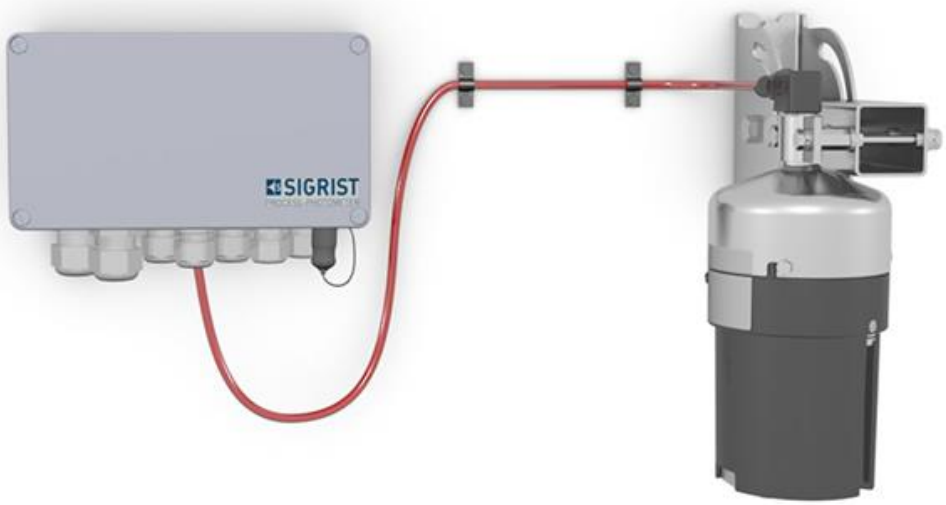
SIGRIST PROCESS-PHOTOMETER	Document number: 13543E
	Version: 4
	Valid from: SW V129

REFERENCE HANDBOOK

FireGuard 2



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/en/glossary/

1.2 Purpose of the Reference Manual

This reference manual provides the user with more detailed information that supplements the Instruction Manual.

1.3 Target group of the documentation

The Reference Manual is intended for all persons who are familiar with the contents of the Instruction Manual and require detailed information about subjects such as design, configuration, repairs etc.

1.4 Additional documentation

DOC. NO.	TITLE	CONTENT
13542E	Instruction Manual	Contains the most important information about the overall life cycle of the instrument.
13544E	Brief Instructions	The most important functions and the servicing schedule.
13654E	Data Sheet	Descriptions and technical data about the instrument.
13545E	Service Manual	Repair and conversion instructions for service engineers.
13692DEF	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 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 notice 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.

1.9 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.
	Manipulations on the touchscreen.
	Work on the PC.
	The screenshot is an example and may differ from current device.

2 Outputs with StromRel module (optional)

The StromRel module has two galvanically isolated current outputs (0/4 .. 20 mA). The minus poles of these outputs are connected together. The maximum load is 500 Ω.

There are also three semiconductor relays, which are also galvanically isolated. These are designed for voltages of up to 30 V and currents of up to 0.12 A. With the contact closed, the resistance is 25 Ω.

The functions described in the Instruction Manual can be assigned to the outputs. Only two of the three outputs are active (C1 and C2).

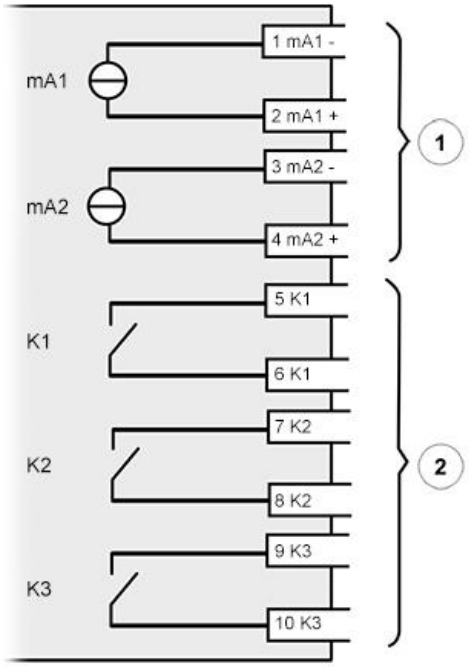


Figure 1: Outputs diagram

①	Two galvanically isolated current outputs mA1/2	②	Galvanically isolated semiconductor relays C1 .. C3

3 Description of menu functions

3.1 General information on the menu description

The menus for photometer operation and the web user interface are generally identical. Differences between the two operation possibilities are separately described in the relevant sections (e.g. “Setting the operating language” or “Switching to service mode”).

SYMBOL	MEANING
	Indicates functions that **cannot** be changed by the user.

The menu structure with the factory settings is found in the Section 7.

3.2 Menu: Display

3.2.1 Submenu: Display\D1 .. n

Source	**Functions / Values / Parameters**	
Setting the sequence for displaying the measuring channels. The source refers to the channels defined in the **Meas. channels** menu.	C1 .. n	▪ D1 Turb ▪ D2 Turb.Gr ▪ D3 Temp ▪ D4 Temp.Gr
	Inactive	The channel is inactive.

Resolution	**Functions / Values / Parameters**
Setting the number of decimal points to be used for the display of small measuring values.	1, 1.2, 1.23, 1.234

3.3 Menu: Recalibration

3.3.1 Submenu: Recalibration\General

Auto start recal.	**Functions / Values / Parameters**	
Setting whether the recalibration should be started automatically or not after the checking unit is inserted.	Inactive	Recalibration is not started when the checking unit is inserted.
	Active	Recalibration is started automatically when the checking unit is inserted.

Cont.1 name	**Functions / Values / Parameters**	
Name of the main checking unit	KStab 1	A maximum of 7 characters can be defined.

Cont.1 value	**Functions / Values / Parameters**	
Nominal value on the main checking unit	Instrument specific	Value recorded during calibration at the factory.

Cont.2 name	**Functions / Values / Parameters**	
Name of the reserve checking unit	KStab 2	A maximum of 7 characters can be defined.

Cont.2 value	**Functions / Values / Parameters**	
Nominal value on the reserve checking unit	Instrument specific	Value recorded during calibration at the factory.

3.3.2 Submenu: Recalibration\C1

Cont. active	Functions / Values / Parameters	
Selection of the checking unit to be used (main/reserve checking unit)	KStab 1	Main checking unit
	KStab 2	Reserve checking unit

Nom. val.	Functions / Values / Parameters
Value on the checking unit belonging to the instrument.	... (instrument specific)
	See also: ▪ Instruction Manual

Act. val.	Functions / Values / Parameters
Current measured value.	... (instrument specific)
	See also: ▪ Instruction Manual 

Adjustment	Functions / Values / Parameters
Initiates adjustment. A new correction factor is calculated from the actual value and nominal value.	initiate...
	See also: ▪ Instruction Manual

Curr. corr.	Functions / Values / Parameters
Current correction factor that specifies the deviation to the factory settings.	1.000
	See also: ▪ Instruction Manual 

Soiling	Functions / Values / Parameters
Displays the current level of soiling on the instrument. ▪ 0% indicates a clean instrument. ▪ At 100%, the fouling limit is reached and a warning message is output on the instrument.	0 .. 100%

3.4 Menu: Sensor check

Sensor check	Functions / Values / Parameters
The sensor check includes the inspection of the entire measuring electronics, plus all light receivers. ⚠ During the check, the actual measurement is not in operation and all output signals remain frozen in their current state.	start... .

3.5 Menu: Simulation

Meas.value mode	Functions / Values / Parameters	
Measuring values can be simulated on the outputs with this function. To be able to clearly differentiate the individual measuring values, each channel has its own multiplication factor for the base simulation value.	Off	Deactivates the function.
	Static	The base simulation value is 1.
	Dynamic	The base simulation value switches between values 1 to 2.
	Simu value	The base simulation value is taken from the **Simu value** parameter.

Simu value	Functions / Values / Parameters
If the function **Simu value** is adjusted in the **Meas.value mode** menu, the value specified here is taken as the base simulation value.	1.000
	See also: ▪ Instruction Manual ▪ Meas.value mode

Fault mode	Functions / Values / Parameters	
All fault messages can be simulated on the digital interfaces with this function.	Off	Deactivates the function.
	See also: ▪ Instruction Manual	

Curr. outputs	**Functions / Values / Parameters**	
Certain values can be output to the current outputs with this function.	Off	Deactivates the function.
	0 mA, 4 mA, 8 mA, 10 mA, 12 mA, 16 mA, 20 mA	Electrical current to be output to the outputs.
	See also: ▪ Instruction Manual	

Outputs	**Functions / Values / Parameters**	
Certain states can be output to the digital outputs with this function.	Off	Deactivates the function.
	All Off	All outputs are on 0.
	All On	All outputs are on 1.
	1 .. n On	Set single output to 1.

Light source	**Functions / Values / Parameters**	
This function can be used to switch the light source on and off manually for testing or isolating a fault.	Off	Light source is switched off.
	1	Light source is switched on.

3.6 Menu: Limits\L1 .. n

The procedure for setting the limits is described in detail in the Instruction Manual.

For each limit (L1 .. n) the following parameters are available:

Source	**Functions / Values / Parameters**	
Setting the source for the corresponding limit channel.	✿ L1 Turb	Channel 1
	L2 Turb.Gr	Channel 2
	L3 Temp	Channel 3
	L4 Temp.Gr	Channel 4

Upper limit	**Functions / Values / Parameters**
Setting the upper threshold value.	... (instrument specific)
	See also: ▪ Instruction Manual

Cut in delay	Functions / Values / Parameters	
Cut in delay: Setting the time span for how long the limit has to be exceeded before a signal is output to the outputs and appears in the display.	6 s for limit 1 .. 4 8 s for limit 5 .. 8	Value in seconds
	See also: ▪ Instruction Manual	

Cut out delay	Functions / Values / Parameters	
Cut out delay: Setting the time span of how long the limit has to be undershot before the signal from the outputs drops out and the limit display disappears from the display.	0 s	Value in seconds
	See also: ▪ Instruction Manual	

3.7 Menu: Curr. outputs

This menu is active only when a StromRel module is integrated and the module type is set to **StromRel** in the **Digi. interf.** menu under **General**.

