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WINNER
AIRLAB
Microsensor
Best accuracy sensor
2023

bettair® MK2



FAQs

(Frequently Asked Questions)

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What parameters can bettair® nodes measure?

- They are currently available with NO_2, NO, O_3, CO, SO_2, H_2S, NH_3, VOC, CO_2, CH_4, HCl, HF, HCN and CH_2O sensors. You can choose which of these sensors the instrument is purchased with.
- In addition, whatever the choice of sensors mentioned above, all nodes include sensors for PM_{10}, $PM_{2.5}$, PM_1, noise, pressure, temperature, humidity, and communications module.

How the sensors are integrated?

- Sensors are integrated in a cartridge that is easily interchangeable by the user. This allows them to be replaced by a new cartridge at the end of their useful life, thus renewing all of them in a single action.



How often should the sensor cartridges be changed?

The bettair® system is currently designed for a sensor life of 24 months, ensuring that data quality is maintained, although in certain circumstances of particularly hostile conditions it is recommended that the sensors are replaced after 18 months.

Which measurement techniques and ranges are used?

Gases					
Parameter	**Technique**	**Range**	**LDL**	**Resolution**	**Accuracy**
NO_2	Electroch. cells	0 -20 ppm	2 ppb	0.1 ppb	± 3 ppb
O_3	Electroch. cells	0 - 50 ppm	1 ppb	0.1 ppb	± 5 ppb
NO	Electroch. cells	0 – 20 ppm	2 ppb	0.1 ppb	± 4 ppb
CO	Electroch. cells	0 - 500 ppm	30 ppb	1 ppb	± 30 ppb
SO_2	Electroch. cells	0 - 50 ppm	10 ppb	0.1 ppb	± 15 ppb
CO_2	NIDR	400 - 10000 ppm	400 ppm	1 ppm	± 30 ppm
H_2S	Electroch. cells	0 - 50 ppm	2 ppb	0.1 ppb	± 10 ppb
NH_3	Electroch. cells	0 – 60 ppm	6 ppb	0.3 ppb	± 10 ppb
CH_4	NIDR	0 - 50000 ppm	250 ppm	10 ppm	± 250 ppb
HCl	Electroch. cells	0 - 20 ppm	5 ppb	0.1 ppb	± 15 ppb
VOC	Electroch. cells	0 – 100 ppm	20 ppb	1 ppb	± 10 ppb

Gases					
Parameter	**Technique**	**Range**	**LDL**	**Resolution**	**Accuracy**
VOC	Semic. óxidos met.	0 - 500 IAQ units	n/a	1 IAQ units	3 IAQ units
CH2O	Electroch. cells	0 – 10 ppm	20 ppb	1 ppb	± 5 %
HCN	Electroch. cells	0 – 50 ppm	400 ppb	10 ppb	± 5 %
HF	Electroch. cells	0 – 20 ppm	200 ppb	10 ppb	± 5 %

Particles					
Parameter	**Technique**	**Range**	**LDL**	**Resolution**	**Accuracy**
PM_1 (µg/m³)	OPC	0 – 1000	1	1	± 2
$PM_{2,5}$ (µg/m³)	OPC	0 – 1000	1	1	± 2
PM_{10} (µg/m³)	OPC	0 - 1000	1	1	± 2

Auxiliary parameters			
Parameter	**Range**	**Resolution**	**Accuracy**
Temperatura (ºC)	-40 - 85	0.01	± 0.4
Humedad (%HR)	0 – 85 85 - 100	0.1	± 0.5 ± 1.5
Presión (hPa)	300 - 1500	0.18 Pa	± 0.6
Ruido (db)	35 - 120	0.1	± 1

How sensors are calibrated?

Prior to delivery to customer, a sensor calibration process is performed at the factory.

This calibration, together with the exclusive data processing software developed by bettair®, allows to maintain a maximum and stable correlation of the final data during the whole life of the sensors.

This same factory calibration process is performed on each cartridge supplied. Thus, a node on which a new cartridge is installed has the same reliability of the pollutant data as a new node.

What is the maintenance cost of the nodes?

