


Datenblatt bluSensor® Mini

Model - Air quality sensor Smart Home (BSP02AIQ)



- Long-term stable sensors
- Integrated sensors
 - TVOC: +/- 15%
 - CO2eq: +/-15%
 - Humidity: +/- 2% RH
 - Temperature: +/- 0.2° C
- Additional calculated values:
 - Air quality index: 1 to 5
- Automatic calibration by ventilation (fresh air)
- Data memory for 3 months (optionally extendable)
- Open interface for integration into external systems
- Robust housing with translucent RGB
- 2.4 GHz Wi-Fi
- Bluetooth low energy
- bluSensor® AIR App 

Product Summary

The bluSensor® air quality sensor is specifically designed to analyze indoor air and assist in proper ventilation. It can be used as a standalone device without an app as well as with an app. As soon as the sensor is supplied with power, it measures the air quality and compares the values with an internal reference value, which is automatically determined after continuous operation for 12 hours. For calibration, only extensive airing within this period is necessary. The sensor continuously recalibrates itself and adjusts its internal reference value on a weekly basis. I.e. at least once a week another extensive airing is necessary. As soon as limit values are exceeded, the device starts blinking in different colors (depending on the status) to signal to the user that the room air is bad. For later analysis, detailed queries of the individual values or for sensor con-

figuration, there is a suitable bluSensor® AIR app available. In a user-friendly manner, all used sensors and their status are displayed in a list. If you are in the immediate proximity of the device, you can connect directly to the sensor via Bluetooth and thus get a faster i.e. every second updated display of the current values. This mode is also recommended for safety-critical users who do not want to have their sensors integrated via Wi-Fi. Sensors integrated via Wi-Fi have a 3-tier security concept (per sensor its own certificate, encrypted data storage on the sensor and SSL encryption of the data transmission) and they transmit their values every 10 minutes. For a small fee, professional users can also use our bluSensor® Cloud Portal to manage the installed base on their computers.

Interval	Maximale Werte	Zeitraum
10 minutes	12.960	3 months
<i>for an extra charge:</i>	<i>individually adjustable</i>	
e.g. 1 minute	1.036.800	2 years


Advantages of bluSensor® technology

- Digitization made easy
- Best price - performance ratio
- Wide range of applications
- User-friendly operation
- Online tutorials and videos
- Integration into any external system

Data sheet bluSensor® Mini

Package - Air quality sensor Smart Home (BSP02AIQ)



- 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 via USB (continuous operation)
- Powerbank optimized for mobile use
- Use of long-term stable sensors
- Reset button on the back for factory settings
- Dimension 48 x 48 x 14 mm

Model BSP02AIQ	Functions
Bluetooth 4.2 (soon 5.0)	x
Wi-Fi 2.4 GHz (soon Wi-Fi MESH)	x
Integrated multicolor LED warning light	x
Power supply	USB 5V
Integrated Sensors	
Relative Humidity	x
Temperature	x
Airquality Index	x
Volatile organic compounds (TVOC)	x
Carbon dioxide equivalence (CO2eq)	x
Data Memory on the Device	
2 Megabyte (MB)	Option

Temperature
Humidity
Volatile organic compounds (TVOC)
Carbon dioxide equivalence (CO2eq)

valid for:

Model - Air Quality Sensor Smart Home (BSP02AIQ)

Recommended operating and storage conditions

The specifications listed are only valid if the sensors are stored and operated under the recommended conditions. Prolonged exposure outside these conditions may accelerate aging. The recommended temperature and humidity range for operation is 10°C to 55°C and 4 g to 30 g/m³ absolute humidity, respectively. It is recommended that the sensor should be stored in a temperature range of 10°C to 30°C and below 30 g/m³ absolute humidity. The sensor must not be exposed to condensing conditions (i.e. >90% relative humidity) at any time.