3.7.1 Submenu: Curr. outputs\General

Range	Functions / Values / Parameters	
Setting the measuring range MR1 .. MR8. It is also possible to define the measuring ranges via inputs **In 1/2** or automatically via **Auto 1/2**.	MR1 .. MR8	Fixed measuring range
	In 1/2	Measuring range switching via inputs Section 3.8
	Auto 1/2	Automatic switching

0/4 mA .. 20 mA	Functions / Values / Parameters	
Setting the current range for the reading output. The output is scaled to each current measuring range.	0-20mA	0% measuring value = 0mA, 100% measuring value = 20mA
	4-20mA	0% measuring value = 4mA, 100% measuring value = 20mA
	See also: ▪ Instruction Manual	

<table>
<tr><th>For service</th><th colspan="2">Functions / Values / Parameters</th></tr>
<tr><td rowspan="5">Setting the measuring value output in service mode.</td><td>0 Value</td><td>During service mode, the measuring value output is set to the value that corresponds to measuring value 0. This value depends on the current range.</td></tr>
<tr><td>Last value</td><td>During service mode, the measuring value output remains (frozen) on the last valid measuring value.</td></tr>
<tr><td>Recalibr.</td><td>During service mode, the measuring value output remains (frozen) on the last valid measuring value. Following a manually initiated calibration check (adjustment), a value corresponding to the correction value is output for 10 seconds (see the following table).</td></tr>
<tr><td colspan="2"><table>
<tr><th>0..20 mA</th><th>4..20 mA</th><th>Correction value</th></tr>
<tr><td>20 mA</td><td>20 mA</td><td>1.5</td></tr>
<tr><td>10 mA</td><td>12 mA</td><td>1.0</td></tr>
<tr><td>0 mA</td><td>4 mA</td><td>0.5</td></tr>
</table></td></tr>
<tr><td>Measure</td><td>The measurement continues to run normally in service mode and the regular measuring value output is available. If you are in a sensor menu, the last values are maintained.</td></tr>
<tr><td colspan="2">See also:
▪ Instruction Manual</td></tr>
</table>

<table>
<tr><th>Max. value</th><th colspan="2">Functions / Values / Parameters</th></tr>
<tr><td rowspan="2">Setting the highest possible electrical current on the measuring value output. Current values over 20.0 mA correspond to more than 100 % measuring value of the current measuring range.</td><td>21 mA</td><td>Adjustable range
20.0 .. 21.0 mA</td></tr>
<tr><td colspan="2">See also:
▪ Instruction Manual</td></tr>
</table>

If fault	Functions / Values / Parameters	
Electrical current value that should be output in the event of an error. This setting is relevant only if **4 mA .. 20 mA** was set as electrical current range (see above).	2 mA	Adjustable range 0 .. 4 mA
	See also: ▪ Instruction Manual	

3.7.2 Submenu: Curr. outputs\S1/2

The following functions are available for each current output:

Source	Functions / Values / Parameters	
Setting the source of the corresponding current output. The source refers to the channels defined in the **Meas.channels** menus.	Chan. 1 .. 4	Depending on selected configuration.
	Inactive	

Range	Functions / Values / Parameters	
Setting the measuring range MR1 .. MR8.	MR1 .. MR8	Fixed measuring range

Lin / Log	Functions / Values / Parameters	
Setting whether a linear or logarithmic signal is output on the current output. The Log value is calculated as follows (see box):	Lin	Linear output
	Log	Logarithmic output
Log value = log10 (Lin value / MR from) / log10 (MR to / MR from). **MR from** has a minimum value of 0.001 here.	See also: ▪ Section 3.7.2.1	

3.7.2.1 Lin/Log function – linear or logarithmic signal output

The **Lin/Log** function is used to set whether the current signal is output in linear (Lin) or logarithmic (Log) form.

This can be useful if very large measuring ranges are to be represented, for example (Example: FireGuard 0.1 .. 3000 mE/m). With the logarithmic signal output, the **Measuring range** can have a minimum value of 0.001.
If a lower value was set in the "From" column in the **Measuring range** menu, then the signal is output according to this minimum value (there is no underflow). The measuring range is transferred in a logarithmic range of 0 .. 1. The measuring range is then output as a current range of 0/4 .. 20 mA.

The measuring value is converted into a current value as follows:
Log value = log10 (Lin value / MR from) / log10 (MR to / MR from)
Current $_{(4\text{-}20mA)}$ = Log value * 16 + 4 [mA]

The current value is converted back into a measuring value as follows:
Log value = (current $_{(4\text{-}20mA)}$ – 4) / 16
Lin value = MR from * (MR to / MR from) $^{\text{Log value}}$

Example: MR from = 0.1, MR actual = 3000

Lin -> Log -> Current			**Current -> Log -> Lin**	
Lin value	Log value	Current (4 .. 20)	Log value	Lin value
0.1	0.00	4.0	0.00	0.1
1	0.22	7.6	0.22	1
10	0.45	11.1	0.45	10
100	0.67	14.7	0.67	100
1000	0.89	18.3	0.89	1000
3000	1.00	20.0	1.00	3000

3.8 Menu: Inp./outputs

The procedure for setting the outputs is described in detail in the Instruction Manual.

Outputs	**Functions / Values / Parameters**	
O1 Limits	Invert	Invert function.
	Fault	Active if a fault has occurred.
O2 Fault	Invert	Invert function.

3.9 Menu: Digi. interf.

The digital interfaces can be configured here. The available parameters are dependent on the integrated interface modules (Modbus RTU / Profibus DP/HART).

After changing these options, the instrument must be switched off and then switched on again. The Modbus RTU/Profibus / Profinet IO / HART menus are displayed only if the concerned modules are installed. → Instruction Manual

3.9.1 Submenu: General

Modul type	**Functions / Values / Parameters**	
Selection of the integrated interface module (add-on module).	Auto.	Automatic detection of the modules after starting the software. This does not work for the HART or StromRel modules, or when the module is integrated in a connection box such as SIPORT 2. In such cases, the **Modul type** has to be selected manually.
	Module name…	The selectable modules are listed according to the specific instrument (e.g. Modbus RTU, Profibus DP etc.)
	See also: ▪ Instruction Manual	

Module location	**Functions / Values / Parameters**	
Selecting the instrument where the interface module was integrated.	Local	If the corresponding module is integrated in the FireGuard 2.
	…Name of the connection box…	If the corresponding module is integrated in a connection box.
	See also: ▪ Instruction Manual	

WLAN-Key	**Functions / Values / Parameters**	
This menu item is only displayed when a WLAN module is integrated. Entry of the WLAN security key.	12345678	A maximum of 14 characters can be defined.

3.9.2 Submenu: Modbus RTU (optional)

This menu item is only available when a Modbus module is installed.

Slave no.	**Functions / Values / Parameters**	
Definition of the slave number with which the photometer is addressed in the control system.	1	Values between 1 and 240 are permissible.
	See also: ▪ Instruction Manual	

Baud rate	**Functions / Values / Parameters**	
Setting of the baud rate of the Modbus interface.	115200 Baud	Baud rate in bits/s Other available values: 4800, 9600, 19200, 38400, 57600, 230400 Baud

Parity	**Functions / Values / Parameters**	
Setting the parity bits of the Modbus interface.	None	No parity bit (NONE)
	Even	Even parity bit (EVEN)
	Odd	Odd parity bit (ODD)

Stopbit	**Functions / Values / Parameters**	
Setting the number of stopbits on the Modbus interface.	1	1 stopbit
	2	2 stopbits

FireGuard Comp.	**Functions / Values / Parameters**	
Setting the compatibility with the previous FireGuard version via the Modbus connection.  If a FireGuard is connected to a SICON M via the Modbus-Rep pcb, **FireGuard Comp.** must be deactivated.	Active	Modbus access compatible with previous version
	Inactive	Modbus access compatible with SICON M

3.9.3 Submenu: Profibus DP (optional)

This menu item is only available when a Profibus module is installed.

Control	Functions / Values / Parameters	
Set whether values can only be read or can also be written via Profibus.	Local	Values can only be read.
	External	Reading and writing the values. The photometer can be controlled via Profibus.

Slave no.	Functions / Values / Parameters	
Definition of the Profibus slave number.	1	Values between 1 and 240 are permissible.
	See also: ▪ Instruction Manual	

3.9.4 Submenu: Profinet IO (optional)

This menu item is only available when a Profinet IO module is installed.

Control	Functions / Values / Parameters	
Setting whether values can only be read or can also be written via Profinet.	Local	Values can only be read.
	External	Values can be read and written. The photometer can be controlled via Profinet.

Station name	Functions / Values / Parameters
Load the current station name.  Loading the station name results in a brief interruption in communication.	load...

3.10 Menu: Configuration

Language	**Functions / Values / Parameters**
Setting the menu language.	English
	Languages that are currently available can be selected.
	See also: ▪ Instruction Manual

Mandatory oper.	**Functions / Values / Parameters**	
Setting the time after which the instrument automatically returns to measuring mode (Mandatory oper.). This concerns the situation in which the instrument is in service mode and no further manipulations are made on the keyboard. This option can be used to prevent the measuring instrument from remaining in service mode for a certain time when no relevant measuring value / limit can be output.	900 s	Adjustable range between 60 .. 60000 s
	60000 s	Mandatory oper. switched off.
	See also: ▪ Instruction Manual	

Access code	**Functions / Values / Parameters**	
Setting the access code for activation of service mode. .	0	Adjustable range 0 .. 999999
	See also: ▪ Instruction Manual	

Disp. contrast	**Functions / Values / Parameters**	
The contrast of the display can be set here. The higher the value, the greater the display contrast.	8	3 .. 31 levels

Disp. brightness	**Functions / Values / Parameters**	
This is where the brightness of the display can be set. The higher the value the brighter the display.	64	0 .. 127 levels

Date	**Functions / Values / Parameters**	
Setting the current date.	DD.MM.YYYY	DD: Day MM: Month YYYY: Year
	See also: ▪ Instruction Manual	

Time	**Functions / Values / Parameters**	
Setting the current time.	hh:mm:ss	hh: Hours mm: Minutes ss: Seconds
	See also: ▪ Instruction Manual	

Clock corr. week	**Functions / Values / Parameters**	
If the clock always runs fast or slow, this can be corrected here.	0.0 s	Correction per week

Date format	**Functions / Values / Parameters**	
Setting the data format which can be set in the **Date** menu.	DD.MM.YYYY	DD: Day MM: Month YYYY: Year
	DD/MM/YYYY	
	MM/DD/YYYY	
	See also: ▪ Instruction Manual	

Summer time	**Functions / Values / Parameters**	
Setting the summer time.	No	Winter time
	Yes	Summer time
	Europe	Changes to summer time on the last Sunday in March and changes to winter time on the last Sunday in October.

