

## Instruction and operation manual

# S130-Ambient

## Laser particle counter



Dear Customer,

Thank you for choosing our product.

Before you start up the device please read this manual in full and carefully observe instructions stated in this manual. The manufacturer cannot be held liable for any damage that occurs as a result of non-observance or non-compliance with this manual.

Should the device be tampered with in any manner other than a procedure that is described and specified in the manual, the warranty is void and the manufacturer is exempt from liability.

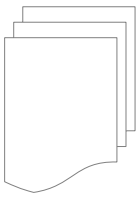
The device is destined exclusively for the described application.

SUTO offers no guarantee for the suitability for any other purpose. SUTO is also not liable for consequential damage resulting from the delivery, capability or use of this device.

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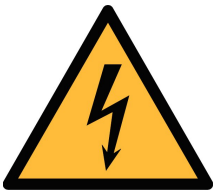
## 1 Safety instructions



**Please check if this instruction manual matches the product type.**

Please observe all notes and instructions indicated in this manual. This manual contains essential information that must be observed before and during installation, operation and maintenance. Therefore this manual must be read carefully by the technician as well as by the responsible user or qualified personnel.

This instruction manual must be available at the operation site of the product at any time. In case of any obscurities or questions regarding this manual or the product, please contact the manufacturer.



### **WARNING!**

**Voltage used for supply!**

**Any contact with energized parts of the device may lead to an electrical shock which can lead to serious injuries or even death!**

- Consider all regulations for electrical installations.
- The system must be disconnected from any power supply during maintenance.
- Any electrical work on system is allowed only by authorized qualified personal.



### **ATTENTION!**

**Permitted operating parameters!**

**Observe the permitted operating parameters. Any operation beyond these parameters can lead to malfunctions and may lead to damage on the product or the system.**

- Do not exceed the permitted operating parameters.
- Make sure that the product is operated under its permitted conditions.
- Store and operate the product at the permitted temperature and pressure.
- The product should be maintained and calibrated frequently, at least annually.

## General safety instructions

- It is not allowed to use the product in explosive areas.
- Please observe the national regulations before and during installation and operation.

### Remark

It is not allowed to disassemble the product.



#### **ATTENTION!**

**Measurement values can be affected by malfunction!**

**The product must be installed properly and maintained frequently. Otherwise it may lead to wrong measurement values, which can lead to wrong results.**

### Storage and transportation

- Make sure that the transportation temperature for the product without display is between  $-30 \dots +70^{\circ}\text{C}$  and for the product with display between  $-10 \dots +60^{\circ}\text{C}$ .
- It is recommended to use the packaging that comes with the product for storage and transportation.
- Make sure that the storage temperature of the product is between  $-10 \dots +50^{\circ}\text{C}$ .
- Avoid direct UV and solar radiation during storage.
- The storage humidity must be  $< 90\%$  with no condensation.



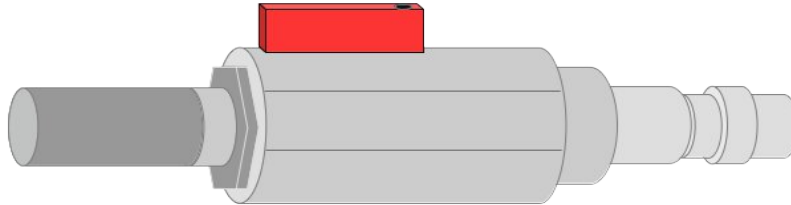
#### **ATTENTION!**

**Equipment may get damaged!**

**Please make sure, that your measuring point is free of excessive contamination and dirt. This should be maintained before every measurement.**

- Observe the measuring point always before measurement if it is free of contamination like water drops, oil drops or other rough contamination.
- Should water hit the inner electronics, the sensors could be seriously damaged.
- Before you start to measure, check your measurement point by

using a simple filter to see if any rough contamination is present. (Example of such a test device is shown below. Ask the supplier if not sure.)



## 2 Registered trademarks

SUTO®	Registered trademark of SUTO iTEC
MODBUS®	Registered trademark of the Modbus Organization, Hopkinton, USA
Android™, Google Play	Trademarks of Google LLC

### 3 Application

The S130-Ambient is a laser particle counter that is designed to measure the particle content under the ambient condition. For the permissible operating parameters, see chapter [5 Technical data](#).

The measurement result can be the number of particles per ft<sup>3</sup> or m<sup>3</sup>. You can choose the unit setting, as needed, using the optional integrated display, an external display, or the service kit.

The S130-Ambient laser particle counter is not designed for use in explosive areas. For the use in explosive areas, please contact the manufacturer.

### 4 Features

- Internal pump to suck in the ambient air.
- Measures particle content under the ambient condition.
- Easy connection through sampling hose and quick connector.
- Applicable to permanent or portable applications.
- Measuring range:  $d \geq 0.3 \mu\text{m}$ .
- Service indication through LEDs.
- Connectable to a display and a data logger produced by the manufacturer and third-party manufacturers.
- IP65 casing provides robust protection in rough industrial environments.
- Optional integrated display for monitoring and configuration.

## 5 Technical data

### 5.1 General data

<b>CE</b>	
Parameters	Particle counts per ft <sup>3</sup> or m <sup>3</sup>
Principle of measurement	Laser detection
Sensor	LED-laser
Measured medium	Ambient air
Measuring channels	CH1: 0.3 µm (d ≥ 0.3 µm) CH2: 0.5 µm (d ≥ 0.5 µm) CH3: 1.0 µm (d ≥ 1.0 µm) CH4: 5.0 µm (d ≥ 5.0 µm)
Flow rate	2.83 l/min
Sample rate	1 minute sampling time (Values are updated every one minute.)
Ambient temperature	+10 ... +40°C
Humidity of the measured medium	< 90% rH, no condensation
Housing material	PC, Al alloy
Protection class	IP65
Dimensions	See dimensional drawing on page <a href="#">10</a> .
Display (optional)	5" graphic display, 800 x 480 pixels with touch interface
Weight	1.9 kg

### 5.2 Electrical data

Power supply	24 VDC±10% , 10 W without display 24 VDC±10% , 20 W with display
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### 5.3 Output signals

Analogue output	4 ... 20 mA
Digital output	RS-485, Modbus/RTU
Alarm output	NO, 32 VDC, 200 mA

