Operating Instructions

Controller and display instrument for level sensors

VEGAMET 391

With SIL qualification

Document ID: 38704

Contents

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1 About this document

1.1 Function

This instruction provides all the information you need for mounting, connection and setup as well as important instructions for maintenance, fault rectification, safety and the exchange of parts. 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 instruction manual is directed to trained personnel. The contents of this manual must be made available to the qualified personnel and implemented.

1.3 Symbols used

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

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

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

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

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

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

Ex applications
This symbol indicates special instructions for Ex applications.

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

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

Disposal
This symbol indicates special instructions for disposal.

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2 For your safety

2.1 Authorised personnel

All operations described in this documentation must be carried out only by trained and authorized personnel.

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

2.2 Appropriate use

VEGAMET 391 mit SIL-Qualifikation is a universal controller for connection of a 4 … 20 mA sensor.

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 operating company 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 operating company has to implement suitable measures to make sure the instrument is functioning properly.

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

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

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 us. Arbitrary conversions or modifications are explicitly forbidden. For safety reasons, only the accessory specified by us must be used.

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

2.5 SIL conformity

This instrument fulfills the requirements of functional safety according to IEC 61508. You can find further information in the supplied Safety Manual.

2.6 Installation and operation in the USA and Canada

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

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

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

2.7 Safety instructions for Ex areas

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

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3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- Controller VEGAMET 391 mit SIL-Qualifikation
- Two clamping elements for panel mounting
- Ex separating wall
- Mini-USB cable
- Carrier rail adapter (optional)
- RS232 modem connection cable (optional)

The further scope of delivery encompasses:

- Documentation
  - Ex-specific "*Safety instructions*" (with Ex versions)
  - Safety Manual (with SIL version)
  - Documentation "*SIL device settings*"
  - If necessary, further certificates

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

Constituent parts

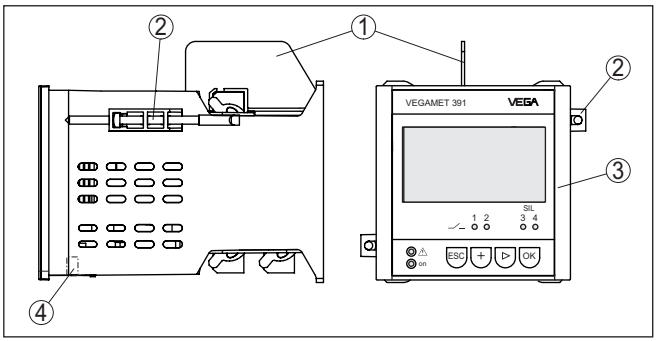

Fig. 1: VEGAMET 391 mit SIL-Qualifikation

1 Ex separating wall
2 Clamping element for panel mounting
3 Display and adjustment unit
4 USB interface

Type label

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

- Instrument type
- Information about approvals
- Configuration information
- Technical data
- Serial number of the instrument
- QR code for device identification
- Manufacturer information

Documents and software

To find order data, documents or software related to your device, you have the following options:

- Move to "www.vega.com" and enter in the search field the serial number of your instrument.
- Scan the QR code on the type label.
- Open the VEGA Tools app and enter the serial number under "***Documentation***".

3.2 Principle of operation

Application area

VEGAMET 391 mit SIL-Qualifikation is a universal controller for a variety of applications such as level, gauge and process pressure measurement. At the same time, it can serve as power supply unit for connected sensors. VEGAMET 391 mit SIL-Qualifikation is designed for connection of any 4 … 20 mA sensor.

Due to the SIL qualification, the instrument can be used in a safety-relevant protective function. With single channel architectur, SIL2 is reached, with multiple channel, diversitary architecture, SIL3. Take note of the specifications and requirements of the "*Safety Manual*".

Functional principle

The VEGAMET 391 mit SIL-Qualifikation controller can power the connected sensor and process its measurement signals. The requested parameter is shown on the display and also output to the integrated current output for further processing. The measurement signal can thus be transferred to a remote display or a superordinate control system. Operating relays for control of pumps or other devices are also integrated.

3.3 Adjustment

The instrument can be adjusted with the following adjustment media:

- With integrated display and adjustment unit
- an adjustment software according to FDT/DTM standard, e.g. PACTware and a Windows PC

The entered parameters are generally saved in VEGAMET 391 mit SIL-Qualifikation, when used with PACTware and PC also optionally in the PC.

Information:
When using PACTware and the respective VEGA DTM, additional settings can be carried out which are not possible or only partly possible with the integrated display and adjustment unit. Communication is carried out via the integrated USB interface.

3.4 Packaging, transport and storage

Packaging

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

The packaging 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 %

4 Mounting

4.1 General instructions

Installation possibilities

The instrument is designed for recessed installation in an instrument panel, housing front plate or switching cabinet door. The required cut-out is 92 x 92 mm (3.63 x 3.63 in) according to EN 60529. When installed correctly, protection rating IP65 is guaranteed. As an alternative, the instrument can be mounted in a switching cabinet or protective housing by means of four screws (attached with screws to rear of housing). A mounting adapter for carrier rail mounting is available as an option (top hat rail 35 x 7.5 according to DIN EN 50022/60715).

Note:
If the instrument is mounted via screws or carrier rail, it must always be inside a switching cabinet or protective case.

A VEGAMET 391 mit SIL-Qualifikation in Ex version is an auxiliary, intrinsically safe instrument and may not be installed in explosion-endangered areas.

Before setup, the Ex separating wall must be attached to Ex versions. Safe operation can only be ensured if the operating instructions manual and the EU type approval certificate are observed. VEGAMET 391 mit SIL-Qualifikation must not be opened.

Ambient conditions

The instrument is suitable for standard ambient conditions acc. to DIN/EN/BS EN/IEC/ANSI/ISA/UL/CSA 61010-1.

Make sure that the degree of contamination specified in chapter "*Technical data*" meets the existing ambient conditions.

4.2 Mounting instructions

Front panel mounting

1. Make sure that the cut-out required for mounting has a size of 92 x 92 mm (3.63 x 3.63 in).
2. Check for the correct position of the seal directly behind the front plate and insert the instrument from the front into the front panel cut-out.
3. Press the two tensioning elements into the provided gaps.
4. Screw in the two screws of the tensioning elements evenly with a screwdriver.

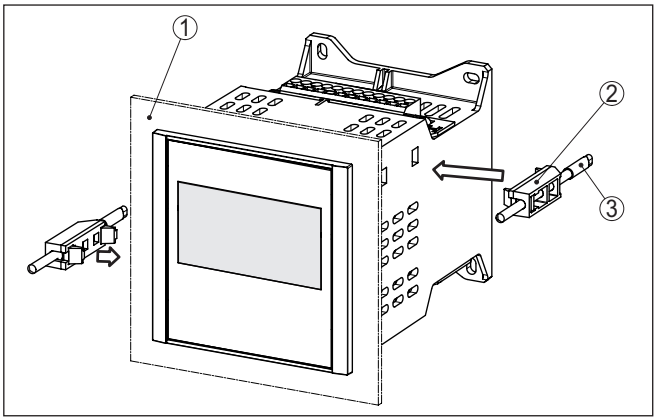

Fig. 2: Front panel mounting

1 Front panel, front plate or switching cabinet door
2 Clamping elements
3 Slotted screw

Screw mounting

→ Fasten the instrument by means of four screws (max. ø 4 mm) to the inner side of the housing or to the mounting plate according to the following illustration.

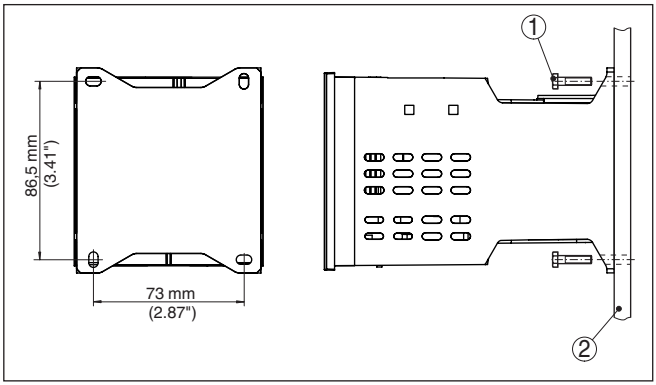

Fig. 3: Screw mounting

1 Fixing screw
2 Rear of the housing or mounting plate

Carrier rail mounting

1. Fasten the mounting plate to the instrument with the four enclosed hexagon socket screws.
2. Screw the carrier rail adapter to the mounting plate with the four enclosed Phillips-head screws.

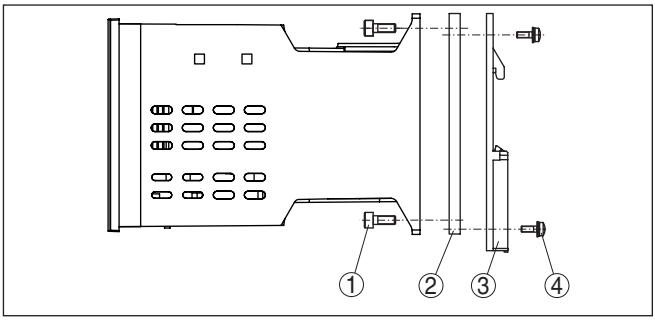

Fig. 4: Carrier rail mounting

1 Hexagon socket screws
2 Mounting plate
3 Carrier rail adapter
4 Phillips head screws

5 Connecting to power supply

5.1 Preparing the connection

Safety instructions

Always keep in mind the following safety instructions:

Warning:
Connect only in the complete absence of line voltage.

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

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).

Safety instructions for Ex applications

In hazardous areas you must take note of the respective regulations, conformity and type approval certificates of the sensors and power supply units.

Voltage supply

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

Connection cable

The voltage supply of VEGAMET 391 mit SIL-Qualifikation is connected with standard cable according to the national installation standards.

