OPTISWITCH 5300 C
Safety manual

For steam boilers
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1 Application area

The OPTISWITCH 5300 C is a point level sensor with tuning fork for level detection. The reliability of the instrument is only ensured if it is used according to the specifications in the operating instructions as well as in the supplementary instructions.

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

![Fig. 1: Configuration of OPTISWITCH 5300 C](image)

1 Housing lid
2 Housing with electronics
3 Temperature adapter
4 Process fitting
5 Extension tube
2 General information and related documentation

Note:
The instruments may be set up and put into operation only by "qualified personnel".
Maintenance and conversion work must only be carried out by persons appropriately instructed by VEGA.
The type label specifies the technical properties of the instrument. An instrument without an instrument-specific type label may not be put into operation!

<table>
<thead>
<tr>
<th>Document-ID</th>
<th>Designation</th>
</tr>
</thead>
</table>
| 51194 | Safety Manual
OPTISWITCH 5300 C
Relay (2 x SPDT)
With SIL qualification |
| 51195 | Safety Manual
OPTISWITCH 5300 C
Transistor (NPN/PNP)
With SIL qualification |
| 51196 | Safety Manual
OPTISWITCH 5300 C
Two-wire (8/16 mA)
With SIL qualification |
| 48078 | Operating instructions
OPTISWITCH 5300 C
Relay (S)
With SIL qualification |
| 48079 | Operating instructions
OPTISWITCH 5300 C
Transistor (T)
With SIL qualification |
| 48077 | Operating instructions
OPTISWITCH 5300 C
Two-wire electronics (L)
With SIL qualification |

3 System components
At least two sensors in redundancy are required for detection of the max. or min. limit level (architecture 1oo2, "one out of two"). To increase availability, the installation of three sensors in architecture 2oo3 ("two out of three") with processing via an SPLC is recommended.
3.1 Version with SPLC

Fig. 2: Processing with SPLC
1 Point level sensor 1
2 Point level sensor 2
3 Optionally an additional sensor for realization of a 2oo3 or diversitary redundancy
4 SPLC or processing system with certification according to EN 12952-11 and EN 12953-9

3.2 System version in architecture 1oo2

System behaviour in normal operation
If the monitored limit value (NW/HW) is reached, all sensors deliver a corresponding output signal within the deviation range (see operating instructions: Document-ID: 48077, 48078, 48079; chapter 9).

System behaviour in the event of a fault
System behaviour in the event of a dangerous detected failure of a sensor
Detection through continuous signal comparison of the sensors in the safety PLC, or for electronics version L (two-wire) through the wiring of the outputs. Detection through proof test.

Caution:
Single fault safety is no longer ensured. Immediate action is required!

3.3 System version in architecture 2oo3

System behaviour in normal operation
If the monitored limit value (NW/HW) is reached, all sensors deliver a corresponding output signal within the deviation range (see operating instructions: Document-ID: 48077, 48078, 48079; chapter
9).

**System behaviour in the event of a dangerous detected failure of a sensor (2003)**

In case of a dangerous detected failure of a sensor, determination through signal comparison (1-2, 2-3, 3-1) in the safety PLC or determination through proof test.

⚠️ **Caution:**

Single fault safety is no longer ensured. Immediate action is required!

Faults occurring during setup or operation are displayed immediately by control lamps, and the outputs of the S or I version switch to a currentless state.

### 4 Installation and setup

**Installation, mounting and wiring**

The point level switch OPTISWITCH 5300 C can be installed either directly inside the vessel or in a connected reference vessel (bypass).

The sensor must be arranged, installed and protected so that its function is not influenced by:

- Foam and turbulence in the boiler water
- Dirt accumulation
- Mechanical influence during operation (e.g. vibration)

The mounting and wiring of the instrument is described in the corresponding operating instructions (Document-ID: 48077, 48078, 48079).

⚠️ **Caution:**

Reliable operation of the instrument requires a correct installation!

**Installation position**

The permissible installation positions of the instrument are also described in the operating instructions (Document-ID: 48077, 48078, 48079).