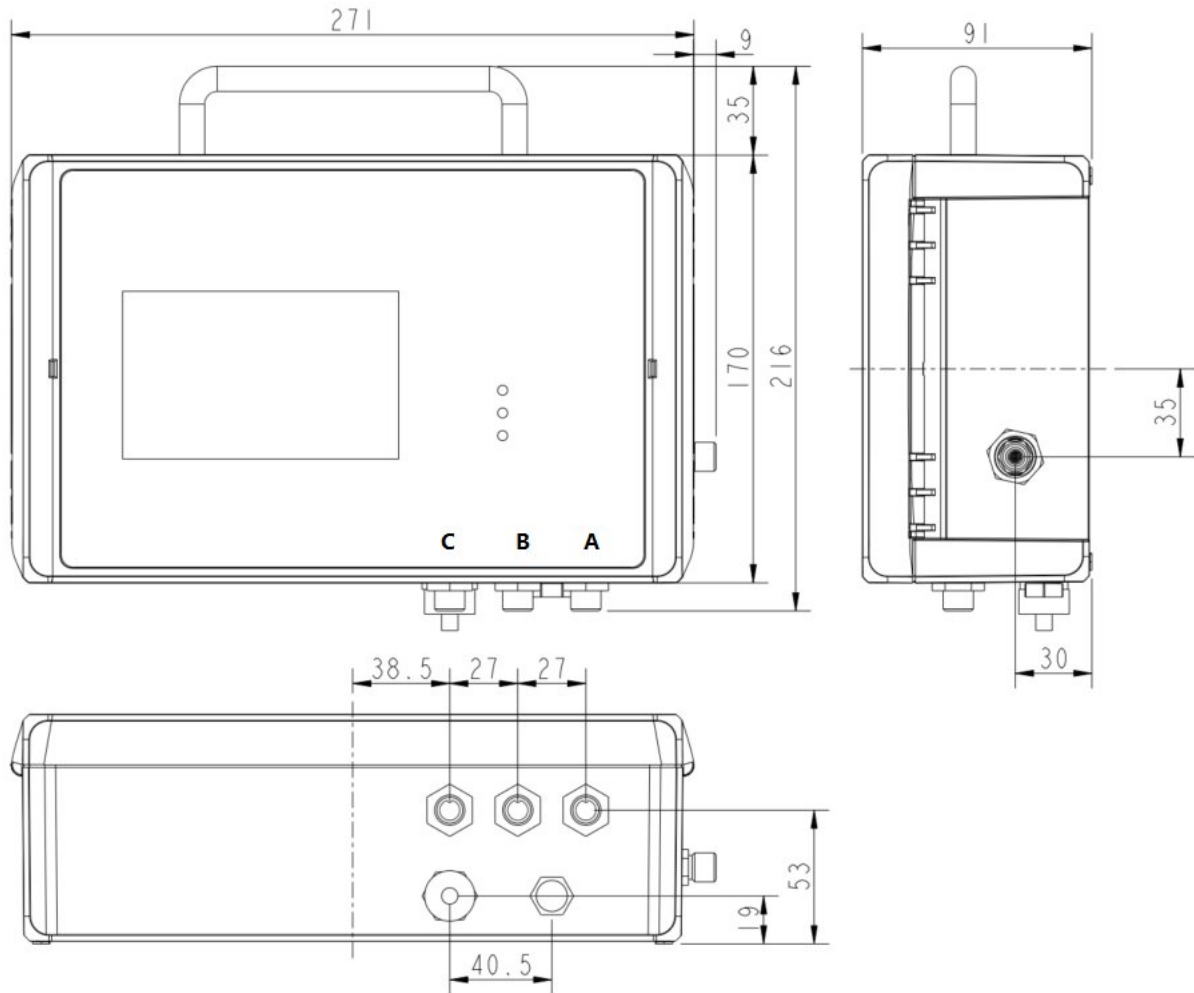
### 5.4 Counting efficiency

Counting efficiency per ISO 21501-4	50% for smallest size and 100% for particles 1.5 times bigger
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### 5.5 General procedure of particle counting

1. The S130-Ambient does not count any particles in the first five minutes. During this period, it performs a purge process to ensure that any remaining particles in the system are blown out.
2. After purging, the S130-Ambient starts sampling at a sampling interval of 1 minute.
  - a. In the next 40 minutes, S130-Ambient classifies the sampled values based on particle sizes and then accumulates them.
  - b. After the 40 minutes, every one minute (sampling interval), S130-Ambient removes the earliest sample values from the accumulated values, and then add the latest sampled value into the accumulated values to obtain the accumulated particle values within the last 40 minutes.

## 6 Dimensional drawing



## 7 Installation

Please make sure that all components listed below are included in your package.

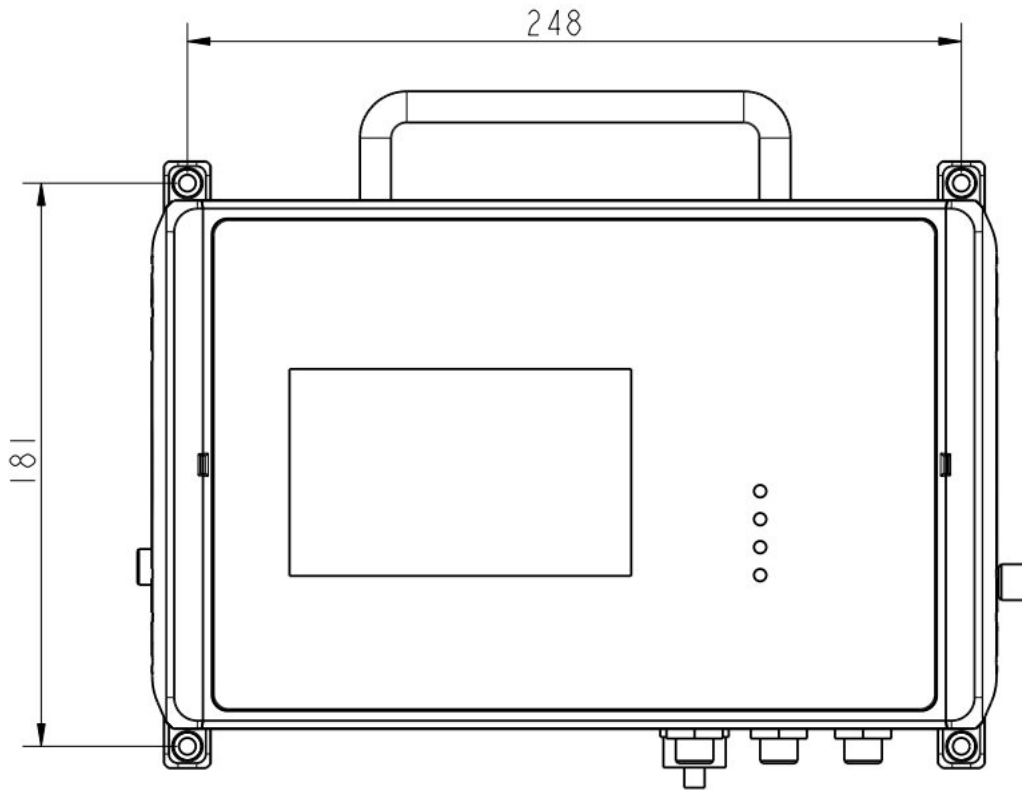
Qty	Description	Item No.
1	S130-Ambient laser particle counter	S604 1313 or S604 1315
<b>Note:</b> S604 1315 has an integrated display and a data logger while S604 1313 does not.		
3	M12 connectors or M12 cables (depending on orders)	Connector: C219 0059 Cable: A553 0104 / A553 0105
1	1.5 m teflon hose with a quick connector	A554 0003
1	Power supply	A554 0108
1	Mounting brackets	No P/N
1	Instruction manual	No P/N
1	Calibration certificate	No P/N
The following are optional accessories.		
1	Isokinetic sampler with stand and hose for ambient conditions	A554 0115
1	Zero count filter	A554 1204