To connect the sensors, standard two-wire cable can be used. If electromagnetic interference is expected which is above the test values of EN 61326 for industrial areas, shielded cable should be used.

Make sure that the cable used has the required temperature resistance and fire safety for max. occurring ambient temperature

5.2 Connection procedure

Move on to electrical connection and proceed as follows:

1. Mount the instrument as described in the previous chapter
2. Remove terminal strip 1 on the upper side of the instrument
3. Connect sensor cable to terminal 1/2 (active input)
4. If necessary, connect digital inputs to 8/9 and 12
5. Plug terminal strip 1 to the upper side of the instrument
6. Remove terminal strip 2 on the lower side of the instrument
7. Connect power supply (switched off) to terminal 13/14
8. Connect current output (if not needed, it should be short-circuited)
9. If necessary, connect relays or other outputs
10. Plug in terminal strip 2 on the lower side of the instrument
11. For connection of additional relais to terminal strip 3, you have to proceed as described earlier

The electrical connection is finished.

Note:
If the current output is not needed, the terminals must be short-circuited, because the output is monitored and a failure message is output when being interrupted.

Remember that with Ex applications, the Ex separating wall must be plugged onto the upper side of the instrument before setup.

Information:
On the active input (terminal 1/2), VEGAMET 391 mit SIL-Qualifikation provides power for the connected sensors. Power supply and measurement data are transmitted over the same two-wire cable. This mode is provided for connection of measuring transducers without separate voltage supply (sensors in two-wire version).

A passive input is not available with VEGAMET 391 with SIL qualification.

5.3 Wiring plan

Wiring plan for two-wire sensor

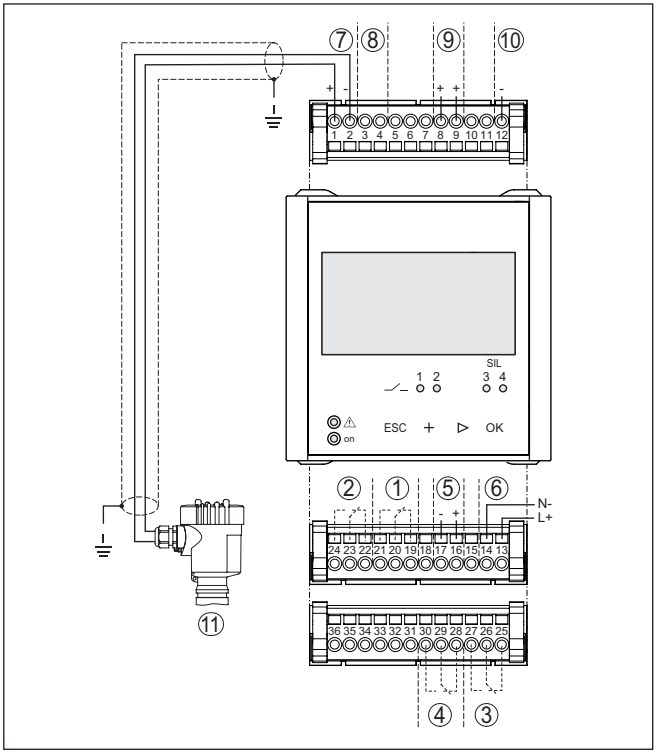

Fig. 5: Wiring plan with two-wire sensor

1 *Relay 1*
2 *Relay 2 (optional fail safe relay)*
3 *Relay 3 (SIL)*
4 *Relay 4 (SIL)*
5 *Current output*
6 *Voltage supply of the controller*
7 *Measurement data input with sensor supply (active input)*
8 *Connection for HART modem for sensor parameter adjustment*
9 *Digital input 1 and 2*
10 *Common ground for digital input 1/2*
11 *4 … 20 mA/HART sensor (two-wire version)*

6 Functional safety (SIL)

6.1 Directive and scope

SIL

In case of dangerous failures, processing facilities and machines can cause risks for persons, environment and property. The risk of such failures must be judged by the plant operator. Dependent thereon are measures for risk reduction through error prevention, error detection and fault control.

The part of plant safety depending on the correct functioning of safety-related components for risk reduction is called functional safety. Components used in such safety-instrumented systems (SIS) must therefore execute their intended function (safety function) with a defined high probability.

The safety requirements for such components are described in the international standard IEC 61508, which sets the measure for unique and comparable judgement of instrument safety and hence contributes to worldwide legal certainty. Depending on the degree of required risk reduction, we distinguish between four safety levels, from SIL1 for low risk to SIL4 for very high risk (SIL = Safety Integrity Level).

6.2 SIL qualification

Additional characteristics and requirements

In the development of instruments used in safety-instrumented systems, avoiding systematic errors as well as determining and correcting random errors is given great importance. The operator also gets information that helps him fulfil the requirements on the functional safety of his system.

Here the most important characteristics and requirements from the perspective of functional safety according to IEC 61508:

- Internal monitoring of safety-relevant circuit parts
- Extended standardization of the software development
- In case of failure, switching of the safety-relevant outputs to a defined safe state
- Determination of the failure probability of the defined safety function
- Reliable parameterization with non-safe user environment
- Recurring function test

The SIL qualification of components is specified in a manual on functional safety (Safety Manual). Here, you can find all safety-relevant characteristics and information the user and the planner need for planning and operating the safety-instrumented system. This document is attached to each instrument with SIL rating and can be also found on our homepage via the device search.

6.3 Application area

The controller is used in combination with a SIL qualified 4 … 20 mA sensor if safety-relevant protective functions are required.

The following inputs/outputs are permitted:

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- 4 … 20 mA sensor input with transmitter power supply
- Relay outputs 3/4
- 4 … 20 mA current output

Note:
The following inputs/outputs are not permitted for safety-relevant applications:

- Digital input 1/2
- Relay output 1/2
- Measured value transmission via the communication interfaces (USB/HART)

6.4 Safety concept of the parameterization

Tool for operation and parameterization

The following tools are permitted for parameterization of the safety function:

- The integrated display and adjustment unit for on-site adjustment
- The DTM suitable for the controller in conjunction with an adjustment software according to the FDT/DTM standard, e. g. PACTware

Note:
For operation of the VEGAMET 391 mit SIL-Qualifikation the DTM Collection 06/2011 or higher is required. The modification of safety-relevant parameters is only possible with active connection to the instrument (online mode).

Safe parameterization

To avoid possible errors during parameterization in a non-safe user environment, a verification procedure is used that makes it possible to detect parameterization errors reliably. For this, safety-relevant parameters must be verified before they are stored in the device. In normal operating condition, the instrument is also locked against parameter changes through unauthorized access. This concept applies to the adjustment on the instrument but also to adjustment with PACTware with DTM.

Safety-relevant parameters

All safety-relevant parameters must be verified after a change and confirmed by a character string comparison. The following parameters of the relays 3/4 are judged as safety-relevant:

- Mode relay output
- Relay switching point Hi
- Relay switching point Lo

The parameter settings of the measurement loop must be documented. For this purpose, the document "*SIL device settings*" is attached to each instrument already listing all safety-relevant parameters in the shipping status as well as containing free space for own notes. This document is also available via the instrument search on our homepage. In addition, a list of the safety-relevant parameters can be stored and printed via PACTware/DTM.

Unlock instrument

For each parameter change, the instrument must be unlocked via a PIN (see chapter "*Setup steps - Unlock adjustment*"). The device status is indicated via the symbol of an unlocked or locked padlock.

Unsafe device status

Warning:
If the instrument is unlocked, the safety function must be classified as unsafe. This applies until the parameterization is terminated correctly. If necessary, other measures must be taken to maintain the safety function.

Change parameters

All parameters changed by the operator are marked automatically so that they can verified in the next step.

Verify parameter/Unlock instrument

For the verification the PIN must be entered first and a comparison of two character strings must be carried out. The user must confirm that both character strings are identical, this is used to check the character representation and the communication channels. The verification texts are provided in German and with all other menu languages in English.

In a second step, all the modified, safety-relevant parameters that are listed must be confirmed. After this process is finished, the adjustment mode will be locked automatically and the safety function is guaranteed again.

Incomplete process

Warning:
If the described process was not carried out completely or correctly (e.g. interruption or voltage loss), the instrument remains in unsafe and unlocked status.

Instrument reset

Warning:
In case of a reset to basic settings, all safety-relevant parameters will also be reset to default. Therefore all safety-relevant parameters must be checked or readjusted.

7 Setup with the integrated display and adjustment unit

7.1 Adjustment system

Function

The integrated display and adjustment unit is used for measured value display, adjustment and diagnosis of VEGAMET 391 mit SIL-Qualifikation. The indication and adjustment are carried out via four keys and a clear, graphic-capable display with background lighting. The adjustment menu with selectable language is clearly structured and enables easy setup.

Certain adjustment options are not available or only partially available with the integrated display and adjustment unit, e.g. the settings for flow measurement. For such applications, the use of PACTware with appropriate DTMs is recommended.

Display and adjustment elements

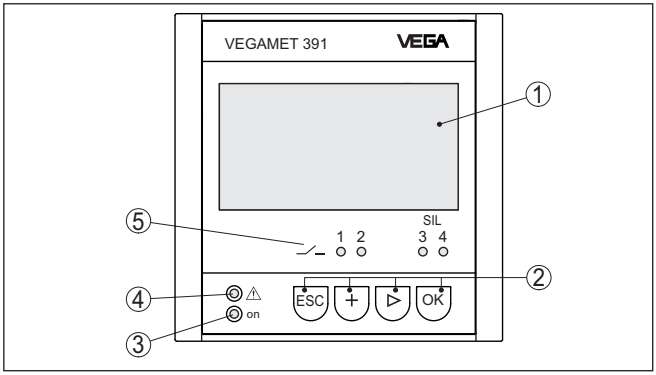


Fig. 6: Display and adjustment elements

1 LC display
2 Adjustment keys
3 Status indication operation
4 Status indication fault signal
5 Status indication operating relay 1 … 4

Key functions

Key	Function
[OK]	Entry to the menu level Jump to selected menu item Edit parameter Save value
[>]	Switching between the individual measured value indications Navigation in the menu items Select editing position
[+]	Change parameter values
[ESC]	Jump to next higher menu Interrupt input

7.2 Setup steps

Parameter adjustment

Through parameter adjustment, the instrument is adapted to the individual application conditions. A measurement loop calibration is the most important step and should always be carried out. A scaling of the measured value to the desired physical variable and unit, possibly including a linearization curve, is often useful. The adaptation of the relay switching points or the setting of a damping to smooth the measured value are further standard adjustment options.

