

Instruction and Operation Manual

S230/S231 S230 Ex/S231 Ex

Dew Point Transmitter for Ex Applications



The Dew Point Transmitter with optional hazardous approval for applications in demanding industrial applications and hazardous environments.

Dear Customer,

Thank you for choosing our product.

The operating instructions must be observed before you start up the device. The manufacturer cannot be held liable for any damage which 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 which 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.

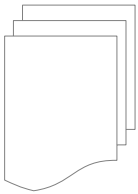
SUTO offers no guarantee for the suitability for any other purpose. SUTO is also not liable for consequential damage resulting from the delivery, capability or use of this device.

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1 Safety Instructions



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

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

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



This document contains important information for the installation and operation of the dew point transmitter in explosive environments (See chapter 8). Please read the instructions carefully and follow the instructions mentioned in this manual.

- Do not exceed the maximum permitted pressure range (see sensors label).
- The installation and the supply connection must be done in compliance with national regulations.
- The compliance with all of the technical data of the device is mandatory (see also nameplate).
- When opening the enclosure make sure that no dust or moisture enters into the casing.
- Ensure that cable entries are tightly sealed
- Materials which come in contact with the medium are of stainless steel and of sealing rubber NBR.



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 use S230 / S231 in hazardous environment without the optional hazardous approval rating.
- Do not exceed the maximum permitted pressure range.
- Only use pressure tight installation material.
- Avoid that persons get hit escaping air or bursting parts of the instrument.
- The system must not be pressurized during maintenance work.
- Consider all regulations for electrical installations.
- The system must be disconnected from any power supply during maintenance work.
- Any electrical work on the system is only allowed by authorized qualified personal.

**ATTENTION!****Permitted operating parameters!**

Observe the permitted operating parameters, any operation exceeding this parameters can lead to malfunctions and may lead to damage on the instrument or the system.

- Do not exceed the permitted operating parameters.
- Make sure the product is operated in its permitted limitations.
- Do not exceed or undercut the permitted storage and operation 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 S230 / S231 in explosive areas.
- Please observe the national regulations before/during installation and operation.
- For S230 Ex/S231 Ex:
 - Repairs of the flameproof joints may only be made by the manufacturer or on behalf of the manufacturer and on his own responsibility. Repair in compliance with the values in IEC 60079-1 is not accepted.

- The external earth connection facility shall be connected reliably.
- The equipment has been assessed with a U_m of 30V DC and shall be installed in accordance with the latest installation requirements of IEC 60079-14 for intrinsically safe equipment for EPL "Gb".
- The cable entries could be connected only with the cable gland which is HSK-M-Ex-d Series cable gland from Hummel with M16*1.5 size, Certificate number is IECEx KEM 07.0013X.
- The end user shall make sure the medium temperature range has no significant influence on the ambient temperature so that may cause a failure of explosion-proof performance of the equipment.
- The equipment must only be wiped with a damp cloth.

Remarks

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



ATTENTION!

Measurement values can be affected by malfunction!

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

Storage and transportation

- Make sure that transportation temperature of the device is between -30°C ... $+70^{\circ}\text{C}$.
- For storage and transportation it is recommended to use the packaging which comes with the device.
- Please make sure that the storage temperature of the device is between 0°C ... $+50^{\circ}\text{C}$.
- Avoid direct UV and solar radiation during storage.
- For the storage the humidity must be $<95\%$ rH, no condensation.

2 Registered Trademarks

SUTO® Registered trademark of SUTO iTEC

MODBUS® Registered trademark of the Modbus Organization,
Hopkinton, USA

3 RF Exposure Information and Statement

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.
- This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

4 Application

The S230/S231/S230 Ex/S231 Ex is a dew point transmitter which is designed to monitor the dew point in hazardous environments and industrial application within the permissible operating parameters.

The S230/S231/S230 Ex/S231 Ex measures the following values:

- Dew point of the compressed air or gas.
- Temperature of the compressed air or gas.
- Other selectable moisture units such as: relative humidity [% rH], absolute humidity [g/m³, mg/m³], humidity grade [g/kg], humidity ratio by volume [ppm_v] of the compressed air or gas.

The default factory settings are: temperature in °C and dew point in °C Td. Other units can be programmed by the service kit.