### 7.1 Installation requirements

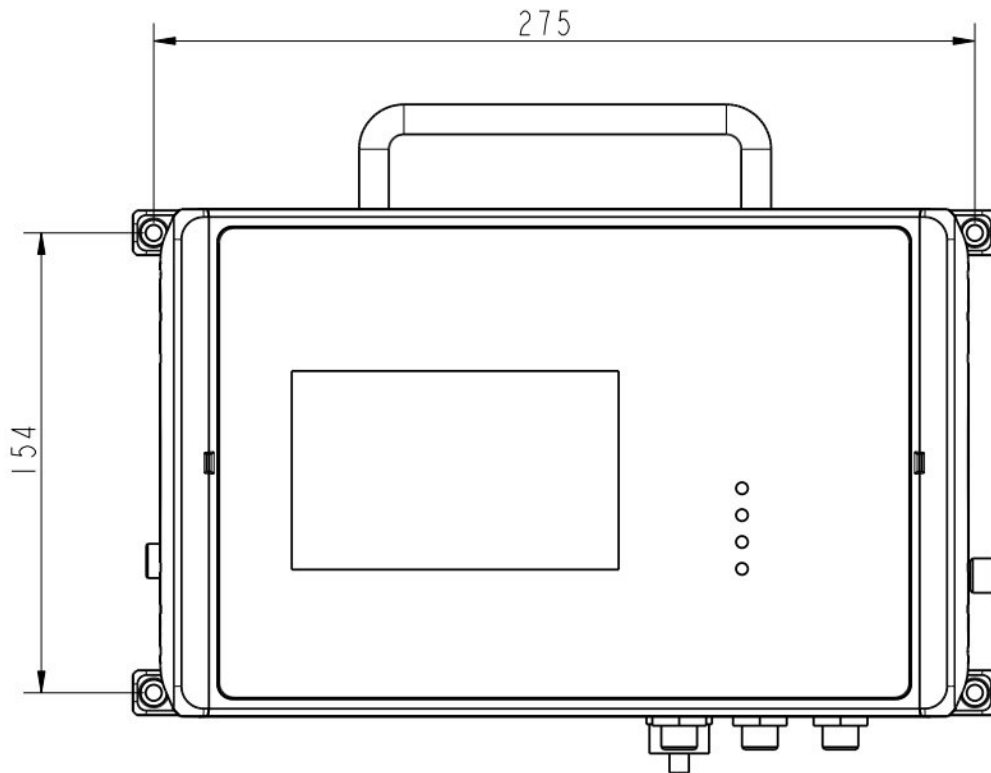
S130-Ambient can be used as a stationary or portable instrument.

S130-Ambient comes with four mounting brackets for the stationary installation. Mount the brackets from the backside of the instrument at each corner. The brackets enable you to install the instrument on the wall easily. The following are dimensional drawings of two installing methods.

Method 1



Method 2



## 7.2 Installation procedure

The following steps explain the procedure of an appropriate installation.



1. Connect the teflon hose with the inlet of the S130-Ambient as shown in the picture.



2. If the optional sampler is ordered, connect the quick connector at the other end of the teflon hose to the hose of the sampler.

Please consider the following recommendations for a successful measurement result:

- All components from the sampling point to the S130-Ambient must be oil and grease free.
- Ambient and gas temperature must be within the specified ranges.
- The inlet gas must be pressurized with the valid ranges.
- The sampling gas must be dry (< 90% rH) and clean.
- Ensure that valves at the sampling point are not lubricated.



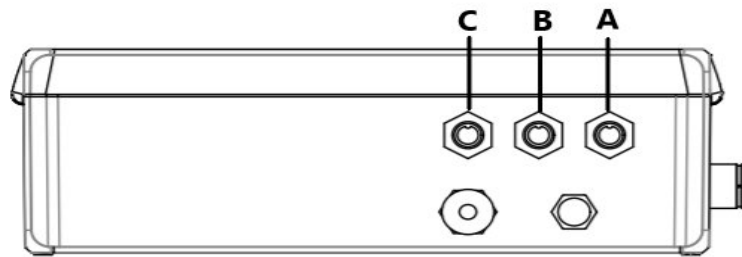
**ATTENTION!**

**Avoid contamination with oil or grease!**

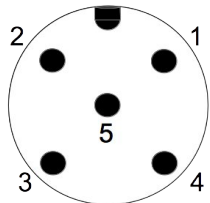
**It will lead to very slow measurement or impossible measurement results!**

**7.3 Electrical connection**

The S130-Ambient comes with three M12 connectors "A", "B" and "C".



**Pin assignment**



Front view

Connector	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5
A	SDI	-V <sub>b</sub>	+V <sub>b</sub>	+D	-D
B	PE	-V <sub>b</sub>	+V <sub>b</sub>	+I	-I
C	Relay	Relay	GND	+D	-D
	brown	white	blue	black	grey

**Legend:**

- SDI     Digital signal (internal use)
- V<sub>B</sub>    Negative supply voltage
- +V<sub>B</sub>    Positive supply voltage
- +I     Positive 4 ... 20 mA signal
- I     Negative 4 ... 20 mA signal
- +D     RS-485, Modbus / RTU
- D     RS-485, Modbus / RTU
- Relay   Alarm output
- PE     Protective Earth
- GND    Communication ground

### Connection to the external displays from SUTO

S130-Ambient		Colour code	S330/S331		S320	
Pin	Signal		Terminal	Pin	Terminal	Pin
A.1	SDI	brown	A	1	G	6
A.2 / B.2	$-V_b$	white		2		7
A.3 / B.3	$+V_b$	blue		3		8
A.4 / C.4	+D	black		4		
A.5 / C.5	-D	grey		5		
B.1	PE	brown		GND		
A.1	SDI	brown	B	1		
A.2 / B.2	$-V_b$	white		2		
A.3 / B.3	$+V_b$	blue		3		
A.4 / C.4	+D	black		4		
A.5 / C.5	-D	grey		5		
B.1	PE	brown			GND	

## 8 Configuration

The S130-Ambient is delivered with standard factory settings (as shown below) or specific customer settings according to the order.

