

Operating Instructions

Radiometric sensor for mass flow
detection

WEIGHTRAC 31

Four-wire 4 ... 20 mA/HART



Document ID: 42374



VEGA

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Safety instructions for Ex areas:

Take note of the Ex specific safety instructions for Ex applications. These instructions are attached as documents to each instrument with Ex approval and are part of the operating instructions.

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1 About this document

1.1 Function

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

1.2 Target group

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

1.3 Symbols used



Document ID

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



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



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



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



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



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



Ex applications

This symbol indicates special instructions for Ex applications.



List

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



Sequence of actions

Numbers set in front indicate successive steps in a procedure.



Disposal

This symbol indicates special instructions for disposal.

2 For your safety

2.1 Authorised personnel

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

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

2.2 Appropriate use

WEIGHTRAC 31 is a sensor for continuous mass flow detection on conveyor belts as well as screw or chain conveyors.

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

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

2.3 Warning about incorrect use

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

2.4 General safety instructions

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

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

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

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

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

2.5 Conformity

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

The corresponding conformity declarations can be found on our homepage.

Electromagnetic compatibility

Instruments in four-wire or Ex d ia version are designed for use in an industrial environment. Nevertheless, electromagnetic interference from electrical conductors and radiated emissions must be taken into account, as is usual with class A instruments according to EN 61326-1. If the instrument is used in a different environment, the electromagnetic compatibility to other instruments must be ensured by suitable measures.

2.6 NAMUR recommendations

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

The device fulfils the requirements of the following NAMUR recommendations:

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

For further information see www.namur.de.

2.7 Installation and operation in the USA and Canada

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

Installations in the US shall comply with the relevant requirements of the National Electrical Code (ANSI/NFPA 70).

Installations in Canada shall comply with the relevant requirements of the Canadian Electrical Code.

2.8 Environmental instructions

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

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

- Chapter " *Packaging, transport and storage* "

- Chapter " *Disposal* "

3 Product description

3.1 Configuration

Type label

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



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

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

Stainless steel type label

Adhesive labels can peel off or become illegible under harsh ambient conditions or the influence of aggressive materials.

The optional stainless steel type label is screwed tightly to the housing and the labelling is permanently resistant.

The stainless steel type label cannot be retrofitted.

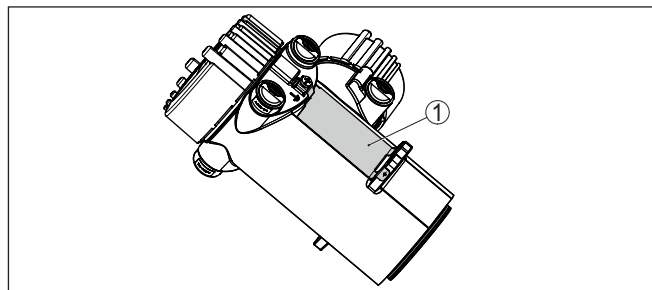


Fig. 2: Position of the stainless steel type label

- 1 Stainless steel type label

Serial number - Instrument search

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

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

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

Alternatively, you can access the data via your smartphone:

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

Scope of this operating instructions

This operating instructions manual applies to the following instrument versions:

- Hardware from 1.0.6
- Software from 2.1.0 ¹⁾
- Hardware from 2.0.0
- Software from 3.0.0

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 PROTRACH.-XX

Scope of delivery

The scope of delivery encompasses:

- Radiometric sensor
- Measuring frame (optional)
- Mounting accessories
- Documentation
- Bluetooth module (optional)
 - This operating instructions manual
 - Ex-specific "*Safety instructions*" (with Ex versions)
 - If necessary, further certificates

¹⁾ It is not possible to update the software to 3.0.0. In this case the electronics module must be exchanged.

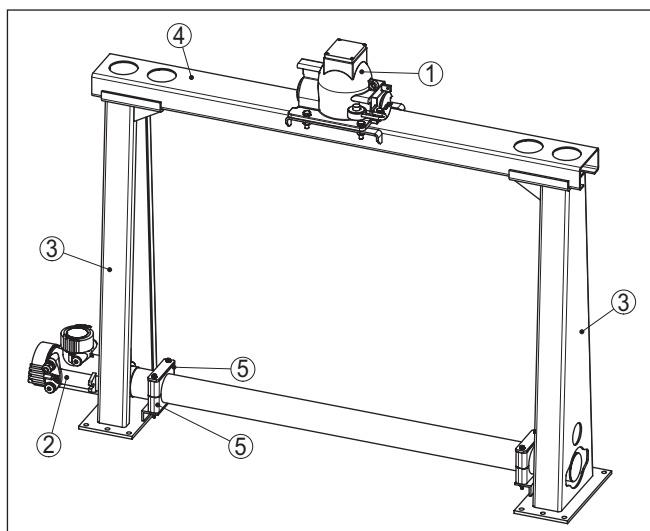


Fig. 3: WEIGHTRAC 31

- 1 Source container (e.g. SHLD-1)
- 2 WEIGHTRAC 31
- 3 Support stand
- 4 Crossbeam
- 5 Clamp collars

**Note:**

The appropriate source container (e.g. SHLD-1) must be ordered separately.

3.2 Principle of operation

Application area

The instrument is suitable for bulk solid applications on conveyor belts and screw conveyors. There are application possibilities in nearly all areas of industry.

Functional principle

In radiometric measurement, a Caesium-137 or Cobalt-60 isotope emits focussed gamma rays that are attenuated when penetrating the conveyor belt and the medium. The PVT detector on the lower side of the conveyor belt receives the radiation, whose strength is proportional to the density. The measuring principle has proven to be very reliable in conjunction with extreme process conditions because it measures contactlessly from outside through the conveyor belt. The measuring system ensures maximum safety, reliability and plant availability, independently 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 consists of environment-friendly, recyclable cardboard. For special versions, PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Transport

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

Transport inspection

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

Storage

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

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

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

Storage and transport temperature

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

Lifting and carrying

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

3.4 Accessories

Display and adjustment module

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

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

VEGACONNECT

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

VEGADIS 81

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

VEGADIS 82

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

Electronics module - PT30

The electronics module PT30... is a replacement part for radiometric sensors WEIGHTRAC 31.

It is located in the large electronics and connection compartment.

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

Supplementary electronics module - PROTRAC.ZE

The supplementary electronics module PROTRAC.ZE... is a replacement part for radiometric sensors WEIGHTRAC 31.

It is located in the lateral adjustment and connection compartment.

Basic mounting set

If you have ordered WEIGHTRAC 31 without a measuring frame, a basic mounting set is enclosed with the instrument. It includes everything needed to fasten the measuring tube reliably.

Measuring frame for mounting

The corresponding measuring frame and mounting accessories can be ordered optionally.

Tachometer

Use a tachometer for detection of the belt speed. The tachometer can be connected to the input of the WEIGHTRAC 31.

Reference absorber

The reference absorber is a test facility for the WEIGHTRAC 31. It is suitable for reference measurement on conveyor belts and screw conveyors. A certain measured value can be exactly reproduced for test purposes when a conveying system is empty.

Gamma modulator

In order to exclude external interference radiation, you can mount a gamma modulator in front of the source holder. This allows reliable measurement even when interference radiation occurs.

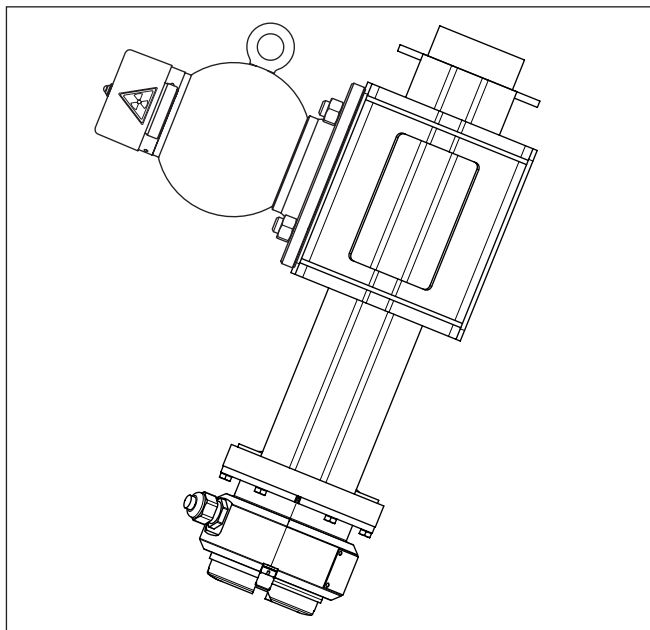


Fig. 4: Gamma modulator (optional) for uninterrupted measurement even with interference radiation

1 Gamma modulator (mounted on the source holder)

For ambient temperatures up to +120 °C (+248 °F) the gamma modulator is optionally available with water cooling.

Any number of devices can be synchronized. To synchronize several gamma modulators, you need a controller.

3.5 Corresponding source container

An isotope in a suitable source container (e.g. SHLD-1) is the prerequisite for a radiometric measurement setup.

The handling of radioactive substances 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 radiometric 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 radioactive substances, 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:

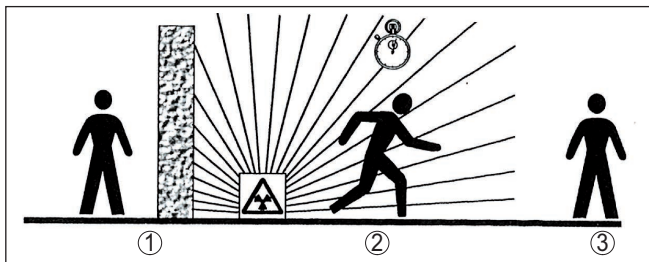


Fig. 5: Measures for protection against radioactive radiation

- 1 Shielding
- 2 Time
- 3 Distance

Shielding: Provide good shielding between the source and yourself as well as all other persons. Special source containers (e.g. SHLD-1) 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.

Distance: 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 for ensuring that the radiation protection ordinance is complied with and for implementing all radiation protection measures.

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 against moisture ingress through the following measures:

- Use a suitable connection cable (see chapter " *Connecting to power supply*")
- Tighten the cable gland or plug connector
- Lead the connection cable downward in front of the cable entry or plug connector

This applies mainly to outdoor installations, in areas where high humidity is expected (e.g. through cleaning processes) and on cooled or heated vessels.



Note:

Make sure that during installation or maintenance no moisture or dirt can get inside the instrument.

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

Process conditions



Note:

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

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

These are mainly:

- Active measuring component
- Process fitting
- Process seal

Process conditions in particular are:

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

Cable glands**Metric threads**

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

You have to remove these plugs before electrical connection.

NPT thread

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

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

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

4.2 Mounting instructions**Installation position****Note:**

During the planning, our specialists will analyse the conditions of the measurement loop to dimension the 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 in 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 position and mount WEIGHTRAC 31 in the measuring frame from both sides.

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

Mount the source container at the specified distance to the conveyor belt. Secure the area with a safety fence and protective grating so that no one can reach into the dangerous area.

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

Basic mounting set

If you have ordered WEIGHTRAC 31 without measuring frame, a basic mounting set is enclosed with the instrument.

Determine the mounting position of the sensor in advance.

1. Fasten the mounting bracket (6) to your conveyor belt.
You can either weld the mounting bracket (6) to your system or fasten it with screws through the two $\varnothing 9$ mm (0.35 in) holes.
2. Place two clamp collars (4) onto the premounted mounting brackets (6).

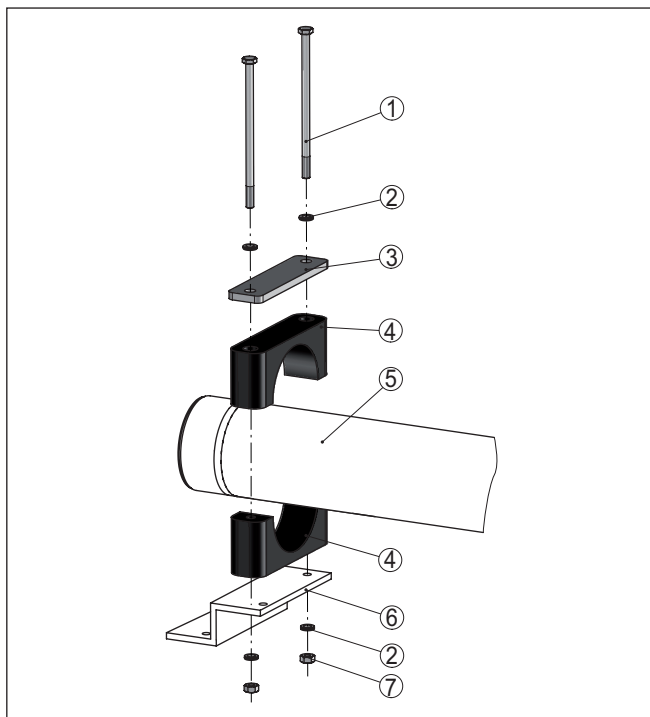


Fig. 6: Mounting of the sensor with the basic mounting set

- 1 Screws M6 x 120 (4 pieces)
- 2 Wedge lock washer M6 Nordlock (8 pieces)
- 3 Cover plate (2 pieces)
- 4 Clamp collar (4 pieces) PA
- 5 Sensor
- 6 Mounting bracket
- 7 Nut M6 (4 pieces)



Note:

Mount the instrument housing of the sensor on an easily accessible side of the conveyor belt so that the instrument is easily accessible for operation and service.

