

Data sheet bluSensor® Pro

Model - Air quality - VOCs (volatile organic compounds) (BSP03AIX)

- Long-term stable sensors
- Integrated sensors:
 - VOC-Index: < +/- 15% (device-to-device variation)
 - Humidity: +/- 2% RH
 - Temperature: +/- 0.2° C
- Additional calculated values:
 - Dew point
 - Absolute humidity
- Automatic calibration by ventilation (fresh air)
- Robust housing with translucent RGB warning lights
- Wall mounting with cable feed-through 12V-24 V or as



- free-standing unit with power supply unit
- Open interface for integration into external systems
- 2.4 GHz Wi-Fi
- Bluetooth low energy
- bluSensor® AIR App 

Product Summary

The blusensor® air quality model with VOCs is specifically designed to analyse indoor air and support proper ventilation. Volatile organic compounds (VOCs) are a major cause of poor air quality. Exposure to high and/or hazardous levels of VOCs can be prevented by appropriate ventilation or by identifying and eliminating the source of pollution. Both the sensor and the VOC algorithm feature unsurpassed robustness to contaminating gases found in real-world applications. The blusensor® technology enables unique long-term stability at a competitive price, as well as low drift and variation from unit to unit. The blusensor® can be used as a stand-alone device without an app or with an app, or can be quickly integrated into existing systems thanks to its open interfaces. As soon as power is supplied to the device, it immediately measures various air quality values and flashes in different colours when limit values are exceeded. Together with the air quality sensor, a first-class humidity and temperature sensor is built in. Ambient humidity and temperature can be measured by this blusensor® without additional components. This

air quality model is unique and enables the analysis of indoor air at the highest level. Thanks to new energy standards and better insulation, houses have become increasingly energy efficient, but air quality can quickly deteriorate. Active ventilation is necessary to maintain a comfortable and healthy indoor climate and improve the well-being and productivity of residents, staff, students, children and patients. Indoor air pollutants can affect health, concentration and well-being to varying degrees when people are indoors. This sensor solution from blusensor® offers the best possible and stable monitoring of air quality. With the blusensor® app, predefined limit values and alarms can be individually configured via a Bluetooth connection and detailed values of the device can be queried. values of the device can be queried. As soon as Wi-Fi is activated on the device, it can also be queried remotely, configured and waded (e.g. software updates). updates). This IoT-enabled device was developed in compliance with the highest and most modern security standards and is protected from hacker access by a 3-stage security system.

Advantages of the blusensor®-technology

- Proper ventilation made easy
- Best price - performance ratio
- Wide range of applications
- Complies with the funding conditions of Salzburg
- Regional product
- 100% Made in Austria

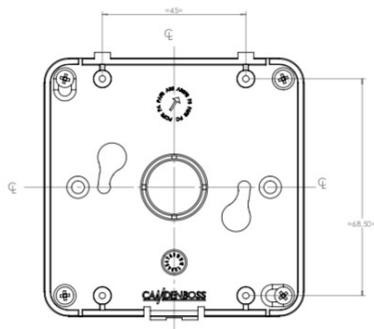
Data sheet bluSensor® Pro

Model - Air quality - VOCs (volatile organic compounds) (BSP03AIX)



- Can be operated with user-friendly blusensor® AIR app 
- Can also be used without app (device flashes in different colors when limit values are exceeded)
- Translucent housing for integrated, multi-color warning light (RGB)
- Power supply by 12/24V DC plug-in power supply unit (continuous operation) or intergrated terminal strip
- Use of long-term stable and calibrated sensors
- Dual radio (Bluetooth and Wi-Fi)
- Robust housing for wall mounting
- Dimension 86 x 86 x 25.5 mm

Model BSP03AIX	Functions
Bluetooth 4.2 (coming soon 5.0)	x
Wi-Fi 2.4 GHz	x
Integrated red warning light	x
Power supply	power supply unit or 12-24 V rail
Integrated Sensors	
Air quality index (VOCs)	x
Relative humidity	x
Temperature	x
Dew point	x
Absolute humidity	x
Data Memory on the Device	
2 Megabyte (MB)	Option



Especially for buildings:

- Wall mounting with a variety of sensors
- Possibility of cable grommet at the back for cables for:
 - Rail for 12-24 volt power supply on the printed circuit board
 - Potential-free outputs on the printed circuit board for external controls e.g. zone valves (optional)
- Wi-Fi data transmission with MQTT interface for Modbus TCP/IP connection (see gateway)
- Also suitable for mounting on flush-mounted boxes

Temperature
Humidity
Air quality index for VOCs

valid for:
 Model - Air quality - VOCs (volatile organic compounds) (BSP03AIX)

Important !
 Please store properly and do not let it condense !

