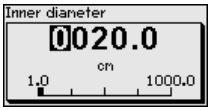


Fig. 20: With inclined mounting, the radiated length of the tube is applicable



Setup/Linearization

In this menu item you can carry out the adjustment of the sensor.

Caution:
During the first setup or after an instrument reset, the linearization stands at the preset value pair (90000 ct/s and 0.500 g/cm³). These values are not suitable for your application and must be replaced by real values. Delete this value pair in the following procedure and carry out the linearization.

Due to the measuring principle, there is no linear relationship between pulse rate and density. Hence, this adjustment (i.e. linearization) must be carried out in any event.

Carry out this adjustment with several points to increase the accuracy of the measurement.

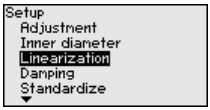
Note:
Water has as a known density value of 1 g/cm³. Carry out the adjustment with water, if possible.

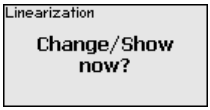
- Prerequisites:

The radiation is switched on - source container is set to "On"

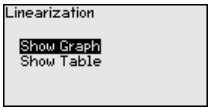
The tube is completely filled. Possible gas bubbles or air inclusions can influence the measurement.

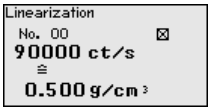
The MINITRAC 31 sorts the points automatically according to their density.



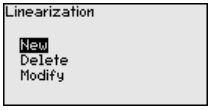


Select "*Show table*" to display and edit the linearization points.

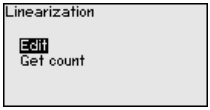




Select "*Linearization - New*" to enter the first point.

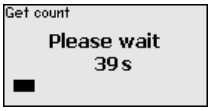


Select "*Determine count rate*" to enter the first point.



The determination of the actual count rate lasts 2 minutes. After the count rate was determined, you can accept the value.

The count rate is stated in ct/s. This is the number of counts per second, i.e. the measured radioactive radiation dose actually reaching the sensor.

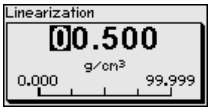


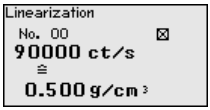
Enter now the corresponding density value (g/cm³).

You thus assign a corresponding density to the actual count rate.

Note:
If possible, take a product sample and determine the density simultaneously in your sampling position.

It has proven marking the product smaples with date and respective count rate. Hence the values can be assigned later on without problems.





Accept the value pair with "*OK*".

Enter as many linearization points as possible. You can influence the accuracy of the density measurement by doing this. The more linearization points you enter and the higher the difference between the density values, the more reliable the measurement.

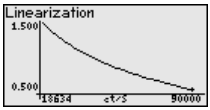
Value pairs that are not yet complete, e.g. due to a missing density determination, can be edited later with the function "*Setup/Linearization*" under the item "*Change/Edit*".

A maximum of 32 linearization points is possible.

Note:
If you cannot change the medium during the adjustment process, it is possible to carry out the linearization with only one point. However, you should enter further linearization points later, if possible.

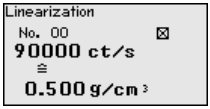
- Show diagram

This menu item is only available if a linearization was already carried out.



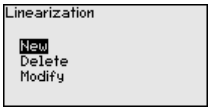
- Show table

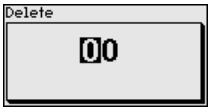
In this menu item you can show the individual value pairs of the linearization.



- Linearization - Delete

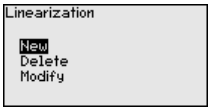
You can also delete individual linearization points. Enter the number of the point you want to delete.

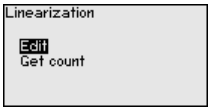


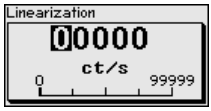


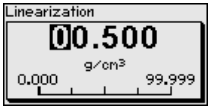
- Linearization - Modify

You can also modify individual linearization points.

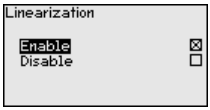








After editing, you have to activate the complete value pair so that the linearization point will be effective.

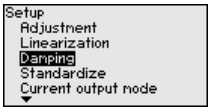


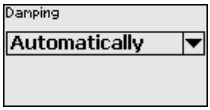
You recognize active linearization points by a small square with a cross next to the number of the linearization point.

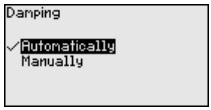
Setup/Damping

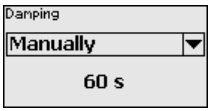
In this menu item you can adjust the damping of the sensor. With it you can suppress fluctuations in the measured value indication, caused e.g. by an agitated product surface. This time can be between 1 and 1200 seconds. Keep in mind that also the reaction time increases and the instrument reacts to quick level changes with a delay. Generally a time of approximately 60 seconds is sufficient to smooth the measured value indication.

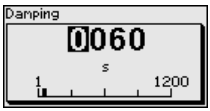
With the setting "Automatic", the instrument itself calculates a suitable damping on the basis of the adjustment and the measured value changes. This setting is particularly suitable for application where fast and slow level changes occur.









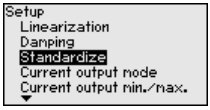


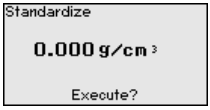
Setup/Real value correction (manually)

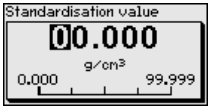
The implementation of a real value corretion is only necessary if the requirements of the measurement loop have changed, for example with abrasion in a tube.

If you know the density of a certain medium, you can enter the determined real density in this menu item to correct the measured value. The function shifts the linearization curve to this determined point.

The measurement can thus be adapted exactly to the conditions in the tube.

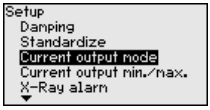


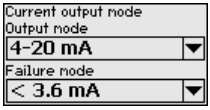


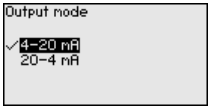


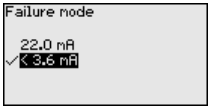
Setup/Current output mode

In this menu item you can define the characteristics of the sensor and its behaviour in case of a fault.





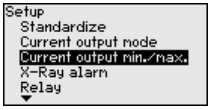


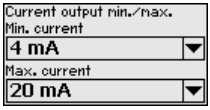


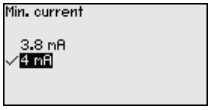
Setup/Current output Min./Max.

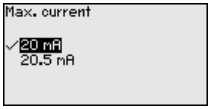
In this menu item you can define the behaviour of the current output.

You can specify the current at minimum and maximum density separately.









Setup/External radiation alarm

Radiation from external sources can influence the measuring result of the sensor.

Possible external radiation sources can be, for example, a weld joint test on a neighbouring facility or other radiation-based instruments.

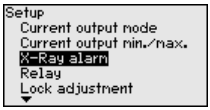
An X-ray alarm is triggered if the impulses (ct/s) are more than 25 % above the max. value from the linearization table.

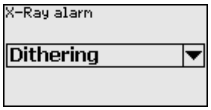
This fault message is only outputted for the period of the increased X-ray radiation. Then the fault message is automatically reset.

In this menu item you can determine the behaviour of the sensor when external radiation sources appear.

You can choose whether the sensor should output modulated current (dithering) or the set fault current in case external radiation appears.

In the case of modulated measuring current (dithering), the last valid current value is maintained and the current output modulates a square-wave voltage ±1 mA around this value.





Setup/Relay

In this menu item you can activate the relay output and determine its function as well as the switching points.

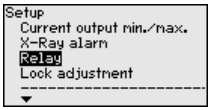
When the output of the process values is set, you can choose between overfill and dry run protection.

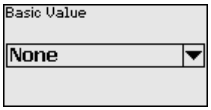
The relay outputs of the sensor react accordingly.

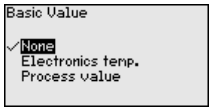
The following reference values can be selected:

- None - Relay operates as fail safe relay
- Electronics temperature
- Process value

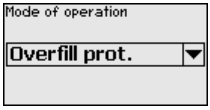
"No" reference value means that the relay output operates as fail safe relay.