Name	**Functions / Values / Parameters**
Setting the name for identifying the measuring point for operation with the web user interface.	13-digit, unique measurement point name.

3.11 Menu: Meas.channels \ Cn

3.11.1 Submenu: Channel C1 Turb

The following parameters are available for the **C1 Turb** channel:

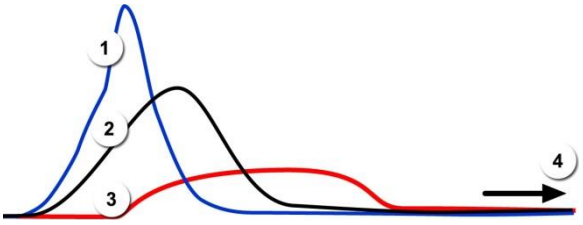
Scaling	**Functions / Values / Parameters**	
Setting the scaling factor for a customer-specific unit of measurement or for adjustment according to the laboratory results. The scaling factor is multiplied by the measuring value. The unit can be set separately (see below).	10.0	mE/m

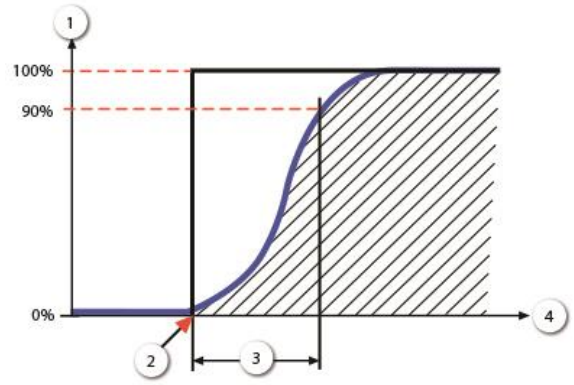
Integration	**Functions / Values / Parameters**	
Setting the integration time for forming the measuring value.	6 s	Adjustable values are: 0 .. 60000 s
	See also: ▪ Instruction Manual ▪ Section 3.11.1.1	

Name	**Functions / Values / Parameters**	
Entry of a name for identifying this channel.	Turb	A maximum of 7 characters can be defined.

Unit	**Functions / Values / Parameters**	
Setting the character sequence for a customer-specific unit of measurement.	mE/m	A maximum of 7 characters can be defined.

3.11.1.1 Integration

Fluctuations in the measuring value can be smoothed out by integration over a particular time so that a slower but more precise measuring value results. The integration time determines the strength of the smoothing process.		 *Figure 2: Effect of the integration time on the measuring signal*	
①	Original signal	②	Short integration time
③	Long integration time	④	Time

Integration in the photometer is made through a low-pass filter. The set integration time corresponds to the step response of the measuring value from 0 % to 90 %.		 *Figure 3: Step response of the measuring value signal*	
①	Measuring value	②	Time of the measuring value step
③	Integration time	④	Time

3.11.2 Submenu: Channel C2 Turb.Gr

The following parameters are available for the **C2 Turb.Gr** channel:

Name	**Functions / Values / Parameters**	
Entry of a name for identifying this channel.	Turb.Gr	A maximum of 7 characters can be defined.

Unit	**Functions / Values / Parameters**	
Setting the character sequence for a customer-specific unit of measurement.	mE/m/mi	A maximum of 7 characters can be defined.

3.11.3 Submenu: Channel C3 Temp

The following parameters are available for the **C3 Temp** channel:

Name	**Functions / Values / Parameters**	
Entry of a name for identifying this channel.	Temp	A maximum of 7 characters can be defined.

Unit	**Functions / Values / Parameters**	
Setting the character sequence for a customer-specific unit of measurement.	°C	A maximum of 7 characters can be defined.

3.11.4 Submenu: Channel C4 Temp.Gr

The following parameters are available for the **C4 Temp.Gr** channel:

Name	**Functions / Values / Parameters**	
Entry of a name for identifying this channel. Temp.Gr stands for temperatur gradient.	Temp.Gr	A maximum of 7 characters can be defined.

Unit	**Functions / Values / Parameters**	
Setting the character sequence for a customer-specific unit of measurement.	°C/min	A maximum of 7 characters can be defined.

3.12 Menu: Spec. function

Check interv.	**Functions / Values / Parameters**	
The interval between two sensor checks can be set here.	24 h (1 day)	Adjustable range 0 .. 10000 h
	The function is inactive when the value is set to zero. When the function is active, the first sensor check is made one hour after the instrument is switched on.	

Heater nom.temp	**Functions / Values / Parameters**	
Setting the absolute temperature to which the sample heater is to be heated. If the nominal temperature +/- 10 °C is not reached within 10 minutes, a **HEATER** warning is output.	40 °C, if heater is installed.	Adjustable range 0 .. 100 °C The sample heater is deactivated when the value is set to 0 °C.

Heater max.temp	**Functions / Values / Parameters**	
Setting the maximum temperature by which the sample heater should be heated. There is generally no fogging at high ambient temperatures. Unnecessary heating can affect the long-term behavior of the plastic inserts.	50°C	Adjustable range 0 .. 75°C

Flow rate limit	**Functions / Values / Parameters**	
Setting the limit for the flow rate warning. Functional principle: The turbidity gradient is constantly monitored. The highest measured value in the last four days is checked. If this value is lower than the set flow rate limit, then a **FLOW RATE** warning is output. The monitoring here is based on the non-scaled value (therefore PLA/min) so that this is not influenced by a change in the scaling factor.	0.300	Adjustable range 0 .. 100 PLA/min
	The function is inactive when the value is set to zero.	

Fouling limit	**Functions / Values / Parameters**	
Setting the limit for the soiling warning. The soiling level is defined by the brightning level in the instrument (offset). If the offset is greater than the value set here, a **SOILING** warning is output. The lowest value measured in the past 14 days is taken as the current offset.	0.200	Unit PLA
	The function is inactive when the value is set to 0.	

3.13 Menu: Meas. info

Figure 4: Meas. info

Line 1	Channel name
Line 2	Current measured values
Line 3	**V IN**: Input voltage **+5V / -10V**: Analog voltages
Line 4	**T-elect.**: Temperature of the electronics **T-heater**: Temperature of the sample heater (when inactive = 0.00 °C)

3.14 Menu: History

This is where you can view a list of events which have occurred.

3.14.1 History\Fault

Fault	Functions / Values / Parameters
Viewing the chronologically recorded faults.	See also: ▪ Instruction Manual 

Please also observe the Instruction Manual/information on troubleshooting concerning this topic.

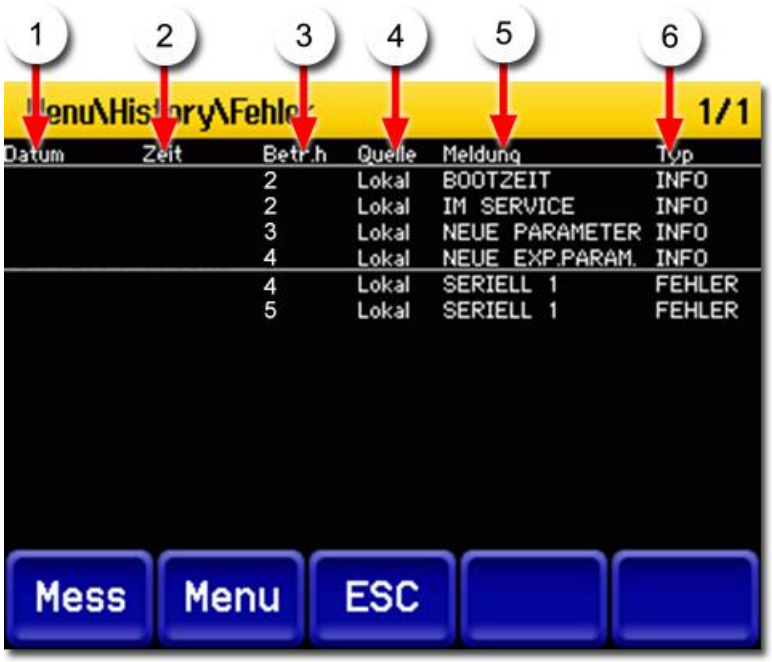


Figure 5: History\Fault

①	**Date** Not available	②	**Time** Not available
③	**Oper.h** Operating hours at the time of the event	④	**Source** Source of the fault message
⑤	**Message** Type of event	⑥	**Type** Type of fault message

3.14.2 Structure of the error messages

The error messages are summarized by type in groups as follows and separated from each other by lines:

Top group (information)
Information is sorted as follows by messages:
1. BOOTTIME
2. IN SERVICE
3. ADJUSTED
4. SENSOR CHECK
5. NEW PARAMETER
6. NEW EXP.PARAM.

Middle group (warnings and faults)
The last occurring event appears at the top.

Bottom group (prio faults)
Only the most recently occurring **Prio** (prioritized error) is displayed.

