Instruction and operation manual

S130

Laser particle counter

S 130
Laser Particle Counter

.SUTO

Actual	cn/m³
0.3 < d ≤ 0.5	217
0.5 < d ≤ 1.0	105
1.0 < d ≤ 5.0	37
5.0 < d	20

Sampling flow: 0.1 CFM
Sampling period: 60s
Sensor status: OK

66% Sampling

0.3 < d ≤ 0.5   0.5 < d ≤ 1.0   1.0 < d ≤ 5.0   5.0 μm < d

Trend   Average   Menu

● Power
● Service
● Counting

⚠ Read instruction manual before use   CE

C   B   A

.SUTO

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 cancelled and the manufacturer is exempt from liability.
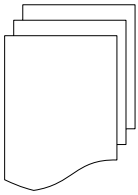
The device is destined exclusively for the described application.

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.

Table of Contents

1. Safety instructions

Please check if this instruction manual accords with 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.
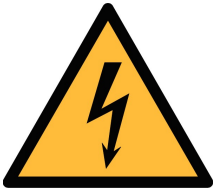
WARNING!

Compressed air!

Any contact with quickly escaping air or bursting parts of the compressed air system can lead to serious injuries or even death!

* Do not exceed the maximum permitted pressure range (see sensors label).

* Use only pressure-tight installation material.

* Prevent persons from being hit by escaping air or bursting parts of the instrument.

* The system must be pressureless during maintenance work.

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 ... +70°C and for the product with display between -10 ... +60°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 ... +50°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 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 senors 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.)
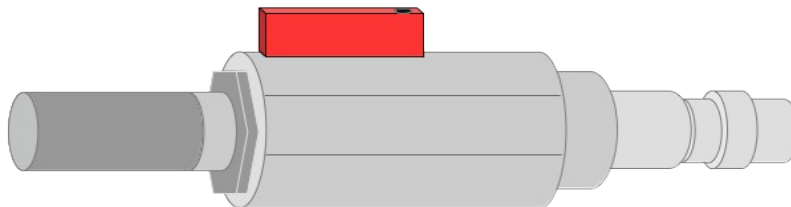
2. Application

The S130 is a laser particle counter which is designed to measure particle in compressed air or compressed gases within the permissible operating parameters. For more information about these parameters, see chapter 4. Technical data.

The measurement values represent the particle counts per ft^3, l or m^3 or alternately in µg/m^3. Settings can be done through the optional integrated display (optional), an external display, or the service kit.

The S130 laser particle counter is mainly used in compressed air systems in industrial environments, and is not designed for use in explosive areas. For the use in explosive areas please contact the manufacturer.

3. Features

- Measures particle content in compressed air or compressed gases.

- Easy connection through sampling hose and quick connector.

- Applicable to permanent or portable applications.

- Measures particle in the range of: 0.3 < d <= 5.0 µm.

- Compliance with ISO 8573-4.

- Service indication through LEDs.

- Connectable to display and data logger produced by the manufacturer and by third-party manufacturers.

- IP65 casing provides robust protection in rough industrial environments.

- Optional integrated display for monitoring and configuration.

4. Technical data

4.1 General data

CE	
Parameters	Particle counts per ft^3, l or m^3, selectable concentration µg/m^3
Principle of measurement	Laser detection
Sensor	LED-laser
Measured medium	Compressed air and gases free of corrosive, aggressive, caustic and flammable constituents
Measuring range	CH1: 0.3 < d <= 0.5 µm CH2: 0.5 < d <= 1.0 µm CH3: 1.0 < d <= 5.0 µm
Flow rate	2.83 l/min
Sample rate	1 minute sampling time (Values are output every one minute.)
Ambient temperature	+10 ... +40°C
Humidity of the measured medium	< 40% rH, no condensation
Operating pressure	0.2 ... 0.8 MPa
Housing material	PC, Al alloy
Protection class	IP65
Dimensions	See dimensional drawing on page 10.
Display (optional)	5" graphic display, 800 x 480 pixels with touch interface
Weight	1.9 kg

4.2 Electrical data

Power supply	24 VDC, 10 W without display 24 VDC, 20 W with display

4.3 Output signals

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

4.4 Accuracy

| Counting efficiency per JIS	50 % @ 0.3 < d ≤ 0.45 µm 100% @ d > 0.45 µm

4.5 General procedure of particle counting

The S130 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.

In the next 30 minutes, the particle counter accumulates all particles detected and classify them to different size channels.

After that, the oldest sample is removed from the internal memory and replaced by the newest one (One sample is the number of particles within one minute.). This guarantees that a 30-minute accumulation of particles at a display update interval of every 1 minute.