**Deviation**

Due to application-specific influences, the specified deviation can increase and hence influence the switching point (see operating instructions chapter 9.1 in Document-ID: 48077, 48078, 48079).

### 5 Instrument behaviour in normal operation and in the event of a fault

**Common instrument functions**

The tuning fork vibrates at its mechanical resonance frequency of approx.

If the tuning fork is covered by the medium, the frequency changes. This change is detected by the integrated electronics module and converted into a switching command.

The electronics module of OPTISWITCH 5300 C continuously monitors the following criteria via frequency evaluation:

- Strong corrosion or damage on the tuning fork
- Loss of vibration
- Break in the vibration drive circuit
- Line break and shortcircuit (two-wire cable)

If a malfunction is detected or in case of power failure, the electronics takes on a defined switching condition, i.e. the output of electronics version "S" and "I" and the VEGATOR 121/122 in conjunction with electronics version "L" is open (safe state).
For details on the display and output status see "Instrument behaviour in case of fault".

**Instrument functions depending on the electronics version**

On the electronics module you will find the display and adjustment elements described below:

**Fig. 3: S (relay version)**

1. Control lamp - fault indication (red)
2. Control lamp - Switching status (yellow)
3. Control lamp - Operating status (green)
4. Mode setting for selection of the switching behaviour (max.)
5. DIL switch for sensitivity adjustment
6. Ground terminal
7. Connection terminals

For the safety function, only the NO contact (NO = Normally Open) may be used (closed circuit principle).

Both NO contacts of the relays must be connected in series!

<table>
<thead>
<tr>
<th>Mode</th>
<th>Overflow protection (mode max.)</th>
<th>Dry run protection (mode min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibrating element</td>
<td>covered</td>
<td>uncovered</td>
</tr>
<tr>
<td>Relay</td>
<td>NO contact open (de-energized)</td>
<td>NO contact open (de-energized)</td>
</tr>
</tbody>
</table>
Fig. 4: I (transistor version)

1 Control lamp - fault indication (red)
2 Control lamp - Switching status (yellow)
3 Control lamp - Operating status (green)
4 Mode setting for selection of the switching behaviour
5 DIL switch for sensitivity adjustment
6 Ground terminal
7 Connection terminals
When the sensor is being operated with a signal conditioning instrument, the mode "max." must be set. Mode selection is carried out on the signal conditioning instrument.

The safe state of the output signal is independent of the mode evaluated by an SPLC.

The function of the adjustment and display elements is described in the operating instructions. During adjustment, the safety function must be considered as unreliable.

If necessary, you must take other measures to maintain the safety function.

The sensor must be protected against inadvertent or unauthorized modification.

6 Instrument behaviour in the event of a fault

6.1 Output signals in case of malfunction

To monitor a limit level, the sensor detects via the conditions "Vibrating element uncovered" or "Vibrating element covered" a limiting value defined by the mounting location.

<table>
<thead>
<tr>
<th>S</th>
<th>I</th>
<th>L</th>
</tr>
</thead>
</table>
| Non-conductive (currentless) | Non-conductive (currentless) | The mode switch on OPTISWITCH 5300 C must be set to "Max.".
| ≤ 3.6 mA ("fail low")         | ≥ 21 mA ("fail high")         |

In the operating instructions (Document-ID: 48078, 48079, 48077 / chapter 7.2), the detection of
failures, their cause as well as suitable measures for fault rectification are described.

7 Maintenance

If the instrument is used properly, no special maintenance is required in normal operation. When used in safety-instrumented systems (SIS), the safety function must be triggered on the instrument in regular time intervals by means of a proof test. Possible undetected, dangerous failures can thus be identified. It is the responsibility of the operator to select the type of test. The time intervals correspond to the implemented PFD$_{AVG}$. During the function test, the safety function must be considered unreliable. It must be noted that the function test influences downstream connected devices. If one of the tests proves negative, the entire measuring system must be switched out of service and the process held in a safe state by means of other measures. You can find detailed information on the proof test in the Safety Manual (SIL).