The temperature should be in the range of 10°C - 30°C and 20% - 60% relative humidity. It is recommended to put the sensors into operation within 1 year from the date of delivery.

Recommended storage conditions

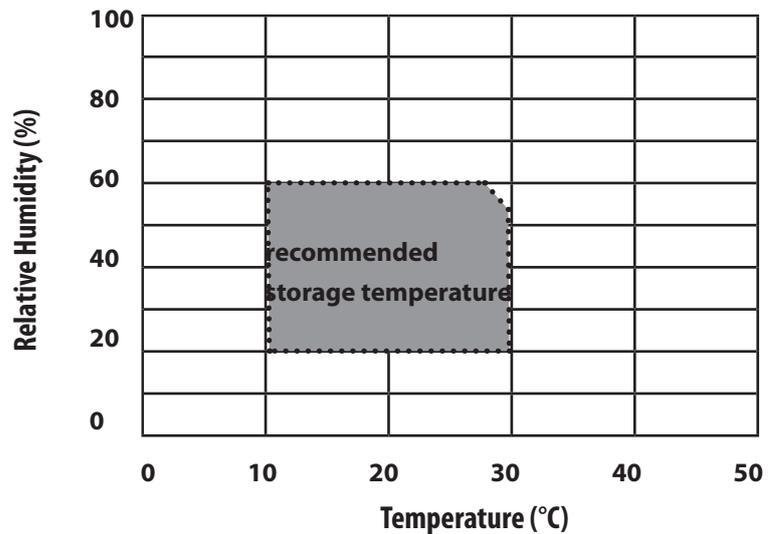


Figure Recommended humidity and temperature for sensor storage.

Recommended operating conditions

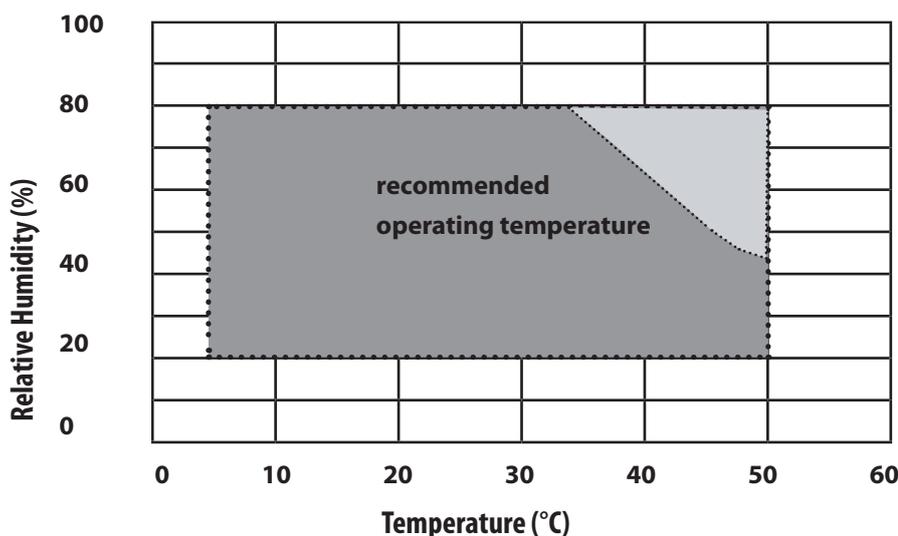


Figure Recommended humidity and temperature for sensor operation.

