BlueSens

BlueInOne FERM

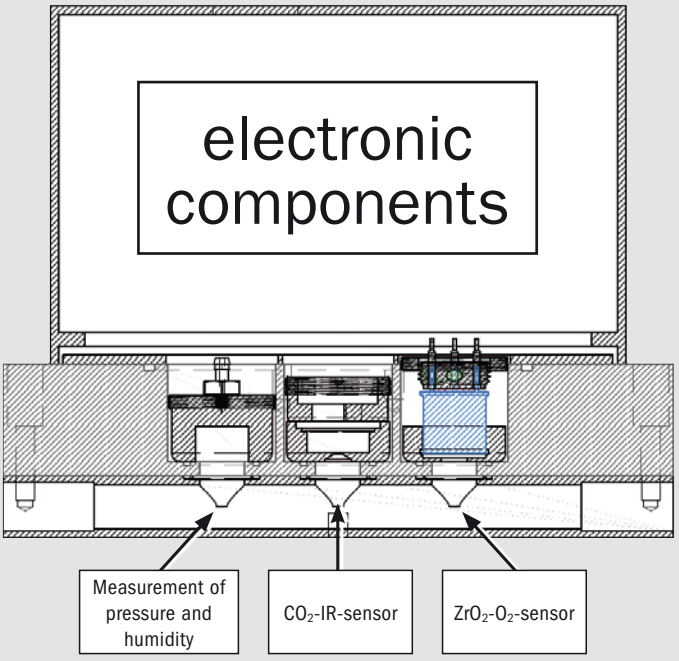
Data Sheet

Advantages

- parallel measurement of O_2 and CO_2
- compact stainless steel housing
- PAT conform in-situ- measurement
- auto compensated humidity and pressure
- no gas cooler, pumps or valves needed
- connectable to any hose/tube or pipe
- status display by luminous pushbuttons

Application areas

- online fermentation monitoring
- real time process optimization
- from lab to industrial scale



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BlueSens

BlueInOne FERM

Data Sheet

Concentration ranges
0 - 10 Vol.% CO_2, 0.1 - 25 Vol.% O_2
0 - 25 Vol.% CO_2, 0.1 - 25 Vol.% O_2
0 - 10 Vol.% CO_2, 1 - 50 Vol.% O_2
0 - 25 Vol.% CO_2, 1 - 50 Vol.% O_2

O_2 sensor unit	
Gas	O_2
Measuring principle	Zirconium dioxide
Accuracy	< 0,2% FS* ± 3% value
Drift	< ± 2% value / year
Lifetime of sensor element	Approx. 15 000 operating hours
Temperature inside of the sensor unit	580°C / 1076°F

CO_2 sensor unit	
Gas	CO_2
Measuring principle	Infrared: dual wavelength
Accuracy	< 0,2% FS* ± 3% value
Drift	< ± 2% value / year
Lifetime of optical components	Approx. 3 years
Temperature inside of the sensor unit	3°C / 5.4°F higher than process temperature

General	
Temperature range	15 - 40°C / 59°F - 104°F
Pressure rage	0.8 - 1.3 bar / 11.6 – 18.85 psi absolute pressure
Operating humidity	0 – 100% RH, integrated humidity compensation
Housing	Stainless steel, IP65
Dimension (WxLxH) / weight	170 x 150 x 120 mm (6.69" x 5.91" x 4.72") ** / 4 kg (8.82 lb)
Mechanical connection	Hose connection for 4, 6, 8, 10, 12mm outer diameter, 4, 6, 8 mm inner diameter. ¼", ⅛" , 1 ¼", ¼" und ½" swagelok***
Materials in contact with process gas	Stainless steel, viton, sapphire, PTFE, polymer H.L., nitrile
Filters	PTFE 0.22 µm, PTFE 5 µm
Power supply	24V 1A
Storage conditions	0 - +60°C / 32- 140°F ; < 75% RH noncondensing

Electronic connections	
Power supply	8 pin M12 male
Output connection	8 pin M12 female
Electronic Output	Active output, maximum 500 Ohm at 24V power supply RS232, RS485 Modbus, 2x 4-20mA, USB, Modbus OPC Server
Maintenance	One point calibration with ambient air (0.04 Vol.% CO_2, 20.97 Vol.% O_2) once a month (other conditions possible), optional factory calibration once a year
CE/FCC/ICES	EN61326-1:2006 / FCC 15:2009 Subpart 107/109, ICES-001:2006
Remarks	Don't use in explosive atmosphere, in anoxic atmosphere, in gases with polymers or silicon components or in gases with halogens (F, Cl, Br, etc.), CFC or SO_x and H_2S

* FS= full scale ** depends on flow adapter dimension ***others on request

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Combined CO_2/O_2 analyzers

BlueInOne

Monitor your process in real-time:

OUR CERRQ

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BlueSens ....makes sense!