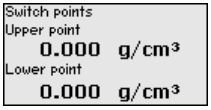


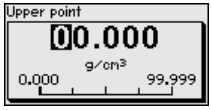


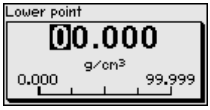


Example for the adjustment of the process value









Caution:
Independent of the selected reference value, the relay will deenergize in case of failure.

Lock setup/adjustment

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

This menu item is described in the operating instructions manual "*Display and adjustment module*".

Display

Display/Language

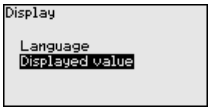
With this parameter you can change the display language.

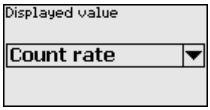
This parameter is described in the operating instructions manual "*Display and adjustment module*".

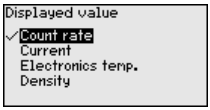
Display/Displayed value

With this parameter you can change the indication of the display.

You can choose if the display should show the actual pulse rate, the output current, the electronics temperature or the percentage value.







Diagnostics

Diagnostics/Device status

In this menu item, you can enquire the status of your sensor. In normal operation, the sensor displays the message "**OK**". In case of fault, you will find the corresponding fault code here.

This parameter is described in the operating instructions manual "*Display and adjustment module*".

Diagnosis/Peak value

The peak value function holds the max. and min. values during operation.

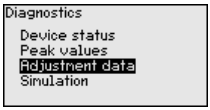
This parameter is described in the operating instructions manual "*Display and adjustment module*".

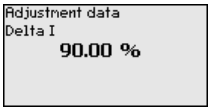
Diagnosis/Adjustment data

Here you can retrieve the adjustment value of the sensor. This is the percentage value of the difference of the min. and max. adjustment points (Delta I). The value is an indication for the reliability and reproducibility of the measurement.

The higher the difference between the two adjustment points, the higher the differential value (Delta I) and the more reliable the measurement. A Delta I value below 10 % is an indication for a critical measurement.

To increase the Delta I value, you have to increase the distance of the min. and max. adjustment points in the linearization.

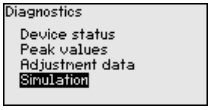


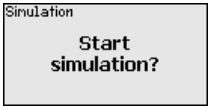


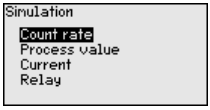
Diagnosis/Simulation

In this menu item you can simulate measured values via the current output. This allows the signal path to be tested, e.g. via downstream indicating instruments or the input card of the control system.

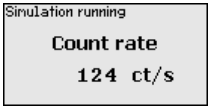
You can simulate different values:

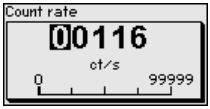




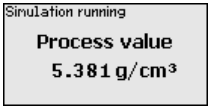


Pulse rate of the sensor

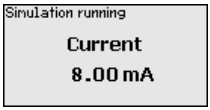




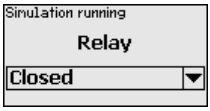
Process value



Current output



Switching function of the relay



Information:
The simulation is terminated automatically 60 minutes after the last key has been pushed.

Additional settings

Additional adjustments/ PIN

In this menu item, the PIN is permanently activated/deactivated. Thus you protect the sensor data against unauthorized access and unintended changes. The default setting of the PIN is 0000.

This parameter is described in the operating instructions manual "*Display and adjustment module*".

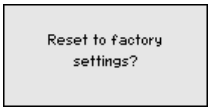
Additional adjustments/ Date time

In this menu item you can set the actual date and time.

This parameter is described in the operating instructions manual "*Display and adjustment module*".

Additional adjustments/ Reset

When a reset is carried out, all settings (with only a few exceptions) are reset. The exceptions are: PIN, language, SIL and HART mode.



The following reset functions are available:

Basic adjustments: Resetting of the parameter adjustmetns to default values at the time of shipment. Order-specific settings will be deleted.

Default settings: Resetting of the parameter adjustment like under "*Basic adjustment*". In addition, special parameters will be reset to default values. Order-specific settings will not be deleted.

Peak values measured value: Resetting of the parameter adjustments in the menu item "*Setup*" to the default values of the respective instrument. Order-specific settings remain but are not taken over into the current parameters.

Peak values temperature: Resetting of the measured min. and max. temperatures to the actual measured value.

The following table shows the default values of the instrument. The values apply for the application "*Level*". First of all you have to select the application.

Depending on the instrument version, not all menu items may be available or they may be differently assigned:

Menu	Menu item	Default value
Adjustment	Measurement loop name	Sensor
	Isotope	Cs-137
	Applications	Density
	Background radiation	0 ct/s
	Unit of the process value	g/cm³
	Temperature unit	° C
	Adjustment min. process value	0.500 g/cm³
	Adjustment max. process value	1.500 g/cm³
	Inner diameter	0.20 m
	Linearization	90000 ct/s and 0.500 g/cm³
	Damping	60 s
	Real value correction	0
	Current output mode	4 … 20 mA, < 3.6 mA
	Current output Min./Max.	Min. current 3.8 mA, max. current 20.5 mA
	X-ray alarm	Modulated measuring current
	Reference value - Relay	None
	Block operation	Released
Display	Language	Selected language
	Displayed value	Pulse rate
	Display unit	ct/s
Additional settings	HART mode	Standard Address 0

Additional adjustments/ HART mode

With this function you can select the mode.

The sensor offers the HART modes standard and multidrop.

The mode 'Standard' with the fixed address 0 (factory setting) means output of the measured value as 4 … 20 mA signal.

This parameter is described in the operating instructions manual "*Display and adjustment module*".

Additional adjustments/ Copy instrument settings

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

This parameter is described in the operating instructions manual "*Display and adjustment module*".

Info

Info

In this menu you will find the following menu items:

- Instrument name - shows instrument name and serial number
- Instrument version - shows hardware and software version of the instrument
- Date of manufacture - shows calibration date and the date of the last change
- Instrument features - shows further instrument features

These parameters are described in the operating instructions manual "*Display and adjustment module*".

6.5 Parameter adjustment - Level detection

Through the parameter adjustment the instrument is adapted to the application conditions. The parameter adjustment is carried out via an adjustment menu.

Information:
In this operating instructions manual, the instrument-specific parameters are described. Further general parameters are described in the operating instructions manual "*Display and adjustment module*".

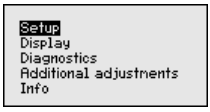
Instrument start

Caution:
During the first setup or after an instrument reset the instrument starts with preset standard values. These value are not suitable for your application and must be replaced by real values.

Carry out a setup in the sequence described in the following.

Main menu

The main menu is divided into five sections with the following functions:



Setup: Settings, e.g. for measurement loop name, isotope, application, background radiation, adjustment, signal output

Display: Settings, for example language, measured value display

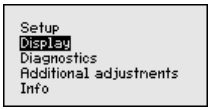
Diagnosis: Information, for example, of device status, peak value, simulation

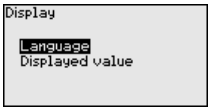
Additional adjustments: Instrument unit, reset, date/time, copying function

Info: Instrument name, hardware and software version, date of manufacture, instrument features

Proceeding

Check if the correct language is already set for the display. If not, you can change the language in the menu item "*Display/Language*".





Start with the setup of MINITRAC 31.

In the main menu point "*Setup*", the individual submenu points should be selected subsequently and provided with the correct parameters to ensure the optimum adjustment of the measurement. The procedure is described in the following.

Possibly keep the sequence of the menu items.

Adjustment

Setup - Measurement loop name

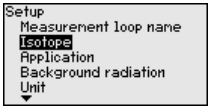
In this menu item you can assign an unambiguous name to the sensor or the measurement loop.

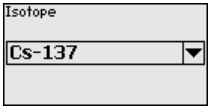
This parameter is described in the operating instructions manual "*Display and adjustment module*".

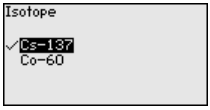
Setup/Isotope

In this menu item you can adjust the MINITRAC 31 to the integrated isotope in the source container.

For this purpose, check which isotope is integrated in the source container. You can find this information on the type label of the source container.







Through this selection, the sensitivity of the sensor is adapted perfectly to the isotope. The normal reduction of the emitter activity is hence considered through the radioactive decay.