5. Dimensional drawing
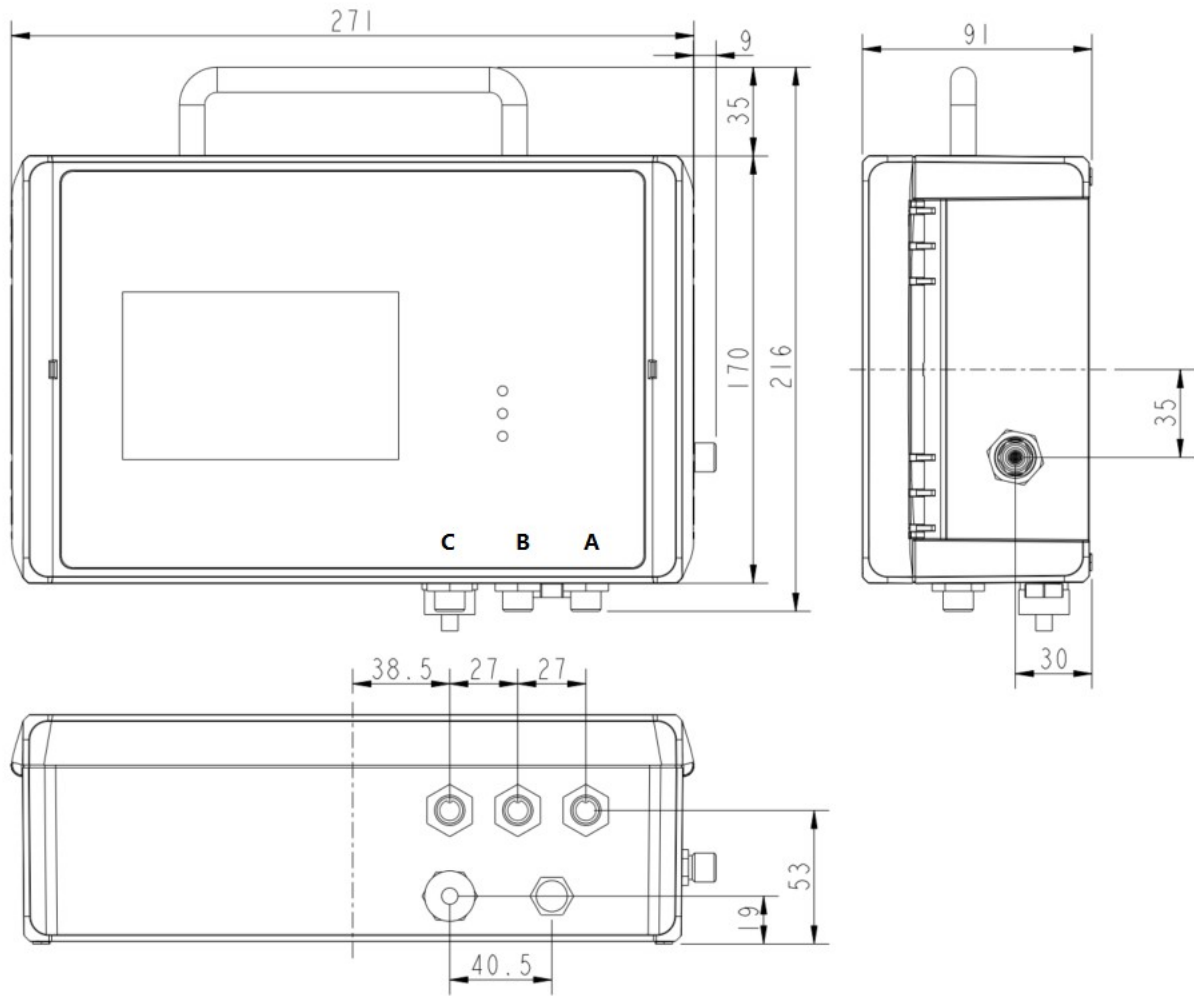
6. Installation

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

Qty	Description	Item No.
1	S130 laser particle counter	S604 1303 or S604 1305

**Note**: S604 1305 is supplied with an integrated display and data logger and S604 1303 has no display and data logo.

3	M12 connectors	C219 0059
1	1.5 m teflon hose with a quick connector	A554 0003
1	Mounting brackets	No P/N
1	Instruction manual	No P/N
1	Calibration certificate	No P/N

## 6.1 Installation requirements

S130 can be used as a stationary or portable instrument.

