INSTRUCTION MANUAL

DualScat Ex

SIGRIST
In-line Turbidimeter

with SIREL SMD/Ex

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Document No.: 10118E	Version: 5	Valid from: SN 450101

Contents

Foreword

This Instruction Manual describes the basic functions employed in operating the DualScat Ex. It is addressed to all persons responsible for operation of the instrument.

Operate the instrument only after familiarizing yourself with the content of the Instruction Manual. In particular, study the section on safety rules very carefully before you start operation.

Additional Documentation

Doc. No.	Title	Content
10121E	Brief Instructions	Most import ant functions and complete menu structure
10119E	Reference Handbook	More sophisticated menu functions and worksteps for advanced users
11766E	Data Sheet	Descriptions and technical data about the instrument.
10120E	Service Manual	Repair and conversion instructions for service technicians
11044E	SIREL Ex Instruction Manual	Contains additional information about the SIREL Ex control unit

Symbols used

	Important information
	Orientation aid
	Supplementary information
	Extremely dangerous voltage
	Caution: danger of explosion **(LIFE-THREATENING DANGER)**
	Separate disposal of electrical and electronic equipment

1 Equipment Description

1.1 General view of measuring station

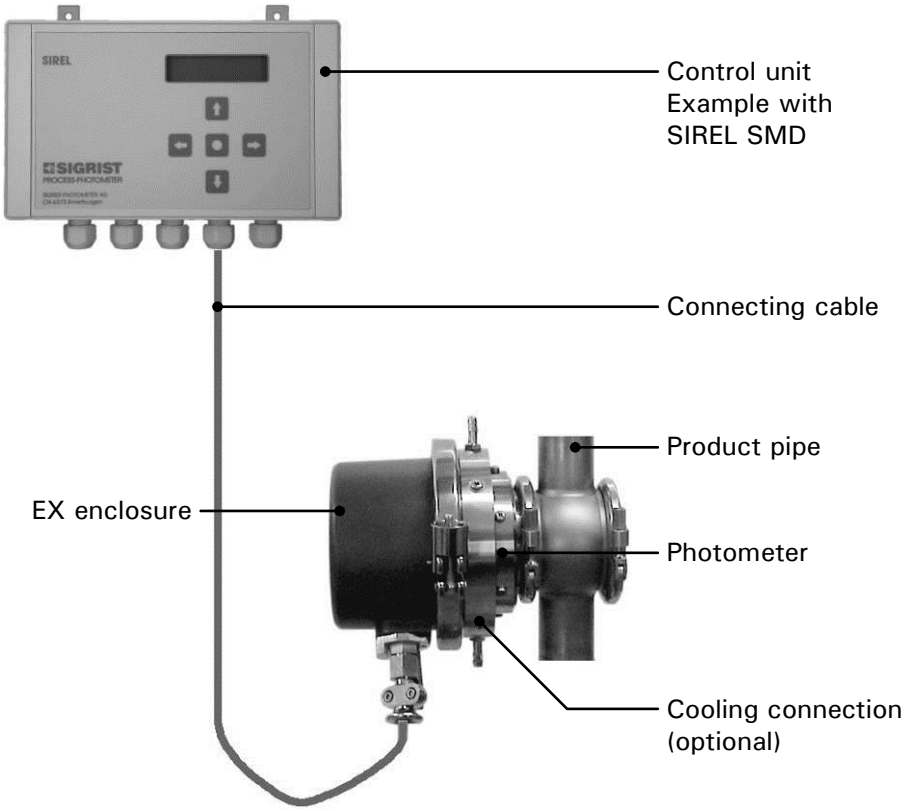


Figure 1: General view DualScat Ex with SIREL SMD .

1.2 Scope of supply and accessories

Standard scope of supply:

Units	Name	Versions/Remarks
1	Photometer	Dual-angle 90°/25°, single-angle 90°, single-angle 25°
1	Control unit, standard or Ex version	SIREL SMD 100..240 VAC or SIREL SMD 24 VDC SIREL SMD Ex 100..240 VAC or SIREL SMD Ex 24 VDC
1	Housing key (square drive) for SIREL Ex	Only for SIREL Ex (118771)
1	Instruction Manual	
1	Reference Handbook	
	Brief Instructions	

Required Accessories:

Art. No.	Name	Versions/Remarks
119125	Blanking glass coated with PVD-chrome, with EPDM O-Ring	Lock ring inclusive. Check chemical compatibility of the blanking glass with medium.
	or	
118786	Blanking plate, sand blasted with EPDM O-Ring	Lock ring inclusive. Check chemical compatibility of the blanking plate with medium.

Optional Accessories:

Art. No.	Name	Versions/Remarks
113064	Checking unit with solid reference	
901800	Junction box	
115637	Bus coupler netTAP	Profibus–DP
112952	Cooling system	Depends on medium temperature and ambient temperature.
	In-line enclosure	Various qualities and nominal widths

1.3 Equipment purpose and conformity

Incorrect use of the photometer, or use for purposes other than the intended duty, can produce false measuring results with possible process-related damage or damage to the photometer itself.

The control unit SIREL SMD and any peripheral components may not be installed or operated in explosive atmospheres.

If a SIREL Ex control unit is used, it is imperative to read manufacturer documentation 11044DEF beforehand.

Intended duty

The instrument is designed to measure turbidity in liquids which are in Zone 0 explosion hazard areas (Ex d IIC T3/T4/T5/T6 Ga/Gb).

The photometer complies with the following standards for electrical equipment and for explosive atmospheres:

EN 60079-0:2012 + A11:2013	General requirements
IEC 60079-0:2011	General requirements
EN 60079-1:2014	Instrument protection with pressure-proof encapsulation “d”
IEC 60079-1:2014	Flameproof enclosure
EN 60079-26:2015	Operating materials with instrument protection level (EPL) Ga
European Directive 2014/34/EU	

Table 1: Standards

The photometer possesses the following certification:

- EC type examination certificate BVS 10 ATEX E 101 X
- IECEx BVS 16.0054X

State-of-the-art engineering practice was followed in the design and manufacture of the photometer. It complies with the generally accepted guidelines with regard to safety and the exercising of due care.
The photometer and control unit comply with the electromagnetic compatibility (EMC) requirements applicable within the European Union (EU) and with the Low Voltage Guidelines (LVG), and it carries the CE mark.

1.4 Identification of the product

Two labels are affixed to the control unit. The instrument number of the control unit is indicated on the back. The electrical connection data are given on the sticker at the bottom left:

Figure 2: Labels for the serial number and the electrical connection data on the SIREL SMD.

X: Rating plate of the manufacturer → SIREL Ex Instruction Manual

Figure 3: Position of the SIGRIST rating plate on the SIREL Ex

Figure 4: Photometer rating plate.

The photometer rating plate provides the following information:

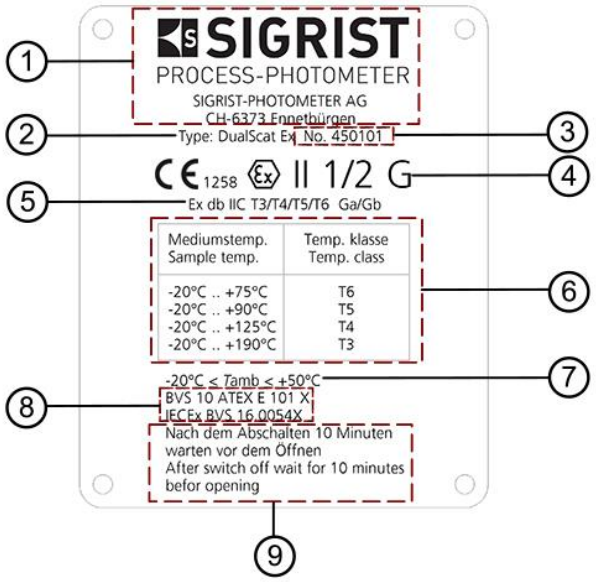


Figure 5: Information on identification plate

Pos	Name
1	Manufacturer
2	Instrument type
3	Serial number
4	Conformity data
5	Ex protection type
6	Temperature classes
7	Ambient temperature
8	Certificates
9	Warning

You can also consult the photometer's serial number in the menu * SYSTEM INFO *. → Reference Handbook

1.5 Technical data

Turbidity measurement

Measuring principle	90°/25° scattered light measurement at 650 nm		
Measuring span	0 .. 2'000 NTU 90° (optional 25°)		
Reproducibility	**NTU**	**90°**	**25°**
	0 .. 8	±1% full scale	±1% full scale
	8 .. 400	±2% full scale	±3% full scale
Resolution	less than ±0.25% full scale		
Warm-up time	less than 3 min		
Temperature stability	less than -0.15%K^{-1} full scale		
Reaction time	less than 2 s (step response → limit switch)		
Servicing interval	see Service Schedule 5.1		
Medium temperature	20 .. +80 °C, max. 120 °C for 1 h		