The BlueInOne sensor

BlueSens is providing modern and inexpensive measuring solutions for in-situ analysis of bioprocesses with its BlueInOne series. BlueInOne is quick and easy to integrate into processes, providing readings with a high level of reliability. All analyzers in the series unite several measuring components in one compact stainless steel housing (IP 65). The measuring signals can be exported as analog signals (4-20 mA each for both signals) as well as digital signals (RS485 Modbus, RS232, USB). Data can be logged during measurement using an optional web server, and is very easy to display when needed in any up-to-date browser via a network connection. Using the data bus module RS485, several analyzers can be connected at once, allowing parallel systems to be activated and making readouts straightforward.

BlueInOne is suitable for integration into any production level and can detect the carbon dioxide and oxygen content there in real time. Each BlueInOne unit reacts automatically to changing conditions. Fluctuations in moisture and pressure are identified and compensated automatically. This ensures the measurements remain precise even under changing process conditions. The two illuminated pushbuttons allow the operating status to be identified quickly on the on-site unit. BlueInOne features a resolution of up to 50 ppm and is suitable as a replacement for cost-intensive mass spectrometers. Standard interfaces such as mod-bus or USB allow it to be connected to any process control system or a PC. Sampling becomes superfluous while automatic and consistent monitoring and documentation of bioprocesses is made possible.

BlueWeb server

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Overview and differences

Benefits:

> Parallel measurement of O_2 and CO_2 in one unit
> O_2 concentrations from 0 - 100 volume percent
> Inexpensive
> Compact stainless steel housing (IP 65)
> Easy installation
> PAT-compliant in-situ measurement
> Automatic compensation of moisture and pressure
> No more valves, gas filtering or gas cooling required
> Connects to every pipe or hose between 4 mm and 1¼”
> Status display on the analyzer

Application areas:

> Cell growth processes (BlueInOne Cell)
> Fermentation processes (BlueInOne Ferm)
> Biotechnology
> Process optimization in real time
> Online fermentation monitoring
> Applications ranging from research to industry

The BlueInOne series is currently comprised of two different models, the BlueInOne Ferm and den BlueInOne Cell. The BlueInOne Ferm is designed to analyze fermentation processes, while the BlueInOne Cells is primarily designed for studying cell growth processes. The analyzers are, of course, also suitable for other applications. The models function with diverse oxygen sensors, therefore allowing them to take reliable measurements under a variety of process conditions. The BlueInOne Ferm functions using an oxygen meter based on a zirconium dioxide sensor. BlueInOne Cell, in contrast, registers the oxygen content with the aid of a galvanic cell. Otherwise, both models are identical. Which sensor might be best suited for your process will depend on the process conditions, the accompanying gases which are produced and the expected concentration of the gas. Each sensor will also be individually adapted and calibrated for your process in order to provide the best possible results for your particular application. The differences between the two models are listed below.

Differences at a glance	BlueInOne Ferm	BlueInOne Cell
Measuring principle O_2	Zirconium dioxide	Galvanic cell
*Concentration ranges****	0.1 - 25 Vol.% O_2, , 1 - 50 Vol.% O_2 0 - 25 Vol.% CO_2	0 - 100 Vol.% O_2 0 - 25 Vol.% CO_2
Fields of application (others possible)	Fermentation processes Process optimizing	Cell growth processes Anaerobic processes
Not to be used with	Oxygen poor processes Explosive gases Gases with polymers or silicon components Gases with halogens (F, Cl, Br, etc.) Gases with CFC or SOX and H_2S	Gases with NH_3 or O_3
Temperature inside of the O_2-sensor unit	580°C (1076°F)	Approx. ambient temperature

