Sludge level meter

Electronic Revision:
1.0.1

Original handbook
1 Safety instructions

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1.1 Software history

The "Electronic Revision" (ER) is consulted to document the revision status of electronic equipment according to NE 53 for all devices. It is easy to see from the ER whether troubleshooting or larger changes in the electronic equipment have taken place and how that has affected the compatibility.

Changes and effect on compatibility

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<td>Downwards compatible changes with new functions</td>
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<td>5</td>
<td>Incompatible changes, i.e. electronic equipment must be changed.</td>
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INFORMATION!

In the table below, "x" is a placeholder for possible multi-digit alphanumeric combinations, depending on the available version.

<table>
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<th>Release date</th>
<th>Electronic revision</th>
<th>Changes and compatibility</th>
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<td>ER 1.0.0</td>
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1.2 Intended use

The OPTISYS SLM 2100 sludge level meter is primarily designed for use in water and waste water treatment plants. There it determines the sedimentation profile in clarifiers and sludge thickeners and detects sludge blanket or fluff level. For this it measures the suspended solids concentration and height of the sensor above ground as the sensor is lowered into the basin or tank.

However, the design of the OPTISYS SLM 2100 makes it possible to use it in other applications where reliable monitoring of interface or stratification in suspensions is necessary.

The OPTISYS SLM 2100 shall not be used in hazardous areas, which e.g. require Ex approvals. It could ignite gases. Additionally, due to the sensors material, the meter shall not be used in applications with a high concentration of salt (e.g. seawater). The device has been constructed for indoor and outdoor use below the maximum altitude of 2000 m / 6562 ft.

By observing the operation instructions, national standards, safety requirements and accident prevention regulations the residual risk is reduced to an acceptable level.

1.3 Certifications

The device meets the essential requirements of the EU directives. The CE marking indicates the conformity of the product with the union legislation applying to the product and providing for CE marking.

For full information of the EU directives and standards and the approved certifications, please refer to the EU declaration on the KROHNE website.
1.4 Safety instructions from the manufacturer

1.4.1 Copyright and data protection

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer’s documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

We draw your attention to the fact that data transmission over the Internet (e.g. when communicating by e-mail) may involve gaps in security. It is not possible to protect such data completely against access by third parties.

We hereby expressly prohibit the use of the contact data published as part of our duty to publish an imprint for the purpose of sending us any advertising or informational materials that we have not expressly requested.

1.4.2 Disclaimer

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect or incidental and consequential damages.

This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.
1.4.3 Product liability and warranty

The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation or operation of the devices (systems) will cause the warranty to be void. The respective “Standard Terms and Conditions” which form the basis for the sales contract shall also apply.

1.4.4 Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer can not accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of icons as shown below.
1.4.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.

**DANGER!**
This warning refers to the immediate danger when working with electricity.

**DANGER!**
This warning refers to the immediate danger of burns caused by heat or hot surfaces.

**DANGER!**
This warning refers to the immediate danger when using this device in a hazardous atmosphere.

**DANGER!**
These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator’s plant.

**WARNING!**
Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator’s plant.

**CAUTION!**
Disregarding these instructions can result in damage to the device or to parts of the operator’s plant.

**INFORMATION!**
These instructions contain important information for the handling of the device.

**LEGAL NOTICE!**
This note contains information on statutory directives and standards.

**• HANDLING**
This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

** RESULT**
This symbol refers to all important consequences of the previous actions.

1.5 Safety instructions for the operator

**WARNING!**
In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.
This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.
2.1 Scope of delivery

**INFORMATION!**
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

**INFORMATION!**
Do a check of the packing list to make sure that you have all the elements given in the order.

**INFORMATION!**
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

---

**Figure 2-1: Scope of delivery**

1. Sludge level meter (optional with cleaning unit and spray shield)
2. Key for cable drum lock and key for electronic compartment lock
3. Mounting accessories
4. Documentation

**Optional accessories**
- Mounting frame
- Rod steel U-bolts for round handrail
- Cleaning unit
2.2 Device description

Figure 2-2: Device description of OPTISYS SLM 2100

1. Fan
2. Electronic compartment door with display
3. Cable drum compartment door
4. Guide roller and zero point reference switch
5. Sensor
6. 4 x cable feedthrough M20
7. Cable drum with heating unit at the back
8. Pickup and axle board with optical interface
9. Safety switch
10. Main electronics and connectors

Main electronics unit
The main electronic unit is located in a separate compartment above the cable drum, which can be accessed via a separate door with a key lock. It contains the mainboard and fan assembly. The mainboard bears the main processor and all electrical connectors. It also controls all mechanical and electrical events in the device and communicates with sensor, display and keyboard. It additionally contains the current outputs and control inputs.

Fan assembly
The position of the fan is on the top right side of the enclosure. In combination with the heater the instrument maintains suitable temperature conditions inside the enclosure of the meter.

DANGER!
The rotating fan blades can be accessed, when the electronic compartment door is open and there is a risk of injury when rotating fan is touched.
Display and keyboard
Display and keyboard are located in the front door of the electronics compartment. Display and keyboard are based on the GDC (general device concept), which means a common HMI (human machine interface) to all KROHNE GDC instruments is provided. The keyboard consists of four membrane keys and the display is a LCD graphic display with a resolution of 128 x 64 Pixel.

Cable drum assembly and heater unit
The cable drum helps to move the sensor up and down in the basin. It is mounted directly on the motor shaft of a synchronous motor, hidden behind the drum mounting plate. The cable drum always moves with a very constant speed. Since the diameter of the cable roll in the drum varies, the speed of the sensor varies. That is why the sensor moves slower during the end of the sampling. Due to the roll design, shortening of cable or movement of the metal sleeve on the sensor cable is prohibited. This will lead to different diameter of the cable roll and finally resulting in wrong results in the height/depth measurements. The heater unit is located behind the drum mounting plate. In combination with the fan the instrument maintains suitable temperature conditions inside the enclosure of the meter.

Guide roller and zero point reference switch
The guide roller helps to keep the cable in place during the measuring process. A stable height measurement is reached by zero point reference switch. The inductive proximity switch reacts on the metal sleeve on the sensor cable and calibrates the home position. Each time when leaving the menu the device performs a zero point calibration. In addition a regular calibration during the process can be performed time based via the setup.

Sensor
The sensor used in the OPTISYS SLM 2100 is a suspended solid sensor. The sensor contains a near-infrared light source and a receiver in an angle of 180°. Both are positioned in such a way that the emitted near-infrared light has to pass through the liquid before reaching the receiver. The suspended solids in the liquid absorb the emitted light leading to a lower intensity at the detector. The light loss is proportional to the suspended solid content.

Pickup board & axle board
The pickup board is mounted on a spring loaded lever arm and transfers power and communication signals to the cable drum.

The axle board on the cable drum is powered contactless (“inductively”) by the pickup board. It communicates with the main electronics unit via the pickup board and with the sensor via an optical interface.

Cable feedthroughs
The 4 M20 cable feedthroughs are for the connection of power, signal and control cables. Only three cable feedthroughs can be used, if the optional cleaning unit is installed.

Safety switch
The safety switch located on the top left corner of the cable drum compartment is a protective device, which de-energizes the motor when the front door is opened in order to avoid danger due to moving parts inside the meter.
Cleaning unit (optional)

The cleaning unit, mounted under the device, consists of a valve and a spraying system to keep the sensor and cable free of deposits ensuring low maintenance efforts of OPTISYS SLM 2100. The cleaning unit uses water which can be supplied either by an external water source [process water] or by water from the clear water phase. The latter can be performed by an external pump which is controlled by the OPTISYS SLM 2100.

2.3 Nameplate

**INFORMATION!**

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

Figure 2-3: Example of a nameplate

1. Manufacturer
2. CE marking
3. Manufacturing year,
   Electronic revision,
   Power supply data
4. Protection categories
5. Observe the operation and installation instruction,
   Electronic / electric device waste marking,
   Data matrix code
6. Order code / TAG no.
7. Production order / Serial number
8. Device name
3.1 General notes on installation

INFORMATION!
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

INFORMATION!
Do a check of the packing list to make sure that you have all the elements given in the order.

INFORMATION!
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

INFORMATION!
The display should be mounted in a height of 1.5...1.8 m / 4.9...5.9 ft to prevent ergonomic hazards.

INFORMATION!
During work on the device above the basin the personnel have to be protected by personal safety equipment.

3.2 Storage and transport

- Store and transport the device in a dry, dust-free environment.
- Store and transport the device in an environment with a temperature between -20...+60°C / -4...+140°F.
- The original packing is designed to protect the equipment. It has to be used if the device is transported or sent back to the manufacturer including the sensor fixation inside the device, to prevent damage of the sensor.

INFORMATION!
Due to the weight above 20 kg / 44.1 lbs please lift and carry the device only with two persons or use appropriate lifting equipment and if the surfaces of the device are wet, please use gloves for lifting.
3.3 Typical measuring point

Figure 3-1: Example of typical measuring points

1. OPTISYS SLM 2100 with brackets for round handrail on horizontal post
2. OPTISYS SLM 2100 with brackets for rectangular handrail (not included of scope of delivery)
3. OPTISYS SLM 2100 mounted on a wall
4. Handrail
3.4 Installation order

**DANGER!**  
Do not install the sludge level meter in hazardous areas, it can ignite explosive gases!

**DANGER!**  
Do not cover or obstruct the ventilation. It can lead to overheating of the device.

**INFORMATION!**  
The device must not be heated by radiated heat (e.g. exposure to the sun) to a electronics housing surface temperature above the maximum permissible ambient temperature. If it is necessary to prevent damage from heat sources, a heat protection (e.g. sun shade) has to be installed.

**INFORMATION!**  
The operator is responsible for providing, securing and the possibility of switching off the supply voltage.

**INFORMATION!**  
The external electrical main switch (red/yellow) of the device has to be located close to the device and easily accessible. An internal main switch is not available.

**INFORMATION!**  
The device should be located at save installation site in order to prevent the danger of falling in the water basin. Furthermore, there should be enough space in front of the device ensuring an easy access.

To install the measuring system in the best way, follow the steps described below.

**Steps to install the meter**

1. Mounting of the sludge level meter  
   (for detailed information refer to Mounting of the sludge level meter on page 18).
2. Installing the cleaning unit (optional)  
   (for detailed information refer to Cleaning unit (optional) on page 74)
3. Connecting the power supply  
   (for detailed information refer to Connecting the power supply on page 32).
4. Connection of the current outputs  
   (for detailed information refer to Current output on page 37).
5. Connecting the rake guard switch / external trigger or maintenance switch - if required  
   (for detailed information refer to Electrical connection of control inputs on page 38).
6. Configuration of the sludge level meter  
   (for detailed information refer to Functions in detail on page 58).
7. Calibration of the sludge level meter  
   (for detailed information refer to Calibration on page 65).

**INFORMATION!**  
For decommissioning of the device please repeat the steps above in reverse order from 5 to 1.
3.4.1 Mounting of the sludge level meter

**INFORMATION!**
To ensure proper assembly, please use only the mounting material provided with the meter.

**INFORMATION!**
All bolts, nuts and washers should be greased to prevent cold welding and ensure simple disassemble after use.

**INFORMATION!**
Please ask a second person to help with this procedure.

Due to many different applications and installation points of sludge level meter a standardised mounting is often not applicable. To overcome the problem of the local conditions three different opportunities exist to order the mounting of the sludge meter.

**Available mounting possibilities**

**INFORMATION!**
Ensure that the handrail is suitable for the weight of the mounting frame and the device (standard: 26.5 kg / 58.4 lbs, with cleaning unit: 31kg / 68.3 lbs); otherwise support the handrail with additional material. The operator is responsible for safe installation, especially against the fall in the sedimentation basin.
Direct mounting without frame

The sludge meter can be mounted directly on the wall. The sludge level meter has 4 M6 threads on the back and on the bottom of the instrument. If the threads on the bottom are used, ensure that there is enough space for sensor, cable feedthroughs and the cleaning unit. For further information refer to Dimensions on page 81.

- Mount the meter using the 4 M6 screws

Figure 3-2: Mounting on wall

1. 4 x M6 screws
2. Wall
3. OPTISYS SLM 2100
Mounting frame

The mounting frame can be used for round or rectangular handrails. For rectangular handrails suitable rectangular brackets should be selected which are not part of the scope of delivery. Use at least 3 fixation points as described in the installation of round handrails. For further information refer to Dimensions on page 81.

Mounting frame with brackets with round handrail (vertical or horizontal)

This option allows installing the sludge level meter on many round handrails. The rod steel U-bolts cover handrails between diameters of 33...60.3 mm / 1.3...2.37 inch. Two round rod steel U-bolts fixate the mounting frame on the upper handrail. A further rod steel U-bolt stabilises the sludge level meter by fixation to a horizontal or vertical bar.

Mounting on round handrail with horizontal bar

![Figure 3-3: Mounting of upper handrail](image)

- Rod steel U-bolts

- Mount the frame using the rod steel U-bolts (M10) and nuts ① in a position that the frame is above the handrail.
Mounting on lower round handrail with horizontal bar

- Find suitable and stable positions of the lower crossbars.
- Fix crossbars with screws (M8 x 20), nuts and washers ①.
- On both crossbars mount the adaption plate ③.
- Mount the rod steel U-bolt (M10) ② to the horizontal pole with washers.
- Use the slot holes to adjust the respective height.
- Adjust the position of all brackets.
- Tighten all screws.
- Position the meter on the frame and tighten it with M6 screws.