3.14.3 History\Adjustment

Adjustment	Functions / Values / Parameters
Viewing the chronologically recorded adjustment values.	See also: ▪ Instruction Manual 

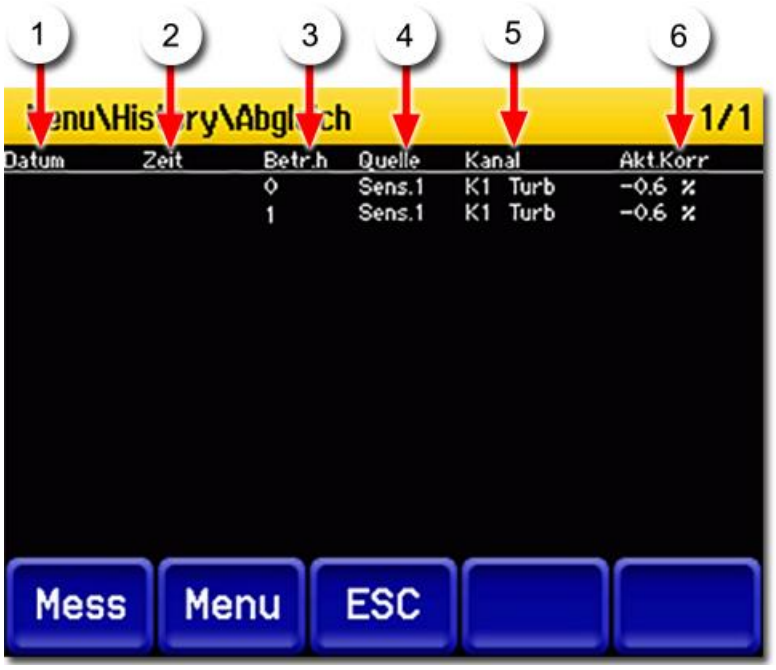


Figure 6: History\Adjustment

①	**Date** Not available	②	**Time** Not available
③	**Oper.h** Operating hours at the time of the adjustment	④	**Source** Source of the adjustment
⑤	**Channel** Channel that was adjusted	⑥	**Curr. corr.** Current correction value when adjusted

3.15 Menu: System info.

Instr. Type	Functions / Values / Parameters
View the type of instrument.	FireGuard 2 

Serial number	Functions / Values / Parameters
Viewing the serial number. This number is important when contacting customer service.	xxxxxx (six-digit number) 

Software vers.	Functions / Values / Parameters
View the version number of the software in use.	xxx (3-digit number)
	See also: ▪ Instruction Manual 

Oper. hours	Functions / Values / Parameters
Viewing the operating time in hours since the initial start-up in the factory. Standstill times (instrument de-energized) are not included in this time.	xxx (e.g. 514)
	See also: ▪ Instruction Manual 

User-> SD	Functions / Values / Parameters
Copying the user data to the microSD card. The saved file can be given to customer service for diagnostic purposes.	copy...

Expert-> SD	Functions / Values / Parameters
Copying the expert data to the microSD card. The saved file can be given to customer service for diagnostic purposes.	copy...

Meas-> SD	**Functions / Values / Parameters**
Copy the measuring data to the microSD card. The saved file can be given to customer service for diagnostic purposes.	copy...

Diag-> SD	**Functions / Values / Parameters**
Copying the diagnostic data to the microSD card. The saved file can be given to customer service for diagnostic purposes.	copy...

Code	**Functions / Values / Parameters**
In the **Code** menu a random number is shown.	xxx

Factory set.	**Functions / Values / Parameters**
Restoring the factory settings of all parameters. ⚠ **Deleting your settings unintentionally.** Carrying out this function permanently overwrites all settings.	load...

Slave Update	**Functions / Values / Parameters**
By pressing the **start...** key, the current software version from the control unit will be transferred into the photometer. The procedure takes about 70 seconds. If the software version of the photometer is newer than that of the control unit, the message **MASTER SW VERS** will be displayed and the update will not be started. For devices with WLAN module, the contents of the microSD card in the photometer must also be updated. Otherwise, the error message **VERS SD CARD** will appear. ⚠ **Faulty data transmission due to interruption of the operating voltage** Should this occur, the current software version must be loaded directly into the photometer with the aid of a microSD card (contact Customer Service).	start...

4 Working with the web user interface

4.1 Working with the web user interface via WLAN

In order to be able to work with the web user interface, a WLAN module must be integrated in the FireGuard 2. This is a module compatible with IEEE 802.11 b/g/n that takes on the function of an access point. The integrated web server can be accessed via a standard web browser. Only one instrument can log on to the access point at any one time. If no data is exchanged for more than two minutes, then the connection is automatically disconnected.

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Establish the service voltage according to the Instruction Manual.	
2.	Establish the WLAN connection: SSID: FireGuard 2 + instrument number Security type: WPA2 Encryption type: AES Security key (default): 12345678	⚠ To prevent unauthorized access, change the security key according to Section 3.9.1 (WLAN-Key). After changing the security key, the connection must be disconnected and then established again with the new security key.
3.	Establish communication between the PC and control unit.	
	3.1: Launch your Internet browser and enter the IP address http://192.168.1.1 in the address line.	ℹ Use Internet Explorer, Firefox, Chrome or Safari.
	3.2: A website for registering the photometer appears.	
	3.3: In the **Code** input field, enter **0** and press **Sign in**. The web user interface for the photometer opens.	ℹ The default code is **0**.
4.	Make the desired changes in the configuration.	
5.	Complete the procedure by pressing **Logout**.	
6.	Disconnect the WLAN connection.	

4.2 Changing the IP address on PCs with Windows 10

If the PC is not in the same IP address range as the photometer, no direct connection can be established with your Internet browser. In this case, the IP address of the PC has to be adapted to that of the photometer. Proceed as follows for **Windows 10**:

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Variant a: Select **Start \ Settings \ Network & Internet**, then **Change network settings \ Change adapter options**. Variant b: Press the **Windows + R** keys simultaneously. Enter **ncpa.cpl** in the input field and confirm by pressing **Enter**.	
2.	Select **LAN connections** and then **Properties**.	
3.	Select **Internet Protocol Version 4 (TCP/IPv4)** and then press **Properties**.	
4.	In the **General** tab, activate the **Use the following IP address** field and enter the following addresses in the entry field: ▪ IP address: 169.254.1.2 ▪ Subnet mask: 255.255.0.0 ▪ Default gateway: 0.0.0.0 Confirm your entry with **OK**.	
5.	Start your Internet browser.	Chrome, Edge, Firefox, Internet Explorer The use of Internet Explorer 9 can lead to problems. In case of doubt, use a different browser.
6.	Enter the IP address of the photometer (e.g. http://169.254.1.1) in the address field of the browser and confirm. The web user interface of the photometer starts.	

4.3 Start page in measuring operation

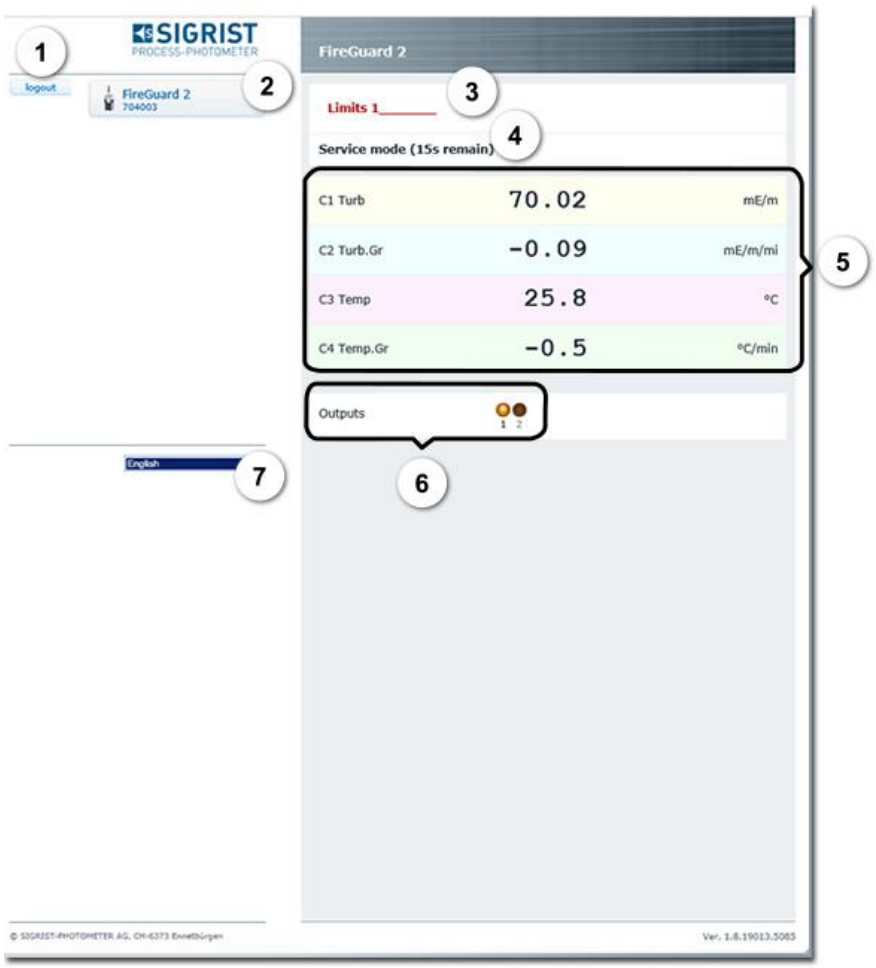


Figure 7: Start page on web user interface

①	**Logout** Communication between the photometer and web user interface is ended.	②	**FireGuard 2** The local menus of the FireGuard 2 are found here.
③	**Display** of warnings, faults and limits.	④	**Display** of how long the instrument will remain in service operation before it is switched back to measuring operation.
⑤	**Current measuring values** The sequence of the channels can be adjusted in the **Display** menu.	⑥	**Outputs:** Status of the outputs. If an event occurs which was activated in the Inp./Outputs menu, the lamp is lit on the corresponding output. This is only displayed when the StromRel option is used.
⑦	**Language** Drop-down menu for changing the language.		

4.4 Setting the operating language with web user interface

The operating language can be selected below the menu tree with the drop-down menu.
Section 4.3

4.5 Switching to service operation in the web user interface

After logging in, the main page appears. The instrument is in measuring operation. Service operation is accessed by pressing the **FireGuard 2** button.
Click the **Home** button once to return to measuring operation (Section 4.6).