- Scaling : 4 mA = 0  
          20 mA = 100000  $\text{cn}/\text{m}^3$
- Alarm : NO, 32 VDC / 200 mA
- Modbus : Device address = Last two digits of the serial number  
          Baudrate = 19200  
          Framing/parity/Stop bit = 8, N, 1  
          Transmission mode = RTU

You can change the factory settings using the following devices.

### 8.1 Integrated display

If the S130-Ambient comes with a display (Item No: S604 1315), you can configure the S130-Ambient settings directly using the display. For detailed operations, see chapter [9 Operations using the integrated display](#).

### 8.2 Service kit

If the S130-Ambient does not come with a display (Item No: S604 1313), you can configure the S130-Ambient using the optional service kit.

For more information, please see chapter [12 Optional accessories](#).

### 8.3 External display

If you have the S330/S331 display available, you can connect the S130-Ambient with S330/S331 via SDI, and change the settings using the display. Please see the instruction manual of the S330/331 for details.

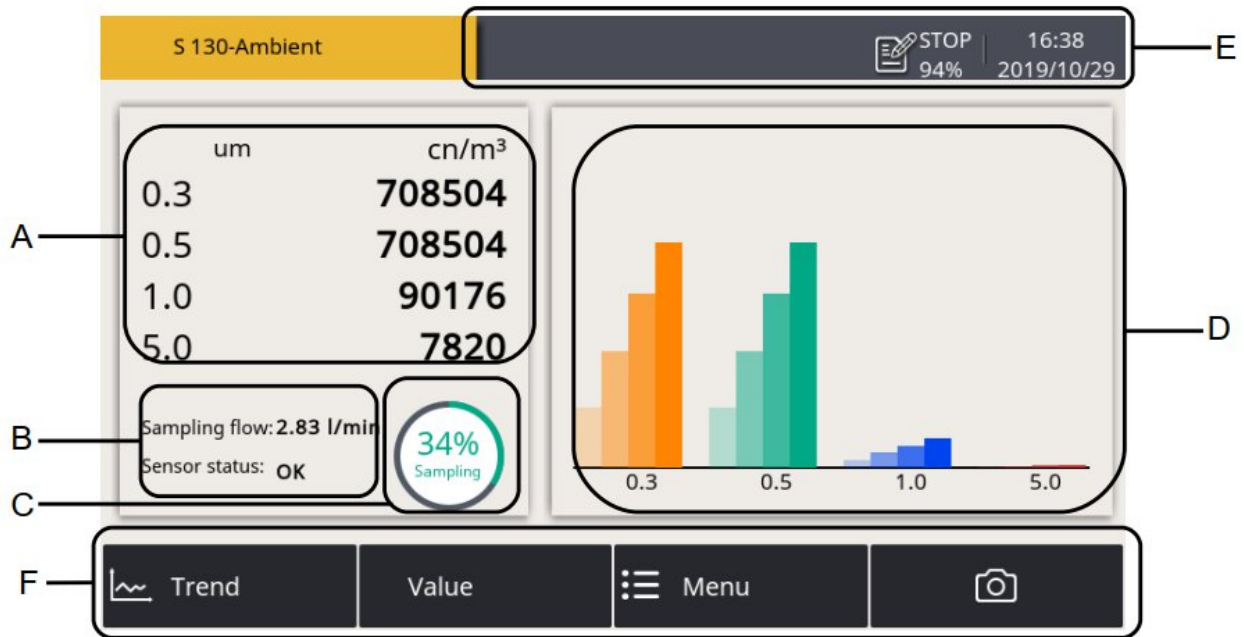


## 9 Operations using the integrated display

If the S130-Ambient comes with a display (Item No: S604 1315), you can view the particle counts in real-time and configure the S130-Ambient using the display.

### 9.1 Value view

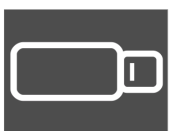
After the S130-Ambient is powered on and initialized, the screen displays the value view as shown below.



Area	Description
A	Shows the actual sampling result in all sizing channels.
B	Shows the sampling status as follows: <ul style="list-style-type: none"> <li>• <b>Sampling flow</b> (0.1 CFM = 2.83 l/min)</li> <li>• <b>Sensor status:</b> <ul style="list-style-type: none"> <li>○ <b>OK:</b> Indicates that everything is normal.</li> <li>○ <b>Service:</b> Indicates that this instrument needs to be serviced and reminds you to contact the customer service.</li> </ul> </li> </ul> <p><b>NOTE:</b> "Service" may be shown if the air is supplied with high concentration of particles or the supply pressure is below the required minimum pressure. In such cases, make sure that you operate in the specified pressure range and purge the sample air through the device for about ten minutes. If "service" is still</p>

Area	Description
	displayed, please contact the customer service.
C	Shows the progress of the sampling or purging process. The S130-Ambient instrument purges sampled data in the first five minutes after powered on. During this period, the progress of "Purging" instead of "Sampling" is displayed.
D	Shows the last four particle counts of each channel in a bar graph.
E	Status bar, shows the S130-Ambient running status. For more information, see <a href="#">9.1.1 Icons in the status bar</a>
F	<p>Quick buttons and icon:</p> <ul style="list-style-type: none"> <li>• <b>Trend:</b> Click to switch to the trend view where the measurements of all channels over a period of time are displayed in line graphs.</li> <li>• <b>Value:</b> Click to switch to the value view where measurements of all channels are displayed in real time.</li> <li>• <b>Menu:</b> Click to switch to the main menu. For more information, see <a href="#">9.3 Menu</a>.</li> <li>• <b>The screenshot icon:</b> Click to capture the current screen and save it in the memory. These screenshots can be read out through the USB port.</li> </ul>