Figure 3-4: Mounting of lower handrail (horizontal)

① Screws and nuts
② Rod steel U-bolt
③ Adapter for lower handrail
Mounting on lower round handrail with vertical bar

Figure 3-5: Mounting of lower handrail (vertical)

1. Screws and nuts
2. Rod steel U-bolt
3. Adapter for lower handrail

- Find suitable and stable positions of the lower crossbars.
- Fix crossbars with screws and nuts ①.
- On one crossbar mount the adaption plate ③.
- Mount the rod steel U-bolt ② to the vertical pole.
- Adjust the position of all brackets.
- Tighten all screws.
- Position the meter on the frame and tighten it with M6 screws.
Fixing the meter

- Fix the meter to the upper part of the mounting frame using screws (M6 x 16) and washers according to the drawing above.
- Please make sure that the meter is mounted in such a height that display and keyboard are at eye level.
- Remove the sensor transportation protection to prevent blocking of the sensor.

Figure 3-6: Mounting device on handrail
3.5 Installing the cleaning unit (optional)

The cleaning unit, mounted under the device, consists of a valve and a spraying system to keep the sensor and cable free of deposits ensuring low maintenance efforts of the device. The cleaning unit is mounted and electrically connected to the device by the manufacturer with exception of the spray shield and the water connection.

If installing a device containing a cleaning unit, keep a safety area around the sensor garage free from electrical device or water sensitive parts, as outlined in the following drawing.

![Figure 3-7: Safety area](image)

- Radius: 2 m / 78.74"

The cleaning unit can be supplied with water by 2 options:
- External water supply by hose with drinking or process water.
- Water supplied by pumped clear water of the sedimentation basin. For further information refer to *Description and properties of the relays* on page 40.
3.5.1 Installation of the water hose to cleaning unit

**WARNING!**
The maximum allowed water pressure should not exceed 6 bar / 87 psi.

**INFORMATION!**
An external separation switch of the water supply has to be located close to the device and easily accessible.

A 3/4” male connector (Whitworth EN 10226) with metric thread provides the mounting junction for the water hose adapter.

When installing the water hose adapter on the connector, carefully fix the nut of the fitting. The electric valve inside the cleaning system housing may be twisted, which may cause water leakage.

When installing the device, make sure the water hose is adequately fixed as outlined. Mount the water hose in such a way that the weight of it is not carried by the hose adapter. When fixing the hose also take into account that it must be avoided that it moves when the system is switched on/off.

![Figure 3-8: Fixing points water hose](image)

1. Water hose
2. Fixing points
Mounting sprayshield

Figure 3-9: Mounting sprayshield

1. Push the sprayshield above the cleaning unit. Please be aware that the holes are align to each other.
2. Insert the 4 M6 screws.

- The sprayshield has to be mounted by the operator using 4 M6 screws to the cleaning unit as described in this drawing.
4.1 Safety instructions

**DANGER!**
All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

**DANGER!**
Observe the national regulations for electrical installations!

**WARNING!**
Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

**WARNING!**
Before performing any work on the device switch off the power and make sure that it cannot be switched on accidently.

**INFORMATION!**
Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

4.2 Used abbreviations

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<th>Abbreviation</th>
<th>Description</th>
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</tr>
<tr>
<td>I_a</td>
<td>Current output active</td>
</tr>
<tr>
<td>I_{max}</td>
<td>Maximum current</td>
</tr>
<tr>
<td>I_{nom}</td>
<td>Nominal current</td>
</tr>
<tr>
<td>R_L</td>
<td>Load resistance</td>
</tr>
<tr>
<td>P</td>
<td>Power</td>
</tr>
<tr>
<td>U_{int, nom}</td>
<td>Nominal internal voltage</td>
</tr>
<tr>
<td>U_{ext}</td>
<td>External voltage</td>
</tr>
<tr>
<td>U_o</td>
<td>Terminal voltage</td>
</tr>
<tr>
<td>VAC</td>
<td>Alternating current (AC) voltage</td>
</tr>
<tr>
<td>CI</td>
<td>Control input</td>
</tr>
<tr>
<td>PCS</td>
<td>Process control system</td>
</tr>
<tr>
<td>NO</td>
<td>Switch (normally open)</td>
</tr>
<tr>
<td>NC</td>
<td>Switch (normally closed)</td>
</tr>
<tr>
<td>LED</td>
<td>Light-emitting diode</td>
</tr>
<tr>
<td>K</td>
<td>Relay</td>
</tr>
</tbody>
</table>
### 4.3 Description of electrical symbols

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Ampere meter" /></td>
<td>Ampere meter, 0...20 mA or 4...20 mA, $R_L$ is the internal resistance of the measuring point including the cable resistance</td>
</tr>
<tr>
<td><img src="image" alt="Internal direct current (DC) voltage source" /></td>
<td>Internal direct current (DC) voltage source</td>
</tr>
<tr>
<td><img src="image" alt="Controlled internal current source in the device" /></td>
<td>Controlled internal current source in the device</td>
</tr>
<tr>
<td><img src="image" alt="Switch, NO contact or similar" /></td>
<td>Switch, NO contact or similar</td>
</tr>
<tr>
<td><img src="image" alt="Input, galvanically insulated" /></td>
<td>Input, galvanically insulated</td>
</tr>
<tr>
<td><img src="image" alt="Positive temperature coefficient (PTC) resistance" /></td>
<td>Positive temperature coefficient (PTC) resistance</td>
</tr>
<tr>
<td><img src="image" alt="LED" /></td>
<td>LED</td>
</tr>
<tr>
<td><img src="image" alt="Protection switch" /></td>
<td>Protection switch</td>
</tr>
<tr>
<td><img src="image" alt="Grounding" /></td>
<td>Grounding</td>
</tr>
<tr>
<td><img src="image" alt="Motor" /></td>
<td>Motor</td>
</tr>
<tr>
<td><img src="image" alt="Heater" /></td>
<td>Heater</td>
</tr>
<tr>
<td><img src="image" alt="Fan" /></td>
<td>Fan</td>
</tr>
</tbody>
</table>
4.4 Important device-specific notes on electrical connection

**DANGER!**
Never install or operate the device in potentially explosive areas, it might cause an explosion that can result in fatal injuries!

**DANGER!**
The device must be grounded in accordance with regulations in order to protect personnel against electric shocks.

**DANGER!**
When installing and wiring the device, note the safety regulations of the current state of the art. Also note the following items to avoid fatal injuries, destruction or damage of the device or measuring errors:

- De-energise the cables of the power supply before you start any installation works!
- All used cables must have a corresponding dielectric strength of min. 2 kV.
- It is recommended to use shielded signal cables which are only connected on one side (e.g. to the protective earth on the mainboard next to the relays).
- If relays are used, note that with inductive loads the interference must be suppressed (spark quenching).
- Assure that all electrical connection works are compliant with the VDE 0100 directive "Regulations for electrical power installations with line voltages up to 1000 V" or equivalent national regulations.
- Use suitable cable glands for the various electrical cables and suitable connecting cables for the field of application. The outer diameter of the connecting cables has to fit to the cable glands.
- The nominal voltage of the connecting cable has to fit to the operating voltage of the device.
- If the handrail is not adequately grounded, ground the device with a wire of 6 mm² / 10 AWG (American Wire Gauge).

**INFORMATION!**
Assembly materials and tools are not part of the delivery. Use the assembly materials and tools in compliance with the applicable occupational health and safety directives.
4.5 Overview of cable connections

**DANGER!**
When installing and wiring the device, note the safety regulations of the current state of the art. Also note the following items to avoid fatal injuries, destruction or damage of the device or measuring errors:

- Do not run cables on pathways. Regularly check the cable runs for loose cables hanging into footpaths.
- Before connecting main power, all connectors at the connecting terminal need to be plugged.
- Please pay attention to the front doors. Make sure that the doors do not shut if hands or tools are inside the meter. Otherwise the sharp edges of the doors can cause fatal injuries or damage to the equipment.

In the bottom lower left corner of the enclosure there are 4 cable feedthrough connections as cable feedthroughs to the electronics compartment (if the cleaning unit is used only 3 feedthroughs are available). All connected cables have to be installed via these feedthroughs.

**INFORMATION!**
In order to assure proper sealing of the cable feedthrough only cables with a diameter between 6...12 mm / 0.24...0.47 inch should be used.

After feeding the cables through the feedthroughs they are run in the cable guide to the bottom of the electronics compartment where they need to be fed into another cable guide in order to be routed further to the connectors at the mainboard.

![Figure 4-1: Overview of cable connections](image)

1. 4 x M20 cable feedthroughs (if the cleaning unit is used only 3 feedthroughs are available)
2. Cable guides
3. Mainboard with connector blocks
4.6 Overview of the terminal compartment

The terminal compartment is located in the electronic compartment at the lower part of the mainboard.

Figure 4-2: Overview of the electrical connections

1. Power connections (for further information refer to Connecting the power supply on page 32.)
2. Motor, heater and fan connection block (connected at factory)
3. Cleaning connection block (connected at factory)
4. Relay connection block (for further information refer to Description and properties of the relays on page 40.)
5. External connection block (connected at factory)
6. Output connection block (for further information) refer to Current output on page 37.
7. Control inputs connection block (for further information refer to Electrical connection of control inputs on page 38.)
4.7 Connecting the power supply

**DANGER!**
Never install or operate the device in potentially explosive areas, it might cause an explosion that can result in fatal injuries!

**DANGER!**
The device must be grounded in accordance with regulations in order to protect personnel against electric shocks.

**CAUTION!**
When connecting the power supply, always note the safety regulations of the current state of the art. To avoid fatal injuries, destruction or damage of the device or measuring errors, also note the following items:

- De-energise the cables of the power supply before you start any installation works!
- Ground the device (cross section of the wire is 6 mm² / 10 AWG).
- The device must be led over a ground fault circuit interrupter (GFCI) 0.03 A which has to be tested every 6 months.
- Inspect the continuous PE conductor connection to all contactable metal parts by carrying out a standardised procedure [The maximum allowed resistance is 0.5 Ohm].
- Assure that there is a fuse protection for the infeed power circuit $I_{\text{nom}} \leq 6$ A.
- Check the nameplate and assure that the power supply meets the voltage and frequency of the device. The device can be operated with 230 VAC (-15+/+10%) at 50 Hz (±10%) and max. 150 VA. A power supply outside these specifications may destroy the device!
- Assure that the protective earth conductor [PE] is approx. 5 mm / 0.20” longer than the L- and N-conductor.

**INFORMATION!**
The operator is responsible for providing, securing and the possibility for switching off the supply voltage.
Before you start to connect the power supply cables, note the following drawing with the function of the terminals:

Figure 4-3: Connecting power supply
① Live (L)
② Neutral (N)
③ Protective earth (PE)

**INFORMATION!**
All cables must have a test voltage of min. 2 kV and an appropriate outer insulation (additional to the insulation of the individual wire). The outer insulation should be removed 40 mm / 1.57”. The minimum cross section of the wires is 1.5 mm² / 16 AWG and the maximum is 2.5 mm² / 12 AWG.

**INFORMATION!**
In order to assure proper sealing of the cable feedthrough only cables with a diameter between 6...12 mm / 0.24...0.47 inch should be used.

**INFORMATION!**
The device contains an internal fuse [1.6 A slow blow]. Replacement of the fuse should only be carried out by a service technician.
4.8 Description and properties of the output and the input

4.8.1 Current output

The electrical properties of the current outputs are described in the following table.

<table>
<thead>
<tr>
<th>Output range</th>
<th>4...20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode of output</td>
<td>Active</td>
</tr>
<tr>
<td>Electrical isolation</td>
<td>All outputs are electrically isolated from the power supply</td>
</tr>
<tr>
<td>Load resistance $</td>
<td>\leq 550 \Omega$ at $I_{\text{max}} \leq 22 \text{ mA}$</td>
</tr>
<tr>
<td>Nominal internal voltage $U_{\text{int, nom}}$</td>
<td>15 VDC</td>
</tr>
</tbody>
</table>

The function of outputs depends on which measuring function has been selected. It is changing automatically if the measuring function has been changed as outlined in the following table.

<table>
<thead>
<tr>
<th>Measuring function</th>
<th>Level</th>
<th>Profile</th>
<th>Zone tracking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current output A</td>
<td>Height / depth of concentration (fluff) ①</td>
<td>Height / depth of the sensor position ①</td>
<td>Height / depth of the sensor position ①</td>
</tr>
<tr>
<td>Current output B</td>
<td>Height / depth of concentration (sludge blanket) ①</td>
<td>Measured concentration ②</td>
<td>Measured concentration ②</td>
</tr>
</tbody>
</table>

① Range is calculated automatically according to the parameters filled in the extended setup; range of analog output is shown in the I/O setup of the device.

② Concentration range of the output must be defined in the I/O setup of the device.

