

Operating Instructions

OPTISWITCH 5100 C, 5150 C

with two-wire output



Variable area flowmeters

Vortex flowmeters

Flow controllers

Electromagnetic flowmeters

Ultrasonic flowmeters

Mass flowmeters

Level measuring instruments

Communications engineering

Engineering systems & solutions

Switches, counters, displays and recorders

Heat metering

Pressure and temperature

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1 About this document

1.1 Function

This operating instructions manual has all the information you need for quick setup and safe operation. Please read this manual before you start setup.

1.2 Target group

This operating instructions manual is directed to trained, qualified personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3 Symbolism used



Information, tip, note

This symbol indicates helpful additional information.



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

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

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



Ex applications

This symbol indicates special instructions for Ex applications.



List

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



Action

This arrow indicates a single action.



Sequence

Numbers set in front indicate successive steps in a procedure.

2 For your safety

2.1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained specialist personnel authorised by the operator. For safety and warranty reasons, any internal work on the instruments must be carried out only by personnel authorised by the manufacturer.

2.2 Appropriate use

OPTISWITCH 5100 C, 5150 C is a sensor for level detection.

Detailed information on the application range of OPTISWITCH 5100 C, 5150 C is available in chapter "*Product description*".

2.3 Warning about misuse

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, e.g. vessel overfill or damage to system components through incorrect mounting or adjustment.

2.4 General safety instructions

OPTISWITCH 5100 C, 5150 C is a high-tech instrument requiring the strict observance of standard regulations and guidelines. The user must take note of the safety instructions in this operating instructions manual, the country-specific installation standards (e.g. the VDE regulations in Germany) as well as all prevailing safety regulations and accident prevention rules.

2.5 CE conformity

OPTISWITCH 5100 C, 5150 C is in CE conformity with EMC (89/336/EWG), fulfils NAMUR recommendation NE 21 and is in CE conformity with LVD (73/23/EWG).

Conformity has been judged according to the following standards:

- EMC:
 - Emission EN 61326/A1: 1998 (class B)
 - Susceptibility EN 61326: 1997/A1:1998
- LVD: EN 61010-1: 1993

2.6 SIL conformity

OPTISWITCH 5100 C, 5150 C fulfills the requirements of functional safety according to IEC 61508/IEC 61511. You can find further information in the supplementary instructions manual "*Safety Manual - Functional safety (SIL) OPTISWITCH 5XXX*".

2.7 Safety instructions for Ex areas

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

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- OPTISWITCH 5100 C, 5150 C level sensor
- Documentation
 - this operating instructions manual
 - Ex specific safety instructions (with Ex versions), if necessary further certificates

Components

OPTISWITCH 5100 C, 5150 C consists of the following components:

- Housing cover
- Housing with electronics
- process fitting with tuning fork

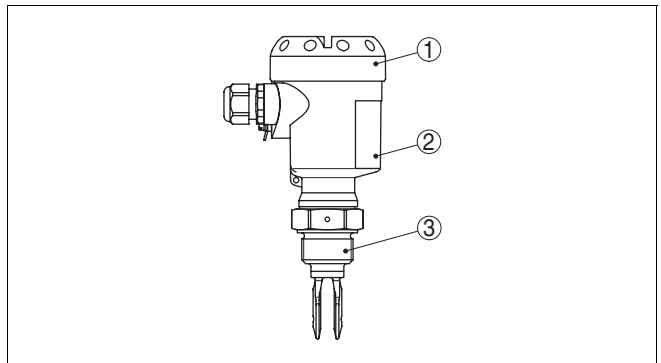


Fig. 1: OPTISWITCH 5100 C, 5150 C with plastic housing

- 1 Housing cover
- 2 Housing with electronics
- 3 Process fitting

3.2 Principle of operation

Area of application

OPTISWITCH 5100 C, 5150 C is a level sensor with tuning fork for level detection.

It is designed for industrial use in all areas of process technology and can be used in liquids.

Typical applications are overflow and dry run protection. With a tuning fork of only 40 mm length, OPTISWITCH 5100 C, 5150 C can be also mounted, e.g. in pipelines from DN 25. The small tuning fork allows use in vessels, tanks and pipes.

Thanks to its simple and robust measuring system, OPTISWITCH 5100 C, 5150 C is virtually unaffected by the chemical and physical properties of the liquid.

It functions even under difficult conditions such as turbulence, air bubbles, foam generation, buildup, strong external vibration or changing products.

Fault monitoring

The electronics module of OPTISWITCH 5100 C, 5150 C continuously monitors via frequency evaluation the following criteria:

- Strong corrosion or damage on the tuning fork
- loss of vibration
- Line break to the piezo drive

If one of these faults is detected, the electronics signals it via a defined current to the signal conditioning instrument. The connection cable to the sensor is also monitored on line break and short-circuit.

Physical principle

The tuning fork is piezoelectrically energised and vibrates at its mechanical resonance frequency of approx. 1200 Hz. The piezos are fastened mechanically and are hence not subject to temperature shock limitations. When the tuning fork is submerged in the product, the frequency changes. This change is detected by the integrated oscillator, transferred to the signal conditioning instrument as current value and converted into a switching command.

Power supply

Depending on your requirements, OPTISWITCH 5100 C, 5150 C with two-wire electronics can be connected to different signal conditioning instruments. Compatible signal conditioning instruments are listed under "*Technical data*".