4.6 Button functions in service operation

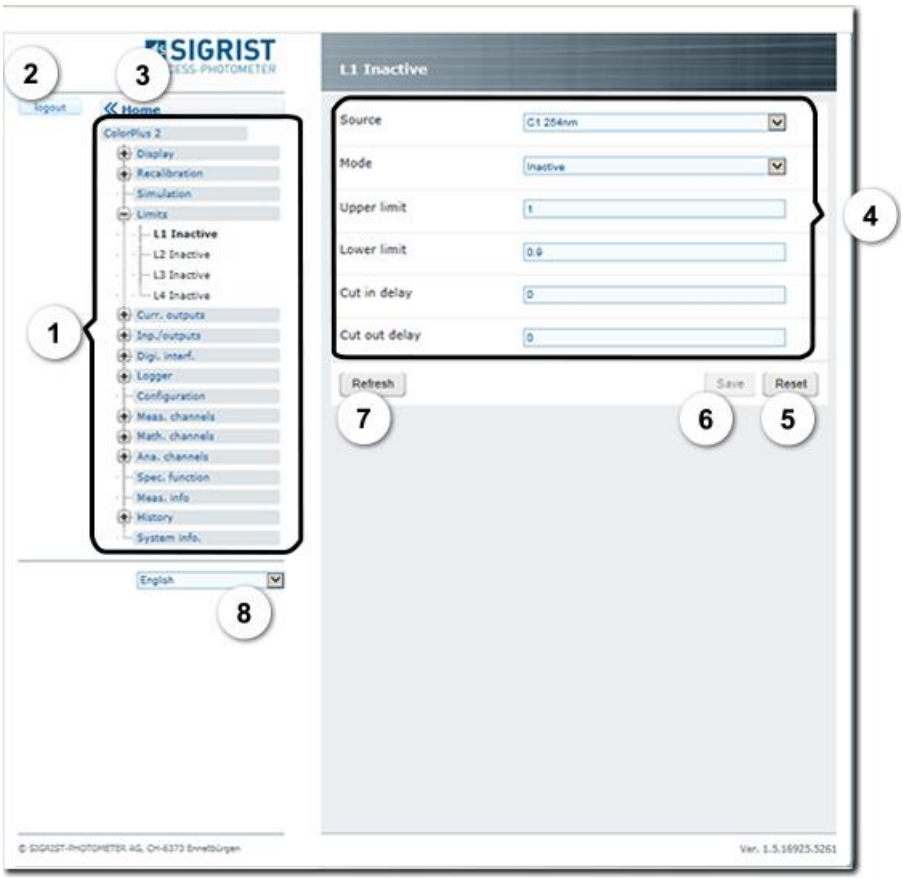


Figure 8: Button functions

①	Menu structure of the FireGuard 2.	②	Click the **Logout** button to log out of the web user interface.
③	The **Home** button returns you to the start screen (measuring operation).	④	**Entry range** Here you can enter values using the keyboard or select functions from the drop-down menus.
⑤	Use the **Reset** button to cancel the entry.	⑥	The **Save** button applies the entered values to the instrument.
⑦	**Refresh** This reads out the values currently stored in the instrument.	⑧	**Language** Drop-down menu for changing the language.

5 Field bus interface

5.1 General

5.1.1 Introduction

The FireGuard 2 can be operated via the Modbus RTU and Profibus DP field buses. The following requirements must be met:

- The computer and/or the management or control system must be connected to the Profibus DP/Modbus RTU bus system.
- The computer and/or the management or control system must have software that can properly process the data provided by the measuring instrument.
  SIGRIST-PHOTOMETER AG cannot offer support for this.
- The corresponding add-on module must be integrated.

The interface definitions of the FireGuard 2 are compatible with those of the FireGuard. The separately available white paper (document number 10662E) provides relevant and thorough information about the bus systems and their use.

The address tables necessary for programming are found separately according to the bus system in the following sections.

5.1.2 Fault codes

The meaning of the individual faults and the measures to be implemented are described in the Operating Instructions.

The error codes on the digital interfaces Modbus RTU and Profibus DP are compatible with those of the previous generation FireGuard. Prerequisite is the active FireGuard compatibility mode (active by default). The error codes with the assigned errors are listed below.

Error codes for Modbus RTU and Profibus DP:

No faults	Prioritized faults	Faults	Warnings
0: NO FAULTS	15: CRCDatEPROM - CRC EXPERTS - CRC USER - CRC DISPLAY 18: Default values - DEFAULT VALUES	1: Measure - V ANALOG - MEASUR.FAULT 2: LED - LIGHTSOURCE 1 17: System fault - WATCHDOG - SLAVE SW VERS - SERIAL 1 - V IN - SENSOR CHECK	3: Adjustment ADJUST FAULT 4: Temp - OVER TEMP 5: Heater - HEATER 6: Flow rate - FLOW RATE 7: Soiling - SOILING 8: Current 1 CURRENT 1 9: Current 2 CURRENT 2

For devices with Profinet IO communication these error codes apply:

No faults	Prioritized faults	Faults	Warnings
0: NO FAULTS	1: DEFAULT VALUES 3: CRC EXPERTS 4: CRC USER 5: CRC DISPLAY 6: EXT RAM 63: SW VERS	7: SLAVE SW VERS 8: SERIAL 1 16: V ANALOG 17: MEASUR.FAULT 19: LIGHTSOURCE 1 53: IO PORT 54: MASTER SW VERS	2: WATCHDOG 25: V IN 26: SOILING 27: ADJUSTMENT 29: OVER TEMP 31: HEATER 32: FLOW RATE 33: CURRENT 1 34: CURRENT 2 41: TEMP.SENSOR 78: SERVICE 79: SD CARD VERS.

EXTERNAL (43) can be configured by the user as a warning, fault or prioritized fault (Section 3.8).

5.2 Modbus RTU / TCP

5.2.1 Modbus RTU, general settings

- To connect to the Modbus RTU, the optionally available Modbus-Rep module must be integrated.
- The electrical installation of the Modbus-Rep module is described in the Instruction Manual.
- To be able to work with the Modbus, the bus parameters in the **Digi.interf. / Modbus** menu must be set correctly.
- If the photometer is used as a terminal device, DIL switch S2/1 must be switched ON on the connection module (see Instruction Manual).
- A rest period of 2 ms must be maintained between two telegrams (this is necessary for switching from send to receive in the Modbus-Rep module).

5.2.2 Address list on the Modbus RTU

Byte addressing is used, and not word (register) addressing. If address 0x2026 with a length of two bytes is polled, the addresses 0x2026 (one byte, fault) and 0x2027 (one byte, relay state) are transmitted in the same answer telegram. The fault is then contained in the first transmitted byte and the relay state in the second byte.

CAUTION!

Writing data in undocumented addresses can render the instrument inoperative.
Only the following documented addresses may be used.

The following values can be read with Modbus function 4 and written with Modbus function 16:

Address	R/W	Bytes	Data type	Name	Min. value	Max. value	Unit	Description
0x2000	R	4	Float	Measuring value	-100	330 * scaling	mE/m	▪ Normal operation: Measuring value in set unit ▪ Fault: -100 (the measuring value is output in the event of a warning) Values above 330 * scaling indicate a measuring range overflow

Address	R/W	Bytes	Data type	Name	Min. value	Max. value	Unit	Description
0x2004	R	4	Float	Measuring gradient	-100	100 * scaling	mE/m/min	▪ Normal operation or in the event of warnings: Gradient of the measuring value ▪ Fault: -100 (the gradient is output in the event of a warning)
0x2008	R	4	Float	Temperature	-100	200	°C	▪ Normal operation: Temperature in °C ▪ In the event of a measuring fault or temperature sensor fault: -100
0x200C	R	4	Float	Temp. Grad.	-100	100	°C/min	▪ Normal operation: Temperature gradient in °C/min ▪ In the event of a measuring fault or temperature sensor fault: -100
0x2026	R	1	Byte	Fault	0	10..18		Section 5.1.2
0x2027	R	1	Byte	Relay	0	3		▪ Bit 0: State relay 1 Bit 1: State relay 2
0x20B6	R	4	Float	Heater temperature	-100	200	°C	▪ Current temperature of the sample heater
0x20DC	R	1	Byte	Soiling	0	15		▪ Soiling 0 = clean 10 = limit reached
0x20DD	R	1	Byte	Live	0	1		▪ Switches between 0 and 1 in one-second intervals (Section 5.2.3)
0x4001	R/W	1	Byte	Integration	0	60	s	▪ Integration time for turbidity value

Address	R/W	Bytes	Data type	Name	Min. value	Max. value	Unit	Description
0x6000	R/W	2	Unsig-ned int	L1-4 cut in delay	0	3600	s	▪ Cut in delay for limit 1 to 4
0x6002	R/W	2	Unsig-ned int	L1-4 cut out delay	0	3600	s	▪ Cut out delay for limit 1 to 4
0x6004	R/W	4	Float	L1 Turb	0	3000	mE/m	▪ Limit 1: Turbidity
0x6008	R/W	4	Float	L2 Turb.Gr	0	25	mE/m/ min	▪ Limit 2: Turbidity gradient
0x600C	R/W	4	Float	L3 Temp	-30	100	°C	▪ Limit 3: Temperature
0x6010	R/W	4	Float	L3 Temp Grad	0	25	°C/min	▪ Limit 4: Temperature gradients
0x6014	R/W	2	Unsig-ned int	L5-8 cut in delay	0	3600	s	▪ Cut in delay for limit 5 to 8
0x6016	R/W	2	Unsig-ned int	L5-8 Cut out delay	0	3600	s	▪ Cut out delay for limit 5 to 8
0x6018	R/W	4	Float	L5 Turb	0	3000	mE/m	▪ Limit 5: Turbidity
0x601C	R/W	4	Float	L6 Turb. Grad	0	25	mE/m/ min	▪ Limit 6: Turbidity gradi-ent
0x6020	R/W	4	Float	L7 Temp	-30	100	°C	▪ Limit 7: Temperature
0x6024	R/W	4	Float	L8 Temp Grad	0	25	°C/min	▪ Limit 8: Temperature gradients
0x6030	R/W	4	Float	Scaling	0.01	303		▪ Scaling factor
0x605C	R/W	4	Float	Flow rate limit	0	25	PLA/ min	▪ Limit for flow rate warning
0x6060	R/W	4	Float	Heater nom.tem p	0	100	°C	▪ Nominal temper-ature of the sample heater
0x6064	R/W	4	Float	Heater max.temp	0	75	°C	▪ Maximum tem-perature of the sample heater
0x608C	R/W	4	Float	Fouling li-mit	0	1.0	PLA	▪ Limit for soiling warning

5.2.3 Function of the live bit in the Modbus

The live bit is used to monitor the communication between the FireGuard 2 and Modbus master. Bit 0 at this address switches between 0 and 1 and back in one-second intervals. To evaluate this field, the field must be polled at least every second.

