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INSTRUCTION MANUAL

FireGuard 2 Integral

Tunnel smoke detector

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Contents

1 General user information

1.1 Terms used in this document (glossary)

Please refer to our website for specialist terms: www.photometer.com/de/abc/index.html

1.2 Purpose of the Instruction Manual

This Instruction Manual provides the user with helpful information about the entire life cycle of the FireGuard 2 Integral and its peripheral devices. Before commissioning the instrument, you should be completely familiar with the Instruction Manual.

1.3 Target group of the documentation

The Instruction Manual is intended for all persons who are responsible for the operation and maintenance of the instrument.

1.4 Additional documentation

DOC. NO.	TITLE	CONTENT
13544E	Brief Instructions	The most important functions and the servicing schedule.
13779E	Reference Manual	More sophisticated menu functions and worksteps for advanced users.
13654E	Data Sheet	Descriptions and technical data about the instrument.
13764E	Service Manual	Repair and conversion instructions for service engineers.
14173DEF	Declaration of Conformity	Compliance with the underlying directives and standards.

1.5 Copyright provisions

1.6 Document storage location

This document is part of the product. It should be stored in a safe place and always be close at hand for the user.

1.7 Order document

The most recent version of this document can be downloaded at www.photometer.com (first time registration required).
It can also be ordered from a SIGRIST representative in your country (→ Instruction Manual "Customer service information").

1.8 Proper use

The photometer and its peripherals are designed for detecting smoke in tunnels at ambient temperatures of between -20 °C (minimum) and +50 °C (maximum).

1.9 User requirements

The instrument may be operated only by trained technical personnel who have read and understood the content of the Instruction Manual.

1.10 Declaration of conformity

Current technological principles were followed in designing and manufacturing the instrument. They comply with the applicable guidelines concerning safety and duty to take due care.

CE

EU: The measuring instrument meets all applicable requirements within the European Union (EU) for carrying the CE mark.

Please refer to the separate declaration of conformity for details. Section 1.4

1.11 Use restrictions

EXPLOSION HAZARD!

Operation in an inappropriate environment.

Use in explosive areas can cause explosions, which can lead to the death of persons in the vicinity.

- It is not permitted to operate the instrument in explosion hazardous areas or rooms.
- It is not permitted to use the instrument with explosive sample substances.

1.12 Dangers when not used properly

DANGER!

Operation when not used properly.

Improper use of the instrument can cause injuries to persons, process-related consequential damage and damage to the instrument and its peripherals.

In the following cases the manufacturer cannot guarantee the protection of persons and the instrument and therefore assumes no legal responsibility:

- The instrument is used in a way not included in the described area of application.
- The instrument is not properly mounted or set up.
- The instrument is not installed and operated in accordance with the Instruction Manual.
- The instrument has been operated with accessory parts which SIGRIST-PHOTOMETER AG has not expressly recommended.
- Improper changes to the instrument have been performed.
- The instrument has not been operated within the specifications, in particular concerning pressure and temperature.

1.13 Meaning of the safety symbols

All **danger symbols** used in this document are explained below:

DANGER!

Danger due to electrical shock that may result in serious bodily injury or death.

Non-observance of this danger warning may lead to electrical shocks and death.

EXPLOSION HAZARD!

Danger due to explosion that may result in serious bodily injury or death.

Non-observance of this notice may cause explosions resulting in serious property damage and death.

WARNING!

Warning about bodily injury or hazards to health with long-term effects.

Non-observance of this warning may lead to injuries with possible long-term effects.

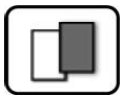
CAUTION!

Notice about possible material damage.

Non-observance of this notice may cause material damage to the instrument and its peripherals.

1.14 Meaning of the pictograms

All **pictograms** used in this document are explained below:

	Additional information about the current topic.
	Practical procedures when working with the FireGuard 2 Integral.
	Manipulations on the touchscreen.
	The screenshot is an example and may differ from current device.

2 Instrument overview

2.1 Overview of a measuring point

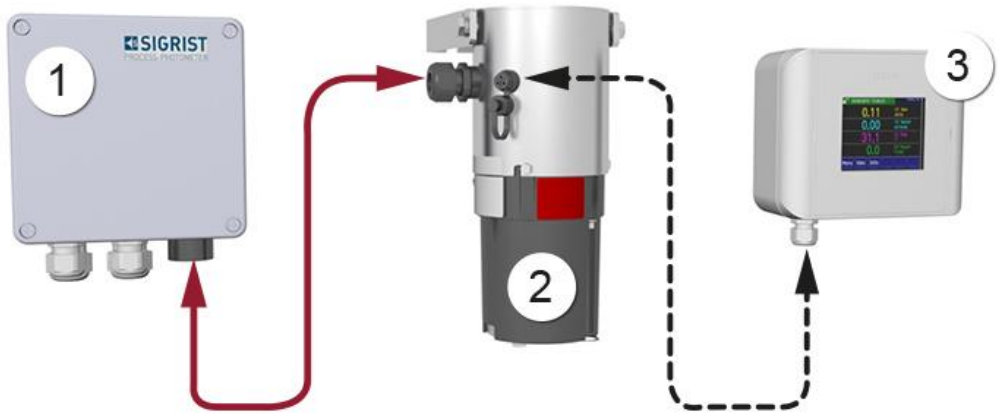


Figure 1: Overview of a measuring point

①	V2 junction box	②	FireGuard 2 Integral photometer (smoke detector)
③	SICON-C portable control unit, can be connected to the FireGuard 2 Integral via cable		

2.2 Designation of the components

2.2.1 Rating plate on FireGuard 2 Integral

The FireGuard 2 Integral photometer is fitted with the following rating plate:

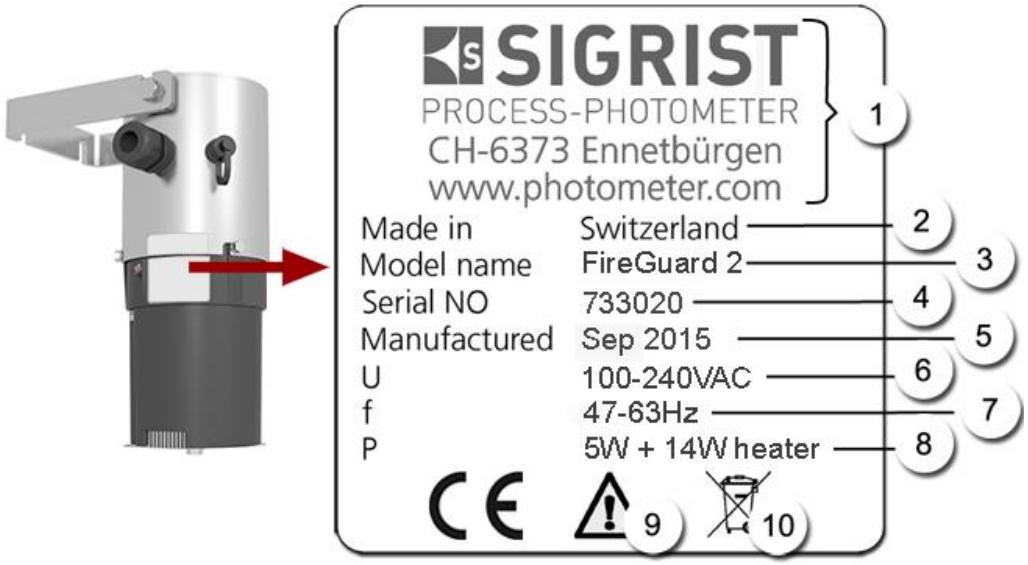


Figure 2: Rating plate on FireGuard 2 Integral

①	Manufacturer	②	Country of origin
③	Product name	④	Serial number
⑤	Date of manufacture	⑥	Service voltage
⑦	Frequency range	⑧	Power
⑨	Observe the Instruction Manual	⑩	Observe the disposal information

A red sticker is attached to the FireGuard 2 Integral (arrow). This distinguishes it from the first version FireGuard.

Figure 3: Red sticker for identifying the FireGuard 2 Integral

2.2.2 Rating plate on SICON-C

The SICON-C portable control unit is fitted with the following rating plate:

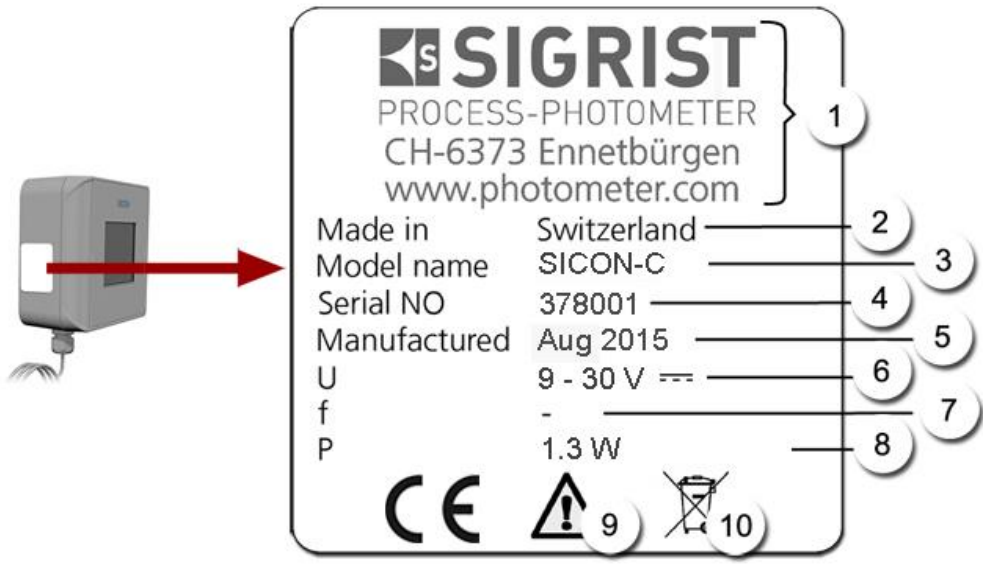


Figure 4: Rating plate on SICON-C

①	Manufacturer	②	Country of origin
③	Product name	④	Serial number
⑤	Date of manufacture	⑥	Service voltage
⑦	Frequency range	⑧	Power
⑨	Observe the Instruction Manual	⑩	Observe the disposal information

2.3 Scope of supply and accessories

Standard scope of supply for the FireGuard 2 Integral:

PCS.	ART. NO.	NAME	VIEW	VARIANT
1	120300	FireGuard 2 Integral with cable 0.9 m		
1	120305	Profibus DP interfaces module		
	120306	StromRel interfaces module		
	120307	Modbus RTU interfaces module		
1	120455	Mounting bracket		

Attached documents:

PCS.	DOC. NO.	NAME	VIEW	VARIANT
1	13763	Instruction Manual		German French English
1	13779	Reference Manual		German English
1	13544	Brief Instructions		German French English

Optional accessory parts:

PCS.	ART. NO.	NAME	VIEW	VARIANT
1	120309	WLAN module		
1	117396	Sample heater, pair		
1	120290	SICON-C portable control unit		
1	120345	V2 junction box		

PCS.	ART. NO.	NAME	VIEW	VARIANT
1	117390	Checking unit		
1	120308	Tool-free maintenance		The instruments can be equipped with knurled screws (optional).

2.4 Technical data for the FireGuard 2 Integral

General:

Data	Values
Measuring principle	Scattered light measurement
Measurement span	0 .. 30 E/m
Wavelength	670 nm
Resolution	± 0.001 E/m
Reproducibility	± 0.001 E/m, or 2 % of the measuring range
Reaction time	5 s (at a wind speed of 1.5 m/s)
Measuring angle	120 °
Ambient temperature	-20 .. 50 °C
Ambient humidity	0 .. 100 % rel. humidity

FireGuard 2 Integral photometer:

Data	Values
Service voltage	100 .. 240 VAC; 47 .. 63 Hz
Power consumption	Sample heater OFF: 5 W/14 VA Sample heater ON: 19 W/33 VA
Weight	2.1 kg (2.3 kg with sample heater)
Protection class	IP66 (electronics only)
Photometer material	Stainless steel 1.4571 (316L)
Measuring cell material	PC/ABS
Interfaces	Profibus DP, Modbus RTU with repeater, StromRel module, WLAN module
Cable for V2 junction	Length: 0.9 m

Data	Values
box	
Dimensions	ca. Ø 150 mm x 186 mm x 247 mm Detailed dimension sheet Section 16

SICON-C portable control unit:

Data	Values
Service voltage	24 VDC
Power consumption	1.3 W
Display	▪ ¼ VGA with touchscreen ▪ Resolution: 320 x 240 pixels with 3.5" diagonal
Protection class	IP66
Weight	0.6 kg
Dimensions	160 x 152 x 60 mm Detailed dimension sheet Section 16
Housing material	ABS

V2 junction box

Data	Values
Protection class	IP66
Weight	1.6 kg
Dimensions	ca. 160 mm x 198 mm x 91 mm Detailed dimension sheet Section 16
Housing material	Glass-fiber reinforced polyester

3 General safety points

3.1 Dangers when properly used

DANGER!