Recommended storage conditions

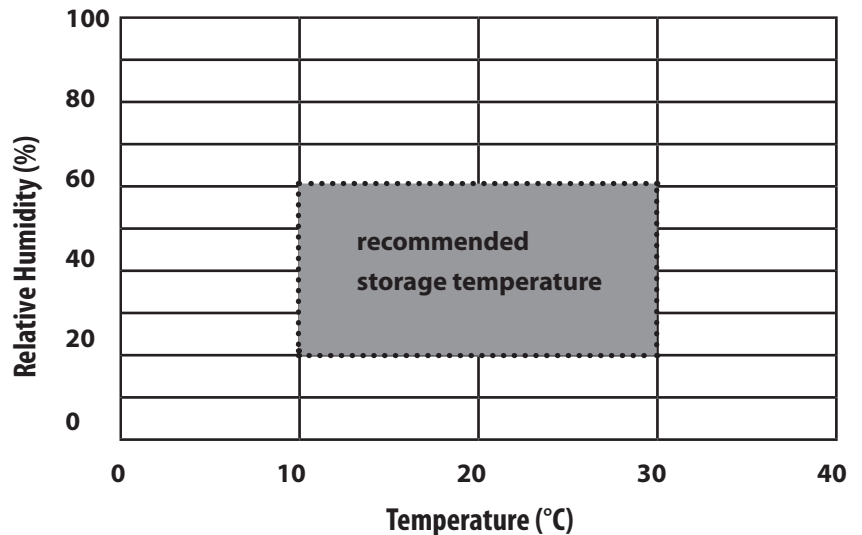


Figure Recommended humidity and temperature for sensor storage.

Recommended operating conditions

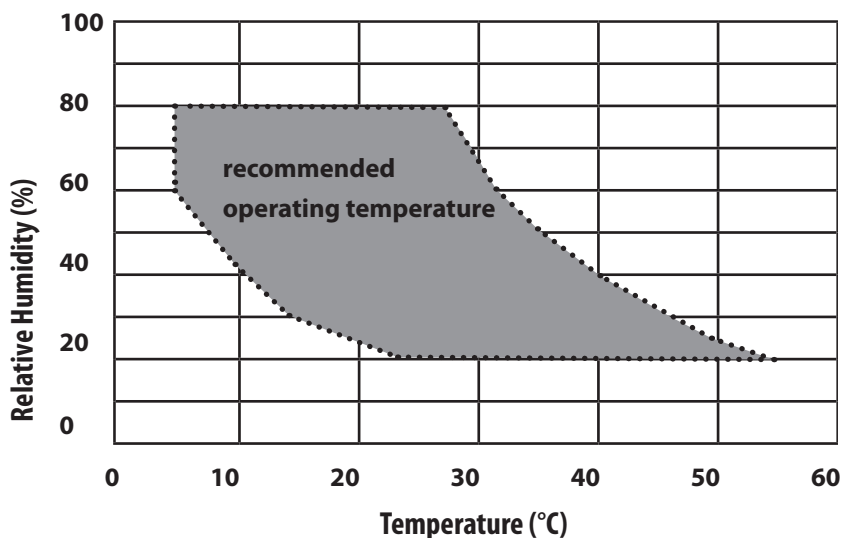


Figure Recommended humidity and temperature for sensor operation.

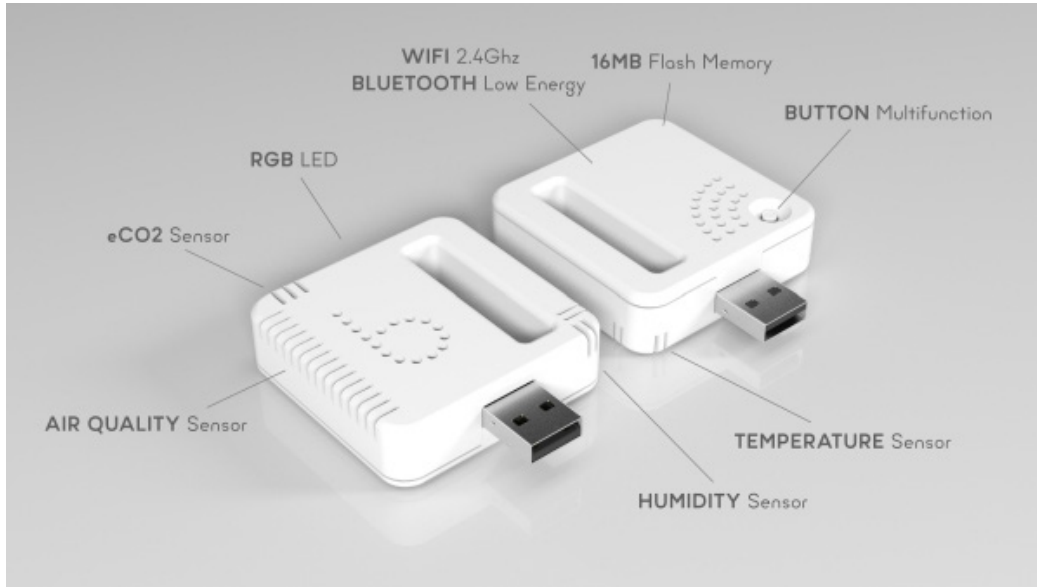
Important !
Please store properly and do not let it condense !