Photometer

Installation	In-line housing (Varivent® or compatible)
Service voltage	24 VDC (of control unit)
Flow cell	borosilicate glass (Pyrex) or Sapphire stainless steel SS316L, 1.4435 seal NBR, EPDM, FPM or Kalrez
Enclosure	cast aluminum enclosure (GK-AlSi 13/ Silavont 15) 2-component synthetic resin finish
Dimensions	about 160 mm x Ø200 mm see section 0 for detailed dimension drawing
Weight	about 6.4 kg
Degree of protection	IP65
Ex protection type/ temperature class	Ex db IIC T3/T4/T5/T6 Ga/Gb
Ambient temp.	-20 .. +50°C
Max. Druck	2 MPa (20 bar) at 80°C <1 MPa (<10 bar) with blanking glass 118775 ≥1 MPa (≥10 bar) with blanking plate 118786 Attention: Consider specification of the Varivent®-housing
Cooling required	from 80 °C medium temperature

SIREL SMD

Service voltage	100 .. 240 V, 47 .. 63 Hz or 18 .. 30 VDC, 25 W
Dimensions	200 mm x 157 mm x 96 mm See Section 0 for detailed dimension drawing
Weight	about 1.5 kg
Degree of protection	IP65
Connections	0/4 .. 20 mA per measuring angle, max. 600 Ω, max. 24 V, with electrical isolation, max. 50V against earth Relay contacts max. 250 VAC, max. 4 A Digital inputs and outputs max. 5 V

SIREL Ex

Service voltage	100 .. 240 V, 47 .. 63 Hz or 18 .. 30 VDC, 25 W
Mains switch	None
Dimensions	320 mm x 645 mm x 203 mm Detailed dimension drawing see Section 0
Weight	Approx. 25 kg
Protection type	IP66
Ambient temperatures	-20°C to +50°C
Connections	See SIREL SMD

Additional technical data of the SIREL Ex is provided in Instruction Manual 11044DEF

2 Safety Rules

2.1 Symbols used

Symbols appearing in this documentation and on the equipment refer to the following safety measures or precautions:

DANGER (BLACK ON YELLOW)
Warning about a general source of danger. This symbol marks areas or manipulations that call for the observation of special safety rules. In these cases consult the Instruction Manual, which specifies the applicable rules.

VOLTAGE (BLACK ON YELLOW)
Warning about a dangerous electric voltage. This symbol marks energized areas with voltages higher than 48 VAC or 65 VDC where an electric shock hazard exists. In these cases be sure to observe the safety precautions and procedures prescribed in the Instruction Manual.

2.2 Rules for ensuring safe operation

Before starting up the instrument, study these rules and be sure to observe them.

- Do not carry out any mechanical or electrical modifications to the instrument or parts of it, because this could compromise its degree of protection.
- Only properly instructed personnel may open and close the photometer.
- Be sure to observe the order of the operating steps contained in this documentation. They are marked with the symbol shown at the left.

3 Installation/Start-up

3.1 Installation

3.1.1 Photometer

The photometer can be installed using a standard in-line housing either in horizontal or vertical product pipes.

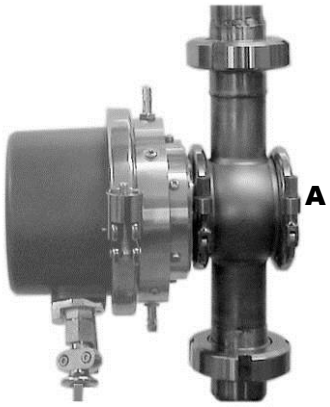


Figure 6: Installation in vertical product pipes.

Figure 7: Installation in horizontal product pipes.

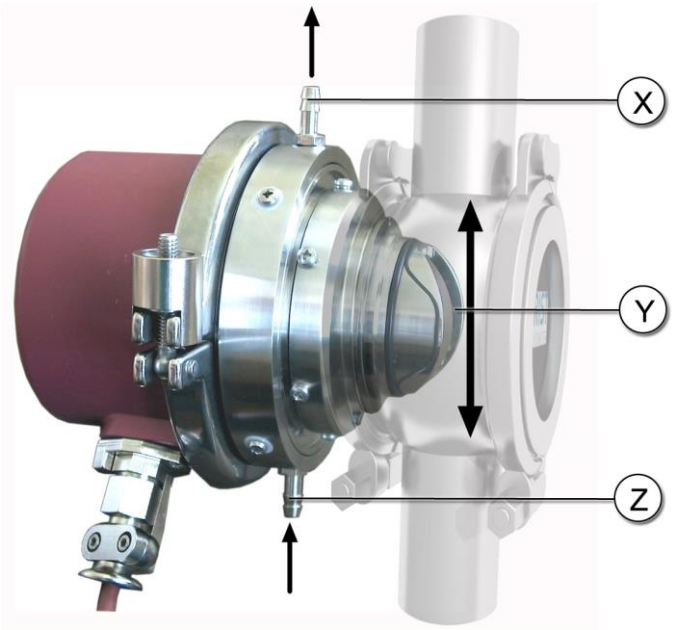


Figure 8: Groove in direction of flow.

Pos	Name
X	Cooling outlet (optional)
Y	Make sure the slot points in the direction of flow!
Z	Cooling inlet (optional)

Important information for photometer installation:

Scratches on the blanking glass can lead to incorrect measurements: Ensure that no scratches occur on the blackened outer face and uncolored inner face when installing and removing the blanking glass. Always handle the blanking glass with care.

The outer face of the blanking glass is blackened with a PVD chrome coating. The inner side of the blanking plate is sand blasted.

The photometer must be installed in the pipe at a point at least 2 m away from inspection windows or other sources of stray light.

3.1.2 Installation of the SIREL SMD Control unit

The SIREL SMD and any peripheral devices may not be installed or operated in explosive atmospheres.

The SIREL SMD can be mounted right on a wall, on a mounting grate, or on a stand.

Depending on the cable used (cross-section), the maximum distance between control unit and photometer is given in the following table:

Cable cross-section [mm^2]	Max. distance SIREL SMD [m]	Max. distance SITRA [m]	
0.14	42	35	
0.25	75	65	
0.34	103	90	
0.50	148	130	
0.75	**223**	**200**	**standard version**
1.00	289	260	
1.50	414	370	

Refer to Section 0 for a detailed dimension drawing of the SIREL SMD.

3.1.3 Installation of the SIREL Ex control unit

Please consult manufacturer documentation 11044DEF when installing the SIREL Ex.

A detailed dimension drawing of the SIREL Ex is in Section 0.

Refer to the table in Section 3.1.2 for distance dependency on cable cross-section.

3.2 Electrical connections

3.2.1 General information about connecting the SIREL SMD Ex

Any attempt to connect live conductors can result in fatal injury and can also damage parts of the installation. When carrying out electrical installation work, always observe the local codes.

In addition, observe the following rules:

- It is absolutely necessary to connect the protective earth conductor.
- Because the SIREL SMD/ Ex has no mains switch, a suitable disconnection device (switch, plug) must be provided close to the mains connection.
- If malfunctions cannot be eliminated, take the instrument out of service and take precautions against it being put back into service inadvertently.

3.2.2 Opening the SIREL SMD

All electrical connections are made with spring-loaded terminals inside the control unit. To open the control unit, unscrew the four screws underneath the side covers. → Figure 9

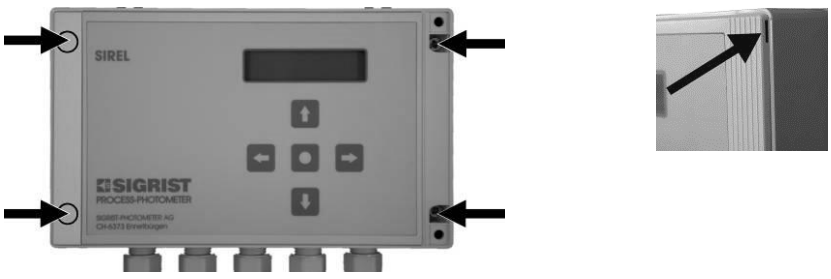


Figure 9: Opening the control unit.

3.2.3 Opening the SIREL Ex housing

You must interrupt the service voltage (explosion hazard) before opening the SIREL Ex housing.

	Action	Remarks
1.	Interrupt the service voltage to the SIREL Ex.	→ Section 3.2.4
2.	Place a square wrench on the square element (arrow) and unlock the cover by rotating a quarter turn to the left. Square wrench → Section 1.2	
3.	Pull down the cover to open.	