The exact range of the power supply is stated in the "*Technical data*" in the "*Supplement*".

3.3 Operation

The switching condition of OPTISWITCH 5100 C, 5150 C with plastic housing can be checked when the housing is closed (signal lamp). With the basic setting, products with a density $>0.7 \text{ g/cm}^3$ ($>0.025 \text{ lbs/in}^3$) can be detected. The instrument can be adapted if products with lower density should be measured.

On the electronics module you will find the following indicating and adjustment elements:

- signal lamp for indication of the switching condition (green/red)
- DIL switch for adaptation to the product density

3.4 Storage and transport

Packaging

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test according to DIN 55439.

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. In addition, the sensor is provided with a protective cover of ABS. For special versions PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Storage and transport temperature

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

4 Mounting

4.1 General instructions

Switching point

In general, OPTISWITCH 5100 C, 5150 C can be mounted in any position. The instrument must be mounted in such a way that the tuning fork is at the height of the requested switching point.

The tuning fork has lateral markings (notches), marking the switching point with vertical mounting. The switching point refers to water with the basic setting of the sensitivity switch $\geq 0.7 \text{ g/cm}^3$ ($\geq 0.025 \text{ lbs/in}^3$). When mounting OPTISWITCH 5100 C, 5150 C, make sure that this marking is at the height of the requested switching point. Keep in mind that the switching point of the instrument is shifted if the medium has a density other than water - water = 1 g/cm^3 ($= 0.036 \text{ lbs/in}^3$). For products $< 0.7 \text{ g/cm}^3$ ($< 0.025 \text{ lbs/in}^3$) and $> 0.5 \text{ g/cm}^3$ ($> 0.018 \text{ lbs/in}^3$) the density switch must be set to $\geq 0.5 \text{ g/cm}^3$.

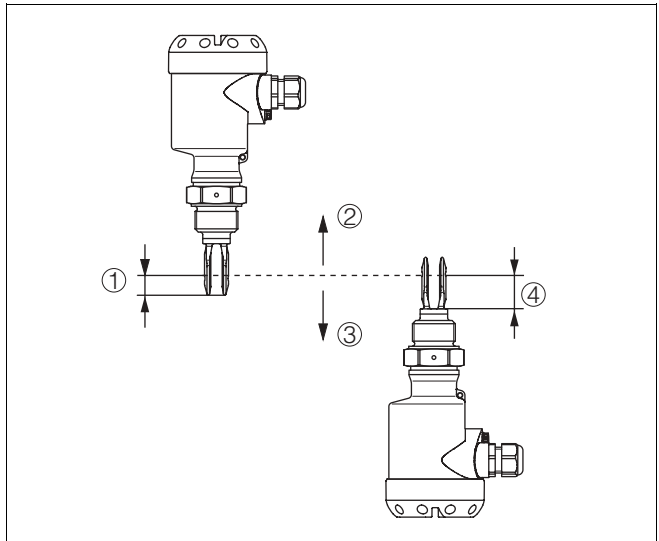


Fig. 2: Vertical mounting

- 1 Switching point approx. 13 mm (approx. 0.51 in)
- 2 Switching point with lower density
- 3 Switching point with higher density
- 4 Switching point approx. 27 mm (approx. 1.06 in)

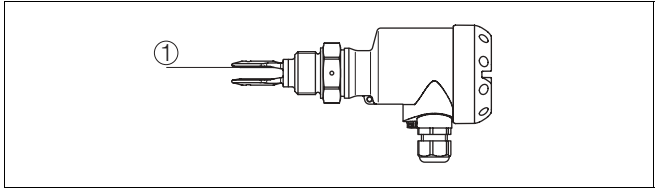


Fig. 3: Horizontal mounting
1 Switching point

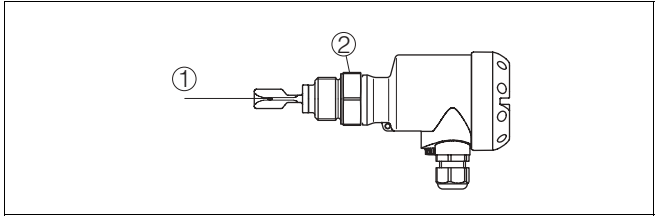


Fig. 4: Horizontal mounting (recommended installation location - particularly for adhesive products)
1 Switching point
2 Marking with screwed version on top - with flange versions directed to the flange holes

With flange versions, the fork is directed to the flange holes in the following way.

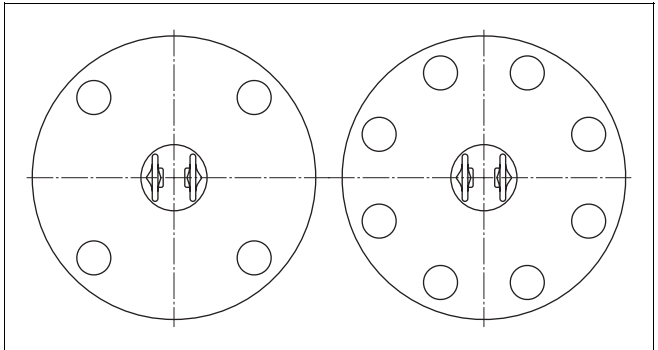


Fig. 5: Fork position with flange versions

Moisture

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

You can give your OPTISWITCH 5100 C, 5150 C additional protection against moisture penetration by leading the connection cable downward in front of the cable entry. Rain and

condensation water can thus drain off. This applies mainly to mounting outdoors, in areas where moisture is expected (e.g. by cleaning processes) or on cooled or heated vessels.