Data sheet bluSensor® Integrated Sensor Technology



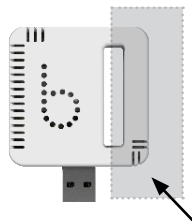
Temperature
Humidity
Volatile organic compounds (TVOC)
Carbon dioxide equivalence (CO2eq)

gültig für:
Model - Air Quality Sensor Smart Home (BSP02AIQ)



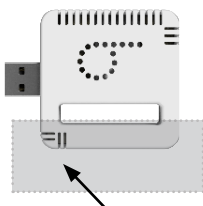
Optimal position

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. If you use a low quality power supply unit which heats up slightly during continuous operation, this can distort your measurement result. A heat cloud is created around the heat-radiating power supply unit, which leads to slightly increased temperature values.



Temperature sensor

The housing was specially designed to achieve the highest measurement accuracy. With regard to temperature, the sensor was positioned in its own area separated by chambers in order to be able to provide unbiased measurement results isolated from the rest of the electronics.



2 ideal positionen

The most optimal position of the device is when the temperature sensor is at the bottom (**see figure on the left or top**) and when it is supplied with fresh air from all sides. USB goosenecks are also available in the accessories to position the sensor as desired and possibly remove it from radiating power plugs.

Data sheet bluSensor® Integrierte Sensorik

Volatile organic compounds (TVOC)
Carbon dioxide equivalence (CO2eq)

valid for:
Model - Air Quality Sensor Smart Home (BSP02AIQ)

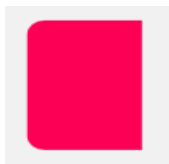


Warning light

You can define limit values for temperature and humidity. If these are exceeded or undershot, a warning light starts to flash. If no warning light is illuminated, either no limit values have been exceeded or no alarms have been activated on the device. The alarm is switched off at the factory and must be activated with the blusensor® app..

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:



Poor air quality:

preset limit values
> 600 ppb TVOC or
> 1.500 ppm CO2eq

Display in App	TVOC	CO2eq
Excellent	0 ppb - 74 ppb	0 ppm - 799 ppm
Good	75 ppb - 219 ppb	800 ppm - 1.399 ppm
Moderate	220 ppb - 649 ppb	1.400 ppm - 1.999 ppm
Poor	650 ppb - 2.199 ppb	2.000 ppm - 2.999 ppm
Unhealthy	>= 2000 ppb	>= 3.000 ppm

If the air quality in terms of TVOC and CO2eq does not exceed either of the two 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)

Volatile organic compounds (TVOC)
Carbon dioxide equivalence (CO2eq)

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

Value ranges, resolution and time response

The maximum possible range is 60'000. Different resolutions are used depending on the value range. In the lower range, which is mostly present, the highest resolution is given. The carbon dioxide value of the earth's atmosphere is about 400 ppm.

Parameter	Value	Value range	
Output range	TVOC	0 ppb to 60.000 ppb	
	CO2eq	400 ppm to 60.000 ppm	
		Range	Resolution
	TVOC	0 ppb to 2.008 ppb	1 ppb
		2.008 to 11.110 ppb	6 ppb
		11.110 to 60.000 ppb	32 ppb
	CO2eq	400 ppm to 1.479 ppm	1 ppm
		1.479 ppm to 5.144 ppm	3 ppm
		5.144 ppm to 17.597 ppm	9 ppm
		17.597 ppm to 60.000 ppm	31 ppm
Response time	TVOC, CO2eq	<5 to 30 seconds	
Sampling rate	TVOC	1 Hz	
	CO2eq	1 Hz	

Table Value ranges and resolution for integrated sensors CO2(eq) and TVOC

Calibration for air quality values (TVOC, CO2eq)

The sensor requires a certain start-up time to perform its automatic calibration. It provides a pre-calibrated factory reference for start-up under poor air conditions. This results in a better user experience and the sensor provides air quality values from the start. Periodic fresh air events are required for sustained accurate results. The measurement principle is based on a comparison to a reference point and is not absolute. The sensor automatically recalibrates itself. If you never ventilate, your sensor will adapt to this environment.

