



## OPTISYS SLM 2100 **Technical Datasheet**

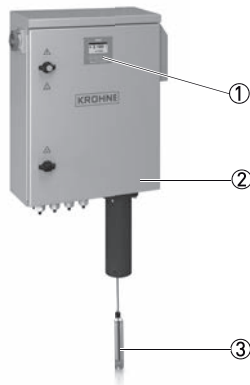
### Sludge level meter

- Optical measuring system for sedimentation profile measurement
- Continuous level measurement of sludge blanket (zone tracking)
- Common operating and service concept with other KROHNE devices

<b>1</b>	<b>Product features</b>	<b>3</b>
1.1	Reliable sludge blanket measurement via optical sensor .....	3
1.2	Design and option .....	4
1.3	Measuring principle.....	6
<b>2</b>	<b>Technical data</b>	<b>7</b>
2.1	Technical data.....	7
2.2	Dimensions .....	10
<b>3</b>	<b>Installation</b>	<b>14</b>
3.1	General notes on installation .....	14
3.2	Intended use .....	14
3.3	Typical measuring point .....	15
3.4	Installation order .....	16
3.4.1	Mounting of the sludge level meter.....	17
3.5	Installing the cleaning unit (optional) .....	22
3.5.1	Installation of the water hose to cleaning unit.....	23
<b>4</b>	<b>Electrical connections</b>	<b>25</b>
4.1	Safety instructions.....	25
4.2	Used abbreviations .....	25
4.3	Description of electrical symbols.....	26
4.4	Important device-specific notes on electrical connection.....	27
4.5	Overview of cable connections .....	28
4.6	Overview of the terminal compartment .....	29
4.7	Connecting the power supply .....	30
4.8	Description and properties of the output and the input .....	33
4.8.1	Current output .....	33
4.8.2	Control input (active).....	34
4.9	Connection of output and input .....	35
4.9.1	Important notes.....	35
4.9.2	Current output .....	36
4.9.3	Electrical connection of control inputs.....	37
4.10	Description and properties of the relays .....	39
4.10.1	Connection of the relays .....	40
4.11	Protection category .....	41
<b>5</b>	<b>Notes</b>	<b>42</b>

## 1.1 Reliable sludge blanket measurement via optical sensor

The sludge level meter **OPTISYS SLM 2100** features an accurate and reliable profile measurement of the sedimentation tank using an optical sensor which travels through all layers of the tank reading suspended solids concentration at the different heights.



- ① Display and keyboard
- ② Cable drum compartment
- ③ Sensor

### Highlights

- Direct measurement via immersion of optical sensor
- Different reliable measurement modes including determination of sedimentation profile, blanket and fluff levels as well as zone tracking
- Automatic change of measuring mode
- Common operating and service concept with flow and level devices
- Build-in heater and ventilation for temperature regulation
- 2 x rake guard switch or trigger inputs
- 1 x maintenance switch
- 2 x programmable relays (status output or limit switch)
- Automatic cleaning unit for low maintenance efforts
- Wiper and 2 x drain channels for reduction of deposit and dirt

### Applications

- Measurement of sludge blanket and fluff zone in primary and secondary clarifiers or sludge thickeners
- Monitoring of sedimentation processes
- Automation of sludge extraction
- Early warning of sludge washout

## 1.2 Design and option

### Unique measuring principle



Contrary to the widely used ultrasonic level measurement, the OPTISYS SLM 2100 uses an optical sensor which is immersed into the media. Thus it can measure the suspended solids concentration in different heights.

The measurement of the suspended solids concentration is based on the unique method of the transmission of light through liquids. This measuring principle utilises the suspended particles ability to absorb and scatter NIR (Near Infra-red) light.

The optical measurement provides accurate results independent of the sludge colour. Misreadings due to echo reflections on walls or separation zones as well as damping of the signal due to fluff or floating sludge are impossible.

### Reliable signal transmission



Axle board and signal transmission

The digital signals produced by the sensor are transmitted via a reliable optical transmission system without any contact problems or wear and tear of mechanical parts.

The power supply of the sensor is realised in an equally reliable manner via an inductive coupling.

### Reduction of deposit



Wiper module

As an extension to the cleaning system an optional wiper can be used that takes place in a drawer below the housing. The wiper reduces ingress of dirt by wiping off the sensor cable.

### 1.3 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.

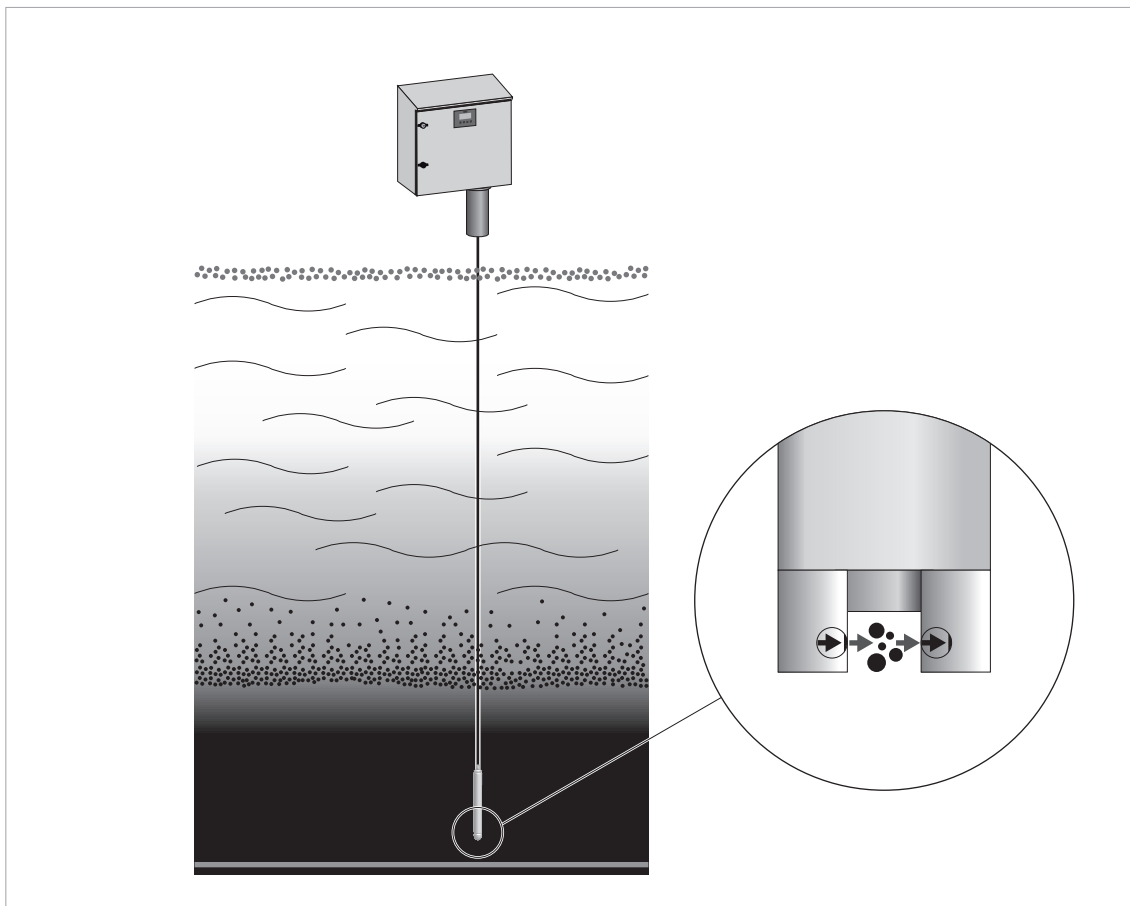


Figure 1-1: Measuring principle

## 2.1 Technical data

- *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

Measuring principle	Level measurement via immersion of optical sensor with straight light transmission of NIR-light for suspended solids measurement.
Application range	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.