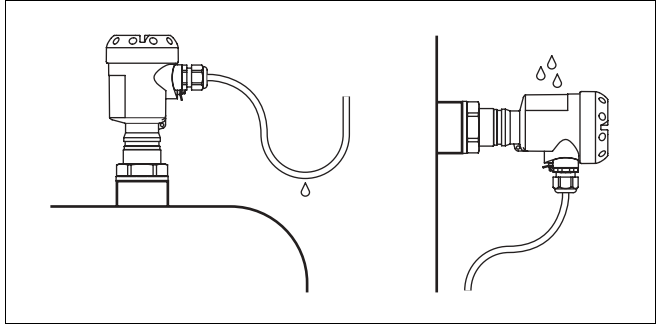


Fig. 6: Measures against moisture penetration

Transport

Do not hold OPTISWITCH 5100 C, 5150 C on the tuning fork. Particularly with flange or tube versions, the tuning fork can be damaged by the instrument weight. Transport coated instruments very carefully and avoid touching the tuning fork.

Remove the protective cover just before mounting.

Pressure/Vacuum

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

The max. permissible pressure is stated in the "Technical data" in the "Supplement" or on the type label of the sensor.

Handling

The vibrating level switch is a measuring instrument and must be treated accordingly. Bending the vibrating element will destroy the instrument.



Warning:

The housing must not be used to screw in the instrument! Applying tightening force on the housing can damage its internal mechanical parts.

To screw in, use the hexagon above the thread.

4.2 Mounting instructions

Welded socket

OPTISWITCH 5100 C, 5150 C has a defined thread starting point. This means that every OPTISWITCH 5100 C, 5150 C is in the same fork position after being screwed in. Remove therefore the supplied seal from the thread of OPTISWITCH 5100 C, 5150 C. This seal is not required when using a welded socket with O-ring in front.

Keep in mind that this welded socket is not suitable for coated instrument versions.

Screw OPTISWITCH 5100 C, 5150 C completely into the welded socket. The later position can be determined already before welding. Mark the appropriate position of the welded socket. Before welding, unscrew OPTISWITCH 5100 C, 5150 C and remove the rubber ring from the welded socket. The welded socket has a marking (notch). Weld the socket with the notch facing upward, or in case of pipelines, aligned with the direction of flow.

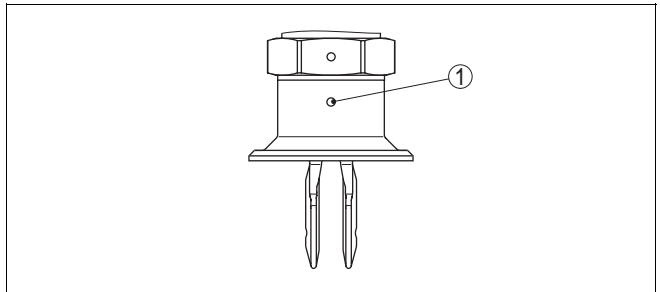


Fig. 7: Marking on the welded socket
1 Marking

Adhesive products

In case of horizontal mounting in adhesive and viscous products, the surfaces of the tuning fork should be vertical in order to reduce buildup on the tuning fork. On the screwed version you will find a marking on the hexagon. With this, you can check the position of the tuning fork when screwing it in. When the hexagon touches the seal, the thread can still be turned by approx. half a turn. This is sufficient to reach the recommended installation position.

With flange versions, the fork is directed to the flange holes.

When used in adhesive and viscous products, the tuning fork should protrude into the vessel to avoid buildup. For that reason, sockets for flanges and mounting bosses should be avoided when mounting horizontally.

Inflowing medium

If OPTISWITCH 5100 C, 5150 C is mounted in the filling stream, unwanted switching signals may be generated. Mount OPTISWITCH 5100 C, 5150 C at a location in the vessel where no disturbing influence from e.g. filling openings, agitators etc. can occur.

Flows

To minimise flow resistance caused by the tuning fork, OPTISWITCH 5100 C, 5150 C should be mounted in such a way that the surfaces of the blades are parallel to the product movement.

Enamel coating

Instruments with enamel coating should be treated very carefully and shocks should be avoided. Unpack OPTISWITCH 5100 C, 5150 C directly before installation. Insert OPTISWITCH 5100 C, 5150 C carefully into the vessel opening and avoid touching any sharp vessel parts.

5 Connecting to voltage supply

5.1 Preparing the connection

Note safety instructions

Generally not the following safety instructions:

- Connect only in the complete absence of line voltage

Take note of safety instructions for Ex applications



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

Select power supply

Connect the power supply according to the following diagrams. Take note of the general installation regulations. As a rule, connect OPTISWITCH 5100 C, 5150 C to vessel ground (PA), or in case of plastic vessels, to the next ground potential. On the side of the instrument housing there is a ground terminal between the cable entries. This connection serves to drain off electrostatic charges. In Ex applications, the installation regulations for hazardous areas must be given priority.

The data for power supply are stated in the "Technical data" in the "Supplement".