Error signalling is possible via current output (error current & error class adjustable via software). For further information refer to Menu C, setup on page 53.
4.8.2 Control input (active)

**INFORMATION!**
The factory default is a disabled control input!

The electrical properties of the 3 control inputs (CI) in detail are the following:

<table>
<thead>
<tr>
<th>Mode of input</th>
<th>Active, not polarity sensitive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximal voltage (U&lt;sub&gt;max&lt;/sub&gt;)</td>
<td>15 VDC</td>
</tr>
<tr>
<td>Voltage out (U&lt;sub&gt;out&lt;/sub&gt;)</td>
<td>8 VDC</td>
</tr>
<tr>
<td>Current out (I&lt;sub&gt;out&lt;/sub&gt;)</td>
<td>-10 mA</td>
</tr>
<tr>
<td>Voltage low (U&lt;sub&gt;low&lt;/sub&gt;)</td>
<td>&lt; 2 V</td>
</tr>
<tr>
<td>Voltage high (U&lt;sub&gt;high&lt;/sub&gt;)</td>
<td>&gt; 4 V</td>
</tr>
</tbody>
</table>

**Function of the control inputs**

The three active control inputs can trigger different events in the meter from outside. They are engaged via simple contact closure of an external contact.

The 3 control inputs (CI) have the following functions:

- Control input 1: Rake guard switch or external trigger (selectable via software)
- Control input 2: Rake guard switch or external trigger (selectable via software)
- Control input 3: Maintenance mode

**Rake guard switch**

**CAUTION!**
To avoid damages or destructions, use a limit rake guard switch in all applications where a rake or other moving devices may come in contact with the sensor or cable! The manufacturer does not assume any responsibility for damages caused by the absence or malfunction of the rake guard limit switch.

To protect the sensor and cable from being damaged or destructed by rakes or other moving parts, the control input 1 and 2 can be used. For this purpose a NO switch has to be connected to CI 1 / 2 (Note the switch is not part of the scope of delivery. The additional part has to be purchased from another manufacturer). In case CI 1 / 2 is set to rake guard switch, the sampling will be interrupted and the sensor hauled back as soon as the external contact is closed.

**External trigger**

The function of the external trigger is to trigger the sampling process. For this purpose a NO switch has to be connected to CI 1 / 2 (Note the switch is not part of the scope of delivery. The additional part has to be purchased from another manufacturer). In case CI 1 / 2 is set to external trigger mode the sampling cycle will start as soon as the external contact is closed.
Maintenance mode

The function of the maintenance mode is to set the device to maintenance mode in order to enable easy cleaning of sensor, cable and meter. For this purpose a NO switch has to be connected to CI 3 (Note the switch is not part of the scope of delivery. The additional part has to be purchased from another manufacturer). In case CI 3 is activated the sampling cycle will be interrupted and the sensor is hauled back to the home position as soon as the external contact is closed. After that, the current outputs are frozen and the sensor can be moved by the simple push of the arrow buttons on the keypad.

4.9 Connection of output and input

4.9.1 Important notes

DANGER!
Never install or operate the device in potentially explosive areas, it might cause an explosion that can result in fatal injuries.

INFORMATION!
• The inputs/outputs must be connected passively or actively or acc. to EN 60947-5-6.
• Active operating mode: the signal converter supplies the power for operation [activation] of the subsequent devices, observe max. operating data.
• Terminals that are not used must not have any conductive connection to other electrically conductive parts.
4.9.2 Current output

**DANGER!**
All work on the electrical connections may only be carried out with the power disconnected.

**CAUTION!**
To avoid damage or destruction of the device always note the following items:
- Observe the connection polarity!
- Note the properties of the current output; for further information refer to Technical data on page 78.

**INFORMATION!**
Assembly materials and tools are not part of the delivery. Use the assembly materials and tools in compliance with the applicable occupational health and safety directives.

Connection diagram of current output (active)

![Connection diagram of current output](image)

Figure 4-4: Current output (active)

The terminals for the connection of the two current outputs are located on the mainboard. Please refer to the following diagram for proper connection of the cables.

![Connection diagram of current output](image)

Figure 4-5: Connection current output

1. Current output A
2. Current output B

**INFORMATION!**
The correct connection of the current outputs takes place with the help of shielded signal cables which are approved for the rated current and voltage.
**INFORMATION!**
All cables must have a test voltage of min. 2 kV and an appropriate outer insulation (additional to the insulation of the individual wire). The outer insulation should be removed 30...50 mm / 1.18...1.97 inch. The minimum allowed cross section of the wires is 0.5 mm² / 20 AWG and the maximum is 1.5 mm² / 16 AWG.

**INFORMATION!**
In order to assure proper sealing of the cable feedthrough only cables with a diameter between 6...12 mm / 0.24...0.47 inch should be used.

- Open the cable drum and electronic compartment door.
- Push the prepared cables through the cable feedthrough and route them to the electronic compartment (for more information refer to Overview of cable connections on page 30).
- Connect the positive and negative lead according to the connection diagrams above.
- Connect the shield to one side only (e.g. to the protective earth on the mainboard next to the relay) side.
- Tighten the screw connection of the cable feedthrough securely.
- Seal all cable feedthrough that are not needed with a plug.
- Close both compartment doors

### 4.9.3 Electrical connection of control inputs

**DANGER!**
All work on the electrical connections may only be carried out with the power disconnected.

**CAUTION!**
To avoid damage or destruction of the device always note the properties of the control input; for further information refer to Technical data on page 78.

**INFORMATION!**
Assembly materials and tools are not part of the delivery. Use the assembly materials and tools in compliance with the applicable occupational health and safety directives.

**INFORMATION!**
All cables must have a test voltage of min. 2 kV and an appropriate outer insulation (additional to the insulation of the individual wire). The outer insulation should be removed 30...50 mm / 1.18...1.97 inch. The minimum allowed cross section of the wires is 0.5 mm² / 20 AWG and the maximum is 1.5 mm² / 16 AWG.
The terminals for the connection of the three control inputs are located on the mainboard. Please refer to the following diagram for proper connection of the cables.

**Connecting the control inputs**

- Open the cable drum and electronic compartment door.
- Push the prepared cables through the cable feedthrough and route them to the electronic compartment [for more information refer to Overview of cable connections on page 30].
- Connect the positive and negative lead according to the connection diagrams above.
- Connect the shield to one side only e.g. on PCS (process control system) side.
- Tighten the screw connection of the cable feedthrough securely.
- Seal all cable feedthroughs that are not needed with a plug.
- Close both compartment doors.

**INFORMATION!**

*In order to assure proper sealing of the cable feedthrough only cables with a diameter between 6...12 mm / 0.24...0.47 inch should be used.*
4.10 Description and properties of the relays

**DANGER!**

Never install or operate the device in potentially explosive areas, it might cause an explosion that can result in fatal injuries.

The electrical properties of the relays in detail are the following:

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximal external voltage ($U_{ex}$)</td>
<td>24 VDC / 250 VAC</td>
</tr>
<tr>
<td>Maximal current (I)</td>
<td>K1 / K2 ≤ 1 A</td>
</tr>
<tr>
<td></td>
<td>K3 ≤ 0.3 A</td>
</tr>
</tbody>
</table>

The device contains 3 relays. Two relays (K1 & K2) can be either configured as limit switch or as status output. The third relay (K3) is reserved for the pump controller of the cleaning unit.

**Status output:**

If an error of the selected class occurs the relays remains active, until the error is cleared by the user or the device is leaving the error state automatically.

**Limit switch:**

When the relay is configured as limit switch the limit parameter used is the sensor position (height/depth). The relays can work as limit switch only in level and zone tracking mode. The parameter “direction” defines the trigger for the relay, which means the relay is switched either when the sensor position about limit value or the sensor position below limit. The hysteresis defines the sensor position, where the limit switch (relay) is reset, relatively to the selected threshold. Combining the parameters threshold and hysteresis a range can be defined, where the limit switch is active. The relay configuration menus can be found in the setup I/O menu. For more information refer to Menu C, setup on page 53.

**Pump controller:**

The pump in the clear water phase of the sedimentation basis can be controlled. The pump connector should be connected to the device only if the external pump is used to transport the cleaning medium. A pump lead time, programmable via menu, can be used to delay the sensor cleaning process until pump system pressure has been setup.
4.10.1 Connection of the relays

**DANGER!**
Never connect an external water pump directly to the sludge level meter connector K3, the output connector is only specified as a control output for a motor protection.

**DANGER!**
All work on the electrical connections may only be carried out with the power disconnected.

**INFORMATION!**
Assembly materials and tools are not part of the delivery. Use the assembly materials and tools in compliance with the applicable occupational health and safety directives.

**INFORMATION!**
The correct connection of the relays may only be ensured by using signal cables which are approved for the rated current and voltage.

**INFORMATION!**
All cables must have a test voltage of min. 2 kV and an appropriate outer insulation (additional to the insulation of the individual wire). The outer insulation should be removed 40 mm / 1.57”. The minimum cross section of the wires is 1.5 mm² / 16 AWG and the maximum is 2.5 mm² / 12 AWG.

**INFORMATION!**
In order to assure proper sealing of the cable feedthrough only cables with a diameter between 6...12 mm / 0.24...0.47 inch should be used.

The terminals for the connection of the two relays (K1 & K2) are located on the mainboard. Please refer to the following diagram for proper connection of the cables.

![Connection diagram of relays K1 and K2](image)

**Figure 4-8:** Connection diagram of relays K1 and K2

- ① LED
- ② Voltage source
The pump connector should be only connected to the OPTISYS SLM 2100 if the external pump is used as cleaning medium. The terminal connection is outlined in the following diagram.

![Connection diagram pump (K3)](image)

For installation of the relays follow the steps below:

- Move the sensor by using the manual operation in the home position and turn off the power of the instrument.
- Open the cable drum and electronics compartment doors.
- Push the prepared cables through the cable feed through and route them to the electronic compartment.
- Connect the positive and negative lead according to the connection diagrams above.
- Connect the shield to one side only e.g. on PCS (process control system) side.
- Tighten the screw connection of the cable entries securely.
- Seal all cable entries that are not needed with a plug.
- Close both compartment doors.

### 4.11 Protection category

**DANGER!**

*Do not install the sludge blanket meter in hazardous areas, it can ignite explosive gases!*

IP 68 (sensor), IP 54 (electronic compartment), IP 44 (cable drum compartment).
5.1 Start-up and general remarks for configuration

**DANGER!**
In order to avoid injuries or damage of the device or plant equipment the device shall only be operated with both doors properly closed and locked. The device also has to be properly mounted and all cable feedthroughs have to be properly tightened or plugged, if unused.

**WARNING!**
In general, the device may only be installed, commissioned, operated and maintained by properly trained and authorised personnel.

**WARNING!**
To avoid damages to the equipment please make sure that power up of the meter takes place above 0° C / +32° F. Once power is connected, the internal heater will than keep the electronics from freezing.

**WARNING!**
The device starts up / restarts automatically as soon the power is switched on.

**INFORMATION!**
If the ambient temperature is below 4° C / +39° F, keep the sensor in the medium to avoid attachment of ice on sensor. Set start position 30 cm / 1 ft below the water surface.

**INFORMATION!**
Ensure that the sensor transportation protection is removed before starting-up the system.

**INFORMATION!**
To install the meter in the best way, follow the steps described below.

Steps for starting up the device:
- Switch the power on
- Configure the device
- Start measurement
5.2 Switching on the power

**DANGER!**
To avoid fatal injuries as well as destruction or damage of the device assure a correct installation before switching on the power. This includes:

- The device is mechanically safe, mounting and power connection comply with the regulations.
- Both doors need to be closed and locked.
- The electrical operating data of the power supply comply with the requirements of the device.

**CAUTION!**
Installation, assembly, start-up and maintenance may only be performed by appropriately trained personnel. The regional occupational health and safety directives must always be observed.

**INFORMATION!**
The manufacturer delivers the device preconfigured and ready for operation. Due to the physics of the measurement, the operator has to perform an onsite calibration or an adjustment to the environmental conditions at the initial start-up.

**Switch on the power**

The device performs a self-test and calibrates the home position of the sensor. For this the sensor is moved inside the meter until it finds the home position. Afterwards the meter is ready for measurement. The display shows 00.0 as values. If this is the first time the device is switched on, it needs to be configured as described in the following chapters.

![Figure 5-1: The previous drawing shows the measured value after successful start-up](image-url)
5.3 Operating elements

The operation elements consist of the four operation keys below the display. In the texts of this documentation each operation key has a specific symbol:

<table>
<thead>
<tr>
<th>Operating key</th>
<th>Symbol in text</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;</td>
<td>▶</td>
</tr>
<tr>
<td>←</td>
<td>◄</td>
</tr>
<tr>
<td>↑ or ↓</td>
<td>▲ or ▼</td>
</tr>
<tr>
<td>Esc: &gt; + ↑</td>
<td></td>
</tr>
<tr>
<td>▼</td>
<td>▼</td>
</tr>
</tbody>
</table>

The function of a key depends on the mode of the device and on the menu level:

<table>
<thead>
<tr>
<th>Key</th>
<th>Measuring mode</th>
<th>Menu mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Main menu level</td>
<td>Sub-menu or function level</td>
</tr>
<tr>
<td>&gt;</td>
<td>Switch from measuring mode to menu mode; press key for 2.5 seconds [display shows “keep key pressed” and countdown] and release it within further 2.5 seconds [display shows “release key now” and countdown]</td>
<td>Access to displayed menu, then 1st submenu is displayed</td>
</tr>
<tr>
<td>←</td>
<td>Reset of the display controller</td>
<td>Return to measuring mode (prompt appears whether the data should be saved)</td>
</tr>
<tr>
<td>↑ or ↓</td>
<td>Switch between measuring pages</td>
<td>Select menu, moving up or down</td>
</tr>
<tr>
<td>Esc: &gt; + ↑</td>
<td>No function</td>
<td>No function</td>
</tr>
<tr>
<td>▼</td>
<td>Starting measurement cycle manually and press key for 2.5 seconds [display shows “keep key pressed” and countdown] and release it within further 2.5 seconds [display shows “release key now” and countdown]</td>
<td>No function</td>
</tr>
</tbody>
</table>
5.4 Measuring page

After switching on the power, the display always shows the measuring page. Right beside all measuring results you see the corresponding unit at the end of the line. Only if there is no unit available it is left out (this is only the case with the diagnosis values).