### Design

Measuring range	0.1...30 g/l (depending on the sludge type)
Units	Concentration in mg/l or g/l
Height / depth	m, cm, feet, inch
Lowering speed sensor	Maximal 7.75 cm / 3.05" per second at 50 Hz. Maximal 9.3 cm / 6.61 per second at 60 Hz
	Full cycle time for 10 m / 32.8 ft: 3 min (50 Hz) or 2.5 min (60 Hz)
Internal heating	"Off" above 18°C / 64 °F, full power below 14°C / 57 °F
Water connection of the cleaning unit (optional)	3/4" connector with metric thread (max. pressure 6 bar / 87 psi)

### Display and user interface

Graphic display	LCD display, backlit 128 x 64 pixels, temperature below -25°C / -13°F may affect the readability of the display
Operating elements	4 push buttons for operator control of the signal converter without opening the enclosure
Operating menu	The operation menu consists of the measuring mode and the menu mode
Measuring mode	2 pages - measuring page with measuring results and status page with status messages
Menu mode	Variety of main and submenus that allows customising the device
Operating and display languages	German, English, French, Spanish, Italian, Turkish, Portuguese, Simplified Chinese

**Measuring accuracy**

Maximum measuring error (concentration)	5% full scale
Maximum measuring error (level)	1% full scale (of 10 meter)

**Operating conditions**

Altitude	≤ 2000 m / 6561.68 ft
Temperatures and pressure	
Ambient temperature (in operation)	-20...+50°C / -4...+122°F (with antifreeze cover)
Process temperature (sensor)	0...+60°C / +32...+140°F
Storage temperature	-20...+60°C / -4...+140°F
Humidity	Max. 90% at 50°C / 122°F (not condensing)
Max. immersion depth	10 m / 32.8 ft
Max. water pressure (process)	10 bar / 145 psi
Protection category	IP 68 (sensor), IP 55 (electronic compartment) and IP 45 (cable drum compartment)

**Installation conditions**

Installation position	Fixing on a handrail at open channels, basins or tanks.
Dimensions & weights	For detailed information refer to <i>Dimensions</i> on page 10.

**Materials**

Enclosures	Stainless steel 1.4301
Sensor	Enclosures: Stainless steel 1.4404
	Optical windows: Sapphire
	Cable gland: Stainless steel 1.4404
	O-Ring: NBR
Sensor cable	PUR

**Electrical connections**

Power supply (voltage)	230 VAC (-15% / +10%) at 50 or 60 Hz (±10%)
Power consumption	100 VA
Power rating	170 VA (maximum)
Internal fuse	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)
Cable feedthrough	M20 x 1.5 PA 6-12 mm
External fuse (recommended)	6 A
Protection class	I
Overvoltage category	II



## Inputs and outputs

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

## 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.

## 2.2 Dimensions

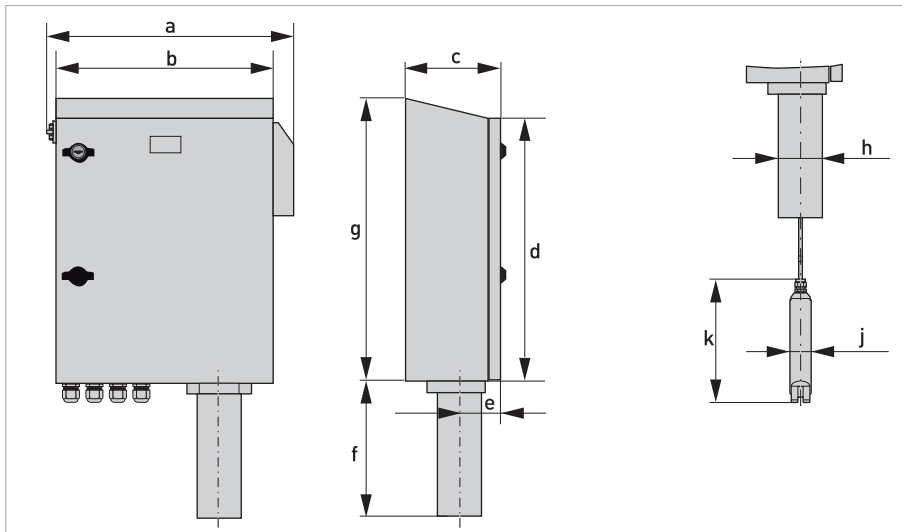


Figure 2-1: Dimensions

	Dimensions [mm]	Dimensions ["]
a	495	19.49
b	420	16.54
c	195	7.7
d	536,5	21.12
e	88.5	3.48
f	260	10.24
g	550	21.65
h	Ø 85	3.35
j	Ø 40	1.57
k	231.5	9.11

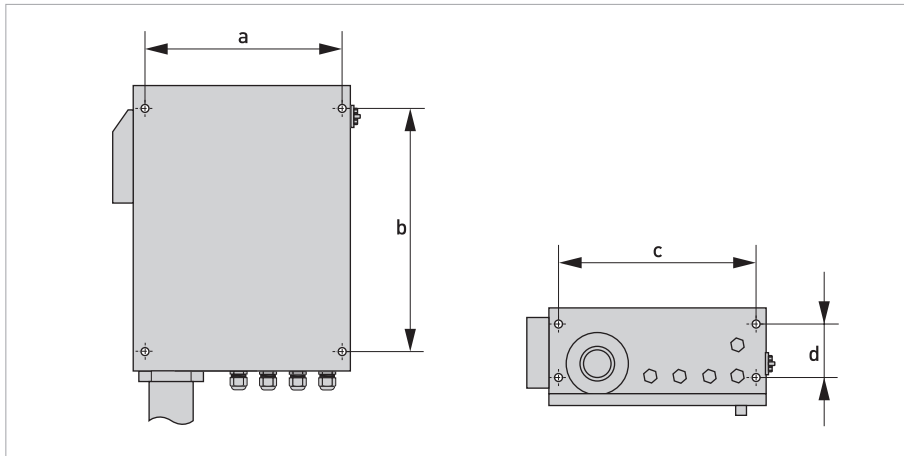


Figure 2-2: Dimensions hole distance (device)