The sensor works best when operated within the recommended normal temperature and humidity range of 5 - 50 °C and 20 - 80 % RH, respectively. Prolonged exposure to conditions outside the normal range, especially high humidity, may cause a temporary shift in the RH signal (e.g. +3 % RH after 60 hours at >80 % RH). After returning to the normal temperature and humidity range, the sensor slowly returns to its calibration state by itself. Prolonged exposure to extreme conditions may accelerate aging. The sensor must not be exposed towards condensing conditions (i.g. >90% relative humidity) at any time.

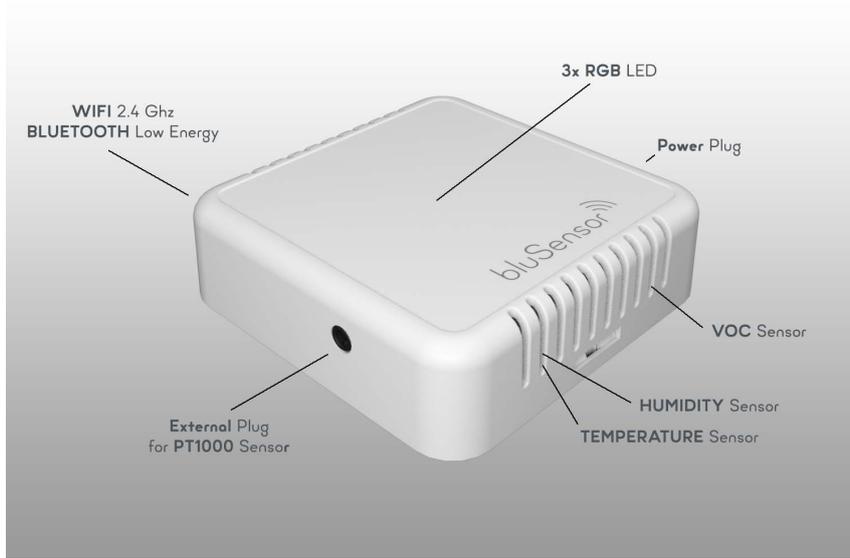
Data sheet bluSensor® Integrated Sensor Technology



valid for:

Model - Air quality - VOCs (volatile organic compounds (BSP03AIX)

Temperature
Humidity
Air quality index for VOCs



Optimal position

To achieve the most accurate measurement results, the environment in which the sensor is positioned must also be taken into consideration. Please note that in one room the air quality can differ. Next to the window is the freshest air, while in corners or niches it is much worse. Position the sensor where you spend the most time. Please also take into consideration that when you ventilate in places that are not easily accessible, the fresh air will be distributed later. The optimum height is usually about 1.5 m (59 inches).



Warning lights

You can define limit values for all integrated sensors. If these are exceeded or undershot, up to three warning light starts to flash. If no warning light is illuminated, either no limit values have been exceeded or no alarms (on the device) have been activated.

Temperature
Humidity
Air quality index for VOCs

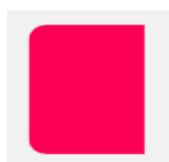


Warning lights

You can define limit values for all integrated sensors. If these are exceeded or undershot, up to three warning light starts to flash. If no warning light is illuminated, either no limit values have been exceeded or no alarms (on the device) have been activated.

Colour chart:

By means of the color you can recognize which limit value has been exceeded. The factory setting for the limit value definition is as follows:



too bad air
 preset limit values
 > 200 Air quality index (VOCs)

Display in App	VOC
Excellent	0 - 99
Good	100 - 199
Moderate	200 - 349
Poor	350 - 449
Unhealthy	>=450

If the air quality in terms of VOCs does not exceed either of the defined limits, two more values, temperature and humidity, are analyzed.



too wet or too warm
 preset limit value:
 > 75 % relative humidity or > 35°C temperature

too cold or too dry:
 preset limit value
 < 10 °C temperature oder < 25% relative humidity

The preset limit values can be changed at any time in the bluSensor® app.