***others on request

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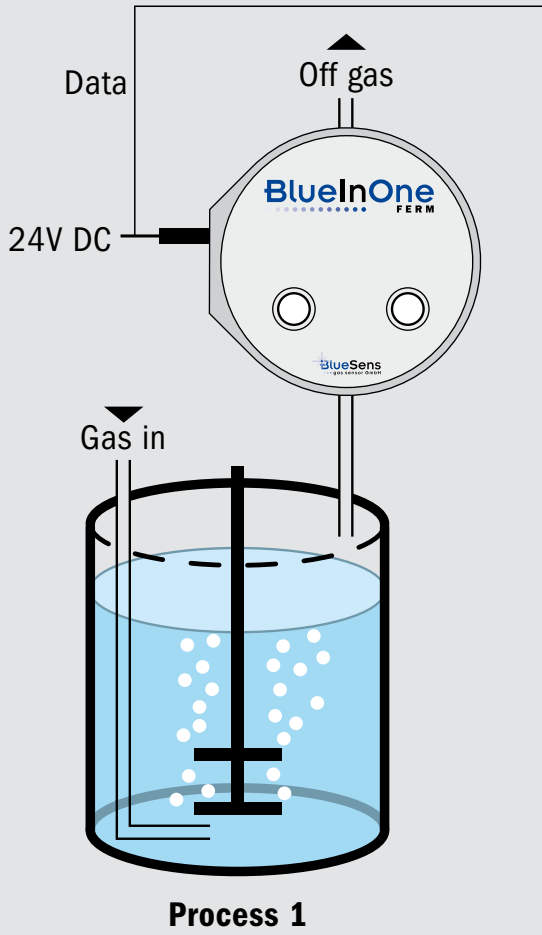
Assembly and measuring

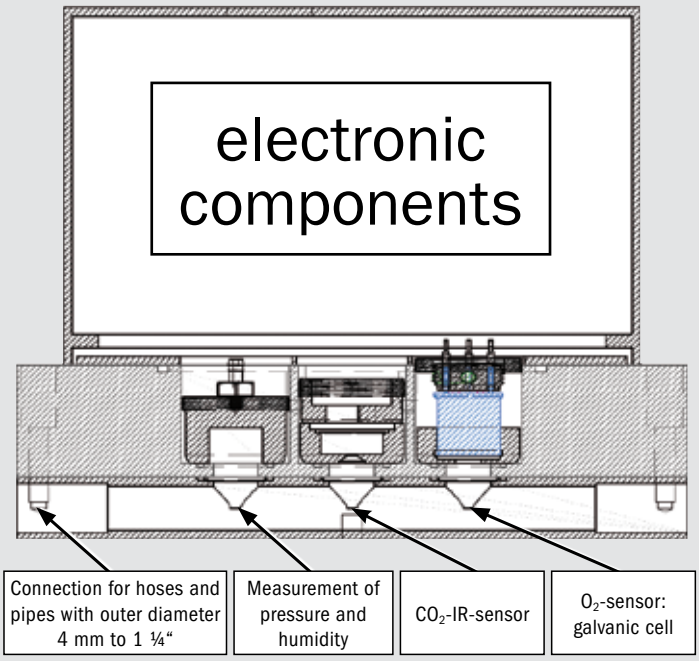
Assembly

Every BlueInOne unit combines several measuring units in one device. This means the analyzer features a combined measurer for moisture and pressure, a carbon dioxide sensor and an oxygen sensor. The individual sensor units are protected by filters. Diverse hose adapters, quick-release connectors and hose fittings can be screwed onto the flow adapter to provide a mechanical connection. Fittings for hoses with an inner diameter of 4 mm and 8 mm can be used, and quick-release connectors for hoses with an outer diameter between 4 mm and 12 mm and screw connections for 1/8"-1¼" pipes can be integrated as standard. Other designs can, of course, be implemented on request. Installation of BlueInOne starts by hooking up the power and data line, after which it is connected to the process mechanically. The power and data lines can be connected using the 8-pin M12 connectors. Serial RS232, RS485 Modbus interfaces, or even a USB connection, all allow the BlueInOne to communicate with a process control system, web server or a computer. The analyzer can also be read out using two analog 4-20 mA signals.

Once a data line and the power supply have been connected, and the mechanical attachments have been connected, measurements using BlueInOne can begin.



Process 1



Measuring

The gas for measuring flows past the diverse sensors in sequence while it is analyzed. The data recorded is conveyed to the internal analysis electronics. The BlueInOne automatically factors in the process conditions and corrects the measured data automatically when applicable. Even under changing process conditions, meaning fluctuating pressure, temperatures and moisture levels, the analyzer consistently issues reliable readings.

