

## Instruction and operation manual

# S 130

## 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 cancelled and the manufacturer is exempt from liability.

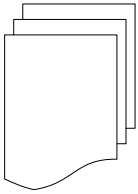
The device is destined exclusively for the described application.

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.....	4
2. Application.....	7
3. Features.....	7
4. Technical data.....	8
4.1 General.....	8
4.2 Electrical data.....	9
4.3 Output signals.....	9
4.4 Accuracy .....	9
5. Dimensional drawing.....	10
6. Installation .....	11
6.1 Installation requirements.....	11
6.2 Wall mounting instructions.....	11
6.3 Installation procedure .....	13
6.4 Electrical connection .....	14
7. Configuration .....	16
7.1 Configuration without a display.....	16
7.2 Configuration using an external display .....	16
7.3 Configuration using the internal display.....	16
7.4 Alarm settings.....	16
8. Operation using the internal display .....	18
8.1 User interface .....	18
8.2 Main menu.....	20
8.3 Icons in the status bar .....	21
9. LED indication at the front panel.....	21
10. Signal outputs.....	22
10.1 Analog output .....	22
10.2 Digital output .....	22
10.3 Alarm output .....	24
11. Optional extra accessories.....	25
11.1 Sensor display (optional).....	25
11.2 Service kit .....	25
12. Calibration.....	26
13. Maintenance.....	26
14. Disposal or waste.....	26
15. Warranty.....	26

## 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.

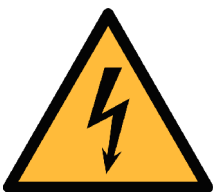


### **WARNING!**

#### **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.

**WARNING!****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.

**Remarks**

- It is not allowed to disassemble the product.
- Always use spanners to mount the product properly.

**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.**

- Always observe the direction of the flow when installing the device. The direction is indicated on the housing.
- Do not exceed the maximum operation temperature at the sensors tip.
- Avoid condensation on the sensor element because it will affect accuracy enormously.

## Storage and transportation

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

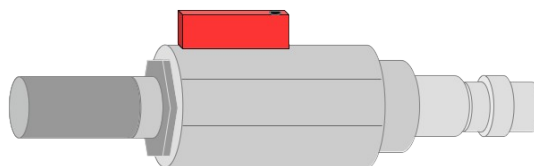


### **ATTENTION!**

#### **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.**

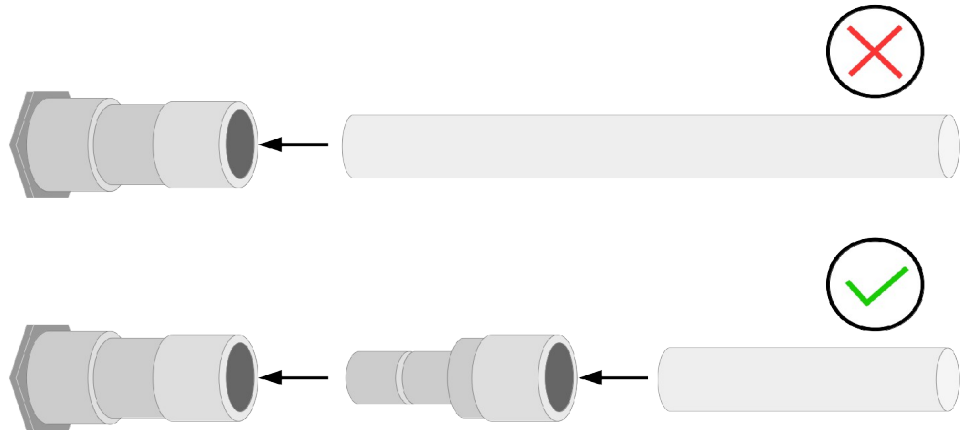
- Observe the measuring point always before measurement if it is free of contamination like water drops, oil drops or other rough contamination.
- Should water hit the inner electronics, the sensors could be seriously damaged.
- Check your measurement point with the enclosed test kit.





**ATTENTION!**

**Always use the 6 mm Teflon hose adapter to connect the teflon hoses to the S 130 and to the isokinetic sampling device! You may damage the device if not used.**



Directly plugging and pulling a teflon hose more than once may lead to particle contamination which can affect the measurement. For this please use the included adapter plugs and keep them on your tubes.