3. Move the sensor (5) laterally beneath the conveyor belt and place the sensor in the two clamp collars (4).

Position the measuring width of the sensor below the conveyor belt as close as possible to the center. Make sure that there is sufficient distance between sensor and conveyor belt when the belt is loaded.

4. Place the other two clamp collars (4) according to the illustration above the clamp collars that are already in place (4).
5. Place a metallic cover plate (3) according to the illustration on each upper clamp collar (4).

6. Insert the screws (1), each with one wedge lock washer (2), through the clamp collars (4).
7. Place a wedge lock washer (2) from below on each screw (1) and screw one nut (7) onto each screw.
8. Align the clamp collars (4) and tighten the nuts (7) evenly with 8 Nm (5.9 lb ft).
9. Check if the sensor (5) is fastened correctly.

Measuring frame (optional)

- Conveyor belts

Mount the measuring frame in such a way that the measurement tube of WEIGHTRAC 31 is below the conveyor belt (tight span).

Keep a distance of at least 10 mm (0.4 in) between the conveyor belt and the measurement tube of WEIGHTRAC 31.

- Screw conveyors

Mount the measuring frame at a position on the spiral conveyor where the product is transported steadily. Avoid places where the product accumulates or falls back over the worm shaft.

- Chain conveyors

When mounting the WEIGHTRAC 31 on a chain conveyor, the installation angle is very important for optimal irradiation.

Follow the instructions in the "Source Sizing" document.

Mounting of the measuring frame (optional)

The measuring frame with mounting accessories can be selected as an option. If you have ordered WEIGHTRAC 31 with measuring frame, then proceed as follows.

Mounting - Crossbeam

Before fastening the support stands, we recommend premounting the measuring frame. By doing this you can easily lay out the holes for fastening the unit to the conveyor belt.

To mount the measuring frame you need a torque wrench (45 Nm or 8 Nm) and two socket wrenches of size 16 and 10.

1. Place the crossbeam (4) on the upper holding fixtures of the two support stands (6).

Make sure that the crossbeam (4) has an excess length of approx. 30 mm on both sides.

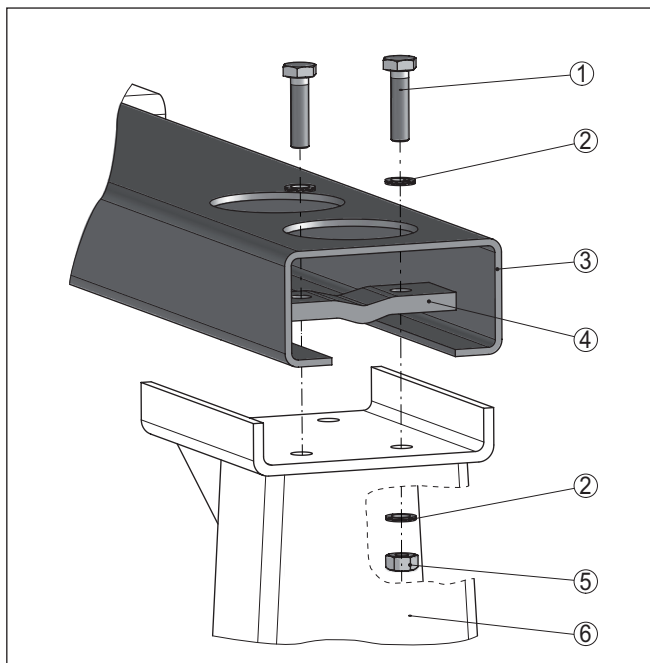


Fig. 7: Mounting the crossbeam

- 1 Screws M10 x 40 (12 pcs.)
- 2 Wedge lock washer M10 Nordlock (24 pieces)
- 3 Crossbeam (1 piece)
- 4 Toe clamps (4 pieces)
- 5 Nut M10 (12 pieces)
- 6 Support stand (2 pieces)

2. Place the four clamping claws (4) with the corrugation downwards into the crossbeam (3).
3. Insert the screws (1) with one wedge lock washer (2) through the clamping claws (4).
4. Place a wedge lock washer (2) from below on each screw (1) and screw one nut (5) onto each screw.
5. Align the crossbeam (3) with the upper holding fixtures of the support stands (6) and tighten the nuts (5) evenly with 45 Nm (33.2 lb ft).

Mounting - Support stand

1. Place the premounted measuring frame above the conveyor belt and determine a suitable position for mounting the support stands (6).

Mount the measuring frame as well centered as possible and at an angle of 90° above the conveyor belt. Keep enough lateral distance to the conveyor belt.

2. Drill the through-holes for the support stands (6) according to the following drilling plan.

The through-holes in the support stands (6 in each) are suitable for screws of size M10.

The screws (14) and the washers (15) for fastening on the conveyor belt are not included in the scope of delivery.

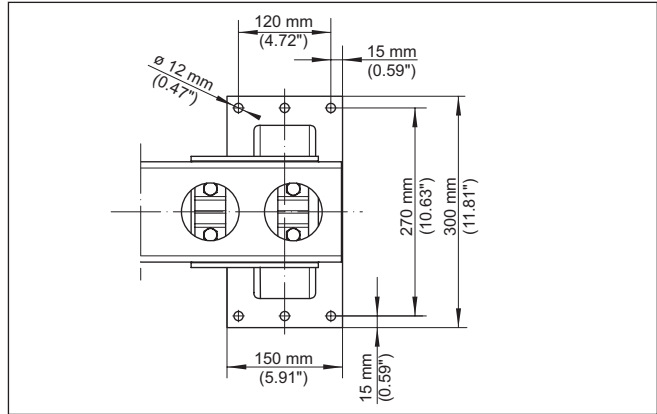


Fig. 8: Drilling plan for support stands

3. Use suitable washers (15) for mounting the support stands (6).

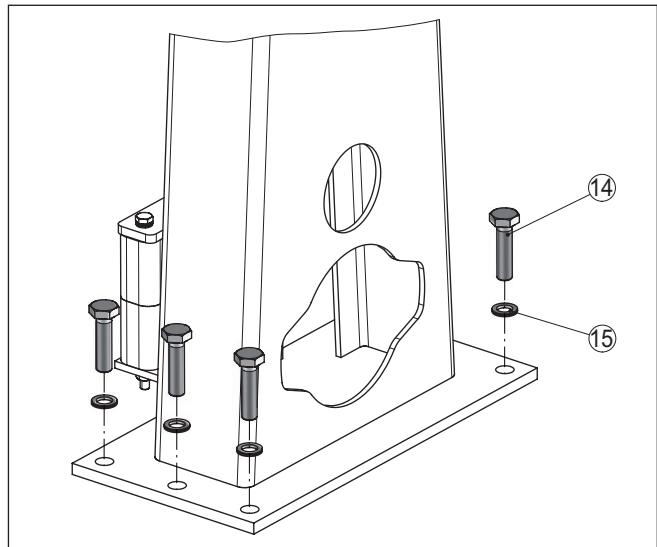


Fig. 9: Mounting the support stands

14 Screw M10 (24 pieces) - provided by the customer
 15 Washer M10 (24 pieces) - provided by the customer

4. Tighten the screws (14) evenly with 45 Nm (33.2 lb ft).

Mounting - Sensor

1. Place two of the clamp collars (11) on the fastening brackets of the support stands (6).

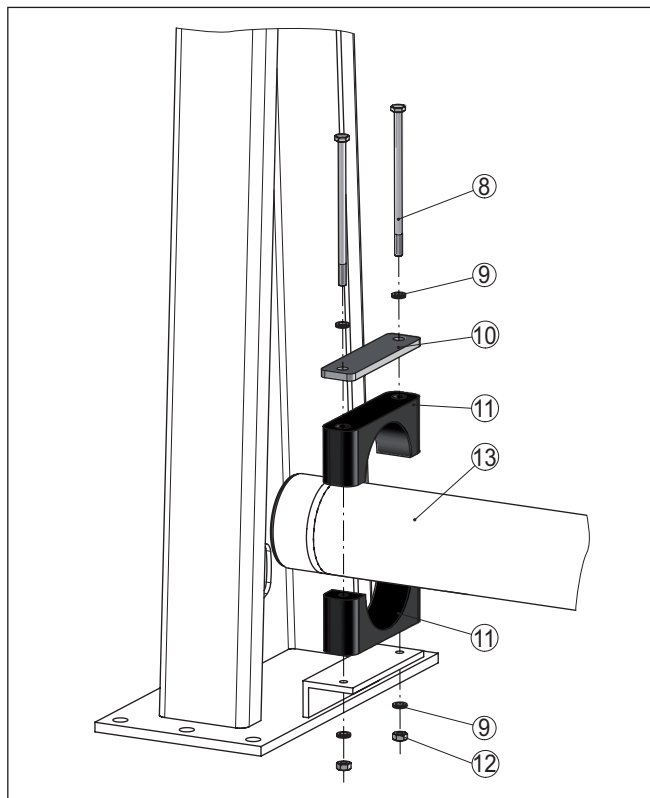


Fig. 10: Mounting the sensor in the measuring frame

- 8 Screws M6 x 120 (4 pieces)
- 9 Wedge lock washer M6 Nordlock (8 pieces)
- 10 Cover plate (2 pieces)
- 11 Clamp collar (4 pieces)
- 12 Nut M6 (4 pieces)
- 13 Sensor



Note:

Mount the instrument housing of the sensor on an easily accessible side of the conveyor belt so that the instrument is easily accessible for operation and service.

2. Insert the sensor (13) laterally into the measuring frame beneath the conveyor belt and place the sensor in the two clamp collars (11).

Position the measuring width of the sensor below the conveyor belt as close as possible to the center. Make sure that there is

sufficient distance between sensor and conveyor belt when the belt is loaded.

3. Place the other two clamp collars (11) according to the illustration above the clamp collars that are already in place (11).
4. Place a metallic cover plate (10) according to the illustration on each upper clamp collar (11).
5. Insert the screws (8), each with one wedge lock washer (9), through the clamp collars (11).
6. Place a wedge lock washer (9) from below on each screw (8) and screw one nut (12) on each of the screws.
7. Align the clamp collars (11) and tighten the nuts (12) evenly with 8 Nm (5.9 lb ft).
8. Check if the sensor (13) is fastened correctly.

Mounting - Source container

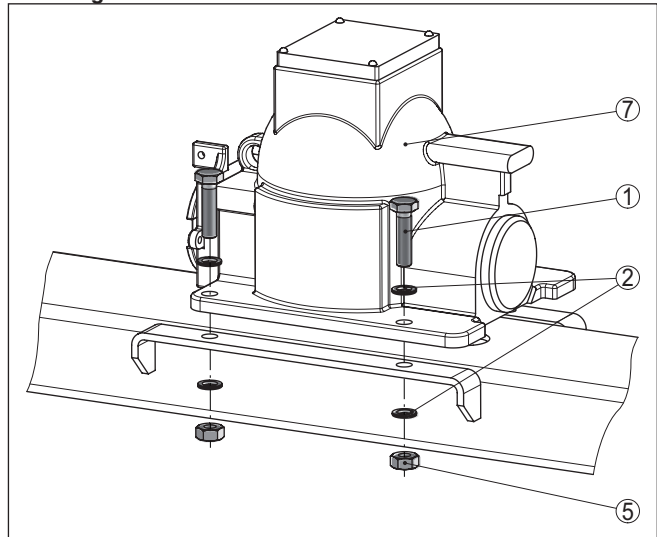


Fig. 11: Mounting the source container on the measuring frame

- 1 Screw M10 x 65 (4 pieces)
- 2 Wedge lock washer M10 Nordlock (8 pieces)
- 5 Nut M10 (4 pieces)
- 7 Source holder (SHLD-1)

1. Place the closed and locked source container (7) from above onto the measuring frame.

The source container is very heavy. Therefore use a suitable lifting device. For this purpose the source container is equipped with a suitable eye-bolt for a lifting hook, etc.



Note:

Select the alignment of the source holder so that the rotary mechanism of the source holder is located on the easily accessible side of the conveyor belt. This makes the rotary mechanism easily accessible

for operation and service at all times. This only applies to source holders with symmetrical beam exit angle.

2. Align the source container (7) with the holes.
Make sure that the source container is placed in the correct direction on the crossbeam.
3. Insert the screws (1) with one wedge lock washer (2) through the flange of the source container (7).
4. Place a wedge lock washer (2) from below on each screw (1) and screw one nut (5) onto each screw.
5. Align the source container (7) and tighten the nuts (5) evenly with 45 Nm (33.2 lb ft).

The mounting of the measuring frame is finished.

Strain the measuring frame

Large measuring frames can deflect when subjected to strong vibration or strong winds.

Therefore, measuring frames used on conveyor belts with widths over 1600 mm (63 in) should be strained with steel cables.

For this there are two fastening straps on the side of the support stand of the measuring frame.

Determine the fastening points on your conveyor belt according to the local conditions.

Provide the straining screws (1) for each cable to ensure reliable straining of the measuring frame.

Make sure that the measuring frame is perfectly vertical after straining.