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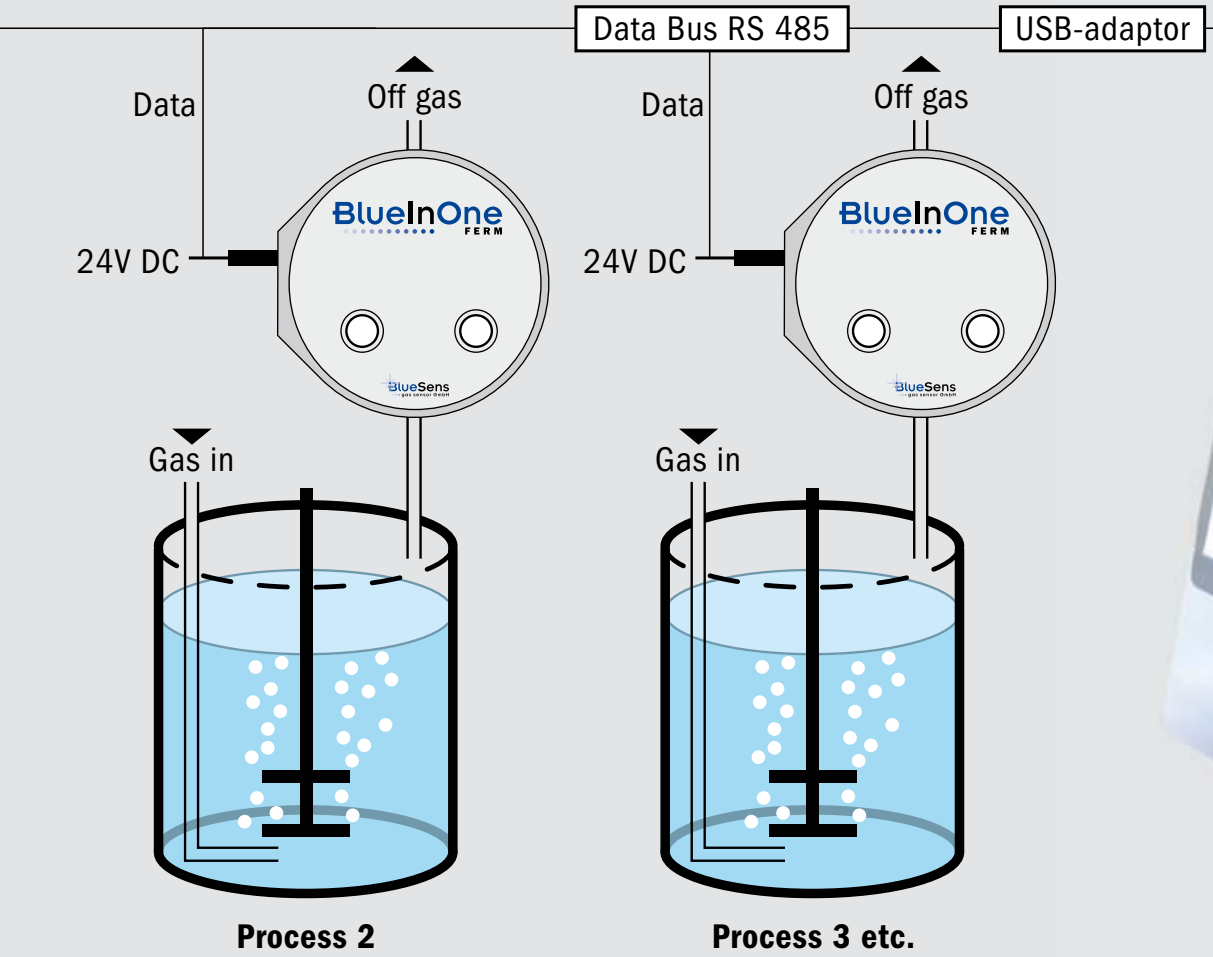
Parallel processes



Perfect for parallel processes

Modern bioprocessing frequently involves performing several processes in parallel. Specific variations can be tested in the individual bioreactors under identical cultivation conditions, allowing the decisive factors to be determined much faster (design of experiments, DOE). Each BlueInOne only measures one process, allowing a very large amount of data to be obtained, and practically eliminating the risk of interprocess contamination. At an industrial level, parallel processes make a continual production flow possible. If a fermenter is shut down for maintenance purposes, the remaining bioreactors can continue their production without problems. Each individual process is comprehensively analyzed and documented. When measurements are made using several BlueInOne units, all analyzers can be conveniently read out and controlled by just one computer.

BlueWeb server and BlueInOne web application for parallel processes on the following pages...