### 9.1.1 Icons in the status bar



USB stick connected



System error



Sensor connection has changed, not matching with configuration



Sensor unit is not matching with configuration



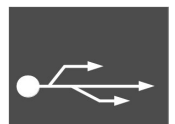
Logger version



RTC backup battery status



Sensor calibration is expired



USB to PC connected



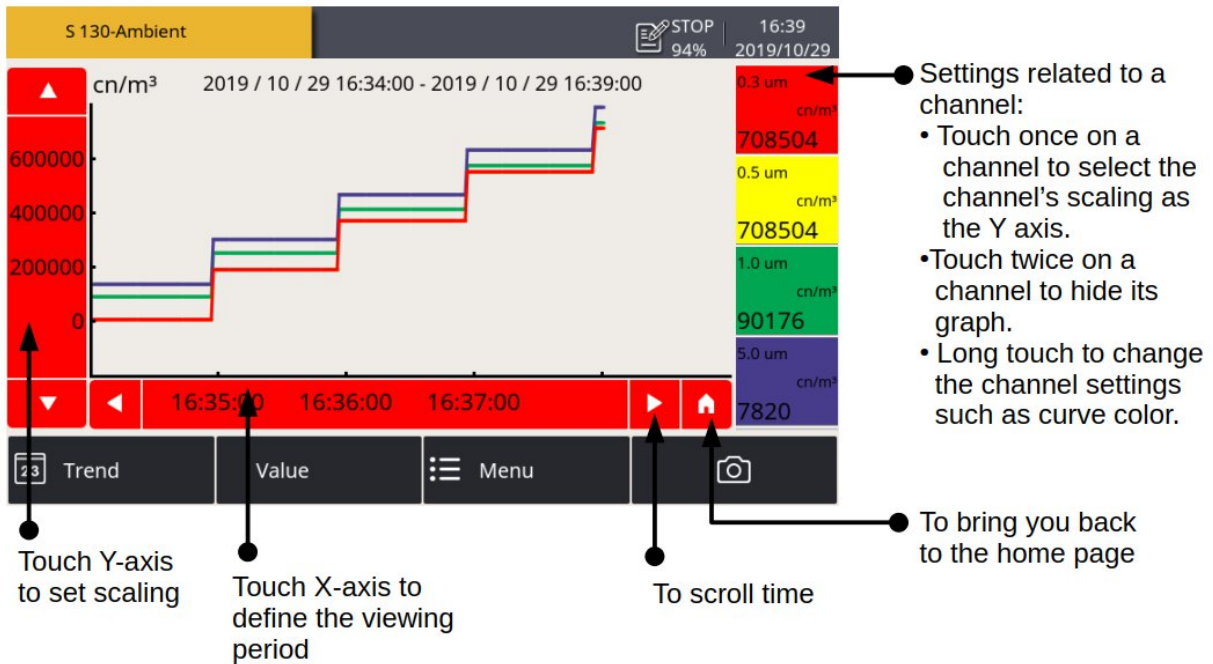
Alarm triggered

## 9.2 Trend view

Shows the dynamic graphs of all measurements. To view the trend screen, press **Trend** in the bottom bar.

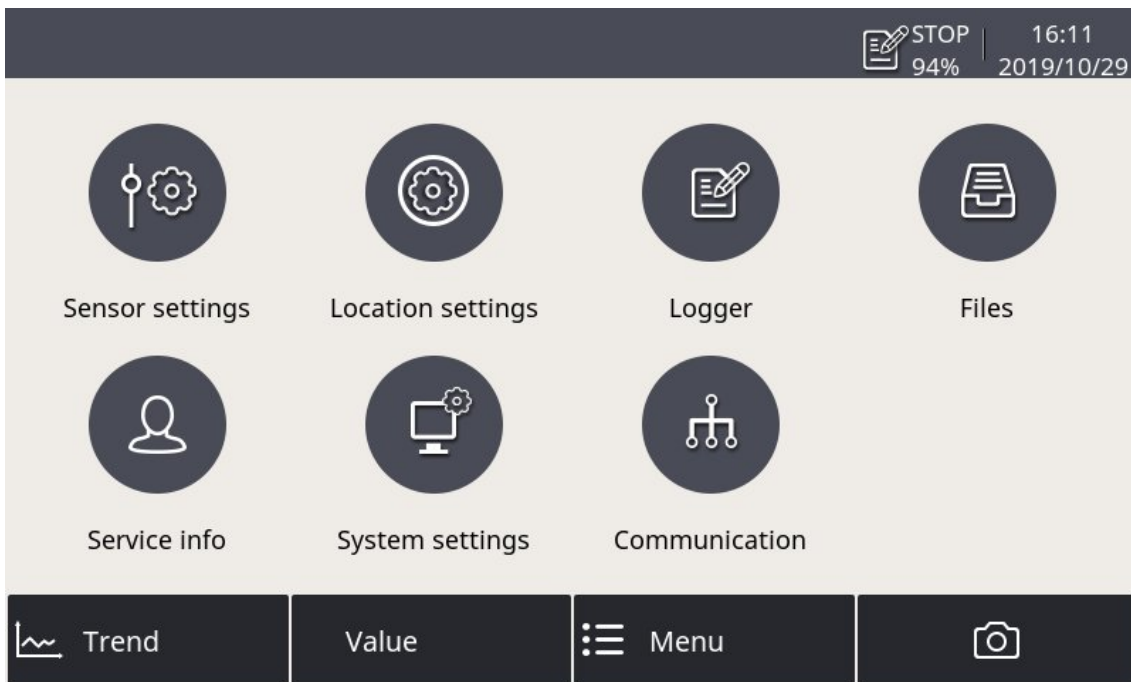
The trend view is pre-configured in the factory. You can view the S130-Ambient

measurement graph without configuring anything. To manipulate the graph, follow the instructions indicated in the following figure.



### 9.3 Menu

Enables you to change the S130-Ambient settings.



The menu consists of the following function buttons:

<b>Sensor settings</b>	To change the S130-Ambient sensor settings
<b>Location settings</b>	To customize the sensor name shown on the top left of the screen
<b>Logger</b>	To change data logger settings
<b>Files</b>	To manage all recorded files and to check the memory status
<b>Service info</b>	To view contact information of the service provider
<b>System settings</b>	To change other system-level settings such as the language setting
<b>Communication</b>	To configure Modbus master and field bus RS-485 related settings

## 9.4 Sensor settings

As stated in Chapter 8, the S130-Ambient is delivered with standard factory settings or with specific customer settings according to the order.

Before starting to measure, you can access sensor settings using the Menu > Sensor settings menu to view and change the sensor settings.

**Note:** After making any changes to the settings, please remember to click the Save button.

### 9.4.1 Analog output

To change the ex-factory settings for the analog output. S130-Ambient provides only one analog output, which means only one measuring channel can be output using the 4 ... 20 mA signal.

The screenshot shows the 'Sensor settings' menu with a green header. The 'Analog output' option is selected, leading to a screen titled 'Analog output'. On the left, a sidebar lists 'Analog output', 'Counter setting', 'Alarm settings', 'Modbus settings', and 'Sensor info'. The main area shows 'Channel' set to '0.3 (cn/m³)' with a dropdown arrow, '4 mA =' set to '0', and '20 mA =' set to '1000000'. A green 'Save' button is at the bottom right.