5 Features

- Double sensor technology for best accuracy over the whole range from -100°C ... +20°C Td dew point in S230 and S230 Ex
- Robust industrial design
- Outputs: 1 x 4 ... 20 mA, RS-485 (Modbus).
- IP67 casing provides robust protection in rough industrial environment
- Very fast response time ensures safe and reliable indication whenever dew points are out of valid ranges
- High accuracy

6 Technical Data

6.1 General

	
Parameters	Dew point: °C Td or °F Td Temperature: °C or °F Other moisture units: - Relative humidity [% rH] - Absolute humidity [g/m³, mg/m³] - Humidity grade [g/kg] - Humidity ratio by volume [ppm_v]
Sensor	S230/S230 Ex: QCM and polymer sensor S231/S231 Ex: Polymer sensor
Measuring range	Dew point: • S230/S230 Ex: -100°C ... +20°C Td • S231/S231 Ex: -50°C ... +20°C Td Temperature: -30 ... +70°C
Response time T ₉₀	≤ 240 sec (-20°C Td → -60°C Td) ≤ 30 sec (-60°C Td → -20°C Td)
Casing material	Process connection: stainless steel Casing: aluminium alloy
Protection class	IP67
Approvals	II 2G Ex db ib IIC T4 Gb II 2D Ex ib tb IIIC T135°C Db CE
Dimensions	See dimensional drawing on page 13.
Process connection	G ½" thread (ISO 228/1)
Weight	770 g

6.2 Electrical Data

Power supply	10 ... 30 VDC, 45 mA @ 24 VDC
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6.3 Output Signals

Analogue output	4 ... 20 mA, isolated
Analogue output scaling (default: dew point)	S230/S230 Ex: 4 mA = -100°C Td 20 mA = +20°C Td S231/S231 Ex: 4 mA = -50°C Td 20 mA = +20°C Td
RS-485	Modbus/RTU

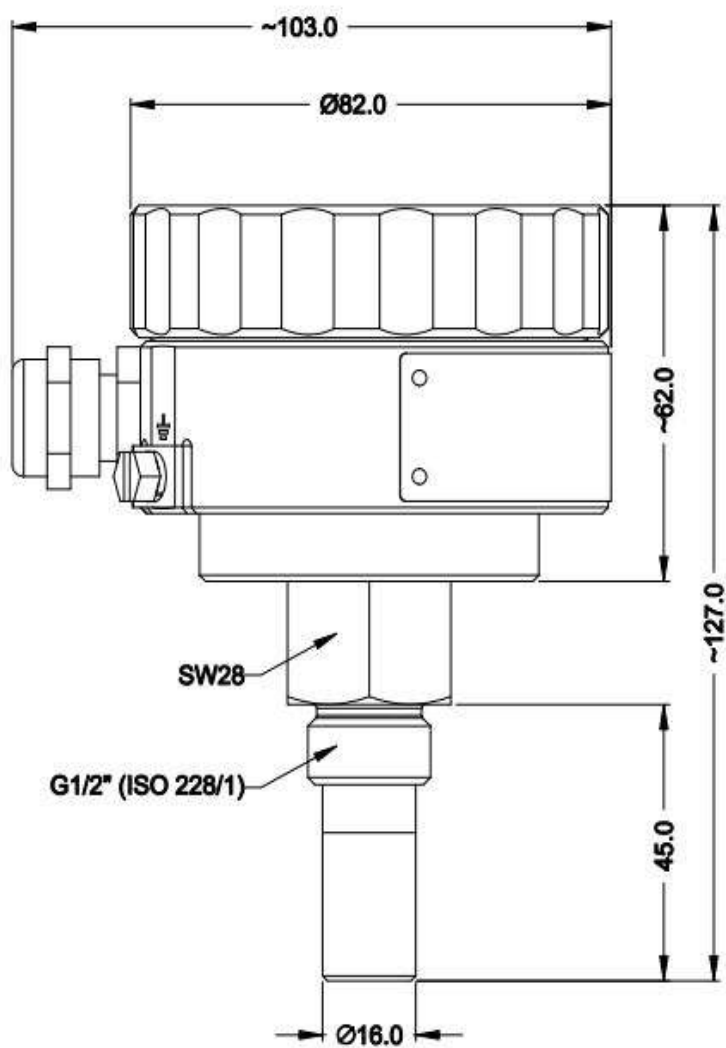
6.4 Accuracy

Accuracy	Dew point	±1°C Td (0 ... 20 °C Td) ±2°C Td (-60 ... 0 °C Td) ±3°C (-100 ... -60 °C Td)
	Temperature	0.3°C
Repeatability	±1.0°C Td	
Stated accuracy at	Ambient/process temperature: 23°C ± 3°C Ambient/process humidity <95% rH, no condensation Airflow > 2 l/min at sensor tip	