Damaged instrument or cabling.

Touching damaged cables may lead to electrical shocks or death.

- The instrument may be operated only when the cables are undamaged.
- The instrument may be operated only if it has been properly installed or repaired.

DANGER!

Dangerous voltage inside the instrument.

Touching live components inside the instrument may lead to electric shocks resulting in death.

- The instrument must not be operated when the housing is removed.

DANGER!

Damage to the instrument due to incorrect service voltage.

If the instrument is connected to an incorrect service voltage, the instrument can be damaged.

- The instrument may be connected only to voltage sources as specified on the rating plate.

DANGER!

Missing Instruction Manual after the instrument changes hands.

Operating the instrument without knowledge of the Instruction Manual may lead to injuries to persons and damage to the instrument.

- If the instrument changes hands, always include the Instruction Manual.
- If the Instruction Manual is lost, you can request a replacement.
  Registered users can download the current version at www.photometer.com.

CAUTION!

Penetration of moisture as well as condensation on the electrical components during servicing duty.

If moisture enters the instrument, the FireGuard 2 Integral can be damaged.

- Work on the inside of the instrument may be performed only in a dry room and at room temperature. The instrument should be at operating or room temperature (avoid condensation on optical and electrical surfaces).

CAUTION!

The use of aggressive chemicals when cleaning.

Use of aggressive chemicals can cause damage to instrument components.

- Do not use aggressive chemicals or cleaning agents when cleaning.
- Should the instrument come in contact with aggressive chemicals, clean it thoroughly with a neutral cleaning agent.

3.2 Residual risk

WARNING!

According to the risk assessment of the applied safety directive DIN EN 61010-1, there remains the risk of a faulty measuring value display. This risk can be reduced with the following measures:

- Use an access code to prevent unauthorized persons from changing parameters.
- Change the password when using the optional WLAN module.
- Perform the specified servicing duties.

3.3 Warning and danger symbols on the instrument

WARNING!

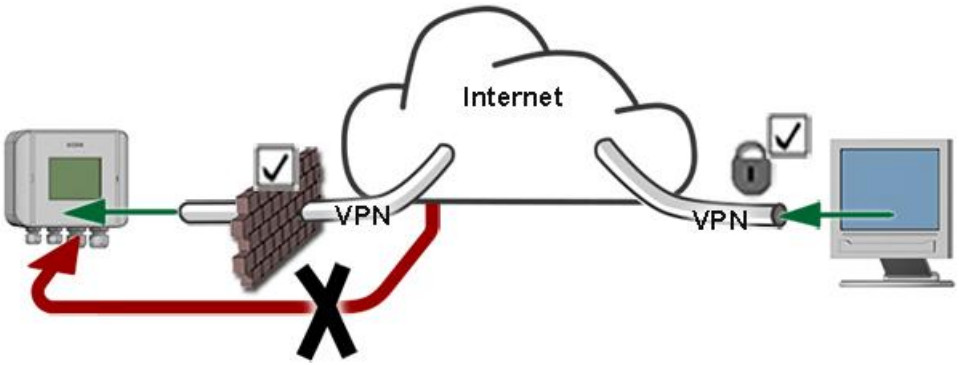
There are no warning or danger symbols on the instrument.

Users must ensure that they observe the safety measures as specified in the Instruction Manual at all times when working with the instrument and its peripheral equipment, even if no warning or danger symbols are attached to the instrument.

The following sections must be internalized:

- Section 1.11
- Section 1.12
- Section 1.13
- Section 3.1
- Section 3.2
- Observe safety pointers when performing the described procedures.
- Observe local safety pointers.

3.4 Preventing undesirable online access attempts



WARNING!

SIGRIST instruments are equipped with an integrated web user interface and Modbus TCP interface, thus offering state-of-the-art administration and control possibilities. However, if these are connected directly to the Internet, then any Internet user can in principle access your instrument and change the configuration.

Please note the following points to prevent this:

- Never connect the instrument directly to the Internet.
- Operate it behind a firewall and block access to the instrument.
- Only connect to branch offices via VPN.
- Change the standard password on commissioning.
- Always keep up to date with the latest changes regarding Internet security so that you can react promptly in the event of alterations.
- Install the latest updates immediately (also for the router and firewall).

4 Mounting

CAUTION!

Danger of the photometer falling onto the road if improperly mounted.

The following requirements must be met when fastening the instruments in place:

- When fastening the photometer, screws with a diameter of at least **M8** must be used.
- The material quality of the screws used must correspond to the local mounting and installation guidelines.

4.1 General information on mounting the FireGuard 2 Integral

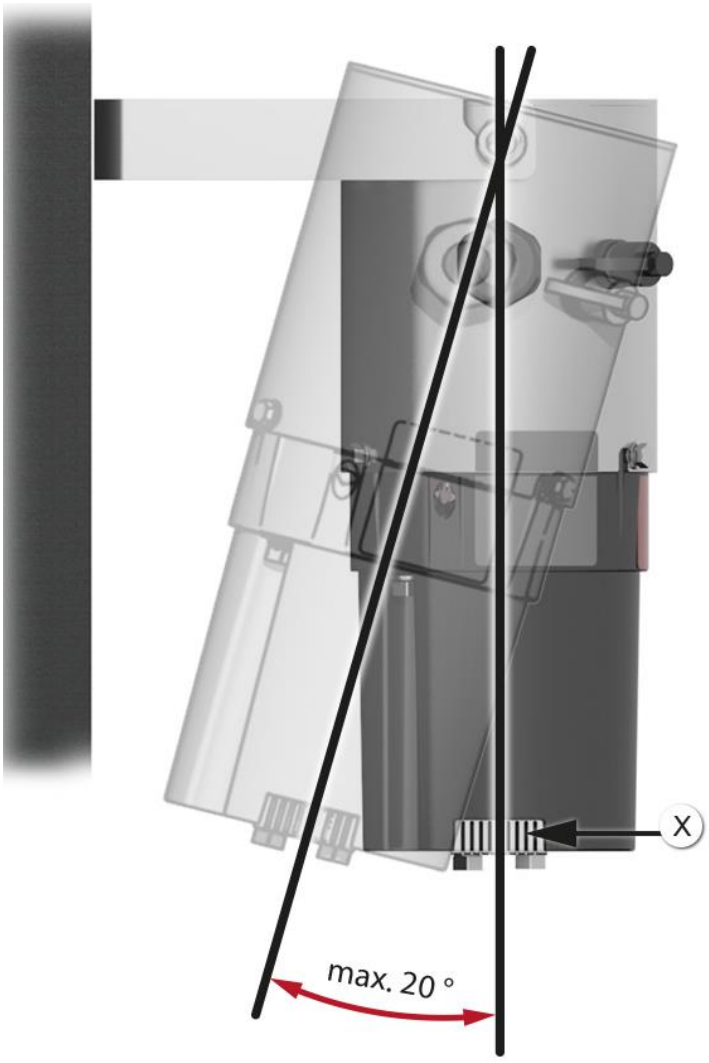
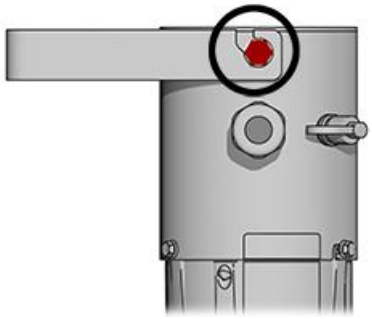


Figure 5: Installation position in the air flow

- The opening on the sampling point (X) must point in the direction of travel in the tunnel.
- The photometer is fastened to the wall using the mounting bracket.
- The inclination of the photometer must not exceed 20°.

Installation of the measuring equipment is carried out in the following steps:

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Fasten the mounting bracket to the wall in the measuring position.	
2.	Mount the photometer in the mounting bracket and then fasten in place (circle).	
3.	Immediately fasten the V2 junction box in place on the wall next to the photometer using the four screws according to the **VDV2-MB** dimension sheet.	The connection cable between the photometer and junction box is 0.9 meters in length.

4.2 Mounting the V2 junction box

The V2 junction box is fastened using four screws on a solid, level surface according to the drawing **VDV2-MB** (Section 16).

When selecting the installation position, please note that the supplied connection cable to the photometer is only 0.9 meters in length.

5 Electrical installation

5.1 Safety pointers for the electrical connection

DANGER!

The improper electrical connection of the components can be potentially fatal. The components can also be damaged.

Note the following basic principles for the electronic connection:

- Local regulations must be observed at all times.
- Because the system has no main switch, a suitable disconnection device (switch, plug) should be installed near the service voltage. It must be designated and easily accessible.
- The power supply must have a back-up fuse with a max. tripping current of 16 A. The cables must be able to withstand this load.
- The mains cable must be able to withstand an ambient temperature of 70 °C.
- It is imperative that the protective conductor is connected.
- The system must not be charged with voltage until the installation is completed and all covers are mounted.
- If faults cannot be remedied, the system must be put out of operation and protected against inadvertent operation.

5.2 Connecting the FireGuard 2 Integral to the V2 junction box

DANGER!

Life-threatening voltage due to accidentally released voltage-carrying wires.

- The wires of the supply connection must be secured with cable ties so that if one wire accidentally becomes loose no other parts can be charged with voltage.
- A high-temperature cable must be used for connecting the service voltage and the interfaces.
- The cable glands must be adjusted according to the outer diameter of the cables. The following cable glands are available:
  2 x 8 .. 17 mm
  2 x 8 .. 13 mm

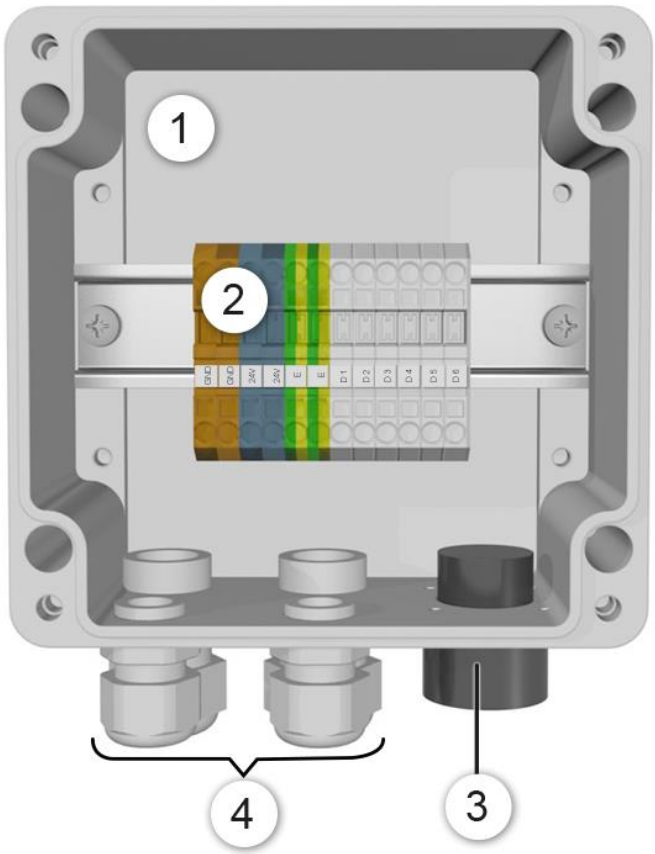


Figure 6: Junction box when open

①	Junction box for connecting the photometer	②	Terminal strip
③	Hybrid connector for the photometer connection	④	Two cable glands each, clamping range 8 .. 13 mm and 8 .. 17 mm.

The terminals are assigned according to the following table:

Terminal number	Meaning	Remarks
D1 .. D6	Digital connections The function of the terminals changes depending on the integrated fieldbus module. Carry out the installation of the digital connections D1 .. D6 according to one of the following sections: ▪ Profibus DP: Section 5.3 ▪ Modbus RTU: Section 5.4 ▪ StromRel: Section 5.5	
P	Live	Terminal pair for forwarding to other instruments (max. 16 A).
N	Neutral	
PE	Protective earth	

5.3 Profibus DP: Overview and installation

- To connect to the Profibus DP, the Profibus module must be integrated in the FireGuard 2 Integral.
- To be able to work with the Profibus, the bus parameters in the **Digi. interf.** \ **Profibus** menu must be set correctly. If the associated parameters are changed, the function only becomes effective after a restart.
- If the photometer is used as a terminal device, DIL switch S2/1 must be switched ON on the Profibus module (Figure 7, pos. 2). The electronics housing must be removed according to the Section 5.6 in order to set the DIL switches.
- The addressing of the Profibus DP interface is described in the Reference Handbook.