Parameter	Value
Switch-on time until first measurement results	3 seconds
Calibration period after initial start-up	12 seconds
Necessary fresh air events within the first 12 hours	air at least 1x extensively
Calibration storage time without power supply	7 days
Recommended fresh air events in continuous operation	at least once a day

Table Calibration for integrated sensor technology TVOC and CO2(eq)

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.

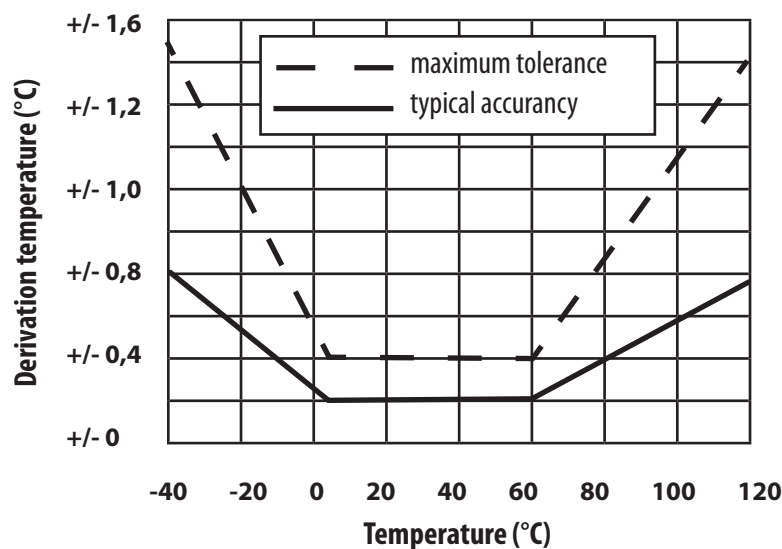


Figure Typical and maximum tolerance in the accuracy of an integrated temperature sensor.

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)

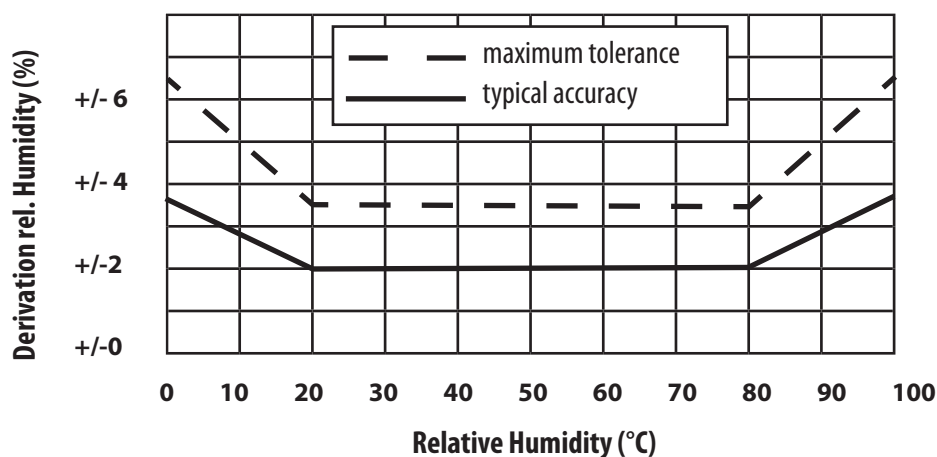


Figure Typical and maximum tolerance in accuracy of an integrated humidity sensor at 25°C.

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.