S130 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
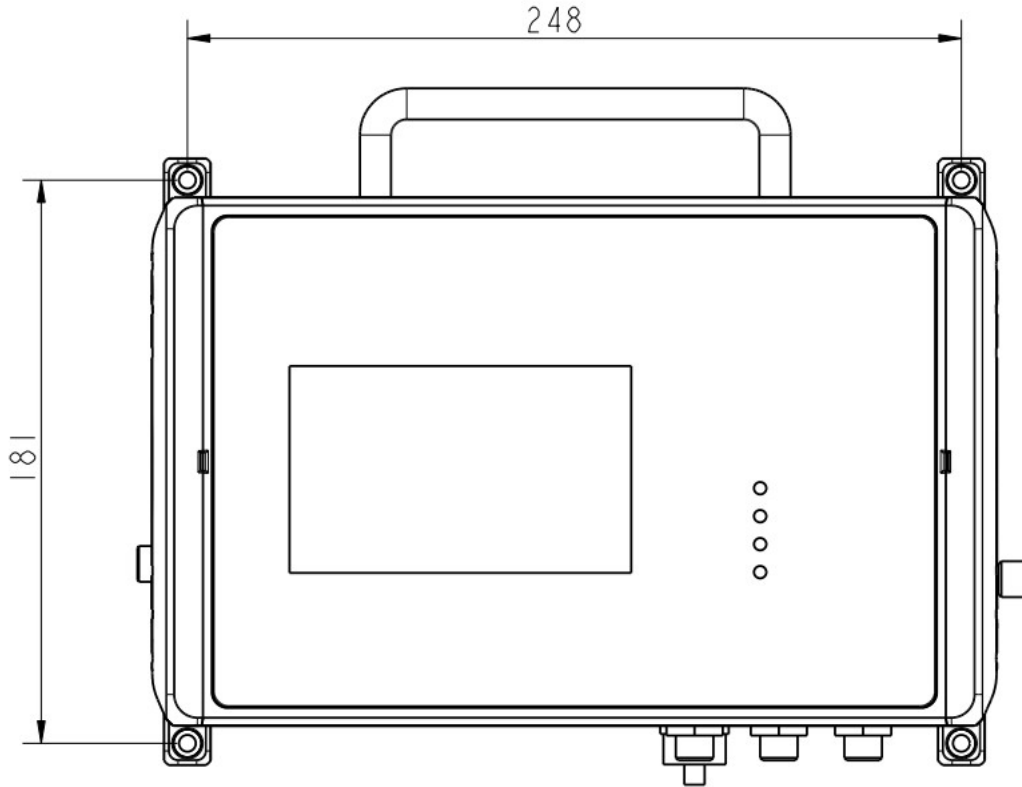
Method 2
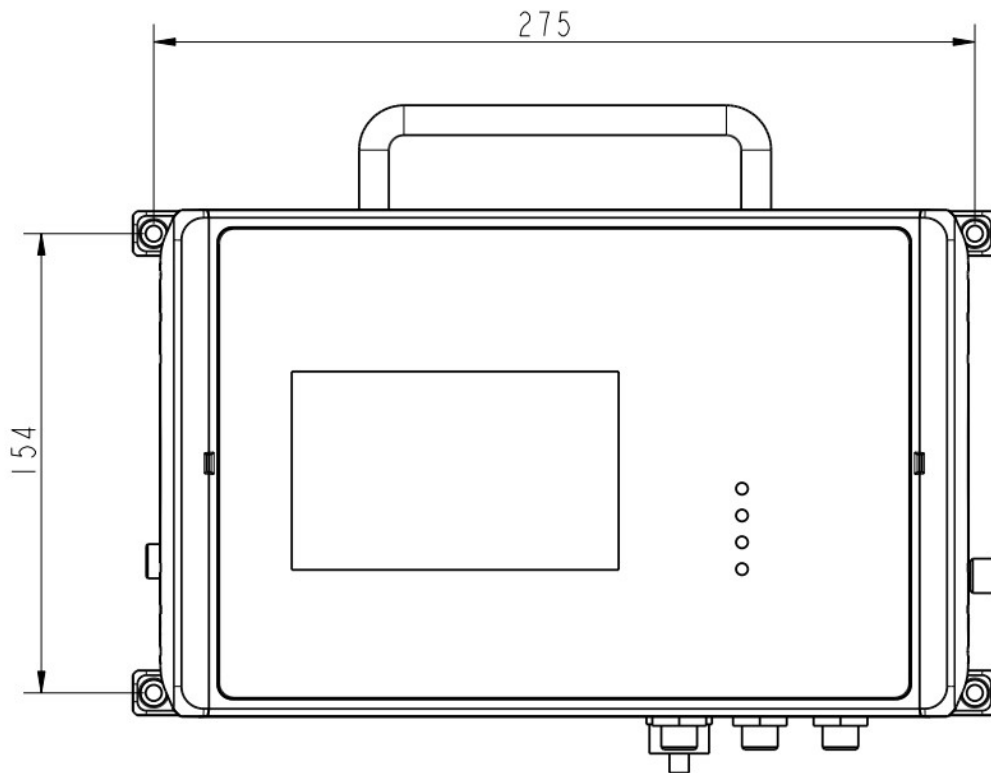
6.2 Installation procedure

The following steps explain the procedure of an appropriate installation.