A setup assistant is available for easy, convenient setup. It guides the user through the standard applications and settings step by step.

As a standard feature, the parameterization of the instrument is locked to protect it against unauthorized operation. The instrument is unlocked by entering a PIN.

Information:
When using PACTware and the respective DTM, additional settings can be carried out which are not possible or only partly possible with the integrated display and adjustment unit. Communication is carried out via the integrated USB interface. You find further information in chapter "*Set up with PACTware*".

Switch-on phase

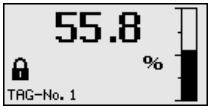
After being switched on, VEGAMET 391 mit SIL-Qualifikation first of all carries out a short self-check. The following steps are carried out:

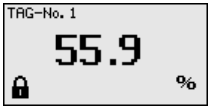
- Internal check of the electronics
- indication of the instrument type, firmware version as well as the instrument TAG (instrument name)
- The output signals jump briefly to the set fault value

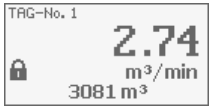
Then the current measured values will be displayed and output.

Measured value indication

The measured value indication shows the digital indication value, the measurement loop name (measurement loop TAG) and the unit. An analogue bargraph can also be displayed. If flow measurement with totalizer is activated, an additional indication window with totalizer becomes available. By pushing the ***[>]*** key you can move between the different indication options.





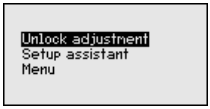


→ By pressing ***[OK]***, you move from measured value indication to the main menu. Here you can choose between the setup assistant for the most important settings and the complete classic menu.

Main menu/Setup assistant/Unlock adjustment

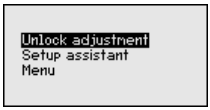
At the beginning of every setup or parameter adjustment, you have the choice of continuing with the setup assistant or the classic menu guidance. We recommend using the setup assistant for the initial setup. If individual settings need to be corrected or added later, the most expedient way to do this is to use the classic menus.

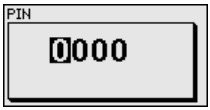
As a standard feature, the parameterization of the instrument is locked to protect it against unauthorized operation. By selecting "Unlock adjustment" and entering a PIN, the instrument is unlocked.



Unlock adjustment SIL

All instrument settings are protected against unauthorized changes. Execution of the safety functions is ensured only in locked mode. Modification is thus only possible after releasing the activated lock and a subsequent verification. The instrument is unlocked by selecting "Release operation" and entering a PIN. PIN "*0000*" is preset but can be modified by the user.



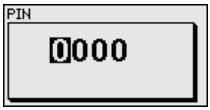


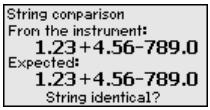
Verify and lock SIL

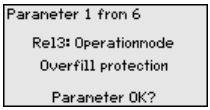
To ensure the execution of the safety functions, the instruments must be locked again after the parameter change. All modified, safety-relevant parameters must be verified and a character string comparison confirmed. Modifications of non safety-relevant parameters are not shown/verified.

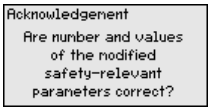
The following parameters of the relays 3 and 4 are classified as safety-relevant: mode, switching point Hi, switching point Lo.

The following example shows the modification of the mode of relay 3.









Setup assistant

The setup assistant leads you step-by-step through the standard settings. The following steps are carried out:

- Device-TAG (individually adjustable instrument name)
- Measurement loop TAG (individually adjustable measurement loop designation)
- Measured variable (for example level or process pressure)
- Min./Max. adjustment
- Activation of the fail safe relay
- Configuration of the relay outputs (e.g. setup of pump control or overfill protection)

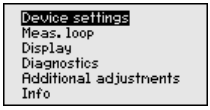
When changing the measurement, the assistant can be called up any time. The subsequent steps can also be reached individually via the traditional menu navigation. A description of the individual menu items

is available in the traditional menus. In chapter "*Application examples*" you will find further information about setup.

Traditional menu navigation/main menu

The main menu is divided into six areas with the following functions:

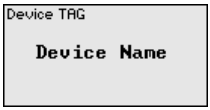
- **Device settings:** Includes the device-TAG
- **Measurement loop:** Includes adjustment, damping, linearization, scaling, outputs, …
- **Display:** Includes settings for the displayed measured value, language and brightness of the background lighting
- **Diagnosis** Includes information on device status, error messages, input current, digital inputs
- **Additional settings:** Contains simulation, reset, PIN, …
- **Info:** Shows serial number, software version, last change, instrument features, …



→ Select the requested menu item via the respective keys and confirm with ***[OK]***.

Device settings - Device-TAG

You can assign an unambiguous name to VEGAMET 391 mit SIL-Qualifikation via the Device-TAG. This function is recommended when several instruments are implemented and a good documentation of larger systems is required.

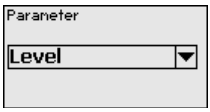


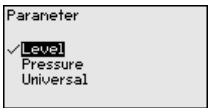
→ Carry out your settings via the appropriate keys and save with ***[OK]***.

Meas. loop - Parameter

The measured variable defines the applicaton of the measurement loop, the following settings are available depending on the connected sensor:

- Level
- Process pressure
- Universal
- Flow (only after activating via PACTware or DTM)



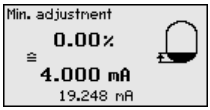


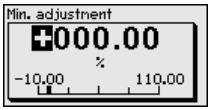
Carry out your settings via the appropriate keys and save with ***[OK]***.

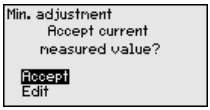
Meas. loop - Adjustment

Through the adjustment, the input value of the connected sensor is converted into a percentage value. This conversion steps allows to image any individual input value range to a relative range (0 % to 100 %). With the adjustment in mA, two sensor current values are

entered which correspond ideally to the levels 0 % and 100 %. As an alternative, sensor current values corresponding to any level in percent can be entered. The greater the difference between these values, the more exact the measurement will be.



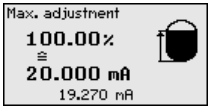


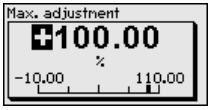


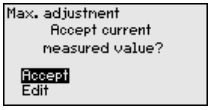
. With ***[OK]*** you prepare the percentage value for editing, with ***[->]*** you place the cursor to the requested position. Set the requested percentage value with ***[+]*** and save with ***[OK]***.

. After entering the percentage value for the min. adjustment, the suitable current value must be entered. If you want to use the currently measured value, select the menu item "*Accept*" (live adjustment or adjustment with medium). If the adjustment should be carried out independently of the measured level, then select the option "*Edit*". Now enter the current value in mA that is suitable for the percentage value (dry adjustment i.e. adjustment without medium).

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







. As described previously, enter now the percentage value for max. adjustment and confirm with ***[OK]***.

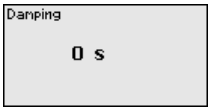
. After entering the percentage value for the max. adjustment, the suitable current value must be entered. If you want to use the currently measured distance value, select the menu item "*Accept*" (live adjustment or adjustment with medium). If the adjustment should be carried out independently of the measured level, then select the option "*Edit*". Now enter the current value in mA that is suitable for the percentage value (dry adjustment i.e. adjustment without medium).

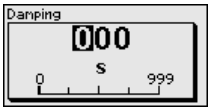
. Finally save your settings with ***[OK]***, the adjustment is finished.

Meas. loop - Damping

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

Note:
The damping does not influence all safety-relevant outputs (relay 3/4, current output).

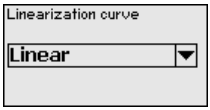


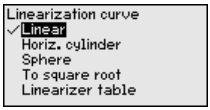


→ Carry out your settings via the appropriate keys and save with ***[OK]***.

Meas. loop - Linearization curve

A linearisation is necessary for all vessels in which the vessel volume does not increase linearly with the level, for example a horizontal cylindrical or spherical tank. Corresponding linearisation curves are preprogrammed for these vessels. They represent the correlation between the level percentage and vessel volume. By activating the appropriate curve, the volume percentage of the vessel is displayed correctly. If the volume should not be displayed in percent but e.g. in l or kg, a scaling can be also set.

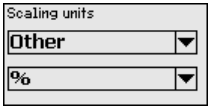


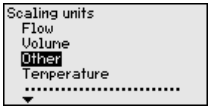


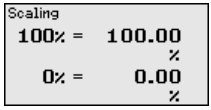
→ Carry out your settings via the appropriate keys and save with ***[OK]***.

Meas. loop - Scaling

Scaling means converting the measured value into a certain parameter and unit. The linearized percentage value is the source signal which is used as basis for the scaling. The indication can then show the volume in litres e.g., instead of the percentage value. Indication values from max. -99999 to +99999 are possible.



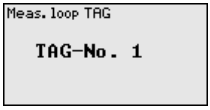




→ Carry out your settings via the appropriate keys and save with ***[OK]***.

Meas. loop - Meas. loop TAG

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



→ Carry out your settings via the appropriate keys and save with ***[OK]***.

Meas. loop - Outputs - Relay 1/2

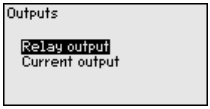
The relay/current outputs are arranged under "*Outputs*". Keep in mind that relays 1/2 are not integrated in the SIL safety concept.