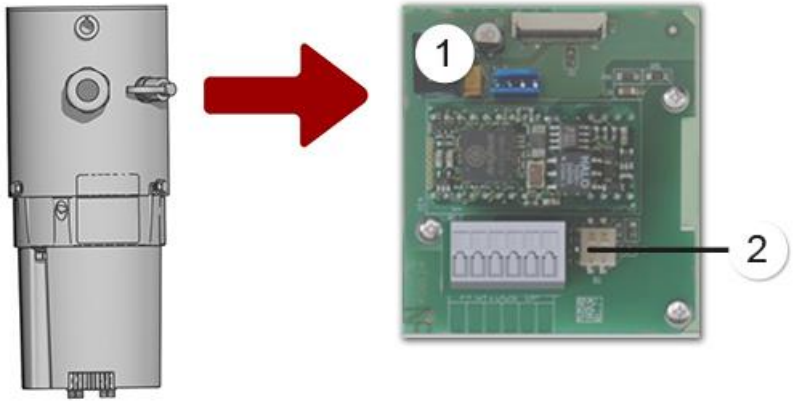


Figure 7: Overview of the Profibus DP module in the FireGuard 2 Integral

①	Field bus interface for Profibus DP (Profibus module)	②	DIL switches for matching resistors. Switches 1 and 2 must be **ON**

The terminals in the junction box are assigned as follows when a Profibus DP module is present:

Profibus DP terminals	**Function**	**Junction box V2 terminals**	**Functional description**
11 ⏚	Ground IN	D1	Connection for cable shielding
12 A	RS485-A IN	D2	Data connection
13 B	RS485-B IN	D3	Data connection
14 ⏚	Ground OUT	D4	Connection for cable shielding
15 A	RS485-A OUT	D5	Data connection
16 B	RS485-B OUT	D6	Data connection

5.4 Modbus RTU with repeater: Overview and installation

- To connect to the Modbus RTU with repeater, a Modbus module must be integrated in the FireGuard 2 Integral.
- To be able to work with the Modbus, the bus parameters in the **Digi. interf. \ Modbus** menu must be set correctly. If the associated parameters are changed, the function only becomes effective after a restart.
- If the photometer is used as a terminal device, DIL switch S2/1 must be switched ON on the Modbus module (Figure 8, pos. 2).
  The electronics housing must be removed according to the Section 5.6 in order to set the DIL switches.
- The addressing of the Modbus RTU interface is described in the Reference Handbook.
- Either a SICON M control unit or in-house control unit can be used as the Modbus master.
- A twisted pair, shielded cable (SF/UTP) should be used. Characteristic impedance 120 ±20 Ohm, capacitance < 60 pF/m.

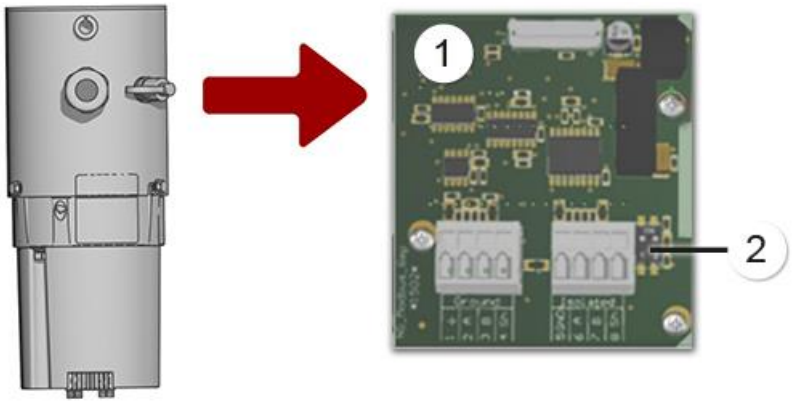


Figure 8: Overview of the Modbus RTU module in the FireGuard 2 Integral

①	Field bus interface (Modbus module) for Modbus RTU with repeater	②	DIL switches for matching resistors. Switches (1 and 2) must be **ON**

The terminals in the junction box V2 are assigned as follows when a Modbus module is present:

Modbus terminals	Function	Potential	V2 junction box terminals	Functional description
1 ⏚	GND – to ground potential	Ground potential	D1	Connection of the GND line
2 A	RS485-A IN		D2	Data connection
3 B	RS485-B IN		D3	Data connection
5 GND	GND	Galvanically isolated	D4	Connection of the GND line
6 A	RS485-A OUT		D5	Data connection
7 B	RS485-B OUT		D6	Data connection

Additional information on the Modbus RTU with repeater
This module has a connection related to ground potential and a galvanically isolated connection. The signals are amplified so that several modules can be connected in series. To do this, a connection related to ground potential must always be connected to a galvanically isolated connection. The ground line must be used.

5.5 StromRel module: Overview and installation

- The configuration of the StromRel module is described in the Section 8.7.
- The current outputs can be loaded with up to 500 Ohm.
- Using the semiconductor relay, currents up to 120 mA and voltages up to 50 V can be connected.
- The typical resistance when switched on is 20 Ohm. The switch is normally open.
- Set the current outputs as described under Section 8.7.

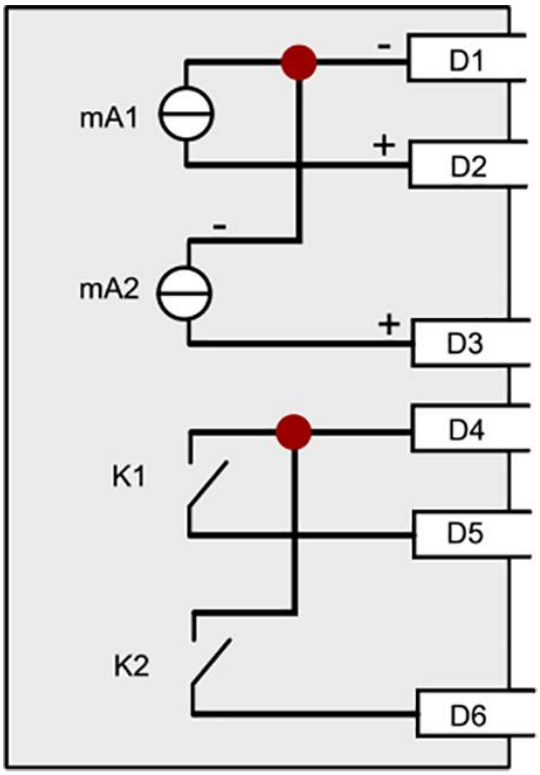


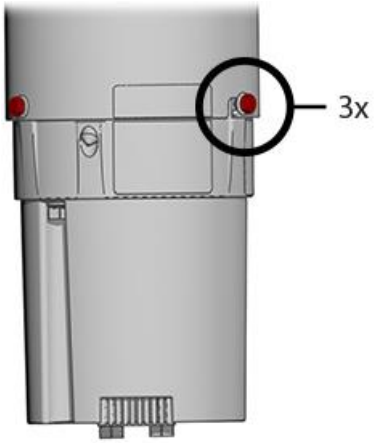
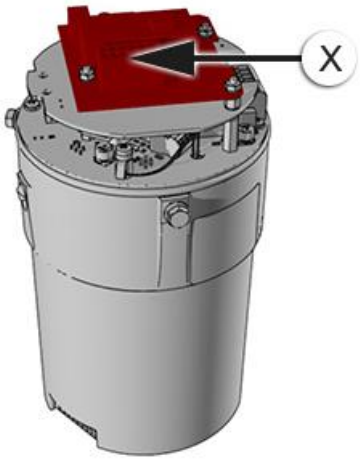
Figure 9: Diagram of StromRel module

The terminals in the junction box are assigned as follows when a StromRel module is present:

Function	Junction box terminals	Functional description
mA 1/2 -	D1	Current output 1/2 -
mA 1 +	D2	Current output 1 +
mA 2 +	D3	Current output 2 +
C shared	D4	Semiconductor relay shared
C1	D5	Semiconductor relay 1 NO
C2	D6	Semiconductor relay 2 NO

5.6 Removing the electronics housing

The housing must be removed in order to set the DIL switches on the fieldbus modules. The following describes this process:

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Interrupt the service voltage to the photometer.	
2.	Remove the three screws used for fastening the housing. The electronics housing can be removed by turning it clockwise slightly. ⚠ The housing is connected with a cable. Therefore, please remove the housing carefully.	
3.	Access to the corresponding interface module (X) is now possible.	

6 Commissioning

The initial start-up of the web user interface via the optional WLAN interface is described in the Reference Manual.

Proceed with the initial start-up in accordance with the following table:

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Ensure that all components are correctly mounted and connected.	Section 4 and Section 5
2.	2.1: Establish the service voltage to the instrument.	
	2.2: Plug the SICON-C into the instrument according to Section 7.3 and wait until the welcome screen appears in the display. The factory setting language is English.	
	2.3: The instrument is ready for measurement.	
3.	Set the language.	Section 8.1
4.	Set the limits.	Section 8.2
5.	Set the outputs.	Section 8.3.4
6.	Configure the adjustment.	Section 8.4
7.	If an optional Profibus module is present, set the Profibus parameters.	Section 8.5
8.	If an optional Modbus module is present, set the Modbus parameters.	Section 8.6
9.	If an optional StromRel module is present, set the current outputs.	Section 8.7
10.	Enter the access code.	Section 8.8
11.	Carry out recalibration.	Section 9.4
12.	Back up the configured data.	Section 8.9

7 Operation

7.1 Operation basics

In this document we describe the practical examples only for the first steps of the menu configuration. All other setting options are described in the Reference Manual. The connection to the optional WLAN module and the web user interface are described in the Reference Manual.

7.2 LED display on the photometer

The FireGuard 2 has a red LED display in order to indicate the most important events during measuring operation without SICON-C.

Figure 10: Position of the LED display

The events are indicated on the LED according to the following table:

LED status on the photometer	**Meaning**	**Next steps**
LED permanently off	Instrument is powered off or defective.	Power on the instrument.
LED flashes every 15 seconds	The instrument is in measuring operation without faults.	
LED flashes twice every 15 seconds	The instrument is in measuring operation without faults. The WLAN access point is active.	
LED switches on and off in one-second intervals	Checking unit recording is running.	Wait until the LED goes out for 5 seconds.
LED switches on and off in four-second intervals	Limit is exceeded	Carry out the measures for when the limit is exceeded.
LED permanently lit	Fault	Isolate the malfunction according to Section 10.

7.3 Connecting the SICON-C to the FireGuard 2 Integral

The SICON-C (2) is connected directly to the FireGuard 2 Integral (1) using the connector (X). The protection cap on the connector must be removed beforehand. If the photometer is connected to the service voltage, the SICON-C starts automatically.

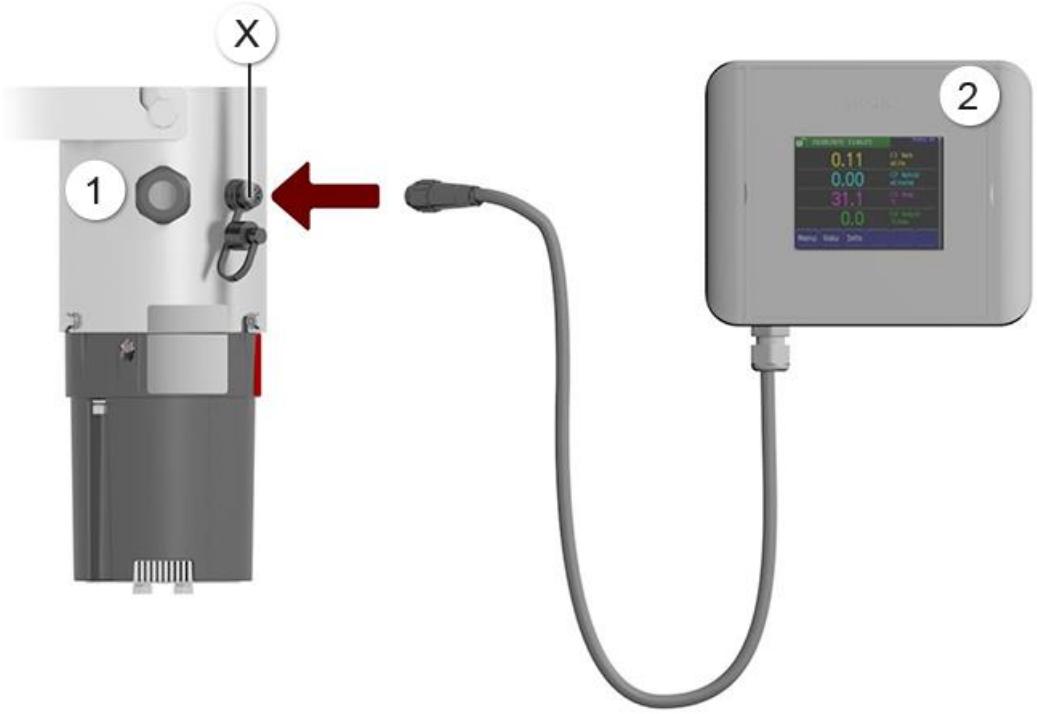


Figure 11: Connecting the SICON-C to the FireGuard 2 Integral

①	FireGuard 2 Integral	②	SICON-C

The SICON-C has a touchscreen. Operation is made by touching the screen with your finger. The navigation elements change color when touched.

CAUTION!

Sensitive touchscreen.

The touch screen can be damaged through improper handling. Damage can be avoided with the following measures:

- Touch the touchscreen only with your fingers and not with sharp objects.
- Use only slight pressure to perform manipulations on the touchscreen.
- Do not use chemicals or solvents to clean the touchscreen.