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BlueWeb server and BlueInOne Web

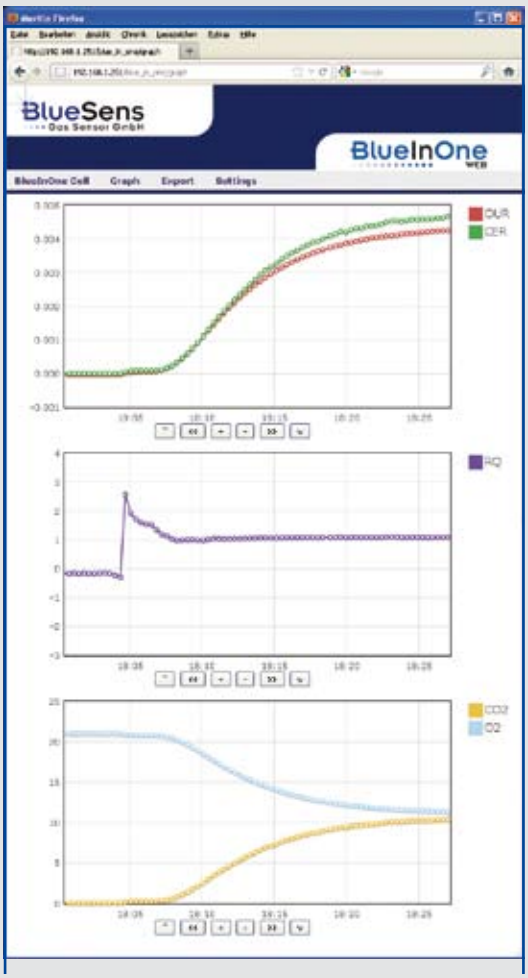
BlueWeb server: connects up to 16 BlueInOne to one interface

With the aid of the optional BlueWeb server, up to 16 BlueInOne units can be read out and configured via one RS485 data bus. The web server is easily integrated into a network using an Ethernet connection or can be connected directly to a computer or process control system. The web server automatically saves all the data it measures without constantly needing to be connected to a computer or network, and is easy to actuate using any up-to-date internet browser. The BlueInOne web application runs automatically on a standard web browser such as Mozilla™ or Safari™. No special software needs to be installed on the computer, and you do not have to use a specific operating system.

The BlueInOne Web application: visualize, save and export all data

The BlueInOne web application is easy to access from any recently-updated web browser. This application makes it very easy to:

> Display the current measurements. The current measurements (CO_2 and O_2 concentration, pressure, moisture, OUR, CER, RQ) can be displayed in the overview.
> Visualize the data. The measurements are displayed as a number of different graphs in real time in an overview. The web server automatically records important indicators such as OUR, CER and RQ. The CO_2 and O_2 measurements are also displayed.
> Export the data. All measurements are stored on the web server and can subsequently be exported in standard formats (Excel, .csv, sqlite). This means it is not necessary to have a PC or laptop connected to the BlueWeb server all the time.



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DMU gas multiplexer

The DMU: Gas multiplexer for the analysis of cell growth processes

During cell growth processes (e.g. Chinese Hamster Ovary, CHO), it is often the case that only very small quantities of gas are produced. The DMU (Dual Multiplexer Unit) is a gas multiplexer for the BlueInOne Cell, which features an integrated web browser which was specially developed for studying cell growth processes. The multiplexer can, in turn, use valves to guide the gas out of the gas mixer (gas in) and convey the gas from the process (gas out) to one individual BlueInOne Cell. The analyzer then alternately measures the respective concentrations of gas. Deviations of the gas-in gas mixture are detected and compensated automatically. This special set-up allows even the most minute metabolizations of up to 50 ppm to be detected. A BlueWeb server is installed inside the DMU. This is connected to a computer via an Ethernet connection or integrated into the local network. Any up-to-date Internet browser can be used to access the DMU without problems. This not only means that the Multiplexer does not need a specific operating system, but also that no special software has to be installed to export the data or change the Multiplexer settings. The BlueInOne Web application for controlling and visualizing the measurements simply runs on your web browser. The web server in the DMU automatically logs the data recorded on an ongoing basis during the process, and is very easy to read out.

A BlueWeb server is installed inside the DMU. With this set-up it is possible to:

> Change all settings of the DMU via the BlueWeb server. This means the valve cycle intervals, as well as the process parameters, can be configured.
> See the valve position.
> Visualize the process.
> Save and export all the data. A PC or laptop must not be connected all the time.

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BlueInOne example installation*

1 Unpacking the sensor

The mains adapter and the connection cable, including a USB adapter, are included in the scope of delivery. The required hose fittings/flow adapters or quick-release connectors must be specified with the order.

2 Connecting the power cable

The 8-pin M12 plug is connected to Port A using the power cable.* When the BlueInOne has just been delivered, waiting 2 hours to allow it to reach room temperature is recommended before unpacking it..

3 Connecting the mains adapter

The mains adapter is then connected. Please only use original accessories!

**Example installation. Other conditions possible. Please follow the operating instructions.*

These work steps are important to ensure the unit functions properly.