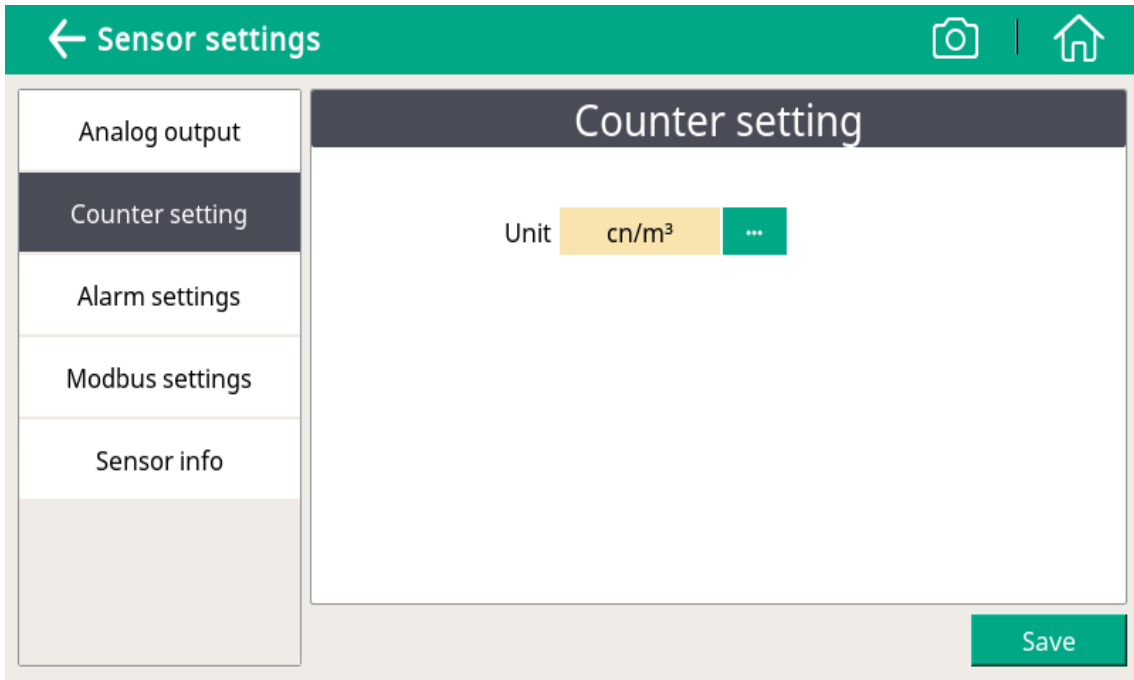
**Channel** To select the channel that the S130-Ambient provides the analog output for.

**4 mA** To enter the particle count that 4 mA is scaled to.

**20 mA** To enter the particle count that 20 mA is scaled to.

### 9.4.2 Counter setting

To change the ex-factory counter settings.

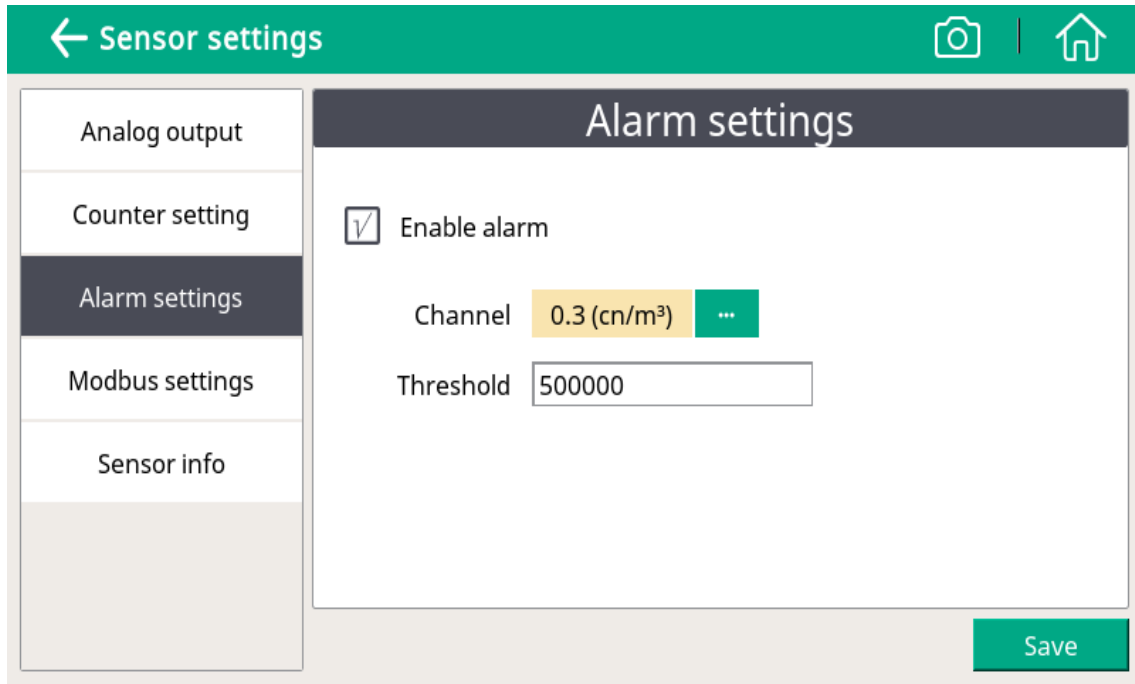


**Unit** To choose the unit of the counter

### 9.4.3 Alarm settings

S130-Ambient provides one alarm relay output through the pin 1 and 2 of connector C (NO, 32 VDC / 200 mA) to trigger an external alarm device.

The Alarm settings menu enables S130-Ambient to trigger the alarm output based on particle counts in a specified channel.



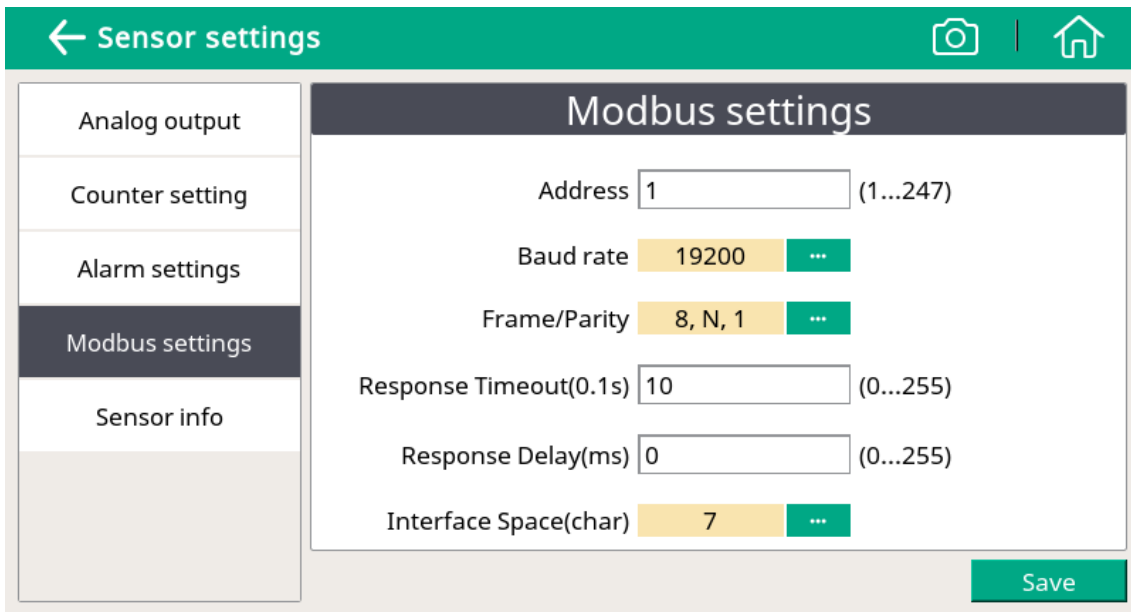
**Enable alarm** To enable or disable the alarm output.