Selecting the connection cable

OPTISWITCH 5100 C, 5150 C is connected with standard cable with round cross-section. An outer cable diameter of 5 ... 9 mm (0.2 ... 0.35 in) ensures the seal effect of the cable entry.

If cable with a different diameter or wire cross section is used, exchange the seal or use an appropriate cable connection.



In hazardous areas, only use approved cable connections for OPTISWITCH 5100 C, 5150 C.

Select connection cable for Ex applications



Take note of the corresponding installation regulations for Ex applications.

5.2 Connection steps



With Ex instruments, the housing cover may only be opened if there is no explosive atmosphere present.

Proceed as follows:

- 1 Unscrew the housing cover
- 2 Loosen compression nut of the cable entry

- 3 Remove approx. 10 cm (4 in) of the cable mantle, strip approx. 1 cm (0.4 in) insulation from the ends of the individual wires
 - 4 Insert the cable into the sensor through the cable entry
 - 5 Open the terminals with a screwdriver
 - 6 Insert the wire ends into the open terminals according to the wiring plan
 - 7 Tighten the terminals with a screwdriver
 - 8 Check the hold of the wires in the terminals by lightly pulling on them
 - 9 Tighten the compression nut of the cable entry, the seal ring must completely encircle the cable
 - 10 Screw the housing cover back on
- The electrical connection is hence finished.

5.3 Wiring plan, single chamber housing



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

Housing overview

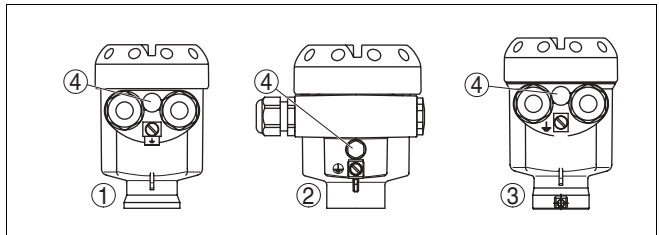


Fig. 8: Material versions, single chamber housing

- 1 Plastic (not with EEx d)
- 2 Aluminium
- 3 Stainless steel (not with EEx d)
- 4 Filter element for pressure compensation (not with EEx d)

Electronics and connection compartment

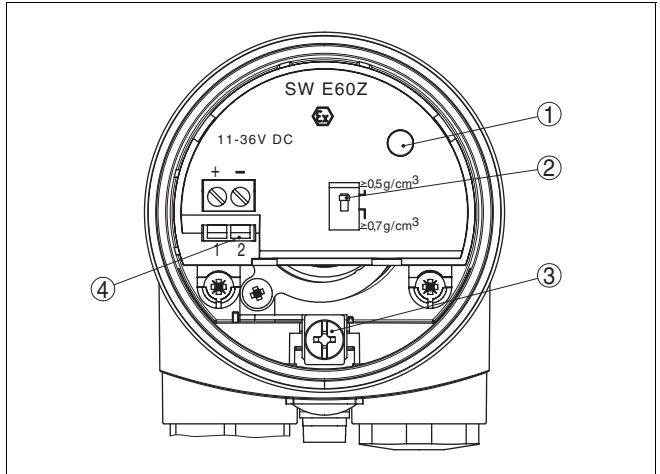


Fig. 9: Electronics and connection compartment, single chamber housing

- 1 Control lamp
- 2 DIL switch for sensitivity adjustment
- 3 Ground terminal
- 4 Screwed terminals

Wiring plan

We recommend connecting OPTISWITCH 5100 C, 5150 C in such a way that the switching circuit is open when there is a level signal, line break or failure (safe condition).

For connection to a signal conditioning instrument dto. Ex, WHG. The sensor is powered by the connected signal conditioning instrument. Further information is available in the Technical data in the Supplement, Ex-technical data are available in the supplied safety information manual.

The wiring example is applicable for all suitable signal conditioning instruments.

The control lamp on OPTISWITCH 5100 C, 5150 C lights in general

- red - with covered tuning fork
- green - with uncovered tuning fork

Take note of the operating instructions manual of the signal conditioning instrument. Suitable signal conditioning instruments are listed in the Technical data.

If OPTISWITCH 5100 C, 5150 C is used in Ex areas as part of an overfill protection system acc. to WHG, take note for the regulations in the safety instructions and conformity certifi-

cares. If OPTISWITCH with oscillator SW E60Z EX, SW E60Z EX E1 should be operated directly on the analogue input of a PLC, a suitable safety barrier should be connected.

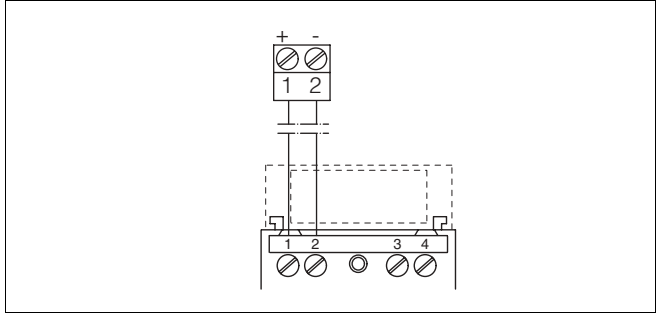


Fig. 10: Wiring plan, single chamber housing

6 Set up

6.1 General

The numbers in brackets refer to the following illustrations.