5.3 Profibus DP

5.3.1 Profibus DP, general settings

- To connect to the Profibus DP, the optionally available Profibus module must be integrated.
- The electrical installation of the Profibus DP is described in the Instruction Manual.
- 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 connection module (see Instruction Manual).

5.3.2 Address list on the Profibus DP

Manufacturer	HMS Industrial Networks
Type	AnyBus-IC PDP
IDENT no.	0x1810
GSD file	hms_1810.gsd
Storage format (word modules)	MSB / LSB (most-significant byte/least-significant byte)

When writing the data, the entire data block defined in the master must be transmitted with valid values. However, it is also possible to shorten the data block in the master and then reduce the data set accordingly (e.g. only define 0 .. 14).

Input address	Output address	Module name	Function	Values
0		0x50 1 word	Status	Bit 10 .. 13 Soiling level 0 .. 15 0: clean 10: fouling limit reached → Warning
				Bit 9 Status sample heater
				Bit 8 Status low temp. heating
				Bit 7 Status of R2 – Relay 2

Input address	Output address	Module name	Function	Values
				Bit 6 Status of R1 – Relay 1
				Bit 5 Live – switches between 0 and 1 in one-second intervals → Section 5.3.3
				Bit 0 .. 4 fault → Section 5.1.2
2		0x51 2 word	Measuring value	Measuring value * 1000 (long) Range 0 .. 1000000 If fault: 0
6		0x50 1 word	Measuring gradient	Measuring gradient * 10 (integer) Range -1000 .. 1000 If fault: -100
8		0x50 1 word	Temperature	Temperature * 10 (integer) Range -1000 .. 1000 If fault: -100
10		0x50 1 word	Temperature gradient	Temperature gradient * 10 (integer) Range -1000 .. 1000 If fault: -100
12	0	0x30 1 byte	Integration	Integration (byte) Range 1 .. 60 s
13	1	0x30 1 byte	Live	Live (byte) inverts the input signal (max. 2.5 s) Section 5.3.3
14	2	0x70 1 word	Scaling	Scaling * 10 (integer) Range 1 .. 1000
16	4	0x70 1 word	L1-4 cut in delay	Limit 1-4 cut in delay (integer) Range 0 .. 3600s
18	6	0x70 1 word	L1-4 cut out delay	Limit 1-4 cut out delay (integer) Range 0 .. 3600s
20	8	0x70 1 word	L5-8 cut in delay	Limit 5-8 cut in delay (integer) Range 0 .. 3600s
22	10	0x70 1 word	L5-8 cut out delay	Limit 5-8 cut out delay (integer) Range 0 .. 3600s

Input address	Output address	Module name	Function	Values
24	12	0x70 1 word	L1 Turb	Limit 1 turbidity * 10 (integer) Range 0 .. 30000 Deactivated: 0
26	14	0x70 1 word	L5 Turb	Limit 5 turbidity * 10 (integer) Range 0 .. 30000 Deactivated: 0
28	16	0x70 1 word	L3 Temp	Limit 3 temperature * 10 (integer) Range -300 .. 1000 Deactivated: -300
30	18	0x70 1 word	L7 Temp	Limit 7 temperature * 10 (integer) Range -300 .. 1000 Deactivated: -300
32	20	0x30 1 byte	L2 Turb.Gr	Limit 2 turbidity gradient * 10 (byte) Range 0 .. 250 Deactivated: 0
33	21	0x30 1 byte	L6 Turb.Gr	Limit 6 turbidity gradient * 10 (byte) Range 0 .. 250 Deactivated: 0
34	22	0x30 1 byte	L4 Temp.Gr	Limit 4 temperature gradient * 10 (byte) Range 0 .. 250 Deactivated: 0
35	23	0x30 1 byte	L8 Temp.Gr	Limit 8 temperature gradient * 10 (byte) Range 0 .. 250 Deactivated: 0
36	24	0x71 2 word	System	Byte 1: Flow rate limit * 10 (byte) Range 0 .. 250 Byte 2: Fouling limit * 100 (byte) Range 0 .. 100 Byte 3: Heater nom. temp. (byte) Range 0 .. 100 Byte 4: Heater max. (byte) Range 0 .. 75

5.3.3 Function of the live fields in the Profibus DP

The two live fields serve to monitor the communication between the photometer and Profibus DP. This is made as follows:

In the state field, the more significant byte changes in half-second cycles between 0 and 1 and back.
To evaluate this field, the field must be polled at least every half second.

A byte field is on output address 1; it can also be used as a check. If this field is written to, the inverted value is output to input address 13.

5.4 Profinet IO

5.4.1 Profinet IO, general settings

- To connect to the Profinet IO, the optionally available Profinet IO module must be integrated.
- The electrical installation of the Profinet IO module is described in the Instruction Manual.
- The Profinet IO module is based on the Hilscher NIC 52/RE PNS. Detailed information can be found in the manufacturer's documentation.

5.4.2 Address list on the Profinet IO (FireGuard 2)

5.4.2.1 GSD file (GSDML-V2.33-SIGRIST-NG PROFINET-20180115.xml)

- The data is divided up into four input modules and three output modules. Only one module is required for the basic functions. These seven modules are permanently assigned to slots 1 .. 8.
- The modules and the variables contained therein are available in pairs (one version for reading and one version for writing). An exception here is the diagnosis data, which can only be read.
- The Profinet IO implementation is identical for all Sigrist instruments. Depending on the instrument type and control unit used, not all data is used.
  The unused data is highlighted in gray in the following tables.

Slot	Module ID	Module name	Bytes	Description
1	mod measurements out	Measurements Output	4	Writing the measuring data
3	mod configuration out	Configuration Output	64	Writing the configuration data
4	mod threshold out	Threshold Output	64	Writing the threshold values
5	mod measurements in	Measurements Input	64	Reading the measuring data
6	mod diagnosis in	Diagnosis Input	64	Reading the diagnosis data
7	mod configuration in	Configuration Input	64	Reading the configuration data
8	mod threshold in	Threshold Input	64	Reading the threshold values

The following variable types are used:

Sigrist	Length in bytes	ANSI C	TIAv14
Byte	1	Char	Byte
word	2	Int16	Word
float	4	Float	Real
long	4	Int32	DWord

When writing a module, all values must be within the permissible limits. Otherwise, all changes for this module are rejected.

5.4.2.2 Measuring data (slot 5: inputs / slot 1: outputs)

The following variables are available in the measuring data:

Variable name	Type	Offset Master input Slot 5	Offset Master output Slot 1	Description	Min. value	Max. value
Live invert	Byte	0	1	Bit invert function Example: Output 0xF0 → Input 0x0F	0	255
Operating mode	Byte	1	1	0: Operation 1: Auto sensor check 2: Auto recalibration 3: Service	0	3
Start	Byte	2	2	LabScat2: Start measurement	0	1

Variable name	Type	Offset Master input Slot 5	Offset Master output Slot 1	Description	Min. value	Max. value
LinTab	Byte	3	3	LabScat2: Linearization table OilGuard2: Active measuring channel	0	7
Live/progress	Byte	4		Bit 7: Live – toggles in one-second intervals Bit 0-6: LabScat 2 progress		
LimitStatus	Byte	5		Current limit status		
FirstWarnFaultPrio	Byte	6		Warning / fault / prio fault (Section 5.1.2)		
FirstWarnFault-Source	Byte	7		Source of warning / fault / prio fault: 0: Local / 1 .. 8: Sensors 1 .. 8		
Measuring value 1	float	8		Current measuring value 1		
Measuring value 2	float	12		Current measuring value 2		
Measuring value 3	float	16		Current measuring value 3		
Measuring value 4	float	20		Current measuring value 4		
Measuring value 5	float	24		Current measuring value 5		
Measuring value 6	float	28		Current measuring value 6		
Measuring value 7	float	32		Current measuring value 7		
Measuring value 8	float	36		Current measuring value 8		
Math value 1	float	40		Current math value 1		
Math value 2	float	44		Current math value 2		
Math value 3	float	48		Current math value 3		
Analog value 1	float	52		Current analog value 1		
Analog value 2	float	56		Current analog value 2		
DigInStatus	Byte	60		Current status of the digi-tal inputs		
DigOutStatus	Byte	61		Current status of the digi-tal outputs		
InfoStatus	Byte	62		Bit 0: Low-temperature heater Bit 1: LED heater Bit 2: Sample heater		
Soiling 1 (0 .. 15)	Byte	63		FireGuard 2: Soiling level 0 .. 15		

5.4.2.3 Diagnosis data (slot 6)

The following variables are available in the diagnosis data:

Variable name	Type	Offset Master input Slot 6	Offset Master output	Description	Min. value	Max. value
Soiling 1	float	0		Soiling channel 1		
Soiling 2	float	4		Soiling channel 2		
Soiling 3	float	8		Soiling channel 3		
Soiling 4	float	12		Soiling channel 4		
InnerTemp	float	16		Inner temperature		
LEDTemp	float	20		LED temperature		
HeaterTemp	float	24		Heater temperature		
Humidity	float	28		Humidity in instrument		
VIn	float	32		Input voltage		
Plus5V	float	36		Voltage of the analog +5 V power supply		
Minus10V	float	40		Voltage of the analog -10 V power supply		
PowerInStatus	Byte	44		Status of the power inputs (Powerbox)		
PowerOutStatus	Byte	45		Status of the power outputs (Powerbox)		
Instrument number	long	46		Instrument number		
Dummy	14	50		Unused		