	Dimensions [mm]	Dimensions ["]
a	380	15
b	470	18.5
c	380	15
d	103	4.1

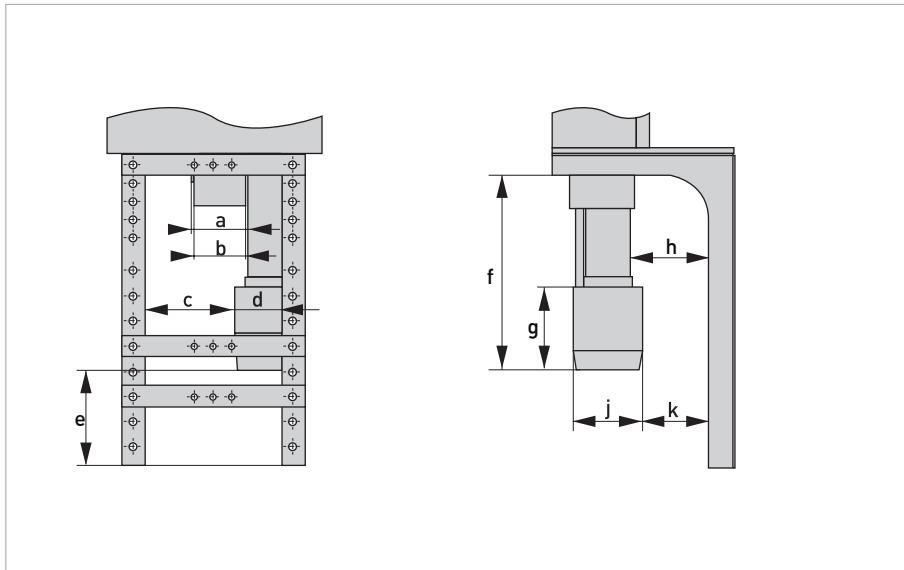


Figure 2-3: Dimensions of mounting frame and cleaning unit

	Dimensions [mm]	Dimensions ["]
a	109.5	4.31
b	105	4.13
c	175.5	6.91
d	100.5	3.96
e	188.5	7.42
f	376.5	14.82
g	161	6.34
h	152.2	5.9
j	135	5.31
k	127.2	5

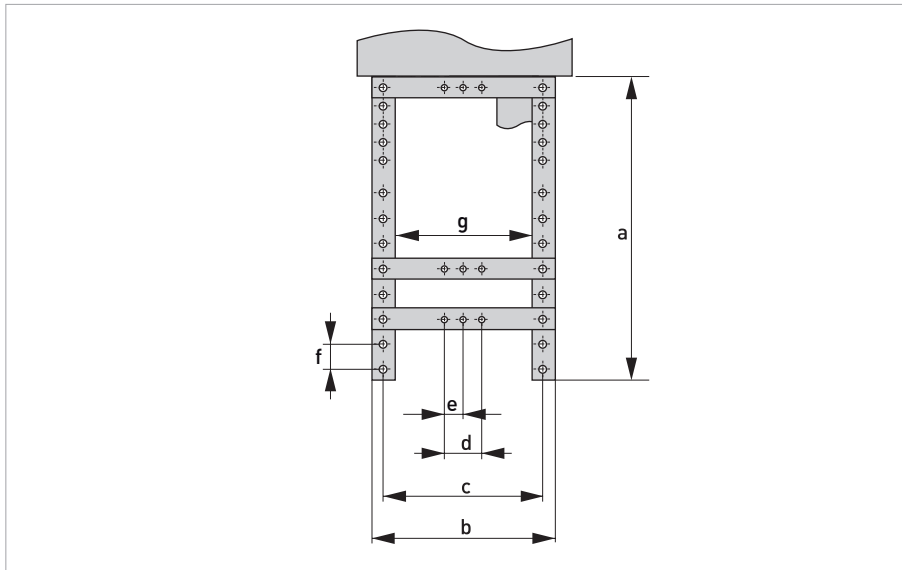


Figure 2-4: Hole distance of the mounting

	Dimensions [mm]	Dimensions ["]
a	607	23.9
b	356	14.0
c	314	12.4
d	71	2.8
e	35.5	1.4
f	50	1.9
g	276	10.8

### Weights

	weight [kg]	weight [lbs]
OPTISYS SLM 2100	26.5	58.4
Cleaning unit	4.5	9.9
Mounting frame	3.3	7.3
Rod steel U-bolts and adaption for round handrails	1.2	2.6

### 3.1 General notes on installation

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

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

*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.*

### 3.2 Intended use

*Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.*

*If the device is not used according to the operating conditions (refer to chapter "Technical data"), the intended protection could be affected.*

*This device is a Group 1, Class A device as specified within CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.*

*The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.*

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.

### 3.3 Typical measuring point

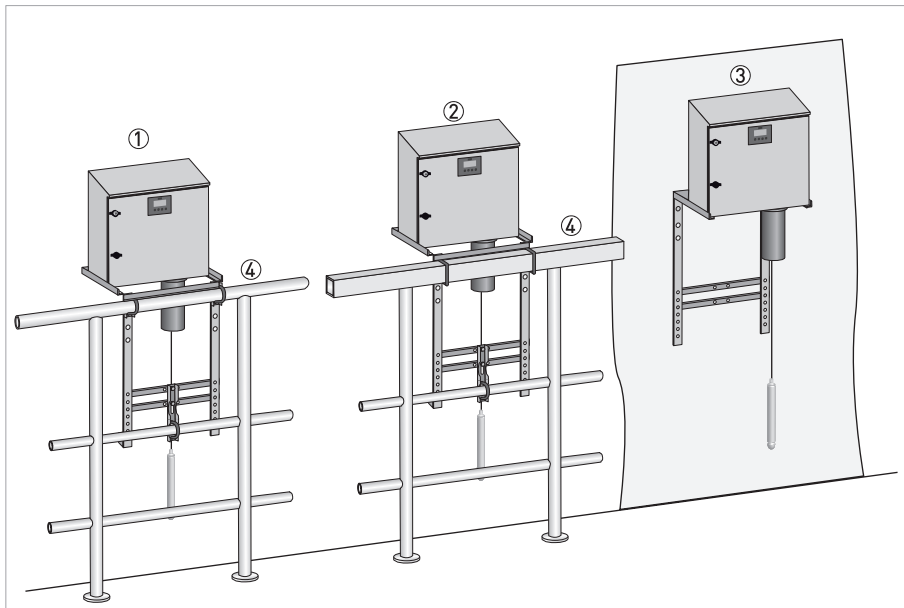


Figure 3-1: Example of typical measuring points

- ① With brackets for round handrail on horizontal post (optional)
- ② With brackets for rectangular handrail (not provided from the manufacturer)
- ③ Mounted on a wall
- ④ Handrail

### 3.4 Installation order

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

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

*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.*

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

*Ensure that the mains power can be switched off by a switch or circuit breaker as external disconnect device and mark it as such. The switch or circuit breaker has to be located close to the device and easily accessible.*

*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 the manual of the system).
- ② Mounting of the drain channels  
(for detailed information refer to the manual of the system).
- ③ Installing the cleaning unit (optional)  
(for detailed information refer to the manual of the system)
- ④ Connecting the power supply  
(for detailed information refer to the manual of the system).
- ⑤ Connection of the current outputs  
(for detailed information refer to the manual of the system).
- ⑥ Connecting the rake guard switch / external trigger or maintenance switch - if required  
(for detailed information refer to the manual of the system).
- ⑦ Configuration of the sludge level meter  
(for detailed information refer to the manual of the system).
- ⑧ Calibration of the sludge level meter  
(for detailed information refer to the manual of the system).

For decommissioning of the device please repeat the steps above in reverse order from ⑥ to ①.



### 3.4.1 Mounting of the sludge level meter

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

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

*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

*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 10.