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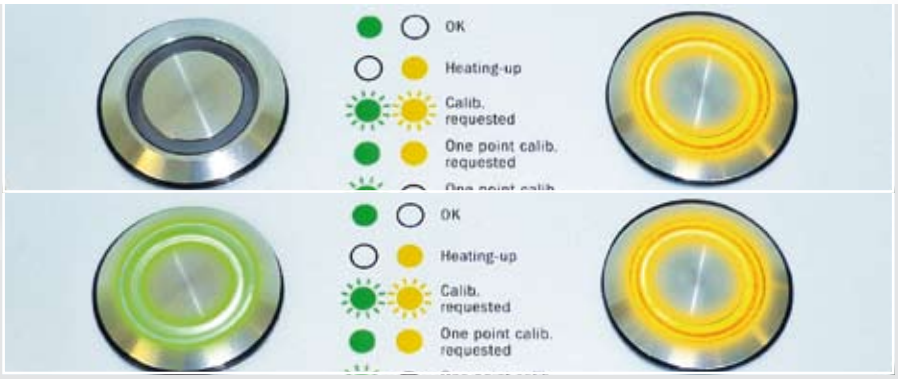
BlueInOne

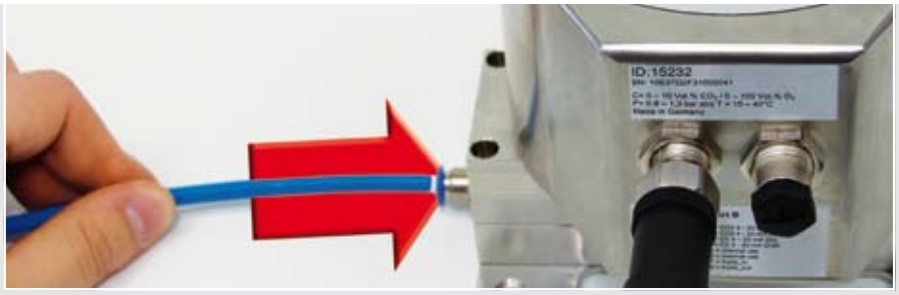
BlueInOne example installation*

4 Warming up the sensor



The BlueInOne warms up for approx. 60 minutes. During this time, the right-hand pushbutton will light up in yellow. The left-hand pushbutton then lights up in green while the right-hand one remains yellow. This is how the analyzer indicates that a 1-point calibration needs to be carried out.

5 Flushing with ambient air



The sensor is flushed with normal ambient air for another 30 minutes for the 1-point calibration. Other configurations (e. g. synthetic air, etc.) are available upon request.

6 1-point calibration

Both pushbuttons are pressed at the same time for 5 seconds to start the automatic calibration of the BlueInOne. Once the 1-point calibration is complete, only the left button lights up, in green. The BlueInOne is then ready for operation.

7 Connecting to the computer

The BlueInOne is connected to a computer using the USB-RS232 adapter. Of course, the BlueInOne can also be connected to any standard process control system (not shown).

**Example installation. Other conditions possible. Please follow the operating instructions.*

These work steps are important to ensure the unit functions properly.

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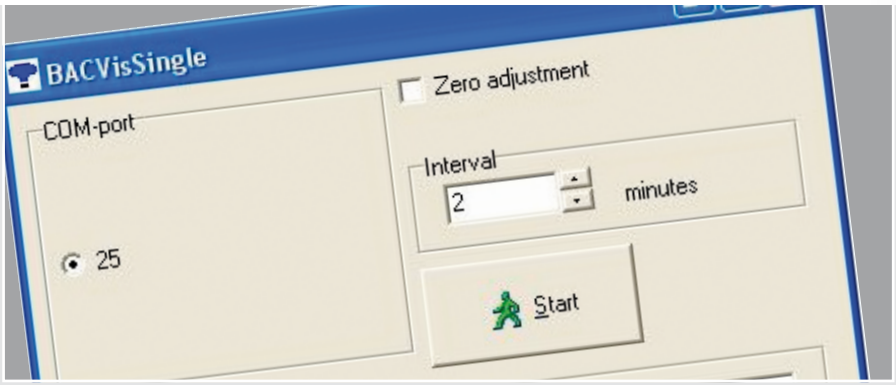
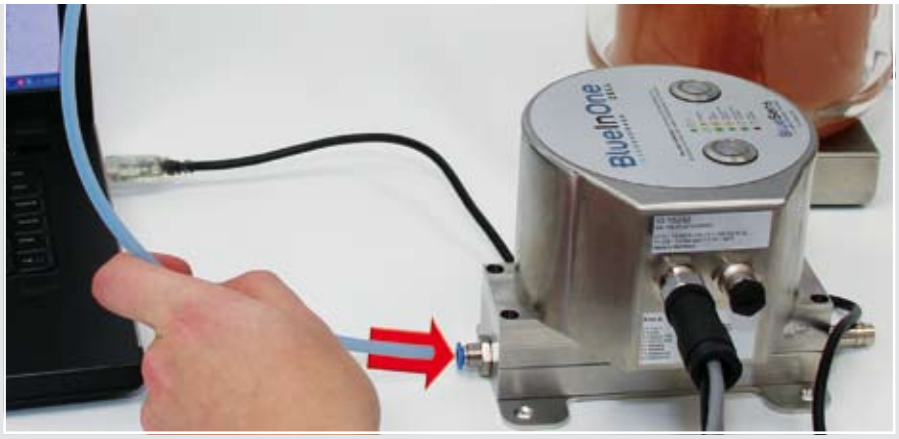
BlueInOne example installation*