The following drawing shows an example of the measuring page in the measuring mode "Level":

![Figure 5-2: Example of the measuring page](image)

Pressing ↑ will bring you to the status page.
If profile mode is applied, a second measuring page can be chosen, presenting the profile of the measurement as bar plot.
5.4.1 Navigating through the menus

To switch from the measuring mode to the menu mode you have to execute the following steps:

- Press ▶ for at least 2.5 seconds (meanwhile the display shows the text “keep key pressed” and a time counting back).
- After 2.5 seconds release the pressed key (you have to do this within the next 2.5 seconds during which the display shows the text “release key now” and a time counting back).

You are in the main menu level of the menu mode. The display always looks as follows:

Display in main menu level

Figure 5-3: Example for selection in main menu level

1. Indicates a possible status message in the status list (only if there are one or more messages)
2. Menu code of selected menu item (see table of menu structure or function tables)
3. Indicates position within the current item list
4. Next menu item, reachable by pressing ↓ (if “- - -” in this line indicates, this signalises the end of the list)
5. Selected menu item in bold characters
6. Previous menu item, reachable by pressing ↑ (if “- - -” in this line indicates, this signalises the beginning of the list)

The main menu mode consists of the main menus “quick setup”, “test”, “setup” and “service”. You can either leave the main menu level and return to the measuring mode or choose and enter a main menu:

- Press ◀ to return to the measuring mode (in this case a prompt appears and asks if you want to save the changed data; choose “Yes” or “No” using ↓ or ↑ and confirm by pressing ▶).
- If you do not want to leave the main menu level, press ▶ to enter the first main menu (“quick setup”) or choose another main menu using ↑ or ↓ and enter it by pressing ▶.

You are in the submenu level. The display always looks as follows:
The submenu level consists of the first and second submenu level. The principle of choosing a menu item is always the same:

- Press > to enter the first menu item or choose another menu item using ↑ or ↓ and enter it by pressing >.
- You navigate through the tree structure of the submenu level, finally you always reach the parameter or data level.
- If you want to return to the main menu level without saving the input, press > and ↑ at the same time.
- If you want to return to the main menu level and save your input, press ← one or more times depending on the level you are (pressing ← results in moving one level upwards until you reach the main menu level).
On the parameter level you see a list with one or more parameters or data. You can scroll through this list using ↑ or ↓:

**INFORMATION!**

Like the lowest menu level (i.e. the parameter or data level) some submenus also offer the possibility to make adjustments. The procedure is similar to the procedure on the parameter level.

On the parameter level you see a list with one or more parameters or data. You can scroll through this list using ↑ or ↓:

**INFORMATION!**

In this list all parameters or data which have been changed (i.e. they deviate from the default setting) have a check mark at the right end of their line (see position number 4 in the following drawing).

Display with list of parameters or data

![Figure 5-5: Example of a list with parameters and data](image)

1. Indicates a possible status message in the status list (only if there are one or more messages)
2. Superior submenu or subsequent submenu
3. Menu code of selected parameter (see table of menu structure or function tables)
4. Denotes the change of a parameter (this marking allows to simply and quickly identify all data which differ from the default setting when browsing through the list); instead of the check mark there can also appear a lock symbol at this position, it indicates a parameter that cannot be changed because of the parameter lock on the front.
5. Indicates position within the current item list
6. Next menu item, reachable by pressing ↓ (if “- - -” in this line indicates, this signals the end of the list)
7. Currently setting of the chosen menu item
8. Selected menu item, in bold characters
9. Previous menu item, reachable by pressing ↑ (if “- - -” in this line indicates, this signals the beginning of the list)

On the parameter or data level you have the possibility to change the decimal point, numbers, units or settings. Before that you have to choose the desired parameter or data and open to edit it as follows:

- Press > to open and edit the first list item or choose another item using ↑ or ↓ and press >.
- You are in the parameter edit mode now. All changeable values are highlighted and shown reverse (if nothing is shown reverse, you are in the read-only view and you cannot change the setting).
- Use ↑ or ↓ to change the highlighted area; if there are numerical values or a decimal point to be changed, you can move the cursor with > to the desired position and change its value using ↑ or ↓.
- If you want to return to the parameter or data list and save your input, press ↵; afterwards you can press ↵ one or more times to return to the main menu.
- If you want to return to the next higher level without saving the input, press > and ↑ at the same time.
Display with parameter or data ready to edit

Figure 5-6: Example of parameter or data ready to edit

1. Indicates a possible status message in the status list (only if there are one or more messages)
2. Superior submenu or subsequent submenu
3. Menu code of selected parameter [see table of menu structure or function tables]
4. Symbol denotes that there is a factory setting
5. Symbol denotes that there is a permissible value range
6. Permissible value range [for numerical values]
7. Currently set value, unit or function that you can change [always appears with highlighted background]
8. Current selected parameter
9. Factory setting of parameter [non-alterable]
### 5.5 Menu mode structure

**INFORMATION!**

The following table just presents an overview. When programming the device, always consult the function tables additionally as they contain further information!

<table>
<thead>
<tr>
<th>Measuring mode</th>
<th>Main menu</th>
<th>Submenu</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 or 4 pages, scrolling with ↓ or ↑</td>
<td>&gt; 2.5 s</td>
<td>A quick setup</td>
<td>&gt; 2.5 s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; A1 language</td>
<td>&gt; A1 language</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; A2 set clock</td>
<td>&gt; A2 set clock</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; A3 reset errors</td>
<td>&gt; A3 reset errors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; A4 measuring function</td>
<td>&gt; A4 measuring function</td>
</tr>
<tr>
<td></td>
<td></td>
<td>↓↑</td>
<td>↓↑</td>
</tr>
<tr>
<td></td>
<td>&gt; 2.5 s</td>
<td>B test</td>
<td>&gt; 2.5 s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; B1 simulation</td>
<td>&gt; B1 simulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; B2 actual values</td>
<td>&gt; B2 actual values</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; B3 logbooks</td>
<td>&gt; B3 logbooks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; B4 information</td>
<td>&gt; B4 information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>↓↑</td>
<td>↓↑</td>
</tr>
<tr>
<td></td>
<td>&gt; 2.5 s</td>
<td>C setup</td>
<td>&gt; 2.5 s</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; C1 measuring</td>
<td>&gt; C1 measuring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; C2 maintenance</td>
<td>&gt; C2 maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; C3 I/O</td>
<td>&gt; C3 I/O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; C4 extended setup</td>
<td>&gt; C4 extended setup</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&gt; C5 device</td>
<td>&gt; C5 device</td>
</tr>
<tr>
<td></td>
<td></td>
<td>↓↑</td>
<td>↓↑</td>
</tr>
<tr>
<td></td>
<td></td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

**D service:** This menu is password protected and contains functions to be used by service personnel only.
5.6 Function tables

5.6.1 Menu A, quick setup

A1, language

Language selection (depends on the region for which the device has been ordered). Available languages: Deutsch, English, Français, Español

A2, set clock

Manual setting of date and time.

A3, reset errors

This function allows to reset all errors that are not reset automatically (e.g. motor blocked). You can answer the question “reset?” with the following options: no (exit without reset) / yes (reset and exit the function).

A4, measuring function

This menu shows the different measurement functions of the sludge level meter. Choose between: “level”, “profile”, “zonetracking” and “manual operation”. For further information refer to Measuring function on page 61.

5.6.2 Menu B, test

The procedure to start the simulation process is the same for all functions:

• Choose the function using ↑ or ↓ and press >.
  
  You see the two options set value (opens the editor to enter the simulation value) and break (exit the menu without simulation).

• Choose the desired option using ↑ or ↓ and press >.
  
  If you choose break you will exit the menu without simulation. If you chose set value, the device asks start simulation and offers the options no (exit the menu without simulation) or yes (starts the simulation finally).

• Choose the desired option using ↑ or ↓ and press >.
  
  If you choose yes, the simulation starts. If you choose no, you will exit the menu without simulation.

B1, simulation

<table>
<thead>
<tr>
<th>Menu level</th>
<th>Designation / function</th>
<th>Settings / descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>current out A</td>
<td>Allows simulation of the corresponding value. It might be useful during installation.</td>
</tr>
<tr>
<td>B1.2</td>
<td>current out B</td>
<td></td>
</tr>
<tr>
<td>B1.3</td>
<td>relay 1</td>
<td></td>
</tr>
<tr>
<td>B1.4</td>
<td>relay 2</td>
<td></td>
</tr>
<tr>
<td>B1.5</td>
<td>cleaning</td>
<td></td>
</tr>
</tbody>
</table>

B2, actual values

<table>
<thead>
<tr>
<th>Menu level</th>
<th>Designation / function</th>
<th>Settings / descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>operating hours</td>
<td>This menu shows the operating time of the devices in hours.</td>
</tr>
<tr>
<td>Menu level</td>
<td>Designation / function</td>
<td>Settings / descriptions</td>
</tr>
<tr>
<td>------------</td>
<td>-------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>B2.2</td>
<td>ADC value</td>
<td>This menu shows the raw ADC value of the sensor.</td>
</tr>
<tr>
<td>B2.3</td>
<td>sensor temperature</td>
<td>This menu shows the actual temperature of the sensor.</td>
</tr>
<tr>
<td>B2.4</td>
<td>electr. temperature</td>
<td>This menu shows the actual temperature of the mainboard.</td>
</tr>
<tr>
<td>B2.5</td>
<td>sensor voltage</td>
<td>This menu shows the actual voltage of the sensor in volt.</td>
</tr>
</tbody>
</table>

5.6.3 Menu C, setup

C1, measuring

<table>
<thead>
<tr>
<th>Menu level</th>
<th>Designation / function</th>
<th>Settings / descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1.1</td>
<td>measuring function</td>
<td>This menu shows the different measurement functions: &quot;level&quot;, &quot;profile&quot;, &quot;zonetracking&quot; and &quot;manual operation&quot;. For further information refer to Measuring function on page 61</td>
</tr>
<tr>
<td>C1.2</td>
<td>measuring mode</td>
<td>This menu shows the different measurement modes of the level measurement and can be switched from &quot;depth&quot; to &quot;height&quot;.</td>
</tr>
<tr>
<td>C1.3</td>
<td>definition fluff</td>
<td>This menu shows the concentration of the fluff and can be set (this menu is displayed only if &quot;level&quot; or &quot;manual operation&quot; is selected in C1.1). Default: 0.5 g/l</td>
</tr>
<tr>
<td>C1.4</td>
<td>def. sludge blanket</td>
<td>This menu shows the concentration of the sludge blanket and can be set (this menu is displayed only if &quot;level&quot;, &quot;zonetracking&quot; or &quot;manual operation&quot; is selected in C1.1). Default: 5 g/l</td>
</tr>
<tr>
<td>C1.5</td>
<td>hysteresis</td>
<td>This function allows to set the hysteresis value of the zone tracking mode. (this menu is displayed only if &quot;zonetracking&quot; is selected in C1.1). Range: 0...5 g/l; Default: 0 g/l</td>
</tr>
</tbody>
</table>
### C1, menu level 1

<table>
<thead>
<tr>
<th>Menu level</th>
<th>Designation / function</th>
<th>Settings / descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1.6</td>
<td>tracking time</td>
<td>Definition of the time period the sensor is remaining in parking position, when elapsed the sludge level will be tracked again (this menu is displayed only if “zonetracking” is selected in C1.1).&lt;br&gt;Range: 20...999 seconds; Default: 30 seconds</td>
</tr>
<tr>
<td>C1.7</td>
<td>tracking position</td>
<td>Definition of the relative parking position of the sensor above the sludge level (this menu is displayed only if “zonetracking” is selected in C1.1).&lt;br&gt;Range: 0.05...0.3 m; Default: 0.15 m</td>
</tr>
<tr>
<td>C1.8</td>
<td>start signal</td>
<td>This menu shows the start signal for the measurement and can be set to “Timer” (via build in timer) or “Trigger input” (via external switch on control input 1 and/or 2). This menu is displayed only if “level” or “profile” is selected in C1.1</td>
</tr>
<tr>
<td>C1.9</td>
<td>timer interval</td>
<td>This menu shows the timer interval for starting the measurement and can be set in minutes (this menu is displayed only if “timer” is selected in C1.8. and “level” or “profile” in C1.1).&lt;br&gt;Range: 1...999 min; Default: 10 min</td>
</tr>
<tr>
<td>C1.10</td>
<td>units</td>
<td>This menu groups several functions to define the units of the measuring results. These units are used for all values of the related unit group on the display (measuring screen and parameters).</td>
</tr>
<tr>
<td>C1.10.1</td>
<td>height / depth</td>
<td>This function allows to define the unit for level measurement. Options: m, feet, inch, cm</td>
</tr>
<tr>
<td>C1.10.2</td>
<td>temperature</td>
<td>This function allows to define the temperature unit. Options: °C, °F, K</td>
</tr>
<tr>
<td>C1.10.3</td>
<td>concentration</td>
<td>This function allows to define the concentration unit. Options: g/l, mg/l</td>
</tr>
</tbody>
</table>