Protection class IP66

If the Sicon-C connection plug is not used, the protective cap must always be mounted and be completely closed to ensure the protection class IP66.

7.4 Control elements in measuring operation

Figure 12: Control elements in measuring operation

①	**Menu** button Calls up the menu structure. Section 7.5	②	**Valu** button Numerical representation of the measuring values. Section 7.6
③	**Info** button Displays the information screen. Section 7.7	④	**Up arrow** Goes to the previous page.
⑤	**Down arrow** Goes to the next page.		

7.5 Menu button

Pressing the **Menu** button and entering the access code takes you to the menu structure. Now the instrument is in service operation. Operator prompting in service operation is described in Section 7.11.

7.6 Valu button

Pressing the **Valu** button displays the measuring values in numerical form. This is described in detail in Section 7.8.

7.7 Info button

When you press the **Info** button, a general overview of the instrument settings appears. These are described below:

7.7.1 Page 1 Info button

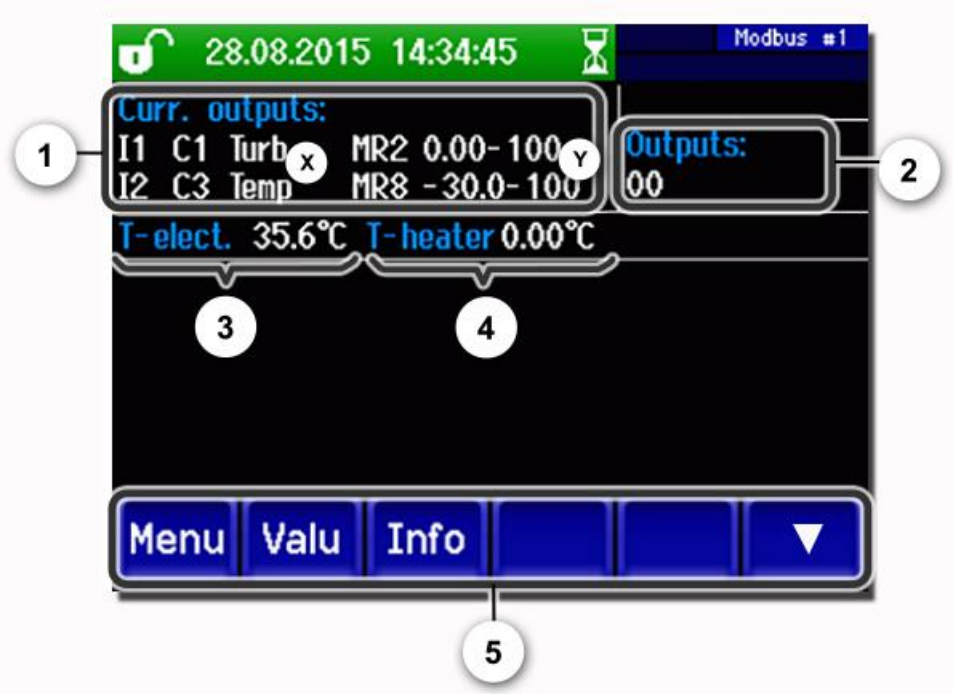


Figure 13: Information screen page 1

①	Information about the available current outputs X: Source of the current output Y: Measuring range of the current output	②	Status of the outputs → Reference Manual
③	Temperature of the electronics	④	Heater temperature (if heater is inactive: 0 °C) → Reference Manual
⑤	Main menu buttons		

7.7.2 Page 2, Info button

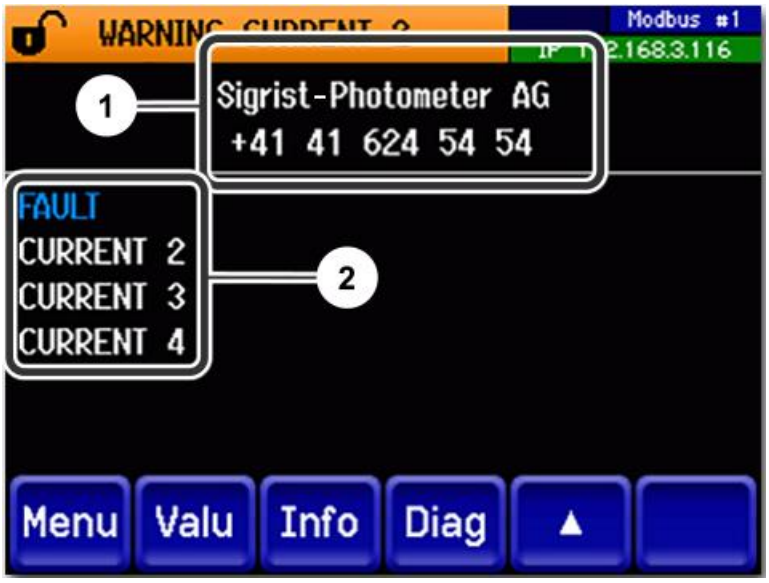


Figure 14: Info screen, page 2

①	Contact information	②	Display of up to 5 pending fault messages

7.8 Display in measuring operation

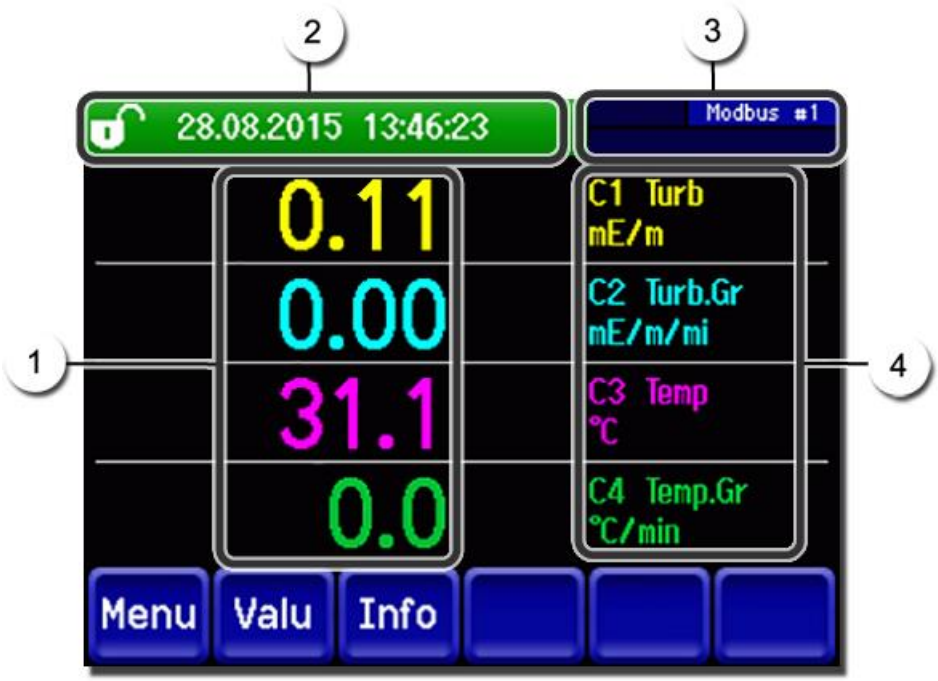


Figure 15: Display in measuring operation

①	Measuring value(s) For values which are greater than the maximum measuring range, no measuring value is displayed; instead, **** is displayed.	②	Status line In normal operation, the status line is green and shows the date and time. If faults should occur, warning and fault messages are shown here and the status line changes to orange or red.
③	Interface information Top: Modbus or Profibus status Bottom: WLAN status with IP address Color coding: Black: Not active / not present Blue: Activated – in idle mode Green: Active Red: Fault	④	Channel name with unit The channel names shown in the figure are examples and can be adjusted individually.

7.9 Activating and deactivating the screen lock

	MANIPULATION	
1.	Press the lock icon top left.	
2.	Within one second press the key bottom at the outside right. Depending on the initial state, the lock icon changes as follows:  Display unlocked  Display locked	

7.10 Switching to service mode

The system is configured in service operation. The measuring procedure is interrupted and the main menus appear on the display. Service operation is accessed as follows:

	MANIPULATION	ADDITIONAL INFO / IMAGES
1.	Press the **Menu** button.	
2.	Set the access code and confirm with **OK**.	Factory setting is **0**.
3.	The main menus appear.	The instrument is now in service operation.

The following applies in service operation:

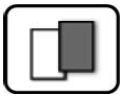
- * The measuring values remain on the last values on the digital interfaces.
- * Depending on the configuration, the current outputs go to 0/4 mA or remain on the last measuring values.
- The limits are deactivated.
- If an output for service is programmed, it is activated.
- Fault messages are suppressed.

* This does not apply when the **Local parameters\Current outputs\General\For service** parameter is set to **Measure**.

For measuring operation, press the **Meas** button. When switching from service operation to measuring operation, an hourglass appears in the information bar for about 20 seconds. The measuring values are frozen during this time.

7.11 Control components in service mode

7.11.1 Input elements in service mode



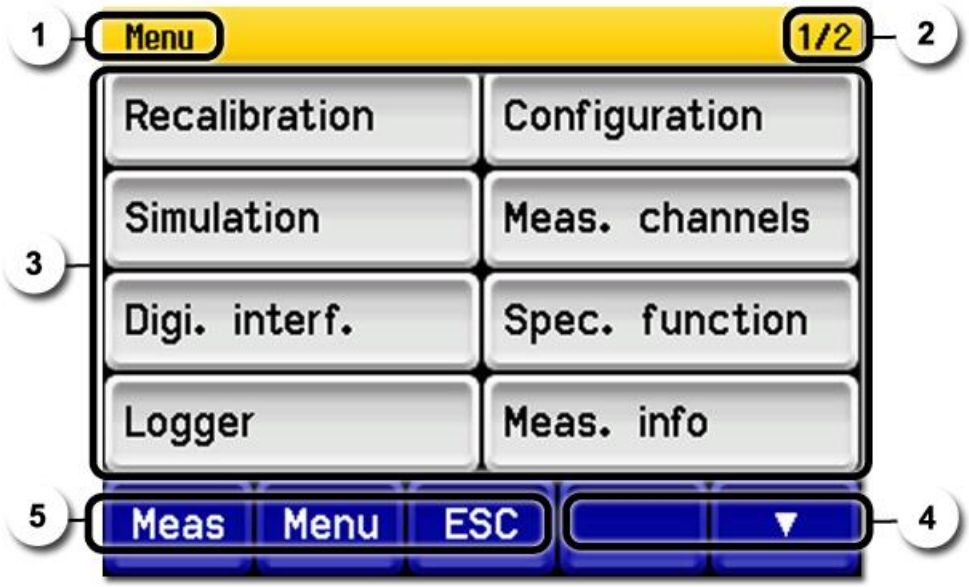


Figure 16: Input elements in service mode

①	Path specification	②	Page number / total number of pages
③	Main menus Instrument-specific menus of the photometer.	④	Next page
⑤	**Meas** button: The instrument changes to measuring operation. **Menu** button: The display goes back to mean menus and remains in service mode. **ESC** button: The display goes back one level in the menu hierarchy until the measuring mode finally is reached.		

7.11.2 Numerical entry

The following screen is for entering numbers and data:

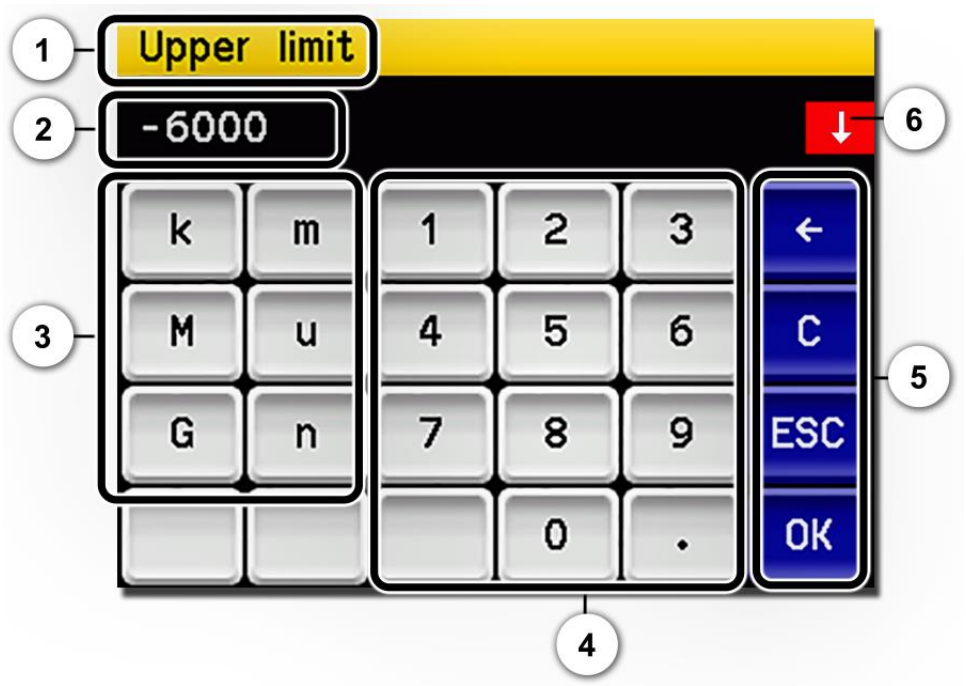


Figure 17: Numerical entry

①	Parameter name	②	Entered values
③	Prefix: For entering very large or very small values. This can be done as follows: 1. Enter value 2. Select SI prefix Function: **n** = 10^{-9}, **u** = 10^{-6}, **m** = 10^{-3}, **k** = 10^{3}, **M** = 10^{6}, **G** = 10^{9}	④	Numerical entry
⑤	**←:** Deletes one digit of the displayed value. **C:** Clears the displayed value. **ESC:** Touching the **ESC** field causes the display to go back one level in the menu hierarchy. The entered value is not saved. **OK:** Confirm entered value.	⑥	If the value entry is too high or too low, a white arrow appears in a red field top right. Arrow points upward: Entry too high Arrow points downward: Entry too low

7.11.3 Single selection of functions

The single selection is identifiable by the **ESC** button below right.