8 Starting the software



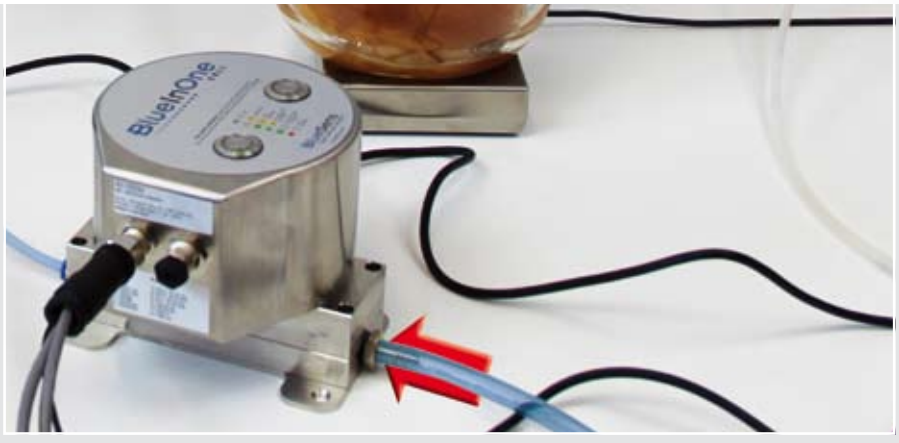
The analysis software BACVis Single is launched and the preferred time interval for recording the data is selected. Recording is started.

9 Connecting the reactor to the sensor



Example: A reactor is connected to the BlueInOne via a 6 mm hose and quick-release connector.

10 Connecting an exhaust gas hose



An exhaust gas hose is connected to the BlueInOne. The example installation is now complete, and the measuring can start.

**Example installation. Other conditions possible. Please follow the operating instructions.*

These work steps are important to ensure the unit functions properly.

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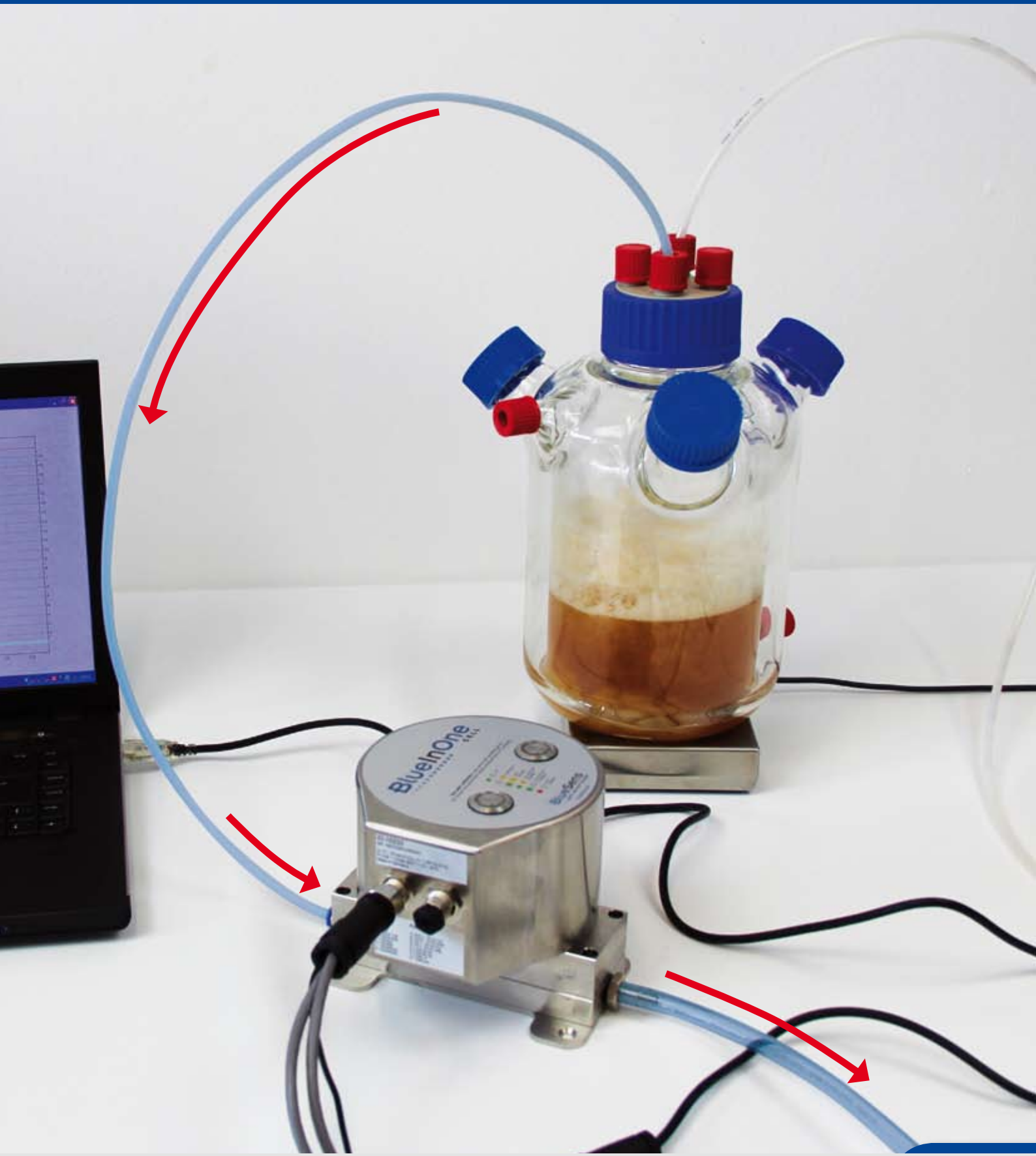