- Mount the meter using the 4 M6 screws

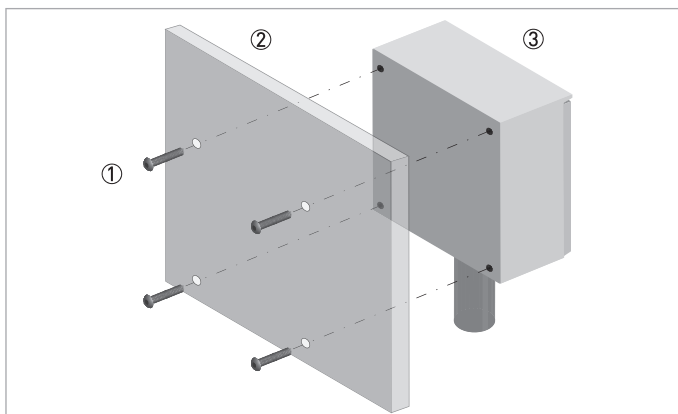


Figure 3-2: Mounting on wall

- 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 10.

### 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

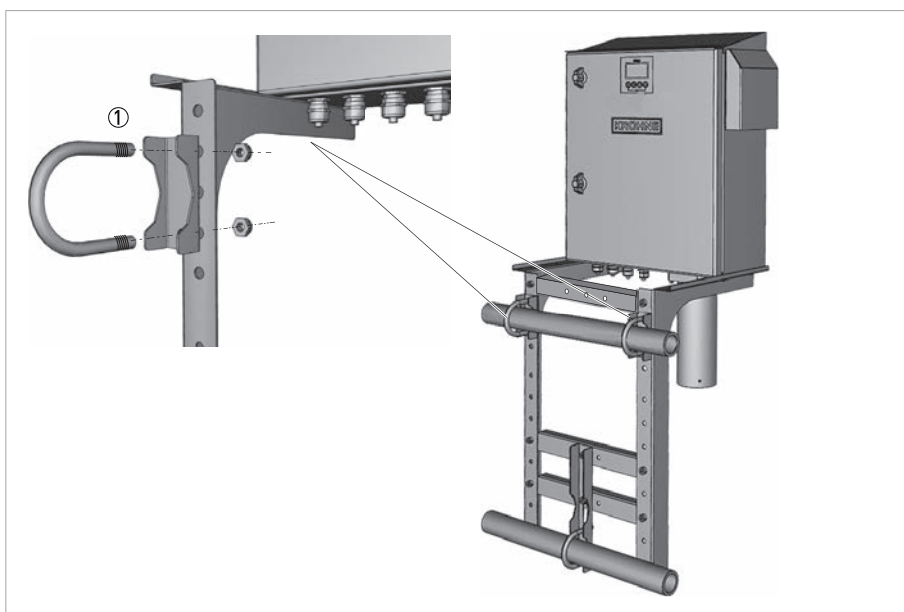


Figure 3-3: Mounting of upper handrail

① 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

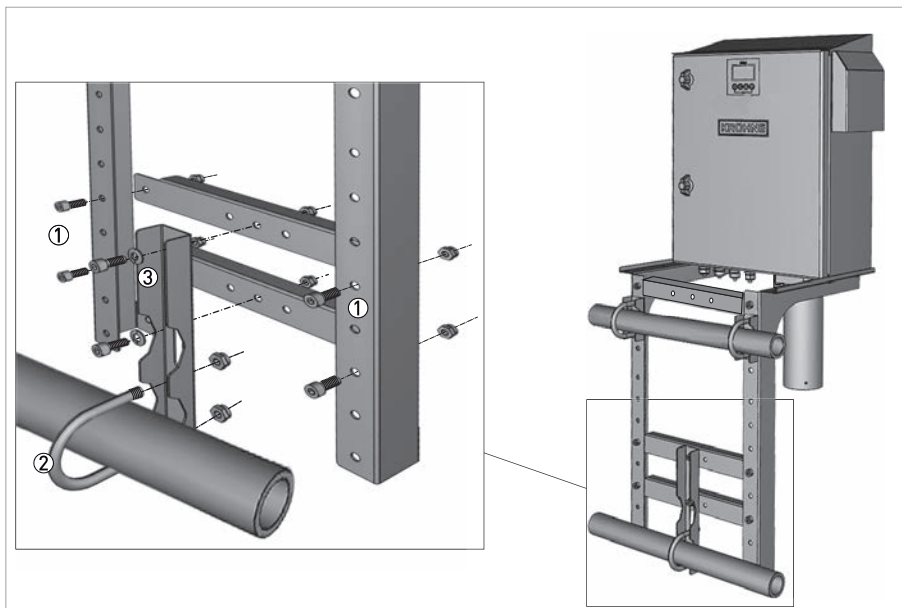


Figure 3-4: Mounting of lower handrail (horizontal)

- 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 (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.

### Mounting on lower round handrail with vertical bar

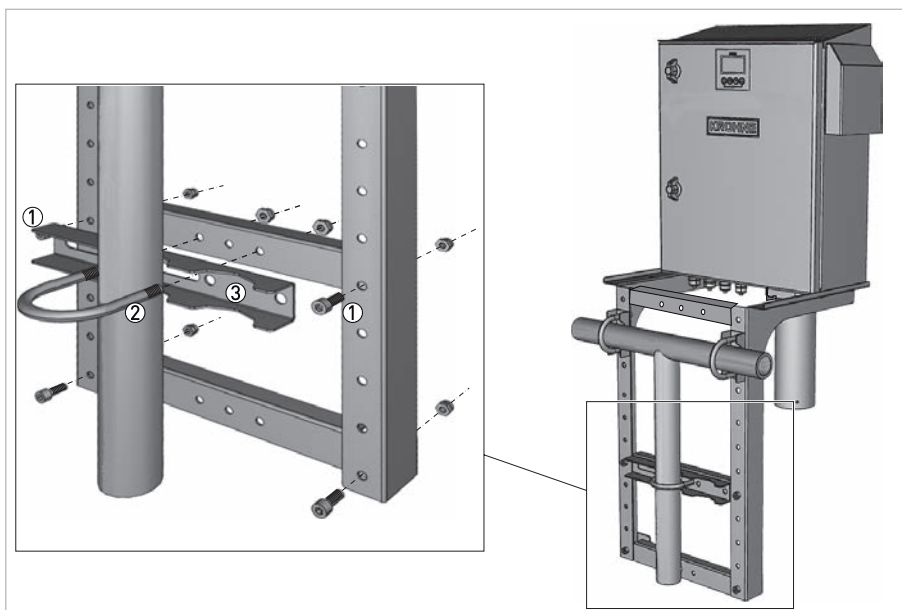


Figure 3-5: Mounting of lower handrail (vertical)