No warning light
= no limit value exceeded !
 (or no alarms activated on the device)

Temperature
Humidity

valid for:

Model - Humidity and Temperature Data Logger (BSP01AIR)

Model - Humidity and Temperature Monitoring (BSP02AIR)

Model - Air Quality Sensor Smart Home (BSP02AIQ)

Model - Air quality - VOCs (volatile organic compounds) (BSP03AIX)

Model - Air quality - CO2 and VOCs (volatile organic compounds) (BSP03AIXC)

Model - Hygiene monitor for commercial kitchens - Warning light (BSP03TEM)

Value ranges, resolution and time response

Parameter	Value	Value range
Specified area	Temperature	-35°C to +75°C
	Humidity	0 % to 99 % rF
Resolution	Temperature	0,1°C
	Humidity	0,1% rF
Response time ³	Temperature	<5 to 30 seconds (τ 63%)
	Humidity ¹	8 seconds (τ 63%)
Sampling rate	Temperature	1 Hz
	Humidity	1 Hz

Table Value ranges and resolution for integrated sensors (temperature, humidity)

1 Time for reaching 63% of a humidity jump function, valid at 25°C and 1 m/s air flow. The humidity response time in the application depends on the sensor design.

2 Typical value for operation in normal humidity/temperature operating range. Max. value is < 0.5% rel. humidity per year. Value may be higher in environments with evaporated solvents, out-gassing tapes, adhesives, packaging materials, etc.

3 If, at a customer's request, a protective membran has also been integrated in the housing, the response time may be slower, since the penetration of air through the protective membran also requires a certain amount of time.

No recalibration necessary !

No calibration required for the temperature and humidity sensor

Each integrated temperature and humidity sensor has been individually tested and calibrated by our sensor supplier. For calibration, the supplier uses transfer standards that are subjected to a scheduled calibration procedure. The calibration of the reference, used to calibrate the transfer standards, is NIST traceable by an ISO/IEC 17025 accredited laboratory. The sensors are stable over time and do not require recalibration when properly used.

Ventilate extensively !
Good for you and good for the sensor !

Value ranges, resolution and time response

The maximum possible and worst index is 500. The best air quality index is 1.

Parameter	Condition	Value range ¹
Measurement range		1 to 500 index points
Resolution		1 index points
Device-to-device variation		< ± 15 index points
Repeatability ²	Changing concentration from 5 to 10 ppm of ethanol at sampling interval 1 s	< 30 s
Response time		<5 to 30 seconds (τ 63%)
Sampling rate		1 Hz
Switch-on time until first measurement result		< 60 seconds

Table Gas sensing specifications at 25 °C and 50 % RH in zero air (considered as clean air for indoor air quality applications)

¹ 99 % of the sensors will be within the minimum–maximum tolerance. Typical tolerance refers to the mean of the distribution for ≥ 100 sensors.

² Evaluated using the calibration and test sequence according to the application note SGP40 – Testing Guide of Sensirion

Automatic calibration by ventilation (fresh air)

Each integrated sensor has been tested and calibrated by our sensor supplier. The VOC algorithm automatically adapts to the environment to which the sensor is exposed.

valid for:

Model - Humidity and Temperature Data Logger (BSP01AIR)

Model - Humidity and Temperature Monitoring (BSP02AIR)

Model - Air Quality Sensor Smart Home (BSP02AIQ)

Model - Proper ventilation in school classrooms - Warning light (traffic light)(BSP03AIX)

Model - CO2 monitor for ventilation systems - warning light (traffic light) (BSP03AIXC)

Model - Hygiene monitor for commercial kitchens - Warning light (BSP03TEM)

Temperature
Humidity

• **Gas measurement performance of the integrated sensor system:**

Temperature, Humidity

typ.: +/-0,2 °C für temperature und +/- 2% RH for humidity

typ.: < 0,02 °C derivation for temperature und 0,25% for humidity per year (log-term drift)

Integrated algorithm for the conversion of dew point, absolute humidity, water vapor partial pressure

The specifications listed apply to the individual components integrated by us and may deviate minimally in our finished housing variants.

Gas measurement performance of the integrated sensors (temperature, humidity)

We only integrate electronic components that meet our quality criteria. The temperature and humidity sensors we integrate are used by suppliers who perform their tests based on the JEDEC JESD47 qualification test method. The Moisture Sensitivity Level classification of the integrated air quality sensors is MSL1, according to IPC/JEDEC J-STD-020. Each integrated temperature, humidity sensor has been individually tested and calibrated by our supplier. For calibration, the supplier uses transfer standards that are subjected to a scheduled calibration procedure. The calibration of the reference, used to calibrate the transfer standards, is NIST traceable by an ISO/IEC 17025 accredited laboratory. The following section discusses the measurement accuracy of the integrated sensor system. The specifications listed apply to the individual components integrated by us.