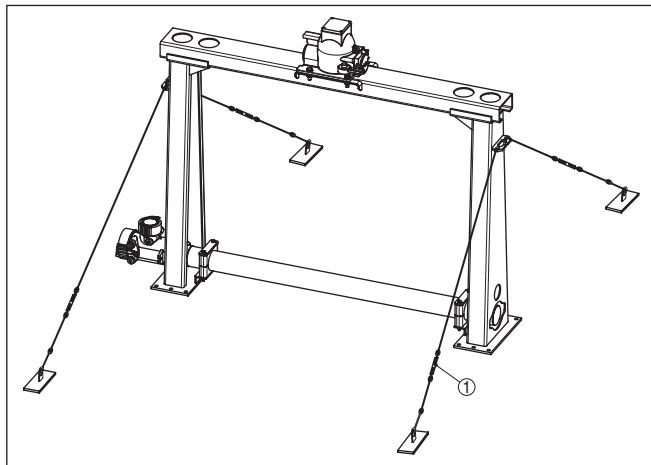


Fig. 12: Straining the measuring frame

1 Straining screw

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 or air cooling system we offer for WEIGHTRAC 31.

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

Mounting of the tachometer

The speed value of the conveyor belt, the conveyor belt is absolutely necessary for mass flow determination.

Apart from other possibilities, a tachometer can be used.

Positioning of the tachometer

Load applied only to one side can cause damage of the tachometer.

To avoid this, you should select a position underneath the conveyor belt where the impeller is nearly vertical to the conveyor belt.

The holder of the tachometer is thus premounted to carrier plate with an angle of 115°

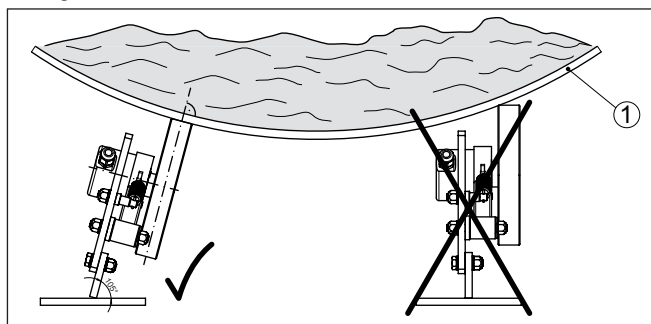


Fig. 13: Impeller of the tachometer, vertically to the conveyor belt

1 Conveyor belt

Direction of rotation

Mount the tachometer according to the following illustration. The correct orientation of the impeller is important. In case of fluctuations, e.g. by alternating load, the impeller can draw aside.

If possible, mount the tachometer close to a support wheel because in these positions the conveyor belt runs evenly.

For height adjustment, the angle bracket of the tachometer is provided with several holes.

Select the height adjustment so that the spring of the impeller is slightly pre-loaded with empty conveyor belt.

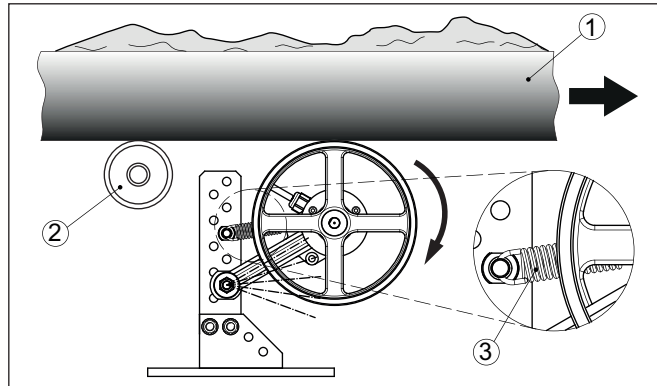


Fig. 14: Direction of rotation of the tachometer

- 1 Conveyor belt
- 2 Support wheel of the conveyor belt
- 3 Spring for pre-loading the impeller

5 Connecting to power supply

5.1 Preparing the connection

Safety instructions

Always keep in mind the following safety instructions:

- The electrical connection must only be carried out by trained, qualified personnel authorised by the plant operator.
- If overvoltage surges are expected, overvoltage arresters should be installed.



Warning:

Only connect or disconnect in de-energized state.



Note:

Install a disconnecting device for the instrument which is easy to access. The disconnecting device must be marked for the instrument (IEC/EN 61010).

Voltage supply via mains voltage

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

Supply voltage and current output 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

General requirements

- Make sure that the cable used has the required temperature resistance and fire safety for max. occurring ambient temperature
- Use cable with round cross section for instruments with housing and cable gland. To ensure the seal effect of the cable gland (IP protection rating), find out which cable outer diameter the cable gland is suitable for.
- Use a cable gland fitting the cable diameter.
- Unused cable glands do not offer sufficient protection against moisture and must be replaced by blind plugs.

Voltage supply

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

Signal cable

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

Cable glands

Metric threads

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

You have to remove these plugs before electrical connection.

NPT thread

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

Before setup you have to replace these protective caps with approved cable glands or close the openings with suitable blind plugs. Unused cable glands do not provide sufficient protection against moisture and must be replaced with blind plugs.

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

Cable screening and grounding

If shielded cable is required, 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, the cable screen in such applications must be connected only on one end to ground potential in the switching cabinet. The cable screen must **not** be connected to the inner ground terminal in the sensor and the outer ground terminal on the housing must **not** be connected to potential equalization!



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.

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 gland and remove blind plug
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

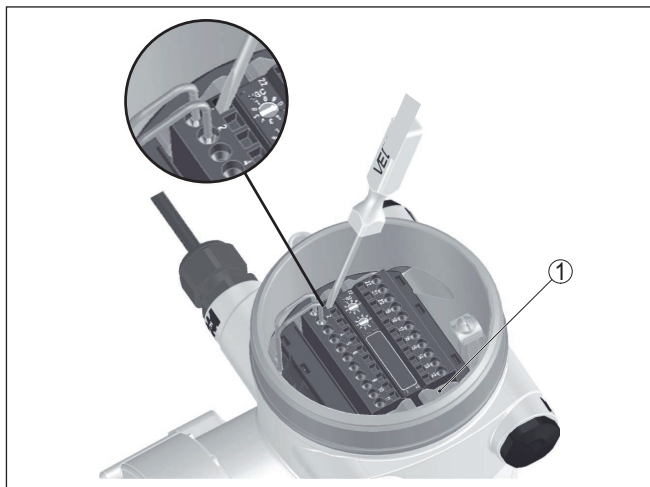


Fig. 15: Connection steps 4 and 5

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 lock opening according to the illustration
 8. Connect the shielding to the internal ground terminal, connect the external ground terminal to potential equalisation
 9. Tighten the compression nut of the cable entry gland. The seal ring must completely encircle the cable
 10. Screw the housing lid back on
- The electrical connection is finished.



Information:

The terminal blocks are pluggable and can be detached from the electronics. To do this, 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 - Mass flow determination

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

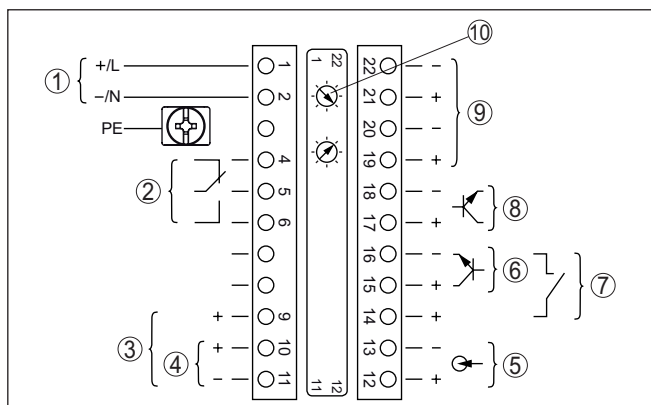


Fig. 16: Electronics and connection compartment with non-Ex instruments and instruments with non-intrinsically safe current output

- 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
- 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) ²⁾

²⁾ MGC = Multi Gauge Communication

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

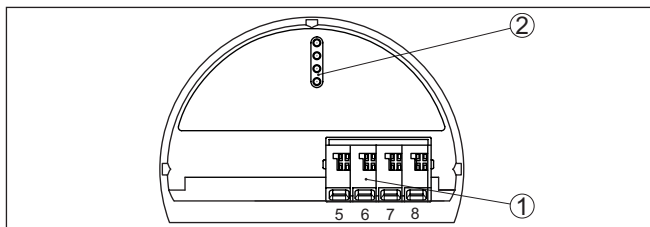


Fig. 17: Adjustment and connection compartment with non-Ex instruments and instruments with non-intrinsically safe current output

- 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.

Electronics and connection compartment - Instruments with intrinsically safe current output

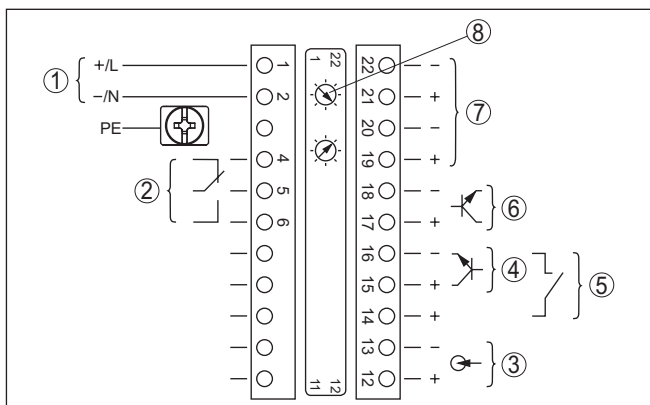


Fig. 18: Electronics and connection compartment (Ex d) with instruments with intrinsically safe current output

- 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) ³⁾

³⁾ MGC = Multi Gauge Communication

Adjustment and connection compartment - Instruments with intrinsically safe current output

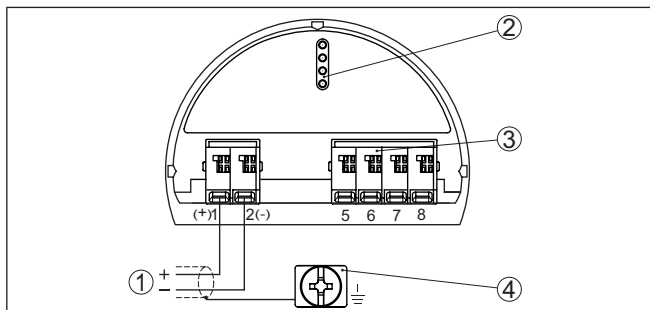


Fig. 19: Adjustment and connection compartment (Ex ia) with instruments with intrinsically safe current output

- 1 Terminals for intrinsically safe signal output 4 ... 20 mA/HART (active)
- 2 Contact pins for the display and adjustment module or interface adapter
- 3 Terminals for the external display and adjustment unit
- 4 Ground terminal

Electronics and connection compartment - summation

5.3 Connection - Summation

Several instruments can be cascaded to measure also broad conveyor belts. The measuring ranges of the instruments must overlap.

Cascading means that two or several instruments are connected which can together cover a longer measuring range.

The instrument acts as Primary instrument and all other instruments operate as Secondary instruments.

The pulse rates of all instruments are summed in the Primary instrument and converted into a common signal.

The Primary instrument must have the function "Mass flow detection". For this purpose, select under the menu item "Setup - Application" the function "Mass flow detection".

Set the address setting (MGC) on the Primary instrument to "99".

For this, the Secondary instruments must be defined as "Summation Secondary". Select under the menu item "Setup - Application" the function "Summation Secondary".

The address setting (MGC) on the Secondary instruments can be freely selected. Only the address "99" is reserved for the Primary instrument.

Connect the instruments according to the following wiring plan:

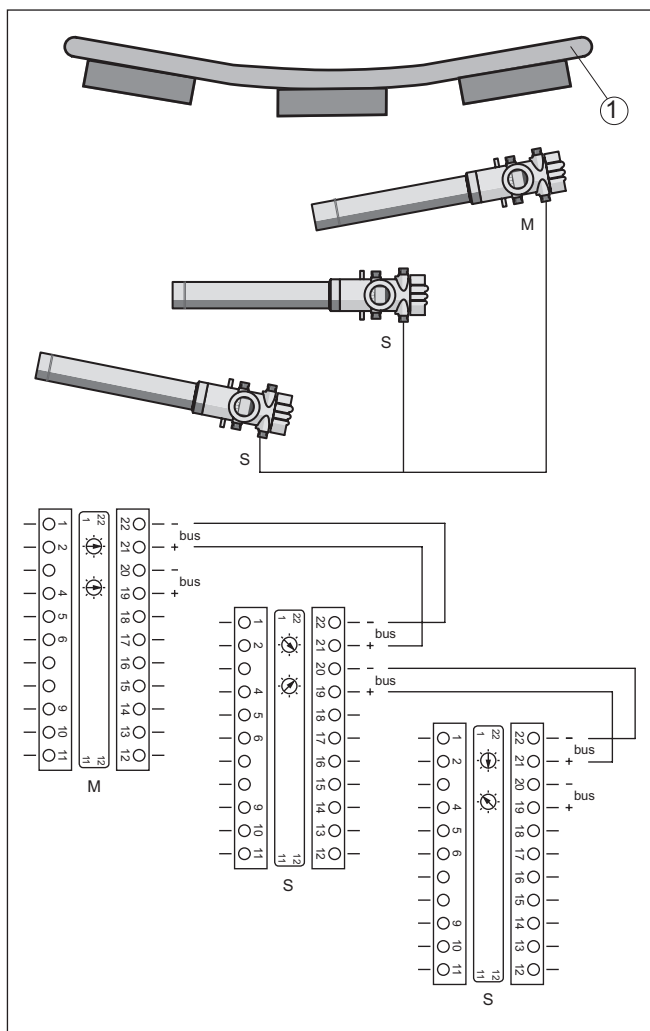


Fig. 20: Electronics and connection compartment with cascading of several instruments.