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

2. Connect the quick connector at the other end of the teflon hose with the process.

Please consider the following recommendations for a successful measurement result:

- All components from the sampling point to the S130 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 mus be dry (< 40% rH) and clean.
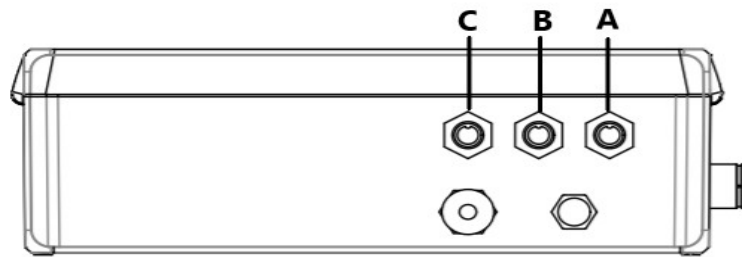- Ensure that valves at the sampling point are not lubricated.

ATTENTION!

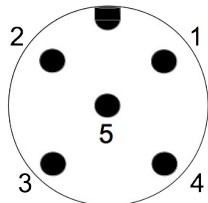**Avoid contamination with oil or grease!**

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

6.3 Electrical connection

The S130 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	$-V_b$	$+V_b$	+D	-D
B	PE	$-V_b$	$+V_b$	+I	-I
C	Relay	Relay	GND	+D	-D
	brown	white	blue	black	grey

Legend to pin assignment

SDI   Digital signal (internal use)

$-V_B$ Negative supply voltage

$+V_B$ 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		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	A	2	G	7
A.3 / B.3	$+V_b$	blue	A	3	G	8
A.4 / C.4	+D	black	A	4		
A.5 / C.5	-D	grey	A	5		
B.1	PE	brown		GND		
A.1	SDI	brown	B	1		
A.2 / B.2	$-V_b$	white	B	2		
A.3 / B.3	$+V_b$	blue	B	3		
A.4 / C.4	+D	black	B	4		
A.5 / C.5	-D	grey	B	5		
B.1	PE	brown		GND		

7. Configuration

The S130 is delivered with standard ex-work configuration or with specific customer settings according to the order.

Standard ex-work configuration is as follows:

Scaling : 4 mA = 0
20 mA =100000 cn/m^3

Alarm : NO, 32 VDC / 200 mA

Modbus : Device address = 1
Baudrate = 19200
Framing/parity/Stop bit = 8, N, 1
Transmission mode = RTU

In your daily operations, if needed, you can also change settings for S130 using the following devices:

- Optional service kit

- External display (such as S330/S331)

- S130 integrated display

7.1 Configuration using the optional service kit

If the S130 does not come with a display (Item No: S604 1303), you can configure the S130 using the optional service kit.

For more information about the connection diagram, please see chapter 11. Optional accessories.

7.2 Configuration using an external display

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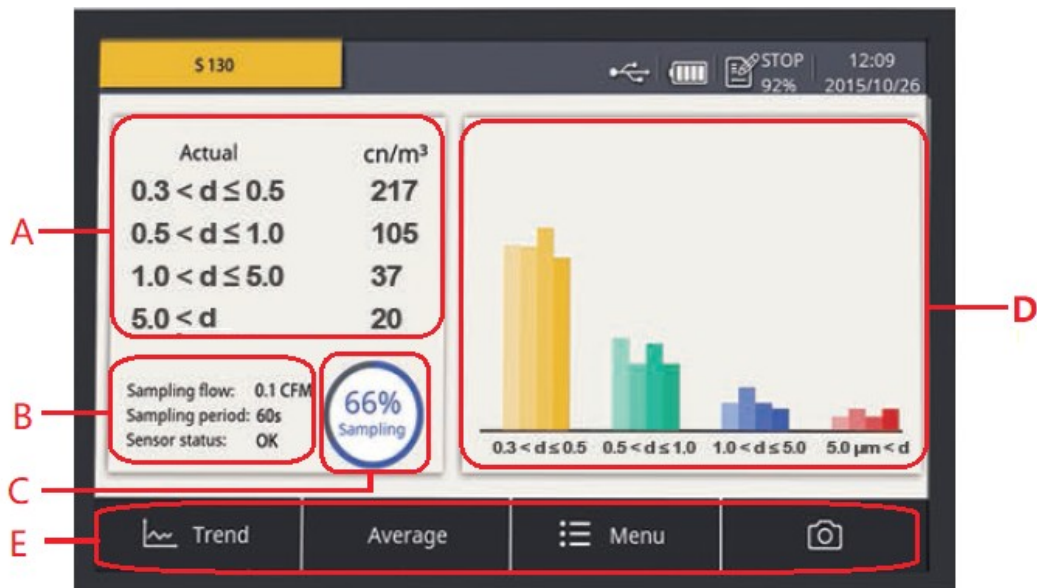
7.3 Configuration using the integrated display

If the S130 comes with a display (Item No: S604 1305), you can configure the S130 settings directly using the display. For more information about detailed operations, see chapter 8. Operations using the integrated display.