### C2, maintenance

<table>
<thead>
<tr>
<th>Menu level</th>
<th>Designation / function</th>
<th>Settings / descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2.1</td>
<td>calibration</td>
<td>In this menu the concentration measurement can be calibrated. For further information refer to Calibration on page 65.</td>
</tr>
<tr>
<td>C2.2</td>
<td>ref. position calib.</td>
<td>In this function the reference point calibration of the height / depth measurement can be set. Depending on the application this might be necessary due to dirt accumulation on the cable. Options: off or timer interval&lt;br&gt;Default: off</td>
</tr>
<tr>
<td>C2.2.1</td>
<td>activation</td>
<td>This function allows to activate the ref. position calibration. Options: off or timer interval&lt;br&gt;Default off</td>
</tr>
<tr>
<td>C2.2.2</td>
<td>timer interval</td>
<td>Timer interval of reference point calibration. This menu is only displayed if “time interval” is selected in C 2.2.&lt;br&gt;Range: 2...999 hours&lt;br&gt;Default: 1 hour</td>
</tr>
</tbody>
</table>

### C3, I/O

<table>
<thead>
<tr>
<th>Menu level</th>
<th>Designation / function</th>
<th>Settings / descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>C3.1</td>
<td>current out A</td>
<td>Settings of the corresponding current output. In height/depth mode, the current output is calculated automatically.</td>
</tr>
<tr>
<td>C3.1.4</td>
<td>height / depth 4 mA</td>
<td>Indicates the height/depth for 4 mA, calculated based on entered basin geometries - read only</td>
</tr>
<tr>
<td>C3.1.5</td>
<td>height / depth 20 mA</td>
<td>Indicates the height/depth for 20 mA, calculated based on entered basin geometries - read only.</td>
</tr>
<tr>
<td>Menu level</td>
<td>Designation / function</td>
<td>Settings / descriptions</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>C3.1.6</td>
<td>error current</td>
<td>This function allows to define the current which indicates the error condition. Range: 3...22 mA (condition: outside of extended range); Default: 21.5 mA</td>
</tr>
<tr>
<td>C3.1.7</td>
<td>error condition</td>
<td>This function allows to define the indicated error categories. Options: • error in device: only errors of category F • application error: errors of category F • out of specification: errors of category S • off</td>
</tr>
<tr>
<td>C3.1.8</td>
<td>time constant</td>
<td>Range: 0...500 seconds; Default: 0 seconds</td>
</tr>
<tr>
<td>C3.2</td>
<td>current out B</td>
<td>Refer to submenus of current output A. Settings of the corresponding current output. In height/depth mode, the current output is calculated automatically.</td>
</tr>
<tr>
<td>C3.2.4</td>
<td>height / depth 4 mA</td>
<td>Indicates the height/depth for 4 mA, calculated based on entered basin geometries - read only (this menu is displayed only if “level” is selected in C1.1).</td>
</tr>
<tr>
<td>C3.2.5</td>
<td>height / depth 20 mA</td>
<td>Indicates the height/depth for 20 mA, calculated based on entered basin geometries - read only (this menu is displayed only if “level” is selected in C1.1).</td>
</tr>
<tr>
<td>C3.2.4</td>
<td>concentration 4 mA</td>
<td>Definition of the sludge concentration at 4 mA (this menu is displayed only if “profile” or “zonetracking” is selected in C1.1). Range: 0...10 g/l; Default: 0 g/l</td>
</tr>
<tr>
<td>C3.2.5</td>
<td>concentration 20 mA</td>
<td>Definition of the sludge concentration at 20 mA (this menu is displayed only if “profile” or “zonetracking” is selected in C1.1). Range 0...100 g/l; Default: 10 g/l</td>
</tr>
<tr>
<td>C3.2.6</td>
<td>error current</td>
<td>Definition of the current which indicates the error condition. Range: 3...22 mA (condition: outside of extended range); Default: 21.5 mA</td>
</tr>
<tr>
<td>C3.2.7</td>
<td>error condition</td>
<td>This function allows to define the indicated error categories. Options: • error in device: only errors of category F • application error: errors of category F • out of specification: errors of category S • off</td>
</tr>
<tr>
<td>C3.2.8</td>
<td>time constant</td>
<td>Range: 0.1...500 seconds; Default: 0 seconds</td>
</tr>
<tr>
<td>C3.3</td>
<td>control input 1</td>
<td>Settings of the corresponding control input.</td>
</tr>
<tr>
<td>C3.3.1</td>
<td>mode</td>
<td>This function allows to define the different modes of the corresponding control input. Options: • off • rake guard • trigger input</td>
</tr>
<tr>
<td>C3.3.2</td>
<td>Invert signal</td>
<td>This function allows to define how the control input is activated. Options: off (control input is activated when the contact get closed at the input), on (control input is activated when the contact is opened at the input).</td>
</tr>
<tr>
<td>C3.4</td>
<td>control input 2</td>
<td>Refer to submenus of control input 1 (all submenus and options are identical, except that they start with C3.4).</td>
</tr>
<tr>
<td>C3.4.1</td>
<td>mode</td>
<td>This function allows to define the different modes of the corresponding control input. Options: • off • rake guard • trigger input</td>
</tr>
<tr>
<td>C3.4.2</td>
<td>invert signal</td>
<td>This function allows to define how the control input is activated. Options: • off (control input is activated when the contact is closed at the input) • on (control input is activated when the contact is opened at the input)</td>
</tr>
</tbody>
</table>
**C4, extended setup**

<table>
<thead>
<tr>
<th>Menu level</th>
<th>Designation / function</th>
<th>Settings / descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>C4.1</td>
<td>maximum depth</td>
<td>Definition of the maximum depth. Default: 0 meter. For further information refer to <em>Definition of positions and zones</em> on page 59.</td>
</tr>
<tr>
<td>C4.2</td>
<td>start position</td>
<td>Definition of the start position. Default: 0 meter. For further information refer to <em>Definition of positions and zones</em> on page 59.</td>
</tr>
<tr>
<td>C4.3</td>
<td>blind zone</td>
<td>Definition of the blind zone. Default: 0 meter. For further information refer to <em>Definition of positions and zones</em> on page 59.</td>
</tr>
<tr>
<td>C4.4</td>
<td>current incl. blind zone</td>
<td>Definition if blind zone is included in the current output calculation of height/depth. Default: no. For further information refer to <em>Definition of positions and zones</em> on page 59.</td>
</tr>
<tr>
<td>C4.5</td>
<td>rake height</td>
<td>Definition of the rake height. Default: 0 meter. For further information refer to <em>Definition of positions and zones</em> on page 59.</td>
</tr>
<tr>
<td>C4.6</td>
<td>cleaning</td>
<td>Settings of the cleaning unit.</td>
</tr>
</tbody>
</table>
### Menu level | Designation / function | Settings / descriptions
--- | --- | ---
C4.6.1 | activation | This function allows to activate cleaning:

**Options:**
- off
- time interval
- counter interval

C4.6.2 | time interval | This menu defines the time of the cleaning intervals (this menu is displayed only if timer interval is selected in C4.6.1).

Range: 10...999 min; Default: 60 min

C4.6.3 | counter interval | This menu defines the number of measurement cycles between cleaning (this menu is displayed only if counter interval is selected in C4.6.1).

Range: 1...99; Default: 1

C4.6.4 | Pump lead time | Definition of pump lead time (this menu is displayed only if "time interval" or "counter interval" is selected in C4.6.1).

Range: 0...120 seconds; Default: 0 seconds

C4.6.5 | Cleaning cycle | In this menu the number of cleaning cycles during one cleaning step can be set (this menu is displayed only if "time interval" or "counter interval" is selected in C4.6.1).

Range: 0...100; Default: 0

C4.6.6 | External pump | This menu defines if the external pump is controlled by the relays K3 (this menu is displayed only if "time interval" or "counter interval" is selected in C4.6.1).

Options: "yes" or "no"

### C5, device

This menu groups all functions that have no effect on the measurement or any output directly.

| Menu level | Designation / function | Settings / descriptions |
--- | --- | ---
C5.1 | device info | Information about the device. |
C5.1.1 | device serial no. | This menu shows the serial number of the device. |
C5.1.2 | mainboard | This menu gives information about the mainboard.
- First line: ID no. of the circuit board
- Second line: software version
- Third line: production date |
C5.1.3 | sensor electronic | This menu gives information about the mainboard.
- First line: ID no. of the sensor
- Second line: software version
- Third line: production date |
C5.1.4 | display | This menu gives information about the display.
- First line: ID no. of the sensor
- Second line: software version
- Third line: production date |
C5.2 display
This menu allows to adjust the contrast and the language of the display.

C5.2.1 language
Refer to A1 “language”.

C5.2.2 contrast
This function allows to adjust the contrast of the display [at extreme temperatures; below -25°C / -13°F may affect the readability of the display]. Note that a change of the contrast takes place immediately, not just when the menu mode is left! You cannot reset a change when leaving the programming mode without saving the changes! Range: -9...+9; Default: 0

C5.3 special functions
This menu groups several special functions.

C5.3.1 reset errors
Refer to A3 “reset”.

C5.3.2 password quick set
This function allows to define and activate a password for the access to the quick setup menu. Options: XXXX (if you enter four digits in the range of 0001...9999, then the password protection is enabled) / 0000 (password protection disabled).

C5.3.3 password setup
This function allows to define and activate a password for the access to the setup menu. Options: XXXX (if you enter four digits in the range of 0001...9999, then the password protection is enabled) / 0000 (password protection disabled).

5.7 Functions in detail

This chapter helps with the initial parametrisation of the device and with change of settings in detail during operation.
5.7.1 Definition of positions and zones

Figure 5-7: Definition of zones and positions

1. **Home position**: this position marks the home (or zero point position) of the sensor. After any change of the settings, a zero point calibration for the level measurement is initiated; the sensor will always return to this position. Additionally, zero point calibration can also be performed by setting a time interval.

2. **Start position**: this marks the position of sensor in which the sensor starts from and returns to during operation.

3. **Blind zone**: in this zone the concentration measurement is not active, in order to avoid wrong measurements due to sunlight or other interferences, before the sensor is immersed into the water. You can prevent unwanted measurement by setting this zone to be 0.3 m / 1 ft below the normal liquid surface.

4. **Maximum immersion depth**: this is the maximum distance from the home position. The sensor will stop at this depth if it detects no sludge. Note: the sensor might stop and return at a shorter distance if a rake height is set.

5. **Measuring zone**: in this zone the sensor delivers its measuring results and the output signal varies from 4...20 mA. Note! In case that no start position is set, the measuring zone equals the maximum depth. Depending on the settings the blind zone can either be in- or excluded in the calculation of the current output.

6. **Measuring range**: distance from liquid surface to bottom of the tank.

7. **Fluff layer**: fluff or sludge cloud. The concentration has to be set as “fluff”.

8. **Sludge blanket**: the concentration has to be set as “sludge blanket”.

9. **Bottom rake zone**: here a possibly existing bottom rake operates. The top of this zone is the height where the sensor always has to stop during lowering to avoid hitting the bottom rake. This has to be set as rake height in the menu.

10. **Floating sludge**: sludge which floats on the surface. To avoid wrong measurements the blind zone has to be set below the floating sludge.
5.7.2 Initial configuration in extended settings

Before start of the operation a few important entries have to be made at the measuring device. For further information refer to Definition of positions and zones on page 59. These settings will also automatically scale the 4...20 mA outputs. Execute the following steps before starting the first measurement:

First step: Change the working mode
- Change the measuring function to manual operation and lower the sensor by using the arrow keys.

Second step: Find out the distances
- Lower the sensor head 0.3 m / 1 ft below the liquid surface and note the level as the blind zone. Lower the sensor further until it reaches the bottom of the tank. (You can identify this point by watching the cable got slack.) Pull up the sensor until you have about 5 cm / 2” of clearance between the bottom of the clarifiers and the sensor. Note the level as the maximum depth.

Third step: Entering the distances
- Select the menu “Extended setup” and enter blind zone and max. depth.
- If rake is present you can go to the option rake height and enter the value.
5.7.3 Measuring function

In the menu point C1.1 the measuring function can be selected. There are 4 different settings:

1. **Level**: In this mode the level of sludge blanket and fluff is monitored. Thus the meter measures the height / depth of two distinctly different concentrations simultaneously. The two heights from the last measurement cycle are held at the current outputs of the device and are updated at the end of every further cycle. This mode is primarily used to control the sedimentation and the sludge washout.

2. **Profile**: The profile measurement gives a broad overview about the sedimentation process from the surface to the bottom of the sedimentation tank. This function allows to create a sludge level profile concentration in g/l versus position. When the mode is selected a third measurement result page can be displayed. On this measurement page a graphical representation of the measured sludge level profile is shown which gives a general overview of the collected information. This function is regularly used during configuration of the instrument. In this mode, the time constant of the analogue outputs and the input at the PLC should be zero to get the profile in real time without any shifts.

3. **Zone tracking**: This menu is primarily used in processes observing the sedimentation level continuously (e.g. sludge abstraction) with high time resolution. The zone tracking mode allows to track a defined sludge level, thus the sensor will remain in the process in a defined parking position above the sludge concentration. The tracking is time controlled. When the tracking time elapses the sensor will be moved down and the sludge level searching will be repeated. When the sludge level has been found the sensor is moved back to the parking position again. When the sludge level is increasing and is reaching the sensor, its position will be moved up until the sludge concentration drops below the user defined limit. Starting from this position the sludge level will be tracked again.