6.5 Operating conditions

Medium	Air, Argon, O ₂ , N ₂ , CO ₂
Medium quality	ISO 8573-1: 4.6.3 or better
Medium temperature	-30°C ... +70°C
Medium humidity	≤ 20 °C Td
Operating pressure	-0.1 ... 1.6 MPa(g) (S230/S230 Ex) -0.1 ... 35 MPa(g) (S231/S231 Ex)
Ambient temperature	-20°C ... +50°C
Ambient humidity	0 ... 100 % rH
Storage temperature	-20°C ... +50°C
Transport temperature	-30°C ... +70°C

7 Dimensional Drawing



8 Installation

8.1 General Installation Considerations

- The Dew Point Transmitter is only allowed to be used in the permitted temperature class.
- Cables, drain plugs, cable glands and cable entries must be suitable and certified.

8.2 Medium Temperature



ATTENTION!

The minimum temperature for compressed air or gas is -30°C .

8.3 Cable Entries

The cable glands/entries must be secured to prevent working loose and the seals must be installed immediately adjacent to the casing.

Please ensure that the cable entries and cable glands are leak-tight!

The cables used must be manufactured in a way that the build-up of electrostatic charges are avoided!

8.4 Fuse

The power supply for the transmitter needs to have a fuse with following specification:

Voltage 16 to 30 VDC, fuse 0.5 A slow blow (cutoff capacity 1500 A)

8.5 Determination of the Installation Point

In order to maintain the accuracy stated in the technical data, the device must be installed correctly. The air must flow on to the sensor tip, otherwise it will lead to wrong measurement values. For further instructions, please read the next chapter carefully.

Please consider that enough space exists at your site for a adequate installation as described in this manual.

**ATTENTION!**

Wrong measurement is possible, if the device is not installed correctly.

It is strongly recommend not to install S230/S231/S230 Ex/S231 Ex permanently in wet applications such as the compressor outlet.

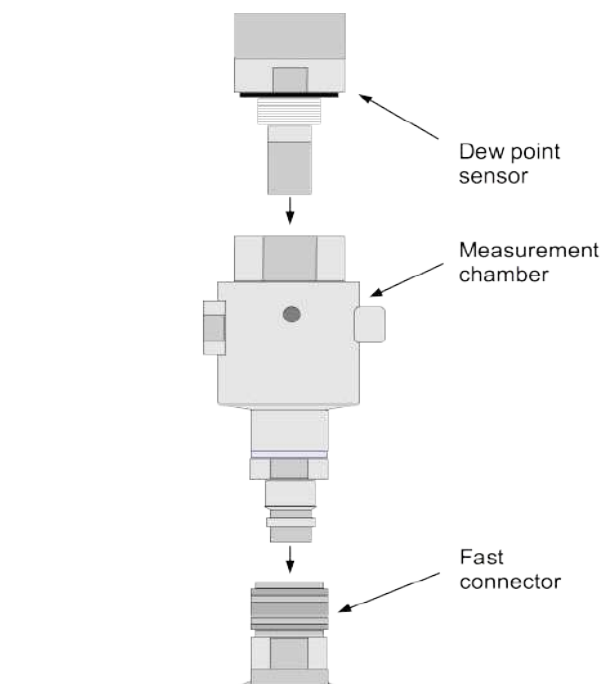
8.6 Installation Requirements

The flowing air or gas must pass the sensor tip for a proper measurement. This can be realized with a measurement chamber. For a installation without measuring chamber you need to concern the installation depth which is described in the next chapter.

8.7 Installation to Compressed Air / Gas

The following steps explain the procedure of an appropriate installation.

Install the device with measurement chamber

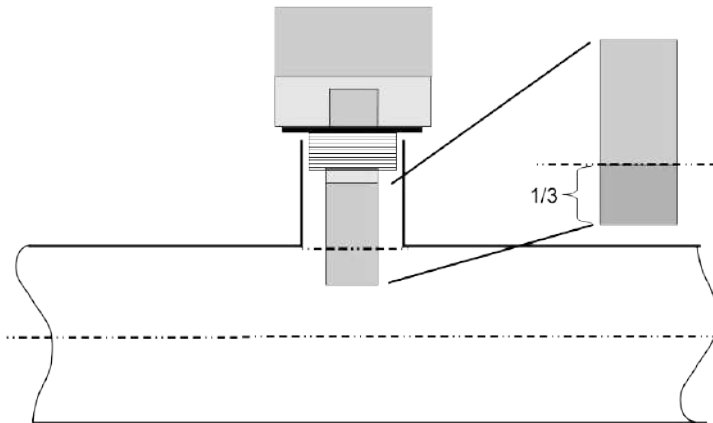


1. Connect the device with the measurement chamber.
2. Connect the device and the measurement chamber with the fast connector.