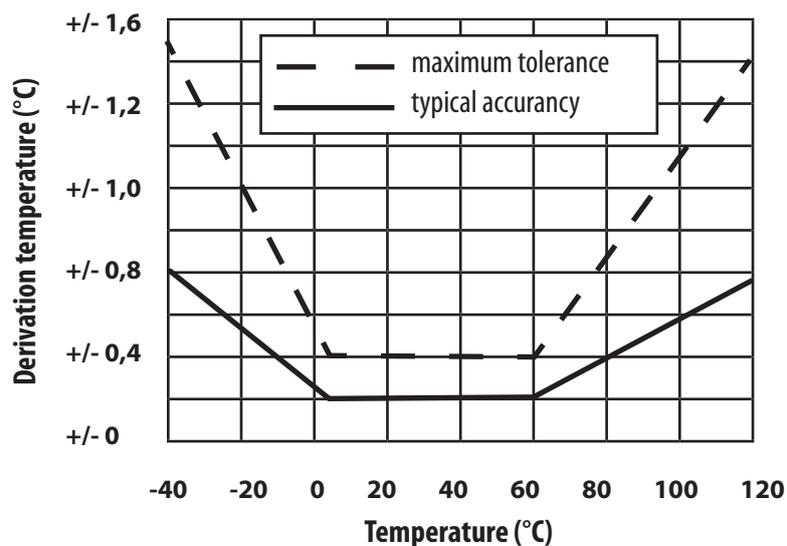


Figure Typical and maximum tolerance in the accuracy of an integrated temperature sensor.

Temperature
Humidity

valid for:

Model - Humidity and Temperature Data Logger (BSP01AIR)

Model - Humidity and Temperature Monitoring (BSP02AIR)

Model - Air Quality Sensor Smart Home (BSP02AIQ)

Model - Proper ventilation in school classrooms - Warning light (traffic light)(BSP03AIX)

Model - CO2 monitor for ventilation systems - warning light (traffic light) (BSP03AIXC)

Model - Hygiene monitor for commercial kitchens - Warning light (BSP03TEM)

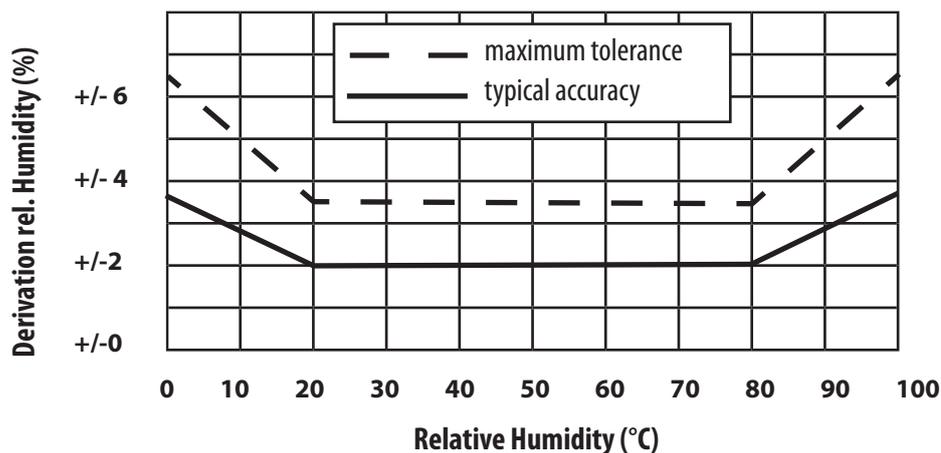


Figure Typical and maximum tolerance in accuracy of an integrated humidity sensor at 25°C.

Accuracy of humidity at different temperatures

The typical accuracy of humidity at 25°C is defined in the previous table. For other temperatures a typical accuracy was determined, which is shown in the following table. The figure refers to the integrated sensor technology and its specification.