4. **Manual operation**: The manual operation can be either selected by the menu or by switching the limit switch. If set to manual operation, the sensor is reeled up out of the medium and no longer react to any trigger (timer or control input). The two current outputs are “frozen” at the last measurement value and the arrow keys on the keypad can be used to move the sensor manually. This function is used for initial configuration and calibration of the device. It also makes it easy to perform maintenance activities.

**INFORMATION!**
As soon the user enters the manual operation mode the current outputs are frozen. After completion of the settings and return to normal measuring mode, the current outputs and display are reset to “0”. If the user needs an actual reading right away, please press ↓ to trigger a manual measuring cycle.

**Selection of measuring functions in menu C1.1**

| Press > for more than 2.5 seconds, then release the button. |
| Press ↓ or ↑ until the main menu **setup** is highlighted. |
| Press > to enter the chosen menu. |
| Press ↓ or ↑ to select **measuring function**. |
| Press > to enter the chosen menu. |
| Press ↓ or ↑ to select **level, profile, zone tracking** or **manual operation**. |
| Press ← to confirm. |
| Press ← several time until you reach the measuring mode again. Choose yes to save and confirm your selection. |
5.7.4 Assignment of current outputs

The function of outputs is different regarding which measuring function has been selected. It is changing automatically if the measuring function has been changed as outlined in the following table.

<table>
<thead>
<tr>
<th>Measuring function</th>
<th>Level</th>
<th>Profile</th>
<th>Zone tracking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current output A</td>
<td>Height / depth of concentration</td>
<td>Height / depth of sensor position</td>
<td>Height / depth of sensor position</td>
</tr>
<tr>
<td>Current output B</td>
<td>Height / depth of concentration</td>
<td>Measured concentration</td>
<td>Measured concentration</td>
</tr>
</tbody>
</table>

1. Range is calculated automatically according to the parameters filled in the extended setup; range of analog output is shown in the I/O setup of the device.
2. Concentration range of the output must be defined in the I/O setup of the device.

5.7.5 Measuring mode

The level measurement can be set in two different ways:

1. Height: The height of the sludge blanket/fluff measured from the bottom of the tank is displayed. Zero (resp. 4 mA) is at the bottom of the tank.
2. Depth: The depth of the sludge blanket/fluff measured from the liquid surface is displayed. Zero (resp. 4 mA) is at the liquid surface or at the home position.

The height / depth ratio of the sensor is calculated in the following way:
Height / depth = maximum immersion depth (- blind zone) - start position.

Selection of measuring functions in menu C1.2

Press > for more than 2.5 seconds, then release the button.
Press ↓ or ↑ until the main menu setup is highlighted.
Press > to enter the chosen menu.

Press ↓ or ↑ to select measuring mode.
Press > to enter the chosen menu.

Press ↓ or ↑ to select height, or depth.
Press ← to confirm.

Press ← several time until you reach the measuring mode again. Choose yes to safe and confirm your selection.

**INFORMATION!**
If the blind zone should be included in this calculation ensure that "yes" is selected in menu C4.4.
5.7.6 Definition of fluff and blanket concentration

In these menus the concentration of the fluff respectively the sludge blanket has to be set. In level mode these two concentrations are monitored in respect to the home position. During the measurement cycle the fluff concentration is tracked first, while the sensor is moving down.

The factory settings of these values are:
1. Concentration fluff: 0.5 g/l
2. Concentration sludge blanket: 5 g/l

Selection of measuring functions in menu C1.3 / C1.4

Press ▶️ for more than 2.5 seconds, then release the button. Press ↓ or ↑ until the main menu setup is highlighted. Press ▶️ to enter the chosen menu. Press ↓ or ↑ to select measuring mode. Press ▶️ to enter the chosen menu. Press ↓ or ↑ until the main menu definition fluff or def. sludge blanket is highlighted. Press ▶️ to enter the chosen menu. An editor opens Press ↓ or ↑ to set concentration. Press ↔ to enter the chosen menu. Press ↔ several time until you reach the measuring mode again. Choose yes to safe and confirm your selection.

5.7.7 Definition of settings in zone tracking mode

Applying the zone tracking mode requires additional setup of the following points:

**Hysteresis:** The sludge concentration definition sludge blanket - hysteresis defines the limit to correct the sensor position and track the sludge level again. For further information refer to Menu C, setup on page 53.

Example for hysteresis: Definition blanket concentration is set to 10 g/l and hysteresis is set the 2 g/l. The concentration 10 g/l is searched, if found the sensor is moving to the parking position. When a concentration increase above 8 g/l is detected while the sensor is in parking position it will be moved up for position correction and for tracking the sludge level again.

**Tracking time:** Definition of the time period the sensor is remaining in parking position, when the time elapsed the sludge level will be tracked again. For further information refer to Menu C, setup on page 53.

**Tracking position:** Definition of the relative parking position of the sensor above the sludge level. For further information refer to Menu C, setup on page 53.
5.7.8 Rake guard / trigger input

The control inputs 1 & 2 can be selected as a rake guard or an external trigger. Here a limit switch should be used which is not part of the scope of delivery (you have to purchase this switch from another manufacturer).

1. **Rake guard**: In this mode the limit switch is used to interrupt the sampling process in case the rake is passing the meter and the sensor is reeled up to avoid collisions and damage. Both control inputs can be set to rake guard via the sub menus C 3.3/3.4 Control input 1 / 2. For further information refer to *Function tables* on page 52. For information concerning the electrical connection of a limit switch refer to *Electrical connection of control inputs* on page 38.

2. **External trigger**: In this mode the limit switch is used to trigger the sampling process. When the moving device (e.g. a rake) contacts the limit switch, the sampling process starts. Both control inputs can be set to external trigger via the sub menus C 3.3/3.4 Control input 1 / 2 and C1.8 start signal. For further information refer to *Function tables* on page 52. For information concerning the electrical connection of a limit switch refer to *Electrical connection of control inputs* on page 38.

**DANGER!**

To avoid damages or destructions, use a limit switch in all applications where a rake or other moving devices may come in contact with the sensor or cable! The manufacturer does not assume any responsibility for damages caused by the absence or malfunction of the rake guard limit switch.

5.7.9 Timer / start signal

If there is no danger for the sensor or cable to be caught by moving devices (i.e. installation in thickeners without rakes) the time based trigger mode can be selected.

- To enable the timer, the start signal has to be set to Timer. This can be done in the submenu C1.8 start signal.
- After that the timer interval in minutes can be selected in the submenu C1.9 timer interval.

For further information refer to *Menu C, setup* on page 53.

5.7.10 Maintenance switch

The maintenance switch allows immediate access to manual operation mode without navigating through the menu, e.g. for maintenance works. The system can be directly controlled with the arrow keys on the keypad. In this case both current outputs are "frozen" at the last measurement value. By deactivating the maintenance switch a new measurement cycle will be initiated.
5.7.11 Calibration

INFORMATION!
Before leaving the factory the sensor is calibrated to offer an accurate measurement. Though it might be necessary to re-calibrate the sensor during the lifetime of the system.

INFORMATION!
Even after the installation, a recalibration might improve the accuracy.

There are two forms of calibration. First is the zero point calibration, which has to be performed if the measured value shows discrepancies in the low measuring range. Second is the calibration of the concentration which has to be performed if the sensor shows discrepancies in the middle or high measuring range.

Both types of calibration can be performed individually. However, for a full recalibration, both calibrations have to be performed in the following order:
1. Zero point calibration [Step 3]
2. Calibration of the concentration [Step 4a, 4b and 4c]

INFORMATION!
As soon the user enters the calibration menu the current outputs are frozen. After completion of the calibration cycle and return to measuring mode, the current outputs are reset to “0”. If the user needs the actual reading right away, please press arrow down to trigger a manual measuring cycle.

Step 1: entering the calibration procedure

Press >> for more than 2.5 seconds, then release the button.
Press ↓ or ↑ until the main menu setup is highlighted.
Press >> to enter the chosen menu.

Press ↓ or ↑ to select maintenance.
Press >> to enter the chosen menu.
Press ↓ or ↑ to select calibration.
Press >> to enter the chosen menu.

set cal. position? is shown.
• Press ↓ or ↑ to choose on.
• Press ← to enter the chosen menu.

Now the info please wait is shown and the sensor moves in the start position.

A submenu with move sensor, calibrate zero and calibrate conc. is shown as explained in the following tables.

Step 2: move sensor

Press ↓ or ↑ until the submenu move sensor is highlighted.
Press >> to enter the chosen menu.
Press ↓ or ↑ to move the sensor in the desired position.

For calibrate zero - Put the sensor in a bucket with deaerated clean water. Cover the bucket with a cloth e.g. in order to protect the sensor from sunlight.
For calibrate conc. - Move the sensor into sludge layer to which the sensor shall be calibrated on.
Press ← to get back in the submenu.
Step 3: calibrate zero

Press \( \downarrow \) or \( \uparrow \) until the submenu `calibrate zero` is highlighted. Press \( \rightarrow \) to enter the chosen menu.

- `actual value` is shown. Press \( \leftrightarrow \) to enter the chosen menu.
- `calibrate zero` is shown. Press \( \downarrow \) or \( \uparrow \) to select `calibrate` to calibrate or `break` to interrupt the calibration. Press \( \leftrightarrow \) to enter the chosen menu.

The calibration zero is done.
- Press \( \leftrightarrow \) several time until you reach the measuring mode again. Choose `yes` to safe and confirm your selection.

Depending if you know the reference value please use either Step 4a or 4b

Step 4a: calibrate conc. with known reference value

Start the calibration process with step 2: move sensor

Press \( \downarrow \) or \( \uparrow \) until the submenu `calibrate conc.` is highlighted. Press \( \rightarrow \) to enter the chosen menu.

- `reference value` is shown. Press \( \downarrow \) or \( \uparrow \) to enter the reference value between 0...100 g/l. Press \( \leftrightarrow \) to confirm the value.
- `ADC value` is shown. Press \( \downarrow \) or \( \uparrow \) to choose between `stored value` to use the stored value or `actual value` to use the actual value for calibration.

Press \( \downarrow \) or \( \uparrow \) to select `actual value`. Press \( \leftrightarrow \) to enter the chosen menu.

- `actual value` is shown. Press \( \leftrightarrow \) to confirm the value.
- `use value` is shown. Press \( \downarrow \) or \( \uparrow \) to choose between `break` to interrupt the calibration, `calibrate` to adjust the actual value to the reference value or `save ADC value` to save the actual value.

Press \( \downarrow \) or \( \uparrow \) to select `calibrate`. Press \( \leftrightarrow \) to enter the chosen menu.

Press \( \leftrightarrow \) several time until you reach the measuring mode again. Choose `yes` to safe and confirm your selection.
Step 4b (I): save raw values (ADC)

Start the calibration process with step 2: move sensor

Press ↓ or ↑ until the submenu calibrate conc. is highlighted.
Press > to enter the chosen menu.

reference value is shown.
Press ← to skip this function.

ADC value is shown.
Press ↓ or ↑ to choose between stored value to use the stored value or actual value to use the actual value for calibration.

Press ↓ or ↑ to select actual value.
Press ← to enter the chosen menu.

actual value is shown.
Press ← to confirm the value.

use value is shown.
Press ↓ or ↑ to choose between break to interrupt the calibration, calibrate to adjust the actual value to the reference value or save ADC value to save the actual value.

Press ↓ or ↑ to select save ADC value.
Press ← to enter the chosen menu.

Press ← several time until you reach the measuring mode again.
Choose yes to safe and confirm your selection.

A sludge sample from the same position where the sensor was for calibration has to be taken and analysed in the lab -> once the lab result is determined return to the meter and enter the reference value in order to calibrate the meter.

Step 4c (II): calibrate conc. with reference value of laboratory results

Press ↓ or ↑ until the submenu calibrate conc. is highlighted.
Press > to enter the chosen menu.

reference value is shown.
Press ↓ or ↑ to enter the reference value.
Press ← to confirm the value.

ADC value is shown.
Press ↓ or ↑ to choose between stored value to use the stored value or actual value to use the actual value for calibration.

Press ↓ or ↑ to select stored value.
Press ← to enter the chosen menu.

stored value is shown.
Press ← to confirm the value.

use value is shown.
Press ↓ or ↑ to choose between break to interrupt the calibration, calibrate to adjust the actual value to the reference value or save ADC value to save the actual value.

Press ↓ or ↑ to select calibrate.
Press ← to enter the chosen menu.

Press ← several time until you reach the measuring mode again.
Choose yes to safe and confirm your selection.

INFORMATION!
When the zero calibration of the sensor is done in a medium with a higher turbidity than used for the concentration reference point, it will cause invalid mapping of sensor values to the mapped unit [g/l]. The device automatically detects this failure and will report an application error message “sensor calibration wrong” on the message screen. The error will remain until the sensor is correctly calibrated by the user.
5.7.12 Reference point calibration

The reference point calibration allows calibrating the home position (height/depth) of the sensor in regular intervals (1...999 h). This might be necessary if e.g. dirt causes deposition on the cable. The reference point calibration compensates accuracy degradation because of dirt depositions on the cable.