3.2.4 Establish SIREL SMD/ Ex electrical connections

For information about control signals, please refer to Section 2 in the Reference Handbook.

The terminals of the SIREL Ex are located in the lower part of the housing (Figure 10). The housing must be open in order to connect the electrical connections. → Section 3.2.3

The terminal assignment is identical for the SIREL SMD and SIREL Ex.
→ Figure 11

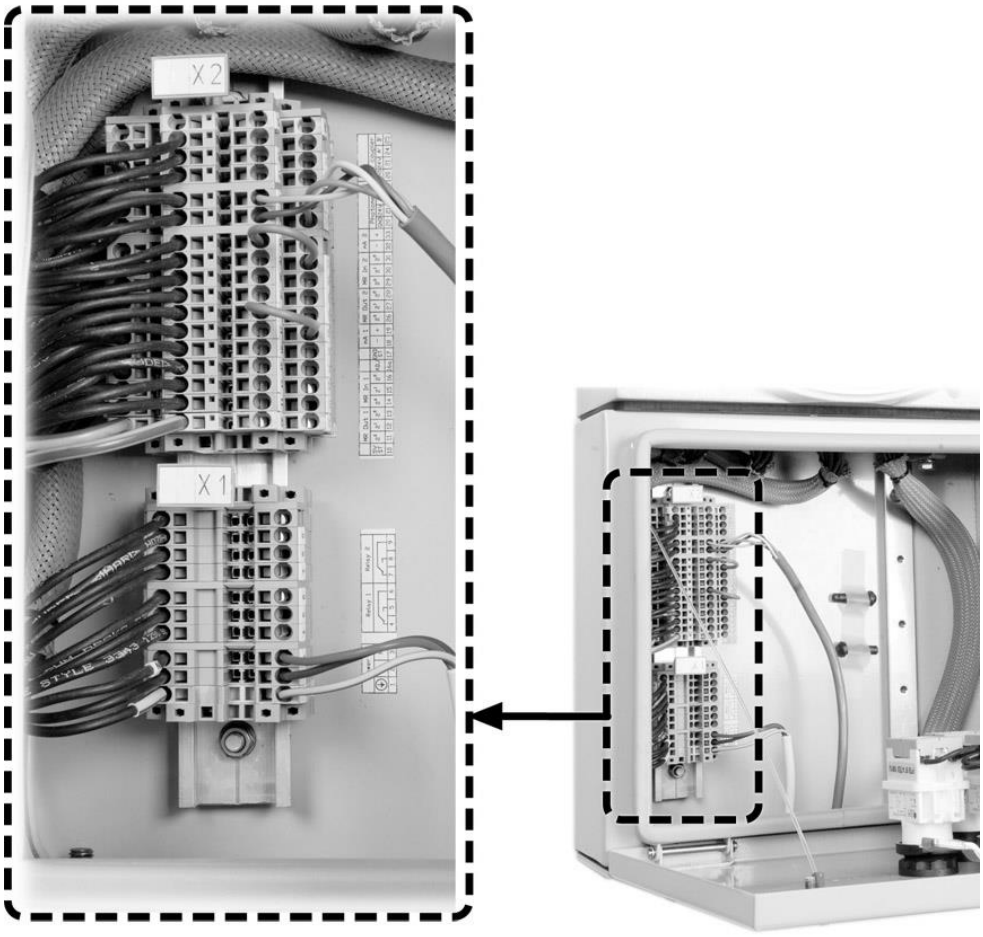


Figure 10: Position of SIREL Ex terminals

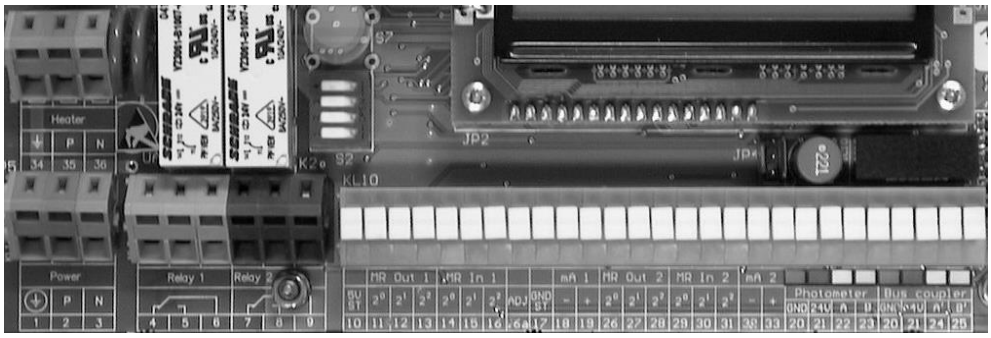


Figure 11: Terminal block for SIREL SMD 100..240 VAC.

Make up the electrical connections in the following order:

Connection

	Terminals	Used for	Remarks
1.	20 .. 23	Connection to photometer	**SIREL SMD**: Connect wires to the terminal block according to color coding. **SIREL Ex**: Connect wires according to numbering.
2.	4 - 5 - 6	Relay output 1	The relay outputs are freely configurable. → Reference Handbook
	7 - 8 - 9	Relay output 2	
	18 - 19	Reading output for 1st meas. angle (90° reading in the case of dual-angle instrument)	0/4 .. 20 mA, max. burden 600 Ω **If unused, these terminals must be shorted with a jumper!**
	32 - 33	Reading output for 2nd meas. angle (25° reading in the case of dual-angle instrument)	Provided on dual-angle instrument only. **If unused, these terminals must be shorted with a jumper!**
3.	10 .. 17	Control signals for 1st meas. angle	→ Reference Handbook
	26 .. 31	Control signals for 2nd meas. angle	Provided on dual-angle instrument only.
	16a	Control signal for sensor check	→ Reference Handbook
	24 - 25	Connection to bus coupler	→ Reference Handbook
4.	1 - 2 - 3	Mains voltage	100 .. 240 V, 47 .. 63 Hz or 18 .. 30 VDC, 25 W

3.3 Initial start-up

For the initial start-up, work through the following table. If you run into trouble, consult Section 6.


Initial start-up

	Action	Remarks
1.	Check to make sure the photometer and control unit are properly installed and connected.	→ Sections 3.1 and 3.2.
2.	Activate the power supply to the control unit.	After a few seconds, either one or two readings appear on the control unit display (depending on instrument version).
3.	Set the language spoken in your region. → Section 4.5	Now the menu texts will appear in the desired language.
4.	Run through a sensor check. → Section 6.3	If no fault message has appeared, the photometer is ready to start measuring.
5.	Set the measuring range required for your duty conditions. → Section 4.6	If automatic range switching is desired (standard), you can skip this step.
6.	Set the relay functions to suit your measuring duty. → Section 4.7	
7.	Protect your settings against unauthorized manipulation with an access code. → Section 4.9	If you don't need an access code, skip this step.

4 Operation

4.1 Operating elements and display SIREL SMD

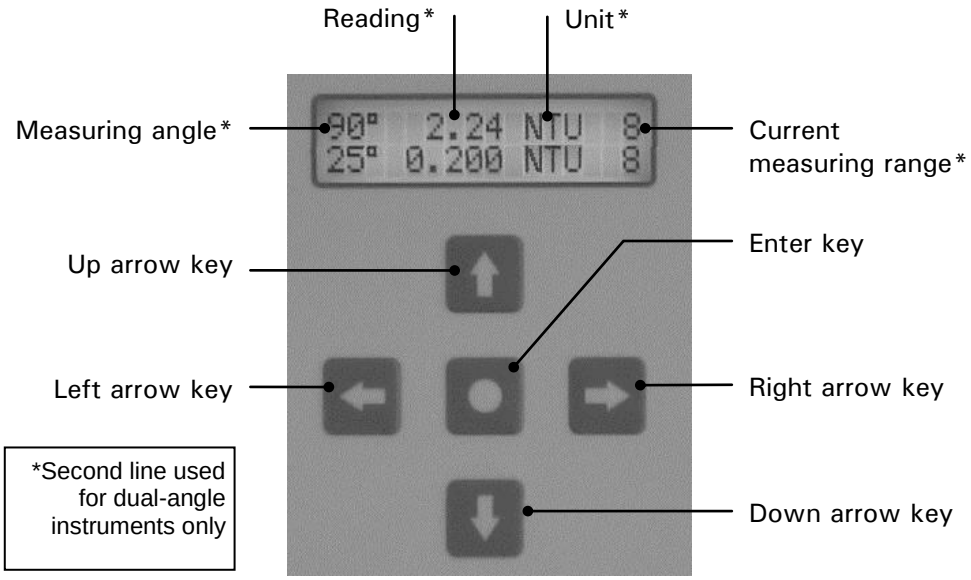


Figure 12: Operating elements and display.