## 2. Application

The S 130 is a laser particle counter which is designed to measure particle in compressed air and gases within the permissible operating parameters. For more information about these parameters, see the 4. Technical data chapter.

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

The S 130 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 and other gases.
- Easy connection through sampling hose and quick connector.
- Applicable to permanent or portable applications.
- Measures particle sizes from 0.2 ... 5.0 µm depending on the model.
- Compliance with ISO 8573-4.
- Service and alarm 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 facilitates viewing actual readings.



## 4. Technical data

### 4.1 General

<b>CE</b>	
Parameters	Particle counts per ft <sup>3</sup> , l or m <sup>3</sup> , selectable concentration µg/m <sup>3</sup>
Principle of measurement	Laser detection
Sensor	LED-laser
Measuring medium	Compressed air and gases free of corrosive, aggressive, caustic and flammable constituents
Measuring range	A: 0.3 ... 0.5 µm; > 0.5 µm B: 0.2 ... 0.3 µm; 0.3 ... 0.5 µm; 0.5 ... 1.0 µm; > 1.0 µm C: 0.5 ... 1.0 µm; 1.0 ... 3.0 µm; 3.0 ... 5.0 µm; > 5.0 µm D: 0.5 ... 5.0 µm; > 5.0 µm E: 0.3 ... 0.5 µm; 0.5 ... 1.0 µm; 1.0 ... 5.0 µm; > 5.0 µm
Flow rate	2.83 l/min
Sample rate	One sample per minute
Ambient temperature	10 °C ... 40 °C
Humidity of the measured medium	< 40% rel. humidity, no condensation
Operating pressure	0.2 ... 0.8 MPa
Housing material	PC, Al alloy
Protection class	IP65
Dimensions	See dimensional drawing on page 11.
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, 30 VDC, 200 mA

## 4.4 Accuracy

Accuracy	A: 0.3 - 50% per JIS; > 0.3 - 100 % per JIS B: 0.2 - 50% per JIS; > 0.2 - 100 % per JIS C: 0.5 - 50% per JIS; > 0.5 - 100 % per JIS D: 0.5 - 50% per JIS; > 0.5 - 100 % per JIS E: 0.3 - 50% per JIS; > 0.3 - 100 % per JIS
----------	---

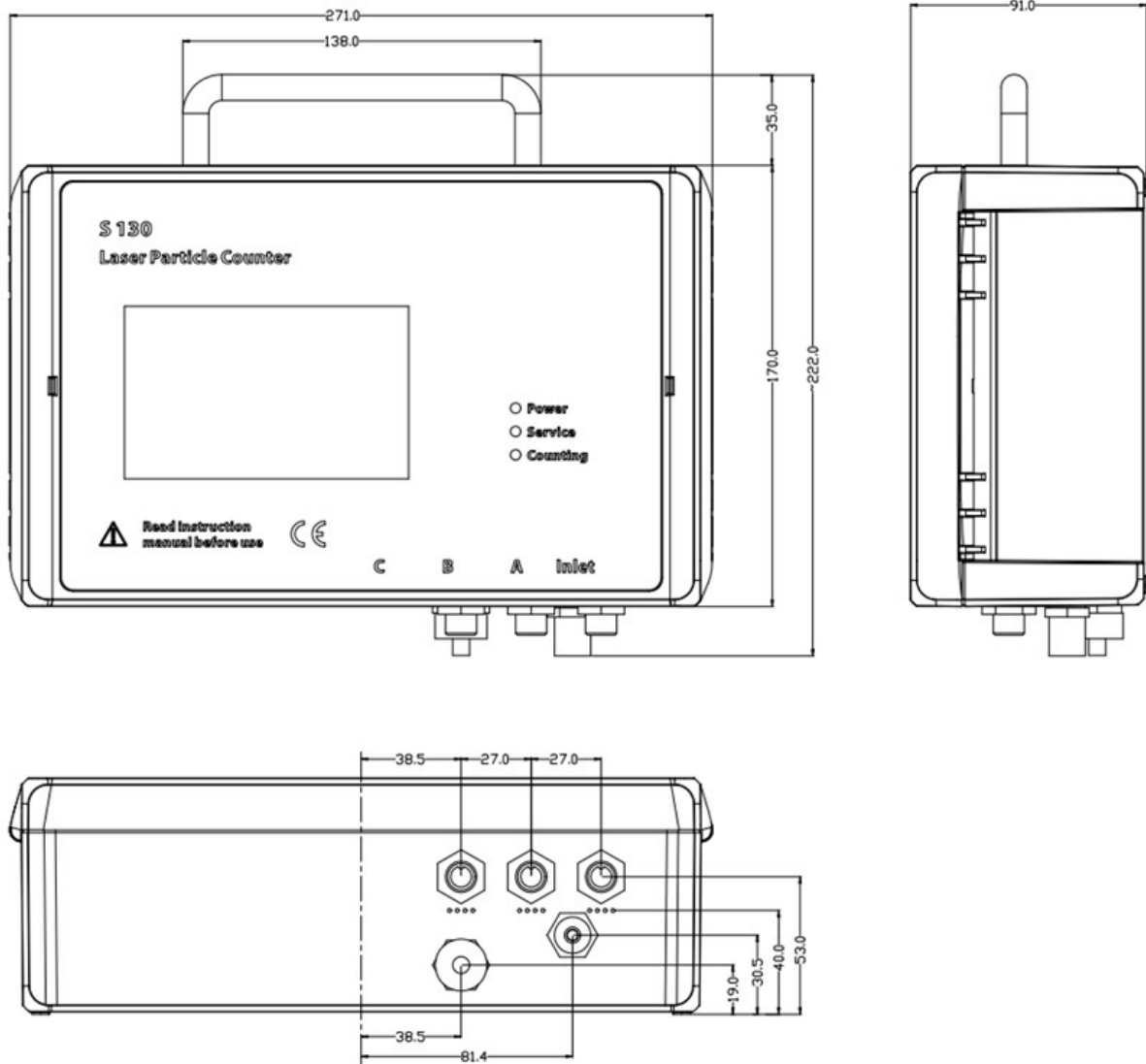
## 4.5 General Particle Counting Procedure