Warning!
- The sensors are hot during operation!
- Serious burns on hands and arms are possible!
- When loosening the probe, steam or hot water can escape!
- Serious scalding of the entire body is possible!
- Carry out installation and maintenance work only when the sensor is cold!
- Dismount the probe only at 0 bar boiler pressure!

8 Checking functionality

The function and safety of the limiter must be checked periodically. The test must be carried out in a way that verifies the proper functioning of the limiting device in interaction with all components. The measurement and trigger functions must be checked by lowering or raising the water level.

Note:
Possible test sequences for OPTISWITCH 5300 C are described in the Safety Manual, chapter 7: "Proof test", in detail in the operating instructions (Doc.: 48078, 48079, 48077), chapter 6.4: "Proof test".

9 Repair

The repair of the instruments must only be carried out by VEGA Grieshaber KG. If the repair is carried out by a third party, the safety-relevant functions can no longer be guaranteed.
Hiermit wird bescheinigt, dass das unten beschriebene Produkt der Firma KROHNE S.A.S
2, allée de Ours / BP 98
26103 Romans Cedex
France
die Anforderungen der folgenden Prüflieferung(en) erfüllt.
fulfills the requirements of the following test regulations.

Geprüft nach: EN 12952-11:2007
Tested in accordance with: EN 12953-9:2007

Beschreibung des Produktes: Level Switch
Description of product: (Details see Annex 1)

Typenbezeichnung: OPTISWITCH 5300 C (VF534.***** * SII/L ****)
Type Description: None

Dieses Zertifikat bescheinigt das Ergebnis der Prüfung an dem vorgestellten Prüfgegenstand. Eine allgemein gültige Aussage über die Qualität der Produkte aus der laufenden Fertigung kann hieraus nicht abgeleitet werden.

This certificate is the result of the examination of the product sample submitted by the manufacturer. A general statement concerning the quality of the products from the series manufacture cannot be derived there from.

Registrier-Nr. / Registration No 44 799 13735107
Prüfbericht Nr. / Test Report No. 3516 8208
Aktenzeichen / File reference 8000445824

Gültigkeit / Validity
von / from 2015-07-13
bis / until 2020-07-12

Essen, 2015-07-13

Bitte beachten Sie auch die umschriftlichen Hinweise
Please also pay attention to the information stated overleaf.

for steam boiler approval OPTISWITCH 5300 C
Hints to the TÜV NORD - Certificate

This TÜV NORD - certificate only applies to the firm stated overseal and the specified product. It may only be transferred to third parties by the certification body.

Each product must be accompanied by the instructions which are necessary for its operation and installation.

The bearer of the TÜV NORD - Certificate undertakes to regularly supervise the manufacturing of products for compliance with the test specifications and in particular properly carry out the checks which are stated in the specifications or required by the test laboratory.

In case of modifications of the tested product the certification body must be informed immediately.

In case of modifications and expiration of validity the original certificate must be returned to the certification body immediately. The certification body decides if the certificate can be supplemented or whether a new certification is required.

In addition to the conditions stated above, all other provisions of the General Agreement are applicable to the TÜV NORD - Certificate. It will be valid as long as the rules of technology on which the test was based are valid, unless revoked previously pursuant to the provisions of the General Agreement.

This TÜV NORD - Certificate will become invalid and shall be returned to the certification body immediately in the event that it shall expire without delay when it has expired or revoked.

Hinweise zum TÜV NORD-Zertifikat

Dieses TÜV NORD - Zertifikat gilt nur für die umseitig bezeichnete Firma und das angegebene Produkt. Es kann nur von der Zertifizierungsstelle auf Dritte übertragen werden.

Notwendige Bedienungs- und Montageanweisungen müssen jedem Produkt beigefügt werden.

Jedes Produkt muss deutlich einen Hinweis auf den Hersteller oder Importeur und eine Typenbezeichnung tragen, damit die Identität des geprüften Baumusters mit den seriennmäßig in den Verkehr gebrachten Produkten festgestellt werden kann.