Attention:

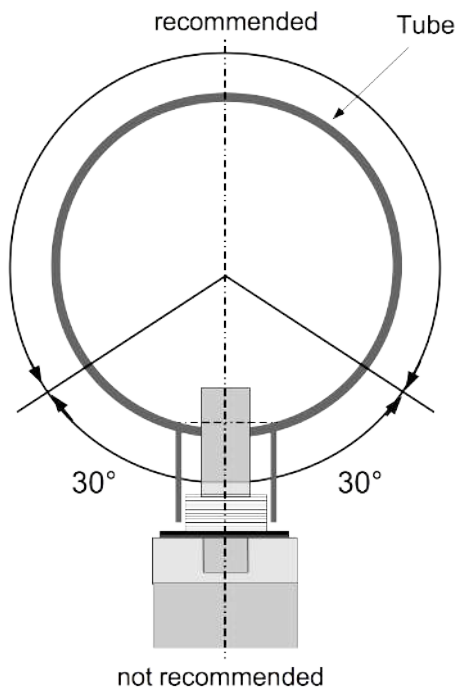
For explosive gas application, installation with measurement chamber is not allowed!

Install the device without measurement chamber



- Install the device only if the system is not pressurized.
- Not less than 1/3 of the sensor tip should be inside of the pipe. For this please check the size of the nozzle.
- The inner thread must be G 1/2".

Remarks

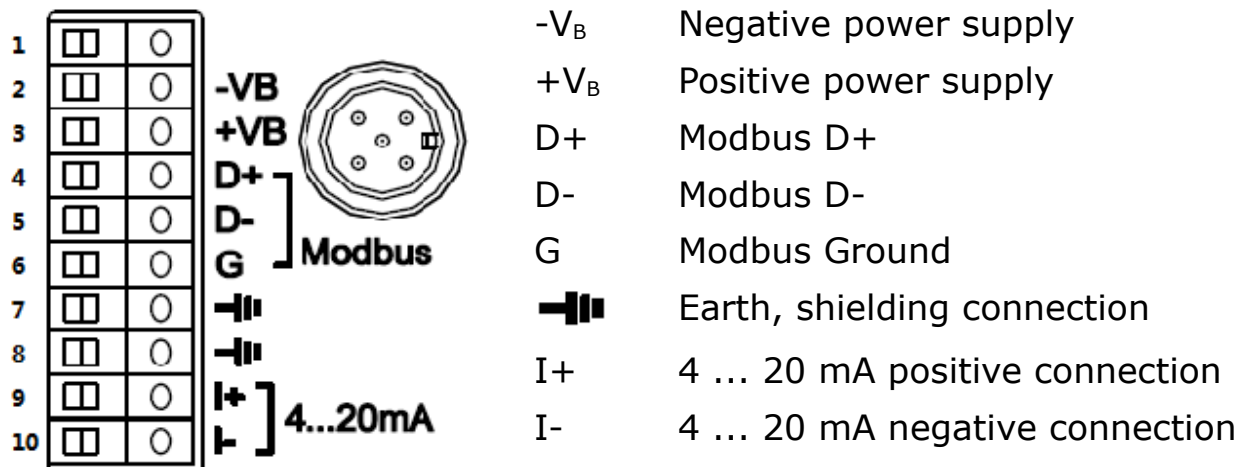


Please install the transmitter only in the recommended area as you can see in the picture. An upside down installation is not permitted. Please consider that the distance to the vertical level must be $>30^\circ$.

Removal of the device

To remove the transmitter unscrew the transmitter from the measurement chamber or from the nozzle. Please observe that the system is not pressurized when the transmitter is removed.

8.8 Electrical Connection



9 Ex Version S230 Ex/S231 Ex

9.1 Special Conditions for the Ex Version

- Ambient temperature range between -20°C and +50°C.
- Do not separate when energized.
- Do not open in hazardous area.
- Integration into the potential equalization is carried out via the installation.
- The device must only be operated with a fuse with a 1500 A cut-off capacity.
- The operating instructions must be observed.
- The intrinsically safe maximum values can be found in Section 7.3.