The S 130 does not count any particles in the first 5 minutes. During this period it performs a purge process to ensure that any remaining particles in the system are blown out.

Then in the next 30 minutes the particle counter accumulates all particles detected and classify them in the different size channels.

After that the oldest sample - one sample is the number of particles within 1 minute - is removed from the internal memory and replaced by the newest one. This guarantees a 30-minute accumulation of particles with 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	S 130 laser particle counter	S604 1300
3	M12 connectors	C219 0059
1	1.5 m teflon hose with fast connector	A554 0003
1	Integrated display and data logger 5", touch screen, with USB cable and S4A software	A1368 (option)
1	Mounting brackets	No P/N
1	Instruction manual	No P/N
1	Calibration certificate	No P/N

### 6.1 Installation requirements

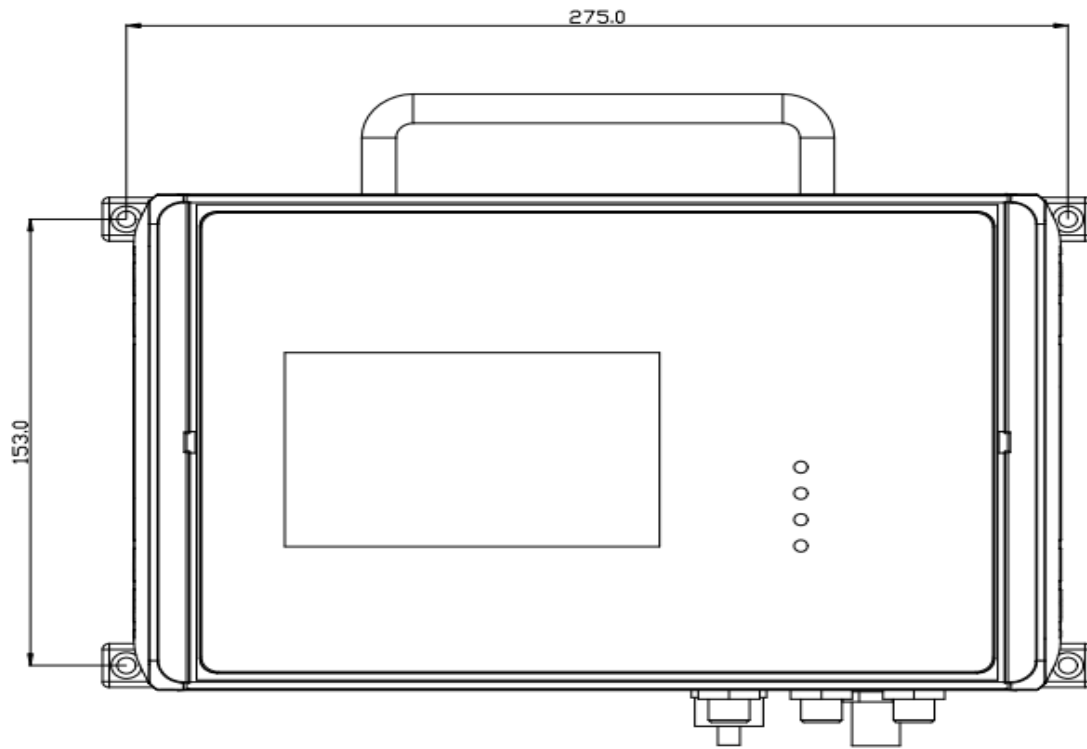
There is two versions of the S 130:

- S 130 for stationary use. The stationary version comes with four mounting brackets which can be mounted from the backside of the instrument at each corner. This allows an easy installation at a wall.
- S 130-P for portable use. The portable version comes in a transport case.

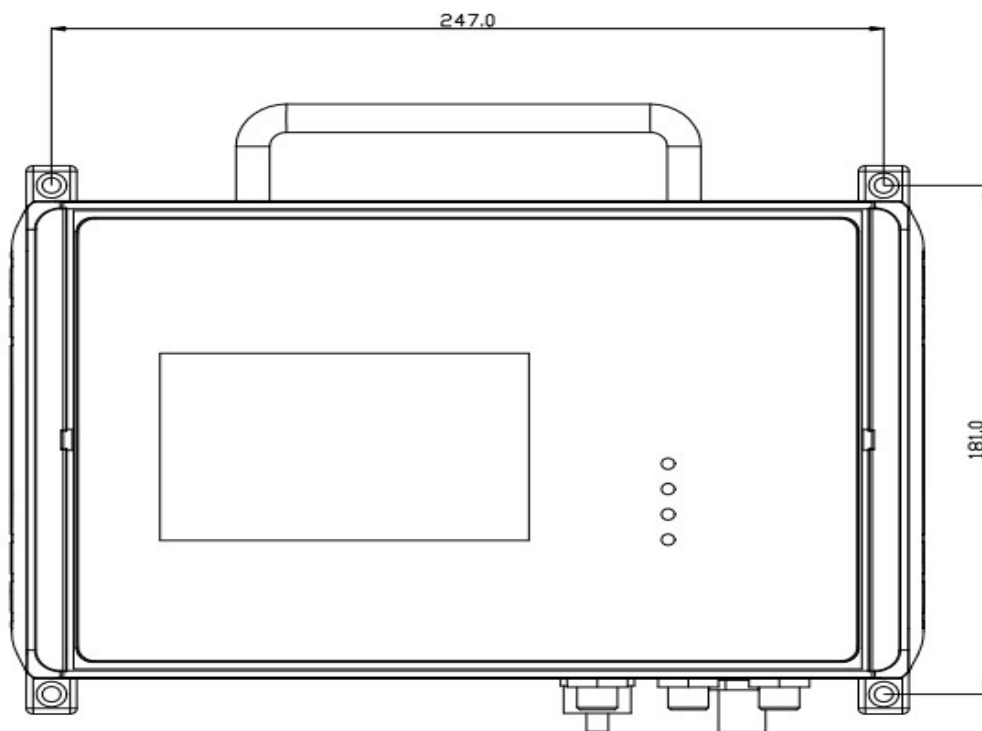
### 6.2 Wall mounting instructions

The device can be mounted on the wall using the supplied brackets. Please use one of the attached dimensions to prepare your holes.

### Method 1

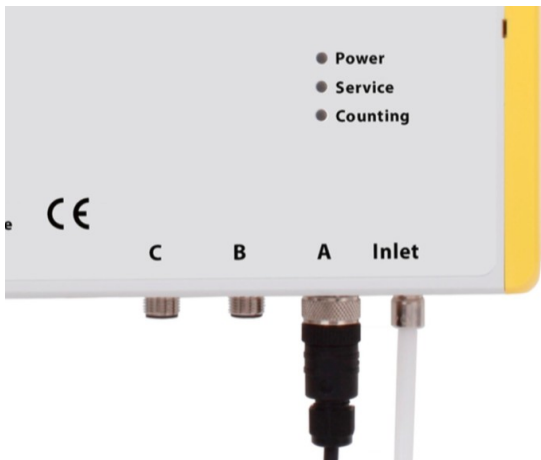


### Method 2



### 6.3 Installation procedure

The following steps explain the procedure of an appropriate installation.