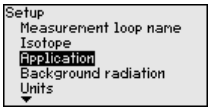
The MINITRAC 31 requires this information of the automatic decay compensation. This ensures an interference-free measurement over the complete life time of the gamma emitter - an annual recalibration is not necessary.

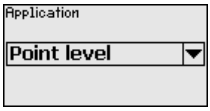
Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

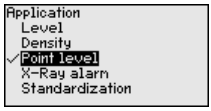
Setup/Application

Enter here, the respective application.

This menu item enables adaptation of the sensor to the requested application. You can choose between the following applications: "*Level*", "*Density*", "*Limit level*", "*X-ray alarm*" or "*Real value correction*".







Setup/Background radiation

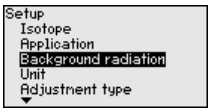
The natural radiation on earth influences the accuracy of the measurement.

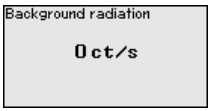
With this menu item the natural background radiation can be faded out.

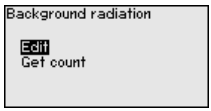
For this purpose, the MINITRAC 31 measures the natural background radiation and sets the pulse rate to zero.

In the future, the pulse rate from this background radiation will be automatically deducted from the total pulse rate. This means: only the component of the pulse rate originating from the source will be displayed.

The source container must be closed for this setting.

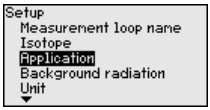


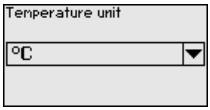


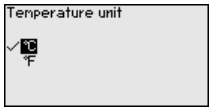


Setup/Unit

In this menu item you can select the temperature unit.







Setup/Adjustment mode

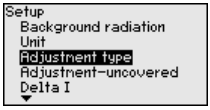
in this menu item you can select if you want to carry out a single or double point adjustment on the sensor.

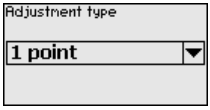
With the double point adjustment, the Delta I value is selected automatically.

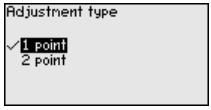
We recommend selecting the double point adjustment. To use this, you must be able to change the level of the vessel so as to carry out the adjustment of the sensor with full status (covered) and with empty status (uncovered).

Hence, you will get a very reliable switching point.

With single point adjustment, you have to define the difference between the min. and max. adjustment points (Delta I) yourself during the following setup.







Setup/Adjustment uncovered (single point adjustment)

This menu item appears only if you have selected "**Single point adjustment**" as adjustment mode (Setup/Adjustment mode).

In this menu item you determine the point at which the MINITRAC 31 should switch in uncovered status.

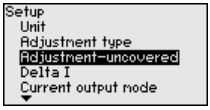
Empty the vessel until the sensor is uncovered.

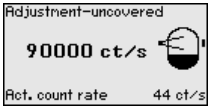
For this enter the requested pulse rate manually or let the rate be determined by MINITRAC 31. Automatic determination of the pulse rate should be given preference.

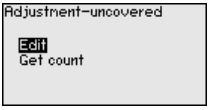
The pulse rate is entered in ct/s. This is the number of counts per second, i.e. the measured gamma radiation reaching the sensor.

Prerequisites:

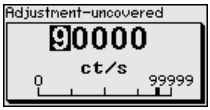
- The radiation is switched on - source container is set to "On"
- There is no medium between source container and sensor







You can enter the value for "*Adjustment uncovered*" (ct/s) manually.



You can have the value for "*Adjustment uncovered*" determined by MINITRAC 31.

Setup/Delta I (single point adjustment)

This menu item appears only if you have selected "**Single point adjustment**" as adjustment mode (Setup/Adjustment mode).

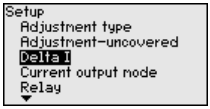
In this menu item you can adjust at which percentage value of the max. pulse rate the sensor should switch over.

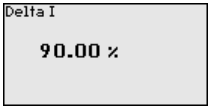
Since in most cases the radiation is almost completely absorbed when the sensor is covered, the pulse rate when the sensor is covered is very low.

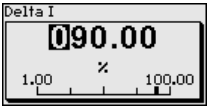
The change between the two statuses is sufficiently clear.

Hence a percentage value of 90 % for the Delta I value is recommended.

You select lower values for the sensitive detection of material cones or buildup which only cause a partial absorption of the radiation.







Adjustment covered (double point adjustment)

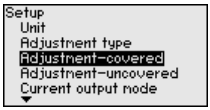
This menu item appears only if you have selected under adjustment mode (setup/adjustment mode) the "**Double point adjustment**".

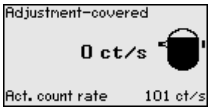
In this menu item you can set the min. pulse rate (ct/s) at which the sensor should switch over.

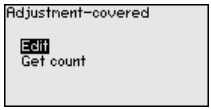
Fill the vessel until the MINITRAC 31 is covered.

You thus get the min. pulse rate (ct/s) for the adjustment covered.

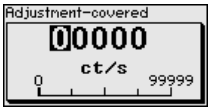
Enter the requested pulse rate manually or let the rate be determined by MINITRAC 31. Automatic determination of the pulse rate should be given preference.







You can enter the adjustment point (ct/s) manually.



You can let the adjustment point be determined by MINITRAC 31.

Adjustment uncovered (double point adjustment)

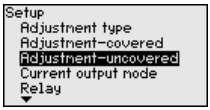
This menu item appears only if you have selected under adjustment mode (setup/adjustment mode) the "**Double point adjustment**".

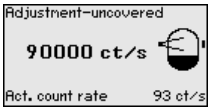
In this menu item you can set the max. pulse rate (ct/s) at which the sensor should switch over.

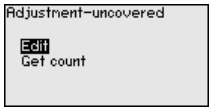
Empty the vessel until the MINITRAC 31 is uncovered.

You thus get the max. pulse rate (ct/s) for the adjustment uncovered.

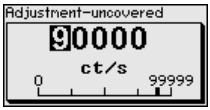
Enter the requested pulse rate manually or let the rate be determined by MINITRAC 31. Automatic determination of the pulse rate should be given preference.







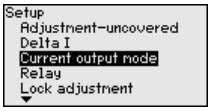
You can enter the adjustment point (ct/s) manually.

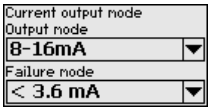


You can let the adjustment point be determined by MINITRAC 31.

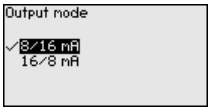
Setup/Current output mode

In this menu item you can select the switching behaviour of the sensor.

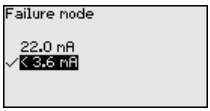




You can choose between an 8 - 16 mA characteristics or a 16 - 8 mA characteristics.



In this menu item you can also define the switching behaviour in case of fault. You can select if the current output should output 22 mA or < 3.6 mA in case of fault.



Setup/Relay

In this menu item you can select which mode the sensor should operate in.

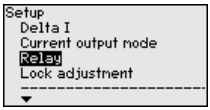
You can choose between overfill and dry run protection.

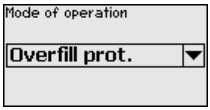
The relay outputs of the sensor react accordingly.

Overfill protection = the relay will deenergise (safe condition) when the max. level is reached.

Dry run protection = the relay will deenergise (safe condition) when the min. level is reached.

Make sure that you have selected the correct characteristics. See menu item "*Setup/Current output mode*".





Lock setup/adjustment

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

This menu item is described in the operating instructions manual "*Display and adjustment module*".

Display

Display/Language

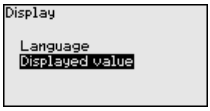
With this parameter you can change the display language.

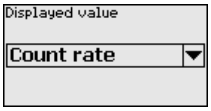
This parameter is described in the operating instructions manual "*Display and adjustment module*".

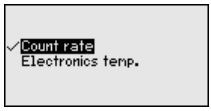
Display/Displayed value

With this parameter you can change the indication of the display.

You can select if the display should show the actual pulse rate of the electronics temperature.







Diagnostics

Diagnostics/Device status

In this menu item, you can enquire the status of your sensor. In normal operation, the sensor displays the message "**OK**". In case of fault, you will find the corresponding fault code here.

This parameter is described in the operating instructions manual "*Display and adjustment module*".

Diagnosis/Peak value

The peak value function holds the max. and min. values during operation.