5.4.2.4 Configuration data (slot 7: inputs / slot 3: outputs)

The following variables are available in the configuration data:

Variable name	Type	Offset Master input Slot 7	Offset Master output Slot 3	Description	Min. value	Max. value
MC 1 Offset	float	0	0	Measuring channel 1 offset	-5000	1.0E9
MC 2 Offset	float	4	4	Measuring channel 2 offset	-5000	1.0E9
MC 3 Offset	float	8	8	Measuring channel 3 offset	-5000	1.0E9

Variable name	Type	Offset Master input Slot 7	Offset Master output Slot 3	Description	Min. value	Max. value
MC 4 Offset	float	12	12	Measuring channel 4 offset	-5000	1.0E9
MC 5 Offset	float	16	16	Measuring channel 5 offset	-5000	1.0E9
MC 6 Offset	float	20	20	Measuring channel 6 offset	-5000	1.0E9
MC 7 Offset	float	24	24	Measuring channel 7 offset	-5000	1.0E9
MC 8 Offset	float	28	28	Measuring channel 8 offset	-5000	1.0E9
MC 1 Scaling	float	32	32	Measuring channel 1 scaling*)	**0.001**	1.0E9
MC 2 Scaling	float	36	36	Measuring channel 2 scaling	-5000	1.0E9
MC 3 Scaling	float	40	40	Measuring channel 3 scaling	-5000	1.0E9
MC 4 Scaling	float	44	44	Measuring channel 4 scaling	-5000	1.0E9
MC 5 Scaling	float	48	48	Measuring channel 5 scaling	-5000	1.0E9
MC 6 Scaling	float	52	52	Measuring channel 6 scaling	-5000	1.0E9
MC 7 Scaling	float	56	56	Measuring channel 7 scaling	-5000	1.0E9
MC 8 Scaling	float	60	60	Measuring channel 8 scaling	-5000	1.0E9

*) Scaling of measuring channel 1: This value can be written via slot 7 as float or via slot 8 as integer. If the float value is used, the integer value must be 0.
To prevent the entire module from being accidentally written with zero values, a minimum value of 0.001 is defined when scaling measuring channel 1.

5.4.2.5 Threshold values (slot 8: inputs / slot 4: outputs)

The following variables are available in the threshold value data:

Variable name	Type	Offset Master input Slot 8	Offset Master output Slot 4	Description	Min. value	Max. value
Integ 1 .. 8	word	0	0	Integration time for measuring channels 1..8	0	60000

Variable name	**Type**	**Offset** Master input Slot 8	**Offset** Master output Slot 4	**Description**	**Min. value**	**Max. value**
L hysteresis	word	2	2	Limit hysteresis*)	0	100
L1 upper	float	4	4	Upper limit 1	-5000	1.0E9
L2 upper	float	8	8	Upper limit 2	-5000	1.0E9
L3 upper	float	12	12	Upper limit 3	-5000	1.0E9
L4 upper	float	16	16	Upper limit 4	-5000	1.0E9
L5 upper	float	20	20	Upper limit 5	-5000	1.0E9
L6 upper	float	24	24	Upper limit 6	-5000	1.0E9
L7 upper	float	28	28	Upper limit 7	-5000	1.0E9
L8 upper	float	32	32	Upper limit 8	-5000	1.0E9
L1 cut in del.	word	36	36	L1 cut in delay	0	60000
L2 cut in del.	word	38	38	L2 cut in delay	0	60000
L3 cut in del.	word	40	40	L3 cut in delay	0	60000
L4 cut in del.	word	42	42	L4 cut in delay	0	60000
L5 cut in del.	word	44	44	L5 cut in delay	0	60000
L6 cut in del.	word	46	46	L6 cut in delay	0	60000
L7 cut in del.	word	48	48	L7 cut in delay	0	60000
L8 cut in del.	word	50	50	L8 cut in delay	0	60000
Flow rate limit	long	52	52	Flow rate limit	-10	20000
Fouling limit	long	56	56	Soiling limit	**0.001**	1000
Heater nom.temp	Byte	60	60	Heater nominal temperature	0	100
Heater max.temp	Byte	61	61	Heater maximum temperature	0	75
Scaling 1 * 10	word	62	62	VisGuard 2 / FireGuard 2**) Measurement channel 1 scaling * 10 as integer	0	65000

*) Limit hysteresis: Lower limit = upper limit * (100.0 - value) / 100.0
**) Scaling of measuring channel 1: This value can be written via slot 7 as float or via slot 8 as integer. If the float value is used, the integer value must be 0.
To prevent the entire module from being accidentally written with zero values, a minimum value of 0.001 is defined for the soiling limit.

5.5 HART

5.5.1 HART, general settings

- To connect to HART, the optionally available HART module must be integrated in the SICON.
- The HART module must be activated in the **Digi.interf./General/Module type** menu. With the activation of HART, the **Current\General\If fault** parameter is set to 3.6 mA according to the HART standard. The range of **Current output 1** is set permanently to **Measuring range 1**.

5.5.2 HART process variables

HART process variables	Function	Values
Primary variable	Measuring value channel 1	Measuring value 1
Secondary variable	Measuring value channel 2	Measuring value 2
Third variable	Measuring value channel 3	Measuring value 3
Fourth variable	Measuring value channel 4	Measuring value 4
Additional status	Status	Prio / Faults / Warnings (Section 5.1.2)
Re-range primary variable	Upper range value	Measuring range 1 from
	Lower range value	Measuring range 1 to

5.5.3 Operating several FireGuard 2 units via the SICON M

The following procedure describes the configuration process for operation with several FireGuard 2 units on a SICON M:

	MANIPULATION	ADDITIONAL INFO / IMAGES
1.	Press the **Menu** button.	
2.	Set the access code and confirm with **OK**.	Factory setting is **0**.
3.	In the SICON M, set **Local\Digi.interf.\ General\Bus type** to **SIPORT2 115200** (or to **SIPORT 2 19200** if the distance between two SIPORT 2 units is greater than 800 m).	If the desired menu does not appear, press the arrow at the bottom right.
4.	Set the following in all connected FireGuard 2 units. 1. In the **Digi.interf.\Modbus\Baud rate** menu, set the baud rate as in the SICON M (19200 or 115200). 2. Set the **Digi.interf.\Modbus\FireGuard Comp.** menu to **No**. In the **Digi.interf.\Modbus\Slave no.** menu, assign an individual slave number for each instrument (1 to 8).	
5.	In the SICON M, start the network scan in the **Local\Digi.interf.\Siginet\Network scan** menu. All connected FireGuard 2 units are then detected and displayed.	
6.	In the SICON M, assign the measuring channels to the connected FireGuard 2 units in the **Local\Meas.channels** menu. Section 3.11	
7.	Press the **Meas** button.	The instrument is in measuring operation again.

6 Repair work

6.1 General information on repair work

DANGER!

Life-threatening voltage on external signal lines

External signal lines may carry life-threatening voltage, even if the service voltage to the control unit is disconnected.

- Before opening the control unit, make sure that no connected lines are charged with voltage.
- Before performing repair work, observe the safety pointers in the Instruction Manual.
- Keep strictly to the sequence of the described work steps.
- Only use original spare parts (→ Instruction Manual/spare parts list).
- When returning components, be sure to follow the instructions in the Instruction Manual regarding packaging and transport.

Check all removed parts for damages or signs of wear and replace with new parts when necessary. (Spare parts → Instruction Manual).

6.2 Replacing the 250 V microfuse on the SIPORT 2

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Interrupt the service voltage to the SIPORT 2. **⚠ Danger due to electrically charged signal lines.** Ensure that all signal lines are de-energized.	
2.	Open the SIPORT 2 as described in the Instruction Manual.	
3.	Pull the microfuse (X) out of the socket.	
4.	Insert the new microfuse in the socket.	
5.	Reattach the cover on the SIPORT 2.	
6.	Close the SIPORT 2 and reconnect the service voltage.	

6.3 Replacing the SIPORT 2

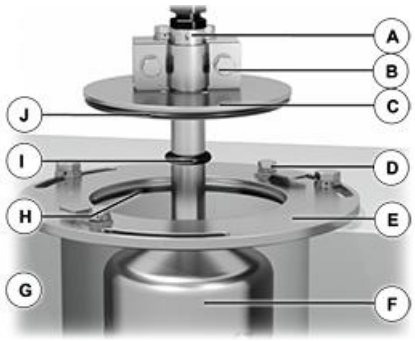
The SIPORT 2 can be replaced without any additional measures or reprogramming. Information on the installation of the new SIPORT 2 can be found in the Instruction Manual.

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Interrupt the service voltage to the SIPORT 2. ⚠ **Danger due to electrically charged signal lines.** Ensure that all signal lines are de-energized.	
2.	Open the SIPORT 2 and remove all cable connections from the terminals according to the Instruction Manual.	
3.	Install the new SIPORT 2 according to the Instruction Manual and restore the electrical connections.	
4.	Put the instrument into operation again according to the Instruction Manual.	

6.4 Replacing the FireGuard 2

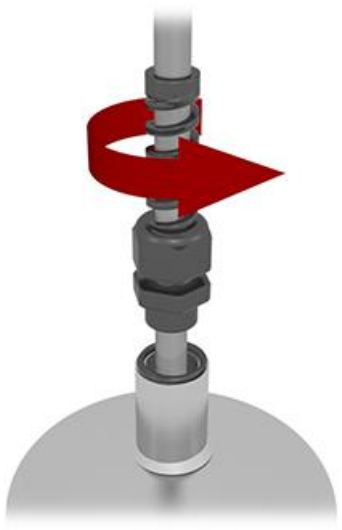
All customer-specific settings are lost when the FireGuard 2 is replaced.

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Interrupt the service voltage to the SIPORT 2. ⚠ **Danger due to electrically charged signal lines.** Ensure that all signal lines are de-energized.	
2.	Open the SIPORT 2 according to the Instruction Manual and remove the cable connections to the FireGuard 2 from the terminals.	
3.	Loosen the cable gland and remove the control cable from the SIPORT 2.	
4.	**4a: Procedure for FireGuard 2 attached with a variable mounting bracket.** Remove the FireGuard 2 according to the Instruction Manual and the FIREGUARD2_0-90-MB drawing.	