- 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

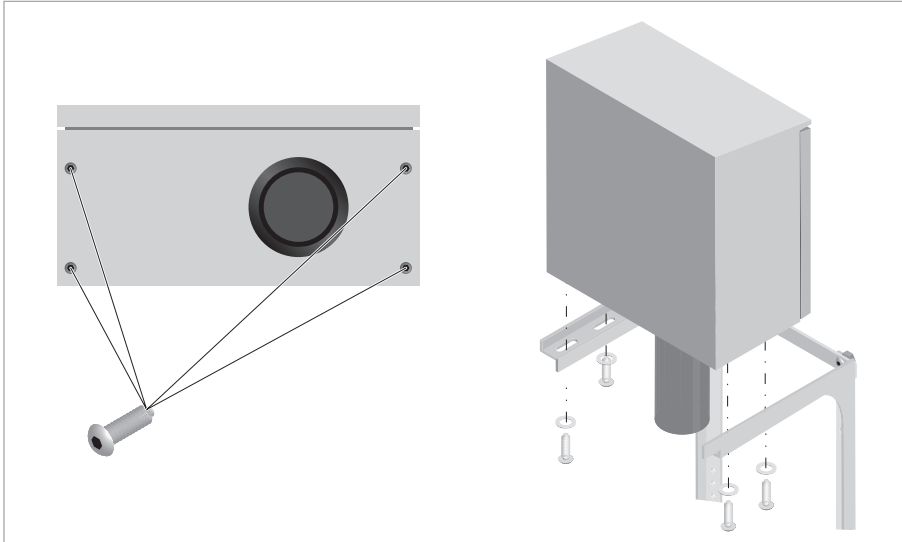


Figure 3-6: Mounting device on handrail

- 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.

### 3.5 Installing the cleaning unit (optional)

*The customer is responsible for ensuring that the water connections are frost-proof.*

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.

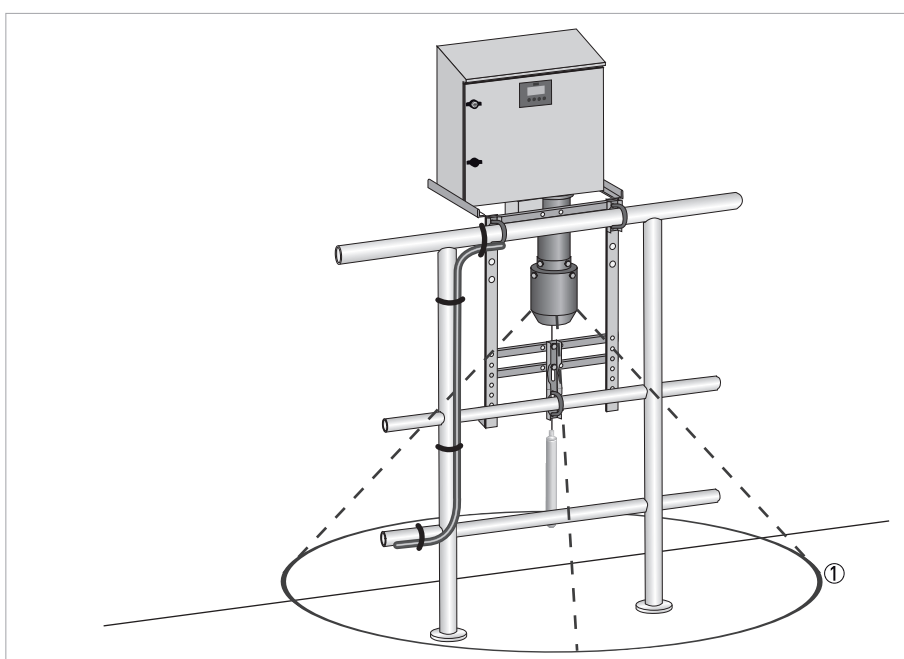


Figure 3-7: Safety area

① Radius: 2 m / 78.74"

*An upstreamed filtration of the water in case of fine particles is necessary.*

**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 39.

For detailed information refer to the manual of the system

### 3.5.1 Installation of the water hose to cleaning unit

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

*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.

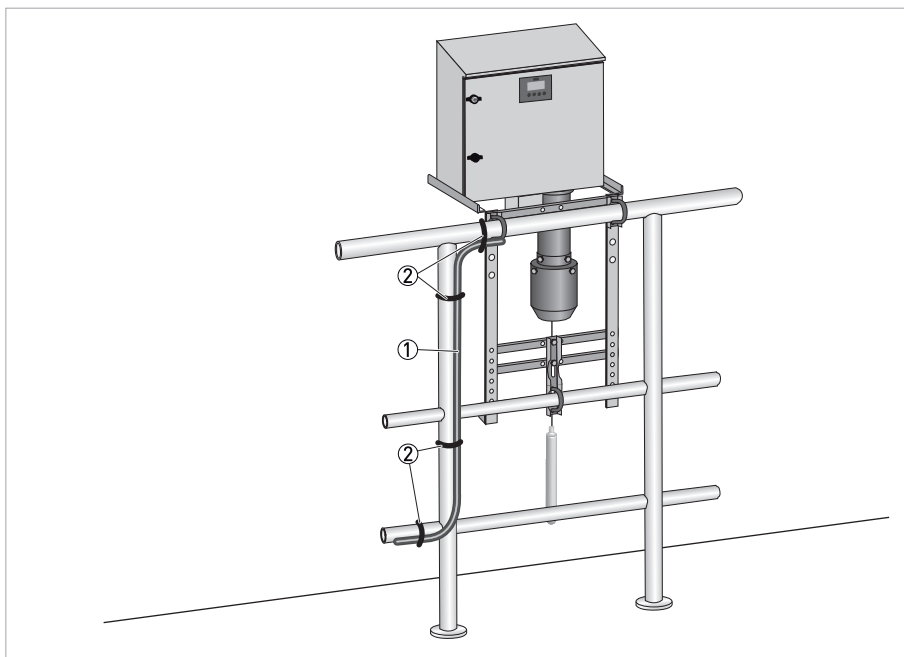


Figure 3-8: Fixing points water hose

- ① Water hose
- ② Fixing points

### Mounting sprayshield

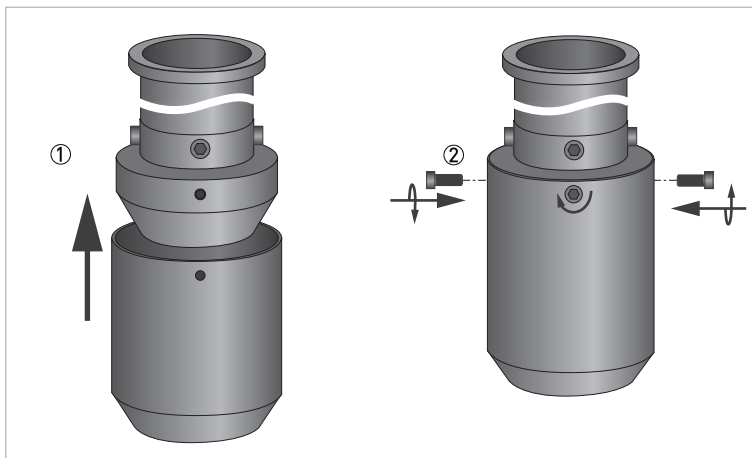


Figure 3-9: Mounting sprayshield

- 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

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

*Observe the national regulations for electrical installations!*

*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.*

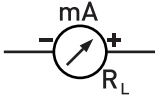
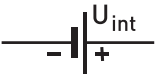


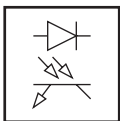


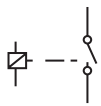

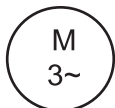


*Before performing any work on the device switch off the power and make sure that it cannot be switched on accidentally.*