**Channel** To select a channel that is monitored to trigger the alarm output.

**Threshold** To enter the alarm threshold for the monitored channel.

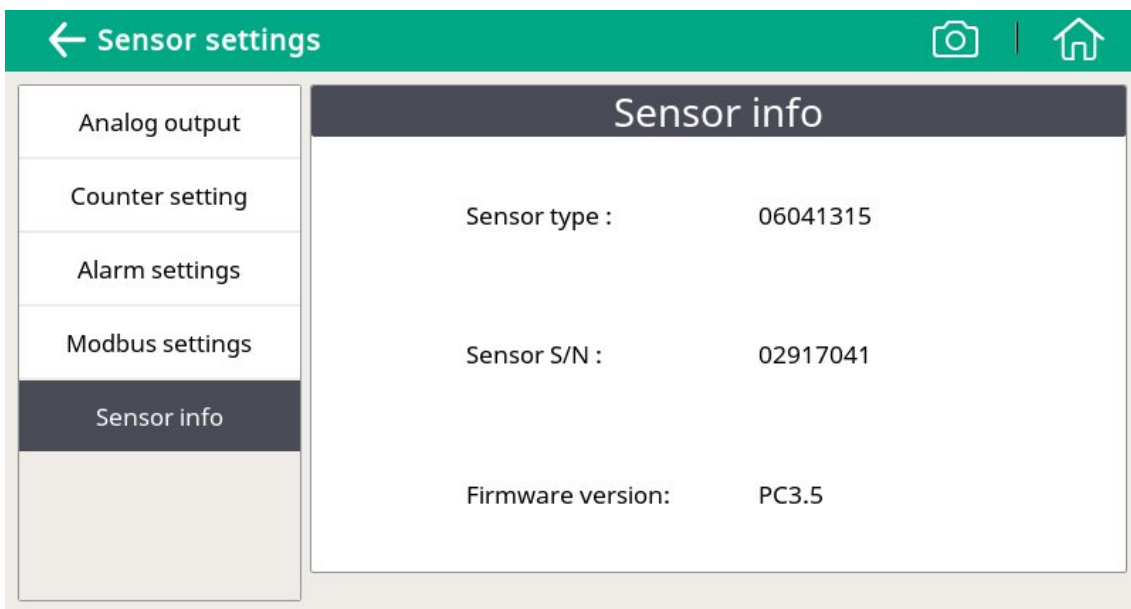
### 9.4.4 Modbus settings

To change the ex-factory Modbus settings.



### 9.4.5 Sensor Info

To view the sensor information including its type, serial number, and firmware version.





## 10 LED indicators at the front panel



- Power LED on—Indicates power supply is connected well.
- Service LED on\*—Indicates the device needs to be serviced.
- Counting LED on—Indicates the device is counting particle.

**NOTE:** The Service indicator may also be turned on if the air is supplied with high concentration of particles or the supply pressure is below the required minimum pressure. In such cases, make sure that you operate in the specified pressure range and purge the sample air through the device for about ten minutes. If the service indicator is still on, please contact the customer service.

## 11 Signal outputs

### 11.1 Analog output

The S130-Ambient provides an analog output range of 4 ... 20 mA. This output is scaled to:

- 4 mA = 0
- 20 mA = 100000  $\text{cn}/\text{m}^3$

### 11.2 Digital output

#### Modbus holding register table

Modbus Register Address	Data type	Data length	Channel description	Unit	Res. *	R/W	
6	UNIT32	4-Byte	Device status	NA	1	R	
8	FLOAT	4-Byte	Count channel	Channel 1	$\text{cn}/\text{m}^3$	1	R
10	FLOAT	4-Byte		Channel 2	$\text{cn}/\text{m}^3$	1	R
12	FLOAT	4-Byte		Channel 3	$\text{cn}/\text{m}^3$	1	R
14	FLOAT	4-Byte		Channel 4	$\text{cn}/\text{m}^3$	1	R
110	ASCII string**	8-Byte	Unit of counting channel	-	-	R	
124	Float	4-Byte	Analog output scaling, 4mA	-	-	R	
126	Float	4-Byte	Analog output scaling, 20 mA	-	-	R	
128	UNIT16	2-Byte	Analog output routing	-	1	R	
130	Float	4-Byte	Alarm threshold	-	1	R	
132	UNIT16	4-Byte	Alarm routing	-	1	R	

\* Res. denotes resolution.

\*\* The size of channel and the unit of channel depends on the model (for example, size: "0.3", "0.5"... , unit: " $\text{cn}/\text{m}^3$ ", " $\text{cn}/\text{l}$ "). If the channel is not available in the model, the string is null.

In the response message that the device returns to the master:

- Function code: 03
- Byte order (32-bit data): MID-LITTLE-ENDIAN.

To properly decode the 4-byte float and unsigned integer data in the response message, the master must change the byte order from MID-LITTLE-ENDIAN to the order that it is using (LITTLE-ENDIAN or BIG-ENDIAN).

### Byte sequencing

Byte order	Byte sequencing (HEX)	Example
MID-LITTLE-ENDIAN (Read from the device)	A B C D	0x 0A 11 42 C5
LITTLE-ENDIAN	B A D C	0x 11 0A C5 42
BIG-ENDIAN	C D A B	0x 42 C5 0A 11

The device provides its statuses via Modbus as well. The 32-bit data information is read as single bits. The meanings of these bits are described as follows.

### Interpretation of system status

Bit	Description
0	Laser alert status: 0 = laser is good, 1 = laser alert
1	Flow alert status: 0 = flow rate is good, 1 = flow rate alert
2	Particle overflow status: 0 = no overflow, 1 = instrument malfunction detected
3	Instrument service status: 0 = working correctly. 1 = threshold exceeded
4	Particle threshold exceeded status: 0 = threshold not exceeded, 1 = threshold exceeded
5	Alarm status 0 = normal, 1 = alarm triggered

### 11.3 Alarm output

The sensor has a relay output with NO, 32 VDC / 200 mA rating. It is possible to monitor, for example the particle content and give an alarm at a particular value.