Key functions

↑/↓	▪ Switch from one menu line to another ▪ Switch from numerical data to editing mode (see below)
←/→	• Switch between functions in a menu line ▪ Change the function values and/or change the decimal place of a numerical value in editing mode (see below)
← + →	▪ Press simultaneously to return to normal operation
○	▪ Activate the editing mode (display shows “>..<“) ▪ Enter the setting (confirmation)

4.2 Control components and display of the SIREL Ex

The operator prompting of the SIREL Ex is identical to that of the SIREL SMD. Only the integrated keyboard and the housing differentiate the SIREL Ex from the SIREL SMD.

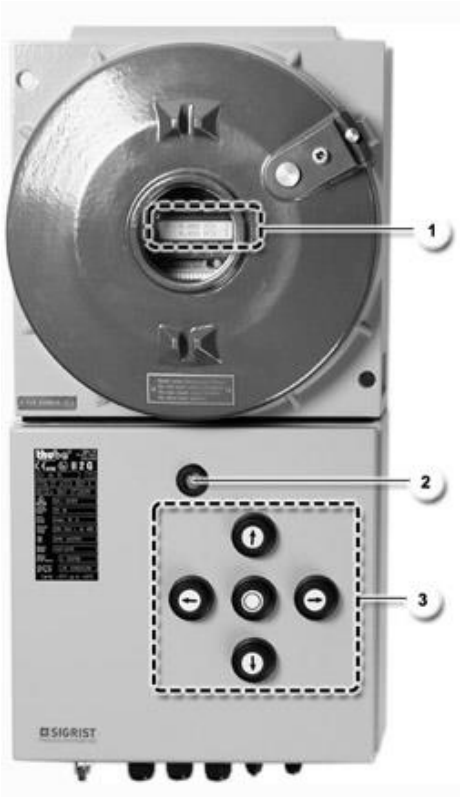


Figure 14: SIREL Ex

Pos.	Name
1	LC display
2	Square element for opening the cover
3	Integrated keyboard

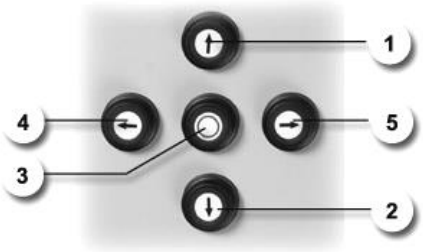


Figure 13: SIREL Ex control components

Key functions, SIREL Ex

Pos.	Symbols	Key functions
1, 2	↑/↓	▪ Switch from one menu line to another • Switch from numerical data to editing mode (see below)
4, 5	←/→	• Switch between functions in a menu line • Change the function values and/or change the decimal place of a numerical value in editing mode (see below)
4, 5	← + →	• Press simultaneously to return to normal operation
3	0	• Activate the editing mode (display shows “>..<”) • Enter the setting (confirmation)

4.3 Normal operation

Whenever the instrument is switched on, it is in normal operation. The current reading/measuring range are displayed continuously (or two readings in the case of a dual-angle instrument).
In addition, displays like these examples may appear:

The display...	means...	In this case, you should...
`90° ***** NTU 1`	...that the reading is outside the current measuring range (measuring range overrun).	- ...make sure the medium's turbidity does not exceed 2000 NTU. - ...ignore the display if your process happens to be in an abnormal phase.
`**** Fault ****` `...`	...that a malfunction has occurred.	- ...try to pinpoint the malfunction. → Section 6

Table 2: Display examples and what they mean.

To display the extremes of the measuring range currently set, press one of the keys ⇦ or ⇨. No other action need be taken at the control unit for normal operation.

4.4 Service mode

The photometer is configured in the service mode. Normal measuring operation is interrupted and a guidance menu appears on the display.

Activate service mode

	Action	Display (Example)	Remarks
1.	⇩	`Access code` `> 00000 <`	If no personal access code has been set, go on to step 3.
2.	Enter code: ⇧/⇩ change number ⇦/⇨ change place	`Access code` `> ..... <`	Here enter your own access code.
3.	ⓞ	`* SENSOR *` `* CHECK *`	Instrument in service mode.

By pressing keys ⇦ and ⇨ simultaneously, you can return from the menu level to the normal measuring mode at any time.

Relays in the service mode:

Relay function	State	Remarks
AL (alarm)	passive	no alarm
LI (limit)	deactivated	no limit exceeded
SE (service)	set	instrument in service mode
CH (check)	deactivated	activated only when sensor check is initiated manually

Depending on the configuration, the reading output either goes to 0/4 mA or remains frozen at the last value measured. → Reference Handbook

4.5 Setting the national language

Set your national language for the menus and messages this way:


Language

	Action	Display (Example)	Remarks
1.	↓	Zugriffscode > ▒00000 <	If no individual access code was set, proceed to step 3.
2.	Enter code: ↑/↓ change number ←/→ change place	Zugriffscode > ..... <	Enter your own access code here.
3.	○	* SENSOR * * CHECK *	Instrument in service mode.
4.	4 x ↓	* KONFIGURIEREN*	
5.	→	> Sprache < Deutsch	
6.	○	Sprache > Deutsch <	Activate editing mode.
7.	Select language: ←/→	Sprache > ... <	
8.	○	> Language < ...	Confirm selection.
9.	← + → (simultaneous)	90° 2.23 NTU 5	Instrument in normal operation.

4.6 Setting the measuring range

On the dual-angle instrument, the measuring ranges for the 90° and 25° measurements can be set separately. If "Automatic" is set, the photometer switches automatically to the optimum measuring range for the momentary measurement.


Measuring range

	Action	Display (Example)	Remarks
1.	↓	Access code > 00000 <	If no individual access code was set, proceed to step 3.
2.	Enter code: ↑/↓ change number ←/→ change place	Access code > ..... <	Enter your own access code here.
3.	o	* SENSOR * * CHECK *	Instrument in service mode.
4.	2 x ↓	* MEAS.RANGE * * LIMITS *	
5.	Select meas. angle: ← (1st meas. angle) ← (2nd meas. angle)	> Meas.range xx< Automatic	
6.	o	Meas.range xx > Automatic <	Activate editing mode.
7.	Select meas. range: ←/→	Meas.range xx > ... <	→ Table 3 below.
8.	o	> Meas.range xx< ...	Confirm selection.
9.	← + → (simultaneous)	90° 2.23 NTU 5	Instrument in normal operation.

Meas. range No.	Meas. span (standard)	Meas. span (user-specific)
1	0 .. 2000 NTU	
2	0 .. 500 NTU	
3	0 .. 100 NTU	
4	0 .. 50 NTU	
5	0 .. 20 NTU	
6	0 .. 10 NTU	
7	0 .. 5 NTU	
8	0 .. 2 NTU	
MR inputs	Remote range switching → Reference Handbook	
Automatic	0 .. 2000 NTU	

Table 3: Measuring ranges

If you need different measuring ranges, have a SIGRIST service technician adapt these and enter new ranges in "user-specific" column.

4.7 Setting the relay functions

The control unit has two relay outputs (→ Section 3.2), the functions of which are freely configurable. Several functions can be assigned to a given relay simultaneously. The relay in question is activated whenever ***one*** of the configured functions becomes active (OR link).


Relay functions

	Action	Display (Example)	Remarks
1.	↓	Access code > 00000 <	If no individual access code was set, proceed to step 3.
2.	Enter code: ↑/↓ change number ←/→ change place	Access code > ····· <	Enter your own access code here.
3.	○	* SENSOR * * CHECK *	Instrument in service mode.
4.	4 x ↓	* CONFIGURATION*	
5.	8 x →	> Relay 1 < li al se ch in	Configure relay 1.
6.	○	Relay 1 >li al se ch in<	Activate editing mode.

	Action	Display (Example)	Remarks
7.	Assign functions: ↑/↓ function on/off ←/→ change function	Relay 1 >LI al se ch in<	li* limit **1** exceeded al alarm (fault occurred) se instrument in service mode ch sensor check running in relay inverted * Functions written in CAPITALS are activated (e.g. LI).
8.	o	> Relay 1 < LI al se ch in	Confirm selection.
9.	→	> Relay 2 < li AL se ch in	Configure relay 2.
10.	o	Relay 2 >li AL se ch in<	Activate editing mode.
11.	Assign functions: ↑/↓ function on/off ←/→ change function	Relay 2 >LI AL se ch in<	li* limit **2** exceeded al alarm (fault occurred) se instrument in service mode ch sensor check running in relay inverted * Functions written in CAPITALS are activated (e.g. LI).
12.	o	> Relay 2 < li AL se ch in	Confirm selection.
13.	← + → (simultaneous)	90° 2.23 NTU 5	Instrument in normal operation.