1 Conveyor belt

M Primary instrument

S Secondary instrument



Information:

For example, a radial connection would be also possible as an alternative. Take note of the polarity.

The selection of the two terminal pairs is individual.

5.4 Connection - Tachometer

The speed of the conveyor belt, the chain conveyor or the feed screw are absolutely necessary for mass flow determination.

There are three different possibilities:

- Entering a constant speed
- Accepting a speed value from the plant control system (e.g. PLC)
- Connection of a tachometer (digital)

Constant belt speed

If a constant speed is entered, fluctuations in the speed are not taken into account. This can cause measurement errors. We recommend using a real value from the plant control system or the optional tachometer.

See "*Parameter adjustment - Mass flow detection*".

If you have entered a constant belt speed, we recommend using a belt stop signal.

If the belt stops, measurement is also halted for this period. Without a belt stop signal, WEIGHTRAC 31 would continue summing the delivery rate.

You can implement the belt stop signal with a switching relay or a signal from the plant control system (PLC).

Connect a switching relay to terminals 14 and 16.

Connect the digital output signal (open collector) from the plant control system (PLC) to terminals 14 and 15.

Tachometer (digital)

Digital tachometers enable reliable measurement results through exact detection of the belt speed.

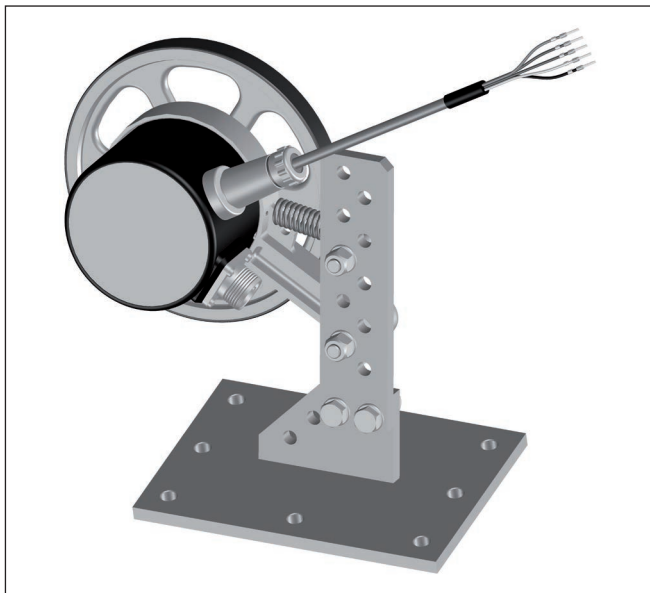


Fig. 21: Digital tachometer

The digital tachometer can be powered by WEIGHTRAC 31. This is only possible if you power WEIGHTRAC 31 with max. 24 V.

Output digital tachometer: Open Collector or HTL output (Push-Pull)

The following cable colours are valid for the fix connected cable.

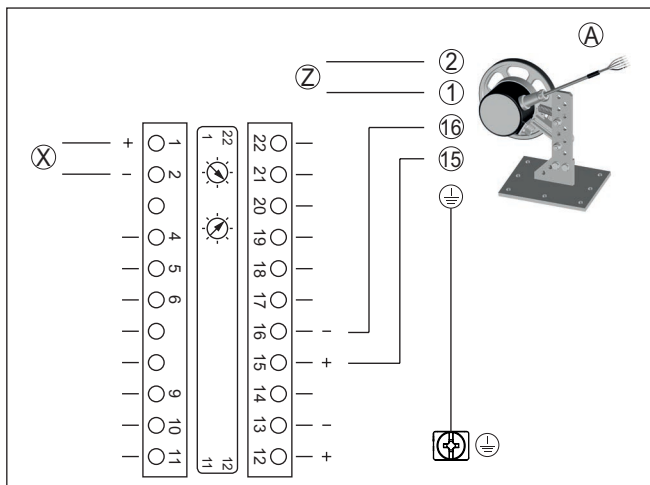


Fig. 22: Belt speed - plant control system (PLC) or tachometer (digital)

A Tachometer (digital)

x Electrical connection - Sensor

z Electrical connection - Tachometer (5 ... 26 V DC)

1 Voltage supply - cable colour brown

2 Voltage supply - cable colour white

15 Digital input - cable colour green

16 Digital input - cable colour yellow

- Shielding - Cable colour black - connect to the ground terminal in the housing

6 Adjustment 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 voltage 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 lid with inspection window tightly back on

Disassembly is carried out in reverse order.

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

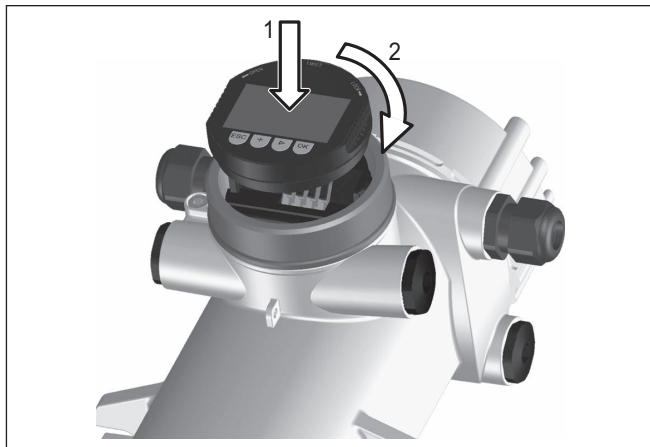


Fig. 23: Insert display and adjustment module



Note:

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

6.2 Adjustment system

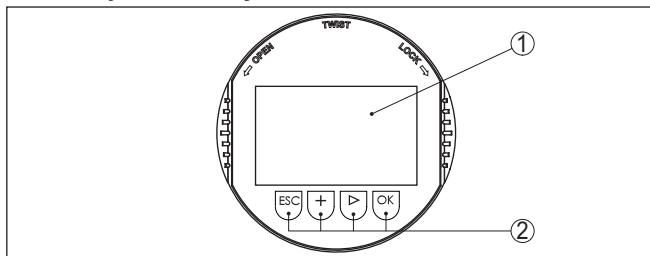


Fig. 24: Display and adjustment elements

- 1 LC display
- 2 Adjustment keys

Key functions

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

Adjustment system

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

Adjustment system - keys via magnetic pen

With the Bluetooth version of the display and adjustment module you can also adjust the instrument with the magnetic pen. The pen operates the four keys of the display and adjustment module right through the closed lid (with inspection window) of the sensor housing.

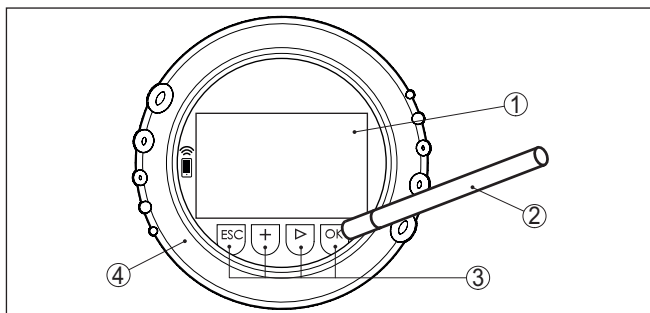


Fig. 25: Display and adjustment elements - with adjustment via magnetic pen

- 1 LC display
- 2 Magnetic pen
- 3 Adjustment keys
- 4 Lid with inspection window

Time functions

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

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

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 Display and adjustment module - Indication of system parameters

Instrument start



Note:

During the first setup or after an instrument reset the instrument starts with an error message (F025 - Invalid linearization table). This is quite normal because the sensor doesn't yet have any reference points for correct operation. Push the button "OK" to acknowledge the error message. Carry out the adjustment with PACTware.

With the display and adjustment module you can only read out the parameters of the WEIGHTRAC 31. Carry out the parameter adjustment of the instrument with the adjustment software PACTware.

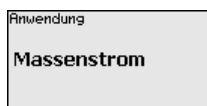
You can find the parameter adjustment in the next chapter.

Application

6.3.1 Setup

In this menu item you can read out the set application.

The application can only be selected in PACTware.

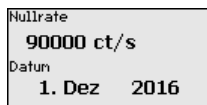


Zero rate

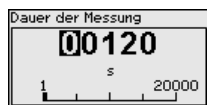
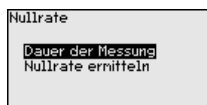
In this menu item you can carry out the zero rate determination.

You can find the process of the zero rate determination in chapter "*Set up with PACTware*"

In the first view you can see the last determined zero rate with the corresponding date.



First of all you have to determine the duration of the zero rate determination. Select a sufficient time so that the belt can traverse several times.



Start the zero rate determination (determine zero rate).



Note:

After this menu window, the zero rate determination is carried out. No further safety inquiry follows.

Linearisation

During linearization, a corresponding total weight of conveyed material is assigned to a particular pulse rate. A linearization is generally necessary.

The linearization of the sensor is only possible in PACTware.

Lock/Unlock adjustment

In the menu item "*Lock/unlock adjustment*", you can protect the sensor parameters against unauthorized or inadvertent modification. The sensor is locked/unlocked permanently.

With locked instrument, only the following adjustment functions are possible without entering a PIN:

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



Before you lock the sensor in unlocked condition, you can modify the four-digit PIN number.

Keep the entered PIN number in mind. Operation of the sensor is only possible with this PIN number.



Caution:

When the PIN is active, adjustment via PACTware/DTM as well as other systems is also blocked.

In delivery status, the PIN is **0000**.

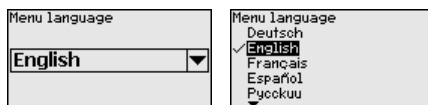
Call our service department if you have modified and forgotten the PIN.

6.3.2 Display

In the main menu point "*Display*", the individual submenu points should be selected one after the other and provided with the correct parameters to ensure the optimum adjustment of the display. The procedure is described in the following.

Menu language

This menu item enables the setting of the requested national language.

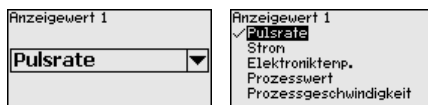


In delivery status, the sensor is set to the ordered national language. If no language is preset, you will be asked during setup.

Displayed value 1

In this menu item, you define the indication of the measured value on the display. You can display two different measured values. In this menu item, you define measured value 1.

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

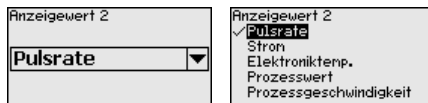


The default setting for the display value 1 is "*Pulse rate*".

Displayed value 2

In this menu item, you define the indication of the measured value on the display. You can display two different measured values. In this menu item, you define measured value 2.

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

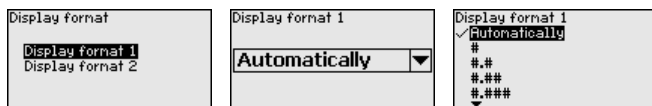


The default setting for the display value 2 is "*Pulse rate*".

Display format

In this menu item, you define the display format of the measured value on the display. You can define different display formats for the two measured values.

You can thus define the number of decimal positions the measured value is displayed with.



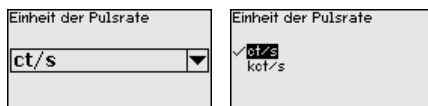
The default setting for the display format is "Automatic".

Unit of the pulse rate

In this menu item, you define the unit in which the pulse rate is displayed.

You can choose between ct/s (counts per second) or kct/s (kilo counts per second).

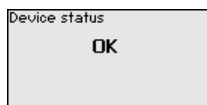
With pulse rates of more than 99,999, the value can no longer be displayed. In this case, select the unit **kct/s** (kilo counts/second).



6.3.3 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.



Peak indicator

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

- Pulse rates - min./max.
- Temperature - min./max./actually

Peak values	
Pulse/sec. min.	0 ct/s
Pulse/sec. max.	35467 ct/s
T _{min} .	21,5 °C
T _{max} .	31,5 °C
T _{act} .	31,0 °C

Electronics

In this menu item you can display the actual electronics temperature and the actual voltage on the photomultiplier (PMT = Photomultiplier Tube).

Elektronik	
Elektroniktemp.	26,5 °C
PMT Spannung	695 V
PMT Spannung akt.	695 V

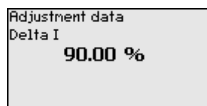
Adjustment data

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 non-repeatability 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.

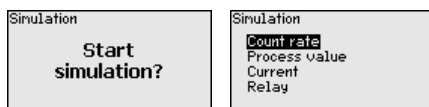
To increase the Delta I value, you have to increase the distance of the min. and max. adjustment points in the linearization.