*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

Abbreviation	Description
$Cl_a$	Control input active
$I_a$	Current output active
$I_{max}$	Maximum current
$I_{nom}$	Nominal current
$R_L$	Load resistance
P	Power
$U_{int, nom}$	Nominal internal voltage
$U_{ext}$	External voltage
$U_o$	Terminal voltage
VAC	Alternating current (AC) voltage
CI	Control input
PCS	Process control system
NO	Switch (normally open)
NC	Switch (normally closed)
LED	Light-emitting diode
K	Relay

## 4.3 Description of electrical symbols

Symbol	Description
	Ampere meter, 0...20 mA or 4...20 mA, $R_L$ is the internal resistance of the measuring point including the cable resistance
	Internal direct current (DC) voltage source
	Controlled internal current source in the device
	Switch, NO contact or similar
	Input, galvanically insulated
	Positive temperature coefficient (PTC) resistance
	LED
	Protection switch
	Grounding
	Motor
	Heater
	Fan

Symbol	Description
	Valve
	Pump
	Limit switch

#### 4.4 Important device-specific notes on electrical connection

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

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

*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.*
- *The grounding takes place directly at the device. For outside use ground the device with a wire of min. 16mm<sup>2</sup> and for inside use with a wire of min. 6mm<sup>2</sup>.*

*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

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 door. Make sure that the door doesn't shut if hands or tools are inside the meter. Otherwise the door can cause fatal injuries or damage to the equipment.

In the bottom lower left corner of the enclosure there are 5 cable feedthrough connections as cable feedthroughs to the electronics compartment (if the cleaning unit is used only 4 feedthroughs are available). All connected cables have to be installed via these feedthroughs.

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.

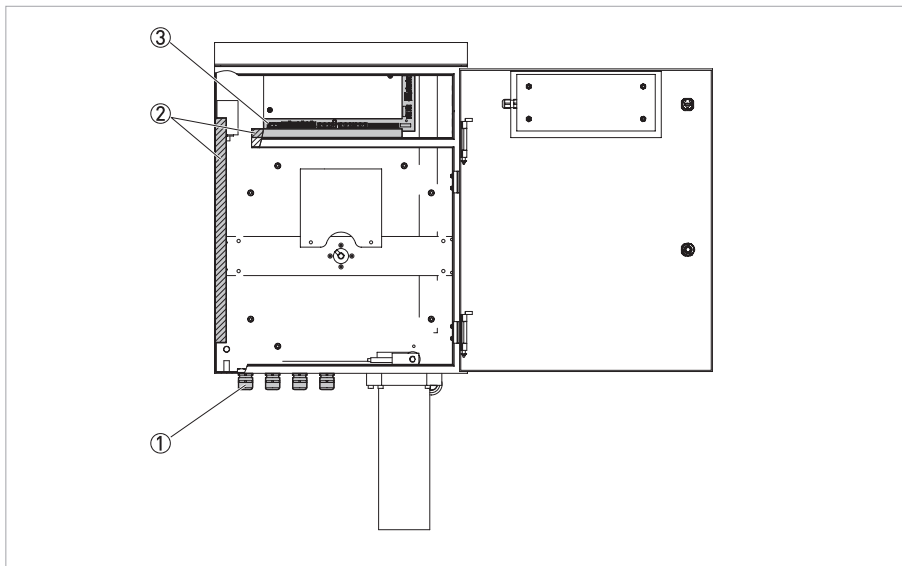
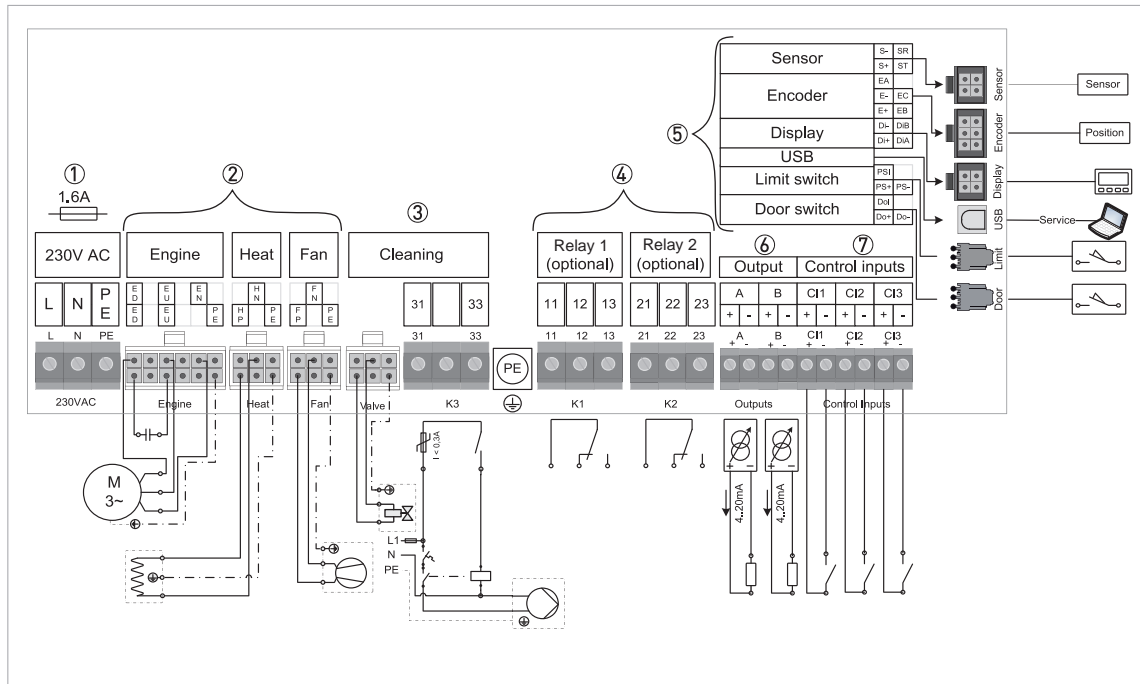


Figure 4-1: Overview of cable connections

- ① 5 x M20 cable feedthroughs (if the cleaning unit is used only 4 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 about the power connections, see the handbook.)
- ② Motor, heater and fan connection block (connected at factory)
- ③ Cleaning connection block (connected at factory)
- ④ Relay connection block (For further information about the relay connection block, see the handbook.)
- ⑤ External connection block (connected at factory)
- ⑥ Output connection block (For further information about the output connection block, see the handbook.)
- ⑦ Control inputs connection block (For further information about the control inputs connection block, see the handbook.)