* If you have configured one or two relays as limits, you still have to set the thresholds. → Section 4.8

4.8 Setting the limits

Note: In order to use the limits, it is necessary to configure the relay outputs accordingly. → Section 4.7

Up to two limits, with upper and lower thresholds, can be programmed. → Figure 15
If the reading reaches the *upper threshold*, the limit is activated; it remains activated until the reading falls back below the *lower threshold*.
On the dual-angle instrument, it is also possible to make a setting for each limit indicating whether it should react to the 90° or the 25° reading.

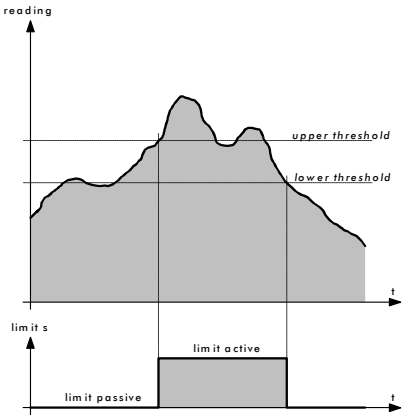


Figure 15: Upper and lower thresholds of a limit.

One or two limits are available only if the relays are programmed accordingly. → Section 4.7

Limits

	Action	Display (Example)	Remarks
1.	↓	Access code > 00000 <	If no individual access code was set, proceed to step 3.
2.	Enter code: ↑/↓ change number ←/→ change place	Access code > ····· <	Enter your own access code here.
3.	○	* SENSOR * * CHECK *	Instrument in service mode.
4.	2 x ↓	* MEAS.RANGE * * LIMITS *	For single-angle instrument, proceed to step 9.
5.	→	> LI1 source < Meas.value90	LI1 = 1st limit LI2 = 2nd limit
6.	○	LI1 source > Meas.value90 <	Activate editing mode.
7.	Select source: ←/→	LI1 source > ··· <	Enter which reading the limit should react to.
8.	○	> LI1 source < ···	Confirm selection.
9.	→	> Upper limit1 < 2.000 NTU	
10.	○	Upper limit1 > 2.000 NTU <	Activate editing mode.

	Action	Display (Example)	Remarks
11.	Set upper threshold: ↑/↓ change number ←/→ change place	Upper limit1 > ··· <	Now set the value at which the limit should switch on.
12.	o	> Upper limit1 < ···	Confirm entry.
13.	→	> Lower limit1 < 0.900 NTU	
14.	o	Lower limit1 > 0.900 NTU <	Activate editing mode.
15.	Set lower threshold: ↑/↓ change number ←/→ change place	Lower limit1 > ··· <	Now set the value at which the limit should switch off.
16.	o	> Lower limit1 < ···	Confirm entry.
17.	→	> LI2 source < Meas.value25	Same procedure for 2nd limit → steps 6 to 16.
18.	← + → (simultaneous)	90° 2.23 NTU 5	Instrument in normal operation.

4.9 Setting the access code

You can set your own access code to protect your DualScat Ex settings against unauthorized manipulation.


Access code

	Action	Display (Example)	Remarks
1.	↓	Access code > ▒00000 <	If no individual access code was set, proceed to step 3.
2.	Enter code: ↑/↓ change number ←/→ change place	Access code > ····· <	Enter your own access code here.
3.	o	* SENSOR * * CHECK *	Instrument in service mode.
4.	4 x ↓	* CONFIGURATION*	
5.	3 x ←	> Access code < 000000	
6.	o	Access code > 000000 <	Activate editing mode.
7.	Enter new code: ↑/↓ change number ←/→ change place	Access code > ····· <	Enter new code below to make sure you don't forget it!

	Action	Display (Example)	Remarks
8.	⊙	> Access code < ...	Confirm selection.
9.	↩ + ↪ (simultaneous)	90° 2.23 NTU 5	Instrument in normal operation.

New access code: | | | | | | |

A forgotten access code can be deleted only by a SIGRIST service technician!

4.10 Additional possibilities

This documentation describes only those options that are required for initial start-up and normal operation of the instrument.
Many other parameters are available to enable you to adapt the DualScat Ex perfectly to your specific duty requirements. Just to mention a couple: You can alter the behavior of the reading outputs, or you can test the instrument in the manual mode.

Consult the Reference Handbook supplied with your instrument to learn about all the things you can do with your SIGRIST DualScat Ex photometer.

5 Servicing

5.1 Service schedule

Recommended servicing work:

When	Who	What	Purpose
Once a year or as needed	User	Check the dry chamber → Section 5.2	Absolutely essential for maintaining detection accuracy and protecting the electronics.
Once a year or as needed	User	Replace desiccant in sensor head → Section 5.3	Absolutely essential for maintaining detection accuracy.
Once a year or as needed	User	Clean the sensor head → Section 5.4	Absolutely essential for maintaining detection accuracy. Interval depends on medium.
Once a year or as needed	User	Replace O-ring 60 x 3 from sensor head and blanking glass or plate → Section 5.5	Absolutely essential for sustaining proper operation.
Once a year or as needed	User	Recalibrate the photometer → Section 5.6	Advisable for maintaining detection accuracy. Interval depends on medium.
Every 2 years	Service organization	Replace seals	Absolutely essential for sustaining proper operation.
Every 5 years or as needed	Service organization	Replace the flow cell windows	Advisable for maintaining detection accuracy. Interval depends on medium and duty conditions.

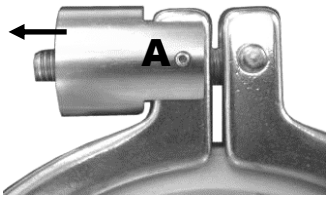
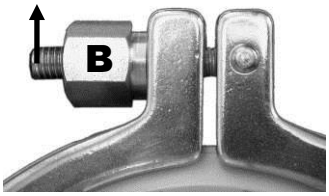
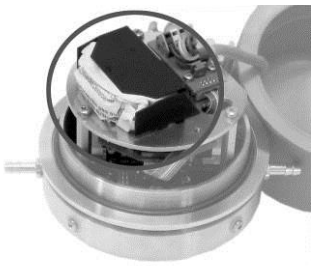
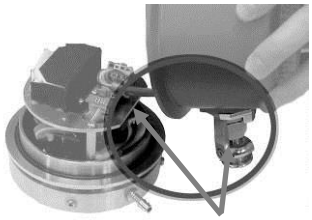
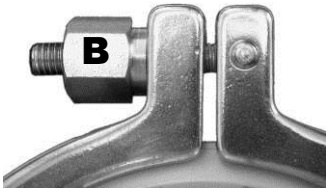
Table 4: Service schedule.

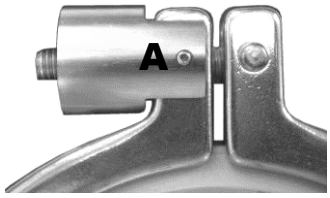
5.2 Replacement of desiccant in the Ex enclosure

Never open the photometer when cold product is flowing through the pipes. Try to do this work during a sterilization phase or when the product is at least at room temperature.

The dry chamber contains a desiccant to protect the optics/electronics against moisture. The desiccant must be replaced whenever a message to this effect appears on the display. → Section 6.2

Replace desiccant

	Action	
1.	Disconnect the power supply to the control unit.	
2.	⚠ **Wait 10 minutes before continuing.**	Allows instrument to cool to a safe temperature level and residual charges to dissipate.
3.	Unscrew socket head screw A by about ½ turn and remove the locking ring.	
4.	Unscrew nut B far enough to be able to swing the locking strap easily. Now remove the closure clamp and then the enclosure.	
5.	Remove the desiccant and dispose of it as directed in the disposal table in Section 9.	
6.	Remove the new desiccant from it protective pouch and insert it as shown in the adjacent illustration (Spares → Section 10). ⚠ **Press the desiccant all the way into the holder, so that it cannot come into contact with the enclosure.**	
	⚠ **Reclose the enclosure immediately to prevent the desiccant from absorbing ambient moisture.** ⚠ **The cable gland must match the flat side of the mounting plate.**	
7.	Put on the closure clamp, swing the locking strap back in place, and retighten the nut B.	

	Action	
8.	Replace the locking ring and retighten socket head screw A.	
9.	Restore the power supply to the control unit and restart the instrument in normal operation.	

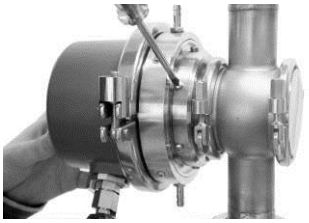
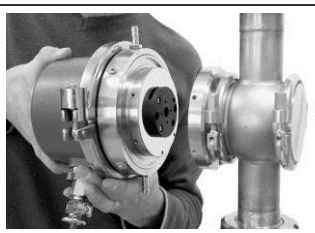
If you find you have to replace the desiccant frequently, have a SIGRIST service technician check whether the Ex enclosure is still tight.