Special Attention!

Integration into the potential equalization is carried out via the installation.

The device must be connected to the potential equalization system.

9.2 Examination Certificates, Certificate of Conformity

The system meets the fundamental health and safety requirements for the design and construction of devices and protective systems intended for use in potentially explosive atmospheres in accordance with directive 2014/34/EU.

9.3 Intrinsic Safety Ratings and Parameters

Electrical parameters supply and signal circuit in type of protection intrinsic safety Ex ib IIC:

- Um: 30V DC
- Max Input power: 1 W
- Max available short circuit current: 1 A

9.4 Name Plates

Below are the name plates when ordered with hazardous approval.

ATEX:

Manufacturer: SUTO iTEC (China) Co.Ltd.

Address: No. 1001 Zhongshanyuan Rd., Nanshan, Shenzhen, PRC

○ ○ S230 Ex Item number : S699 0230 Serial number : 0623 XXXX Supply : 10 ... 30 VDC, 1 W Tmed : -30 ... +70°C (T4) Tamb : -20 ... +50°C Max. pressure : 1.6MPa(g) Range TD : -100 ... +20°C Td Isc. : 1 A IP67	○ ○ SUTO iTEC (China) Co. Ltd. No. 1001 Zhongshanyuan Rd., Nanshan, Shenzhen, PRC  www.suto-itec.com  II 2G Ex db ib IIC T4 Gb/ II 2D Ex ib tb IIIC T135°C Db TÜV CY 23 ATEX 0206824 X  2261 Caution! - Please read instruction manual before working on device. - Do not open when an explosive atmosphere is present. - Potential electrostatic charging hazard - see instructions.
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○ ○ S231 Ex Item number : S699 0231 Serial number : 0623 XXXX Supply : 10 ... 30 VDC, 1 W Tmed : -30 ... +70°C (T4) Tamb : -20 ... +50°C Max. pressure : 35MPa(g) Range TD : -50 ... +20°C Td Isc. : 1 A IP67	○ ○ SUTO iTEC (China) Co. Ltd. No. 1001 Zhongshanyuan Rd., Nanshan, Shenzhen, PRC  www.suto-itec.com  II 2G Ex db ib IIC T4 Gb/ II 2D Ex ib tb IIIC T135°C Db TÜV CY 23 ATEX 0206824 X  2261 Caution! - Please read instruction manual before working on device. - Do not open when an explosive atmosphere is present. - Potential electrostatic charging hazard - see instructions.
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IECEX:

Manufacturer: SUTO iTEC (China) Co.Ltd.

Address: No. 1001 Zhongshanyuan Rd., Nanshan, Shenzhen, PRC

S230 Ex Item number : S699 0230 Serial number : 0623 XXXX Supply : 10 ... 30 VDC, 1 W Tmed : -30 ... +70°C (T4) Tamb : -20 ... +50°C Max. pressure : 1.6MPa(g) Range TD : -100 ... +20°C Td Isc. : 1 A IP67	SUTO iTEC (China) Co. Ltd. No. 1001 Zhongshanyuan Rd., Nanshan, Shenzhen, PRC  www.suto-itec.com Ex db ib IIC T4 Gb/ Ex ib tb IIIC T135°C Db IECEX NEP 23.0001X  Caution! - Please read instruction manual before working on device. - The device should be opened in a non-explosive atmosphere. - Potential electrostatic charging hazard.
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S231 Ex Item number : S699 0231 Serial number : 0623 XXXX Supply : 10 ... 30 VDC, 1 W Tmed : -30 ... +70°C (T4) Tamb : -20 ... +50°C Max. pressure : 35MPa(g) Range TD : -50 ... +20°C Td Isc. : 1 A IP67	SUTO iTEC (China) Co. Ltd. No. 1001 Zhongshanyuan Rd., Nanshan, Shenzhen, PRC  www.suto-itec.com Ex db ib IIC T4 Gb/ Ex ib tb IIIC T135°C Db IECEX NEP 23.0001X  Caution! - Please read instruction manual before working on device. - The device should be opened in a non-explosive atmosphere. - Potential electrostatic charging hazard.
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9.5 Installation

9.5.1 General Installation Considerations

Cables and pipe entries must be certified (Ex d IIC) and must be suitable for operating temperatures of up to 105°C. When using pipe entries, the associated sealing equipment must be fitted directly at the housing.