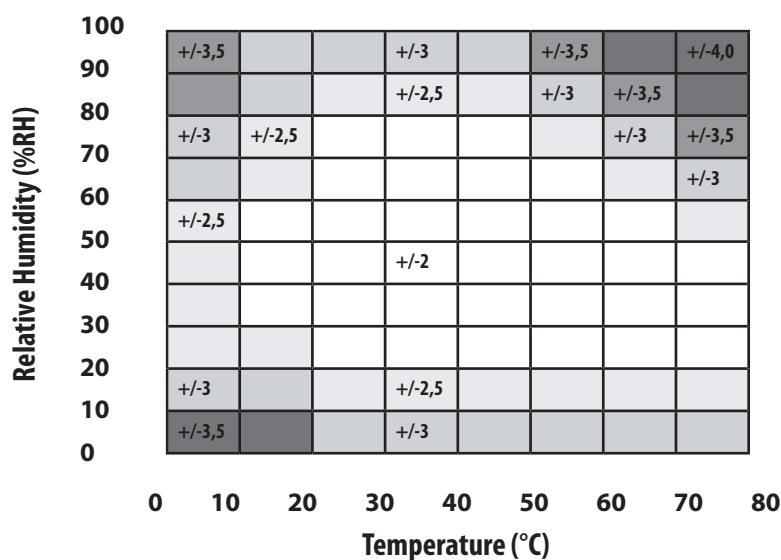


Figure Typical accuracy of relative humidity measurement of integrated sensor in %RH at temperatures from 0°C to 80°C.

Data sheet bluSensor® Integrated Sensor Technology



Volatile organic compounds (TVOC)
Carbon dioxide equivalent (CO2eq)

valid for:

Model - Air Quality Sensor Smart Home (BSP02AIQ)

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

TVOC, eCO2:

Measurement method based on ethanol and H2 ¹
typ.: 15% Accuracy for ethanol and 10% for H2
typ.: 1,3% Deviation per year (long-term drift)
Integrated algorithm for the conversion of
ethanol and H2 to air quality values such as TVOC
and CO2eq.

¹ Test conditions: Operation at 250ppm decamethylcyclotrisiloxane (D5) for 200h - simulating 10 years of operation in an indoor air environment. Exposure to ethanol and H2 concentrations up to 1000 ppm were tested. Specifications are for 25° C and 50% rel. humidity and a minimum operating time of 24h. 90% of sensors are within typical accuracy tolerance, >99% within maximum tolerance.

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 (TVOC, CO2eq)

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 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. In the following section, we will discuss the measurement accuracy of the integrated sensor technology.

Parameter	Sensor	Values
Measurement range	Ethanol	0 ppm to 1.000 ppm
	H2	0 ppm to 1.000 ppm
Specified range	Ethanol	03 ppm bis to ppm
	H2	0.5 ppm to 3 ppm
Accuracy	Ethanol	typical 15% of the measured value
	H2	typical 10% of the measured value
Long-term drift	Ethanol	typical 1,3% of the measured value
	H2	typical 1,3% of the measured value
Sampling rate	Max. 40 Hz	

Table Performance of gas measurement for integrated sensor technology. Specifications are for 25°C, 50% relative humidity. The integrated sensors were operated by the supplier for initial characterization for at least 24h.

Volatile organic compounds (TVOC) Carbon dioxide equivalent (CO2eq)
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valid for:
 Model - Air Quality Sensor Smart Home (BSP02AIQ)