## 4.7 Connecting the power supply

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

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

*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!*
- *The grounding takes place directly at the device. For outside use ground the device with a wire of min. 16 mm<sup>2</sup> and for inside use with a wire of min. 6 mm<sup>2</sup>.*
- *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 ( $I_{nom} \leq 6 A$ ).*
- *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 or 60 Hz ( $\pm 10\%$ ) and max. 170 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.*

*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:

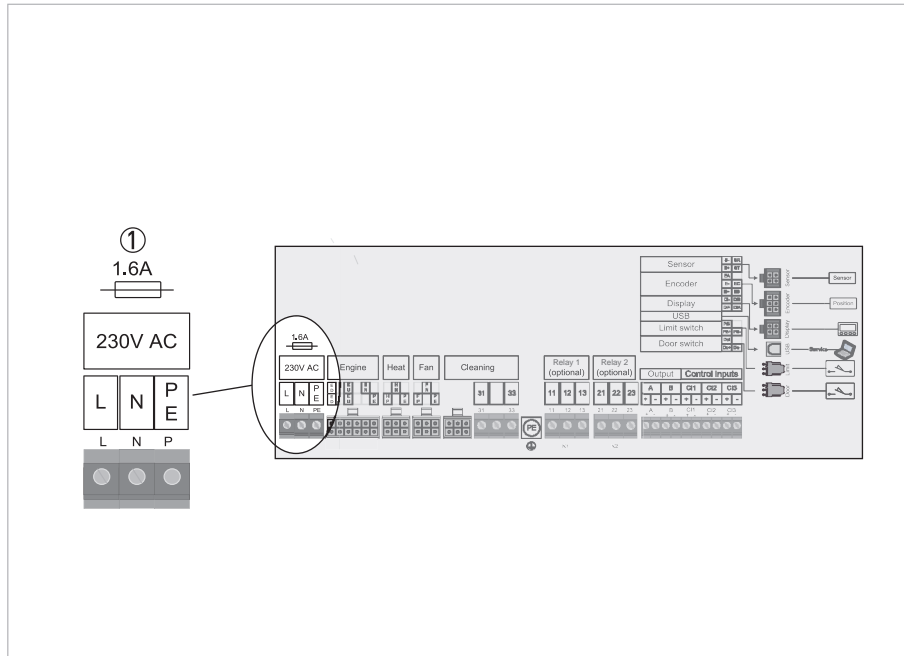


Figure 4-3: Connecting power supply

- ① Live (L)
- ② Neutral (N)
- ③ Protective earth (PE)

*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 mm<sup>2</sup> / 16 AWG and the maximum is 2.5 mm<sup>2</sup> / 12 AWG. The use of wire ferrules is recommended.*

*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 device contains an internal fuse (1.6 A slow blow). Replacement of the fuse should only be carried out by a service technician.*

## Connecting the power supply

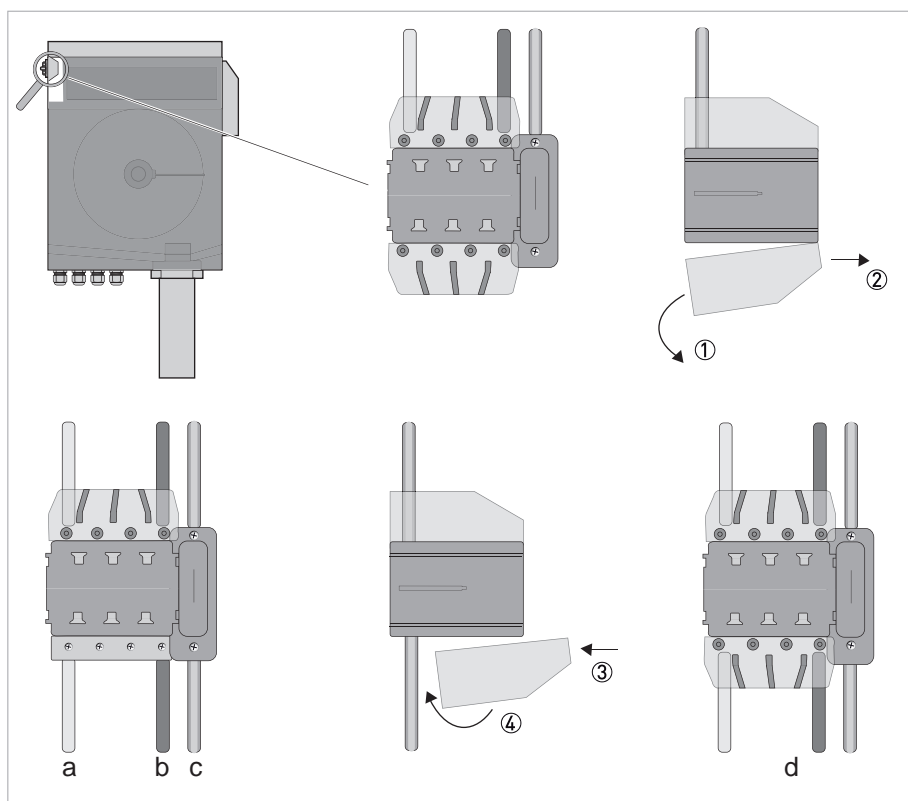


Figure 4-4: Connecting the switch for the power supply

a = Brown cable  
 b = Blue cable  
 c = Green / Yellow cable  
 d = Final installation

- ① Pull the cover down
- ② Slide the cover off
- ➡ Now it is possible to connect the power supply as shown
- ③ Slide the cover on
- ④ Click the cover onto the switch



## 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.

Output range	4...20 mA
Mode of output	Active
Electrical isolation	All outputs are electrically isolated from the power supply
Load resistance [ $L_R$ ]	$\leq 550 \Omega$ at $I_{max} \leq 22 \text{ mA}$
Nominal internal voltage ( $U_{int, nom}$ )	15 VDC

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.

	Measuring function		
	Level	Profile	Zone tracking
Current output A	Height / depth of concentration (sludge level) ①	Height / depth of the sensor position ①	Height / depth of the sludge level ①
Current output B	Height / depth of concentration (fluff) ①	Measured concentration ②	Measured concentration ②

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 about the current output, see the handbook.

### 4.8.2 Control input (active)

*The factory default is a disabled control input!*

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

Mode of input	Active, not polarity sensitive
Maximal voltage ( $U_{\max}$ )	15 VDC
Voltage out ( $U_{\text{out}}$ )	8 VDC
Current out ( $I_{\text{out}}$ )	-10 mA
Voltage low ( $U_{\text{low}}$ )	< 2 V
Voltage high ( $U_{\text{high}}$ )	> 4 V

#### 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

*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

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

- *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

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

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 7.

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)

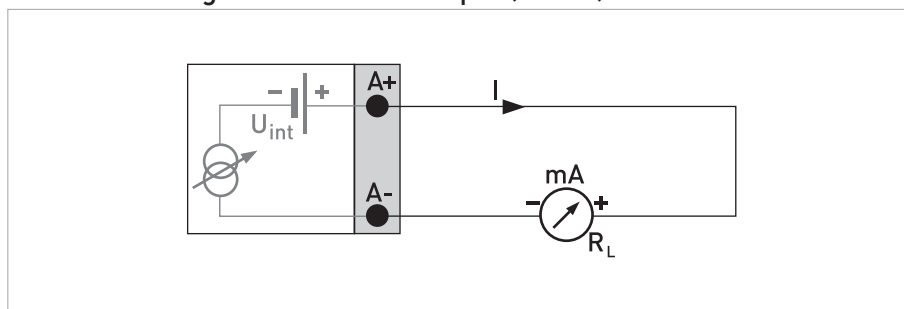


Figure 4-5: Current output (active)

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.