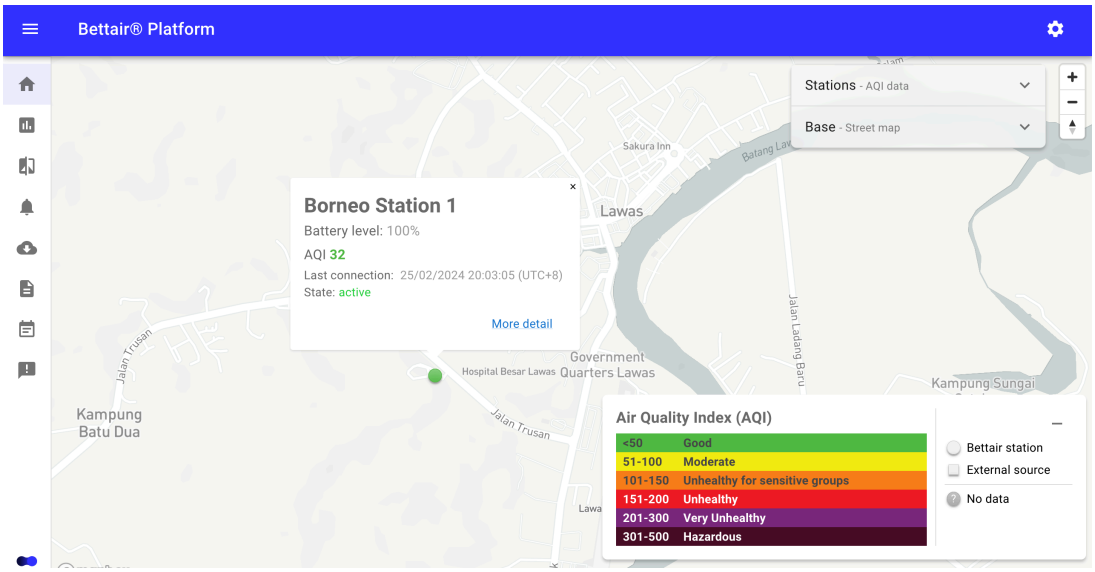
None. Factory calibration is included in the purchase price of the nodes and cartridges and, due to the design of the specific data processing based on machine-learning technology, no additional action is required.

How is the data displayed?

Through any internet browser, without the need to install any software, on PC, mobile or tablet.

With the purchase of a bettair® node, access to a specific portal with different functionalities for viewing and downloading reports is provided by means of a username and password.

Each user can view the real-time data of all the nodes he/she has purchased, which will be displayed geo-positioned on a map, due to the integrated GPS. By default, the GPS location of the device is updated every midnight, unless another frequency is specifically requested.



For every customer, is also available a **public data website**, where they can offer a simplified version just to share with the general public basic information of location and real time & historic data of nodes. You can find an example at:

https://public.bettair.city/baena

How much does it cost to subscribe to data management and visualization software?

None. It is included free of charge for all users who purchase a node.

In addition, when a new cartridge is purchased to replace a depleted one, this subscription is automatically renewed.

How to connect a node to send data?

There are different ways to connect a node. Although connection via network cable is available, the most common way is via 3G/4G mobile connectivity (integrated as standard).

To achieve mobile connectivity, a SIM card with activated data transmission must be inserted in the node.

For the supply of nodes in the EU and associated countries, neither the SIM card nor the data connection service has any cost for the user, nor does the user have to make any arrangements to activate it, as it is factory configured.

For the rest of the countries, a SIM card with worldwide coverage can be supplied, but the cost of this should be passed on, being much more advisable for the user or local distributor to install a card with a data contract for that country[1].

Optionally, it is possible to connect the nodes via Ethernet, or even to a LoRaWAN network.

What happens if there is a failure in the mobile antenna network?

Although it is not easy for this situation to arise nowadays, the node can have a large internal memory, which allows the data storage, which will be sent to the central server when the device recovers the connection.

How is it supplied with power and what is its consumption?

The node is supplied as standard with a power cable for connection to the mains. With an integrated universal transformer, it can be powered at 110-220 V and 50-60 Hz. A DC version of the node is also available in the 18-75 V range.

Average power consumption is around 1 W, with peaks of 12 W when the internal battery is charging.

This internal battery allows it to continue to operate for 3-4 days in case of power failure.

It also has (optional) a solar panel specially designed for the node, which makes the node autonomous in the absence of connection to electrical network.

PoE power supply is also available.

What are the advantages of the cloud technology used by bettair®?

The current processing system, whose development was initiated in 2012 by researchers at the Polytechnic University of Catalonia, is based on the knowledge of the behavior of the sensors throughout their useful life in changing environmental conditions.

So, the principles on which this technology is based are twofold: high-level quality control of the components used, and machine-learning based data processing that allows the intelligent system to model the sensors performance, throughout their useful life and considering the conditions of the environment, in order to guarantee the data reliability.

In addition, with this centralized processing using complex algorithms, developed through years of research and field testing, the user will immediately benefit from any future improvements to the system.

[1] Bettair has a list of "supported operators". If not on this list, nodes will simply require a firmware update to support the new operator.

On the other hand, the configuration of both the autonomous sending of data from the sensor and the web access platform frees the user from any type of investment or software installation on their own computer systems.