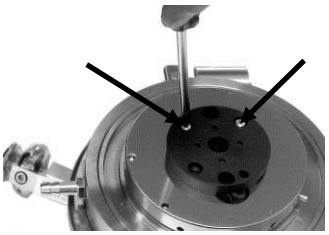
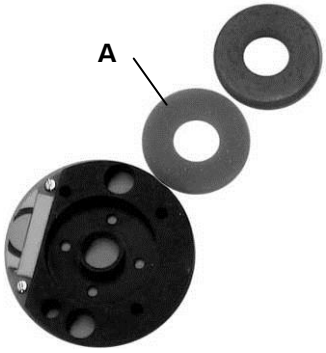
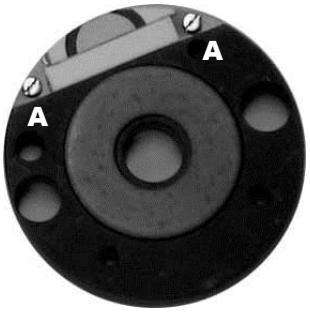
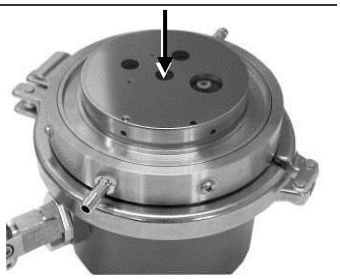
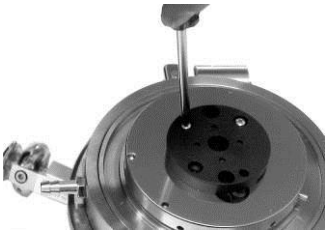
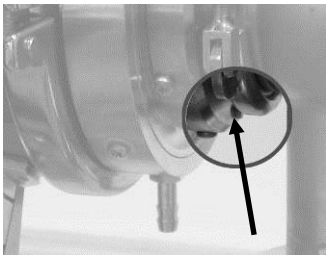
5.3 Replacement of desiccant in the sensor head

Never open the photometer when cold product is flowing through the pipes. Try to do this work during a sterilization phase or when the product is at least at room temperature.

The desiccant in the sensor head can be replaced during normal operation.

Replace desiccant in the sensor head

	Action	
1.	Disconnect the power supply to the control unit.	
2.	⚠ **Wait 10 minutes before continuing.**	Allows instrument to cool to a safe temperature level and residual charges to dissipate.
3.	Remove the six screws around the periphery of the sensor head.	
4.	Withdraw the back part of the instrument out of the sensor head.	

	Action	
5.	Remove the two screws from the desiccant holder.	
6.	Replace the desiccant disk. ⚠ **Be sure to insert dust protector (A) first!**	
7.	Remove the moisture indicator by unscrewing the two screws (A), then install the new indicator.	
8.	Clean the optics with a cotton rag (entire surface, see arrow).	
9.	Reattach the desiccant holder using the two screws (i.e. step 5 in reverse) and reassemble the unit with the sensor head.	
10.	Loosen hex-head screw on the sensor head to allow excess air to escape.	

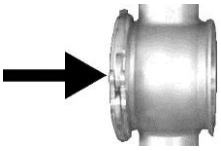
	Action	
11.	Slide the back part of the instrument in place and retighten the six screws.	
12.	⚠ **Be sure to retighten the hex-head screw (step 10)!**	

If you find you have to replace the desiccant frequently, have a SIGRIST service technician check whether the Ex enclosure is still tight.

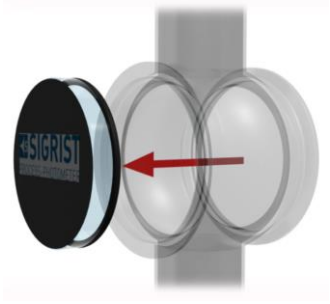
5.4 Cleaning the sensor head

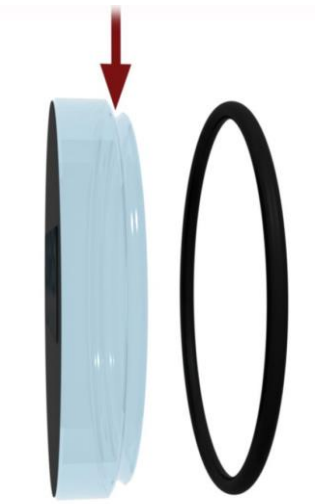
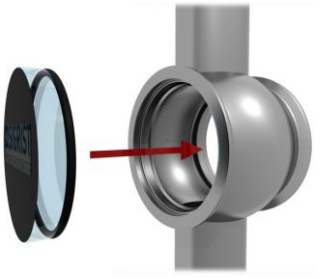
Any fouling of the sensor head will be largely compensated by DualScat Ex. But after a certain amount of duty time – depending on the service conditions and the medium – the extent of fouling may become too great to be compensated.

Clean sensor head

	Action	
1.	Make sure the product pipe is empty.	
2.	Disconnect the power supply to the control unit.	
3.	Remove the photometer from the product pipe.	
4.	Clean the sensor head including the glass (arrow) with an acidic, nonabrasive cleaning agent and a soft, lint-free rag. **Do not use any other cleaning methods or cleaning agents!**	
5.	Remove the blanking glass or blanking plate opposite the photometer from the in-line housing (arrow) and clean its inner surface the same way.	
6.	Mount the blanking glass or blanking plate and the photometer on the pipe and restart the instrument.	

5.5 Replacing the O-ring 60 x 3 on the sensor head or replacing the blanking glass / blanking plate

	Action	
1.	Make sure the product pipe is empty.	
2.	Disconnect the power supply to the SIREL control unit. ⚠ **Make sure the product pipe remains empty during the entire procedure!**	
3.	Remove the photometer from the product pipe.	
4.	Remove the O-ring and replace it with a new, clean O-ring.	
5.	Remove the closure clamp (X) on the side of the blanking glass or plate, then remove the lock ring (Y). ⚠ **Scratches on the blanking glass can lead to incorrect measurements:** Ensure that no scratches occur on the blackened outer face and uncoloured inner face when installing and removing the blanking glass. Always handle the blanking glass with care.	
6.	Press the blanking glass or plate out of the Varivent housing (from the photometer side).	

	Action	
7.	If only the O-ring on the blanking glass or plate needs to be replaced, then proceed as follows: 1. Remove the old O-ring from the blanking glass or plate. 2. Clean the groove (see arrow) on the blanking glass or plate with a cotton bud and ethanol, when necessary. 3. Insert the new O-ring into the groove.	
8.	Insert the blanking glass or plate with O-ring into the opening on the Varivent housing.	
9.	Place the lock ring on the blanking glass or plate and fasten it with the closure clamp.	
10.	Reattach the photometer in the product pipe.	
11.	Restore the power supply to the SIREL control unit.	

5.6 Recalibrating the photometer

Recalibration of the photometer can cause the readings to differ from the previous ones, because the instrument is readjusted to a fixed reference standard.

Recalibration can be carried out in either of two ways:

- Recalibrate using a checking unit supplied by SIGRIST with a built-in solid reference. This is the method we recommend. → Section 5.6.1
- Recalibrate with formazine. To do so, you must be able to prepare or procure an 8 NTU standard suspension of sufficient accuracy (better than ±2%). → Section 5.6.2

5.6.1 Preparations for recalibration with the checking unit

Make sure to use the proper SIGRIST checking unit: the serial number printed on the calibration unit must match with the instrument serial number!