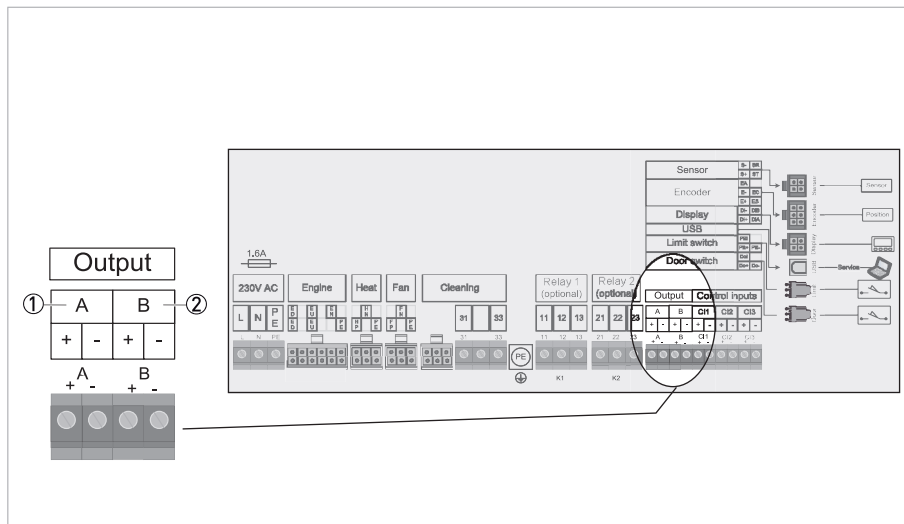


Figure 4-6: Connection current output

- ① Current output A
- ② Current output B

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.

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 mm<sup>2</sup> / 20 AWG and the maximum is 1.5 mm<sup>2</sup> / 16 AWG.

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 door.
- Remove the cover of the electronic compartment.
- 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 28).
- 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.
- Fix the cover of the electronic compartment and close the door.

### 4.9.3 Electrical connection of control inputs

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

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 7.

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.

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 mm<sup>2</sup> / 20 AWG and the maximum is 1.5 mm<sup>2</sup> / 16 AWG.

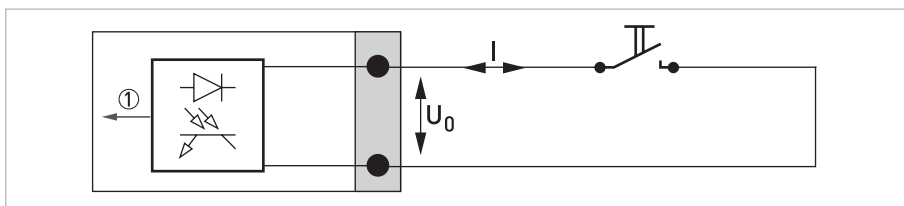


Figure 4-7: Control input

① Signal

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.

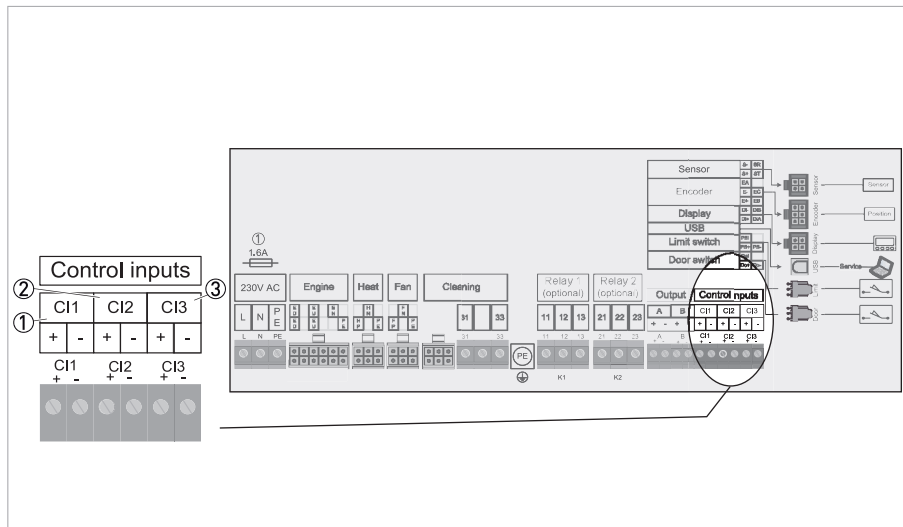


Figure 4-8: Connection control input

- ① Control input (CI1)
- ② Control input (CI2)
- ③ Control input (CI3)

### Connecting the control inputs

- Open the door.
- Remove the cover of the electronic compartment.
- 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 28).
- 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.
- Fix the cover of the electronic compartment and close the door.

*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

*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:

Maximal external voltage ( $U_{ext}$ )	Maximal external voltage K3: 24 V DC / 250 VAC Maximal external voltage K1, K2: 24 V DC / VAC If relay K2 is not connected, the maximal external voltage for relay K1 can be 250 VAC
Maximal current (I)	K1 / K2 $\leq 1$ A K3 $\leq 0.3$ A

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 further information about the limit switch, see the handbook..

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

*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.*

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

*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.*

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

*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 mm<sup>2</sup> / 16 AWG and the maximum is 2.5 mm<sup>2</sup> / 12 AWG. The use of wire ferrules is recommended.*

*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.

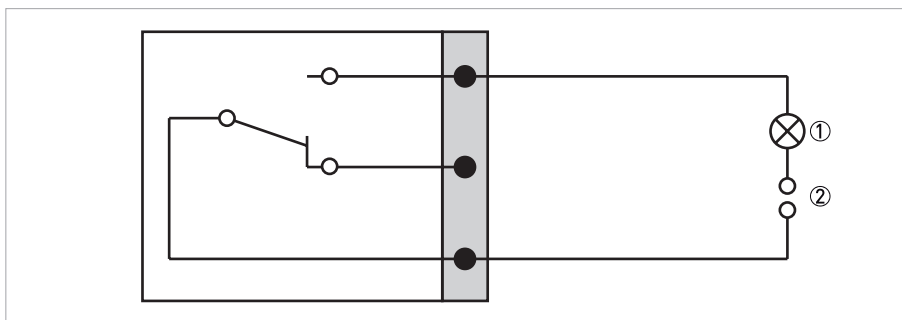


Figure 4-9: Connection diagram of relays K1 and K2

- 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.

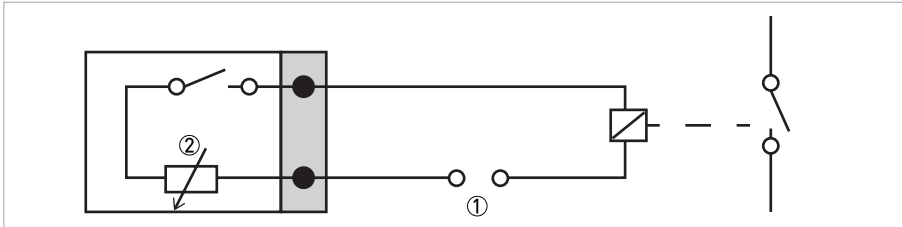


Figure 4-10: Connection diagram pump (K3)

- ① External voltage
- ② PTC resistance ( $I_{\max} = 0.3 \text{ A}$ )

#### 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 door.
- Remove the cover of the electronic compartment
- 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.
- Fix the cover of the electronic compartment and close the door.

## 4.11 Protection category

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

IP 68 (sensor), IP 55 (electronic compartment), IP 45 (cable drum compartment).





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