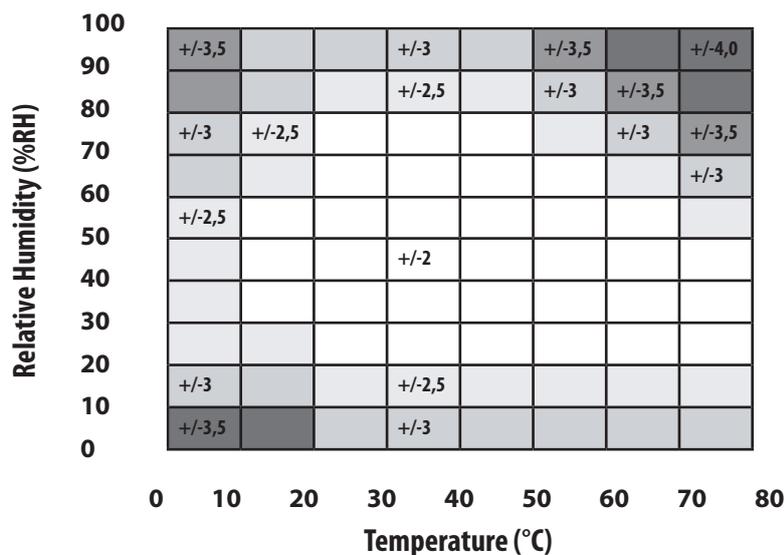


Figure Typical accuracy of relative humidity measurement of integrated sensor in %RH at temperatures from 0°C to 80°C.

Air quality index (VOCs)

- Gas measurement performance of the integrated sensor technology:**

VOC-Index:

MOx based gas sensor for indoor air quality application

Measurement method based on ethanol ¹

typ.: < +/- 15 index point device-to-device variation

Integrated algorithm for the conversion of

ethanol to air quality values such as VOC-Index

¹ The integrated chip provides a digital raw signal of ethanol which is sensitive to most VOC gases typically present in indoor environments and which is proportional to the logarithm of the resistance of the sensing material. This signal is intended for further processing by an algorithm providing quantitative information about the VOC based indoor air quality. For this purpose we implemented a robust VOC algorithm from the chip provider. The algorithm maps all VOC and fresh air events to a VOC Index scale. For the specifications given below, ethanol in clean air has been used as proxy gas for typical indoor air events.

The specifications listed apply to the individual components integrated by us and may deviate minimally in our finished housing variants.

Gas measurement performance of the integrated sensors (VOC-Index)

We only integrate electronic components that meet our quality criteria. The air quality sensors we integrate are used from suppliers who perform their tests based various test methods. In the following section, we will discuss the measurement accuracy of the integrated sensor technology.

Parameter	Condition	Value range ¹
Measurement range	VOC-Index	1 to 500 index points
	Ethanol in clear air	0 -1'000 ppm
Specified range	Ethanol in clear air	0.3 - 30 ppm
Limit of detection	Ethanol in specified range	< 0.05 ppm
Device-to-device variation		< ± 15 index points
Repeatability ²	Changing concentration from 5 to 10 ppm of ethanol at sampling interval 1 s	< 30 s

Table Gas sensing specifications at 25 °C and 50 % RH in zero air (considered as clean air for indoor air quality applications)

¹ 99 % of the sensors will be within the minimum–maximum tolerance. Typical tolerance refers to the mean of the distribution for ≥100 sensors.

² Evaluated using the calibration and test sequence according to the application note SGP40 – Testing Guide of Sensirion

Air quality index (VOCs)

Typical response

of raw signal to various VOCs as a function of their concentrations in otherwise clean air.