This parameter is described in the operating instructions manual "*Display and adjustment module*".

Diagnosis/Adjustment data

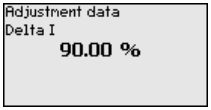
Here, you can retrieve the adjustment value of the sensor. This is the percentage value of the max. pulse rate at which the sensor switches over.

If you have carried out a single point adjustment, this is the entered value. With a double point adjustment, this is the calculated value.

The value is an indication for the reliability and reproducibility of the switching point.

The greater the difference in the pulse rate between covered and uncovered status, the greater the differential value (Delta I) and the more reliable the measurement. The automatically calculated damping is also oriented around the Delta I value. The higher the value, the lower the damping.

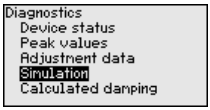
A Delta I value below 10 % is an indication for a critical measurement.

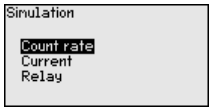


Diagnosis/Simulation

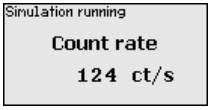
In this menu item you can simulate measured values via the current output. This allows the signal path to be tested, e.g. via downstream indicating instruments or the input card of the control system.

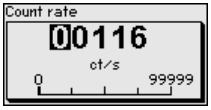
You can simulate different values:



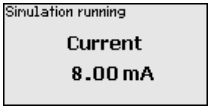


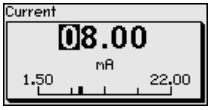
Pulse rate of the sensor



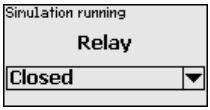


Current output





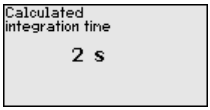
Switching function of the relay



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

Diagnosis/Calculated damping

The sensor calculates a suitable integration time automatically.



Additional settings

Additional adjustments/ PIN

In this menu item, the PIN is permanently activated/deactivated. Thus you protect the sensor data against unauthorized access and unintended changes. The default setting of the PIN is 0000.

This parameter is described in the operating instructions manual "*Display and adjustment module*".

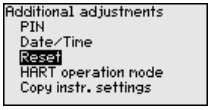
Additional adjustments/ Date time

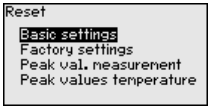
In this menu item you can set the actual date and time.

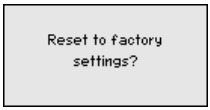
This parameter is described in the operating instructions manual "*Display and adjustment module*".

Additional adjustments - Reset

When a reset is carried out, all settings (with only a few exceptions) are reset. The exceptions are: PIN, language, SIL and HART mode.







The following reset functions are available:

Basic adjustments: Resetting of the parameter adjustmetns to default values at the time of shipment. Order-specific settings will be deleted.

Default settings: Resetting of the parameter adjustment like under "*Basic adjustment*". In addition, special parameters will be reset to default values. Order-specific settings will not be deleted.

Peak values measured value: Resetting of the parameter adjustments in the menu item "*Setup*" to the default values of the respective instrument. Order-specific settings remain but are not taken over into the current parameters.

Peak values temperature: Resetting of the measured min. and max. temperatures to the actual measured value.

The following table shows the default values of the instrument. The values apply for the application "*Level*". First of all you have to select the application.

Depending on the instrument version, not all menu items may be available or they may be differently assigned:

Menu	Menu item	Default value
Adjustment	Measurement loop name	Sensor
	Isotope	Cs-137
	Applications	Limit level
	Adjustment mode	Single point adjustment
	Adjustment - uncovered	90000 ct/s
	Adjustment - covered	9000 ct/s only with two-point adjustment
	Delta I	90 %
	Background radiation	0 ct/s
	Temperature unit	°C
	Damping	Is calculated automatically by the instrument
	Current output mode	8/16 mA, < 3.6 mA
	X-ray alarm	Modulated measuring current
	Mode - Relay	Overfill protection
	Block operation	Released
Display	Language	Selected language
	Displayed value	Pulse rate
Additional settings	Temperature unit	°C
	HART mode	Standard

Additional adjustments/ HART mode

With this function you can select the mode.

The sensor offers the HART modes standard and multidrop.

If the measured value is outputted via the 4 … 20 mA output, you must not switch over to HART Multidrop.

The mode 'Standard', with fixed address 0 (factory setting), means output of the measured value as 8/16 mA signal.

This parameter is described in the operating instructions manual "*Display and adjustment module*".

Additional adjustments/ Copy instrument settings

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

This parameter is described in the operating instructions manual "*Display and adjustment module*".

Info

Info

In this menu you will find the following menu items:

- Instrument name - shows instrument name and serial number
- Instrument version - shows hardware and software version of the instrument
- Date of manufacture - shows calibration date and the date of the last change
- Instrument features - shows further instrument features

These parameters are described in the operating instructions manual "*Display and adjustment module*".

6.6 Parameter adjustment - X-ray alarm

X-ray alarm

X-ray radiation, for example, cause with weld joint tests can influence your measured values unnoticeably. Hence it is importnat to recognized interfering X-ray radiation.

The MINITRAC 31 recognizes the X-ray raditation and reacts from an individually definable raditiation volume.

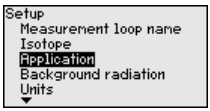
The level or density measuring instrument acts as Master and the MINITRAC 31 operates as Slave.

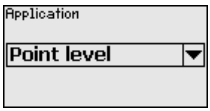
First of all, define the function of the Slave instrument before you define the Master instrument. The Master instrument can thus immediately recognize the connected Slave.

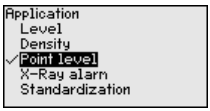
For this purpose, the Slave instrument must be defined as "X-ray alarm". Select under the menu item "*Setup/Application*" the function "X-ray alarm".

You can set the address (MGC) on the Slave instrument at will. Only the address "0 - 0" is reserved for the Master instrument.

Set the address setting (MGC) on the Master instrument to "0 - 0".





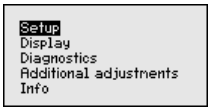


You have to enter the address of the Slave instrument in the list of the Master instrument. This function is not possible in the display and

adjustment module. To do this you need PACTware with the respective DTM.

Main menu

The main menu is divided into five sections with the following functions:



Setup: Settings, e.g. for measurement loop name, isotope, application, background radiation, adjustment, signal output

Display: Settings, for example language, measured value display

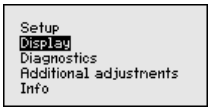
Diagnosis: Information, for example, of device status, peak value, simulation

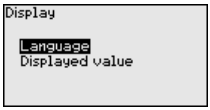
Additional adjustments: Instrument unit, reset, date/time, copying function

Info: Instrument name, hardware and software version, date of manufacture, instrument features

Proceeding

Check if the correct language is already set for the display. If not, you can change the language in the menu item "*Display/Language*".





Start with the setup of MINITRAC 31.

In the main menu point "*Setup*", the individual submenu points should be selected subsequently and provided with the correct parameters to ensure the optimum adjustment of the measurement. The procedure is described in the following.

Possibly keep the sequence of the menu items.

Adjustment

Setup - Measurement loop name

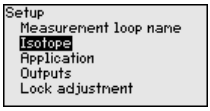
In this menu item you can assign an unambiguous name to the sensor or the measurement loop.

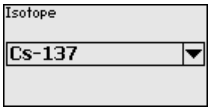
This parameter is described in the operating instructions manual "*Display and adjustment module*".

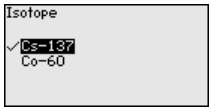
Setup/Isotope

In this menu item you can adjust the MINITRAC 31 to the integrated isotope in the source container.

For this purpose, check which isotope is integrated in the source container. You can find this information on the type label of the source container.







With this selection, the sensitivity of the sensor is adapted in an optimum way to the isotope.

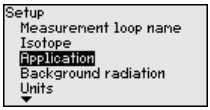
The MINITRAC 31 requires this information for the decay compensation. An annual recalibration is hence not necessary.

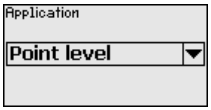
Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

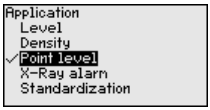
Setup/Application

Enter here, the respective application.

This menu item enables adaptation of the sensor to the requested application. You can choose between the following applications: "*Level*", "*Density*", "*Limit level*", "*X-ray alarm*" or "*Real value correction*".