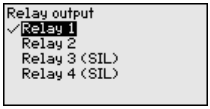
First of all, select the requested mode ("*Overfill protection/Dry run protection*" or "*Pump control*").

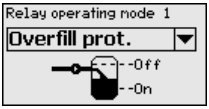
- **Overfill protection**: Relay is switched off when the max. level is exceeded (safe currentless state), relay is switched on again when the level falls below the min. level (switch-on point < switch-off point)
- **Dry run protection**: Relay is switched off when the level falls below the min. level (safe currentless state), relay is switched on again when the max. level is exceeded (switch-on point > switch-off point)
- **Pump control**: With several pumps having the same function, the pumps will be alternately switch on and off according to the adjustable criteria

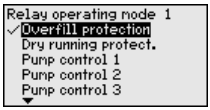
Additional modes such as "*Switching window*", "*Flow*" and "*Tendency*" can be only adjusted via PACTware and DTM.

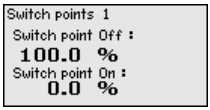
Relay 2 can be alternatively configured as fail safe relay. The following example shows the adjustment of an overfill protection. Further information to pump control are available in chapter "*Application examples*".





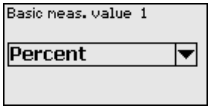


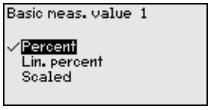




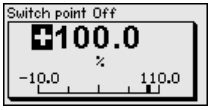
Select the requested mode and save with ***[OK]***. By pushing ***[->]***, you reach the next menu item.

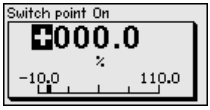
. Now enter the reference value to which the relay switching points relate. By pushing ***[->]***, you reach the next menu item.



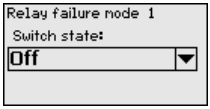


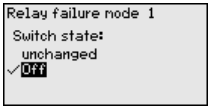
. Now enter the switching points for switching the relay on and off.





In the following window the reaction of the relay in case of failure can be determined. Here you can define whether, in case of failure, the switching condition of the relay remains unchanged or the relay is switched off.





Meas. loop - Outputs - Relay 3/4 SIL

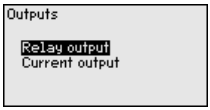
The relay/current outputs are arranged under "*Outputs*". The relays 3/4 are integrated in the SIL safety concept, hence only limited adjustment options are available compared to relays 1/2.

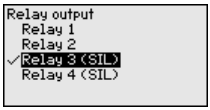
First of all select the requested mode ("*Overfill protection/Dry run protection*").

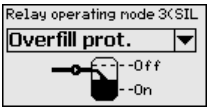
- **Overfill protection**: Relay is switched off when the max. level is exceeded (safe currentless state), relay is switched on again when the level falls below the min. level (switch-on point < switch-off point)
- **Dry run protection**: Relay is switched off when the level falls below the min. level (safe currentless state), relay is switched on again when the max. level is exceeded (switch-on point > switch-off point)

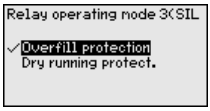
Due to the SIL rating, the behaviour in case of failure is fix set to "*Off*".

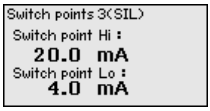
The following example shows the setting of an overfill protection.





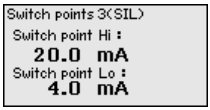


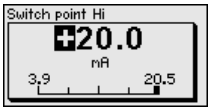


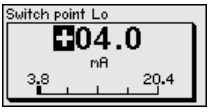


Select the requested mode and save with ***[OK]***. By pushing ***[->]***, you reach the next menu item.

→ Now enter the switching points for switching the relay on and off.



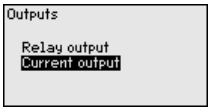


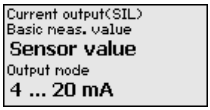


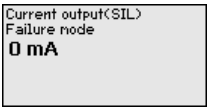
Meas. loop - Outputs - Current output SIL

The current output is used to transfer the measured value to a superordinate system, e.g. a PLC, a process control system or a measured value indication. This is an active output, i.e. the current is provided actively. The processing must hence have a passive current input. The current output must always be connected (see chapter "*Connection steps*")

The characteristics of the current output is set to 4 … 20 mA and cannot be changed due to the SIL rating. The behaviour in case of failure is permanently set to 0 mA.



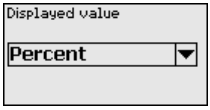


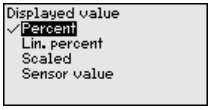


Display - Indicated value

In the menu item "*Display - Indication value*", you can set the requested indication value. The following options are available:

- **Percent:** adjusted measured value without taking a saved linearisation into account
- **Lin. percent:** adjusted measured value taking a saved linearisation into account
- **Scaled:** adjusted measured value taking a saved linearisation into account as well as the values entered under "*Scaling*"
- **Sensor value:** Input value delivered by the sensor.



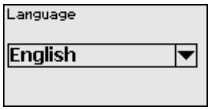


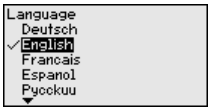
→ Carry out your settings via the appropriate keys and save with ***[OK]***.

Display - Language

In the menu item "*Display - Language*", the requested display language can be adjusted. The following languages are available:

- German
- English
- French
- Spanish
- Russian
- Italian
- Dutch

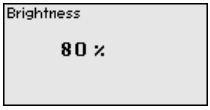


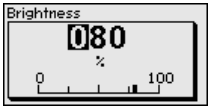


→ Carry out your settings via the appropriate keys and save with ***[OK]***.

Display - Brightness

In the menu item "*Display - Brightness*", the brightness of the background lighting can be continuously adjusted.

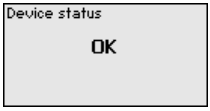


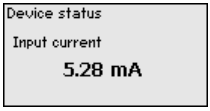


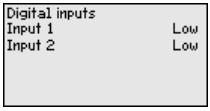
→ Carry out your settings via the appropriate keys and save with ***[OK]***.

Diagnostics

When the instrument displays a fault signal, further information of the failure is available via the menu item "*Diagnosis - Device status*". Furthermore the indication of the input current, the sensor status, the switch on period and the relay status as well as the input status of the digital inputs are possible.



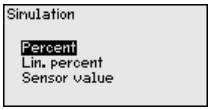


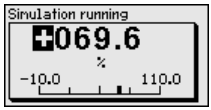


Additional adjustments - Simulation

The simulation of a measured value is used to check the outputs and connected components. The simulation can be applied to the percentage value, the lin. percentage value and the sensor value.

Note:
Please note that connected system components (valves, pumps, motors, control systems) are influenced by the simulation, thus unintentional plant operating conditions can occur. The simulation is terminated automatically after approxminately 10 minutes.

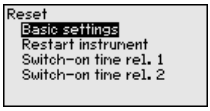




→ Carry out your settings via the appropriate keys and save with *[OK]*.

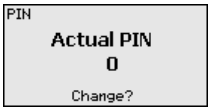
Additional settings - Reset

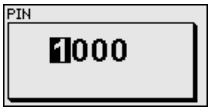
There are several reset options available. With a reset to basic setting, all settings, except the language are reset to default. Other options are reset of the totalizer as well as switched-on period and relay malfunction. In addition, a restart of the instrument can be carried out in this menu.



Additional settings - PIN

As a protection against unauthorized changes of the adjusted parameters, the controller can be locked via a PIN. After activation, it is not possible to carry out a parameterization without entering the previously determined PIN. This locking is valid for the integrated indicating and adjustment unit and for parameterization with PACTware and the respective DTM.

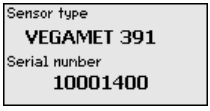


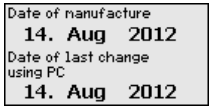


Info

In the menu item "*Info*" the following information is available:

- Sensor type and serial number
- Software and hardware version
- Date of manufacture and date of the last change using PC
- Features of VEGAMET 391 mit SIL-Qualifikation





Optional settings

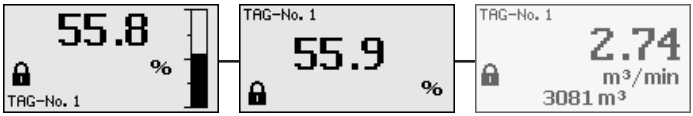
Additional adjustment and diagnostics options are available via the Windows software PACTware and the suitable DTM. Connection is carried out via the USB interface in the instrument. Further information

is available in chapter "*Parameter adjustment with PACTware*" and in the online help of PACTware or the DTMs.

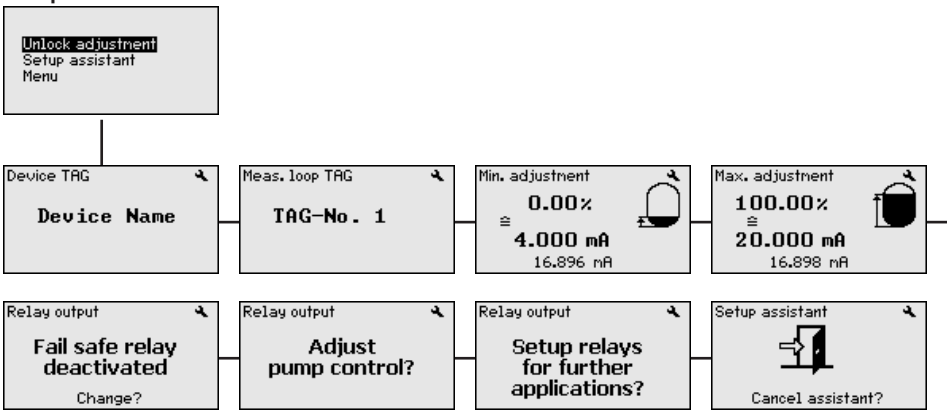
7.3 Menu schematic

Information:
Depending on the instrument version and application, the highlighted menu windows are not always available.