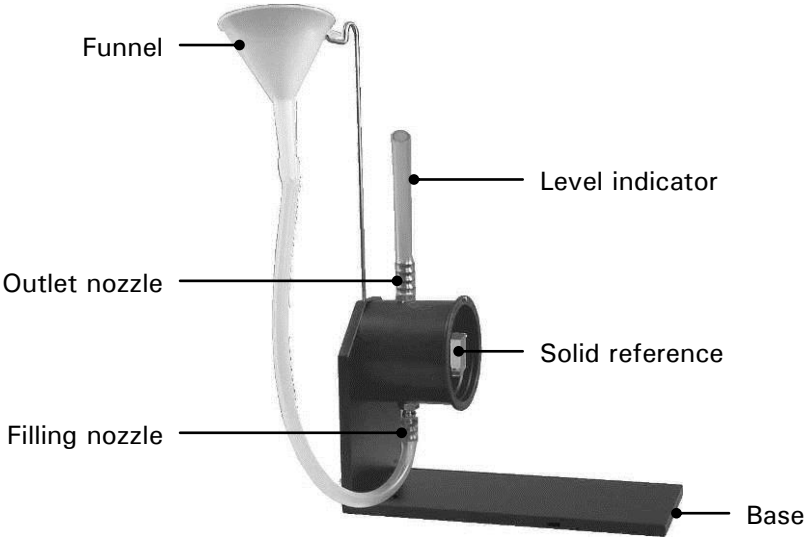
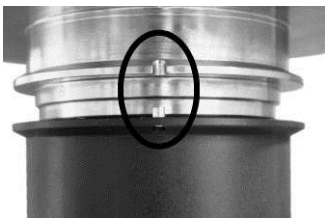
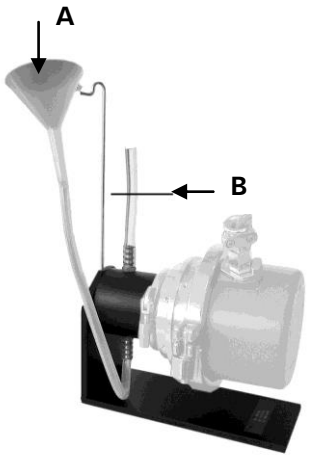
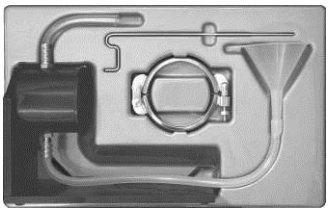


Figure 16: SIGRIST checking unit.

Preparations for checking unit

	Action	
1.	Make sure the product pipe is empty, disconnect the power supply to the control unit, and remove the photometer from the pipe.	
2.	Clean the sensor head as directed in Section 5.4.	
3.	Remove the calibration unit **supplied with the instrument** from its box. Clean the calibration unit, inside and out, with a soft, lint-free rag.	Make sure the serial number printed on the calibration unit matches with the instrument serial number.
4.	Set the checking unit vertically on a flat surface. Align the photometer so that the groove on the sensor head mates with the guide pin on the checking unit. **Be very careful not to insert the photometer into the checking unit turned incorrectly or to rotate it during insertion, because this would damage the solid reference!**	

	Action	
5.	Insert the photometer into the checking unit and clamp it firmly in place.	
6.	Turn the entire assembly to the horizontal position and place the filling funnel on top (→ Figure 16).	
7.	Switch on the power supply to the control unit and let the instrument warm up for at least 3 minutes.	
8.	Fill in distilled water carefully through the funnel (A) until the level indicator is about half full of water (B). **Make sure no bubbles are created when the water flows into the checking unit, so that no troublesome bubbles occur inside it.**	
9.	Carry out the recalibration on the control unit as directed in Section 5.6.3.	The nominal value(s) are printed on the checking unit.
10.	Drain the checking unit, remove the photometer and replace it in your product pipe. → Section 3.1	
11.	Restart the instrument in normal operation.	
12.	Clean and dry the checking unit, inside and out, with a soft, lint-free rag. If severely fouled, use an acidic, nonabrasive cleaning agent. **Do not use any other cleaning methods or cleaning agents!**	

	Action	
13.	Stow the checking unit in the case supplied for this purpose. **To make sure the checking unit remains in perfect condition, always keep it protected against dirt, moisture, frost and temperatures above +80°C.**	

5.6.2 Preparations for recalibrating with formazine

To recalibrate the photometer with formazine, a suitable test setup is required. You can use an empty standard in-line housing (→ Figure 17), the lower opening of which is closed off with an end plate, or the SIGRIST checking unit with removed solid reference (two screws must be removed in this case).
→ Figure 16

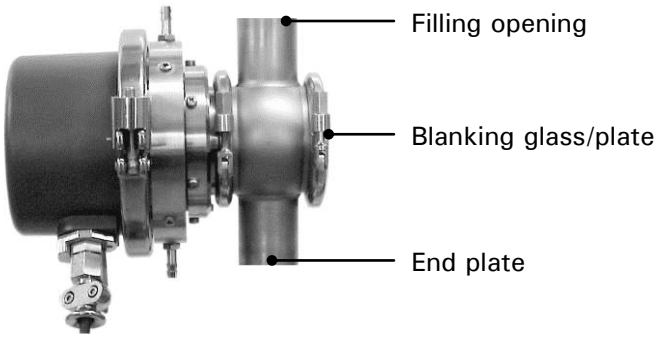


Figure 17: Test setup for formazine recalibration.

Preparations for formazine recalibration

	Action	
1.	From a formazine stock solution, prepare a dilution of 6 .. 8 NTU (calibration suspension). You will find a recipe for producing the formazine stock solution in the Reference Handbook. **The more accurately you know the value of the calibration suspension, the more precisely you will be able to recalibrate the instrument.**	
2.	Make sure the product pipe is empty, disconnect the power supply to the control unit, and remove the photometer from the pipe.	
3.	Clean the sensor head as directed in Section 5.4.	
4.	Insert the photometer into your test setup and clamp it firmly in place. Make sure it is correctly aligned. → Figure 8	

	Action	
5.	Reconnect the power supply to the control unit and let the instrument warm up for at least 3 minutes.	
6.	Flush out the test setup two or three times with the calibration suspension.	
7.	Fill calibration suspension carefully into the test setup until it is completely full. **Be careful not to allow any bubbles to form during filling, because air bubbles inside the test setup could cause trouble.**	
8.	Make sure the measuring chamber is protected against outside light.	
9.	Carry out the recalibration on the control unit as directed in Section 5.6.3.	
10.	Drain the test setup, remove the photometer and replace it in your product pipe. → Section 3.1	
11.	Restart the instrument in normal operation.	

5.6.3 Recalibration procedure

The recalibration itself is carried out on the control unit.


Recalibration

	Action	Display (Example)	Remarks
1.	↓	Access code > 00000 <	If no individual access code was set, proceed to step 3.
2.	Enter code: ↑/↓ change number ←/→ change place	Access code > ····· <	Enter your own access code here.
3.	○	* SENSOR * * CHECK *	Instrument in service mode.
4.	↓	* RECALIBRATION*	
5.	→	> Val.Adjust 90< 0.00 NTU	On single-angle instrument: depending on meas. angle 90° or 25°.
6.	○	Val.Adjust 90 > 0.00 NTU <	Activate editing mode.
7.	Enter nominal value: ↑/↓ Wert ändern ←/→ Stelle wechseln	Val.Adjust 90 > .00 NTU <	Now enter the nominal value of the checking unit for the relevant measuring angle or the precise value of the calibration suspension in the NTU unit.

	Action	Display (Example)	Remarks
8.	⊙	> Val.Adjust 90< 34.5 NTU	For single-angle instrument, proceed to Point 12.
9.	→	> Val.Adjust 25< 0.00 NTU	
10.	Enter nominal value: ↑/↓ change number ←/→ change place	Val.Adjust 25 > ▓.00 NTU <	Now enter the nominal value of the checking unit for the relevant measuring angle or the precise value of the calibration suspension in the NTU unit.
11.	⊙	> Val.Adjust 25< 3.50 NTU	
12.	→	-Meas90 -Meas25 34.5 3.50	Display of the detected values without corrections. If they are in line with the previously entered nominal values, no recalibration is necessary; proceed to Point 18.
13.	→	> Adju. < Retain	
14.	⊙	Adju. > Retain <	
15.	→	Adju. > Adapt <	
16.	⊙	Adju. running ...	Compute the calibration factors.
17.	Wait until the DualScat Ex has computed the calibration factors and the display changes	-Meas90 -Meas25 34.5 3.50	Display of the "rough" reference values without detected value corrections. If "outside tolerance" appears on the display, the nominal values and detected values differ too widely. If this happens, check whether the entered nominal values agree with the values of the calibration suspension or the checking unit.
18.	← + → (simultaneous)	90° 34.5 NTU 1 25° 3.50 NTU 1	Instrument in normal operation.

The entered nominal values are stored internally and remain un-changed until the next recalibration.

6 Troubleshooting

6.1 Pinpointing causes of trouble

Work through the following table step by step to narrow down the possible causes of a malfunction. If the listed corrective steps fail to produce the desired results, please consult Customer Service. → Section 6.4

Perceived malfunction	Corrective steps
No display	- Make sure the supply voltage is actually applied to the control unit. → Section 3.2 - Check fuses in the control unit. → Reference Handbook
Fault message displayed	- Analyze the fault message. → Section 6.2
Reading is very suspect	- Check whether the medium in the product pipe still meets the normal duty conditions. → Section 1.5 - Carry out a sensor check. → Section 6.3 - Check whether the photometer is properly installed. → Section 3.1 - Check whether the service work has been carried out according to the Service Schedule. → Section 5.1 - Check the dry chamber in the Ex enclosure. → Section 5.2 - Check the dry chamber in the sensor head. → Section 5.3 - Clean the sensor head. → Section 5.4 - Calibrate the photometer. → Section 5.6
No measured value output signal (0 mA)	- This status signals that a fault has occurred in the photometer. - Analyze the fault displayed fault message. → Section 6.2

6.2 Fault messages

If a malfunction occurs during operation, the display shows `**** Fault ****` with a fault message that can help pinpoint the cause of the trouble.