8. Operations using the integrated display

If the S130 comes with a display (Item No: S604 1305), you can view the particle counts in real-time and configure the S130 using the display.

8.1 User interface

The screen below shows the user interface provided on the S130 display.

Area	Description
A	Shows the actual sampling result in all sizing channels.
B	Shows the sampling status as follows: • **Sampling flow** (0.1 CFM = 2.83 l/min) • **Sampling period**: Fixed to 60 seconds • **Sensor status**: ○ **OK**: Indicates that everything is normal. ○ **Service**: Indicates that this instrument needs to be serviced and reminds you to contact the customer service. Note: "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"

| Area	Description
	is still displayed, please contact the customer service.
C	Shows the progress of the sampling or purging process. The S130 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	Quick buttons and icon:
	  • **Trend**: Click to switch to the graphic screen displaying the 4 channels and its values in a line graph.
	  • **Average**: Click to show the average particle counts.
	  • **Menu**: Click to switch to the main menu. For more information, see 8.1 1 Main menu.
	  • **The screenshot icon**: Click to capture the current screen and save it in the memory. These screenshots can be read out through the USB port.

8.1 1 Main menu

The menu consists of the following function buttons:

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

8.1.2 Icons in the status bar
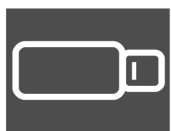
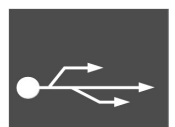|			
	USB stick connected		System error
	Sensor connection has changed, not matching with configuration		Sensor unit is not matching with configuration
	Logger version		RTC backup battery status
	Sensor calibration is expired		USB to PC connected
	Alarm triggered		

8.2 Sensor settings

As stated in Chapter 7, the S130 is delivered with standard ex-factory configuration 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 the sensor settings; and If needed, you can change these settings.

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

8.2.1 Analog output

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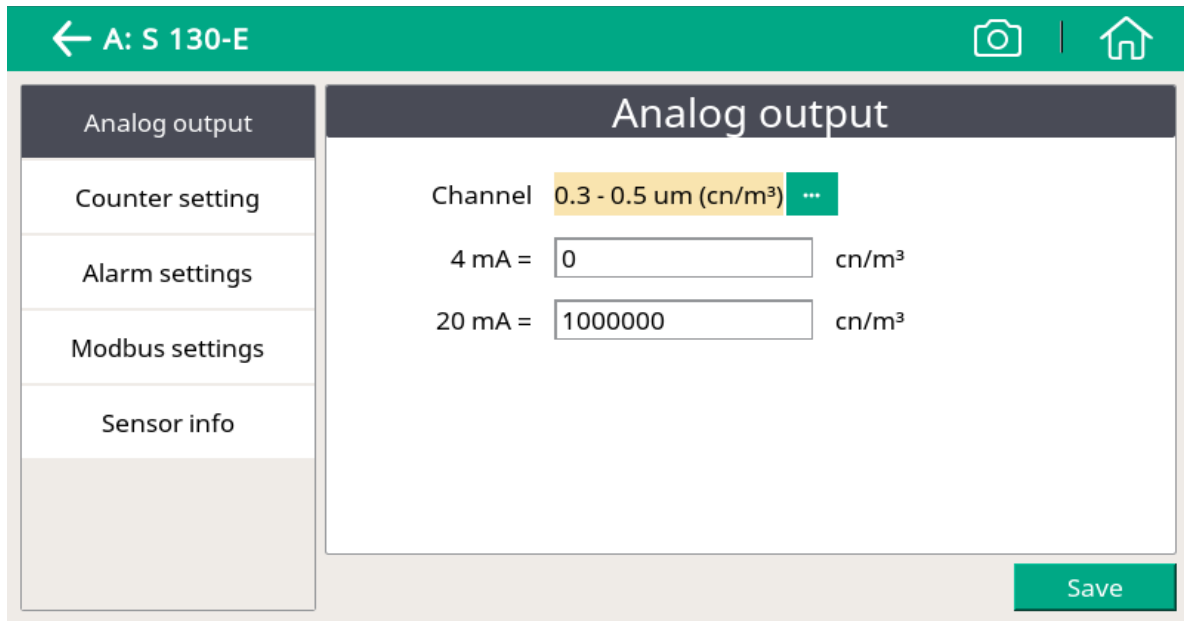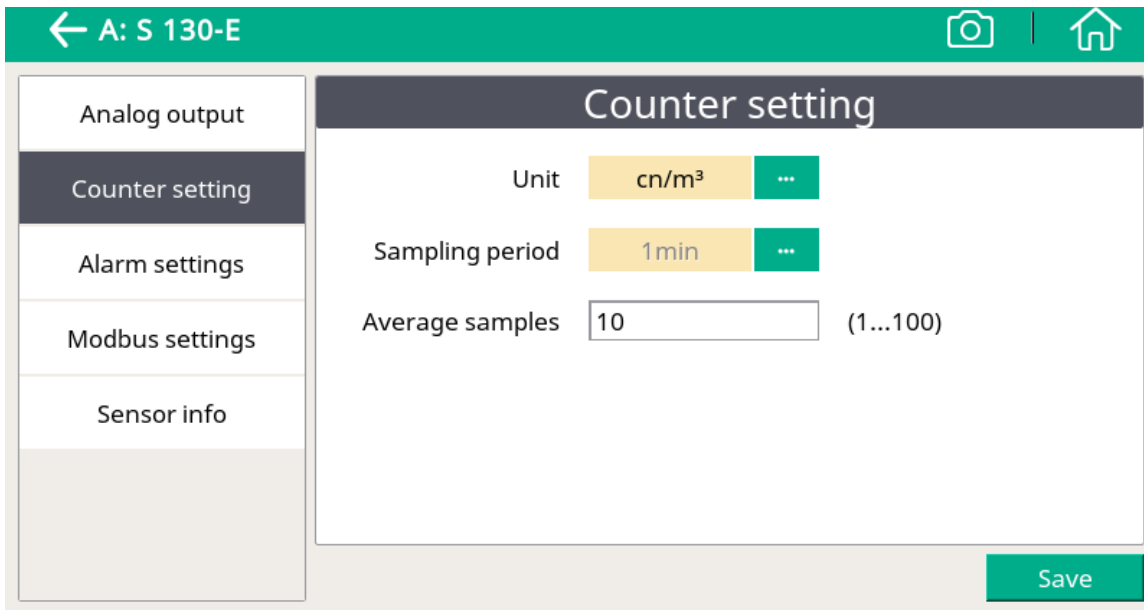