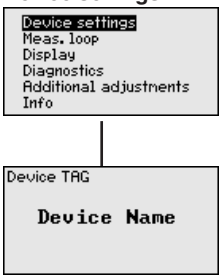
Measured value indication



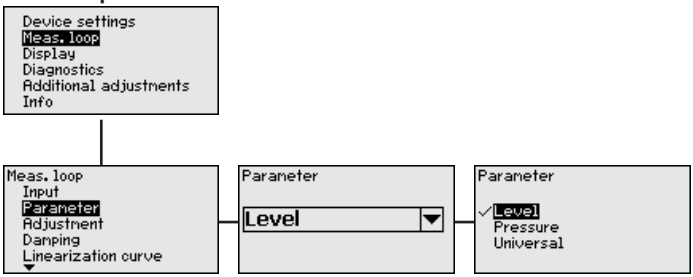
Setup assistant



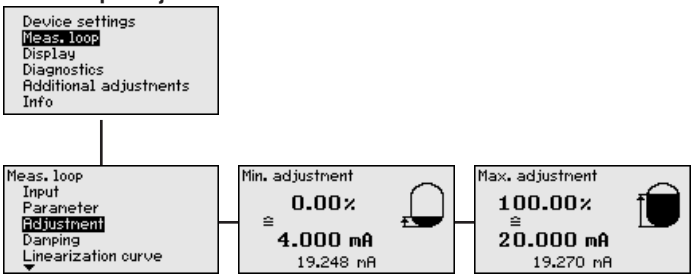
Device settings



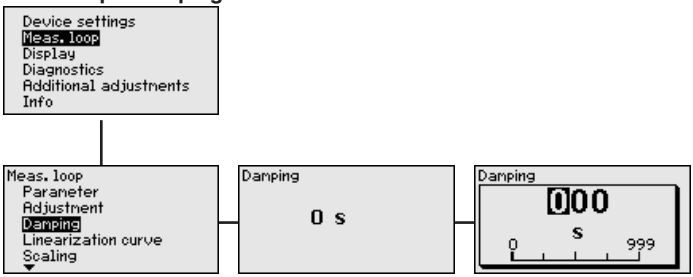
Meas. loop - Parameter



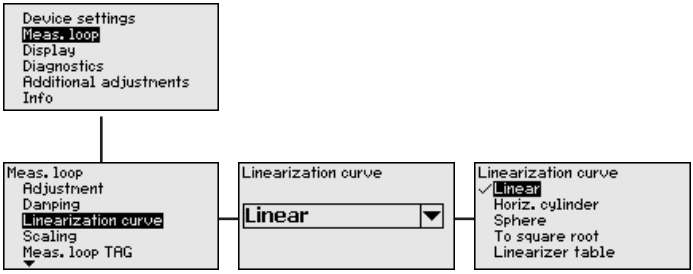
Meas. loop - Adjustment



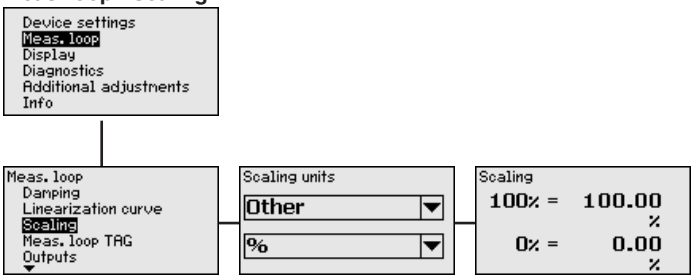
Meas. loop - Damping



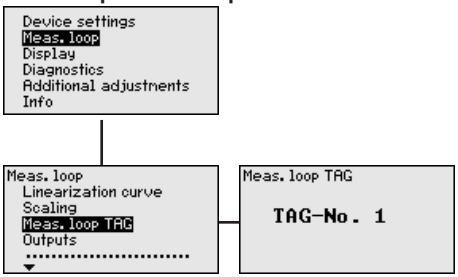
Meas. loop - Linearization curve



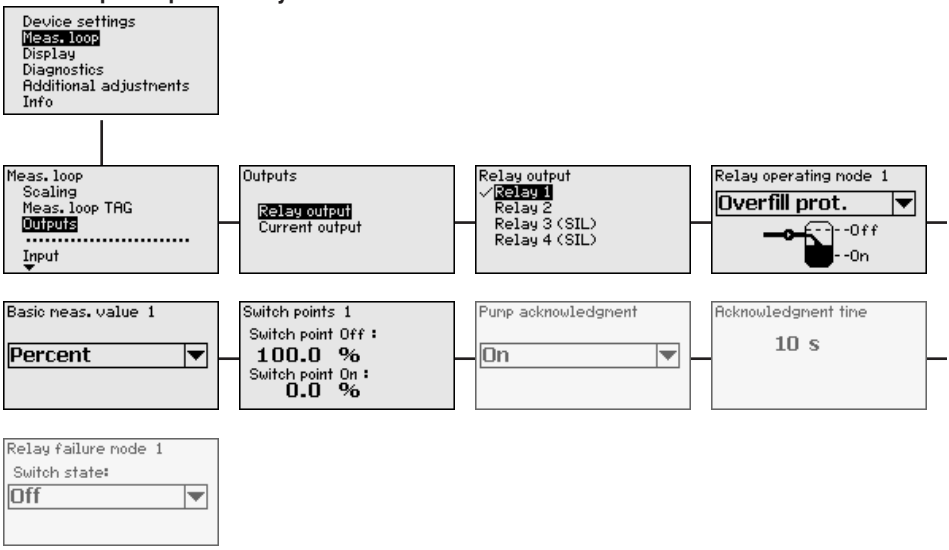
Meas. loop - Scaling



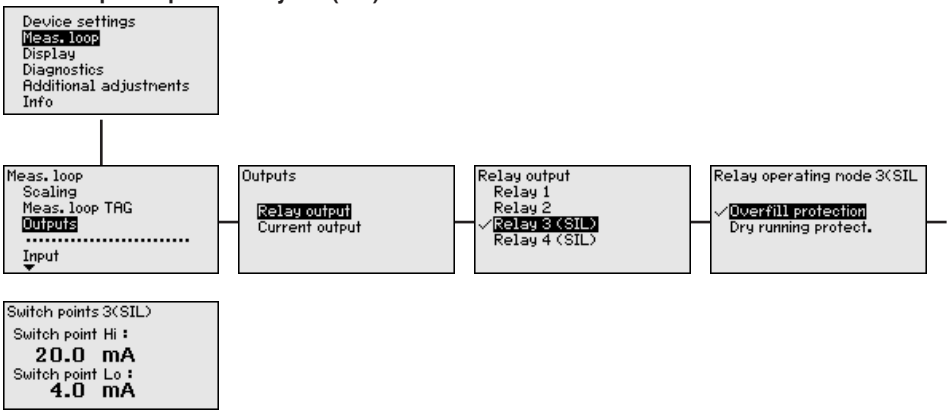
Meas. loop - Meas. loop TAG



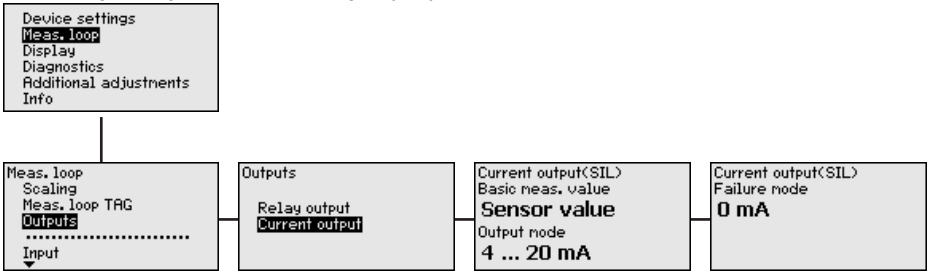
Meas. loop - Outputs - Relay 1/2



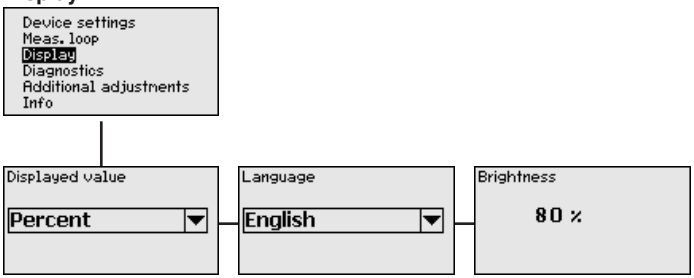
Meas. loop - Outputs - Relay 3/4 (SIL)