	WORKSTEP	ADDITIONAL INFO / IMAGES
	4b: Procedure for FireGuard 2 attached with a suspended ceiling set. 1. Loosen and swing away the two fastening clips (D). 2. Lift the FireGuard 2 with instrument panel (C) out of the measuring position. 3. Measure out the position of the instrument panel (C) on the old photometer. 4. Loosen the pipe clamp (B) and then remove the instrument panel (C) from the old photometer. 5. Fasten the instrument panel (C) at the same height on the new photometer with the pipe clamp (B). 6. Position the new FireGuard 2 on the mounting flange (E) and align it in the direction of travel according to the Instruction Manual. 7. Fasten the instrument panel (C) with photometer in place by tightening the two fastening clips (D). Check the gaskets and replace when necessary (→ Instruction Manual/spare parts list).	 A: Mounting tube B: Pipe clamp C: Instrument panel D: Fastening clips E: Mounting flange F: Photometer G: Tunnel ceiling with bore hole H: Gasket on mounting panel I: Gasket, 19 x 4 J: Gasket, 113.97 x 2.62
5.	Attach the cable connections to the terminals on the SIPORT 2 according to the Instruction Manual.	
6.	Fasten the control cable in place in the SIPORT 2 by tightening the cable gland.	
7.	Close the SIPORT 2 and reconnect the service voltage.	
8.	Carry out commissioning according to the Instruction Manual.	

6.5 Replacing the instrument cable on the FireGuard 2

The control cable is fixed on the FireGuard 2 with a cable penetration. The control cable is connected to terminals on the inside of the FireGuard 2.

	WORKSTEP	ADDITIONAL INFO / IMAGES
1.	Interrupt the service voltage to the SIPORT 2. **⚠ Danger due to electrically charged signal lines.** Ensure that all signal lines are de-energized.	
2.	Open the SIPORT 2 according to the Instruction Manual and remove the connections to the FireGuard 2 from the terminals.	
3.	Loosen the cable gland and remove the instrument cable from the SIPORT 2.	
4.	Turn the cable gland (straight or 90°) counterclockwise and then remove it from the FireGuard 2 (arrow). Check the cable gland and replace when necessary (→ Instruction Manual/spare parts list).	
5.	Unscrew the three screws until the housing can be turned, then remove the housing. Check the housing for damages and replace when necessary (→ Instruction Manual/spare parts list).	

<table>
<tr><th></th><th>WORKSTEP</th><th>ADDITIONAL INFO / IMAGES</th></tr>
<tr><td>6.</td><td>Remove the wires from the terminals (circle) of the VG_Basi print and then remove the instrument cable.</td><td>  </td></tr>
<tr><td>7.</td><td>Connect the new instrument cable to the FireGuard 2 as follows.
1. Feed the new instrument cable through the cable penetration in the housing.
2. Connect the new instrument cable to the terminals on the FireGuard 2 (circle).
<table>
<tr><td>Name</td><td>GND</td><td>24V</td><td>SA</td><td>SB</td><td>A</td><td>B</td></tr>
<tr><td>Color</td><td>Black and white</td><td>Green and brown</td><td>Blue</td><td>Red</td><td>Gray</td><td>Yellow</td></tr>
</table>
3. Attach the housing and fasten in place.
4. Tighten the cable gland on the housing.
5. Fasten the housing in place by tightening the three screws.
⚠ The screws must not be overtightened, as the thread may then be damaged. Do not exceed a tightening torque of 1 Nm</td><td></td></tr>
<tr><td>8.</td><td>Feed the new instrument cable through the cable gland in the SIPORT 2.</td><td></td></tr>
<tr><td>9.</td><td>Attach the cable connections to the terminals on the SIPORT 2 according to the Instruction Manual.</td><td></td></tr>
<tr><td>10.</td><td>Fasten the instrument cable in place by tightening the cable gland.</td><td></td></tr>
<tr><td>11.</td><td>Close the SIPORT 2 and reconnect the service voltage.</td><td></td></tr>
<tr><td>12.</td><td>The instrument is in measuring operation.</td><td></td></tr>
</table>

7 Menu structure & factory settings

▷ Display	▷ Display D1 .. n ■ Source: C1 .. n | Inactive | **Active** ■ Resolution: 1.234, 1.23, 1.2, 1	▷ Menu (select) ■ Option (changeable) ☐ Information (read only) ▣ Function (perform) ↘ Example value **Bold** = factory setting Italics = optional
▷ Recalibration	▷ General ■ Auto start recal.: Inactive | **Active** ■ Cont.1 name: **KStab 1** ■ Cont.1 value: instrument specific ■ Kont.2 Name: **KStab 2** ■ Cont.2 value: instrument specific ▷ C1 Turb ■ Cont. active: **1 KStab 1** | 2 KStab 2 ■ Nom. val.: ↘9.546 ☐ Act. val.: ↘9.235 ▣ Adjustment: initiate... ☐ Curr. corr.: ↘1.025 ☐ Soiling: ↘50 %	
▷ Sensor check	▣ start…	
▷ Simulation	■ Meas.value mode: **Off** | Static | Dynamic | Simu value ■ Simu value: **1.000** ■ Fault mode: **Off** | Fault ■ Current: **Off** | 0 mA | 4 mA | 8 mA | 10 mA | 12 mA | 16 mA | 20 mA ■ Outputs: **Off** | All Off | All On | 1 .. 2 On ■ Light source: **Off** | 1	
▷ Limits	▷ Limits L1 .. n ■ Source: **C1 Turb** | C2 Turb.Gr | C3 Temp | C4 Temp.Gr | ■ Upper limit: see Instruction Manual ■ Cut in delay: **6 s** for L1 .. L4 / **8 s** for L5 .. L8 ■ Cut out delay: **0 s**	
▷ Curr.outputs	▷ General ■ Ranges: ▣ Define… ▷ MR1: ■ From: **0.000** ■ To: **50** ▷ MR2: ■ From: **-20.00** ■ To: **80.00** ▷ MR3: ■ From: **0.000** ■ To: **0.000** ▷ MR4: ■ From: **0.000** ■ To: **0.000** ▷ MR5: ■ From: **0.000** ■ To: **0.000** ▷ MR6: ■ From: **0.000** ■ To: **0.000** ▷ MR7: ■ From: **0.000** ■ To: **0.000** ▷ MR8: ■ From: **0.000** ■ To: **0.000** ■ 0/4mA..20mA: 0-20mA | **4-20mA** ■ For service: 0 Value | **Last value** | Recalibr. | Measure ■ Max. value: **21 mA** ■ If fault: **2 mA**	
	▷ Current outputs C1/2	
	■ Source: **Chan. 1 .. 4** | Inactive ■ Range: MR**1** .. 8	
▷ Inp./outputs	▷ Outputs: ■ A1 Limit: **Invert** | Fault ■ A2 Fault: Invert	

Continuation ➔

▷ Digi. interf.	▷ General ■ Module type: **Auto.** | HART | Profibus DP | Modbus | StromRel | Profinet IO ■ Module location: **Local** | SIPORT 2 ■ WLAN Schlüssel: **12345678** (optional)	▷ Menu (select) ■ Option (changeable) ☐ Information (read only) ▣ Function (perform) ↘ Example value **Bold** = factory setting
	▷ Modbus RTU (optional) ■ Slave no.: **1** | .. | 240 ■ Baudrate: 4800 | 9600 | 19200 | 38400 | 57600 | **115200** | 230400 Baud ■ Parity: **Even** | None | Odd ■ FireGuard Comp.: **Active** | Inactive	
	▷ Profibus DP (optional) ■ Control: **Local** | External ■ Slave no.: **1** | .. | 240	
	▷ Profinet IO (optional) ■ Control: **Local** | External ▣ Station name – load…	
▷ Configuration	■ Language: **English** | Languages that are currently available ■ Mandatory oper.: 60 .. **900 s** .. 60000 s ■ Access code: **0** ■ Disp. contrast: **8** (3 .. 31 levels) ■ Disp. brightness: **64** (0 .. 127 levels) ■ Date: **DD.MM.YYYY** ■ Time: **hh:mm:ss** ■ Clock corr.week: **0.0 s** ■ Date format: **DD.MM.YYYY** | DD/MM/YYYY | MM/DD/YYYY ■ Summer time: No | Yes | **Europe** ■ Name: …13-digit measurement point name	
▷ Meas. channels	▷ C1 Turb ■ Scaling: **10** ■ Integration: **6 s** ■ Name: **Turb** ■ Unit: **mE/m**	
	▷ C2 Turb.Gr ■ Name: **Turb.Gr** ■ Unit: **mE/m/mi**	
	▷C3 Temp ■ Name: **Temp** ■ Unit: **°C**	
	▷C4 Temp.Gr ■ Name: **Temp.Gr** ■ Unit: **°C/min**	
▷ Spec. function	■ Check interv.: 0 .. **168 h** .. 100000 ■ Heater nom.temp: **40 °C** (if heater is installed) ■ Heater max.temp: **50 °C** ■ Flow rate limit: **0.300** ■ Fouling limit: **0.2**	

Continuation ➔

▷ Meas. info	Information on the FireGuard 2	▷ Menu (select) ■ Option (changeable) ☐ Information (read only) ▣ Function (perform) ↘ Example value **Bold** = factory setting
▷ History	▷ Fault ▷ Adjustment	
▷ System info.	▷ Instr. Type: ☐ FireGuard 2 ▷ Serial number: ☐ ↘ 733010 ▷ Software vers.: ☐ ↘ 126 ▷ Oper. hours: ☐ ↘ 514 ▷ User-> SD → ▣ copy... ▷ Expert-> SD → ▣ copy... ▷ Meas-> SD → ▣ copy... ▷ Diag-> SD → ▣ copy... ▷ Code ☐ ... ▷ Factory set. → ▣ load... ⚠ **Overwrites your settings with the factory settings** ▷ Slave update → ▣ start...	

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