Accuracy Ethanol

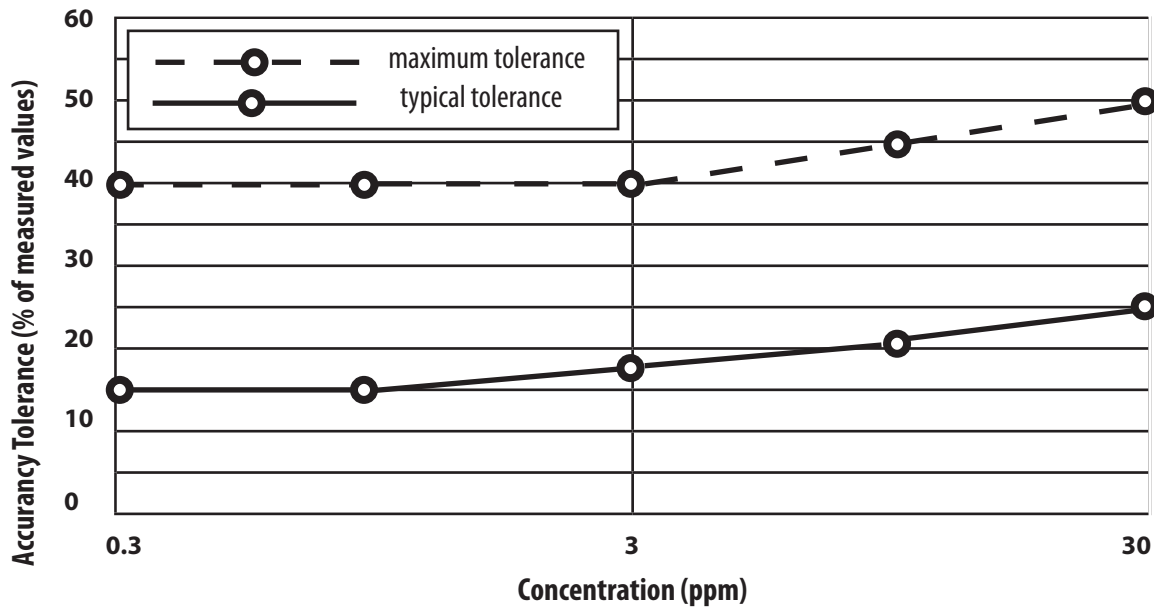


Figure Typical and maximum tolerance in % of the measured value at 25°C, 50% rel. humidity and an operating time of at least 24 hours.

Accuracy H2

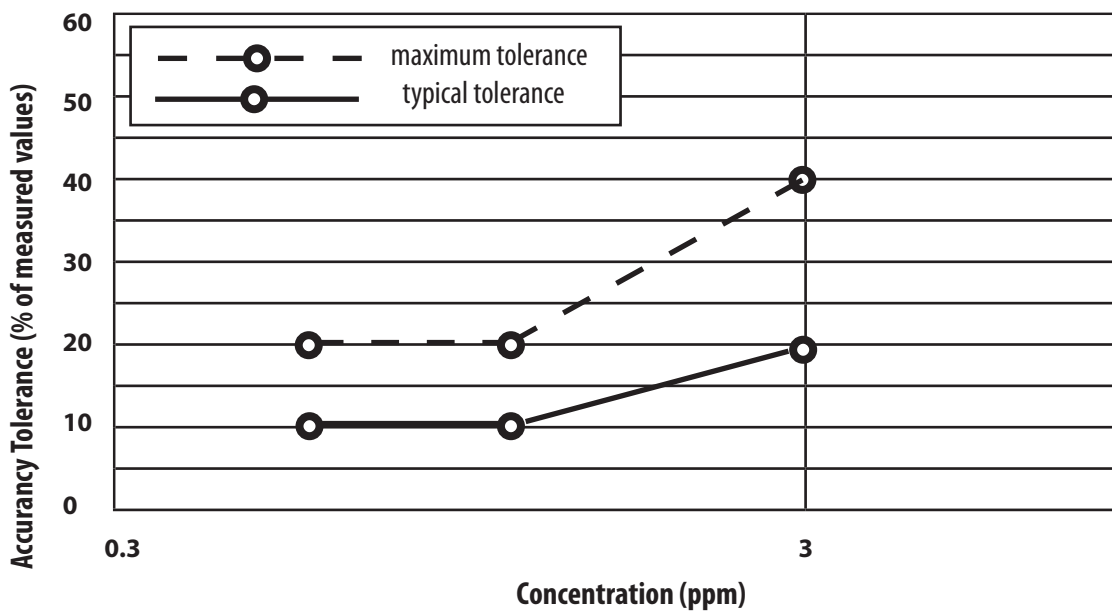


Figure Typical and maximum tolerance in % of the measured value at 25°C, 50% rel. humidity and an operating time of at least 24 hours.

Volatile organic compounds (TVOC) Carbon dioxide equivalent (CO2eq)
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valid for:
 Model - Air Quality Sensor Smart Home (BSP02AIQ)