9.5.2 Cable Entries

The cable glands/entries must be secured to prevent working loose and the seals must be installed immediately adjacent to the casing.

Please ensure that the cable entries and cable glands are leak-tight!

The cables used must be manufactured in a way that the build-up of electrostatic charges are avoided!

Only following cable gland is allowed to be used and can be ordered at SUTO:

	Hummel Order No.	Description	Thread size	Cable entry
Gland	1.622.1600.50	HSK-M-Ex-d/Metr	M16 x 1.5	5 ... 10 mm

Cable outer diameter must be between 5.0 ... 10 mm!

9.6 Potential Equalization

For the safety of the operation in explosive environment the potential equalization is very important. The device has a screw terminal outside the enclosure to connect the earth signal.

The device can also be integrated to the equalization through the pipeline as long the earth connection is conform to regulations.

9.7 Service Kit

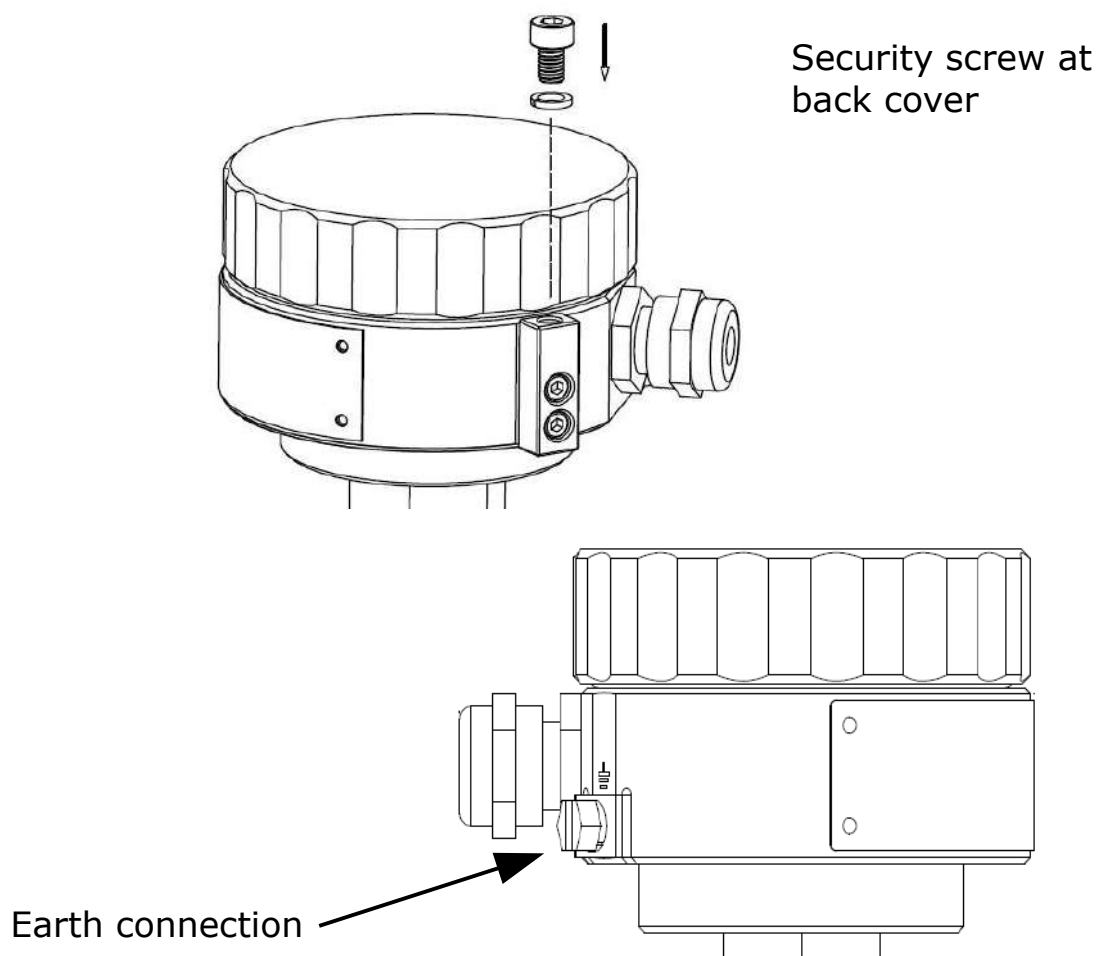
No connection of service-kit or any other devices are permitted if the atmosphere is considered to be explosive.