Simulation

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

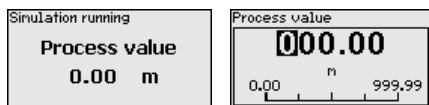
You can simulate different values:



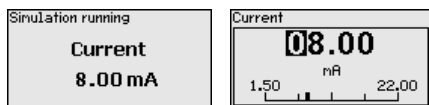
Pulse rate of the sensor



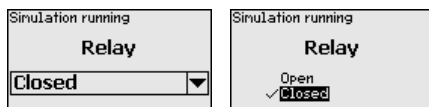
Process value



Current output



Switching function of the relay

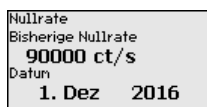


Information:

The simulation is terminated automatically 60 minutes after the last key has been pressed.

Zero rate

In this menu item you can display the actual zero rate and the date of the zero rate.



Info

6.3.4 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, such as e.g. approval, electronics ...

Examples for info display:

Softwareversion 2.0.1 Hardwareversion 1.06	Kalibrierdatum 3. April 2013 Letzte Änderung 4. Nov 2016	Gerätemerkmale Housing / Protection Aluminium / IP66/IP67
-------------------------------------------------------------------	---------------------------------------------------------------------------------	-----------------------------------------------------------------

On paper

6.4 Save parameter adjustment data

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

In the display and adjustment module

If the instrument is equipped with a display and adjustment module, the parameter adjustment data can be saved therein. The procedure is described in menu item "*Copy device settings*".

7 Setup with PACTware

7.1 Connect the PC

Via the interface adapter directly on the sensor

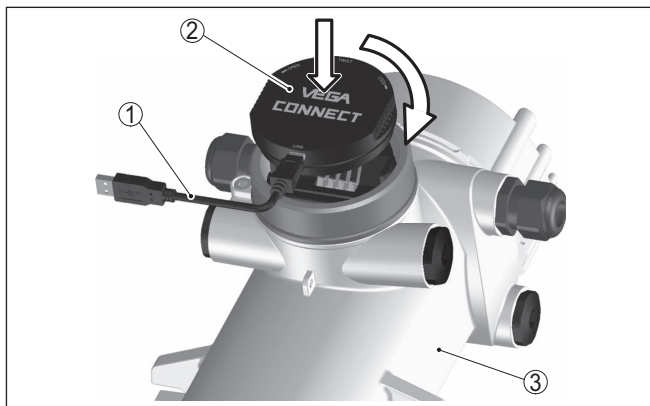


Fig. 26: Connection of the PC directly to the sensor via the interface adapter

- 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

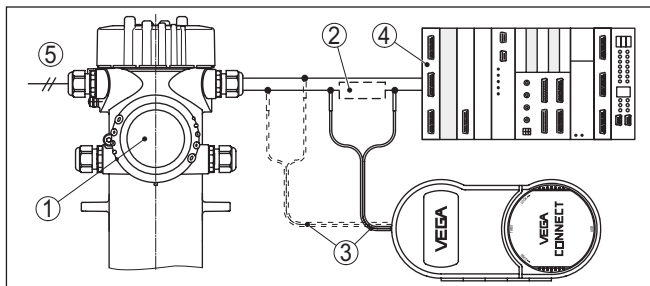


Fig. 27: Connecting the PC via HART to the signal cable

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

Necessary components:

- WEIGHTRAC 31
- PC with PACTware and suitable VEGA DTM
- VEGACONNECT 4
- HART resistance approx. 250 Ω

- Voltage supply

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 (from DTM Collection 06/2012). 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.

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 Parameter adjustment - Mass flow detection

The parameter adjustment adapts the instrument to the application conditions.

Instrument start



Note:

During the first setup or after an instrument reset the instrument starts with an error message (F025 - Invalid linearization table). This is quite normal because the sensor doesn't yet have any reference points for correct operation. Push the button "OK" to acknowledge the error message.

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

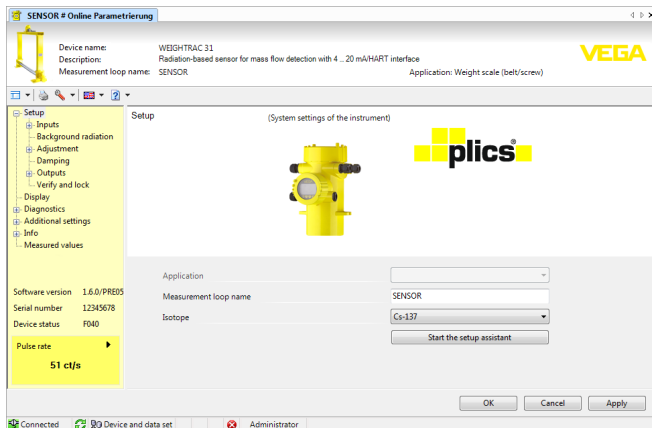
Presettings

Check if the correct language is already set for the software. If not, you can change the language in the menu item "Extras/Options".

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

Start screen

After starting PACTware, you can choose if you want to carry out the extended adjustment with the DTM (Device Type Manager) or work with the setup assistant.



Setup assistant

Setup

Start the setup assistant by clicking the respective button.

Work as far as possible according to the sequence of the setup assistant.

Setup - Selection of the application (step)

This menu item enables adaptation of the sensor to the requested application. You can choose between the following applications: " *Mass flow (belt/spiral)*" or " *Mass flow summation Secondary*".

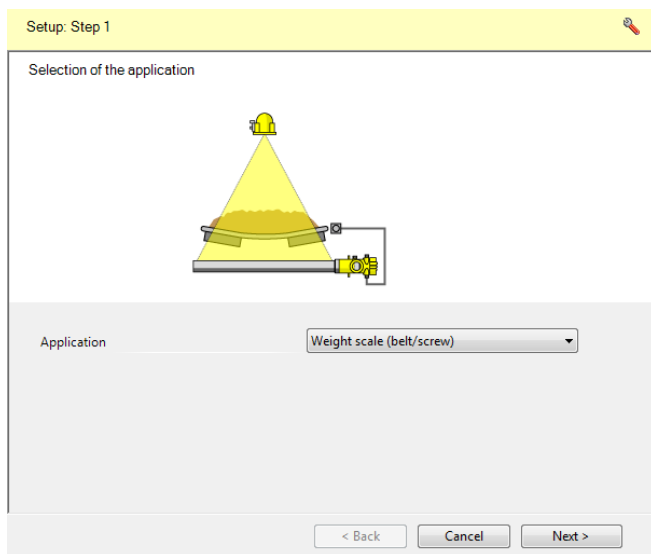


Fig. 28: Select application

Mass flow (belt/spiral)

The application "*Mass flow (belt/spiral)*" is for the detection of the mass flow of bulk solids on a conveyor belt or a conveyor spiral.

Mass flow summation Secondary

The application "*Mass flow summation Secondary*" is for the detection of the mass flow of bulk solids, for example on a broader conveyor belt with several instrument whereby the concerned instrument works as a Secondary device.

When you have selected this function, you can activate the Secondary outputs via a selection field. When you activate this field, then the current output of WEIGHTRAC 31 functions.

When the output is activated, the instrument remains in its function as a Secondary instrument, but the 4 ... 20 mA output can be also used als single instrument. The instrument provides the complete range of functions when the output is active.



Information:

If you want to operate your Primary instrument as master of a mass flow summation, select application "*Mass flow (belt/spiral)*".

Setup - Select inputs (step)

In this window you can carry out the settings for the inputs of WEIGHTRAC 31.

If no selection is made, the instrument operates as a single instrument.

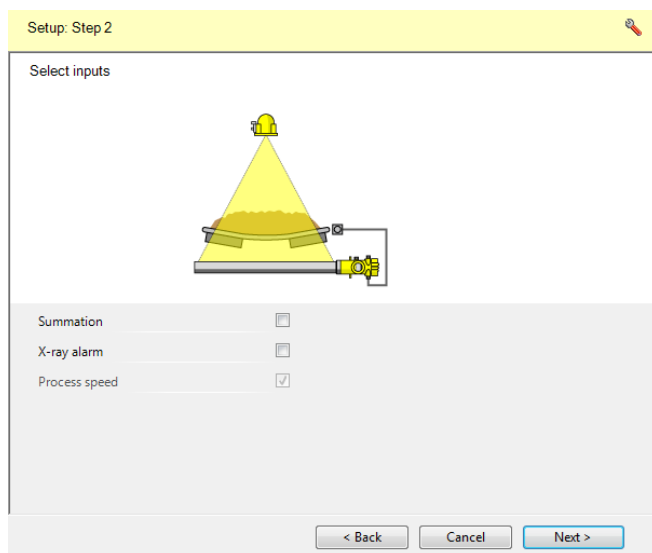


Fig. 29: Select inputs

Summation

If you want to use several instruments, for example on a broad conveyor belt, activate the function "Summation".

The instrument then operates as Primary instrument of a cascading group.

X-ray 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 radiometric instruments.

For this you need an additional sensor (X-ray alarm sensor) for detection of the external radiation.

The X-ray alarm is only output for the period of increased external radiation. Then the X-ray alarm is automatically reset.

In this menu item you can determine the behaviour of the sensor when external radiation sources appear. You can also select the switching threshold as needed in case of external radiation.

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.



Information:

If you have activated the X-ray alarm, you have to enter in the next step the type and the data of the connected X-ray alarm sensor.

NORM compensation

Some media contain radioactive substances. This is often found in the ore and primary industries.

This would lead to inaccuracies in measurement. An external sensor can compensate for this additional radiation.

Moisture compensation

Changing moisture can modify the weight of the medium. Especially in outdoor areas, rain and ground water are important influencing factors.

An external humidity sensor can detect the changes in moisture in the medium and offset them against the measurement result.

Process speed

The speed of the conveyor belt is important for the measuring result of the sensor.

This function is selected as a standard feature. Hence the input can be used for an external tachometer or a speed value from the control room.

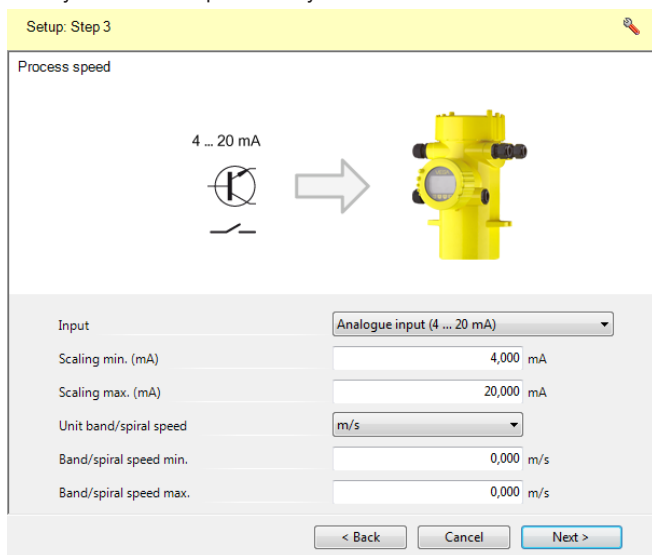
Automatic real value correction

If the belt is very worn, or if the belt has been changed, you must regularly carry out a real value correction.

To start automatic real value correction, you can use a push-button or a PLC connected to the digital input.

Setup - Process speed (step)

In this window you can carry out the settings for the speed of the conveyor belt or the spiral conveyor.



Setup: Step 3

Process speed

4 ... 20 mA

Input: Analogue input (4 ... 20 mA)

Scaling min. (mA): 4,000 mA

Scaling max. (mA): 20,000 mA

Unit band/spiral speed: m/s

Band/spiral speed min.: 0,000 m/s

Band/spiral speed max.: 0,000 m/s

< Back Cancel Next >

Fig. 30: Select process speed

Input

If you have neither a tachometer on the conveyor belt nor the actual belt speed from the plant control system, you should deactivate the input of the process speed by selecting "No belt/spiral stop signal". In such case you have to enter a fixed conveyor belt speed.

You can transmit the conveyor belt speed via an "Analogue input (4 ... 20 mA)" or a "Digital input (frequency input)". Tachometers are designed mainly for digital input.

Here you have the possibility to process only one "Belt stop signal". In this case you have to enter a fixed belt speed.

Scaling min./max.

If you have selected one of the inputs for the process speed, you can determine here the min. and max. values for the input. Specify mA for analogue input and Hz for digital input.

Unit - Belt/screw speed

Here you can select the unit of the conveyor belt speed (e.g. m/s, ft/min etc.)

Belt/screw speed min./max.

Here you can enter the min. and max. speed of the conveyor belt.

Connection of a tachometer

Typically digital tachometers are mounted to conveyor belts detecting the belt speed continuously.

In this case you have to assign a respective belt speed to the digital output value of the tachometer.

In the example, you have a diameter of the tachometer wheel of 0.160 m and the tachometer delivers 200 impulses per turn

Let the belt run at max. speed and read out the max. frequency (in Hz) in the diagnosis window of the tachometer. These are 480 Hz in the following example.

The belt speed can be calculated as follows:

$$\begin{aligned}
 U_T &= \pi * d & V_B &= \frac{U_T}{P_R} * F \\
 U_T &= \pi * 0,16\text{m} & V_B &= \frac{0,50\text{m}}{200} * 480 \text{ Hz} \\
 U_T &= \underline{0,50\text{m}} & V_B &= \underline{1,2 \text{ m/sec}}
 \end{aligned}$$

Fig. 31: Calculation of the belt speed

U_T Circumference of the tachometer wheel (m)

d Diameter of the tachometer wheel (m)

V_B Belt speed (m/s)

P_R Impulses per turn (depending on the tachometer used)

F Actual frequency (Hz)

For having a sufficiently large measuring range with changes on the conveying system, we recommend doubling the frequency and belt

speed values. By doing so you will have a sufficient reserve with a probably higher belt speed.