Long-term deviation Ethanol

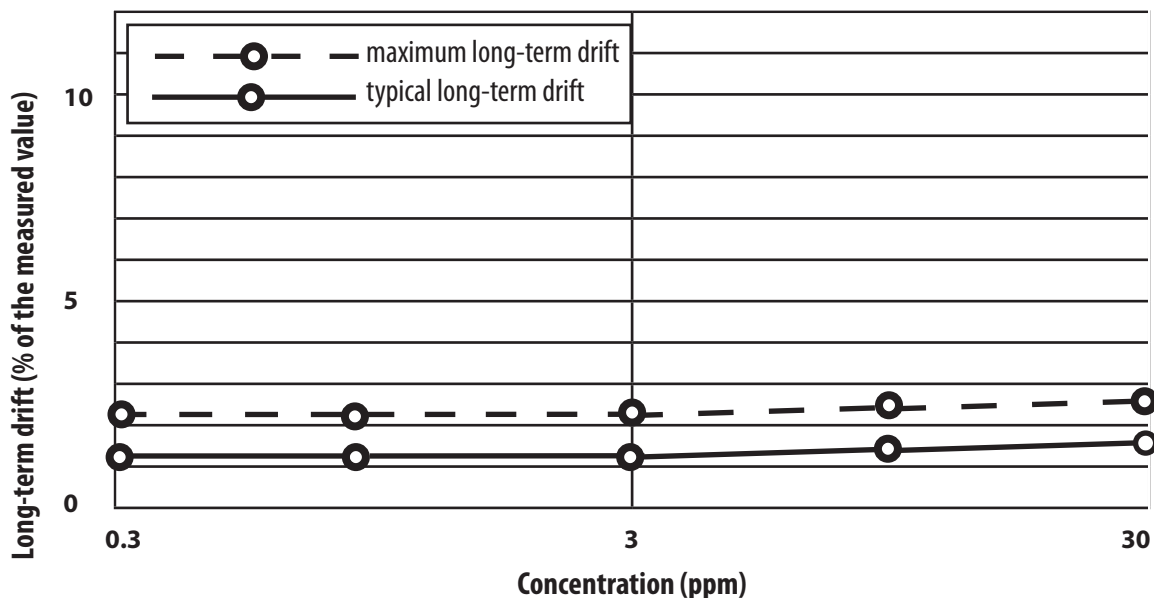


Figure Typical and maximum long-term drift in % of the measured value at 25°C, 50% rel. humidity and an operating time of at least 24 hours.

Long-term deviation H2

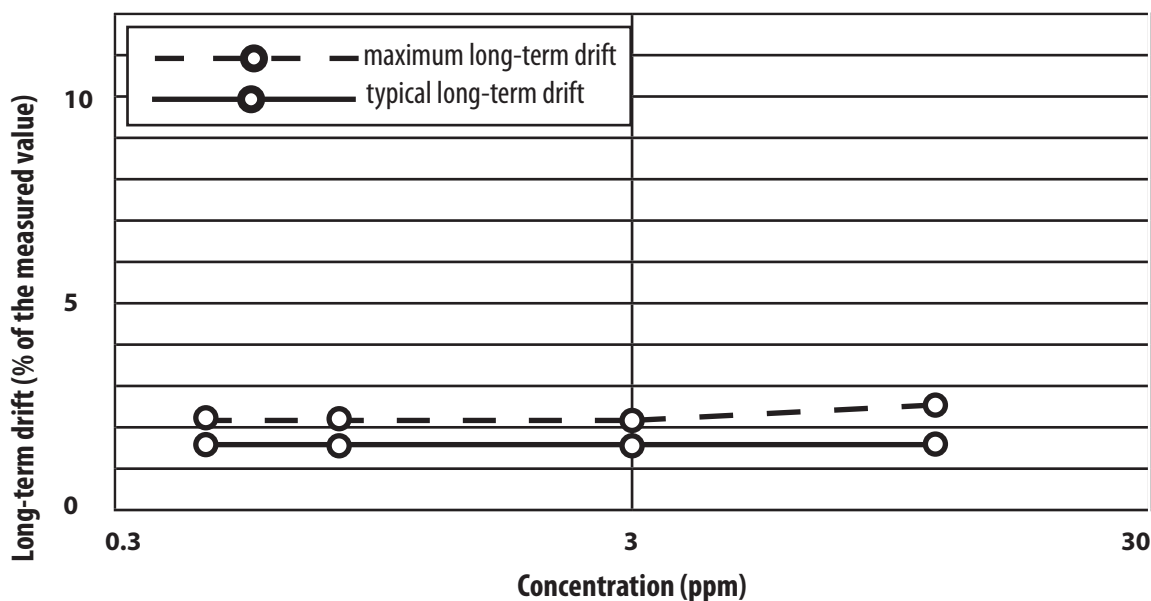


Figure Typical and maximum long-term drift in % of the measured value at 25°C, 50% rel. humidity and an operating time of at least 60 hours.

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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