1. Connect the teflon hose with the inlet of the S 130 like shown in the picture.



2. Connect the other end of the teflon hose with a quick connector. The teflon hose with quick connector is used to connect the S 130 to the process.

Please consider the following recommendations for a successful measurement result:

- All components from the sampling point to the S 130 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 (< 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!**

## 6.4 Electrical connection

### Connection to the following external display units

S 130		Colour code	S 330 / 331		S 320	
Pin	Signal		Terminal	Pin	Terminal	Pin
A.1	SDI	brown	A	1	G	6
A.2 / B.2	-V <sub>b</sub>	white		2		7
A.3 / B.3	+V <sub>b</sub>	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 <sub>b</sub>	white		2		
A.3 / B.3	+V <sub>b</sub>	blue		3		
A.4 / C.4	+D	black		4		
A.5 / C.5	-D	grey		5		
B.1	PE	brown		GND		

### Connection to third party displays and control units

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 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	Earth connection
GND	Communication ground



## 7. Configuration

The S 130 is delivered with standard ex-work configuration or with specific customer settings according to the order.

### Standard ex-work configuration

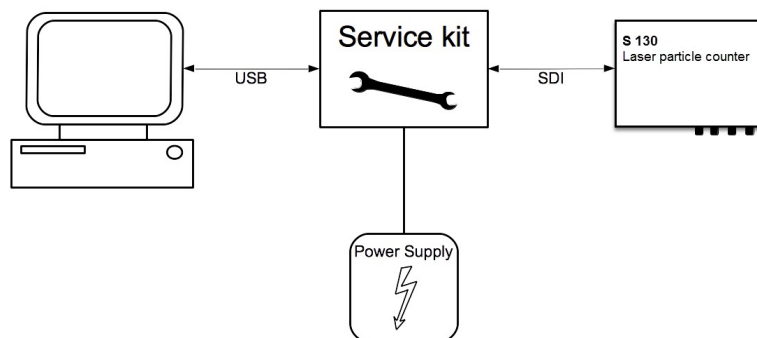
Scaling : 4 mA = 0  
 20 mA = 100000 cn/m<sup>3</sup>

Alarm : NO, 32 VDC / 200 mA

Modbus : Device address = 130  
 Baudrate = 19200  
 Framing/parity/Stop bit = 8, N, 1  
 Transmission mode = RTU

### 7.1 Configuration without a display

Other configurations as the ex-work configuration can be programmed by the service kit.



### 7.2 Configuration using an external display

Please see the instruction manual of the S 330/331.

### 7.3 Configuration using the internal display

Please see sensor settings in the next chapter.

### 7.4 Alarm settings

The alarm settings of the S 130 can be changed using the service kit and the service software for S 130.

To change the threshold values using service kit, do the following:

1. Connect the service kit to Port A of the S 130.

2. Start the service software for S 130.
3. Go to Sensor settings.
4. Change the threshold values.

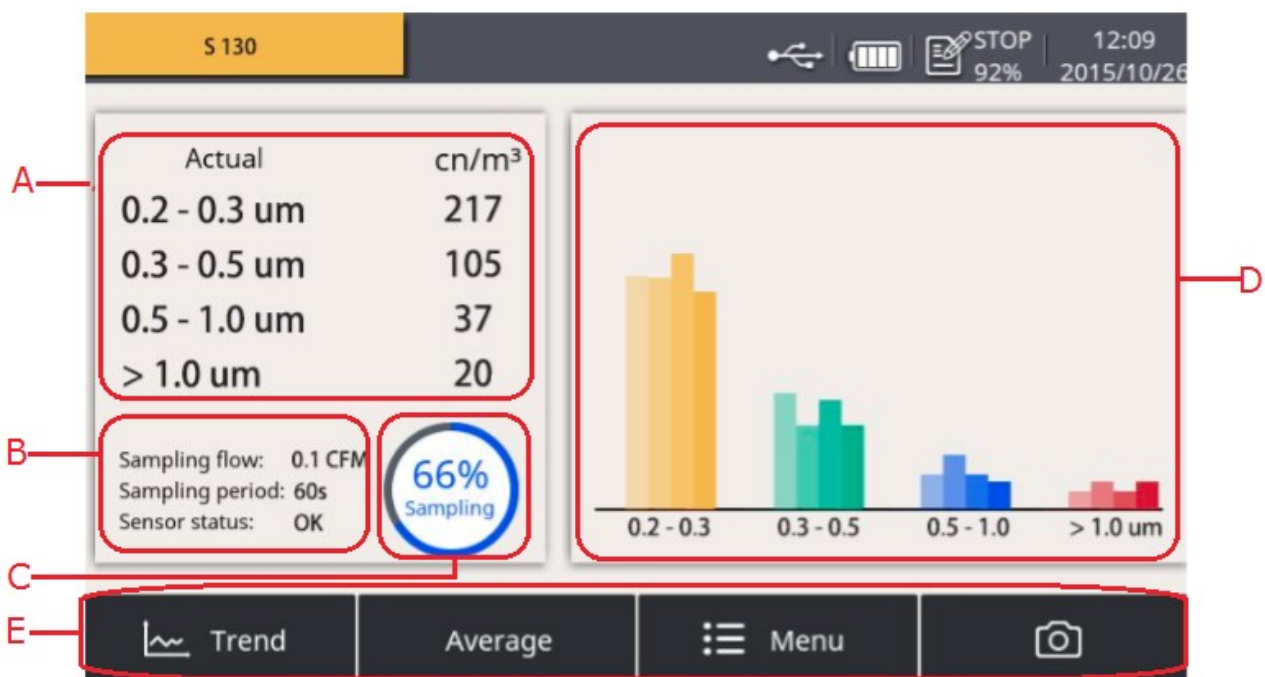
If the S 130 is equipped with the optional Display A1368, you can maintain the threshold value for each channel through the display.

If user-specific alarms are needed, especially for the version without integrated display, the alarm threshold values should be specified when the order is placed, otherwise a service kit is needed.

## 8. Operation using the internal display

### 8.1 User interface

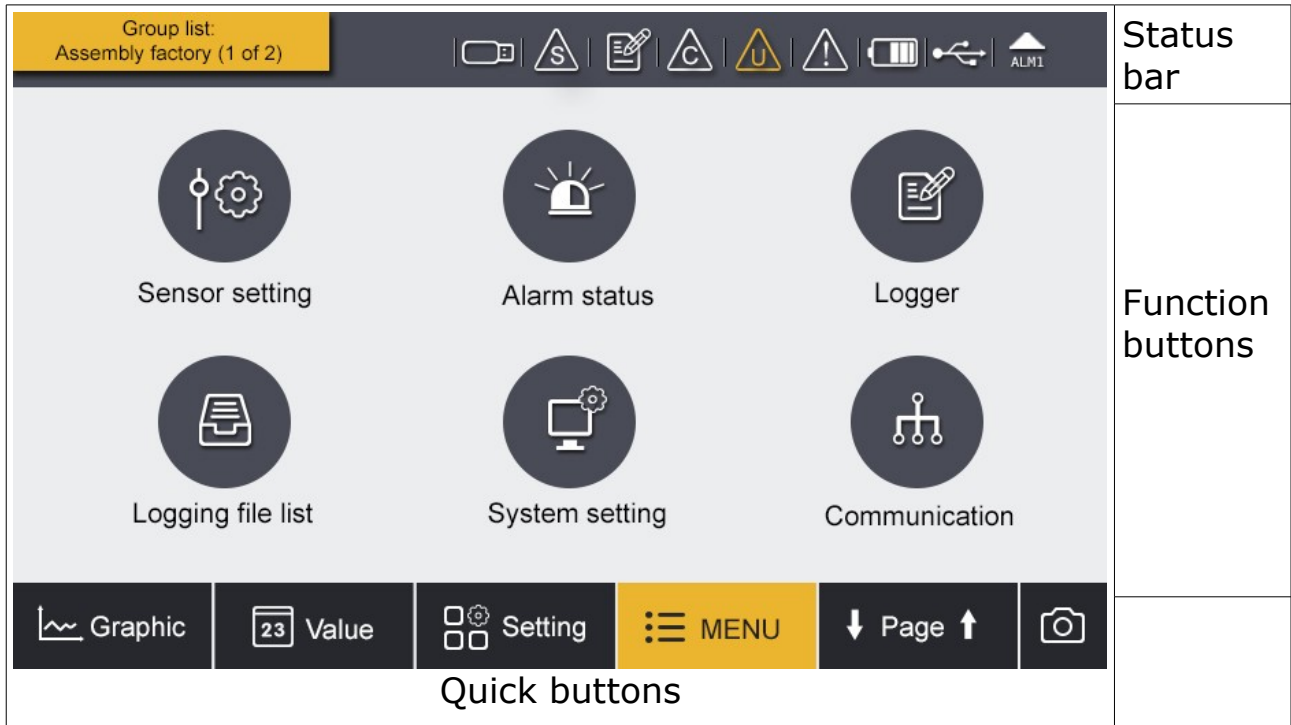
The screen below shows the user interface of the S 130.