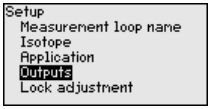


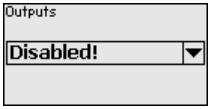
Setup/Outputs

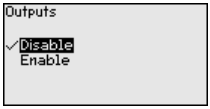
In this menu item you can activate the function of the current output.

When the output is activated, the instrument remains in its function as a Slave, but the 4 … 20 mA output of the MINITRAC 31 can be also used als single instrument.

The instrument has again the complete functionality when the output is active again.







Lock setup/adjustment

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

This menu item is described in the operating instructions manual "*Display and adjustment module*".

6.7 Parameter adjustment/Real value correction

Real value correction

To correct a level measurement, a real value correction can be carried out when a certain level is reached. This is for example necessary in case of recurring buildup on the vessel wall.

The level measurement can thus be reset to the correct real value.

The level measuring instrument acts as Master and the MINITRAC 31 operates as Slave.

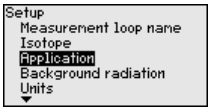
First of all, define the function of the Slave instrument before you define the Master instrument. The Master instrument can thus immediately recognize the connected Slave.

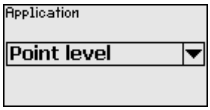
For this purpose, the Slave instrument must be defined as "Real value correction". Select under the menu item "*Setup/Application*" the function "Real value correction".

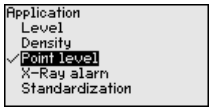
You can set the address (MGC) on the Slave instrument at will. Only the address "0 - 0" is reserved for the Master instrument.

The Master instrument must have the function "Level". For this purpose, select under the menu item "*Setup/Application*" the function "Level".

Set the address setting (MGC) on the Master instrument to "0 - 0".



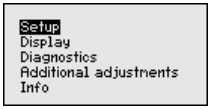




You have to enter the address of the Slave instrument in the list of the Master instrument. This function is not possible in the display and adjustment module. To do this you need PACTware with the respective DTM.

Main menu

The main menu is divided into five sections with the following functions:



Setup: Settings, e.g. for measurement loop name, isotope, application, background radiation, adjustment, signal output

Display: Settings, for example language, measured value display

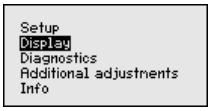
Diagnosis: Information, for example, of device status, peak value, simulation

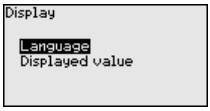
Additional adjustments: Instrument unit, reset, date/time, copying function

Info: Instrument name, hardware and software version, date of manufacture, instrument features

Proceeding

Check if the correct language is already set for the display. If not, you can change the language in the menu item "*Display/Language*".





Start with the setup of MINITRAC 31.

In the main menu point "*Setup*", the individual submenu points should be selected subsequently and provided with the correct parameters to ensure the optimum adjustment of the measurement. The procedure is described in the following.

Possibly keep the sequence of the menu items.

Adjustment

Setup - Measurement loop name

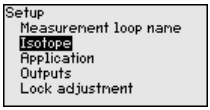
In this menu item you can assign an unambiguous name to the sensor or the measurement loop.

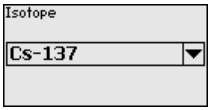
This parameter is described in the operating instructions manual "*Display and adjustment module*".

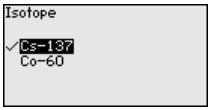
Setup/Isotope

In this menu item you can adjust the MINITRAC 31 to the integrated isotope in the source container.

For this purpose, check which isotope is integrated in the source container. You can find this information on the type label of the source container.







With this selection, the sensitivity of the sensor is adapted in an optimum way to the isotope.

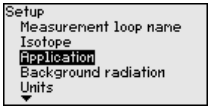
The MINITRAC 31 requires this information for the decay compensation. An annual recalibration is hence not necessary.

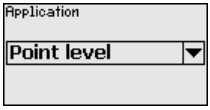
Enter the requested parameters via the appropriate keys, save your settings with ***[OK]*** and jump to the next menu item with the ***[ESC]*** and the ***[->]*** key.

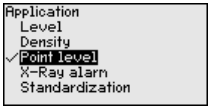
Setup/Application

Enter here, the respective application.

This menu item enables adaptation of the sensor to the requested application. You can choose between the following applications: "*Level*", "*Density*", "*Limit level*", "*X-ray alarm*" or "*Real value correction*".







Lock setup/adjustment

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

This menu item is described in the operating instructions manual "*Display and adjustment module*".

6.8 Saving the parameter adjustment data

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

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

The following data or settings for adjustment of the display and adjustment module are saved:

- All data of the menu "*Setup*" and "*Display*"
- In the menu "*Additional adjustments*" the items "*Sensor-specific units, temperature unit and linearization*"
- The values of the user programmable linearization curve

The function can also be used to transfer settings from one instrument to another instrument of the same type. If it is necessary to exchange a sensor, the display and adjustment module is inserted into the replacement instrument and the data are likewise written into the sensor via the menu item "*Copy sensor data*".

7 Setup with PACTware

7.1 Connect the PC

Via the interface adapter directly on the sensor

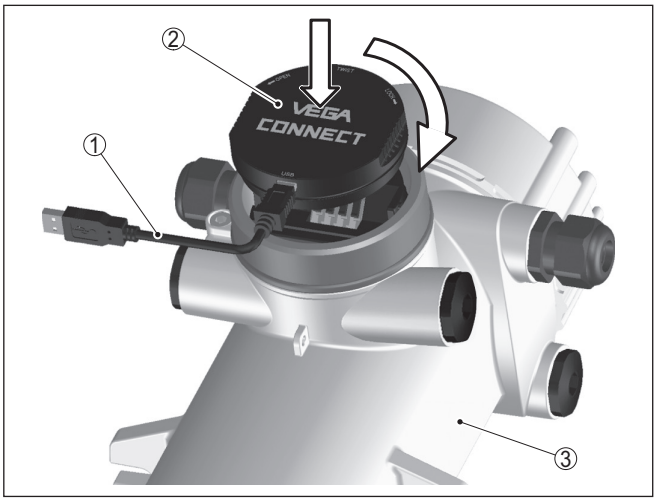


Fig. 21: Connection of the PC directly to the sensor via the interface adapter

1 USB cable to the PC
2 Interface adapter VEGACONNECT 4
3 ">Sensor

Information:
The interface adapter VEGACONNECT 3 is not suitable for connection to the sensor.

Connection via HART

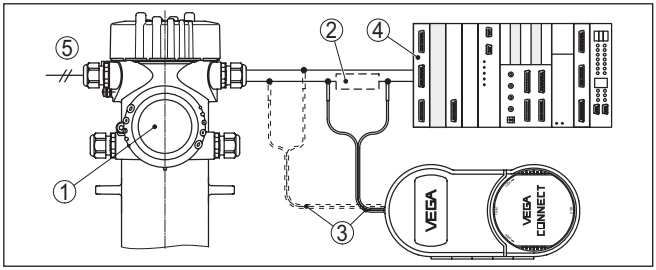


Fig. 22: Connecting the PC via HART to the signal cable

1 MINITRAC 31
2 HART resistance 250 Ω (optional depending on processing)
3 Connection cable with 2 mm pins and terminals
4 Processing system/PLC/Voltage supply
5 Voltage supply

Necessary components:

- MINITRAC 31
- PC with PACTware and suitable VEGA DTM

- VEGACONNECT 4
- HART resistance approx. 250 Ω
- Voltage supply

Note:
With power supply units with integrated HART resistance (internal resistance approx. 250 Ω), an additional external resistance is not necessary. This applies, e.g. to the VEGA instruments VEGATRENN 149A, VEGAMET 381 and VEGAMET 391). Commercially available Ex separators are also usually equipped with sufficient current limitation resistance. In such cases, VEGACONNECT 4 can be connected parallel to the 4 … 20 mA cable.

7.2 Parameter adjustment with PACTware

Prerequisites

For parameter adjustment of the sensor via a Windows PC, the configuration software PACTware and a suitable instrument driver (DTM) according to FDT standard are required. The up-to-date 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.