The currently selected function is green. Use the Up/Down arrows to navigate the options in long lists. Use the **ESC** button to cancel the entry.
Pressing a selection item saves the configuration and completes the entry.

Figure 18: Example of single selection

7.11.4 Multiple selection of functions

The multiple selection is identifiable by the **OK** button bottom right:

The currently selected values are green. Use the Up/Down arrows to navigate the options in long lists. Pressing a selection item changes the active status of the corresponding item. Press the **OK** button to save the configuration and complete the entry.

Figure 19: Example of multiple selection

8 Settings

8.1 Setting the operating language

	MANIPULATION	ADDITIONAL INFO / IMAGES
1.	Press the **Menu** button.	
2.	Set the access code and confirm with **OK**.	Factory setting is **0**.
3.	Press the **Configuration** button to access language selection.	If the desired menu does not appear, press the arrow bottom right.
4.	Press language field (circle). The list of all languages appears (factory setting is **English**).	
5.	Apply the desired language by pressing the corresponding field, or press the **ESC** button to cancel.	
6.	Press the **Meas** button.	The instrument is in measuring operation again.

8.2 Configuring the limits

8.2.1 General information on setting the limits

The monitoring mode of the FireGuard 2 is defined by the settings of the limit function. The following parameters can be monitored:

- Turbidity limit
- Limit for turbidity gradient (→ Section 8.2.6)
- Temperature limit
- Limit for temperature gradient (→ Section 8.2.6)

The following limits are set in the standard configuration:

Limit	Source	Limit	Cut-in delay	Cut-out delay	Remarks
1	Turbidity	10.0	6 s	0 s	Pre-alarm
2	Turb.Grad.	0.0	6 s	0 s	Inactive
3	Temperature	-30.0	6 s	0 s	Inactive
4	Temp.Grad	0.0	6 s	0 s	Inactive
5	Turbidity	30.0	8 s	0 s	Main alarm
6	Turb.Grad.	0.0	8 s	0 s	Inactive
7	Temperature	-30.0	8 s	0 s	Inactive
8	Temp.Grad	0.0	8 s	0 s	Inactive

On the temperature limits, the value -30.0 indicates that the function is deactivated. On all other limits, the value 0.0 indicates that the function is deactivated.

The following applies for limit monitoring:

CAUTION!

The limits used must be adjusted according to the local conditions.

- Limits 1 .. 4 are intended for the lower limit level (pre-alarm) and are assigned to output A1.
- Limits 5 .. 8 are intended for the higher limit level (main alarm) and are assigned to output A2.
- In the standard setting, only the monitoring of the turbidity value is used.
- In order for a pre-alarm to always be triggered first before a main alarm, the cut-in delay of the main alarm must be greater than that of the pre-alarm.

The limits have to be configured according to Section 8.3 so that they are not only displayed, but also output accordingly.

8.2.2 Setting the limits

The limits can be set as follows:

	MANIPULATION	ADDITIONAL INFO / IMAGES
1.	Press the **Menu** button.	
2.	Set the access code and confirm with **OK**.	Factory setting is **0**.
3.	Press the **Limits** button.	If the desired menu does not appear, press the arrow at the bottom right.
4.	Select between **Limit 1 .. 8**.	
5.	Define the source.	The following selection is available (when present): ▪ C1: Turbidity ▪ C2: Turbidity gradient ▪ C3: Temperature ▪ C4: Temperature gradient
6.	Define the upper limit, cut-in delay (Section 8.2.4) and cut-out delay (Section 8.2.5) with the number pad. Limits of -30.0 °C for the temperature and 0.0 for the turbidity and gradient values mean that the function is **inactive**.	Pressing the current number value takes you to the entry mode.
7.	Press the **Meas** button.	The instrument is in measuring operation again.

8.2.3 How a limit is formed

A **non-integrated measuring value** is used internally to form the limit for the turbidity value. If all measuring values are above the limit across the set cut-in delay time, then an alarm is triggered. This procedure prevents false alarms caused by individual peaks in the measuring values. The limit status (relay) can also be read via the fieldbus interface.

An integration time of 6 seconds is set as standard for the turbidity value (→ Reference Manual). This only affects the display and output value on the customer interface, but **not** the formation of the limit.

If monitoring of the limits is made using external software, then the following procedure is recommended:

1. Set integration to 0.
2. Read the measuring value every 0.5 seconds.
3. Trigger an alarm if all measuring values are above the limit across the cut-in delay time (typically 6 seconds for a pre-alarm and 8 seconds for a main alarm).
4. Integrate the turbidity value, for displaying as needed.

8.2.4 Defining the cut-in delay

A cut-in delay prevents alarms caused by individual peaks in the measuring values. Setting this value too low can lead to an increase in the amount of false alarms. Setting this value too high can lead to a delay in the alarm being triggered.

To prevent false alarms, we recommend setting a cut-in delay of **at least six seconds** for monitoring the turbidity limit.

In order to enable a quick reaction if the turbidity limit is exceeded, monitoring of the turbidity is made based on the **non**-integrated measuring value.

The event (E) must persist for at least the cut-in delay time (T_{EV}) for the relay (R) to switch on.

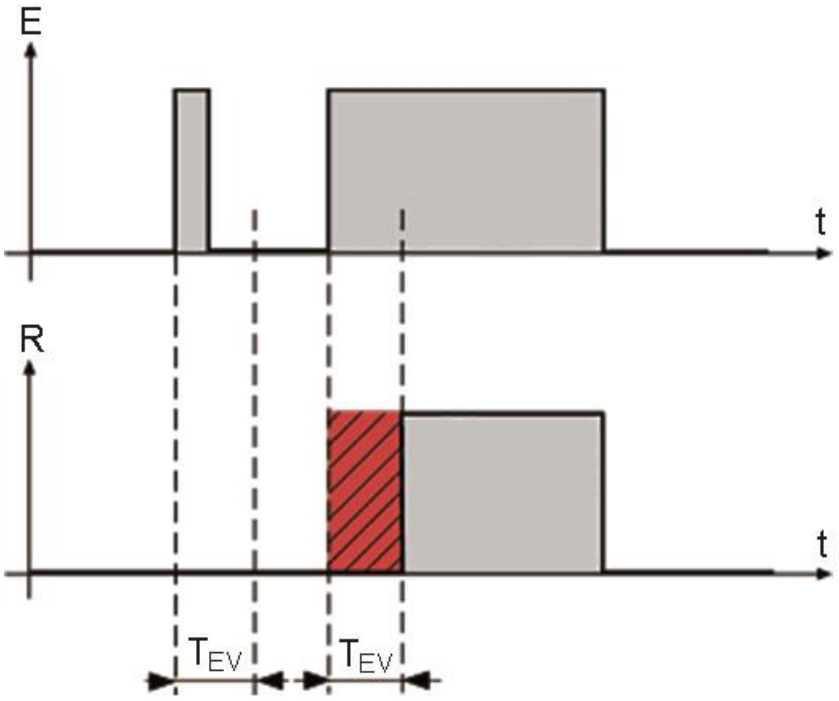


Figure 20: Cut-in delay

8.2.5 Defining the cut-out delay

The event (E) must be interrupted for at least the cut-out delay time (T_{AV}) for the relay (R) to switch off. Short interruptions to an active event can thus be bridged.

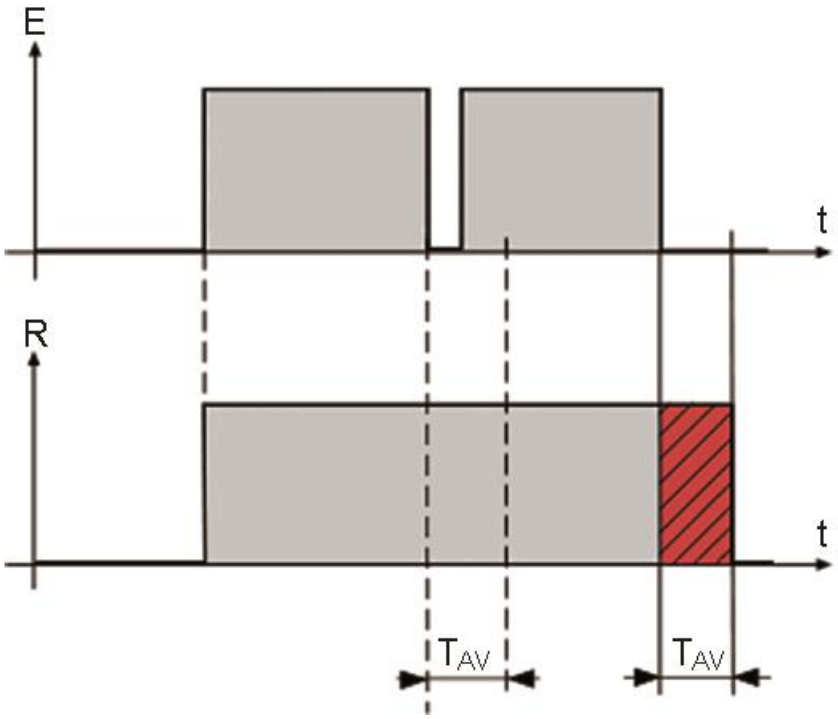


Figure 21: Cut-out delay

8.2.6 Calculating the gradient

A constant mean value (Mw 1/2) is calculated from two consecutive five-second intervals (first block with 10 measuring values, second block with 10 measuring values).
The difference between both mean values forms the gradient, which is then scaled to one minute. The gradient of the turbidity value and temperature is calculated.

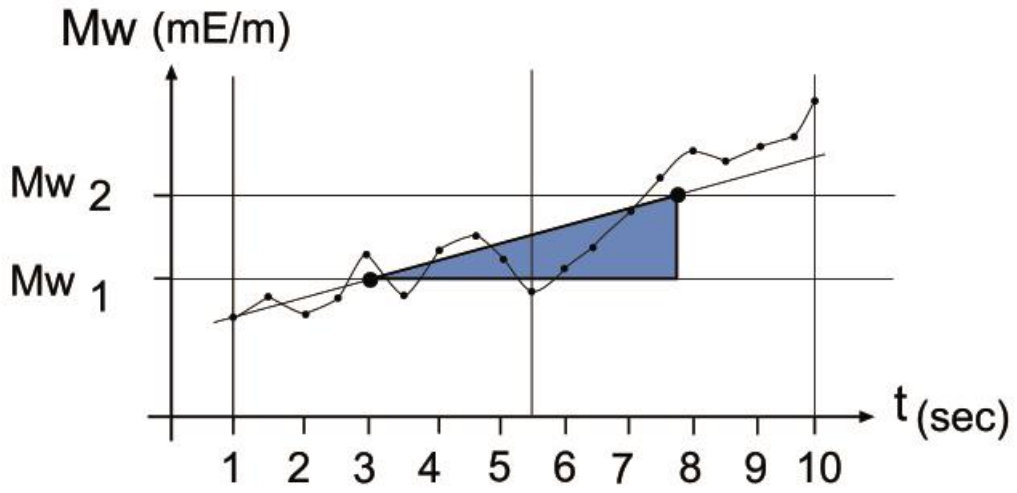


Figure 22: Calculating the gradient

The turbidity gradient is determined from the integrated measuring value. Changing the integration time thus also has an effect on the turbidity gradient.

8.2.7 Reading if limit exceeded or undershot

If a limit event occurs during operation, it has the following effects on measuring operation:

- Threshold value display indicates an unusual state.
- If an output for the corresponding limit channel is programmed, it is switched.

If the message **Limit** appears, the color of the status display changes to **white** and the numbers of the limit channels are listed with their channel numbers in **red** if limits have been exceeded or undershot. Inactive limits are indicated with "_".

8.3 Setting the outputs for limit monitoring

8.3.1 General information on limit monitoring

Two digital outputs (O1/O2) are available for the status output of faults and limits. These two outputs (O1/O2) are coded. The states of these outputs are also available via the fieldbus interface, although no physical outputs are present in this case.