Alternatively device settings can be done through the Modbus interface from a remote location (non-explosive area) if the cable is installed.

Please contact our service for available devices and software.

9.8 Back Cover / Security Seal

The Back cover of the device is secured with a screw to avoid the opening of the cover by unauthorized persons. Please ensure that the security screw is tighten up after finishing the installation!



9.9 Used Standards

ATEX:

EN IEC 60079-0:2018

EN 60079-1:2014

EN 60079-11:2012

EN 60079-31:2014

IECEX:

IEC 60079-0:2017

IEC 60079-1:2014-06

IEC 60079-11:2011

IEC 60079-31:2022-01

10 Signal Outputs

10.1 Analog Output

The device has an analog output range of 4 ... 20 mA. The signal is isolated from the power supply. This output is scaled to:

	S230/S230 Ex	S231/S231 Ex
4 mA	-100°C Td	-50°C Td
20 mA	+20°C Td	+20°C Td

Ex factory the dew point signal is routed to the analogue output. However the user can choose other moisture signals to be used instead. Contact our service for assistance.

10.2 Modbus Interface

Mode	: RTU
Baud rate	: 19200
Device address	: Last two digits of the serial number
Framing / parity / stop bit	: 8, N, 1
Response time	: 1 second
Response delay	: 0 ms
Inter-frame spacing	: 7 char

Response message that the device returns to the master:

- Function code: 03

The information for the byte order is shown in the table below:

Byte Order	Sequence				Data Type
	1st	2nd	3rd	4th	
1-0-3-2	Byte 1 (MMMMMMMM*)	Byte 0 (MMMMMMMM *)	Byte 3 (SEEEEEEE)	Byte 2 (EMMMMMMM *)	FLOAT
1-0-3-2	Byte 1	Byte 0 LSB	Byte 3 MSB	Byte 2	UINT32 INT32
1-0	Byte 1 MSB	Byte 0 LSB	---	---	UINT16 INT16
1-0	Byte 1 XXX *	Byte 0 DATA	---	---	UINT8 INT8

* S: Sign, E: Exponent, M: Mantissa, XXX: no value

Explanations of MSB and LSB

MSB MSB refers to Most Significant Byte first, which follows the Big-Endian byte order.
For example, if the main system follows the MSB first order:
When the 4-byte floating number, in the order of Byte1-Byte0-Byte3-Byte2, is received from the slave (sensor), the master must change the byte order to Byte3-Byte2-Byte1-Byte0 for the correct display of the value.

LSB LSB refers to Least Significant Byte first, which follows the Little-Endian byte order.
For example, if the main system follows the LSB first order:
When the 4-byte floating number, in the order of Byte1-Byte0-Byte3-Byte2, is received from the slave (sensor), the master must change the byte order to Byte0-Byte1-Byte2-Byte3 for the correct display of the value.

Note: If your application needs other Modbus settings, please state it in the order. Modbus communication settings as well as other settings can be changed by the service App **S4C-DP** or through the windows based **Service Software**.

Available measurement channels:

Holding register	Channel description	Format
1	Temperature	FLOAT
3	Relative humidity	FLOAT
5	Reserved	FLOAT
7	Pressure dew point	FLOAT
9	Alternative measurement unit	FLOAT
41	Temperature unit	INTEGER
43	Relative humidity unit	INTEGER
45	Reserved	INTEGER
47	Pressure dew point unit	INTEGER
49	Alternative humidity unit	INTEGER

Holding register	Channel description	Format
51	Status	INTEGER

Notes:

- Data length is always 4 Byte
- FLOAT representation according to IEEE 754
- The physical units are coded according to the table below
- Status definition:

Bit2	DP over range
Bit3	Temperature over range
Bit6	Calibration overdue
Bit7	EEPROM broken
Bit8	DP sensor broken
Bit10	QCM sensor broken
Bit11	NTC broken