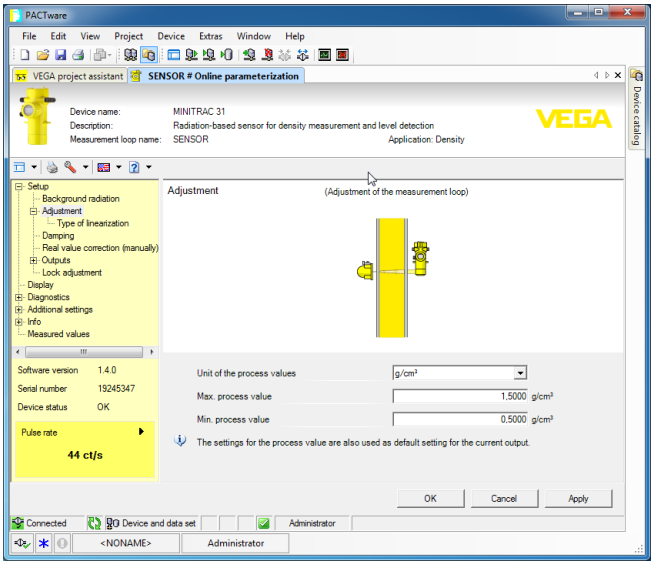


Fig. 23: Example of a DTM view

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 and "*Software*". The full version is available on CD from the agency serving you.

7.3 Saving the parameter adjustment data

We recommend documenting or saving the parameter adjustment data via PACTware. That way the data are available for multiple use or service purposes.

8 Set up with other systems

8.1 DD adjustment programs

Device descriptions as Enhanced Device Description (EDD) are available for DD adjustment programs such as, for example, AMS™ and PDM.

The files can be downloaded at www.vega.com/downloads under "*Software*".

8.2 Field Communicator 375, 475

Device descriptions for the instrument are available as EDD for parameter adjustment with the Field Communicator 375 or 475.

40447-EN-130430

9 Diagnostics and service

9.1 Maintenance

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

The corresponding source container must be checked in regular intervals. You can find further information in the operating instructions manual of the source container.

9.2 Status messages

The instrument features self-monitoring and diagnostics according to NE 107 and VDI/VDE 2650. In addition to the status messages in the following tables there are more detailed error messages available under the menu item "*Diagnostics*" via the display and adjustment module, PACTware/DTM and EDD.

Status messages

The status messages are divided into the following categories:

- Failure
- Function check
- Out of specification
- Maintenance requirement

and explained by pictographs:

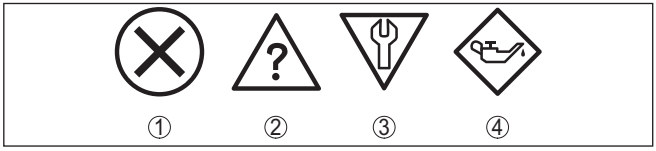


Fig. 24: Pictographs of the status messages

1 Failure - red
2 Out of specification - yellow
3 Function check - orange
4 Maintenance - blue

Failure: Due to a malfunction in the instrument, a failure message is outputted.

This status message is always active. It cannot be deactivated by the user.

Function check: The instrument is in operation, the measured value is temporarily invalid (for example during simulation).

This status message is inactive by default. It can be activated by the user via PACTware/DTM or EDD.

Out of specification: The measured value is unstable because the instrument specification is exceeded (e.g. electronics temperature).

This status message is inactive by default. It can be activated by the user via PACTware/DTM or EDD.

Maintenance: Due to external influences, the instrument function is limited. The measurement is affected, but the measured value is

still valid. Plan in maintenance for the instrument because a failure is expected in the near future (e.g. due to buildup).

This status message is inactive by default. It can be activated by the user via PACTware/DTM or EDD.

Failure

The following table shows the error codes and text messages in the status message "*Failure*" and provides information on causes as well as corrective measures.

Example for a failure message

Code Text message	Cause	Rectification
F008 Error multi sensor communication	– Additional sensors not switched on – EMC influences – No other sensor available	– Check wiring between the sensors – Connect the sensors correctly and make them ready for operation
F013 Sensor signals a fault	– Error on the current input – No valid measured value – Connected instruments without function	– Check current input – Check connected instruments (Slaves)
F016 Adjustment data exchanged	– Values of the min. and max. adjustment exchanged	– Correct adjustment data
F017 Adjustment span too small	– The values of the min. and max. adjustment are too close together	– Correct adjustment data
F025 Invalid linearization table	– Empty linearization table – Wrong value in the linearization table	– Create linearization table – Correct linearization table
F030 Process value out of limits	– Process values are not within the adjusted measuring range	– Repeat adjustment
F034 EPROM hardware error	– Electronics defective	– Restart instrument – Exchanging the electronics
F035 EPROM data error	– Error in the internal instrument communication	– Carry out a reset – Exchanging the electronics
F036 Faulty program memory	– Error during software update	– Repeat software update – Exchanging the electronics

Code Text message	Cause	Rectification
F037 RAM hardware error	– Error in RAM	– Restart instrument – Exchanging the electronics
F038 Slave signals failure	– Connection cable to the Slave instrument interrupted – Instrument not defined as Slave instrument	– Check the connection cable to the Slave instrument – Define instrument as Slave
F040 Hardware error	– Sensor defective	– Restart instrument – Exchanging the electronics
F041 Photomultiplier error	– Error in the measured value recording	– Restart instrument – Exchanging the electronics
F045 Error on the current output	– Error on the current output	– Check wiring of the current output – Exchanging the electronics
F052 Faulty configuration	– Invalid parameter adjustment	– Carry out a reset
F066 Faulty adjustment	– Adjustment not yet carried out – Error during adjustment or when entering the linearization table	– Carrying out adjustment – Carry out linearization
F068 Count rate too high	– Faulty instrument settings	– Carry out a reset
F072 Limit exceeded	– Faulty instrument settings	– Carry out a reset
F073 Error real value correction	– Faulty real value correction	– Carry out real value correction again
F080 System error	– Instrument error	– Restart instrument – Call our service
F086 Communication error	– Error in the Fieldbus communication	– Restart instrument – Call our service
F114 Error real time clock	– Discharge accumulator	– Readjust real time clock
F120 Filter time error	– Faulty or missing instrument adjustment	– Carrying out adjustment

Code Text message	Cause	Rectification
F121 Faulty participant list on the multisensor communication bus	– Slave instruments not found	– Check Slave instruments – Check Slave list in Master instrument – Slave instrument with wrong address
F122 Double addresses on the multisensor communication bus	– Instrument addresse was assigned several times	– Change instrument addresses
F123 X-ray alarm	– External instruments cause radiation	– Determine reason for X-ray alarm – In case of brief X-ray radiation: Monitor switching outputs for this time manually
F124 Alarm due to increased radiation	– Radiation dose too high	– Determine reason for increased radiation
F125 Ambient temperature too high	– Ambient temperature on the housing outside the specification	– Cool the instrument or protect it with isolating material against radiation heat

Function check

The following table shows the error codes and text messages in the status message "*Function check*" and provides information on causes as well as corrective measures.

Code Text message	Cause	Rectification
C029 Simulation	– Simulation active	– Finish simulation – Wait for the automatic end after 60 mins.

Out of specification

The following table shows the error codes and text messages in the status message "*Out of specification*" and provides information on causes as well as corrective measures.

Code Text message	Cause	Rectification
S017 Accuracy outside the specification	– Accuracy outside the specification	– Correct adjustment data

Code Text message	Cause	Rectification
S025 Bad linearization table	– Bad linearization table	– Carry out linearization
S038 Slave outside the specification	– Slave outside the specification	– Check Slave
S125 Ambient temperature too high/too low	– Ambient temperature too high/too low	– Protect instrument with isolating material against extreme temperatures

Maintenance

The instrument has no status messages to the section "*Maintenance*".

9.3 Rectify faults

Reaction when malfunctions occur

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

Procedure for fault rectification

The first measures are:

- Evaluation of fault messages, for example via the display and adjustment module
- Checking the output signal with 4 … 20 mA instruments
- Treatment of measurement errors

Further comprehensive diagnostics options offer a PC with the software PACTware and the suitable DTM. In many cases, the reasons can be determined in this way and faults can be rectified.