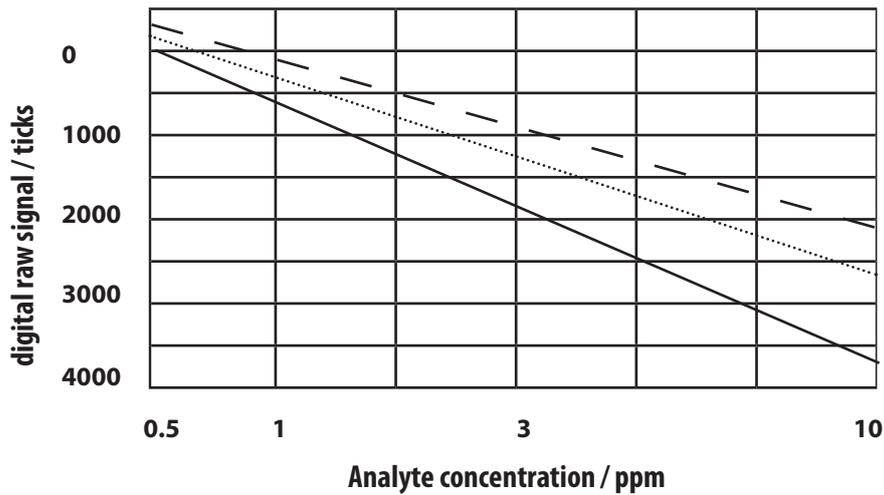


Figure Typical sensor response to various VOCs normalized to 500 ppb of ethanol. ISO 2-gas mix according to ISO16000-29 is composed of n-octane and m-xylene in a molar ratio of 53:47. Data were recorded at 25 °C and 50 % RH.

Data sheet bluSensor® - all Models

General Information



Time specifications

For the use of the sensor you have to consider certain time factors. These can be found in the table below.

Parameter	Value
Switch-on time until ready for operation	10 seconds
Active Bluetooth connection	1 Hz (update rate)
Passive Bluetooth connection	10 seconds
Wi-Fi connection	10 minutes (default update rate)
Alarms (soon available)	1x immediately in the event of a limit being exceeded 1x as soon as normal range is reached again

Table Time specifications / general and for integrated sensor technology

Absolute minimum and maximum values

Loads exceeding the values shown in the table below may cause permanent damage to the device. These are load values for electrical components. The function of the device under these conditions cannot be guaranteed. Exposing the device to maximum values over a longer period of time may affect the reliability of your device.

Parameter	Wert
Supply voltage for models with battery	3 V
Supply voltage for models with USB	5 V
Supply voltage for models with power supply unit	12-24 V
Supply voltage for models with terminal strip	12-24 V
Temperature range storage	according to integrated sensor specifications
Temperature range operation	according to integrated sensor specifications
Humidity range	according to integrated sensor specifications

Table Absolute minimum and maximum values.

Data sheet bluSensor® - all Models

General Information

Handling instructions

Humidity, temperature and air quality sensors are highly accurate environmental sensors. Please follow the guidelines below carefully to ensure that you benefit from the excellent performance of the sensor.

Exposure to chemicals

The sensor must **not come into close contact with volatile chemicals** such as solvents or other organic compounds. In particular, high concentrations and long exposure must be avoided. Ketene, acetone, ethanol, isopropyl alcohol, toluene, etc. are known to cause moisture measurement drift - irreversible in most cases. Please note that such chemicals are integral components of epoxies, glues, adhesives, etc. and outgas during baking and curing. These chemicals are also added as plasticizers in plastics used for packaging materials and outgas for some time.

Acids and bases can irreversibly attack the sensor and must be avoided: HCl, H₂SO₄, HNO₃, NH₃ etc. Ozone in high concentration or H₂O₂ also have the same effect and should be avoided. Please note that the above examples are not a complete list of pollutants.

The sensor must **not come into contact with cleaning agents** or strong air blasts from an air gun (non-oil-free air). Exposure of the sensor to cleaning agents may cause drift of the measured value or complete failure of the sensor.

Ensure **good ventilation (fresh air supply)** to avoid high concentrations of volatile chemicals (solvents, e.g. ethanol, isopropanol, methanol, acetone, cleaning solutions, detergents...).

Important !
Protect your Sensor !

Use and installation

Do not apply mechanical force to any part of the sensor during mounting and operation. Prevent dust or particles from entering the sensor opening (sensor performance may be affected). For use in corrosive environments - such as condensation or corrosive gases - it may be necessary to protect the electronics of the sensor with a passivation. Please contact the support for this (support@blusensor.com). Such a passivation can be achieved by a conformal coating, by applying special agents to the sensor or by integrating a membrane in the housing.