Channel	To select the channel that the S130 provides the analog output for.
4 mA	To enter the particle count that 4 mA is scaled to.
20 mA	To enter the particle count that 20 mA is scaled to.

8.2.2 Counter setting

To change the ex-factory counter settings.

|	
Unit	To select the unit of the counter
Sampling period	To view the sampling period
Average samples	To configure the average number of samples in a sampling period

8.2.3 Alarm settings

S130 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 you to configure how to trigger the alarm output based particle counts in a specified channel.
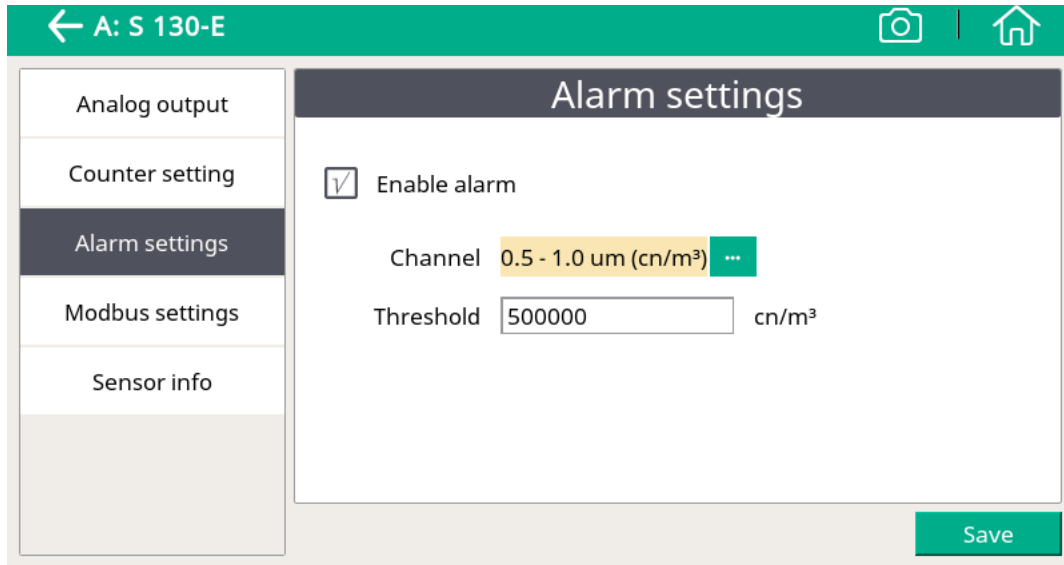
Enable alarm   To enable or disable the alarm output.

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

Threshold   To enter the alarm threshold for the monitored channel.

8.2.4 Modbus settings

To change the ex-factory Modbus settings if needed.

8.2.5 Sensor Info

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

9. 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.