Check 4 … 20 mA signal (level measurement)

Connect a handmultimeter in the suitable measuring range according to the wiring plan. The following table describes possible errors in the current signal and helps to remove them:

Error	Cause	Rectification
4 … 20 mA signal not stable	Level fluctuations	Set damping according to the instrument via the display and adjustment module or PACTware/DTM
4 … 20 mA signal missing	Electrical connection faulty	Check connection according to chapter "*Connection steps*" and if necessary, correct according to chapter "*Wiring plan*"
	Voltage supply missing	Check cables for breaks; repair if necessary
	Operating voltage too low or load resistance too high	Check, adapt if necessary

Error	Cause	Rectification
Current signal greater than 22 mA or less than 3.6 mA	Instrument on failure message	Note failure message on the display and adjustment module

Check output signal (level detection)

The following table describes possible faults that may not generate an error message:

Error	Cause	Rectification
The instrument signals covered without covering with the medium The instrument signals covered with covering with the medium	Voltage supply missing	Check cables for breaks; repair if necessary
	Operating voltage too low or load resistance too high	Check, adapt if necessary
	Electrical connection faulty	Check connection according to chapter "*Connection steps*" and if necessary, correct according to chapter "*Wiring plan*"
	Electronics defective	Change the switching behaviour of the sensors under "Diagnosis/Simulation". If the instrument does not switch over, send it in for repair.
	Buildup on the inner wall of the vessel	Remove buildup Check the Delta I value. Improve the switching threshold - carry out a double point adjustment
Current signal greater than 22 mA or less than 3.6 mA	Electronics module in the sensor defective	Note error messages on the display and adjustment module

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.

9.4 Exchanging the electronics module

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

In Ex applications only one instrument and one electronics module with respective 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 electron-

ics 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, first of all the order data must be downloaded from the Internet (see operating instructions manual "*Electronics module*").

9.5 Software update

The following components are required to update the sensor software:

- Sensor
- Voltage supply
- Interface adapter VEGACONNECT 4
- PC with PACTware
- Current sensor software as file

You can find the actual sensor software as well as detailed information of the procedure under "www.vega.com/downloads" and "*Software*".

You can find information about the installation in the download file.

Caution:
Instruments with approvals can be bound to certain software versions. Therefore make sure that the approval remains effective with a software update.

You can find detailed information on www.vega.com/downloads and "*Approvals*".

9.6 How to proceed in case of repair

The following procedure refers only to the sensor. Should a repair of the source container be necessary, you can find the respective instructions in the operating instructions manual of the source container.

You can find a repair form as well as detailed information on how to proceed under www.vega.com/downloads and "*Forms and certificates*".

By doing this you help us carry out the repair quickly and without having to call back for needed information.

If a sensor repair is necessary, please proceed as follows:

- 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

- Please ask the agency serving you for the address of your return shipment. You can find the competent agency on our website www.vega.com.

10 Dismounting

10.1 Dismounting steps

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

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

10.2 Disposal

The instrument consists of materials which can be recycled by specialised recycling companies. We use recyclable materials and have designed the parts to be easily separable.

Correct disposal avoids negative effects on humans and the environment and ensures recycling of useful raw materials.

Materials: see chapter "*Technical data*"

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

WEEE directive 2002/96/EG
This instrument is not subject to the WEEE directive 2002/96/EG and the respective national laws. Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points. These may be used only for privately used products according to the WEEE directive.

11 Supplement

11.1 Technical data

General data	
316L corresponds to 1.4404 or 1.4435	
Materials, non-wetted parts	
– Scintillation material	NaI (sodium iodide)
– Aluminium die-casting housing	Aluminium die-casting AlSi10Mg, powder-coated - basis: Polyester
– Stainless steel housing	316L
– Seal between housing and housing cover	NBR (stainless steel housing, investment casting), silicone (Aluminium housing)
– Inspection window in housing cover (optional)	Polycarbonate
– Ground terminal	316L
Process fittings	
– Fastening lugs	ø 9 mm (0.35 in), hole centre distance 119 mm (4.69 in)
Weight	
– Aluminium housing, with electronics	4.1 kg (9 lbs)
– Stainless steel housing, with electronics	9.1 kg (20.1 lbs)
Max. torque, mounting screws - fastening lugs on the sensor housing	50 Nm (36.88 lbf ft)
Max. torque for NPT cable glands and Conduit tubes	
– Aluminium/Stainless steel housing	50 Nm (36.88 lbf ft)

Input variable	
Measured variable	The measured variable is the intensity of the gamma radiation of an isotope. If the radiation intensity decreases, e.g. due to increasing product density, the measured value of MINITRAC 31 changes in proportion to the density.
Analogue input	
– Input type	4 … 20 mA, passive
– Internal load	250 Ω
Switching input	
– Type of input - Open Collector	10 mA
– Type of input - Relay contact	100 mA

Output variable - Level measurement	
Output signals	4 … 20 mA/HART - active; 4 … 20 mA/HART - passive
Terminal voltage passive	9 … 30 V DC
Shortcircuit protection	Available
Potential separation	Available

Signal resolution	0.3 µA
Failure signal current output (adjustable)	22 mA, < 3.6 mA
Max. output current	22 mA
Starting current	≤ 3.6 mA
Load	
– 4 … 20 mA/HART - active	< 500 Ω
– 4 … 20 mA/HART - intrinsically safe	< 300 Ω
Damping (63 % of the input variable)	1 … 1200 s, adjustable
HART output values	
– PV (Primary Value)	Level
– SV (Secondary Value)	Electronics temperature

Output variable - Density measurement	
Output signals	4 … 20 mA - aktiv; 4 … 20 mA/HART - passiv
Terminal voltage passive	9 … 30 V DC
Shortcircuit protection	Available
Potential separation	Available
Signal resolution	0.3 µA
Failure signal current output (adjustable)	22 mA, < 3.6 mA
Max. output current	22 mA
Starting current	≤ 3.6 mA
Load	
– 4 … 20 mA/HART - active	< 500 Ω
– 4 … 20 mA/HART - intrinsically safe	< 300 Ω
Damping (63 % of the input variable)	Automatically
HART output values	
– PV (Primary Value)	Density value
– SV (Secondary Value)	Electronics temperature

Output variable - Level detection	
Output signals	8/16 mA
Terminal voltage passive	9 … 30 V DC
Shortcircuit protection	Available
Potential separation	Available
Failure signal current output (adjustable)	22 mA, < 3.6 mA
Max. output current	22 mA
Starting current	≤ 3.6 mA
Load	
– 4 … 20 mA/HART - active	< 500 Ω
– 4 … 20 mA/HART - intrinsically safe	< 300 Ω
Damping (63 % of the input variable)	Automatically
HART output values	

– PV (Primary Value)	Switching status
– SV (Secondary Value)	Electronics temperature

Output variable - X-ray alarm	
Output signals	4 … 20 mA/HART - active; 4 … 20 mA/HART - passive
Terminal voltage passive	9 … 30 V DC
Shortcircuit protection	Available
Potential separation	Available
Signal resolution	0.3 µA
Failure signal current output (adjustable)	22 mA, < 3.6 mA
Max. output current	22 mA
Starting current	≤ 3.6 mA
Load	
– 4 … 20 mA/HART - active	< 500 Ω
– 4 … 20 mA/HART - intrinsically safe	< 300 Ω
Damping (63 % of the input variable)	Automatically
HART output values	
– PV (Primary Value)	X-ray alarm
– SV (Secondary Value)	Electronics temperature

Output variable - Real value correction	
Output signals	8/16 mA/HART - active; 8/16 mA/HART - passive
Terminal voltage passive	9 … 30 V DC
Shortcircuit protection	Available
Potential separation	Available
Signal resolution	0.3 µA
Failure signal current output (adjustable)	22 mA, < 3.6 mA
Max. output current	22 mA
Starting current	≤ 3.6 mA
Load	
– 4 … 20 mA/HART - active	< 500 Ω
– 4 … 20 mA/HART - intrinsically safe	< 300 Ω
Damping (63 % of the input variable)	1 … 1200 s, adjustable
HART output values	
– PV (Primary Value)	Switching status
– SV (Secondary Value)	Electronics temperature

Relay output	
Output	Relay output (SPDT), floating spdt
Switching voltage	
– Min.	10 mV
– Max.	253 V AC, 253 V DC