Message	Means	Possible causes
`Connection lost ...`	The connection between the control unit and the photometer is lost.	- Open connection to photometer - Defective electronics → Service technician
`Sealing`	The moisture monitor in the DualScat Ex has responded.	- Desiccant in sensor head is moist → Section 5.3 - Desiccant in Ex enclosure is moist → Section 5.2 - Moisture indicator defective → Service technician - The seals in the sensor head are defective → Service technician **➔ Remove the photometer from the product pipe immediately to prevent flooding of the sensor head!**
`Light source`	The detectors are not receiving any light.	- Turbidity excessively high (> 2000 NTU) in the product pipe - Severely fouled sensor head → Section 5.4 - Defective light source → Service technician
`Measurement`	The detectors are receiving too much light.	- Photometer not installed in the product pipe - The cover on the mounting flange opposite the photometer is not in place → Section 3.1 - Air bubbles/foam in the product pipe - External light near the detection point (e.g. inspection window) - DualScat Ex electronics defective → Service technician
`SensorCheck`	The automatic system check has failed.	- Too much external light near the detection point (e.g. inspection window) - Defective optics/electronics → Service technician

Message	Means	Possible causes
`Current (1/2)`	The reading output (1 or 2 in the case of the dual-angle instrument) is malfunctioning.	- Open connection terminals at the reading output → Section 3.2 - Open current loop of the reading output
`Systemfault`	An internal system fault has occurred.	- The parameter memory has lost its data → Service technician - The fault history is overfilled → Service technician
`Temperature`	Excessive temperature in the Ex enclosure.	- Cooling system defective or lacking - Medium temperature too high

6.3 Carrying out a sensor check

The sensor check is an internal photometer plausibility check that, with the factory setting, is carried out automatically once a day. The checking interval can be changed without restriction or switched off entirely. Irrespective of this automatic mode, the sensor check can be initiated at any time either manually or by means of external control signals. → Reference Handbook


Sensor check

	Action	Display (Example)	Remarks
1.	↓	`  Access code` `> 00000 <`	If no individual access code was set, proceed to step 3.
2.	Enter code: ↑/↓ change number ←/→ change place	`  Access code` `> ..... <`	Enter your own access code here.
3.	o	`* SENSOR *` `* CHECK *`	Instrument in service mode.
4.	→	`> Start check <` `  No`	
5.	o	`  Start check` `> No <`	Activate editing mode.
6.	→	`  Start check` `> Yes <`	
7.	o	`Check` `running ...`	
8.	Wait max. 45 s	`REF 90: 25:` `100 100 100`	Instrument runs down successively to 010.

	Action	Display (Example)	Remarks
9.	Read message	SensorCheck No fault	Instrument o.k.
		**** Fault ****	→ Section 6.2
10.	↵ + ↵ (simultaneous)	90° 2.23 NTU 5	Instrument in normal operation.

6.4 Customer service information

Whenever you have questions about SIGRIST products, please start by studying the documentation you received along with your product. Don't forget to check the documentation's Errata as well; it contains information that became available after the publication went to press.
If you don't find the answer, please contact the responsible service organization in your country or region. In case you don't know how to contact it, Customer Service of SIGRIST-PHOTOMETER AG in Switzerland will be happy to give you address.
You will also find a current list of all SIGRIST country representatives on the Internet at www.photometer.com.

Whenever you contact a SIGRIST service organization or Customer Service in Switzerland, please be sure to have the following information at hand:

- The serial number of the control unit. → Section 1.4
- A description of the instrument's behavior and the worksteps being carried out as the problem arose.
- A description of the procedure you followed trying to solve the problem yourself.
- Documentation on equipment of other makes that you use in conjunction with the photometer or its peripherals.

Additional information

If you're having problems with the instrument's readings, please have the following additional information at hand, which you can obtain from the "INFORMATION" section of the menu structure:

Item	Option	Value
Serial No. of the control unit	→ Section 1.4	
Serial No. of the photometer	Instr. No.	

Item	Option	Value
Fault messages	F01	
	F02	
	F03	
	F04	
	F05	
	F06	
	F07	
	F08	
	F09	
	F10	
System faults	S01	
	S02	
	S03	
	S04	
	S05	
Recalibration	Recal.1	
	Recal.2	
	Recal.3	
	Recal.4	
	Recal.5	
	Recal.6	
LED temperature	LED temp	
Max. temperature in the Ex enclosure	Max temp	
Calibration factors	Moni/meas 90	
	Moni/meas 25	
Moisture level	Moisture level	
Adjustment values	Val.Adjust 90	
	Val.Adjust 25	

7 Taking Out of Service/Storage

The objective of this procedure is proper preparation of the photometer for storage and retention of its normal condition during the storage period.

You must interrupt the service voltage (explosion hazard) before opening the SIREL Ex housing.

Taking out of service

	Action
1.	Disconnect the power supply to the control unit and remove all electrical connections from the control unit.
2.	Shut off the flow in the product pipe and drain it.
3.	Remove the photometer from the product pipe and clean the sensor head. → Section 5.4
4.	⚠ Thoroughly clean all surfaces that have come into contact with the medium. Now no toxic, corrosive or loose deposits should remain inside.
5.	Check the photometer's dry chamber and if necessary replace the desiccant. → Section 5.2
6.	Demount the control unit.
7.	Make sure all covers and hoods for the photometer and control unit, and all closures on them, are properly locked.

No particular conditions are required for storage of the equipment, but do observe the following points:

- Because the photometer and control unit contain electronic components, the conditions should meet the normal requirements for such components. In particular, the storage temperature should be within the -20 .. +50°C range.
- All components that have come into contact with the medium during operation must be dry and clean for protracted storage or shipment.
- The photometer, control unit and accessories must be protected against weathering, condensing moisture and aggressive gases while in storage.

8 Packing/Transport

Wherever possible, use the original packing materials for packing the photometer and its peripheral components. If these materials are no longer available, observe the following points:

- Prior to packing, close off the control unit's openings with self-adhesive tape or plugs to prevent any packing material from getting into the unit.
- The photometer contains optical and electronic components. Pack the instrument in such a way that it will be protected against impact during transport.
- Pack all peripherals and accessories separately and mark each one with the equipment number (→ Section 1.4). This will prevent mix-ups later on and facilitate identification of the components.

If the photometer and control unit are packed this way, they can be dispatched with any of the usual means of transport and in any position.

9 Disposal

This product falls in Category 9 "Monitoring and Control Instruments" of European Directive **RL 2002/95/EC (RoHS)**.

Disposal of the photometer and its peripheral devices must be carried out in accordance with the regional legal provisions!

The photometer and control unit do not possess any sources of radiation that might pollute the environment. Dispose of or recycle their materials according to the following table:

Category	Materials	Disposal possibilities
Packing	Cardboard, wood, paper	Reuse as packing material, local disposal points, incinerator
	Plastic sheet, polystyrene shells	Reuse as packing material, recycling
Electronics	Printed circuit boards, electromechanical components	Disposal as electronic scrap
Optics	Glass, aluminum, brass	Recycling via scrap glass and scrap metal collection points
Enclosure	Stainless steel	Scrap metal collection points
	Cast aluminum	Scrap metal collection points
Desiccant	Rubingel	Disposal as tailings (GRAS)

Table 5: Materials and their disposal.

10 Spares

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

Art. No.	Article designation	Remarks
111391	Desiccant bag, 30g	tightly packed, 2 years shelf life
113162	Desiccant set sensor head DualScat Ex	tightly packed, 2 years shelf life
116268	Control unit SIREL SMD 100..240 VAC	observe service voltage
116547	Control unit SIREL SMD 24VDC	
119083	Control unit SIREL SMD EX 100..240 VAC	Ex-version 24VDC is available too, observe service voltage
108157	Cover with membrane keypad for SIREL	
118771	Housing key (square drive) for SIREL Ex	only for SIREL Ex
119125	Blanking glass, coated with PVD chrome, with EPDM O-Ring	→ Section 5.5
118786	Blanking plate, sand blasted with EPDM O-Ring	→ Section 5.5
108247	O-Ring EPDM 60x3, 75 Shore A	→ Section 5.5
112379	O-Ring NBR 60x3, 70 Shore A	→ Section 5.5
112698	O-Ring FPM 60x3, 75 Shore A	→ Section 5.5
114446	O-Ring FFPM 60x3, 80 Shore A	→ Section 5.5

Table 6: Spare parts and article numbers.

11 Appendix

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