Data sheet bluSensor® - all Models

General Information

Packing

We recommend storing the devices in metallic, antistatically shielded ESD bags. In particular, it is recommended not to reseal the ESD bags with adhesive or adhesive tapes after opening. Sensors must not be packed in outgassing plastics that could cause contamination of the sensor. In addition to antistatically shielded metal ESD bags, paper or cardboard-based packaging, thermoformed plastic trays (PE, PET, PP) can also be considered. Do not use polyethylene anti-static bags (light blue, pink or rose); be very careful with bubble wrap and foam. Pay attention to stickers that are inside the packaging. Sticker size should be kept to a minimum, and the sticky side must adhere completely to a surface. Note that many packaging materials may have additives (plasticizers) that can have an environmentally harmful effect on the sensor. As a general rule, if a material gives off a strong odor, do not use it. Even materials listed for recommended use may have additives. For high safety, device housings and shipping packages must be qualified.

Such a qualification test may involve exposing the device in the shipping package to a temperature $\geq 65^{\circ}\text{C}$ for at least 168 hours. (If shipping or storage conditions are expected to be harsh, the qualification test conditions must be adjusted for the packaging material.) The sensor reading must then show no changed deviation from a reference compared to the same measurements before exposure.

Do not use polyethylene antistatic bags (light blue, pink or rose colored). Do not use adhesive tapes in the packaging.

Ordering information

When ordering the air quality sensor, use the product names listed in the table. For current product information and distributors, visit www.blusensor.com.

bluSensor Mini		quantity	EAN-number
Model Beacon	(BSP01BE)		
Model Humidity and Temperature Data Logger	(BSP01AIR)		0742832891417
Model Humidity and Temperature Monitoring	(BSP02AIR)		0742832891431
Model Air Quality Sensor Smart Home	(BSP02AIQ)		0742832891424
Model Usage Counter	(BSP02COUNT)		
Model Motion	(BSP02MOTION)		
bluSensor Pro		quantity	EAN-number
Model Air quality - VOCs (volatile organic compounds)	(BSP03AIX)		0742832891448
Model Air quality - CO2 and VOCs (volatile organic compounds)	(BSP03AIXC)		0742832891455
Model Air quality - Particulate Matter Sensor	(BSP03PM)		0742832891462
Model Temperature Monitoring	(BSP03TEM)		
Model Relay control	(BSP03RELAY)		

Data sheet bluSensor® - all Models

General Information

Revision History

Datum	Version	Seite	Änderungen
February 2021	1.0	-	-
May 2021	2.0	all	Particulate matter sensor
November 2021	3.0	all	VOC and CO2 sensor

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Warning, personal injury

Do not use this product as a safety or emergency stop switch or in any other application where failure of the product could result in injury. Do not use this product for applications other than those for which it is intended and approved. Before installing, handling, using or servicing this product, please read the data sheet and application instructions. Failure to follow these instructions could result in death or serious injury.

If purchaser purchases or uses bluSensor® products for an unintended or unauthorized use, purchaser shall indemnify and hold harmless ALMENDO and its officers, employees, subsidiaries, affiliates and distributors from and against all claims, costs, damages and expenses, and reasonable attorneys' fees, arising directly or indirectly from any claim of personal injury or death in connection with such unintended or unauthorized use, even if ALMENDO is alleged to be negligent in the design or manufacture of the product.

ESD precautions

The device is sensitive to electrostatic discharge (ESD). To avoid ESD-induced damage and/or impairment, take the usual and legally prescribed ESD precautions when handling this product.

Warranty

ALMENDO warrants exclusively to the original purchaser of this product, for a period of 24 months (two years) from the date of delivery, that this product will be of the quality, materials and workmanship defined in ALMENDO's published specifications for the product. Within this period, if this product is found to be defective, ALMENDO will, at its option, repair and/or replace this product at no charge to the purchaser, provided that:

- the defects are reported and described in writing to ALMENDO within fourteen (14) days after their occurrence;
- such defects are found to be due to defects in design, materials or workmanship on the part of ALMENDO;
- the defective product is returned to ALMENDO at the Purchaser's expense;

The warranty period for any repaired or replaced product is limited to the unexpired portion of the original warranty period. This warranty does not apply to equipment that has not been installed and used within ALMENDO's recommended specifications for the intended and proper use of the

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