Example: The two values: 480 Hz \Rightarrow 1.2 m/s will be doubled:
960 Hz \Rightarrow 2.4 m/s.

Select the digital input and enter these two max. values.

Setup - Check inputs (step)

Check that all external sensors are correctly connected and working reliably.

Setup - Accept application (step)

In this window you can accept the modifications previously made. The data are written into the instrument.

Setup - Isotope (step)

In this menu item you can adjust the WEIGHTRAC 31 to the isotope installed in the source container.

For this purpose, check which isotope is 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 source activity through radioactive decay is thus taken into account.

The WEIGHTRAC 31 requires this information for the automatic decay compensation. This ensures error-free measurement over the entire lifetime of the gamma emitter - an annual recalibration is not necessary.

Setup - Background radiation (step)

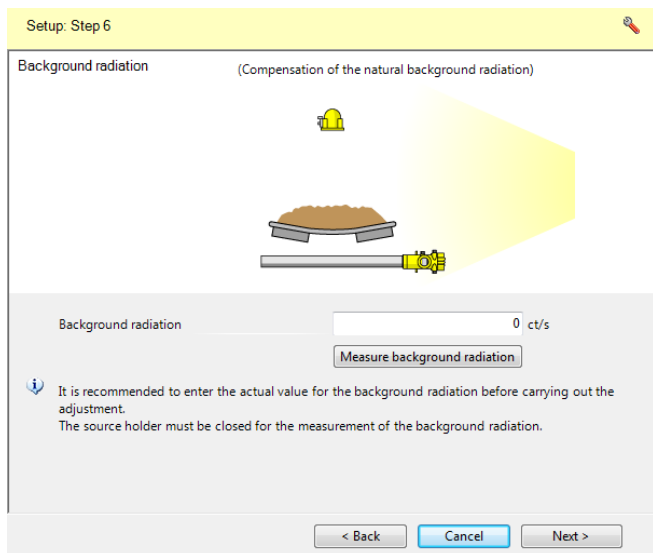


Fig. 32: Fade out background radiation

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 WEIGHTRAC 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.



Caution:

For this setting, the source container must be closed and the sensor already in operation for five minutes.



Note:

If you want to use an already existing source container, we recommend measuring the background radiation without connected source container. A source container with a Cs-137 isotope should have a distance of at least 3 m (10 ft) to the sensor for measurement of the background radiation. A source container with a Co-60 isotope should have a distance at least 5 m (17 ft).

This ensures that the measured pulse rate really originates from the source used.

Setup - Adjustment (step)

Setup: Step 7

Adjustment (Adjustment of the measurement loop)

Unit of the process values: t/h

Max. process value: 999,0 t/h

Min. process value: 0,0 t/h

The settings for the process value are also used as default setting for the current output.

< Back Cancel Next >

Fig. 33: 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 "t/h". This corresponds to an output current of 20 mA.

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

Setup - Damping (step)

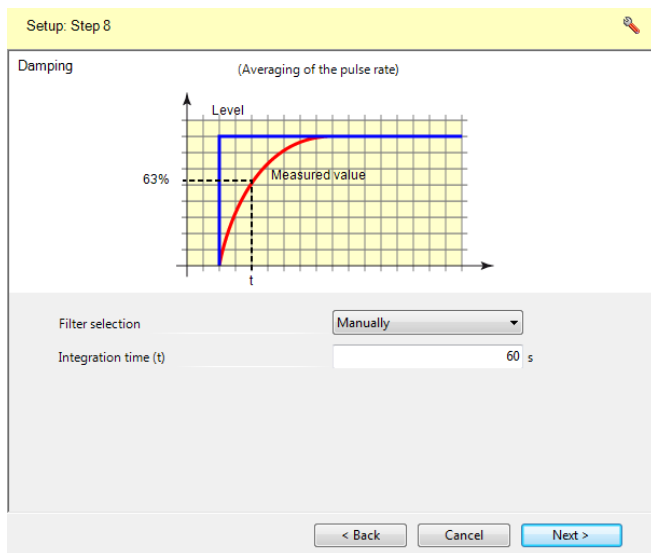


Fig. 34: Set damping

In this menu item you can adjust the damping of the sensor with filter selection "Manually". 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 the reaction time also 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 - Current output (step)

Setup: Step 9

Current output (Conversion of the percentage values into current values)

Output characteristic: 4 ... 20 mA

Failure mode: < 3.6 mA

Min. current: 4 mA

Max. current: 20 mA

< Back Cancel Next >

Fig. 35: Select behaviour of the current outputs

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

In this menu item you can define the behaviour of the current output. You can determine the current with min. and max. level separately.

Setup - Relay (step)

Setup: Step 10

Relay (Settings of the relay function)

Basic value: Process value

Mode of operation: Overfill protection

Failure mode: Switch mode OFF

Upper switching point: 0,000 t/h

Lower switching point: 0,000 t/h

< Back Cancel Next >

Fig. 36: Relay output

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.

This does not apply if "X-ray alarm" is selected as reference value. In this case the fault message is not active.

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



Caution:

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

This does not apply if "X-ray alarm" is selected as reference value. In this case the fault message is not active.

Setup - Totalizer (step)

Fig. 37: Set up totalizer

With this function you can activate the totalizer. As a default setting, the totalizer is deactivated.

You can set material quantity that causes a counting pulse to be output via the digital output (NPN transistor).

The leak volume suppression determines which degree of filling (in percent) activates the totalizer.

With this you can avoid a continued summation of contamination or slight buildup on an otherwise empty conveyor belt.

Setup - Complete (step)

In a last step, complete the adjustment with the setup assistant. After terminating the assistant, the program jumps back to the usual DTM program environment.

**Information:**

After the successful run through the setup wizard, you must set two more points in the DTM (zero rate determination and linearisation).

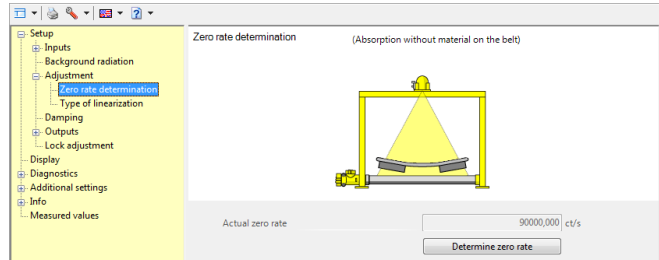
Adjustment**Adjustment - Zero rate determination (DTM)**

Fig. 38: Determine zero rate (tare measurement)

To increase measurement accuracy, you have to carry out the zero rate determination with an empty conveyor belt. During the zero rate determination make sure that no material is transported and that no residues fall onto the conveyor belt. In such case, you have to repeat the procedure.

The conveyor belt should make several circulations to compensate for irregularities of the conveyor belt or the conveyor system. The more often the conveyor belt circulates during the zero rate determination, the more precise the result will be.

**Tip:**

To check the zero rate determination (taring), you can carry out a test measurement after the adjustment with empty belt over a period of 5 to 10 minutes. If no or only a negligible feed rate sums up during the measurement, the zero rate determination has been carried out correctly.

1. Start empty conveyor belt and let it run idle
Tip: Mark the conveyor belt with coloured adhesive tape
2. Set the source container to "ON"
3. Click the button "Determine zero rate"
4. Let the conveyor belt run for two to three belt lengths
5. Terminate the zero rate determination
6. Stop conveyor belt

The determined value of the zero rate is transferred to the sensor

**Note:**

In case of heavy belt wear, a real value correction should be carried out regularly to keep the measuring accuracy constant.

If you replace the belt, you must also carry out a real value correction.

Adjustment - Linearization (DTM)

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

During linearization, a corresponding total weight of conveyed material is assigned to a particular pulse rate.

It is therefore important to detect the weight of the conveyed material correctly. This means that you have to use a precise, possibly also calibrated, scale.

Make sure that no material is lost from the belt or the transport and that no foreign material is added. If you carry out the measurement with a truck, make sure that you have comparable measuring conditions (always measure with or without driver, use the same vehicle or compensate for differences, make sure there is no residue buildup on the loading platform of the vehicle, etc.).

Make sure that the density of the material during the linearization corresponds to the original material measured later on.

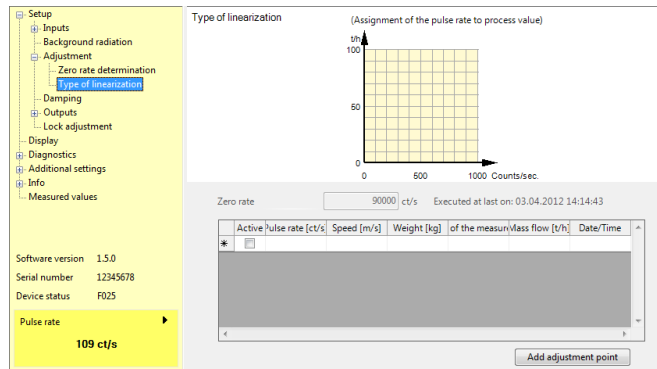


Fig. 39: Add adjustment points

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

For very precise measuring results, you should carry out this adjustment with different filling heights (flow rates) on the conveyor belt. The bigger the difference in flow rates, the more precise the linearization.

The way you measure the total quantity of the conveyed material depends on the options you have on site.

You can collect the total quantity of conveyed material on a truck and determine the weight with a truck scale. But you can also weigh the material before the measurement and keep it ready for the linearization. Another possibility would be to transfer the conveyed material to a container sitting on load cells.

You can carry out the linearization with two different principles:

- Dynamically - with running conveyor belt
- Statically - with stationary conveyor belt

Dynamic linearization

During dynamic linearization you simulate the actual operation of the conveyor belt with the known material quantity. For a dynamic

linearization you need at least 20 % of the max. process value. If the measuring range is e.g. 0 ... 200 t, then at least 40 t of material should be available for linearization.

As with zero point determination, the linearization will be more precise the longer the linearization runs and the larger the filling height differences are. Hence, linearizations are often carried out with the max. conveyed quantity, in our example with 200 t.



Tip:

During linearization many technical and process-related factors can cause a faulty measurement. Therefore, have enough material ready for the linearization so that, if necessary, you can repeat the measurement.

- You have a known quantity of material that is continuously loaded onto the conveyor belt.
 - If possible, load the conveyor belt to maximum (100 %).
1. Load the conveyor belt continuously with a known quantity of material.
Measure the material quantity with a belt weigher or weigh the material with a truck scale.
Make sure that the material used corresponds to the material that is measured later on.
 2. Start the conveyor belt.
 3. Click to "*Start measurement*", as soon as the first material passes by the measuring point.
 4. The run should last several minutes.
 5. Click to "*Stop measurement*", as soon as the last material passes the measuring point.
 6. The measured 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.
 7. Now enter the corresponding material quantity (e.g. kg, t, lb). In this case, this is the total quantity of material that has passed by during the measurement.
This assigns a corresponding material quantity to the current pulse rate.
 8. Click to "*Finish*".
Accept the value pair with "*Accept*".

Carry out such a linearization with several different loading heights. We recommend two to three measurements.

The measurement will be more reliable if you enter several linearization points with different loading heights.

Static linearization

During static linearization you simulate a typical loading of the conveyor belt with a known quantity of material on a defined belt length. Enter the adjustment points in kg/m.



Tip:

To ensure that the material is loaded onto the belt continuously and without loss, we recommend the use of a ready-made wooden frame.

- You have a known quantity of material lying in typical way and at a typical height on a short section of the conveyor belt.
- You know the later, continuous belt speed or can measure it.
- The conveyor belt is loaded as completely as possible (100 %).
- You can slowly move the conveyor belt manually.

If you do not have the option of moving the conveyor belt slowly by hand and the materials are light weight, place the material on a long piece of foil that you slowly pull through the measuring frame. In case the weight of the foil is not negligible, you should add the weight of the foil to the total weight later on.

Make sure that you do not reach into the control area of the measuring plant. Cut the foil to an appropriate length.

1. Make sure that the source container is closed and locked (operating position: Off)
2. Load the conveyor belt evenly with a known quantity of material, for example 60 kg over a length of 1 m.

Make sure that the material type and loading height corresponds to the material that is measured later on.

3. Move the stretch of material into the measuring frame of WEIGHTRAC 31.
4. Switch on the source container.
5. Click to " *Start measurement*".
6. Slowly move the belt manually or move the material slowly by pulling on the foil. This process should take 5 to 10 minutes.
7. Click to " *Stop measurement*".
8. The measured 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.
9. Now enter the corresponding material quantity (e.g. kg, t, lb). In this case, this is the total material quantity lying on the conveyor belt during the measurement.

Enter the length of the portion of belt used (e.g. 1 m).

This assigns a corresponding material quantity to the actual pulse rate (e.g. 60 kg/m).

10. Click to " *Finish*".

Accept the value pair with " *Accept*".

11. Repeat this procedure with a larger quantity of material (e.g. 120 kg) until you have reached the max. loading height of the conveyor belt.

Further settings in PACTware

You can select further options in PACTware.

A detailed description of the functions is available in the PACTware online help.