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>Sampling period:</b> Fixed to 60 seconds</li> <li>• <b>Sensor status:</b></li> </ul>

	<ul style="list-style-type: none"> <li>○ OK: Indicates that everything is normal.</li> <li>○ Service: Indicates that a service on this product is required and you should contact the customer service.  Note: "Service" may also 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 it's recommended you operate in the specified pressure range and have sample air purged through the device for about 10 minutes. If the service indication is still shown, please contact the customer service.</li> </ul>
C	Progress indicator for the sampling or purging period. The S 130 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 4 samples of each channel in the bar graph.
E	Quick buttons and icon: <ul style="list-style-type: none"> <li>• <b>Trend</b>: Click to switch to the graphic screen displaying the 4 channels and its values in a line graph.</li> <li>• <b>Average</b>: Click to show the average of the actual values.</li> <li>• <b>Menu</b>: Click to switch to the main menu. For more information, see 8.2 Main menu.</li> <li>• <b>The screenshot icon</b>: Click to capture an image of the current screen and save it in the memory. These screenshots can be read out through the S4M software.</li> </ul>

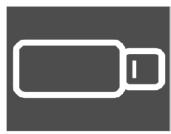
## 8.2 Main menu



The menu consists of the following sub-menus:

- Sensor settings**      Settings related to the connected sensors.
- Alarm status**        Alarm settings and status.
- Logger**                data logger settings.
- Logging file list**     All recorded files and the memory status can be checked.
- Service setting**      Many different settings are under this menu.
- Communication**      Modbus master, field bus RS-485

### 8.3 Icons in the status bar



USB stick connected



Sensor connection has changed, not matching with configuration



Logger version S 331



Sensor calibration is expired



Alarm triggered



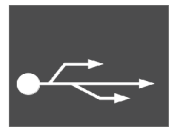
System error



Sensor unit is not matching with configuration



RTC backup battery status



USB to PC connected

### 9. LED indication 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 indication may also be activated if the air is supplied with high concentration of particles or the supply pressure is below the required minimum pressure. In such cases it's recommended you operate in the specified pressure range and have sample air purged through the device for about 10 minutes. If the service indication is still shown, please contact the customer service.

## 10. Signal outputs

### 10.1 Analog output

The S 130 has an analog output range of 4 ... 20 mA. This output is scaled to:

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

### 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	$\text{cn}/\text{m}^3$	1	FLOAT	R	8
2		Channel 2	$\text{cn}/\text{m}^3$	1	FLOAT	R	10
3		Channel 3	$\text{cn}/\text{m}^3$	1	FLOAT	R	12
4		Channel 4	$\text{cn}/\text{m}^3$	1	FLOAT	R	14
5	Weight channel	Channel 1	$\mu\text{g}/\text{m}^3$	0.001	FLOAT	R	40
6		Channel 2	$\mu\text{g}/\text{m}^3$	0.001	FLOAT	R	42
7		Channel 3	$\mu\text{g}/\text{m}^3$	0.001	FLOAT	R	44
8		Channel 4	$\mu\text{g}/\text{m}^3$	0.001	FLOAT	R	46
9	Original channel	Channel 1	$\text{Cn}/2.8$ 3 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/2.8 3l"	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<sup>3</sup>", "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  $\mu\text{g}/\text{m}^3$  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 a 60 V / 1 A rating. It is possible to monitor, for example the particle content and give an alarm at a particular value.