10. Signal outputs

10.1 Analog output

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

- 4 mA = 0
- 20 mA = 100000 cn/m^3

10.2 Digital output

Modbus operation

Index	Channel description		Unit	Res.	Format	Access	Modbus address
0	Device status			1	UNIT32	R	6
1	Count channel	Channel 1	cn/m^3	1	FLOAT	R	8
2		Channel 2	cn/m^3	1	FLOAT	R	10
3		Channel 3	cn/m^3	1	FLOAT	R	12
4		Channel 4	cn/m^3	1	FLOAT	R	14
5	Weight	Channel 1	µg/m^3	0.001	FLOAT	R	40

Index	Channel description		Unit	Res.	Format	Access	Modbus address
6	channel	Channel 2	µg/m^3	0.001	FLOAT	R	42
7		Channel 3	µg/m^3	0.001	FLOAT	R	44
8		Channel 4	µg/m^3	0.001	FLOAT	R	46
9	Original channel	Channel 1	Cn/2.83 l	1	UNIT32	R	80
10		Channel 2		1	UNIT32	R	82
11		Channel 3		1	UNIT32	R	84
12		Channel 4		1	UNIT32	R	86
13	Size of channel 1				ASCII string*	R	100
14	Size of channel 2				ASCII string*	R	102
15	Size of channel 3				ASCII string*	R	104
16	Size of channel 4				ASCII string*	R	106
17	Unit of count channel				ASCII string*	R	110
18	Unit of weight channel				ASCII string*	R	114
19	Unit if original channel				"cn/2.83l"	R	118
20	Analog output scaling, 4mA				**	R / W	124
21	Analog output scaling, 20 mA				**	R / W	126
22	Analog output routing			1	UNIT16 **	R / W	128
23	Alarm threshold				**	R / W	130
24	Alarm routing			1	UNIT16 **	R / W	132

*   The size of channel and the unit of channel is depending on the model (for example, size: "0.3", "0.5".... , unit: "cn/m^3", "cn/l"....).

If the channel is not available in the model, the string is null.

**   The format depends on the selected routing path.

***   Program Modbus address of the wanted channel. For example, if channel 2 with the unit of µg/m^3 is selected as the output, the Modbus address is integer 42.

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

10.3 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 cn/m³

Please find the different states in the table below.

Situation	Relay state
S130 is powered off	OPEN
S130 is powered on / The alarm value is not reached	CLOSED
S130 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.
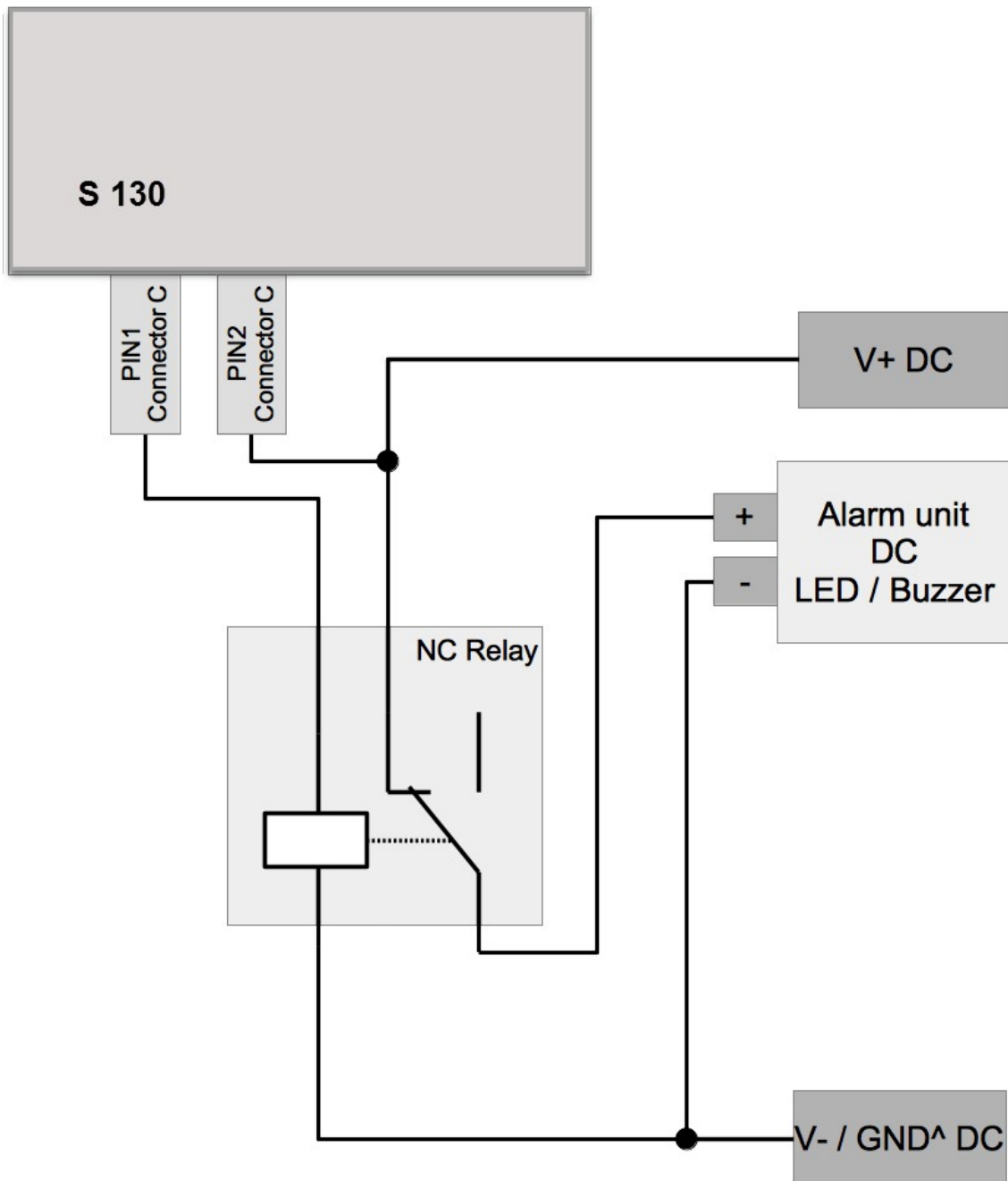
11. Optional accessories