Additional settings - Reset

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

The following reset functions are available:

Basic settings: Restores the parameter settings at the time of shipment Ex factory including the order-specific settings. The measured value memory is deleted.

Factory settings: Resets parameter settings including special parameters to the default values of the respective instrument. The measured value memory and the order-specific settings are deleted.

Peak indicator: Resets the parameter settings 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. The measured value memory as well as the event memory remain unaffected.

The following table shows the default values of the instrument. The values apply for the application "Mass flow". The application must be selected first.

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

Setup

Menu item	Default value	Modified value
Measurement loop name	Sensor	
Isotope	Cs-137	
Application	Mass flow	
Input - Process speed	No belt/screw stop signal	
Unit - Belt/screw speed	m/s	
Speed	1 m/s	
Background radiation	0 ct/s	
Process value unit	m	
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	
Lock adjustment	Released	

Display

Menu item	Default value	Modified value
Language	Selected language	

Menu item	Default value	Modified value
Display unit	ct/s	
Displayed value	Pulse rate	
Temperature unit	°C	

Additional adjustments

Menu item	Default value	Modified value
Linearisation	Empty	
HART mode	Standard Address 0	

7.4 Save parameter adjustment data

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

7.5 Real value correction

With a real value correction, you can adapt the measurement to the actual conditions of the plant. In this way, you can avoid measurement deviations and inaccuracies in the conveyed quantity.

In case of heavy belt wear, a real value correction should be carried out regularly to keep the measuring accuracy constant.

If you replace the belt, you must also carry out a real value correction.

Automatic real value correction

The automatic real value correction gives you the possibility of triggering a real value correction via a pulse from the digital input.

This allows you to activate the real value correction e.g. from the control room.

1. Activate the digital input in the setup assistant.
2. To start the real value correction you can use either a push button or a PLC connected to the digital input.
This is not possible if a revolution counter is already connected there. The digital input can only be used once.
3. To start the automatic real value correction, the push button or the start signal of the PLC must be held for at least 3 seconds.
4. The duration of the real value correction is preset to 120 s.

You can adapt this time in the DTM under the setting "Zero rate" to the conditions of your system.

Process - Real value correction

To increase measurement accuracy, you have to carry out the real value correction with an empty conveyor belt. During the real value correction make sure that no material is transported and that no residues fall onto the conveyor belt. In such case, you have to repeat the procedure.

The conveyor belt should make several circulations to compensate for irregularities of the conveyor belt or the conveyor system. The more often the conveyor belt circulates during the real value correction, the more precise the result will be.

1. Start empty conveyor belt and let it run idle

Tip: Mark the conveyor belt with coloured adhesive tape

2. Set the source container to "ON"
3. Click the button "*Real value correction*"
4. Let the conveyor belt run for two to three belt lengths
5. Terminate the real value correction
6. Stop conveyor belt

With the determined value of the real value correction, the zero rate of the sensor will be adapted respectively.



Tip:

To check the real value correction, you can carry out a test measurement after the adjustment with empty belt over a period of 5 to 10 minutes. If no or only a negligible feed rate sums up during the measurement, the real value correction has been carried out correctly.

8 Diagnostics and servicing

8.1 Maintenance

If the device is used properly, no special 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.

8.2 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 and PACTware/DTM.

Status messages

The status messages are divided into the following categories:

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

and explained by pictographs:

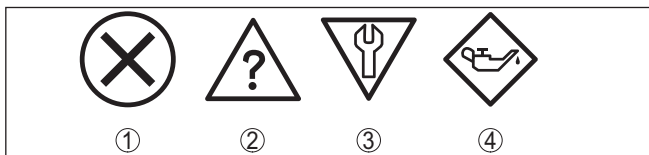


Fig. 40: Pictographs of the status messages

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

Malfunction (Failure):

Due to a malfunction in the instrument, a fault signal is output.

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

Function check:

The instrument is being worked on, 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 unreliable because an instrument specification was 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 required:

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

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/digital input No valid measured value Connected instruments without function	Check current input Check connected instruments (Secondary instrument)
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	Wrong or empty linearization table (1074, 1075, 1080, 1100, 1106) Wrong value in the linearization table (1143, 1144) No valid zero rate (1149)	Create linearization table Correct linearization table Carry out a zero rate determination
F029 Simulation active	Simulation mode is switched on	Switch off simulation Simulation is ended automatically after 60 minutes
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
F037 RAM hardware error	Error in RAM	Restart instrument Exchanging the electronics

Code Text message	Cause	Rectification
F038 Secondary signals failure	Connection cable to the Secondary instrument interrupted Instrument not defined as Secondary instrument One of the Secondary instruments signals a failure	Check the connection cable to the Secondary instrument Define instrument as Secondary Check Secondary instruments
F040 Hardware error	Instrument defective (1092, 1126) Temperature outside the specification (1091)	Restart instrument Exchanging the electronics Cool the instrument or protect it with isolation material against heat/cold
F041 Photomultiplier error	Error in the measured value recording	Restart instrument Exchanging the electronics
F045 Error on the current output	Current output is activated, no device connected to the current output	Check parameter adjustment Call our service
F052 Faulty configuration	Invalid parameter adjustment	Carry out a reset
F053 Input adjustment range too small	Adjustment range of the analogue inputs outside the permitted range	Carry out adjustment Call our service
F057 Error in linearization table for input device	Fehler in der Temperaturkompensation	Linearisierungstabelle für die Temperaturkompensation überprüfen und evtl. anpassen.
F059 Faulty adjustment of the steam density compensation	Abgleich der Dampfdichtekompensation außerhalb des zulässigen Bereiches	Dampfdichtekompensation erneut durchführen
F066 Faulty adjustment	Adjustment not yet carried out Error during adjustment or when entering the linearisation table	Carry out adjustment Carry out linearisation
F068 Count rate too high	Faulty instrument settings (1031) Faulty steam density compensation (1101)	Carry out a reset Check Secondary instrument (steam density)
F071 SIL error - check parameters	Unexpected interruption during the SIL verification	Repeat SIL verification
F072 Limit exceeded	Faulty instrument settings	Carry out a reset
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

Code Text message	Cause	Rectification
F120 Filter time error	Faulty or missing instrument adjustment	Carry out adjustment
F121 Faulty participant list on the multisensor communication bus	Secondary instruments not found Secondary instrument with wrong address	Check Secondary instruments Check Secondary list in Primary instrument Correct address of Secondary instruments
F122 Double addresses on the multisensor communication bus	Instrument address was assigned several times	Change instrument addresses
F123 X-ray alarm	External instruments cause radiation Radiation above the max. adjustment value	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
F126 Error in the trend recording	Instrument error	Call our service
F127 Trend execution error	Measured value memory faulty	Stop and restart measured value memory
F141 Communication error on the multisensor communication bus	Secondary instrument does not answer	Check Secondary instruments

Tab. 4: Error codes and text messages, information on causes as well as corrective measures

Function check

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

Tab. 5: Error codes and text messages, information on causes as well as corrective measures

Out of specification

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 linearisation
S038 Secondary outside the specification	Secondary instrument outside the specification	Check Secondary instruments
S125 Ambient temperature too high/too low	Ambient temperature too high/too low	Protect instrument with isolating material against extreme temperatures

Tab. 6: Error codes and text messages, information on causes as well as corrective measures

Maintenance

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

8.3 Rectify faults

Reaction when malfunction occurs

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

Fault rectification

The first measures are:

- Evaluation of fault messages
- Checking the output signal
- Treatment of measurement errors

A smartphone/tablet with the adjustment app or a PC/notebook with the software PACTware and the suitable DTM offer you further comprehensive diagnostic possibilities. In many cases, the causes can be determined in this way and the faults eliminated.

Check 4 ... 20 mA signal (mass flow determination)

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

Error	Cause	Rectification
4 ... 20 mA signal not stable	Loading fluctuations	Adjust damping via PACTware/DTM
	Conveyor belt was changed	Carry out real value correction
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
Current signal greater than 22 mA or less than 3.6 mA	Instrument on failure message	Note error message on the display and adjustment module

Additional interferences

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

Error	Cause	Rectification
Instrument displays loading of the conveyor belt. However, the belt is empty.	Loading fluctuations	Carry out real value correction
Instrument sums up the material quantity. However, belt is empty.	Contamination, buildup on the conveyor belt	Activate leak volume suppression
	Conveyor belt was changed - belt connections	Activate leak volume suppression
Inaccurate measured values	Changing product density	Carry out linearisation

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.

8.4 Exchanging the electronics module

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



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

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

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

- In the factory
- Or on site by the user

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

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



Information:

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

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

8.5 Software update

The following components are required to update the instrument software:

- Instrument
- Voltage supply
- Interface adapter VEGACONNECT
- PC with PACTware
- Current instrument software as file

You can find the current instrument software as well as detailed information on the procedure in the download area of our homepage: www.vega.com.

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 is still effective after a software update is carried out.

You can find detailed information in the download area at www.vega.com.

8.6 How to proceed if a repair is necessary

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 an instrument return form as well as detailed information about the procedure in the download area of our homepage: www.vega.com

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

If a 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 contact the agency serving you to get the address for the return shipment. You can find the agency on our home page www.vega.com.

9 Dismount

9.1 Dismounting steps

To remove the device, carry out the steps in chapters " *Mounting*" and " *Connecting to power supply*" in reverse.



Warning:

When dismounting, pay attention to the process conditions in vessels or pipelines. There is a risk of injury, e.g. due to high pressures or temperatures as well as aggressive or toxic media. Avoid this by taking appropriate protective measures.

9.2 Disposal



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

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

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

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

10 Supplement

10.1 Technical data

Note for approved instruments

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

All approval documents can be downloaded from our homepage.

General data

316L corresponds to 1.4404 or 1.4435

Materials, non-wetted parts

– Detector tube	316L
– Scintillation material	PVT (Polyvinyltoluene)
– Aluminium die-cast housing	Aluminium die-casting AlSi10Mg, powder-coated (Basis: Polyester)
– Stainless steel housing	316L
– Seal between housing and housing lid	NBR (stainless steel housing, investment casting), silicone (Aluminium housing)
– Inspection window in housing cover (optional)	Polycarbonate or glass
– Ground terminal	316L
– Stainless steel type label (optional)	316L
– Cable gland	PA, stainless steel, brass
– Sealing, cable gland	NBR
– Blind plug, cable gland	PA, stainless steel
– Measuring frame (optional)	Galvanized steel, stainless steel
– Clamp collar (DIN 3015, part 1)	PA (Polyamide)

Process fittings

– Fastening lugs	ø 9 mm (0.35 in), hole centre distance 119 mm (4.69 in)
------------------	---------------------------------------------------------

Weight

– Aluminium housing, with electronics	3.4 kg (7.5 lbs) + measurement tube
– Stainless steel housing, with electronics	8.36 kg (18.43 lbs) + measurement tube
– Measurement tube	7.1 kg/m (4.77 lbs/ft)
– Measuring frame (optional)	28 ... 72 kg (62 ... 159 lbs) ⁴⁾
– Maximum total weight, incl. accessory	72 kg (158 lbs)

Conveyor belt width (see table in the appendix) 500 ... 2800 mm (19.7 ... 110 in)

Length of the detector (instrument length L) 610 ... 3000 mm (24 ... 118 in)

⁴⁾ For measuring width 500 ... 2800 mm (19.7 ... 110 in)

Max. torque, mounting screws

- Fastening lugs in the sensor housing 15 Nm (11.1 lbf ft), stainless steel A4-70

Max. torque for NPT cable glands and Conduit tubes

- Aluminium/Stainless steel housing 50 Nm (36.88 lbf ft)

Input variable

Analogue input

- Input type 4 ... 20 mA, passive
- Internal load 250 Ω
- Input voltage max. 6 V

Switching input

- Type of input - NPN (Open Collector) 10 mA
- Type of input - Relay contact 100 mA
- Frequency 0 ... 10000 Hz
- Input voltage max. 24 V

Measured variable

The measured variable is the intensity of the gamma radiation of an isotope. In case the radiation intensity decreases, for example due to rising loading volume of the conveyor belt, the measured value of WEIGHTRAC 31 changes in proportion to the loading volume.