The following two modes are available for monitoring the limits:

- In mode 1, one limit level (alarm) is monitored
- In mode 2, two limit levels (pre-alarm and factory-set main alarm) are monitored

Both modes are described in detail in the following Section 8.3.2 and Section 8.3.3:

8.3.2 Mode 1

Mode 1 is active if the limits 5 .. 8 in the **Limits** menu are all set to **inactive**. Output 1 is used for when the limit is exceeded (alarm) and output 2 for the fault messages.
Outputs O1 and O2 can be inverted. On output 1, the behavior in the event of a fault can also be defined. If **Fault** is activated on output 1 (O1), then this is activated both when a limit is exceeded and in the event of a fault on the instrument. The three states Normal, Alarm and Fault are not coded.

The following table shows how the behavior of the outputs (A1/A2) can be influenced:

O1 Limit Invert	No		Yes		No		Yes		No		Yes		No		Yes	
Fault	No		No		No		No		Yes		Yes		Yes		Yes	
O2 Fault Invert	No		No		Yes		Yes		No		No		Yes		Yes	
State	O2	O1	O2	O1	O2	O1	O2	O1	O2	O1	O2	O1	O2	O1	O2	O1
Normal	0	0	0	1	1	0	1	1	0	0	0	1	1	0	1	1
Alarm 1	0	1	0	0	1	1	1	0	0	1	0	0	1	1	1	0
Fault	1	0	1	1	0	0	0	1	1	1	1	0	0	1	0	0

0 = high-resistance output
1 = low-resistance output

8.3.3 Mode 2 (factory setting)

Mode 2 is active if one of the limits 5 .. 8 is active. Two limit levels are monitored. The four states “Normal”, “Pre-alarm”, “Main alarm” and “Fault” are coded in binary. The following table shows how the behavior of the outputs (O1/O2) can be influenced:

O1 Limit Invert	No		Yes		No		**Yes**	
O2 Fault Invert	No		No		Yes		**Yes**	
State	O2	O1	O2	O1	O2	O1	**O2**	**O1**
Normal	0	0	0	1	1	0	**1**	**1**
Alarm 1 (pre-alarm)	0	1	0	0	1	1	**1**	**0**
Alarm 2 (main alarm)	1	0	1	1	0	0	**0**	**1**
Fault	1	1	1	0	0	1	**0**	**0**

0 = high-resistance output
1 = low-resistance output
Bold = factory setting

The **Fault** parameter on output 1 has no effect here. Limits 5 .. 8 are prioritized. If the same event should be monitored on different levels on output 1 and 2, then it is absolutely essential that the lower level (pre-alarm) is configured on output 1 and the higher level (main alarm) is configured on output 2.

8.3.4 Setting the outputs

The outputs can be set as follows:

	MANIPULATION	ADDITIONAL INFO / IMAGES
1.	Press the **Menu** button.	
2.	Set the access code and confirm with **OK**.	Factory setting is **0**.
3.	Press the **Inp./outputs** button.	If the desired menu does not appear, press the arrow at the bottom right.
4.	Press the **Outputs** button.	
5.	Select **O1 Limit .. O2 Fault**.	
6.	Activate the outputs (multiple selection possible).	Activated outputs are highlighted green. ▪ Invert: Inverts the outputs ▪ Fault (on O1 only)
7.	Press the **Meas** button.	The instrument is in measuring operation again.

8.4 Setting the recalibration

If the **Auto start recal.** parameter is activated, then the installation of the checking unit in the photometer automatically triggers a recalibration. This allows servicing duties to be carried out without the use of a control unit. The state of the recalibration can be monitored via the LED display (Section 9.4).

	MANIPULATION	ADDITIONAL INFO / IMAGES
1.	Press the **Menu** button.	
2.	Set the access code and confirm with **OK**.	Factory setting is **0**.
3.	Press the **Recalibration** button.	
4.	Press the **General** button.	
5.	Set **Auto start recal.** to **Active** or **Inactive**.	
6.	Press the **Meas** button.	The instrument is in measuring operation again.

8.5 Setting the Profibus parameters

This setting only has to be carried out if the optional Profibus module is used.

	MANIPULATION	ADDITIONAL INFO / IMAGES
1.	Press the **Menu** button.	
2.	Set the access code and confirm with **OK**.	Factory setting is **0**.
3.	Press the **Digi. interf.** button.	
4.	Press the **Profibus DP** button.	
5.	In the **Control** menu, select either **Local** or **External**.	▪ **Local:** Values can only be read via Profibus. ▪ **External:** Values can be read and written via Profibus.
6.	Enter the desired number under **Slave no.**.	Values between 1 and 240 are possible.
7.	Press the **Meas** button.	The instrument is in measuring operation again.
8.	To activate the parameters, the instrument must be switched off and then switched on again.	

8.6 Setting the Modbus parameters

This setting only has to be carried out if the optional Modbus module is used.

	MANIPULATION	ADDITIONAL INFO / IMAGES
1.	Press the **Menu** button.	
2.	Set the access code and confirm with **OK**.	Factory setting is **0**.
3.	Press the **Digi. interf.** button.	
4.	Press the **Modbus** button.	
5.	Enter the desired number under **Slave no.**.	Values between 1 and 240 are possible.
6.	Select the **Baudrate** menu.	Values between 4800 and 230400 baud are possible.
7.	Select the **Parity** menu.	The settings **None**, **Even** and **Odd** are possible.
8.	Select the **Stopbit** menu.	1 or 2 Stopbit are possible.
9.	Press the **Meas** button. The parameters are activated.	The instrument is in measuring operation again.

8.7 Setting the current outputs

This setting only has to be carried out if the optional StromRel module is used.

	MANIPULATION	ADDITIONAL INFO / IMAGES
1.	Press the **Menu** button.	
2.	Set the access code and confirm with **OK**.	Factory setting is **0**.
3.	Press the **Curr. outputs** button.	
4.	Select between **C 1 .. 2**.	
5.	Select the **Source** menu.	For C1: C1 Turb For C2: C3 Temp
6.	Select the **Range** menu.	For C1: MR1 0 .. 50 mE/m For C2: MR2 -20 .. 80 °C
7.	Press the **Meas** button.	The instrument is in measuring operation again.

Measuring range no.	Measuring range (standard)	Measuring range (customer-specific)
MR1	0 .. 50	
MR2	-20 .. 80	
MR3	0 .. 0	
MR4	0 .. 0	
MR5	0 .. 0	
MR6	0 .. 0	
MR7	0 .. 0	
MR8	0 .. 0	

If other measuring ranges are needed, the table above can be reprogrammed as required. Other parameters for the current outputs are described in the Reference Manual.

8.8 Setting or changing the access code

You can protect the settings of the instrument against unauthorized manipulations by defining your own access code.

	MANIPULATION	ADDITIONAL INFO / IMAGES
1.	Press the **Menu** button.	
2.	Set the access code and confirm with **OK**.	Factory setting is **0**.
3.	Press the **Configuration** button.	If the desired menu does not appear, press the arrow bottom right.
4.	Press the button to the right of the **Access code** description text.	
5.	Enter the access code and confirm with **OK**.	
6.	Press the **Meas** button.	The instrument is in measuring operation again.

A forgotten access code can be cleared only by a SIGRIST service engineer.

Enter your personal access code here:

8.9 Backup configured data

These measures can be of use to the service engineers for service purposes.

	MANIPULATION	ADDITIONAL INFO / IMAGES
1.	Press the **Menu** button.	
2.	Set the access code and confirm with **OK**.	Factory setting is **0**.
3.	Press the **System info.** button.	If the desired menu does not appear, press the arrow bottom right.
4.	In the **User -> SD** and **Expert -> SD** submenus press the **Copy** function.	The user and expert data are copied to the microSD card. After a successfully completed procedure, acknowledge with the **OK** button.
5.	Press the **Meas** button.	The instrument is in measuring operation again.

9 Servicing

9.1 Servicing schedule

WARNING!

Alarms can be triggered during servicing duties. Therefore, evaluations of the alarm events should be suppressed in advance.

WHEN	WHO	WHAT	PURPOSE
Annually or as needed	Operator	Cleaning the measuring cell Section 9.2	Obligatory measure for maintaining measuring accuracy.
As needed or in the event of an adjustment fault	Operator	Cleaning the optics Section 9.3	Obligatory measure for maintaining measuring accuracy.
Annually	Operator	Recalibration of the photometer Section 9.4	Obligatory measure for maintaining measuring accuracy.
Every 10 years or as needed	Operator	Replacing the battery in the SICON-C Section 9.5	Obligatory measure for maintaining functional efficiency.

Table 1: Servicing schedule

9.2 Cleaning the measuring cell

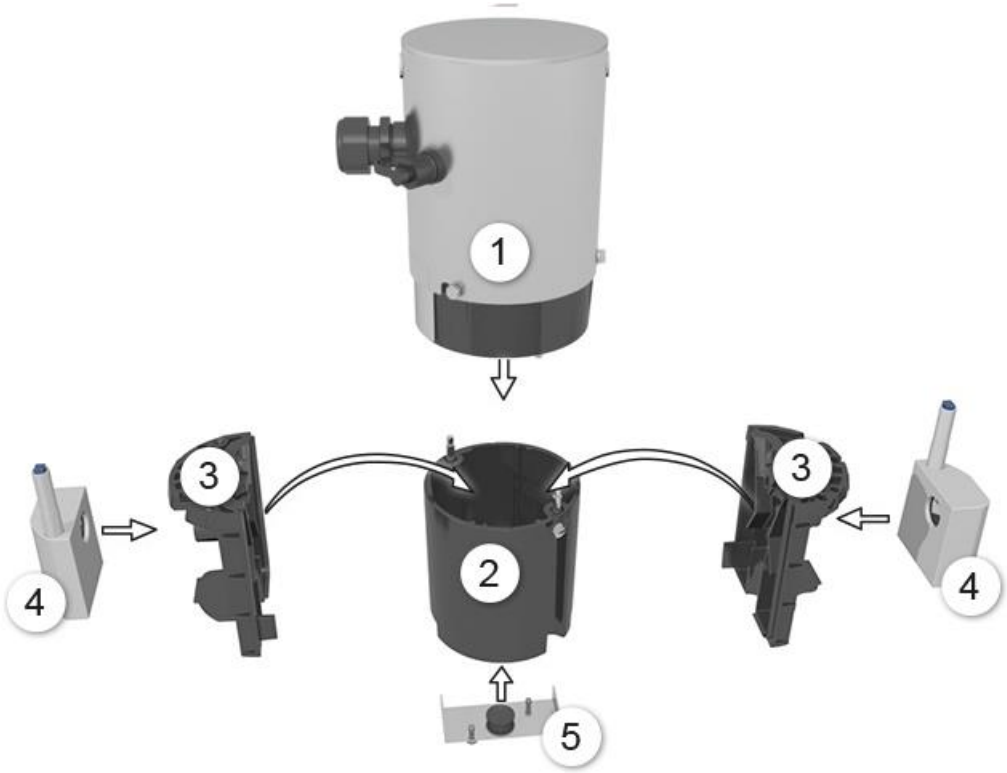
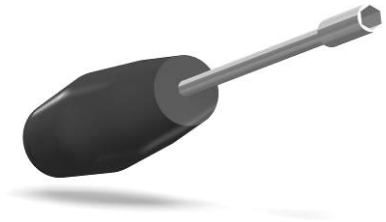


Figure 23: Exploded drawing of the FireGuard 2 Integral

①	Electronic component	②	Measuring cell housing
③	Measuring cell inserts, left and right	④	Heater, left and right (depending on equipment)
⑤	Contamination protector		

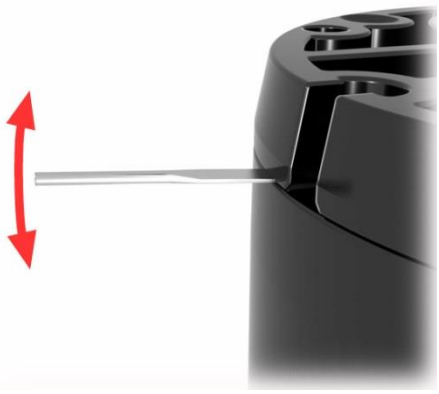
The following procedure describes how to clean the measuring cell on the FireGuard 2 Integral:

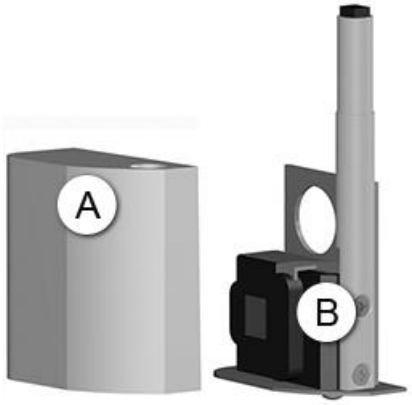
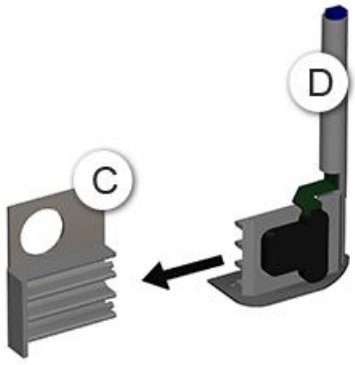
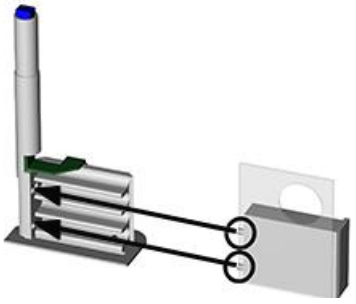
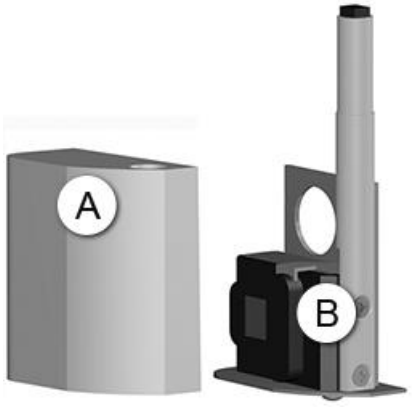
- The photometer can be disassembled using an Allen wrench (size 7).