**INFORMATION!**
*When zone tracking is the selected measuring function, the sensor will be moved out of the medium for zero calibration.*

5.7.13 Passwords

You can activate passwords for different menu levels:

### Password levels

<table>
<thead>
<tr>
<th>Menu</th>
<th>Password required</th>
<th>Point of query</th>
<th>Preview of setting possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quick setup</td>
<td>For quick setup</td>
<td>At entry to the parameter edit mode</td>
<td>No</td>
</tr>
<tr>
<td>Test</td>
<td>For setup</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service</td>
<td>For service</td>
<td>At entry to the service menu</td>
<td>No</td>
</tr>
</tbody>
</table>

**Common usage**

- Protection of the menus “Test” and “Setup” with a password, free access to the menu “Quick setup”. You can achieve this by activating a setup password only.
- Protection of the quick setup with a known password and confidential setup password to protect the quick setup against arbitrary use and the setup and test menus against misuse. This is done by activating a password for the menus “setup” and “quick setup”.

**INFORMATION!**
*If you activate a password for the menu “Quick setup” only and not for the menu “Setup”, the menus “Setup” and “Test” will not be protected by the quick setup password.*

5.7.14 Timeout function

**INFORMATION!**
*Independent of the mode (menu mode or test mode, see below), all changes done until an automatic return are lost if this return happens!*

**Menu mode**

If the user does not press any key in a 5 minutes time frame and the device is not in the test mode, it automatically returns to the measuring mode (i.e. the display shows one or more measuring results).
5.8 Status messages and diagnostic information

INFORMATION!
Note the following information concerning the tables with the status messages in the following subsections:

- The device groups all error messages and maps them according to their category and importance; the following subsections and their tables represent the categories and the order of importance. You find a short description of the error category in the table below.
- On the display you recognize the error category with the help of the character in front of the message (e.g. all failure messages start with a bold "F"); these characters are independent of the used language, they were individually defined by the manufacturer.
- If messages of the category F, F and S appear and the device is in the normal measuring mode, a triangle in the header appears (this triangle does not appear if only information is shown).
- Different error classes can be set on status output or current output fault current (depending on the severity of the fault).

INFORMATION!
Note that messages are shown in the GDC device for information purposes, too. They do not affect any status change of the device or the measured values and are not planned in NE64, VDI/VDE 2650 or NE107.

The sludge level meter provides a status log book which is capable of storing the occurrence as well as the disappearances of error of the classes: device failure, application failure and out of specification errors.

An entry within the status log book consists of two lines
1. Line 1: Error class and message test
2. Line 2: Number, date and time (1 for occurrence and 0 for disappearance)

The latest status log entry is always displayed first, older values are stored in ascending order based on date and time of the entry. The number of log book entries is limited to 128, as soon as the limit is reached the existing entries will be overwritten by new entries.
**Explanation of the error categories**

<table>
<thead>
<tr>
<th>Letter on display</th>
<th>Error category according to:</th>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bold “F”</td>
<td>Failure</td>
<td>Device failure</td>
<td>Repair or replacement necessary!</td>
</tr>
<tr>
<td>F (not bold)</td>
<td>Application failure</td>
<td>No internal error, but application error has occurred; device ok, but measurement not possible.</td>
<td>Application test or operator action necessary!</td>
</tr>
<tr>
<td>S</td>
<td>Out of specification</td>
<td>Measurement out of specification; measurement continues, but measured values only restrictedly usable.</td>
<td>Maintenance and an accurate check required!</td>
</tr>
<tr>
<td>C</td>
<td>Check request</td>
<td>Either the device is outside operation (standby, measured value is fixed or specified), or the output values are partially simulated or fixed.</td>
<td>Maintenance required.</td>
</tr>
<tr>
<td>I</td>
<td>-</td>
<td>Information, current measurement is okay and values unrestrictedly valid.</td>
<td>Depends on error message, see table in relevant section.</td>
</tr>
</tbody>
</table>

**5.8.1 Error category "Device failure" (bold "F")**

**INFORMATION!**

*Regard that in case of an error message of the category "F" the measured values are not valid!*

<table>
<thead>
<tr>
<th>Messages on the display</th>
<th>Description</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>F motor blocked</td>
<td>The motor has been blocked three times consecutively.</td>
<td>Check if sensor and cable can be freely moved, if so reset error manually and restart measuring cycle. Check zero point reference switch.</td>
</tr>
<tr>
<td>F sensor comm error</td>
<td>Communication to sensor is permanently interrupted.</td>
<td>Check if pick up axle board is correctly positioned and the optical path is clean. Error needs to be reset manually and measurement can be started again.</td>
</tr>
<tr>
<td>F limit switch error</td>
<td>Indicating a failure of the sensor limit switch.</td>
<td>Check if the sensor can move up and down by using the manual operation. If the sensor does not reel down open the cable drum compartment and look if the cable is reeled up correctly. If the sensor is blocked, try to pull it down carefully.</td>
</tr>
<tr>
<td>F sensor calibration</td>
<td>Zero calibration was performed with higher turbidity than used for the calibration of the concentration.</td>
<td>Repeat calibration in correct order again.</td>
</tr>
</tbody>
</table>
5.8.2 Error category "Application error" ("F", not bold)

**INFORMATION!**

Regard that also in case of an error message of the category "F" the measured values are not valid!

<table>
<thead>
<tr>
<th>Messages on the display</th>
<th>Description</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>F Door open</td>
<td>The door of the cable drum compartment is open. Motor stops and measurement cycle is interrupted.</td>
<td>Close the door; if closed check safety switch; Error will be automatically reset, if problem was solved.</td>
</tr>
<tr>
<td>F Sensor supply voltage</td>
<td>Voltage supply out of range.</td>
<td>Check if pick up axle board is correctly positioned and the optical path is clean. Error needs to be reset manually and measurement can be started again. The distance for correct transmission should not exceed 2 mm / 0.079 inch.</td>
</tr>
</tbody>
</table>

5.8.3 Error category "Information" (I)

<table>
<thead>
<tr>
<th>Messages on the display</th>
<th>Description</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Search reference point</td>
<td>Sensor returns to home position to set zero point of level measurement.</td>
<td>No action necessary!</td>
</tr>
<tr>
<td>I Motor up</td>
<td>Motor reeels up.</td>
<td></td>
</tr>
<tr>
<td>I Motor down</td>
<td>Motor reeels down.</td>
<td></td>
</tr>
<tr>
<td>I Heater active</td>
<td>Internal heater is switched on.</td>
<td></td>
</tr>
<tr>
<td>I Fan active</td>
<td>Fan is switched on.</td>
<td></td>
</tr>
<tr>
<td>I Concentration not found</td>
<td>The sensor did not detect the concentration set by the user during this measuring cycle.</td>
<td></td>
</tr>
<tr>
<td>I Cable cleaning active</td>
<td>Cleaning unit is switched on.</td>
<td></td>
</tr>
<tr>
<td>I Sensor cleaning active</td>
<td>Cleaning unit is switched on.</td>
<td></td>
</tr>
<tr>
<td>I Rake guard</td>
<td>Rake guard switch is active.</td>
<td></td>
</tr>
<tr>
<td>I Pump lead time</td>
<td>Pump lead time for external pump is active.</td>
<td></td>
</tr>
<tr>
<td>I Relay 1 active</td>
<td>Indicating that relay 1 is active.</td>
<td></td>
</tr>
<tr>
<td>I Relay 2 active</td>
<td>Indicating that relay 2 is active.</td>
<td></td>
</tr>
</tbody>
</table>

5.8.4 Error category "Out of specification" (S)

**INFORMATION!**

Regard that in case of an error message of the category "S" the measured values are only conditionally usable!

<table>
<thead>
<tr>
<th>Messages on the display</th>
<th>Description</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>S Sensor comm. warning</td>
<td>The communication to the sensor was interrupted.</td>
<td>Warning, that communication to sensor was interrupted for a short time. No action necessary. Error will be automatically reset, if error does not occur again.</td>
</tr>
<tr>
<td>S Out of spec. concentration</td>
<td>Current output out of range (valid in Profile / tracking mode for current channel B, proportional to the measured concentration).</td>
<td>Check the limits of the 4…20 mA current outputs. If the maximum concentration is exceeded please enter a larger value.</td>
</tr>
</tbody>
</table>
6.1 Manual initiation of a measurement

For service or maintenance you can manually initiate a measurement:

- Press ↓ on the Keypad for five seconds.

The meter starts with a measurement cycle as soon as possible: the sensor goes down to
the defined maximum depth and returns to its start position, afterwards the meter works in
the normal mode.

6.2 Maintenance

**DANGER!**
All work on the electrical connections may only be carried out with the power disconnected. Take
note of the voltage data on the nameplate!

**DANGER!**
Shut down the instrument by use of the external main switch if opening the compartment doors
or maintenance of moving parts.

**DANGER!**
The surface in the both compartments becomes hot during operation and can cause burns. Wait,
after switching off the device until the surfaces have been cooled down.

**INFORMATION!**
For standard applications we recommend the following schedule.

<table>
<thead>
<tr>
<th>Maintenance action</th>
<th>Once a month</th>
<th>Once every six months</th>
<th>Once a year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual check of sensor and clean if necessary</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Visual check of lenses and clean if necessary</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Visual check of cable and drum</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cleaning or replacement of air filter</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Check of screws and nuts</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Sensor check in water</td>
<td>-</td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>

**INFORMATION!**
During work on the device above the basin the personnel have to be protected by personal safety
equipment.

Drive the Sensor in the start position by changing the measurement function to "manual
operation". For more information refer to *Menu C, setup* on page 53.

**Visual check and cleaning of sensor**
Check the sensor for any build-up, i.e. a large amount of dirt. If necessary, clean it with a damp
soft cloth or a soft brush.
Visual check and cleaning of lens
Check the lens for any build-up or film. If necessary, clean it with a suitable agent like water or isopropyl alcohol and a soft rag or a soft brush.

Check of screws and nuts
Check if all screws of the reeling unit as well as on the mounting frame are properly tight and secured.

Sensor check in water
Check the sensor by immersion in water; this should give a low measuring value or even a “0” on the converter display. By placing something solid (e.g. your finger) in the gap between the LED and the sensor you should get a measuring value of 3100...3200 (depending on the calibration).

Visual check of cable and drum
Check the cable, it must not have any damages or wear and has to be spooled correctly on the drum. Always replace the cable if it shows any damage or severe wear of the insulation!

If the cable is not correctly spooled up or shows a large amount of dirt, lower the sensor manually to the maximum position at first. During back hauling monitor the correct guidance of the cable and that it spools up properly, clean it with a soft cloth if necessary.

Cleaning of the optical interface

**WARNING!**
Open and close the pick-up arm carefully to prevent the hazard of squashing and bruising.
Follow the steps for the maintenance of the optical interface.

- Open the cable compartment door.
- Pull the pick-up arm back and hold it.
- Clean the optical interface with damp soft cloth with isopropyl alcohol.
- Close the pick-up arm carefully and make sure that the connection is closed.
- Close the cable compartment door.
Cleaning or replacement of air filter

**DANGER!**
If the air filter is blocked the meter can catch fire which could result in health and safety hazards or damage of the plant equipment.

**WARNING!**
Turn off the device during maintenance of the fan and fan filter.

- Loosen the 2 nuts in the ventilation shaft.
- Remove the ventilation shaft by pulling it up.
- Remove the cover of the fan.
- Clean or replace the air filter.

For assembling the ventilation please repeat the steps above in reverse order.

### 6.2.1 Cleaning unit (optional)

The cleaning unit is an optional feature, nevertheless it is part of the standard menu to allow an easy upgrade of the standard sludge level meter.

The sensor cleaning feature will be active either time based or cycle based. The cycle based mode is only valid when the device is operating in level or profile measuring mode. In zone tracking mode cleaning can be controlled only time based.

A measurement cycle is finished when the sensor reaches the bottom position in profile mode or the position of the sludge level to search in level mode.

The sensor cleaning is a two phase process, in the bottom position the cleaning is enabled and the sensor is moved back to the garage for cable cleaning. When the sensor has reached the upper position the sensor cleaning phase starts and the sensor is moved through the cleaning head in the garage. The number of passes is selectable in the cleaning menu.

Select the cleaning activation type in the menu first. In case of the activation mode is set to "timer interval" the sensor cleaning is periodically performed when the selected time interval has elapsed. By setting the cleaning activation mode to "counter interval" the sensor cleaning is performed each time the selected number of measurement cycles has been conducted. Note that the zone tracking measuring mode is not cycle based, in this mode for proper operation of the sensor cleaning select the time based activation mode.

If an external water pump is connected to the device then the menu item "pump lead time" can be used to delay the sensor cleaning process until pump system pressure has been setup. The value of the pump lead time can remain at 0 seconds when no external water pump is in use.

The menu item "cleaning cycle" is defining the number of passes of the sensor through the cleaning head. An external water pump can be controlled by the sludge level meter when it is enabled in the menu item external pump. Each cleaning cycle the external pump is switched on when the water valve will be activated. Note that when the cleaning sequence is finished the water valve remains open for 1 minute to empty cleaning system for protecting the system against freezing at low temperatures.
6.3 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

6.4 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, maintenance, technical support and training.

INFORMATION!
For more precise information, please contact your local sales office.

6.5 Returning the device to the manufacturer

6.5.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.

CAUTION!
Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

• Due to statutory regulations on environmental protection and safeguarding the health and safety of the personnel, the manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.

• This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.