Can the nodes be integrated into a customer's own information system?

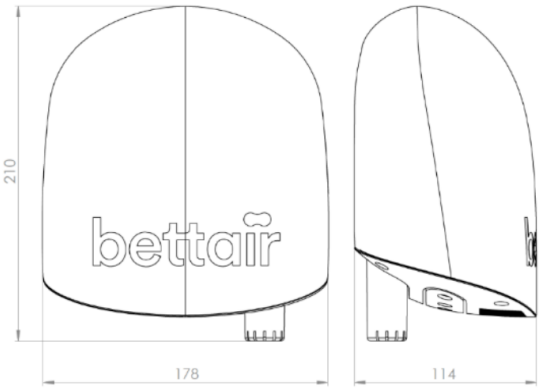
Yes. bettair® provides the API for the user to integrate the final data obtained after data processing into the user's own system as he/she sees fit. This information can be found in a section of the platform, and also in this link: https://docs.cloud.bettair.city/api/

bettair® technology is based on the intelligent processing of the raw data sent by the nodes, using complex algorithms specially designed for this purpose. This is why the data that would be transferred to the user's system via the API comes from the bettair® servers, not directly from the nodes.

We also offer, upon request, the service of integrating the data into the user's tools, if the user does not have technical resources to do it.

Can the location be easily changed?

The bettair® MK2.5 node dimensions are 210 x 178 x 114 mm (8.27 x 7.01 x 4.49 in), and weighs approximately 1.5 kg (3.31 lb) with cartridge. In addition, it only needs to be connected to a nearby source of electricity (mains or solar panel supplied as an option), which makes the ease of relocation optimal.



How to fasten the node?

The node has an anchorage on its back that allows, by use of simple commercial clamps, its attachment to poles or lampposts (the most common way).

In any case, a small accessory for wall mounting can also be supplied.

There is also an accessory consisting of a magnetic holder to be fixed on the roof of a vehicle, for example, and thus make the change of measurement location more immediate.

What accessories are available?

The following accessories are currently available:

- Solar power panel
- Mechanical wind speed & direction sensor
- Sonic wind speed & direction sensor
- Complete weather station, adding precipitation, wind speed and direction, and solar radiation.
- Wall mounting bracket
- Magnetic bracket

What product quality certifications do bettair® nodes have?

- EMC compliance: Directive 2014/30/EU
- Emissions: EN55032 Class BA -> “Class A”
- Immunity: EN55024 Class BA -> “Class A”
- LVD compliance: Directive 2014/35/EU
- Electrical Safety: EN62368-1
- RED compliance: Directive 2014/53/EU
- FCC compliance: FCC Part 15 Subpart B, IEC 661672-1:2013

Is it approved according to air quality standards?

Obviously, this type of analyzers do not have the same approvals as the standard analyzers that are installed in the "reference" air quality stations, the philosophy is to be complementary to them.

The cost of a complete equivalent station, with all the analyzers measuring the same as these nodes, could be more than 200 k€.

The European Committee for Standardization, through Working Group WG42 (CEN/TC 264 WG42) has published two parts of a new standard (UNE CEN/TS 17660-1:2021 and UNE CEN/TS 17660-2:2024) that defines the methodology for testing and classifying “indicative” gas and particulate sensors respectively, and classifying them into three groups according to their accuracy. bettair® engineers have been part of the development of these standards and, although at the moment there are no certifying companies that can certify against these standards, our nodes will probably be the first to obtain these approvals.

There are also guidelines developed by the US EPA which, along the same lines, provide criteria for evaluating these devices (EPA/600/R-20/279, EPA/600/R-20/280 and EPA/600/R-23/146).

The bettair® device holds the only certification as such, with worldwide recognition, that currently exists for this type of compact, sensor-based stations, which is the UK Environment Agency's Monitoring Certification of Equipment Certification Scheme (MCERTS) for the measurement of particulate matter.

During the last years, bettair® nodes have participated in many intercomparisons carried out by independent entities, obtaining the best results in the market. Some of them have been carried out by the University of Cambridge (UK) and by the Swiss multinational certification company SGS, following the US EPA recommendations for this type of field tests.

To corroborate all this, bettair® also participated in the AIRLAB Microsensors Challenge 2023, considered the most exhaustive test in existence. These tests have been carried out by comparing the devices for months with reference equipment in France and Thailand simultaneously, and bettair® nodes have been proclaimed **the most accurate device in the world**.



It should also be noted that **"Most Innovative Digital Product or Solution of the Year 2024"** at the Air Quality & Emissions Expo (AQE) held in Birmingham (UK).