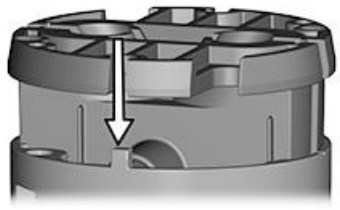


- If the FireGuard 2 Integral is equipped with the optional knurled screws (tool-free maintenance), then the following steps can be carried out without the wrench.
- ⚠ The screws must not be overtightened, as the thread may then be damaged. **Do not exceed a tightening torque of 1 Nm**.
- Check all removed parts for possible damages or signs of wear and replace with new parts when necessary.

	WORKSTEP	**ADDITIONAL INFO / IMAGES**
1.	Remove the Contamination protector protector by removing both screws (circles) on the photometer.	
2.	Remove the measuring cell housing (Figure 23, pos. 2) by loosening the screws on both sides of the electronic component. ⚠ The sample heater can reach temperatures of up to 80 °C!	

	WORKSTEP	ADDITIONAL INFO / IMAGES
3.	Clean the measuring cell inserts. Lift the measuring cell inserts (Figure 23, pos. 3) out of the measuring cell housing and clean them. Pay special attention to the radiation absorption surfaces (circle) when doing this – these must be clean. ⚠ Use a brush and damp cloth for cleaning (no solvents!) ℹ If the measuring cell inserts (Figure *23*, pos. 3) are stuck in the measuring cell housing, insert the screwdriver into the gap and carefully lever out the inserts. 	
4.	Clean the sample heaters. ℹ Only carry out this step if sample heaters are present. 4.1: Let the sample heaters (Figure 23, pos. 4) cool down first. ⚠ The sample heater can reach temperatures of up to 80 °C!	
	4.2: Pull the sample heaters (Figure 23, pos. 4) from the measuring cell inserts (Figure 23, pos. 3).	

	WORKSTEP	ADDITIONAL INFO / IMAGES
	4.3: Using your thumb (see arrow in figure below), push the heating element (B) out of the insulating shell (A). 	
	4.4. Clean the heating element with the brush. The heating element can be disassembled into the following two elements: C: Heating element 1 D: Heating element 2 ⚠ Do not use moisture when cleaning the heating elements.	
	4.5: Assemble the two heating elements (C) and (D) together with the sample heater. Pay attention to the pins (circles).	
	4.6: Insert the heating elements (B) into the insulating shell (A).	
	4.7: Reinsert the sample heaters (Figure 23, pos. 4) into the measuring cell inserts (Figure 23, pos. 3).	

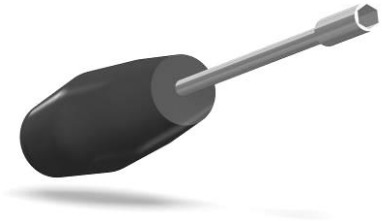
	WORKSTEP	ADDITIONAL INFO / IMAGES
5.	Clean the inside of the measuring cell housing (Figure 23, pos. 2). ⚠ Use a brush and damp cloth for cleaning (no solvents!)	
6.	Assemble the measuring cell housing: Put the two measuring cell inserts together (Figure 23, pos. 3) and insert into the measuring cell housing (Figure 23, pos. 2). The cam on the measuring cell housing (arrow) must be aligned to the continuous slot on the measuring cell insert. Check that the two white points (circle) are aligned to one another.	 
7.	Connect the measuring cell housing to the electronic component. The pin on the optics holder (arrow) must be aligned to the bore, and the white markings on the electronic component and measuring cell housing must be aligned to one another. If sample heaters (Figure 23, pos. 3) are present, then these must be aligned to the bores on the optics holder (circles). See figure below. 	

	WORKSTEP	ADDITIONAL INFO / IMAGES
8.	Fasten the measuring cell housing in place on the electronic component with both screws. ⚠ The screws must not be overtightened, as the thread may then be damaged. Do not exceed a tightening torque of 1 Nm. ⚠ In order to prevent cold welding, the fastening screws must be greased before assembly (Molykote 1000 has proven a suitable grease for this purpose).	
9.	Refasten the Contamination protector (Figure *23*, pos. 5). ⚠ The screws must not be overtightened, as the thread may then be damaged. Do not exceed a tightening torque of 1 Nm. ⚠ In order to prevent cold welding, the fastening screws must be greased before assembly (Molykote 1000 has proven a suitable grease for this purpose).	
10.	The photometer is now ready for operation and can be fastened back in the measuring position.	

9.3 Cleaning the optics

The following procedure describes how to clean the optics on the FireGuard 2 Integral:

- The photometer can be disassembled using an Allen wrench (size 7).



If the FireGuard 2 Integral is equipped with the optional knurled screws (tool-free maintenance), then the following steps can be carried out without the wrench.

- ⚠ The screws must not be overtightened, as the thread may then be damaged. **Do not exceed a tightening torque of 1 Nm**.
- Check all removed parts for possible damages or signs of wear and replace with new parts when necessary.

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Remove the measuring cell housing (**Figure 23**, pos. 2) by loosening the screws on both sides of the electronic component. ⚠ The sample heater can reach temperatures of up to 80 °C!	
2.	Clean the lens and window on the optics holder with a cotton-tipped applicator soaked in ethanol (circles). The optics holder is found on the electronic component (**Figure 23**, pos. 1). Also inspect the gasket (X) on the optics holder and replace, if necessary. The article numbers are listed in the Section 15.	

	WORKSTEP	ADDITIONAL INFO / IMAGES
3.	Connect the measuring cell housing to the electronic component. The pin on the optics holder (arrow) must be aligned to the bore, and the white markings on the electronic component and measuring cell housing must be aligned to one another. If sample heaters (**Figure 23**, pos. 3) are present, then these must be aligned to the bores on the optics holder (circles). See figure below. 	
4.	Fasten the measuring cell housing in place on the electronic component with both screws. ⚠ The screws must not be overtightened, as the thread may then be damaged. Do not exceed a tightening torque of 1 Nm. ⚠ In order to prevent cold welding, the fastening screws must be greased before assembly (Molykote 1000 has proven a suitable grease for this purpose).	
5.	The FireGuard 2 Integral is now ready for operation and can be fastened back in the measuring position.	

9.4 Recalibrating the FireGuard 2 Integral

9.4.1 General information on recalibrating the FireGuard 2 Integral

Recalibrating the photometer can result in deviations from the previous measuring value as the instrument is newly reset to a reference value (checking unit). The instrument should be cleaned before recalibration according to Section 9.2.

- Recalibration can be triggered via the SICON-C portable control unit, or automatically by plugging in the checking unit. The automatic triggering of a recalibration can be activated under **Recalibration\General\Auto start recal.**.
- The nominal values on two checking units can be saved in the FireGuard 2 Integral. The checking units are identified via a serial number.
- The checking unit currently in use must be defined in the **Recalibration\C1\Cont. active** menu. Checking unit 1 is set as standard.

9.4.2 Setting checking unit number in use

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Switch to service operation as described in Section 7.10.	
2.	Select the checking unit currently in use in the **Recalibration\C1\Cont. active** menu.	

9.4.3 Manual adjustment with a SICON-C

The following procedure describes how manual adjustment is made with a SICON-C:

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Plug the SICON-C into the FireGuard 2 Integral.	
2.	Remove the contamination protector by removing both screws (circles) on the photometer.	
3.	Switch the FireGuard 2 Integral to service operation as described in Section 7.10.	
4.	Check the serial number of the checking unit against the number of the instrument. These must match.	
5.	Insert the checking unit up to the stop. The markings on the checking unit and FireGuard 2 Integral must match (circles) and the pin (arrow) must be aligned to the bore on the FireGuard 2 Integral.	
6.	Switch to the **Recalibration\C1** menu.	
7.	Check whether the saved nominal value matches the information on the checking unit.	

	WORKSTEP	ADDITIONAL INFO / IMAGES
8.	Carry out the adjustment as follows: Press the **initiate...** button and wait. The LED on the photometer also starts to flash. If the adjustment was successful, this is confirmed with **Adjustment OK**. This completes the adjustment. If the adjustment was **not** successful, it is indicated with **Adjust. fault**. In this case, check the points in the following list one after the other: ▪ Cleanliness of the checking unit? ▪ Correct checking unit used? ▪ Does the nominal value match the value on the checking unit? ▪ Soiled optics in the instrument? In this case, check the cleanliness of the optics as described in Section 9.3 and then repeat the procedure.	If the check could not be successfully completed, contact your country representative. Section 11
9.	Remove the checking unit again and mount the contamination protector back on the photometer.	
10.	The instrument can now be operated again.	

A new recalibration factor is determined if adjustment is successful. The deviation from the original state is displayed under **Curr. corr.**.

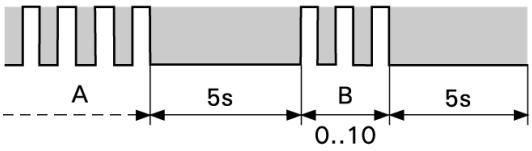
9.4.4 Automatically triggered adjustment without SICON-C

WARNING!

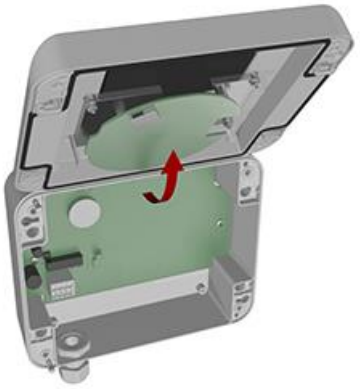
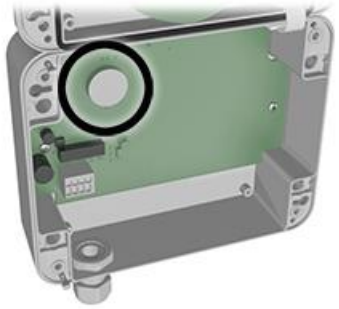
Alarms can also be triggered as a result of the automatically triggered adjustment.
Therefore, switch the instrument to service operation in advance or inform the alarm center.

The following procedure describes how adjustment is made automatically without a SICON-C control unit. However, this can only be carried out when **Auto start recal.** has been activated according to Section 8.4.

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Remove the contamination protector by removing both screws (circles) on the photometer.	
2.	Check the serial number of the checking unit against the number of the instrument. These must match.	
3.	Insert the checking unit as follows. 1. Insert the checking unit up to the stop. The markings on the checking unit and FireGuard 2 Integral must match (circles) and the pin (arrow) must be aligned to the bore on the FireGuard 2 Integral. 2. The LED flashes in four-second intervals.	

	WORKSTEP	ADDITIONAL INFO / IMAGES
4.	**The checking unit is detected** If the checking unit is detected by the instrument, then the LED starts flashing in one-second intervals and the adjustment is carried out automatically. **The checking unit is not detected** If the checking unit is not detected by the instrument, then the LED continues to flash in four-second intervals. In this case, check the points in the following list one after the other: ▪ Cleanliness of the checking unit? ▪ Correct checking unit used? ▪ Does the nominal value match the value on the checking unit? ▪ Soiled optics in the instrument? In this case, check the cleanliness of the optics as described in Section 9.3 and then repeat the procedure.	
5.	After the adjustment has been made successfully, the current soiling level is indicated by a flash code on the LED: 1. The LED goes out for five seconds. 2. The flash code indicates the current soiling level. 3. A second phase where the LED goes out for five seconds indicates that the code is finished.  If the LED flashes more than five times, then the soiling level is too high. The FireGuard 2 Integral must be cleaned according to the servicing schedule. 4. Remove the checking unit.	A: Adjustment flashes approximately 20 times in one-second intervals. B: Flash code key: Flashes zero times = clean Flashes up to ten times = soiling limit reached
6.	Return the instrument to its initial state.	

9.5 Changing the battery in the control unit

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Unplug the connection tot he instrument.	
2.	Open the flaps on the instrument.	
3.	Loosen the four screws (circles).	
4.	Open the cover of the instrument.	
5.	Remove the battery (circle) and replace with a new one.	
6.	Close the instrument.	