Measuring width (L)

610 ... 3000 mm (24 ... 118 in)

Output variable/Mass flow rate measurement

Output signals	4 ... 20 mA/HART - active; 4 ... 20 mA/HART - passive
Range of the output signal	3.8 ... 20.5 mA/HART
Terminal voltage passive	9 ... 30 V DC
Shortcircuit protection	Available
Potential separation	Available
Signal resolution	0.3 μ A
Fault signal, current output (adjustable)	22 mA, < 3.6 mA
Max. output current	22 mA
Starting current	\leq 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)	Mass flow
– SV (Secondary Value)	Electronics temperature
– TV (Third Value)	Output value freely selectable, e.g. pulse rate
– QV (Quaternary Value)	Output value freely selectable, e.g. loading
Fulfilled HART specification	7.0

Further information on Manufacturer ID, Device ID, Device Revision See website of HART Communication Foundation

Relay output

Output	Relay output (SPDT), floating change-over contact
Switching voltage	max. 253 V AC/DC With circuits > 150 V AC/DC, the relay contacts must be in the same circuit.
Switching current	max. 3 A AC (cos phi > 0.9), 1 A DC
Switching current	
– Standard	max. 3 A AC (cos phi > 0.9), 1 A DC
– USA, Canada	max. 3 A AC (cos phi > 0.9)
Breaking capacity	
– Min.	50 mW
– Max.	Standard: 750 VA AC, 40 W DC (at U < 40 V DC) USA, Canada: 750 VA AC 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 ₂ each with 3 µm gold plating

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

Measurement 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)
Non-repeatability	1 % of the measuring range end value
Deviation with bulk solids	The values depend on the quality of the linearization
Deviation under EMC influence	≤ 1 %

Variables influencing measurement accuracy

Specifications apply also to the current output

Temperature drift - Current output	±0.03 %/10 K relating to the 16 mA span or max. ±0.3 %
Deviation in the current output due to analogue/digital conversion	<±15 µA

Deviation on the current output due to strong, high frequency electromagnetic interference acc. to EN 61326 $< \pm 150 \mu\text{A}$

Characteristics and performance data

Step response time ⁵⁾ $\leq 5 \text{ s}$ (with damping 1 s)

Ambient conditions

Storage and transport temperature $-40 \dots +60 \text{ }^\circ\text{C}$ ($-40 \dots +140 \text{ }^\circ\text{F}$)

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) $-40 \dots +60 \text{ }^\circ\text{C}$ ($-40 \dots +140 \text{ }^\circ\text{F}$)

Vibration resistance - sensor ⁶⁾ mechanical vibrations up to 1 g in the frequency range 5 ... 200 Hz

Vibration resistance - mounted in the measuring frame mechanical vibrations up to 1 g in the frequency range 5 ... 200 Hz

Electromechanical data - version IP66/IP67

Options of the cable entry

- Cable entry M20 x 1.5; ½ NPT
- Cable gland M20 x 1.5; ½ NPT (cable diameter see below table)
- Blind plug M20 x 1.5; ½ NPT
- Closing cap ½ NPT

Material cable gland	Material seal insert	Cable diameter				
		4.5 ... 8.5 mm	5 ... 9 mm	6 ... 12 mm	7 ... 12 mm	10 ... 14 mm
PA	NBR	–	●	●	–	●
Brass, nickel-plated	NBR	●	●	●	–	–
Stainless steel	NBR	–	●	●	–	●

Flammability class - Supply lines at least VW-1

Wire cross-section (spring-loaded terminals)

- Massive wire, stranded wire $0.2 \dots 2.5 \text{ mm}^2$ (AWG 24 ... 14)
- Stranded wire with end sleeve $0.2 \dots 1.5 \text{ mm}^2$ (AWG 24 ... 16)

Integrated clock

Date format Day.Month.Year

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).

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

Time format	12 h/24 h
Time zone, factory setting	CET
Max. rate deviation	10.5 min/year

Additional output parameter - Electronics temperature

Output of the temperature values

– Analogue	Via the current output
– Digital	Via the digital output signal (depending on the electronics version)
Range	-40 ... +50 °C (-40 ... +122 °F)
Resolution	< 0.1 K
Accuracy	±5 K

Voltage supply

Operating voltage	24 ... 65 V DC (-15 ... +10 %) or 24 ... 230 V AC (-15 ... +10 %), 50/60 Hz
Reverse voltage protection	Available
Max. power consumption	6 VA (AC); 4 W (DC)

Electrical protective measures

Application area	Outdoor areas
Altitude above sea level	2000 m (6561 ft)
Protection class	I
Pollution degree	4 ⁷⁾
Relative humidity	max. 100 %
Protection, depending on housing version	IP66/IP67 (NEMA Type 4X) ⁸⁾
Overvoltage category	III ⁹⁾

10.2 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⁾ Micro-environment in housing: pollution degree 2

⁸⁾ A suitable cable is required for maintaining the protection rating.

⁹⁾ Alternative: Overvoltage category II with operating height up to 5000 m

Aluminium and stainless steel housing

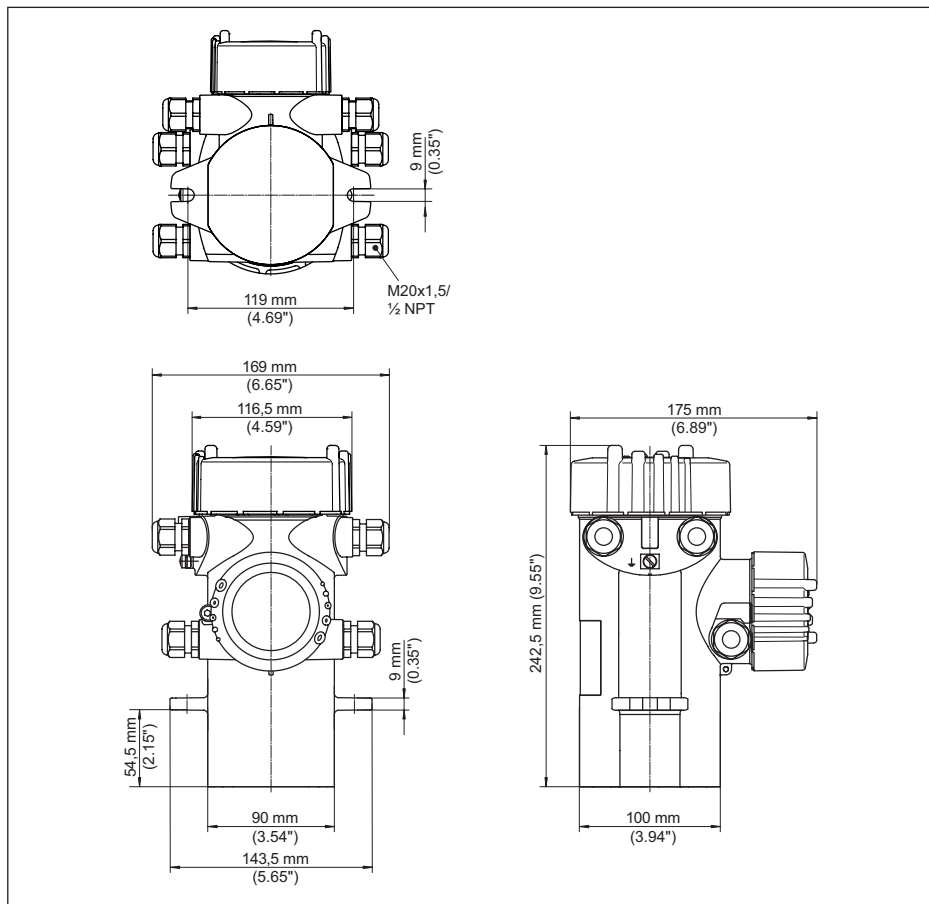


Fig. 41: Aluminium housing or stainless steel housing (precision casting)

WEIGHTRAC 31

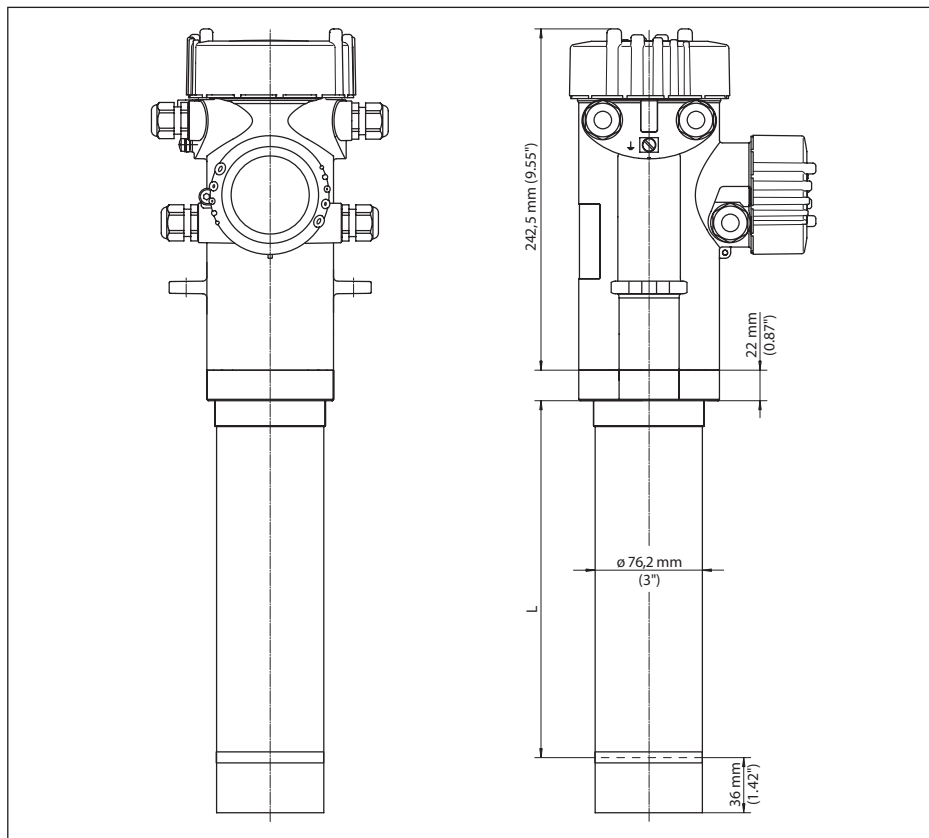


Fig. 42: WEIGHTRAC 31

L Measurement width

WEIGHTRAC 31 mounted in the measuring frame (optionally)

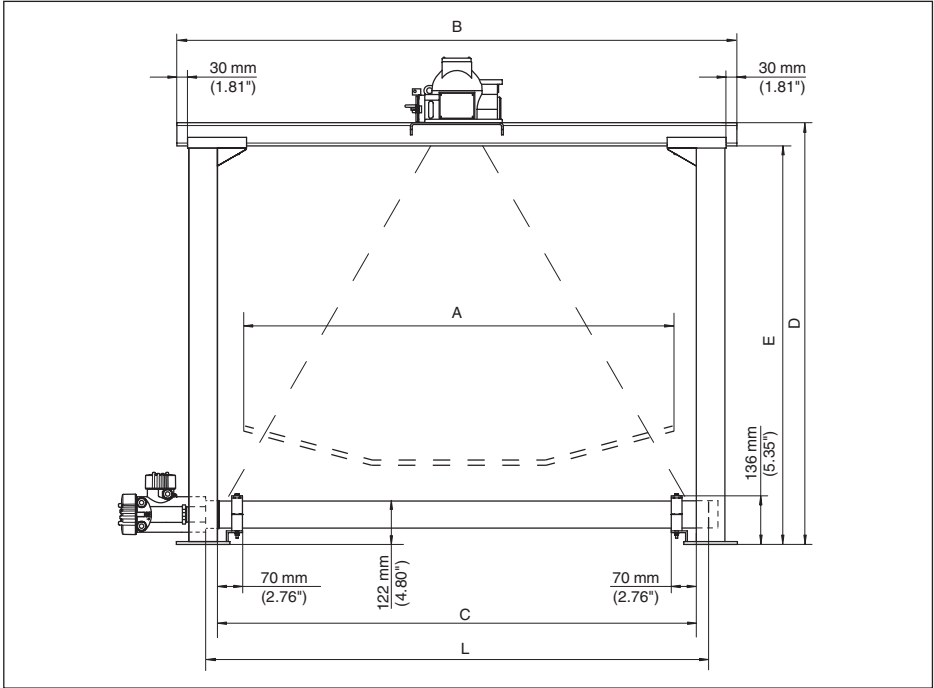


Fig. 43: WEIGHTRAC 31 in the measuring frame with source container SHLD-1 (can be ordered separately)

- A Maximum conveyor belt width
- B Total width - Crossbeam
- C Clear width (internal dimension) - measuring frame
- D Total height - measuring frame
- E Clear height (internal dimension) - measuring frame
- L Measuring width (length of the detector)

Dimensions/measuring frame (optional)

A	B	C	D	E	L
500 mm (19.68 in)	880 mm (34.65 in)	635 mm (25 in)	500 mm (19.68 in)	435 mm (17.13 in)	610 mm (24 in)
800 mm (31.5 in)	1175 mm (46.26 in)	948 mm (37.32 in)	770 mm (30.32 in)	705 mm (27.76 in)	1000 mm (39.37 in)
1000 mm (39.37 in)	1370 mm (53.94 in)	1143 mm (45 in)	1000 mm (39.37 in)	935 mm (36.81 in)	1219 mm (48 in)
1200 mm (47.24 in)	1570 mm (61.81 in)	1343 mm (52.87 in)	1180 mm (46.46 in)	1115 mm (43.9 in)	1500 mm (59.06 in)
1600 mm (63 in)	1960 mm (77.17 in)	1733 mm (68.23 in)	1550 mm (61.02 in)	1485 mm (58.46 in)	1829 mm (72 in)
2000 mm (78.74 in)	2450 mm (96.46 in)	2223 mm (87.52 in)	1970 mm (77.56 in)	1905 mm (75 in)	2500 mm (98.43 in)

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A	B	C	D	E	L
2400 mm (94.49 in)	2826 mm (111.26 in)	2599 mm (102.32 in)	2357 mm (92.8 in)	2292 mm (90.24 in)	2743 mm (107.99 in)
2800 mm (110.24 in)	3198 mm (125.91 in)	2971 mm (116.97 in)	2775 mm (109.25 in)	2710 mm (106.69 in)	3000 mm (118.11 in)

10.3 Industrial property rights

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10.4 Trademark

All the brands as well as trade and company names used are property of their lawful proprietor/originator.

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