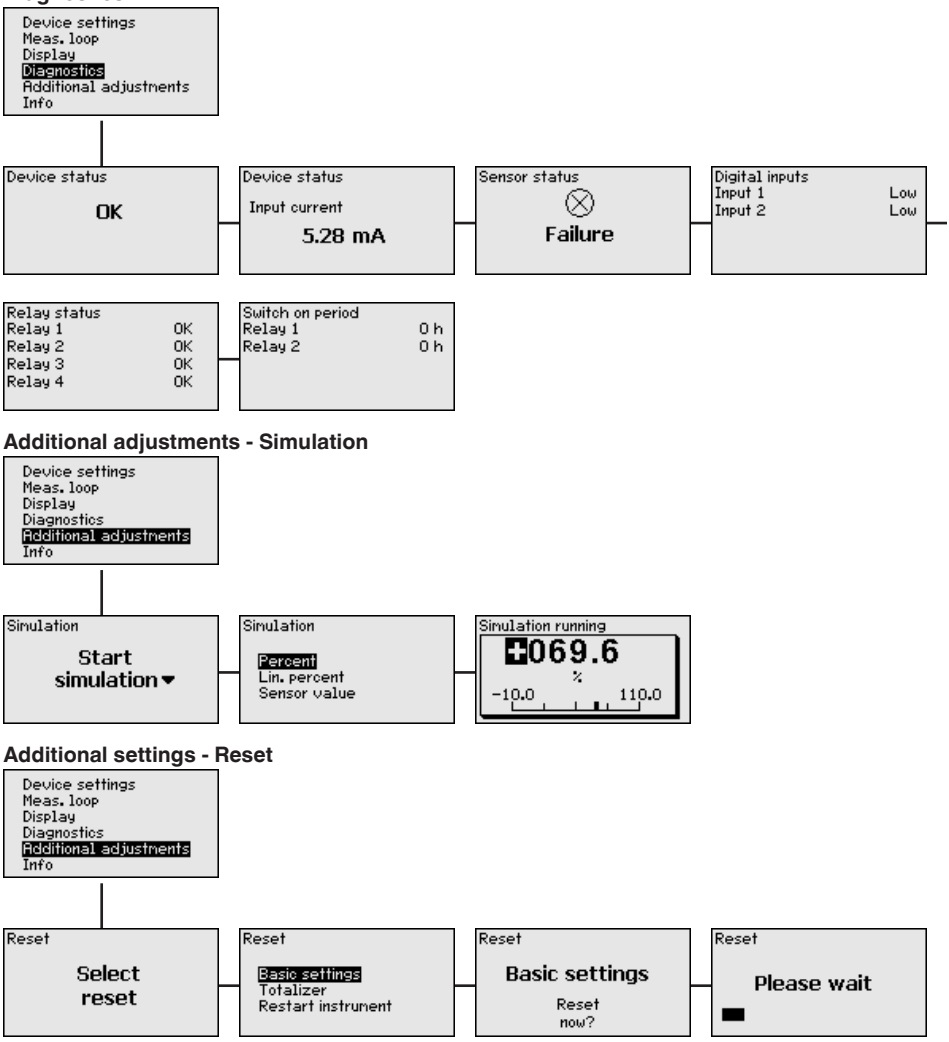
Meas. loop - Outputs - Current output (SIL)



Display



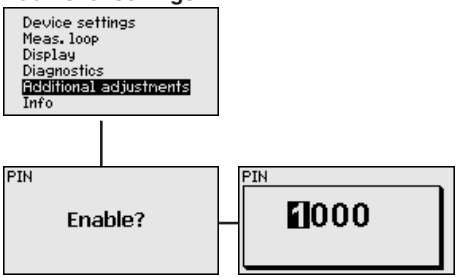
Diagnostics



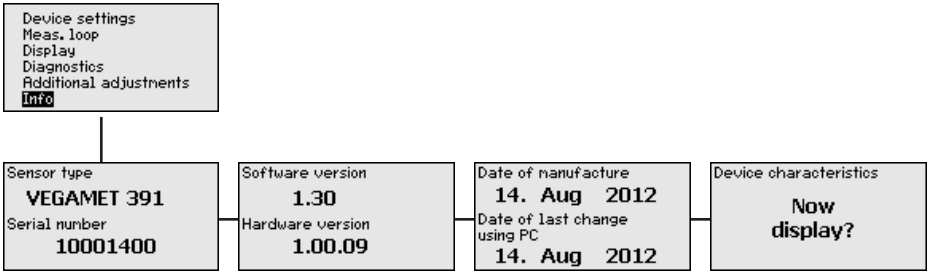
Additional adjustments - Simulation

Additional settings - Reset

Additional settings - PIN



Info



8 Setup with PACTware

8.1 Connect the PC

Connection of the PC via USB

For a brief connection to the PC, for example for parameter adjustment, you should use the USB interface. The required connection socket is on the lower side of all instrument versions. Keep in mind that correct functioning of the USB interface is only guaranteed in the (limited) temperature range of 0 … 60 °C.

Note:
The connection via USB requires a driver. First install the driver before connecting VEGAMET 391 mit SIL-Qualifikation to the PC.

The required USB driver is included on the CD "*DTM Collection*". You should always use the latest version to ensure support of all instrument functions. The system requirements for operation correspond to those of the "*DTM Collection*" or of PACTware.

During installation of the driver package "*DTM for Communication*", the suitable instrument driver is installed automatically. When VEGAMET 391 mit SIL-Qualifikation is connected, the driver installation is completed autonomously and is ready for operation without a restart.

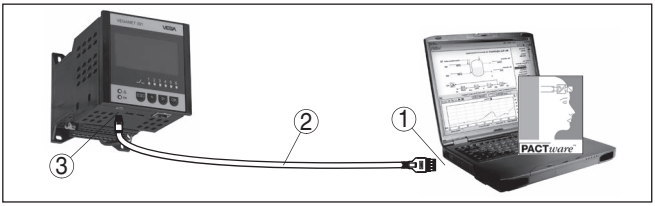


Fig. 7: Connection of the PC via USB

1 USB interface of the PC
2 Mini-USB connection cable (in the scope of delivery)
3 USB interface of VEGAMET 391 mit SIL-Qualifikation

8.2 Parameter adjustment with PACTware

Prerequisites

As an alternative to the integrated display and adjustment unit, the adjustment can be also carried out via a Windows PC. For this, the configuration software PACTware and a suitable instrument driver (DTM) according to the FDT standard are required. The current PACTware version as well as all available DTMs are compiled in a DTM Collection. Furthermore, the DTMs can be integrated into other frame applications compliant with the FDT standard.

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

Further setup steps are described in the operating instructions manual "*DTM Collection/PACTware*" attached to each DTM Collection and which can also be downloaded from the Internet. A detailed description is available in the online help of PACTware and the DTMs as well as in the supplementary instructions manual "*RS232/Ethernet connection*".

All functions for a complete setup are included in the VEGA DTMs. An assistant for easy project setup simplifies the adjustment considerably.

Additionally an extended printing function for complete device documentation as well as a tank calculation program is included. Furthermore, the "*DataViewer*" software is available. This serves for convenient display and analysis of all information saved by the service recording.

The DTM Collection can be downloaded free of charge from our homepage.

The user agreements allow you to copy a VEGA DTM as often as you like and to use it on as many computers as you like. The complete End User License Agreement (EULA) can be found in the appendix of this manual.

9 Application examples

9.1 Overfill protection according to SIL

Functional principle SIL

The described setup of sensor and VEGAMET is specified for overfill protection according to SIL2. Filling and emptying are realized via a separate control (e.g. PLC).

The level is detected via a sensor and transferred by means of the 4 … 20 mA signal to the controller. To prevent an overfilling, the SIL relay integrated in the controller switches off the filling pump when the adjustable switching threshold is exceeded.

Due to the geometrical form of the spherical tank, the vessel volume does not increase linearly with the level. This can be compensated for by selecting the linearization curve integrated in the sensor. It specifies the relationship between percentage level and vessel volume. If the level should be displayed on the sensor in litres, a scaling must also be carried out. For this purpose, the linearized percentage value is converted into a volume, e.g. in the unit "litre." If the controller should also display the level in litres, the scaling must also be carried out in the controller.

Note:
The settings for the indication of the controller (adjustment, linearization and scaling) do not influence the safety function of the SIL relay.

For overfill protection, the relay mode "*Overfill protection*" is set for SIL relay 3. The relay is thus switched off when the max. level is exceeded (switching point High) (safe currentless state), and switched on again when the min. level (switching point Low) is underrun.

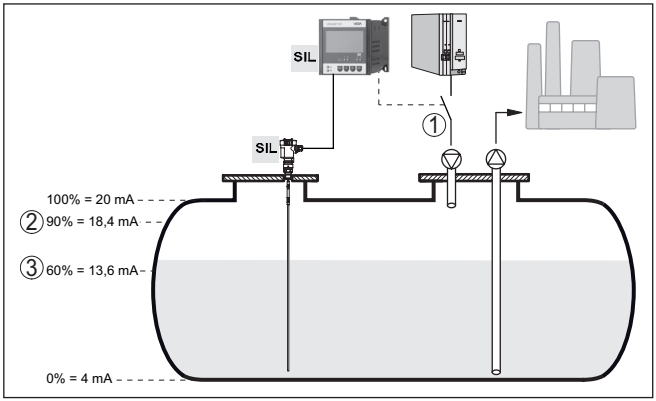


Fig. 8: Overfill protection according to SIL

1 *SIL relay 3*
2 *Upper switching point Hi (OFF) of SIL relay 3*
3 *Lower switching point Lo (ON) of SIL relay 3*

Example

A cylindrical tank has a capacity of 10000 litres. The measurement is carried out with a level sensor operating according to the principle of the guided microwave. Filling is carried out by a pump controlled via

a PLC. Relay 3 of VEGAMET is connected to prevent overfilling. The max. filling should be at 90 % level, which corresponds to 9538 litres in a standard vessel (according to sounding chart). The filling quantity should be displayed in litres.

Adjustment

Carry out the adjustment as described in the respective operating instructions of the sensor. After that, further adjustment must not be carried out on the controller.

Linearisation

To have the percentage volume displayed correctly, a linearization must be carried out. As described in the respective operating instructions of the sensor, select the linearization curve "*Cylindrical tank*". After that, a linearization must not be carried out on the controller.

Scaling

To display the volume in litres, you have to enter in the controller under "*Measurement loop - Scaling*" as unit "*Volume*" in litres. Then the allocation is carried out, in this example 100 % ⍰ 10000 litres and 0 % ⍰ 0 litres.

Relay

The mode of relay 3 must be set to mode "*Overfill protection*". The switching points are set as follows:

- Switch-off point (switching point Hi) 90 % ⍰ 18.4 mA
- Switch-on point (switching point Lo) 60 % ⍰ 13.6 mA

In this example, the vessel can be filled until the relay switches off when 90% are reached and thus the filling pump switches off. If the level falls below 60%, the relay is switched on again and thus enabled for the filling process.