10 Troubleshooting

10.1 Pinpointing malfunctions

MALFUNCTION	MEASURE
No reading	▪ Check whether the supply voltage is connected.
Fault message in the display	▪ Analyze the fault message according to the following sctions.
The reading appears to be wrong	▪ Carry out recalibration. Section 9.4 ▪ Check whether the instrument is correctly mounted. Section 4 ▪ Ensure that the servicing duties have been performed according to the servicing schedule. Section 9.1

Table 2: Pinpointing malfunctions

If the listed measures do not lead to the desired results, please consult customer service. Section 11

10.1.1 Warning messages and effect on operation

Warnings indicate an unusual state.

FEHLER	
If a warning occurs during operation, it has the following effects: ▪ The system continues to operate. However, the measuring results must be evaluated with caution. The cause of the warning message should be remedied at the next possible opportunity. ▪ When the cause of the warning has been remedied, it is automatically deleted. ▪ When the **Warning** message occurs, the color of the status display changes to **orange** and the warning text describes the warning in question.	 Example: **WARNING CURRENT 1**

The following warning messages can be displayed:

WARNING MESSAGE	DESCRIPTION	POSSIBLE CAUSES
V IN	The input voltage is outside the permitted range (9 to 30 VDC).	▪ The service voltage is faulty
ADJUST FAULT	Recalibration could not be carried out.	▪ The instrument is soiled ▪ The nominal value for the adjustment does not match the value of the checking unit
SOILING	The soiling level is greater than the set limit.	▪ The measuring cell is soiled and has to be cleaned ▪ The cleaning interval is too long ▪ The installation position is incorrect
FLOW RATE	The flow rate monitoring has been actuated. In the last 24 hours, the value of the turbidity gradient was always smaller than the flow rate limit.	▪ No air flow in tunnel ▪ No traffic ▪ The foreign body protector is extremely soiled ▪ The optics are extremely soiled
HEATER	The sample heater does not reach its nominal temperature.	▪ Very cold environment with high winds ▪ The heater is defective
OVER TEMP	The temperature in the instrument has exceeded 65 °C.	▪ The medium or ambient temperature is too high and defective/no cooling
CURRENT 1 .. 2	Current output 1 .. 2 is disturbed.	▪ Terminals are open ▪ Interruption of the current loop of the reading output
TEMP.SENSOR	The inner temperature sensor failed.	▪ Defect in the electronic system → Service technician
WATCHDOG	The internal fault monitoring has been actuated. The program has been restarted.	▪ Program crash

Table 3: Possible warning messages

10.1.2 Fault messages and effect on operation

FAULTS	
If a fault occurs during operation, it has the following effects: ▪ A fault is a malfunction which prevents correct measurement value acquisition. ▪ The measuring values of the concerned photometer go to **0**. ▪ Assigned current outputs go to the programmed electrical current **If fault**. ▪ Assigned limits are deactivated. ▪ When the **Fault** message appears, the color of the status display changes to **red** and the text describes the fault in question. ▪ If an output for faults is programmed, it is activated.	 Example: **FAULT SERIAL 1** If the cause of the fault has been remedied, it is automatically deleted.

The following fault messages can be displayed:

FAULT MESSAGE	DESCRIPTION	POSSIBLE CAUSES
SLAVE SW VERS	The software version of the photometer does not match that of the control unit.	▪ Different delivery data on instrument and control unit. Carry out a slave update with a SICON-C → Reference Manual
SERIAL 1	The control unit cannot establish a connection to the photometer.	▪ Interrupted connection to the photometer. ▪ Defect in the electronic system. → Service technician
V ANALOG	One of the internal analog voltages is outside the permitted range.	▪ Defect in the electronic system. → Service technician
MEASUR.FAULT	Measuring value acquisition is faulty.	▪ External light (e.g. measuring cell removed). ▪ Defect in the electronic system. → Service technician
LIGHTSOURCE 1	The detector for monitoring the light source receives no light from the corresponding light source.	▪ Defective light source. → Service technician
MASTER SW VERS	This fault message is displayed when the software version of the SICON-C is older than the version of the connected photometer.	▪ Software is not the most recent version. In this case, the software of the control unit must be updated to the most recent version. → Reference Manual

Table 4: Possible fault messages

10.1.3 Prioritized fault messages and their effect on operation

When there is a prioritized fault, the cause of the malfunction is serious.

PRIO (PRIORITIZED FAULT)	
If a prioritized fault occurs during operation, it has the following effects: ▪ The measuring values go to 0. ▪ Prioritized faults can be cleared only by a service engineer. ▪ When the **Prio** message occurs, the color of the status display changes to **red** and the text describes the prioritized fault in question.	 Example: **PRIO DEFAULT VALUES**

The following prioritized fault messages can be displayed:

PRIO MESSAGE	DESCRIPTION	POSSIBLE CAUSES
DEFAULT VALUES	The default values were loaded.	▪ If no parameters were initialized or if all parameters were lost, the default values are loaded.
CRC EXPERTS	A fault was determined when the expert data was checked.	▪ Electromagnetic malfunctions. ▪ Defect in the electronic system.
CRC USER	A fault was determined when the user data was checked.	▪ Electromagnetic malfunctions. ▪ Defect in the electronic system.
CRC DISPLAY	A fault was determined when the display data was checked.	▪ Electromagnetic malfunctions. ▪ Defect in the electronic system.
EXT RAM	A fault was determined when the RAM in the graphic controller was checked.	▪ Defect in the electronic system.
SW VERS	Software which is unsuitable for this instrument type was loaded.	▪ Faulty software update. → Service technician

Table 5: Possible prioritized fault messages

11 Customer service information

Should you have any questions, please contact the responsible service center in your country or region. If this is not known, SIGRIST-PHOTOMETER AG customer service in Switzerland would be glad to provide you with a contact address.

A current list of all SIGRIST country representatives is available in the Internet at www.photometer.com.

Please have the following information ready when you contact a SIGRIST service point or customer service:

- The serial number of the FireGuard 2 Integral.
- A description of the instrument behavior and the work steps involved when the problem occurred.
- A description of what you did when trying to solve the problem yourself.
- The documentation of the third-party products you use in conjunction with the photometer or peripheral devices.

12 Decommissioning/storage

12.1 Decommissioning the photometer

The aim of decommissioning is to prepare the individual components of the system properly for storage.

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Interrupt the service voltage.	
2.	Remove the electrical connections.	Section 5
3.	Remove the FireGuard 2 from the measuring position and clean thoroughly.	
4.	Remove all other components.	
5.	Close all openings on the components.	

12.2 Storing the photometer

There are no special requirements for storing the instruments. However, please note the following information:

- The FireGuard 2 Integral and the belonging components contains electronic parts. Storage for such components must fulfill the usual conditions. It is important to note that the storage temperature must be between -30 and +55 °C.
- All components that come into contact with the sample during operation have to be dry and clean for a long time before being put into storage.
- The measuring equipment with all of the accessory parts must be protected against weather factors, condensing humidity and aggressive gases during storage.

13 Packaging/Transport/Returning

DANGER!

Injuries to persons caused by dangerous samples in the returned instrument.

Instruments that have come into contact with dangerous samples may not be sent to be repaired without information regarding the concerned sample.

Detailed information about the samples must be received by SIGRIST-PHOTOMETER so that relevant precautionary measures can be taken when unpacking.

The original packaging of the photometer and its peripheral devices should be used for packaging when possible. If the original packaging is no longer available, note the following information:

- Before packaging, close the openings of the photometer with adhesive tape or plugs so that no packaging materials can enter the instrument.
- The photometer contains optical and electronic components. Make sure that the packaging protects the instrument from being damaged by impact during transport.
- All peripheral devices and accessory parts must be packaged separately and marked with serial numbers (Section 2.2). This prevents confusion and mix-ups later while also making it easier to identify parts.
- When sending for repairs, ensure that the complete instrument including the **checking unit** is sent.
- Fill in the repair note and attach to the inside of the packaging.

When packaged in the way described above, the instruments can be transported by the usual shipping methods and in all positions.

14 Disposal

Disposal of the system and its peripheral devices is to be carried out in compliance with regional statutory regulations.

The system has no environmentally damaging sources of radiation. The materials listed below should be disposed of or recycled as described in the following table:

CATEGORY	MATERIALS	DISPOSAL POSSIBILITIES
Packaging	Cardboard, wood, paper	Reuse as packaging material, local disposal center, incineration plants
	Protective foils, polystyrene shells	Reuse as packaging material, recycling
Electronics	Circuit boards, electromechanical components, display, touchscreen, transformer and cables	To be disposed of as electronic waste
Optics	Glass, aluminum, brass	Recycling via centers for recycling glass and waste metal
Measuring cell	PC/ABS	Recycling via centers for recycling plastics
Battery on SICON-C	Lithium	Recycling via locally organized collection point
FireGuard 2 housing	Stainless steel	Local disposal center

Table 6: Materials and their disposal

15 Spare parts list

The parts mentioned in this documentation and their article numbers are listed in the following table:

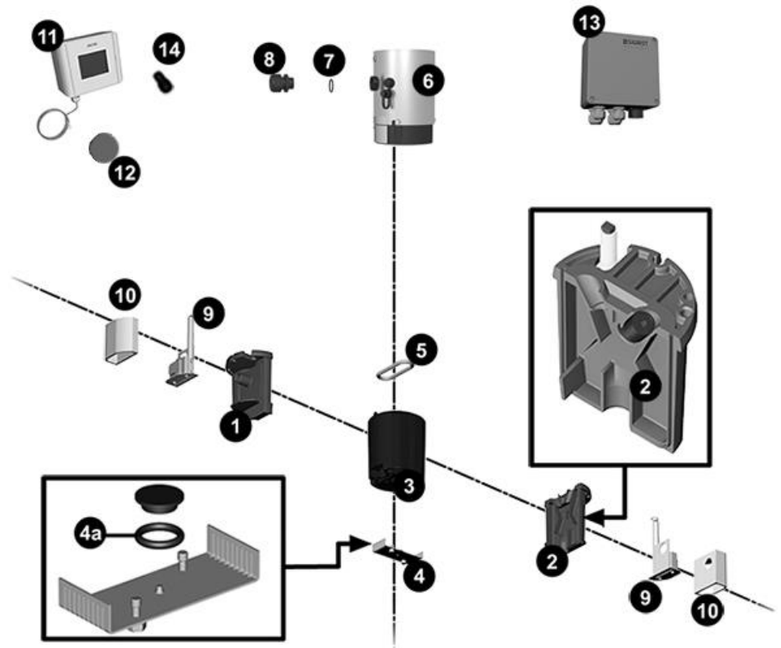
A fold-out overview of the spare parts can be found in the Section 16.1.

ARTICLE NUMBER	NAME	REMARKS
118128	Measuring cell insert, left	→ Section 9.2 / Section 16.1</dg_ref_source_inline>, pos.1
117373	Measuring cell insert, right (with shutter)	→ Section 9.2</dg_ref_source_inline> / Section 16.1</dg_ref_source_inline>, pos. 2
117381	Measuring cell housing	→ Section 9.2</dg_ref_source_inline> / Section 16.1</dg_ref_source_inline>, pos. 3
117380	Contamination protector, complete	→ Section 9.2</dg_ref_source_inline> / Section 16.1</dg_ref_source_inline>, pos. 4
117231	O-ring silicone14 x 3 for contamination protector/checking unit	→ Section 9.2</dg_ref_source_inline> / Section 16.1</dg_ref_source_inline>, pos. 4a
117152	EPDM o-ring gasket for optics holder	→ Section 9.3</dg_ref_source_inline> / Section 16.1</dg_ref_source_inline>, pos. 5
120303	Electronics housing L = 120 mm	→ Reference Handbook (Replacement of the instrument cable FireGuard 2 Integral) Section 16.1</dg_ref_source_inline>, pos. 6
116383	Cable gland M20 x 1.5	→ Reference Handbook (Replacement of the instrument cable FireGuard 2 Integral) Section 16.1</dg_ref_source_inline>, pos. 8
118599	O-ring FPM 17 x 1.8	→ Reference Handbook (Replacement of the instrument cable FireGuard 2 Integral) Section 16.1</dg_ref_source_inline>, Pos. 7
117273	Heater, complete with insulation	→ Section 9.2</dg_ref_source_inline> / Section 16.1</dg_ref_source_inline>, pos. 9 und 10
117204	Insulation for heater	→ Section 9.2</dg_ref_source_inline> / Section 16.1</dg_ref_source_inline>, pos. 10
120290	SICON-C portable control unit, 24 VDC	→ Section 16.1</dg_ref_source_inline>, pos. 11
111834	Battery	→ Section 16.1</dg_ref_source_inline>, pos. 12
120345	V2 junction box	→ Section 16.1</dg_ref_source_inline>, pos. 13
117442	Fuse, microfuse 250 V 2 AT RM5	→ Reference Handbook, Section 16.1</dg_ref_source_inline>, pos. 14

16 Appendix

16.1 Disassembly diagram for the FireGuard 2 Integral

The position numbers in the following disassembly diagram refer to the spare parts list (Section 15).



Please fold out ⇨ Disassembly diagram for the FireGuard 2 Integral

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