Function/Configuration

The switching status of the electronics can be checked when the cover of the plastic housing is closed (signal lamp). In the basic setting, products with density $> 0.7 \text{ g/cm}^3$ (0.025 lbs/in^3) can be detected. For products with lower density, the switch must be set to $> 0.5 \text{ g/cm}^3$ (0.018 lbs/in^3).

On the electronics module you will find the following indicating and adjustment elements:

- Signal lamp (1)
- DIL switch for sensitivity adjustment (2)

Mode switch (A/B)

On the signal conditioning instrument via the signal conditioning instrument (only permissible in mode A when used acc. to WHG).

The switching condition can be changed with the A/B switch. You can set the required mode acc. to the "Function chart" (A - max. detection or overflow protection, B - min. detection or dry run protection). The integration time can also be modified on the signal conditioning instrument.



Note:

For test purposes, immerse the tuning fork of OPTISWITCH 5100 C, 5150 C always in liquids. Do not test the function of OPTISWITCH 5100 C, 5150 C with the hand. This can damage the sensor.

6.2 Adjustment elements

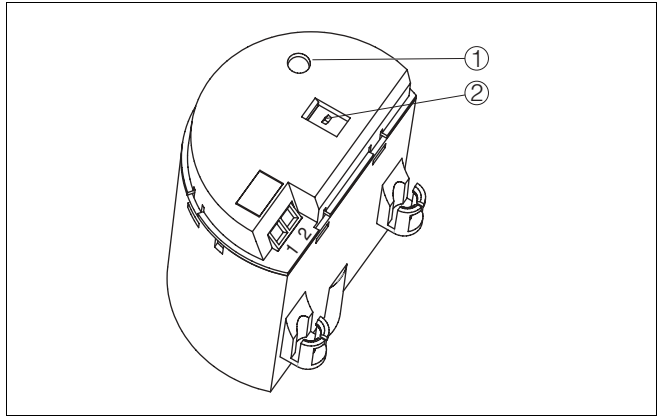


Fig. 11: Oscillator SW E60Z - two-wire output

- 1 Signal lamp (LED)
2 DIL switch for sensitivity adjustment

Signal lamp (1)

Control lamp (LED) for indication of the switching condition















- green = tuning fork uncovered
- red = tuning fork covered
- off = failure

Sensitivity adjustment (2)

With this DIL switch (2) you can set the switching point to liquids having a density between 0.5 and 0.7 g/cm^3 (0.018 and 0.025 lbs/in^3). With the basic setting, liquids with a density of $>0.7 \text{ g/cm}^3$ ($>0.025 \text{ lbs/in}^3$) can be detected. In liquids with lower density, you must set the switch to $>0.5 \text{ g/cm}^3$ ($>0.018 \text{ lbs/in}^3$). The specifications for the position of the switching point relate to water - density value 1.0 g/cm^3 (0.036 lbs/in^3). In products with a different density, the switching point will shift in the direction of the housing or tuning fork end depending on the density and type of installation.

6.3 Function chart

The following chart provides an overview of the switching conditions depending on the adjusted mode and level.

Mode on the signal conditioning instrument	Level	Signal current - Sensor	Analogue input control ¹⁾	Signal lamp - sensor	Signal lamp - signal conditioning instrument
Mode A Overfill protection		approx. 8 mA	>3.6 mA <11 mA	 Green	
Mode A Overfill protection		approx. 16 mA	>13 mA <21 mA	 red	
Mode B Dry run protection		approx. 16 mA	>13 mA <21 mA	 red	
Mode B Dry run protection		approx. 8 mA	>3.6 mA <11 mA	 Green	
Fault signal (mode A/B)	any	approx. 1.8 mA	<=3.6 mA >=21.6 mA		

6.4 Recurring test and function test

Acc. to WHG and IEC 61508. The implementation of the recurring test acc. to WHG is stipulated in the general type approval, item 8.

Take note of the overwhelming approvals, if OPTISWITCH 5100 C, 5150 CEx is used as part of an overfill protection system acc. to WHG.

OPTISWITCH 5100 C, 5150 CEx in conjunction with an SU 501 (Ex) is qualified in mode A (overfill protection) for use in measuring chains of SIL2 acc. to IEC 61508 (redundant, SIL3).

¹⁾ Electronics directly evaluated via the analogue input of a control system (without signal conditioning instrument)

WHG

The following instrument combinations meet the requirements acc. to WHG:

OPTISWITCH 5100 C, 5150 C EX with

- Oscillator SWE60Z EX
- signal conditioning instrument SU 501 (Ex) or PLC

SIL

The following instrument combinations meet the requirements according to SIL:

OPTISWITCH 5100 C, 5150 C EX

- Oscillator SW E60Z (EX)
- signal conditioning instrument SU 501 (Ex)

Recurring test and function test

The recurring test according to WHG and the function test according to IEC 61508 can be carried out by pushing the test key on the signal conditioning instrument or by briefly (> 2 seconds) interrupting the cable to the sensor. The correct sequence of the switching conditions must be monitored via the two signal lamps on the signal conditioning instrument as well as the connected systems. The sensor must neither be removed nor must a response be triggered by filling the vessel. This applies to OPTISWITCH 5100 C, 5150 C with two-wire oscillator SW E60Z EX.