CAUTION!
If the device has been operated with toxic, caustic, radioactive, flammable or water-endangering products, you are kindly requested:

• to check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,

• to enclose a certificate with the device confirming that is safe to handle and stating the product used.
6.5.2 Form (for copying) to accompany a returned device

**CAUTION!**
To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.

<table>
<thead>
<tr>
<th>Company:</th>
<th>Address:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department:</td>
<td>Name:</td>
</tr>
<tr>
<td>Tel. no.:</td>
<td>Fax no. and/or Email address:</td>
</tr>
<tr>
<td>Manufacturer’s order no. or serial no.:</td>
<td></td>
</tr>
</tbody>
</table>

The device has been operated with the following medium:

This medium is:
- radioactive
- water-hazardous
- toxic
- caustic
- flammable
- We checked that all cavities in the device are free from such substances.
- We have flushed out and neutralized all cavities in the device.

We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.

<table>
<thead>
<tr>
<th>Date:</th>
<th>Signature:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stamp:</td>
<td></td>
</tr>
</tbody>
</table>

6.6 Disposal

**CAUTION!**
Disposal must be carried out in accordance with legislation applicable in your country.

Separate collection of WEEE (Waste Electrical and Electronic Equipment) in the European Union:

According to the directive 2012/19/EU, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste**. The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.
7.1 Measuring principle

The meter is using an optical sensor which travels through the media. Thus it can directly measure the suspended solids concentration at different heights. The measurement of the suspended solids content is based on the method of the transmission of light, which provides precise measurement results independent of the sludge colour. The direct measuring principle excludes incorrect measurements due to echo returns from walls or separating zones as well as signal damping by fluff or floating sludge.

Figure 7-1: Measuring principle
7.2 Technical data

**INFORMATION!**
- The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website [Downloadcenter].

### Measuring system

<table>
<thead>
<tr>
<th>Measuring principle</th>
<th>Level measurement via immersion of optical sensor with straight light transmission of NIR-light for suspended solids measurement.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application range</td>
<td>Level measurement of sludge blanket, fluff zone and zone tracking in clarifiers, sedimentation basins as well as in thickeners of water and wastewater treatment plants.</td>
</tr>
</tbody>
</table>

### Design

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>0.1...30 g/l (depending on the sludge type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units</td>
<td>Concentration in mg/l or g/l</td>
</tr>
<tr>
<td>Height / depth</td>
<td>m, cm, feet, inch</td>
</tr>
<tr>
<td>Lowering speed sensor</td>
<td>Maximal 7.75 cm / 3.05” per second at 50 Hz</td>
</tr>
<tr>
<td></td>
<td>Full cycle time for 10 m / 32.8 ft: 3 min</td>
</tr>
<tr>
<td>Internal heating</td>
<td>“Off” above 8°C / 46.4°F, full power below 4°C / 39.2°F.</td>
</tr>
<tr>
<td>Water connection of the cleaning unit (optional)</td>
<td>3/4” connector with metric thread (max. pressure 6 bar / 87 psi)</td>
</tr>
</tbody>
</table>

### Display and user interface

<table>
<thead>
<tr>
<th>Graphic display</th>
<th>LCD display, backlit 128 x 64 pixels, temperature below -25°C / -13°F may affect the readability of the display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating elements</td>
<td>4 push buttons for operator control of the signal converter without opening the housing</td>
</tr>
<tr>
<td>Operating menu</td>
<td>The operation menu consists of the measuring mode and the menu mode</td>
</tr>
<tr>
<td>Measuring mode</td>
<td>2 pages - measuring page with measuring results and status page with status messages</td>
</tr>
<tr>
<td>Menu mode</td>
<td>Variety of main and submenus that allows customising the device</td>
</tr>
<tr>
<td>Operating and display languages</td>
<td>English, German, French and Spanish</td>
</tr>
</tbody>
</table>
### Measuring accuracy

<table>
<thead>
<tr>
<th>Category</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum measuring error (concentration)</td>
<td>5% full scale</td>
</tr>
<tr>
<td>Maximum measuring error (level)</td>
<td>1% full scale [of 10 meter]</td>
</tr>
</tbody>
</table>

### Operating conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude</td>
<td>≤ 2000 m / 6561.68 ft</td>
</tr>
<tr>
<td>Temperatures and pressure</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature (in operation)</td>
<td>-20...+50°C / -4...+122°F</td>
</tr>
<tr>
<td>Process temperature (sensor)</td>
<td>0...+60°C / +32...+140°F</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-20...+60°C / -4...+140°F</td>
</tr>
<tr>
<td>Humidity</td>
<td>Max. 90% at 50°C / 122°F [not condensing]</td>
</tr>
<tr>
<td>Max. immersion depth</td>
<td>10 m / 32.8 ft</td>
</tr>
<tr>
<td>Max. water pressure (process)</td>
<td>10 bar / 145 psi</td>
</tr>
<tr>
<td>Protection category</td>
<td>IP 68 [sensor], IP 54 [electronic compartment] and IP 44 [cable drum compartment]</td>
</tr>
</tbody>
</table>

### Installation conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation position</td>
<td>Fixing on a handrail at open channels, basins or tanks.</td>
</tr>
<tr>
<td>Dimensions &amp; weights</td>
<td>For detailed information refer to Dimensions on page 81.</td>
</tr>
</tbody>
</table>

### Materials

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosures</td>
<td>Stainless steel 1.4301</td>
</tr>
<tr>
<td>Sensor</td>
<td>Enclosures: Stainless steel 1.4404</td>
</tr>
<tr>
<td></td>
<td>Optical windows: Sapphire</td>
</tr>
<tr>
<td></td>
<td>Cable gland: Stainless steel 1.4404</td>
</tr>
<tr>
<td></td>
<td>O-Ring: NBR</td>
</tr>
<tr>
<td>Sensor cable</td>
<td>PUR</td>
</tr>
</tbody>
</table>

### Electrical connections

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply (voltage)</td>
<td>230 VAC (-15% / +10%) at 50 Hz [±10%]</td>
</tr>
<tr>
<td>Power consumption</td>
<td>100 VA</td>
</tr>
<tr>
<td>Power rating</td>
<td>150 VA [maximum]</td>
</tr>
<tr>
<td>Internal fuse</td>
<td>1.6 A slow blow, dimensions: 5 mm x 20 mm / 0.20” x 0.78” (IEC 60127-2, 250 VAC; UL: 115...300 VDC)</td>
</tr>
<tr>
<td>Cable feedthrough</td>
<td>M20 x 1.5 PA 6-12 mm</td>
</tr>
<tr>
<td>External fuse (recommended)</td>
<td>6 A</td>
</tr>
<tr>
<td>Protection class</td>
<td>I</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>II</td>
</tr>
</tbody>
</table>
Inputs and outputs

<table>
<thead>
<tr>
<th>General</th>
<th>All inputs and outputs are electrically isolated from the power supply.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inputs</td>
<td>Control inputs: Three active control inputs, not polarity sensitive</td>
</tr>
<tr>
<td></td>
<td>( U_{\text{out}} = 8, \text{VDC} )</td>
</tr>
<tr>
<td></td>
<td>( I_{\text{out}} = -10, \text{mA} )</td>
</tr>
<tr>
<td></td>
<td>( U_{\text{low}} \leq 2, \text{V} )</td>
</tr>
<tr>
<td></td>
<td>( \text{min} I_{\text{typical}} \text{ at } 2, \text{V} = -8.7, \text{mA} )</td>
</tr>
<tr>
<td></td>
<td>( U_{\text{high}} \geq 4, \text{V} )</td>
</tr>
<tr>
<td></td>
<td>( \text{max} I_{\text{typical}} \text{ at } 4, \text{V} = -6.8, \text{mA} )</td>
</tr>
<tr>
<td>Operating modes</td>
<td>Control input 1: Rake guard switch or external trigger [switchable via Software]</td>
</tr>
<tr>
<td></td>
<td>Control input 2: Rake guard switch or external trigger [switchable via Software]</td>
</tr>
<tr>
<td></td>
<td>Control input 3: Maintenance mode</td>
</tr>
<tr>
<td>Outputs</td>
<td>Current outputs</td>
</tr>
<tr>
<td></td>
<td>Two outputs (4...20 mA), galvanic isolated from power supply, active mode</td>
</tr>
<tr>
<td>Output data</td>
<td>Current output A: level of fluff</td>
</tr>
<tr>
<td></td>
<td>Current output B: level of sludge blanket or concentration (profile)</td>
</tr>
<tr>
<td>Operating data</td>
<td>( U_{\text{max}} = 18, \text{VDC} )</td>
</tr>
<tr>
<td></td>
<td>( I = 4...20, \text{mA} )</td>
</tr>
<tr>
<td></td>
<td>( I_{\text{max}} \leq 22, \text{mA} )</td>
</tr>
<tr>
<td></td>
<td>( R_L \leq 550, \Omega )</td>
</tr>
<tr>
<td>Relays</td>
<td>Operating modes</td>
</tr>
<tr>
<td></td>
<td>Relay 1 and 2: Limit switch or status output</td>
</tr>
<tr>
<td></td>
<td>Relay 3: Pump protection</td>
</tr>
<tr>
<td>Operating data for all relays</td>
<td>( U_{\text{ext}} \leq 24, \text{VDC/250} , \text{VAC} )</td>
</tr>
<tr>
<td></td>
<td>( K1 / K2 \leq 1, \text{A} )</td>
</tr>
<tr>
<td></td>
<td>( K3 \leq 0.3, \text{A} )</td>
</tr>
</tbody>
</table>

Approvals and certifications

CE

The device meets the essential requirements of the EU directives. The CE marking indicates the conformity of the product with the European Union legislation applying to the product and providing for CE marking.

For full information of the EU directives and standards and the approved certifications, please refer to the EU declaration on the website of the manufacturer.
7.3 Dimensions

<table>
<thead>
<tr>
<th></th>
<th>Dimensions [mm]</th>
<th>Dimensions [°]</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>460</td>
<td>18.11</td>
</tr>
<tr>
<td>b</td>
<td>420</td>
<td>16.54</td>
</tr>
<tr>
<td>c</td>
<td>195</td>
<td>7.7</td>
</tr>
<tr>
<td>d</td>
<td>512</td>
<td>20.16</td>
</tr>
<tr>
<td>e</td>
<td>88.5</td>
<td>3.48</td>
</tr>
<tr>
<td>f</td>
<td>260</td>
<td>10.24</td>
</tr>
<tr>
<td>g</td>
<td>550</td>
<td>21.65</td>
</tr>
<tr>
<td>h</td>
<td>Ø 85</td>
<td>3.35</td>
</tr>
<tr>
<td>j</td>
<td>Ø 40</td>
<td>1.57</td>
</tr>
<tr>
<td>k</td>
<td>231.5</td>
<td>9.11</td>
</tr>
</tbody>
</table>

Figure 7-2: Dimensions
Figure 7-3: Dimensions hole distance (device)

<table>
<thead>
<tr>
<th></th>
<th>Dimensions [mm]</th>
<th>Dimensions [°]</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>380</td>
<td>15</td>
</tr>
<tr>
<td>b</td>
<td>470</td>
<td>18.5</td>
</tr>
<tr>
<td>c</td>
<td>380</td>
<td>15</td>
</tr>
<tr>
<td>d</td>
<td>103</td>
<td>4.1</td>
</tr>
</tbody>
</table>
Figure 7-4: Dimensions of mounting frame and cleaning unit

<table>
<thead>
<tr>
<th></th>
<th>Dimensions [mm]</th>
<th>Dimensions [°]</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>109.5</td>
<td>4.31</td>
</tr>
<tr>
<td>b</td>
<td>105</td>
<td>4.13</td>
</tr>
<tr>
<td>c</td>
<td>175.5</td>
<td>6.91</td>
</tr>
<tr>
<td>d</td>
<td>100.5</td>
<td>3.96</td>
</tr>
<tr>
<td>e</td>
<td>188.5</td>
<td>7.42</td>
</tr>
<tr>
<td>f</td>
<td>376.5</td>
<td>14.82</td>
</tr>
<tr>
<td>g</td>
<td>161</td>
<td>6.34</td>
</tr>
<tr>
<td>h</td>
<td>152.2</td>
<td>5.9</td>
</tr>
<tr>
<td>j</td>
<td>135</td>
<td>5.31</td>
</tr>
<tr>
<td>k</td>
<td>127.2</td>
<td>5</td>
</tr>
</tbody>
</table>
Figure 7-5: Hole distance of the mounting

<table>
<thead>
<tr>
<th>Dimensions [mm]</th>
<th>Dimensions [°]</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>607</td>
</tr>
<tr>
<td>b</td>
<td>356</td>
</tr>
<tr>
<td>c</td>
<td>314</td>
</tr>
<tr>
<td>d</td>
<td>71</td>
</tr>
<tr>
<td>e</td>
<td>35.5</td>
</tr>
<tr>
<td>f</td>
<td>50</td>
</tr>
<tr>
<td>g</td>
<td>276</td>
</tr>
</tbody>
</table>

Weights

<table>
<thead>
<tr>
<th></th>
<th>weight [kg]</th>
<th>weight [lbs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPTISYS SLM 2100</td>
<td>26.5</td>
<td>58.4</td>
</tr>
<tr>
<td>Cleaning unit</td>
<td>4.5</td>
<td>9.9</td>
</tr>
<tr>
<td>Mounting frame</td>
<td>3.3</td>
<td>7.3</td>
</tr>
<tr>
<td>Rod steel U-bolts and adaption for round handrails</td>
<td>1.2</td>
<td>2.6</td>
</tr>
</tbody>
</table>
KROHNE – Process instrumentation and measurement solutions

- Flow
- Level
- Temperature
- Pressure
- Process Analysis
- Services

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info@krohne.com

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www.krohne.com