#### Alarm relay specifications:

Rating: 32 VDC / 200 mA

Power off state: NO (normally open)

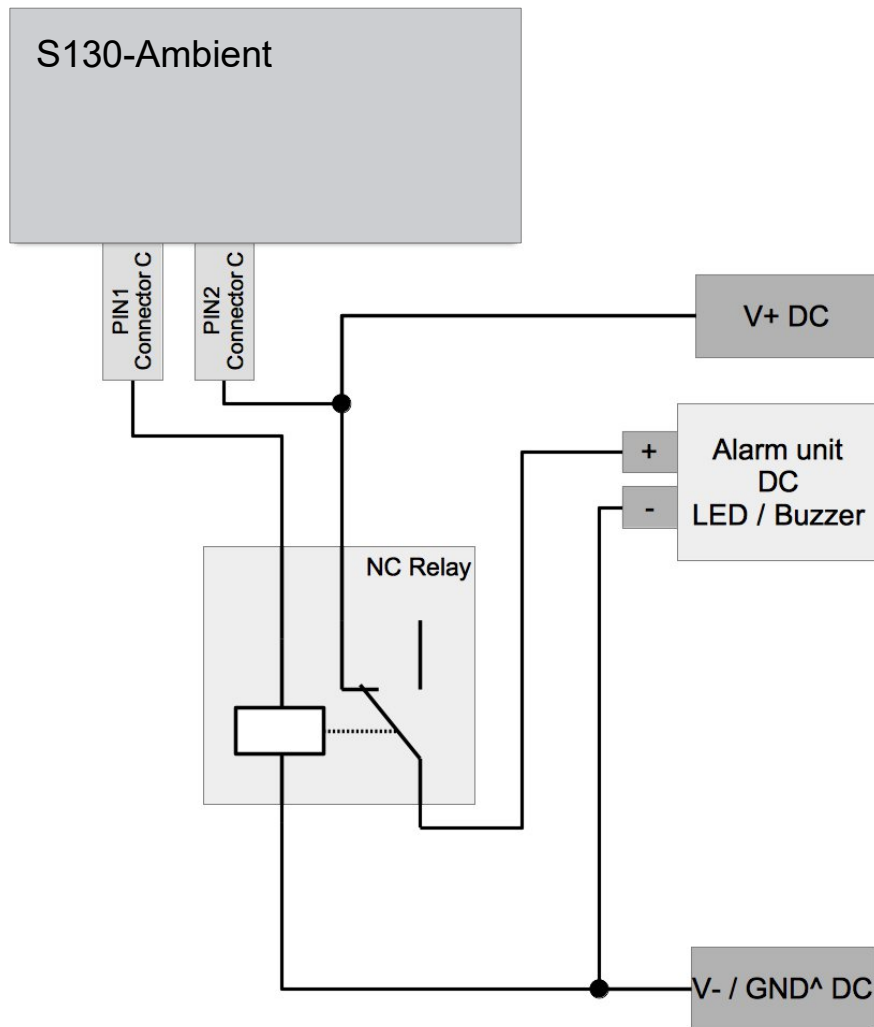
Default threshold value: 500000  $\text{cn}/\text{m}^3$

Please find the different states in the following table.

Situation	Relay state
S130-Ambient is powered off	OPEN
S130-Ambient is powered on / The alarm value is not reached	CLOSED
S130-Ambient is powered on / The alarm value is reached	OPEN

The advantage of the normally open relay is, that both critical situations can be detected, not only if the alarm value is reached, also if the device has any power loss.

To trigger an external buzzer or alarm light, you need to invert the signal and build an external alarm circuit. The following figure illustrates an example.



## 12 Optional accessories

The S130-Ambient provides the following optional accessories:

### Zero count filter

Used to test particle counters used in the SUTO products such as S130, S130-Ambient, S132, S600, S601 and / or equivalent products.

### Isokinetic sampler

Used to collect ambient air more efficiently, and comes with a stand and a hose. See its picture in section [7.2](#).

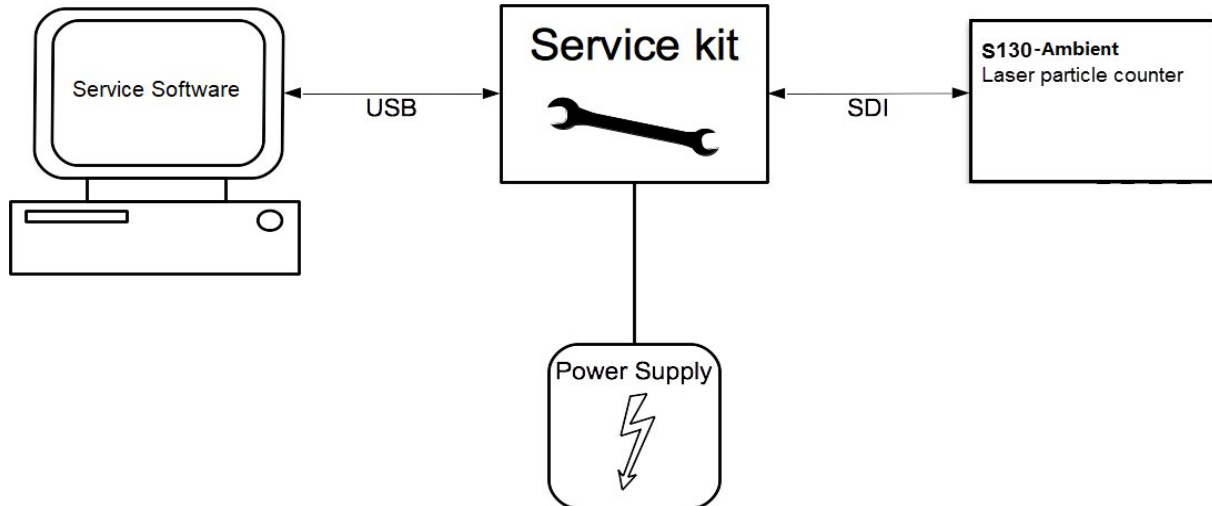
### Service kit

Service kit is a tool designed to connect SUTO sensors with a computer so that you can manage and monitor sensors on a computer.

The following diagram shows the connection of the service kit, S130-Ambient, and the computer. Please ensure that either the S130-Ambient

or the service kit is connected with the power supply because the USB port cannot supply enough power to both these two devices.

For more information about how to use the service kit, please see its instruction manual.



### 13 Calibration

The sensor is calibrated before delivery. The exact calibration date is printed on the certificate which is supplied together with the sensor. The accuracy of the sensor is regulated by the on-site conditions, and parameters such as oil, high humidity or other impurities can affect the calibration and furthermore the accuracy. However we recommend the instrument be calibrated at least once per year.

The calibration is excluded from the instruments warranty. To inquire with the calibration service, please contact the manufacturer.

### 14 Maintenance

To clean the device and its accessories, it is recommended to use moist cloth only.



#### **ATTENTION!**

**Do not use isopropyl alcohol to clean the display!**

## 15 Disposal or waste



Electronic devices are recyclable material and do not belong in the household waste.

The sensor, the accessories and its packings must be disposed according to your local statutory requirements.

The dispose can also be carried by the manufacturer of the product, for this please contact the manufacturer.

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