If you are subject to the WHG regulations, you can carry out the function test with the outputted current values also directly via a PLC or a process control system.

The implementation and switching sequence of the function test is described also in the operating instructions manual of the appropriate signal conditioning instrument.

Test key on the signal conditioning instrument

A function test can be carried out for measuring systems in conjunction with the two-wire oscillator SW E60Z EX. For this the integration time must be set to 0.5 s. The signal conditioning instrument has an integrated test key. The test key is recessed in the front plate of the signal conditioning instrument. Push the test key for > 2 seconds with a suitable object (screwdriver, pen, etc.).

For WHG the following is also applicable: If OPTISWITCH 5100 C, 5150 C is connected to a processing system or a PLC, you have to interrupt the connection cable to the sensor for > 2 seconds.

After releasing the test key or interrupting the connection cable to the sensor, the complete measuring system can be checked





on correct function. The following operating conditions are simulated during the test:

- Fault signal
- Empty signal
- Full signal

Check if all three switching conditions occur in the correct sequence and the stated time period. If this is not the case, there is a fault in the measuring system (see also the operating instructions manual of the signal conditioning instrument). Keep in mind that connected instruments are activated during the function test. By doing this, you can check the correct function of the measuring system.

Test procedure

(after releasing the test key)

	Sensor current - Sensor	Level re-lay A - overfill protection	Level re-lay B - dry run protection	Signal lamp A - Overfill protection	Signal lamp B - Dry run protection	Fail safe relay	Control lamp
1. Fault signal (approx. 3 s)	<2.0 mA	currentless	currentless	○	○	currentless	
2. Empty signal (approx. 1.5 s)	approx. 8 mA	energized	currentless		○	energized	○
3. Full signal (approx. 1.5 s)	approx. 16 mA	currentless	energized	○		energized	○
4. Return to the actual operating condition							



Note:

Mode B is not permissible when used as part of an overfill protection system acc. to WHG and use in measuring chains acc. to IEC 61508.

You can carry out the function test with the outputted current values also directly with a PLC or a process control system (WHG).

7 Maintenance and fault rectification

7.1 Maintenance

When used as directed in normal operation, OPTISWITCH 5100 C, 5150 C is completely maintenance free.

7.2 Rectify faults

Causes of malfunction

OPTISWITCH 5100 C, 5150 C offers maximum reliability. Nevertheless faults can occur during operation. These may be caused by the following, e.g.:

- Sensor
- Process
- Power supply
- Signal processing

Fault rectification

The first measure to be taken is to check the output signal. In many cases, the causes can be determined this way and the faults rectified.

Checking the switching signal

- ? OPTISWITCH 5100 C, 5150 C signals "covered" when the vibrating element is not submerged (overflow protection)
- ? OPTISWITCH 5100 C, 5150 C signals "uncovered" when the vibrating element is submerged (dry run protection)
 - Supply voltage too low
 - Check the power supply
 - Electronics defective
 - Press the mode switch (min./max.). If the instrument then changes the mode, the instrument may be mechanically damaged. Should the switching function in the correct mode still be faulty, return the instrument for repair.
 - Push the mode switch. If the instrument then does not change the mode, the oscillator may be defective. Exchange the oscillator.
 - Check if there is buildup on the vibrating element, and if so, remove it.
 - Unfavourable installation location
 - Mount the instrument at a location in the vessel where no dead zones or air bubbles can form.

- Wrong mode selected
 - Set the correct mode on the mode switch (max.: overfill protection; min.: dry run protection). Wiring should be carried out according to the quiescent current principle.

- ? Signal lamp flashes red
 - Electronics has detected a failure
 - Exchange instrument or return instrument for repair

- ? The signal lamp flashes alternately red and green
 - instrument defective
 - Exchange instrument or return instrument for repair

7.3 Instrument repair

If a repair is necessary, please proceed as follows:

You can download a return form from our website http://www.krohne-mar.com/fileadmin/media-lounge/PDF-Download/Specimen_e.pdf.

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

- Print and fill out one form per instrument
- Clean the instrument and pack it damage-proof
- Attach the completed form and possibly also a safety data sheet to the instrument

8 Dismounting

8.1 Dismounting procedure

**Warning:**

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

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



With Ex instruments, the housing cover may only be opened if there is no explosive atmosphere present.

8.2 Disposal

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

WEEE directive 2002/96/EG

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

Correct disposal avoids negative effects to persons and environment and ensures recycling of useful raw materials.

Materials: see "*Technical data*"

If you cannot dispose of the instrument properly, please contact us about disposal methods or return.