Unit Table

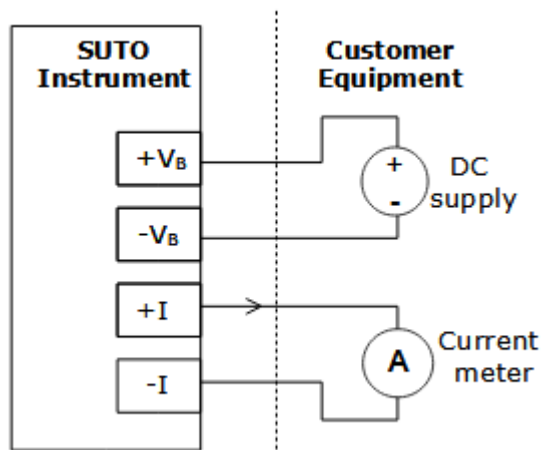
Temperature in °C	1	Absolute humidity in mg/m ³	7
Temperature in °F	2	Mixing ration in g/kg	8
Relative humidity in % rH	3	Absolute humidity in g/m ³	9
Dew point in °C Td	4	Parts per million in ppm _v	30
Dew point in °F Td	5	Atmospheric dew point in °C Td	31
Mixing ratio in mg/kg	6	Atmospheric dew point in °F Td	32

10.3 Connection between S230/S231 Outputs and Customer Equipment

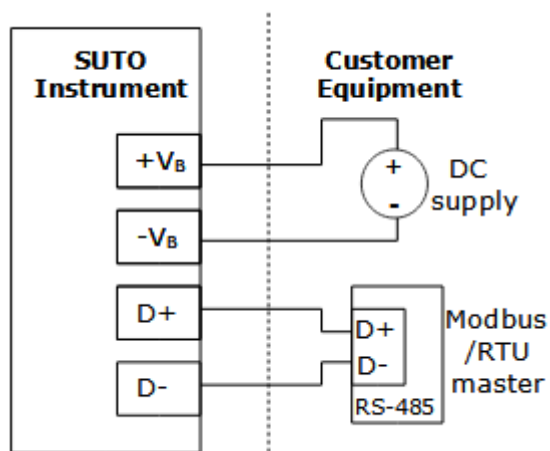
This section provides figures to show how outputs supported by the S230/S231 or S230 Ex/S231 Ex connect with the customer equipment.

In the following figures, the **SUTO Instrument** indicates the S230/S231 or S230 Ex/S231 Ex.

Isolated 4 ... 20 mA
analog output



Modbus/RTU output



11 Optional Extra Accessories

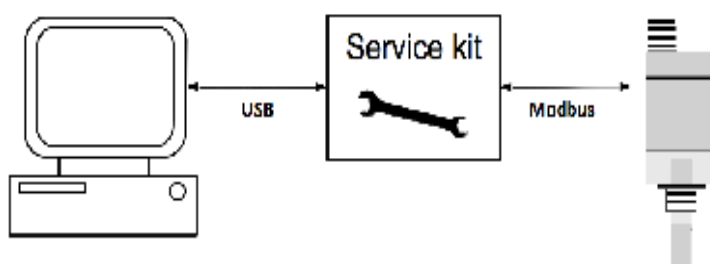
11.1 Measuring Chambers

There are different types of measuring chambers for example Measuring chamber with fast connector, by-pass-by chamber with in and out connection, measuring chamber for dryer installation or high pressure chamber. For more information please contact your retailer or the manufacturer.

11.2 Service Kit

The service kit is used to connect the device with the PC. The device parameters such as analogue output scaling, alarm values, units etc. can be easily changed by using the service kit.

The diagram below shows the connection when using the optional service kit. In case the device is connected with power supply and Modbus to a master device, **please remove the Modbus connection.** first before connecting the service kit.



12 Calibration

The instrument is calibrated ex work. The exact calibration date is printed on the certificate which is supplied together with the instrument. The accuracy of the instrument 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

Please observe from time to time the sinter cap. If it appears to be dirty, it is recommended to replace it for this please contact the manufacturer.

14 Disposal or Waste



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

The device, 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.

Jakarta

**Komplek Gading Bukit Indah Blok V No. 23
Kelapa Gading - Jakarta Utara 14240
Indonesia
Telp : +62 21 2938 2790**

Bandung

**Taman Holis Indah Blok E4 No. 21
Kel. Cigondewah Kidul Kec. Bandung Kulon
Bandung, Jawa Barat 40214
Indonesia
Telp : +62 22 2057 3429**

Solo

**Jl. Raya Solo Sragen KM.15 Dukuh Nglarangan RT.03/RW.01
Kel.Kebak, Kec. Kebakramat, Kab.Karanganyar,
Jawa Tengah 57762
Indonesia
Telp : +62 271 601 2023**

Workshop

**Pergudangan Central Cakung Business Park
Blok D No. 11 Jl. Cakung Cilincing Timur KM 3
Jakarta Utara 14140
Indonesia**