#### Alarm relay specifications:

Rating: 30 VDC / 200 mA  
 Power off state: NO (normally open)  
 Default threshold value: 1.0 mg/m<sup>3</sup>

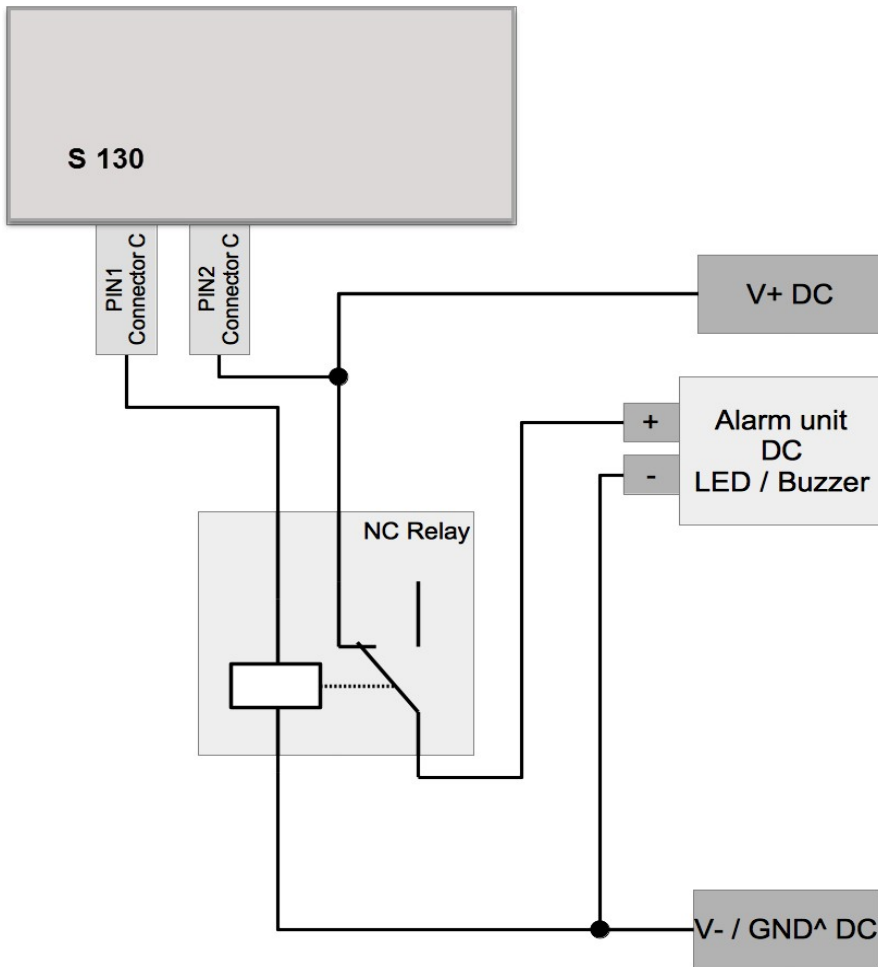
Please find the different states in the table below.

Situation	Relay state	Alarm LED
S 130 is powered off	OPEN	OFF
S 130 is powered on / no alarm value is reached	CLOSED	OFF
S 130 is powered on / alarm value is reached	OPEN	ON

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 an power loss.

To power on an external buzzer or alarm light with the device, you need to invert the signal. For this an external alarm circuit is needed in addition. Please see the example below.





## 11. Optional extra accessories

### 11.1 Sensor display (optional)

With the Sensor display it is possible to show the actual values, to change settings and it shows error messages.

### 11.2 Service kit

The diagram below shows the connection when using the optional service kit. Please ensure that also in this case the power supply of either S 130 or of the service kit is connected because the USB port is not supplying enough power.

## 12. Calibration

The sensor is calibrated ex work. 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, parameters like oil, high humidity or other impurities can affect the calibration and furthermore the accuracy. However we recommend to calibrate the instrument at least once per year. The calibration is excluded from the instruments warranty. For this 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 occurring 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.**

---

## **SUTO iTEC GmbH**

Werkstr. 2  
79426 Buggingen  
Germany

Tel: +49 (0) 7631 936889-0  
Fax: +49 (0) 7631 936889-19  
Email: [sales@suto-itec.com](mailto:sales@suto-itec.com)  
Website: <http://www.suto-itec.com>

## **SUTO iTEC Co., Ltd.**

Room 10, 6/F, Block B, Cambridge Plaza  
188 San Wan Road, Sheung Shui, N.T.  
Hong Kong

Tel: +852 2328 9782  
Fax: +852 2671 3863  
Email: [sales@suto-itec.asia](mailto:sales@suto-itec.asia)  
Website: <http://www.suto-itec.com>