Information:
The switch-on and switch-off points of the relays must not be set to the same switching point because this would cause a continuous switching on and switching off when this threshold is reached. Hence, this setting is not accepted and a corresponding error message is outputted. To avoid this effect also with a fluctuating medium surface, setting a difference (hysteresis) of 5 % between the switching points is a good idea.

9.2 Dry run protection according to SIL2

Functional principle SIL

The described setup of sensor and VEGAMET is specified as dry run protection according to SIL2. Filling and emptying are realized via a separate control (e.g. PLC).

The level is detected via a sensor and transfered by means of the 4 … 20 mA signal to the controller. To prevent dry run, the SIL relay integrated in the controller switches off the emptying pump when the level falls below the adjustable switching threshold.

Due to the geometrical form of the spherical tank, the vessel volume does not increase linearly with the level. This can be compensated for by selecting the linearization curve integrated in the sensor. It specifies the relationship between percentage level and vessel volume. If

the level should be displayed on the sensor in litres, a scaling must also be carried out. For this purpose, the linearized percentage value is converted into a volume, e.g. in the unit "litre." If the controller should also display the level in litres, the scaling must also be carried out in the controller.

Note:
The settings for the indication of the controller (adjustment, linearization and scaling) do not influence the safety function of the SIL relay.

For the application "Dry run protection", the relay mode "*Dry run protection*" is set for SIL relay 3. The relay is thus switched off when the level falls below the min. level (switching point Lo) (safe currentless state), and switched on again when it exceedes the max. level (switching point Hi).

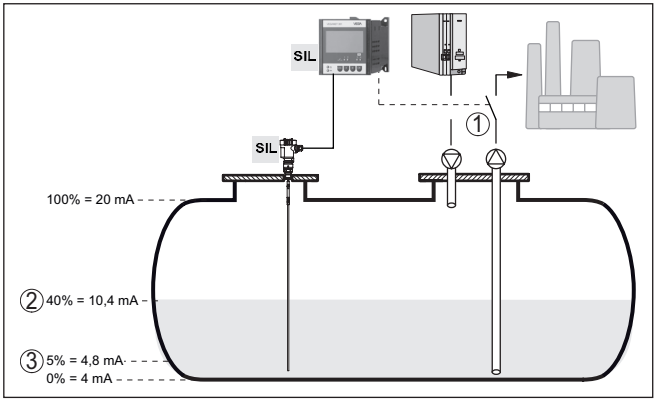


Fig. 9: Dry run protection according to SIL2

1 SIL relay 3 of VEGAMET 391 mit SIL-Qualifikation
2 Upper switching point Hi (ON) of SIL relay 3
3 Lower switching point Lo (OFF) of SIL relay 3

Example

A cylindrical tank has a capacity of 10000 litres. The measurement is carried out with a level sensor operating according to the principle of the guided microwave. Emptying is carried out by a pump controlled via a PLC. Relay 3 of VEGAMET is connected to prevent dry running of the emptying pump. The min. filling level should be set to 5 %, which corresponds to 181 litres in a standard vessel (according to sounding chart). The filling quantity should be displayed in litres.

Adjustment

Carry out the adjustment as described in the respective operating instructions of the sensor. After that, further adjustment must not be carried out on the controller.

Linearisation

To have the percentage volume displayed correctly, a linearization must be carried out. As described in the respective operating instructions of the sensor, select the linearization curve "*Cylindrical tank*". After that, a linearization must not be carried out on the controller.

Scaling

To display the volume in litres, you have to enter in the controller under "*Measurement loop - Scaling*" as unit "*Volume*" in litres. Then the allocation is carried out, in this example 100 % ⍰ 10000 litres and 0 % ⍰ 0 litres.

Relay

The mode of relay 3 must be set to mode "*Dry run protection*". The switching points are set as follows:

- Switch-on point (switching point Hi) 40 % ⍰ 10.4 mA
- Switch-off point (switching point Lo) 5 % ⍰ 4.8 mA

In this example, the vessel can be emptied until the relay switches off when 5 % are reached and the emptying pump thus switches off. If the level rises again to over 40 %, the relay is switched on and emptying begins again.

Information:
The switch-on and switch-off points of the relays must not be set to the same switching point because this would cause a continuous switching on and switching off when this threshold is reached. Hence, this setting is not accepted and a corresponding error message is outputted. To avoid this effect also with a fluctuating medium surface, setting a difference (hysteresis) of 5 % between the switching points is a good idea.

9.3 Pump control 1/2 (run time controlled)

Functional principle

Pump control 1/2 is used to control several pumps with the same function, in dependence on their respective elapsed running times. The pump with the shortest elapsed running time is switched on and the pump with the longest running time switched off. In case of increased pumping requirement, all pumps can also run at the same time, in dependence on the entered switching points. This measure achieves an even utilization of the pumps and increases operational reliability.

All relays with activated pump control are not assigned to a certain switching point but are switched on or off depending on the accumulated operating time. The controller selects the relay with the shortest elapsed operating time when the switch-on point is reached and the relay with the longest elapsed operating time when the switch-off point is reached.

Pump failure signals can also be processed via the digital inputs.

This pump control system offers two different options:

- Pump control 1: The upper switching point determines the switch-off point for the relay, whereas the lower switching point determines the switch-on point
- Pump control 2: The upper switching point determines the switch-on point for the relay, whereas the lower switching point determines the switch-off point

Example

Two pumps should empty the vessel when a certain level is reached. At 80 % filling, the pump with the shortest elapsed running time

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should switch on. If the level nevertheless increases, a second pump should switch on at 90 %. Both pumps should switch off again at 10 % filling.

Setup

Select in the DTM navigation section the menu items "*Meas. loop - Outputs - Relay*".

- Set mode "*Pump control 2*" for relay 1 and 2.
- Enter the switching points for the affected relays as follows:
  - Relay 1 upper switching point = 80.0 %
  - Relay 1 lower switching point = 10.0 %
  - Relay 2 upper switching point = 90.0 %
  - Relay 2 lower switching point = 10.0 %

The function of pump control 2 is shown in detail in the following diagram. The previously described example is used as a basis.

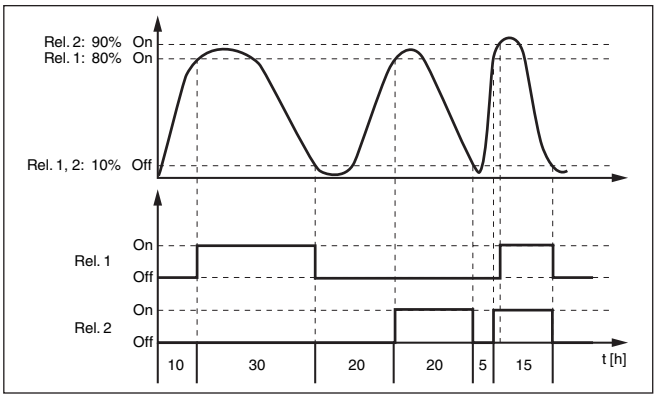

Fig. 10: Example of pump control 2

Pump monitoring

With a pump control, there is also the possibility of switching on pump monitoring. For this purpose, a feedback signal is required on the respective digital input. The digital inputs are assigned 1:1 to the relays. Digital input 1 acts on relay 1, etc.

If the pump monitoring for a relay was switched on, a timer is started when the relay is switched on (time allowance with parameter "*Report time*"). If the checkback signal comes from the pump on the respective digital input within the defined report time, the pump relay remains energized, otherwise the relay is immediately switched off and a failure signal outputted. A failure signal and a switching off of the relay is carried out even if the relay is already switched on and the pump checkback signal changes during the running time of the pump. In addition, a switched-off relay of the pump control is looked for and switched on instead of the faulted relay. A Low signal on the digital input is evaluated as a pump error signal.

The fault signal is cancelled when the signal on the digital input changes to "Good" or when it is reset via the "*OK*" key and selection of the menu item "*Acknowledge failure*". If the fault message is reset via the menu and the pump still signals failure, a fault signal is

triggered after the enquiry period. The enquiry period is started as described above when the relay is switched on.

Switch-on behaviour of pump control 2
When the controller is switched on, the relays are at first in a switched-off status. Depending on the actual input signal and the switched-on period of the individual relays, the following relay switching conditions can occur after the start procedure:

- Input signal is higher than the upper switching point -> Relay with the shortest switched-on period is switched on
- Input signal is between lower and upper switching point -> Relay remains switched off
- Input signal is smaller than the lower switching point -> Relay remains switched off

10 Diagnostics and servicing

10.1 Maintenance

Maintenance

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

Cleaning

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

Take note of the following:

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

10.2 Rectify faults

Reaction when malfunction occurs

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

Causes of malfunction

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

- Measured value from sensor not correct
- Voltage supply
- Interference in the cables

Fault rectification

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

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.

10.3 Diagnosis, fault messages

Fault signal

The controller and the connected sensors are permanently monitored during operation and the values entered during parameter adjustment are checked for plausibility. If irregularities occur or in case of incorrect parameter adjustment, a fault signal is triggered. In case of

an instrument defect or line break/shortcircuit, a fault signal is also triggered.

The fault indication lights up in case of failure and the current output as well as the relays react according to the configured fault mode. If the fail safe relay was configured, it will deenergize. In addition, one of the following error messages is outputted on the display.