Der Inhaber des TÜV NORD - Zertifikates ist verpflichtet, die Fertigung der Produkte laufend auf Übereinstimmung mit den Prüfbestimmungen zu überwachen und insbesondere die in den Prüfbestimmungen festgelegten oder von der Zertifizierungsstelle geforderten Kontrollprüfungen ordnungsgemäß durchzuführen.

Bei Änderungen am geprüften Produkt ist die Zertifizierungsstelle umgehend zu verständigen.

Bei Änderungen und bei befristeten Zertifikaten ist das Zertifikat nach Ablauf der Gültigkeit unscriflicht an die Zertifizierungsstelle zurückzugeben. Die Zertifizierungsstelle entscheidet, ob das Zertifikat ergänzt werden kann oder ob eine erneute Zertifizierung erforderlich ist.

Für das TÜV NORD - Zertifikat gelten außer den vorgenannten Bedingungen auch alle übrigen Bestimmungen des allgemeinen Vertrages. Es hat solange Gültigkeit, wie die Regeln der Technik gelten, die der Prüfung zu Grunde gelegt worden sind, sofern es nicht auf Grund der Bedingungen des allgemeinen Vertrages früher zurückgezogen wird.

Dieses TÜV NORD - Zertifikat verliert seine Gültigkeit und muss unverzüglich der Zertifizierungsstelle zurückgegeben werden, falls es ungültig wird oder für ungültig erklärt wird.
## A N L A G E
### A N N E X

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Annex 1, page 1 of 1

zum Zertifikat Registrier-Nr. I to Certificate Registration No. 44 789 13735107

Allgemeine Angaben
General information

Produktbeschreibung:
Product Description

Typbezeichnung:
Type Description

Besondere Bedingungen zur sicheren Verwendung:
Special conditions for safe use

For using as a limiting device of the boiler and accessories a redundant structure has to be applied.
For details see the safety handbook

<table>
<thead>
<tr>
<th>Voltage supply:</th>
<th>&quot;G&quot; Relay with SIL Qualification</th>
<th>&quot;F&quot; Transistor with SIL Qualification</th>
<th>&quot;F&quot; Two wire with SIL Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output:</td>
<td>20 Hz, 50 Hz, 60 Hz</td>
<td>9.6 V to 55 V DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Voltage loss &lt; 400 mA</td>
<td>Mode max.</td>
</tr>
<tr>
<td></td>
<td>Switching voltage:</td>
<td></td>
<td>Vibration element uncovered:</td>
</tr>
<tr>
<td></td>
<td>10 V DC</td>
<td></td>
<td>6 mA ± 1.5 mA</td>
</tr>
<tr>
<td></td>
<td>U乓max = 25 V DC</td>
<td></td>
<td>Vibration element covered:</td>
</tr>
<tr>
<td></td>
<td>Switching current:</td>
<td></td>
<td>10 mA ± 1.5 mA</td>
</tr>
<tr>
<td></td>
<td>ISat = 15 mA</td>
<td></td>
<td>U乓max message &lt; 3.5 mA</td>
</tr>
<tr>
<td></td>
<td>Imax = 5 A AC, 4 A DC</td>
<td></td>
<td>Fault message &gt; 21 mA</td>
</tr>
<tr>
<td>Power consumption</td>
<td></td>
<td>max. 0.5 W</td>
<td></td>
</tr>
<tr>
<td>Test Key</td>
<td></td>
<td>To activate</td>
<td></td>
</tr>
<tr>
<td>Over Voltage category</td>
<td></td>
<td>III</td>
<td>III</td>
</tr>
<tr>
<td>Protection class</td>
<td>I</td>
<td>II</td>
<td>II</td>
</tr>
</tbody>
</table>

Ambient temperature on the housing: -40 ... +70°C (-40 ... +158°F)
Length: 74 mm for compact version resp. 0.2 ... 3.0 m for tube version
Swiching Point: approximately 13 mm (submerged) in vertical installation others see Safety Manual

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Essen, 2015-07-13

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www.tuev-nord-cert.de technology@tuev-nord.de

for steam boiler approval OPTISWITCH 5300 C

13
KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature assemblies
- Pressure transmitters
- Analysis products
- Products and systems for the oil and gas industry

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