9 Supplement

9.1 Technical data

General data

Material 316L corresponds to 1.4404 or 1.4435

Materials, wetted parts

- Process fitting - thread 316L, Hastelloy C4 (2.4602)
- Process fitting - flange 316L, 316L with Hastelloy C4 plated, enamelled steel, 316L with ECTFE coated, 316L with PFA coated
- Process seal Klingersil C-4400
- Tuning fork 316L, Hastelloy C4 (2.4610)
- Extension tube \varnothing 21.3 mm (0.84 in) 316L, Hastelloy C4 (2.4610), Hastelloy C4 (2.4610) enamelled, 316L with ECTFE coating, 316L with PFA coating

Sensor length

- length OPTISWITCH 5100 C, 5150 C See "*Supplement - Dimensions*"

Materials, non-wetted parts

- Housing Plastic PBT (Polyester), Alu die-casting powder-coated, 316L
- Seal ring between housing and housing cover NBR (stainless steel housing), silicone (Alu/plastic housing)
- waveguide in the housing cover PMMA (Makrolon)
- Ground terminal 316L
- Temperature adapter (optional) 316L
- Gas-tight leadthrough (optional) 316L/glass

Weights

- Plastic housing 760 g (27 oz)
- Aluminium housing 1170 g (41 oz)
- Stainless steel housing 1530 g (54 oz)

Layer thickness

- Enamel approx. 0.8 mm (0.03 in)
- ECTFE approx. 0.5 mm (approx. 0.02 in)
- PFA approx. 0.5 mm (approx. 0.02 in)

Surface quality

- | | |
|---|---|
| – Standard | R_a approx. 3 μm (approx. 1.18 ⁻⁴ in) |
| – Hygienic version 3A (OPTISWITCH 5150 C) | R_a <0.8 μm (<3.15 ⁻⁵ in) |

Process fittings

- | | |
|---------------------|---|
| – Thread | G $\frac{3}{4}$ A, $\frac{3}{4}$ NPT, G1 A, 1 NPT |
| – Flanges | DIN from DN 25, ANSI from 1" |
| – hygienic fittings | Bolting DN 40 PN 40, Tri-Clamp 1", Tri-Clamp 1½" PN 10, conus DN 25 PN 40, Tuchenhagen Varivent DN 50 PN 10 |

High voltage test (enamel)

max. 5 KV

Gas-tight leadthrough (optional)

- | | |
|-----------------------|---|
| – leakage rate | <10 ⁻⁶ mbar l/s |
| – pressure resistance | PN 64 |
| – hygienic fittings | Bolting DN 40 PN 40, Tri-Clamp 1", Tri-Clamp 1½" PN 10, conus DN 25 PN 40, Tuchenhagen Varivent DN 50 PN 10 |

Output variable

Output Two-wire output

Output signal

- | | |
|---------------------|---------------|
| – empty (uncovered) | approx. 8 mA |
| – full (covered) | approx. 16 mA |
| – Fault signal | <2.0 mA |

Possible signal conditioning instruments SU 501 (Ex)

Modes (adjustable via the signal conditioning instrument)

- | | |
|-----|--|
| – A | Max. detection or overflow/overflow protection |
| – B | Min. detection or dry run protection |

Measuring accuracy

Hysteresis	approx. 2 mm (0.08 in) with vertical installation
Integration time	approx. 500 ms
Frequency	approx. 1200 Hz

Ambient conditions

Ambient temperature on the housing	-40 ... +70 °C (-40 ... +158 °F)
Storage and transport temperature	-40 ... +80 °C (-40 ... +176 °F)

Process conditions

Parameter	Limit level of liquids
Process pressure	-1 ... 64 bar (-14.5 ... 938 psi) depending on the process fitting, e.g. flange
OPTISWITCH 5100 C, 5150 C of 316L/Hastelloy C4 (2.4610)	-50 ... +150 °C (-58 ... +302 °F)
Process temperature (thread or flange temperature) with temperature adapter (option)	
- OPTISWITCH 5100 C, 5150 C of 316L/Hastelloy C4	-50 ... +250 °C (-58 ... +482 °F)
- OPTISWITCH 5100 C, 5150 C enamelled	-50 ... +200 °C (-58 ... +392 °F)
- OPTISWITCH 5100 C, 5150 C with ECTFE coating	-50 ... +150 °C (-58 ... +302 °F)
- OPTISWITCH 5100 C, 5150 C with PFA coating	-50 ... +150 °C (-58 ... +302 °F)

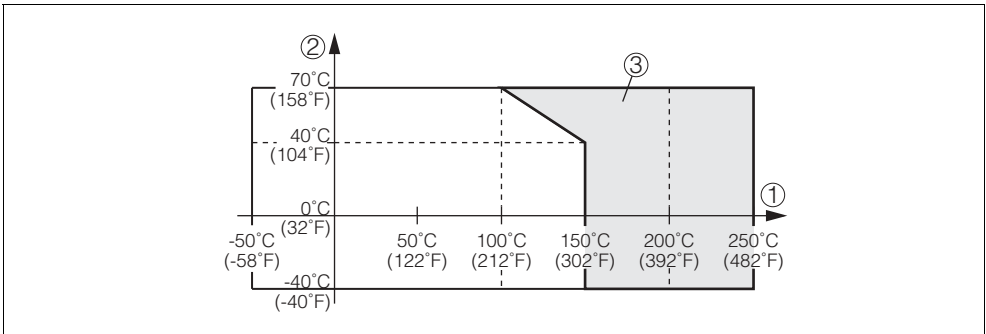


Fig. 12: Ambient temperature - Product temperature
 1 Product temperature
 2 Ambient temperature
 3 Temperature range with temperature adapter

Viscosity - dynamic	0.1 ... 10,000 mPa s (requirement: with density 1)
Density	0.7 ... 2.5 g/cm ³ (0.025 ... 0.09 lbs/in ³); 0.5 ... 2.5 g/cm ³ (0.018 ... 0.09 lbs/in ³) by switching over