Error code	Cause	Rectification
E012	Hardware error, sensor input	Switch the instrument off and on Send instrument for repair
E014	Sensor current > 21 mA or short-circuit	Check sensor, e.g. on fault signal Remove short-circuit
E015	Sensor in boot phase Sensor current < 3.6 mA or line break	Check sensor, e.g. on fault signal Remove line break Check connection of the sensor
E017	Adjustment span too small	Carry out a fresh adjustment and increase the distance between min. and max. adjustment
E021	Scaling span too small	Carry out a fresh scaling, increase the distance between min. and max. scaling.
E034	EEPROM CRC error	Switch the instrument off and on Carry out a reset Send instrument for repair
E035	ROM CRC error	Switch the instrument off and on Carry out a reset Send instrument for repair
E037	RAM error	Switch the instrument off and on Carry out a reset Send instrument for repair
E040	Hardware error	Switch the instrument off and on Carry out a reset Send instrument for repair
E062	Pulse priority too small	Increase under "*Output*" the entry "*Pulse output all*" so that max. one pulse per second is output
E080	Microcontroller error	Switch the instrument off and on Carry out a reset Send instrument for repair
E110	Relay switching points too close together	Increase the difference between the two relay switching points
E111	Relay switching points interchanged	Change relay switching points for "***On/Off***"
E113	Hardware error, current output	Switch the instrument off and on Shortcircuit terminals of the unused current output Send instrument for repair

Error code	Cause	Rectification
E115	Several relays are assignef to the pump control which are not set to the same failure mode	All relays which are assigned to the pump control must be set to the same failure mode
E116	Several relays that are not configured with the same mode are assigned to the pump control	All relays which are assigned to the pump control must be set to the same mode
E117	A monitored pump signals failure	Check the faulty pump. For acknowledgement, carry out the reset "*Failure relay 1 … 4*" or switch the instrument OFF and ON again
E125	Temperature outside the permissible range	Operate instrument at permissible ambient temperature (see technical data)

10.4 How to proceed if a repair is necessary

On our homepage you will find detailed information on how to proceed in the event of a repair.

So that we can carry out the repair quickly and without queries, generate a instrument return form there with the data of your device.

You will need:

- The serial number of the instrument
- A short description of the problem
- Details of the medium

Print the generated instrument return form.

Clean the instrument and pack it damage-proof.

Send the printed instrument return form and possibly a safety data sheet together with the device.

You will find the address for the return on the generated instrument return form.

11 Dismount

11.1 Dismounting steps

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

11.2 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.

12 Certificates and approvals

12.1 Approvals for Ex areas

Approved versions for use in hazardous areas are available or in preparation for the device or the device series.

You can find the relevant documents on our homepage.

12.2 Approvals as overfill protection

Approved versions for use as part of an overfill protection system are available or in preparation for the device or the device series.

The corresponding approvals can be found on our homepage.

12.3 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

The instrument is 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 a class A instrument according to EN 61326-1. If the instrument is used in a different environment, its electromagnetic compatibility with other devices must be ensured by suitable measures.

12.4 Environment management system

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.

Help us to meet these requirements and observe the environmental instructions in the chapters "*Packaging, transport and storage*", "*Disposal*" of this instructions manual.

13 Supplement

13.1 Technical data

Note for approved instruments

The technical data in the respective safety instructions are valid for approved instruments (e.g. with Ex approval). In some cases, these data can differ from the data listed herein.

All approval documents can be downloaded from our homepage.

General data	
Series	Instrument for mounting into front panel, switching cabinet or housing
Weight	620 g (1.367 lbs)
Housing materials	Valox 357 XU
Connection terminals	
– Type of terminal	Pluggable spring-loaded terminal with coding
– Max. wire cross-section	2.5 mm² (AWG 14)

Voltage supply	
Operating voltage	
– Nominal voltage AC	24 … 230 V (-15 %, +10 %) 50/60 Hz
– Nominal voltage DC	24 … 65 V (-15 %, +10 %)
Max. power consumption	7 VA; 3 W

Sensor input	
Number of sensors	1 x 4 … 20 mA
Input type	
– Active input	Sensor supply through VEGAMET 391 mit SIL-Qualifikation
Measured value transmission	
– 4 … 20 mA	analogue for 4 … 20 mA sensors
Deviation	
– Accuracy	±20 µA (0.1 % of 20 mA)
Terminal voltage	19 … 14.5 V at 4 … 20 mA
Current limitation	approx. 26 mA
Detection line break	≤ 3.6 mA
Detection shortcircuit	≥ 21 mA
Adjustment range 4 … 20 mA sensor	
– Empty adjustment	2.4 … 21.6 mA
– Full adjustment	2.4 … 21.6 mA
– min. adjustment delta	16 µA
Connection cable to the sensor	two-wire shielded standard cable

Digital input	
Quantity	2 x digital input
Input type	Passive
Switching threshold	
– Low	-3 …5 V DC
– High	11 …30 V DC
Max. input voltage	30 V DC
Max. input current	4 mA
Max. sampling rate	10 Hz

Relay outputs	
Quantity	4 x operating relay
Function	Switching relay for level (relay 1 … 4)
	Fault signal or pulse relay for flow/sampling pulse (relay 1/2)
Contact	Floating change-over contact (SPDT)
Contact material	AgSnO2, hard gold-plated
Switching voltage	min. 10 mV DC, max. 250 V AC/60 V DC
Switching current	min. 10 µA DC, max. 3 A AC, 1 A DC
Breaking capacity[1)]	min. 50 mW, max. 500 VA, max. 54 W DC
Min. programmable switching hysteresis	0.1 %
Mode pulse output (relay 1/2)	
– Pulse length	350 ms

Current output	
Quantity	1 x output
Function	Current output for level
Range	4 … 20 mA
Resolution	1 µA
Max. load	500 Ω
Fault signal	0 mA
Accuracy	
– Standard	±20 µA (0.1 % of 20 mA)
– with EMC interferences	±200 µA (1 % of 20 mA)
Temperature error relating to 20 mA	0.005 %/K

[1)] 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.

USB interface[2)]	
Quantity	1 x
Plug connection	Mini-B (4-pole)
USB specification	2.0 (Fullspeed)
Max. cable length	5 m (196 in)

Indicators	
Measured value indication	
– graphic-capable LC display (65 x 32 mm), lighted	digital and quasianalogue indication
– Max. indicating range	-99999 … 99999
LED displays	
– Status, operating voltage	1 x LED green
– Status fault signal	1 x LED red
– Status operating relay 1 … 4	4 x LED yellow

Adjustment	
Adjustment elements	4 x keys for menu adjustment
PC adjustment	PACTware with respective DTM

Ambient conditions	
Ambient temperature	
– Instrument in general	-20 … +60 °C (-4 … +140 °F)
– USB interface	0 … +60 °C (32 … +140 °F)
Storage and transport temperature	-40 … +80 °C (-40 … +176 °F)
Relative humidity	< 96 %

Electrical protective measures	
Protection rating	
– Front	IP65
– Instrument	IP20
Overvoltage category (IEC 61010-1)	
– up to 2000 m (6562 ft) above sea level	II
– up to 5000 m (16404 ft) above sea level	II - Only with connected overvoltage protection
– up to 5000 m (16404 ft) above sea level	I
Protection class	II
Pollution degree	2

[2)] Limited temperature range, see ambient conditions

Measures for electrical separation

Reliable separation according to VDE 0106 (part 1) between voltage supply, input and digital component

- Reference voltage 250 V
- Voltage resistance of the insulation 3.75 kV

Galvanic separation between relay output and digital part

- Reference voltage 250 V
- Voltage resistance of the insulation 4 kV

Approvals

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

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

13.2 Dimensions

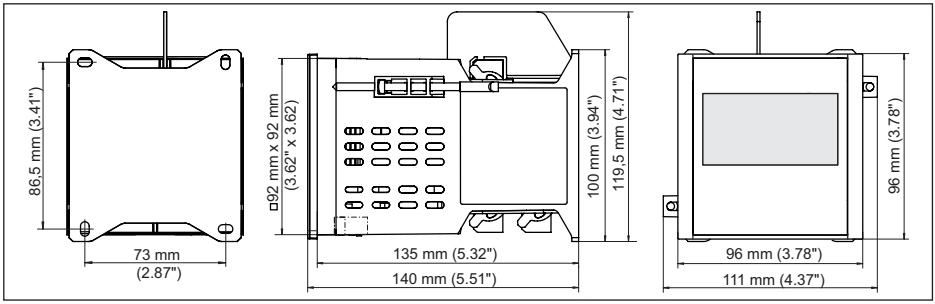

Fig. 11: Dimensions VEGAMET 391 mit SIL-Qualifikation

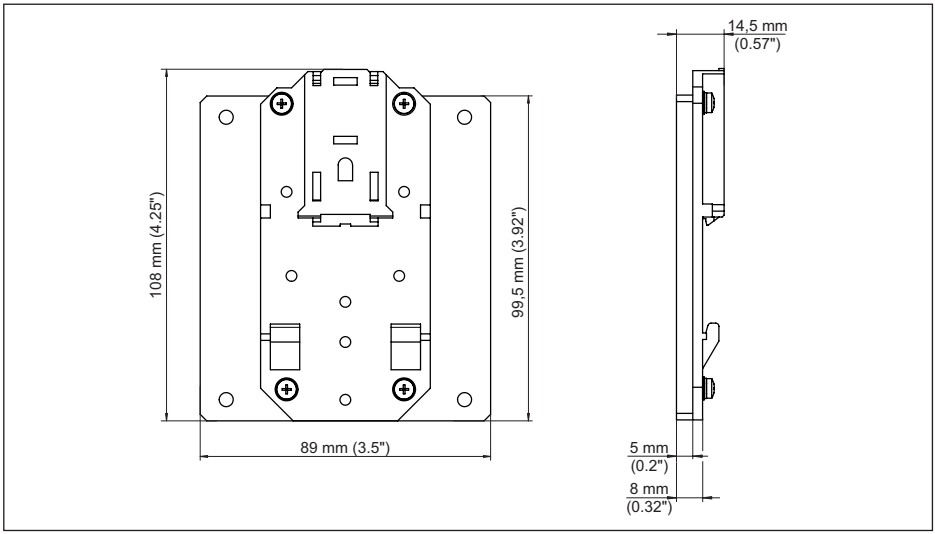

Fig. 12: Dimensions of optional carrier rail adapter

13.3 Industrial property rights

VEGA product lines are global protected by industrial property rights. Further information see www.vega.com.

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13.4 Trademark

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

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All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the information available at the time of printing.
Subject to change without prior notice

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