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, and the computer. Please ensure that either the S130 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.
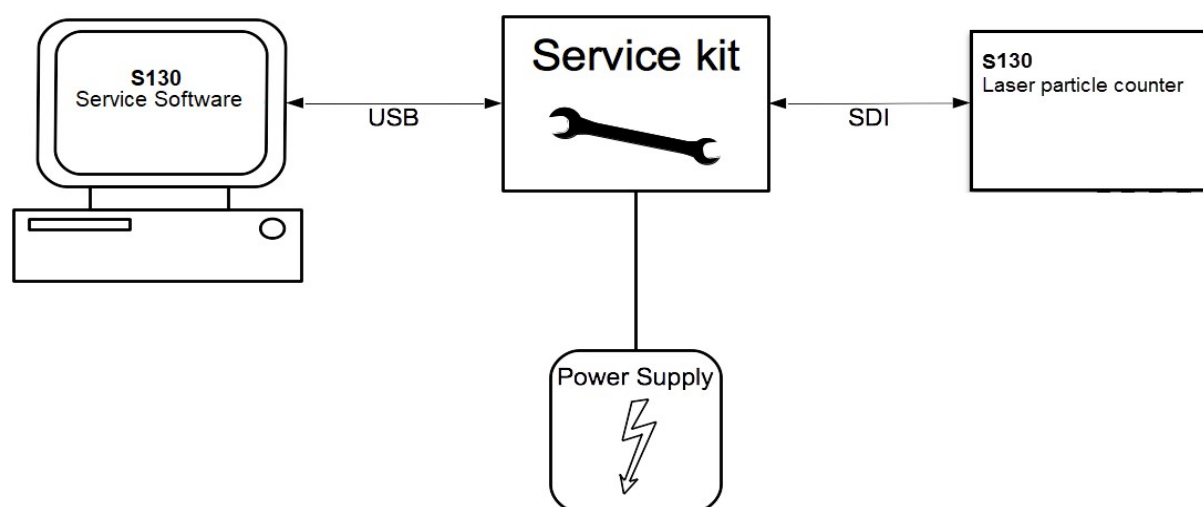
12. Calibration

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 you calibrate the instrument at least once per year. The calibration is excluded from the instruments warranty. For the calibration service, please contact the manufacturer.

13. 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!

14. 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.

15. Warranty

SUTO provides a warranty for this product of 24 months covering the material and workmanship under the stated operating conditions from the date of delivery. Please report any findings immediately and within the warranty time. If faults occur during the warranty time, SUTO will repair or replace the defective unit, without charge for labour and material costs but there is a charge for other service such as transport and packing costs.
Excluded from this warranty is damage caused by any of the following actions:

- Improper use and non-adherence to the instruction manual.

- Use of unsuitable accessories.

- External influences (e.g. damage caused by vibration, damage during transportation, excess heat or moisture).

The warranty is cancelled:

- If the user opens the measurement instrument without a direct request written in this instruction manual.

- If repairs or modifications are undertaken by third parties or unauthorised persons.

- If the serial number has been changed, damaged or removed.

Other claims, especially those for damage occurring outside the instrument are not included unless responsibility is legally binding.

Warranty repairs do not extend the period of warranty.

ATTENTION!

Batteries have a reduced warranty time of 12 month.