Electromechanical data

Cable entry/plug²⁾

– Single chamber housing

- 1x cable entry M20x1.5 (cable- \varnothing 5 ... 9 mm), 1x blind stopper M20x1.5

or:

- 1x closing cap ½ NPT, 1x blind plug ½ NPT

or:

- 1x plug (depending on the version), 1x blind plug M20x1.5

Screw terminals

for wire cross-section up to 1.5 mm²
(0.0023 in²)

Adjustment elements

Sensitivity switch

– 0.5

0.5 ... 2.5 g/cm³ (0.018 ... 0.9 oz/in³)

– 0.7

0.7 ... 2.5 g/cm³ (0.025 ... 0.9 oz/in³)

Voltage supply

Supply voltage

11 ... 36 V DC (via the signal conditioning instrument)

Electrical protective measures

Protection

IP 66/IP 67

Overvoltage category

III

Protection class

II

Approvals³⁾

ATEX II 1G, 1/2G, 2G EEx ia IIC T6

ATEX II 1/2G, 2G EExd d IIC T6⁴⁾

Overfill protection acc. to WHG

Ship approvals

²⁾ Depending on the version M12x1, according to DIN 43650, Harting, Amphenol-Tuchel, 7/8" FF.

³⁾ Deviating data in Ex applications: see separate safety instructions.

⁴⁾ Only with Aluminium housing.

9.2 Dimensions

Housing

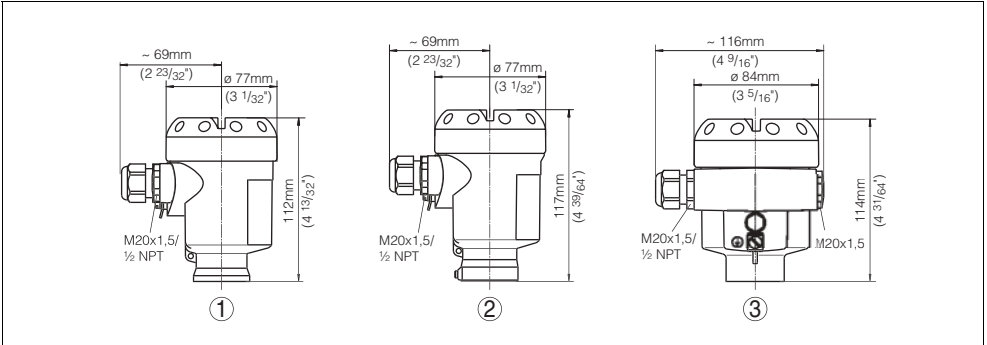


Fig. 13: Housing versions

- 1 Plastic housing
- 2 Stainless steel housing
- 3 Aluminium housing

OPTISWITCH 5100 C, 5150 C

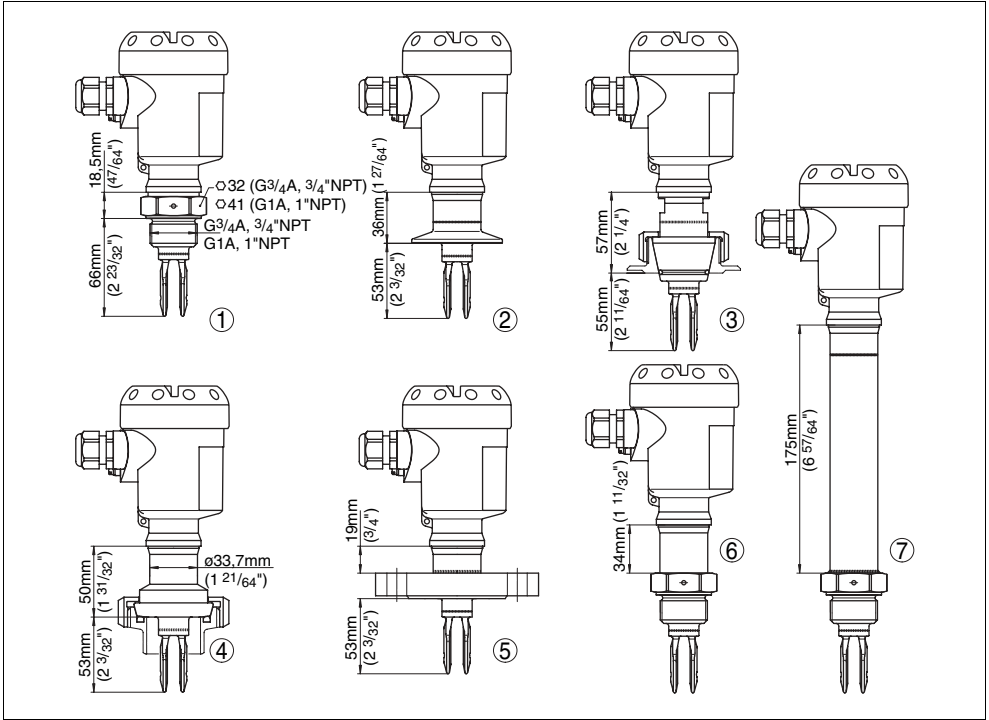


Fig. 14: OPTISWITCH 5100 C, 5150 C, threaded version

- 1 Thread
- 2 Tri-Clamp
- 3 Cone DN 25
- 4 Bolting DN 40
- 5 Flange
- 6 Gas-tight leadthrough
- 7 Temperature adapter

Subject to change without notice