Switching current	
– Min.	10 µA
– Max.	3 A AC, 1 A DC
Breaking capacity	
– Min.	50 mW
– Max.	750 VA AC, 40 W DC
	If inductive loads or stronger currents are switched through, the gold plating on the relay contact surface will be permanently damaged. The contact is then no longer suitable for switching low-level signal circuits.
Contact material (relay contacts)	AgNi or AgSnO and Au plated

Transistor output

Output	Floating transistor output, permanently shortcircuit-proof
Load current	< 400 mA
Voltage loss	< 1 V
Switching voltage	< 55 V DC
Blocking current	< 10 µA

Accuracy (according to DIN EN 60770-1)

Process 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)
Repeatability	≤ 0.1 %
Deviation with bulk solids	The values depend to a great extent on the application. Binding specifications are thus not possible.
Deviation under EMC influence	≤ 1 %

Variables influencing measurement accuracy

Specifications apply to the digital measured value

Temperature drift - HART signal	±0.16 %/10 K relating to the max. measuring range

Specifications apply also to the current output

Temperature drift - Current output	±0.03 %/10 K relating to the 16 mA span max. ±0.3 %
Deviation on the current output by analogue/digital conversion	<±15 µA
Deviation on the current output due to strong, high frequency electromagnetic interference acc. to EN 61326	< ±150 µA

Characteristics and performance data

Step response time[5)]	≤ 5 s (with damping 1 s)

[5)] Time span after a sudden measuring distance change by max. 0.5 m in liquid applications, max 2 m with bulk solids applications, until the output signal has taken for the first time 90 % of the final value (IEC 61298-2).

Ambient conditions	
Ambient, storage and transport temperature	-40 … +60 °C (-40 … +140 °F)

Process conditions	
For the process conditions, please also note the specifications on the type label. The lower value always applies.	
Process pressure	Unpressurized
Process temperature (measured on the detector tube)	-40 … +60 °C (-40 … +140 °F) With temperatures of more than 60 °C we recommend the use of water cooling
Vibration resistance[6)]	mechanical vibrations up to 1 g in the frequency range 5 … 200 Hz

Electromechanical data - version IP 66/IP 67	
Cable entry	
– M20 x 1.5	2 x cable gland M20 x 1.5 (cable: ø 6 … 12 mm), 4 x blind plug M20 x 1.5 Included: 1 x cable gland M20 x 1.5
– ½ NPT	5 x closing cap (red) ½ NPT Included: 3 x cable gland ½ NPT (cable: ø 6 … 12 mm), 4 x blind plug ½ NPT
Spring-loaded terminals for wire cross-section	
– Massive wire, cord	0.2 … 2.5 mm² (AWG 24 … 14)
– Stranded wire with end sleeve	0.2 … 1.5 mm² (AWG 24 … 16)

Display and adjustment module	
Display element	Display with backlight
Measured value indication	
– Number of digits	5
– Size of digits	W x H = 7 x 13 mm
Adjustment elements	4 keys
Protection rating	
– unassembled	IP 20
– mounted into the housing without cover	IP 40
Material	
– Housing	ABS
– Inspection window	Polyester foil

Integrated clock	
Date format	Day.Month.Year
Time format	12 h/24 h
Time zone Ex factory	CET

[6)] Tested according to the guidelines of German Lloyd, GL directive 2.

Measurement electronics temerature	
Resolution	1 °C (1.8 °F)
Accuracy	±1 °C (1.8 °F)

Voltage supply	
Operating voltage	20 … 72 V DC or 20 … 253 V AC, 50/60 Hz
Interpolation protection	Available
Max. power consumption	6 VA (AC); 4 W (DC)

Electrical protective measures	
Protection, depending on housing version	IP 66/IP 67[7)]
Overvoltage category	III
Protection class	I

Approvals

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

For that reason the associated approval documents of these instruments must be carefully noted. They are part of the delivery or can be downloaded under www.vega.com and "*VEGA Tools*" as well as under "Downloads" and "*Approvals*".

11.2 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*".

7) A suitable cable is the prerequisite for maintaining the protection rating.

Aluminium and stainless steel housing

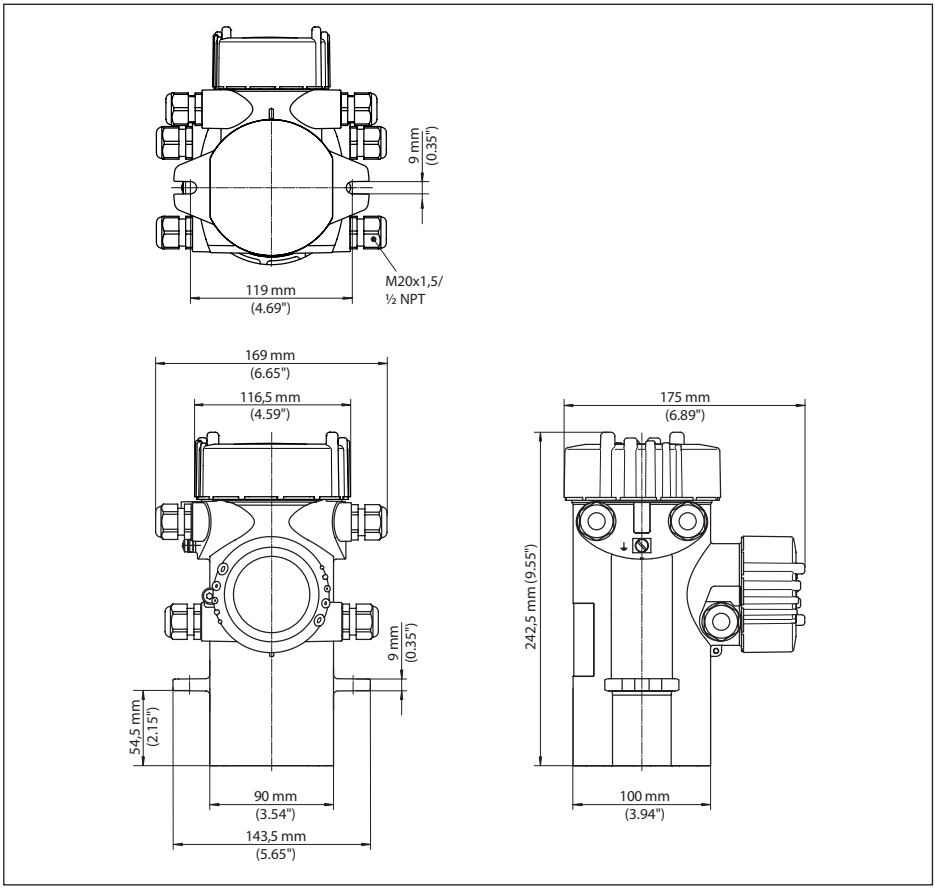


Fig. 25: Aluminium housing or stainless steel housing - Precision casting

MINITRAC 31

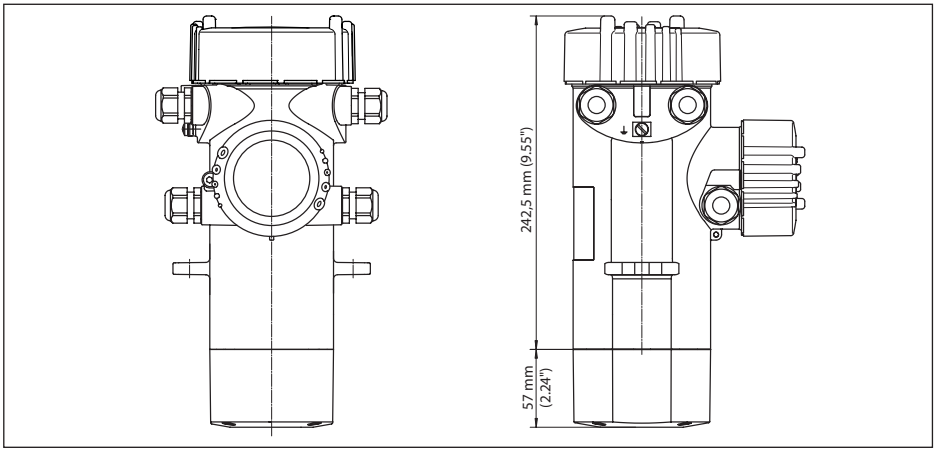


Fig. 26: MINITRAC 31

L Measuring range

11.3 Industrial property rights

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11.4 Trademark

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INDEX

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