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Data sheet BlueInOne

BlueInOne FERM	BlueInOne CELL

O_2 sensor unit		
*Concentration ranges****	0.1 - 25 Vol.% O_2 / 1 - 50 Vol.% O_2	0 - 100 Vol.% O_2
Measuring principle	Zirconium dioxide	Galvanic cell
Accuracy	< ± 0.2% FS* ± 3% value	
Drift	< ± 2% value / year	
Lifetime of sensor element	Approx. 15 000 operating hours	Approx. 900 000 Vol.% h operating hours at 1 bar (14.5 psi)
Temperature inside of the sensor unit	580°C / 1076°F	Approx. room temperature

CO_2 sensor unit	
*Concentration ranges****	0 - 10 Vol.% CO_2 / 0 - 25 Vol.% CO_2
Measuring principle	Infrared: dual wavelengths
Accuracy	< ± 0.2% FS* ± 3% value
Drift	< ± 2% value / year
Lifetime of optical components	Approx. 3 years
Temperature inside of the sensor unit	3°C / 5.4°F higher than process temperature

General		
Temperature range	15 - 40°C / 59°F - 104°F	
Pressure range	0.8 - 1.3 bar / 11.6 – 18.85 psi absolute pressure	
Operating humidity	0 – 100% RH, integrated humidity compensation	5 – 100% RH, integrated humidity compensation
Housing	Stainless steel, IP65	
Dimension (WxLxH) / weight	170 x 150 x 120 mm (6.69" x 5.91" x 4.72") ** / 4 kg (8.82 lb)	
Mechanical connection	4, 6, 8, 10, 12mm outer diameter, 4,6,8mm inner diameter, ¼", ⅛" , 1 ¼", ¼" und ½" swagelok"***	
Materials in contact with process gas	Stainless steel, viton, sapphire, PTFE, polymer H.L., nitrile	
Filters	PTFE 0.22 µm, PTFE 5 µm	
Power supply	24V 1A	
Storage conditions	0 - +60°C / 32- 140°F ; < 75% RH noncondensing	0 - 60°C (32-140°F); 5 - 75% RH noncondensing

Electronic connections		
Power supply	8 pin M12 male	
Output connection	8 pin M12 female	
Electronic Output	Active output, maximum 500 Ohm at 24V power supply RS232, RS485 Modbus, 2x 4-20mA, USB, Modbus OPC Server	
Maintenance	One point calibration with ambient air (0.04 Vol.% CO_2, 20.97 Vol.% O_2) once a month (other conditions possible), optional factory calibration once a year	
CE/FCC/ICES	EN61326-1:2006 / FCC 15:2009 Subpart 107/109, ICES-001:2006	
Remarks	Don't use in explosive atmosphere, in anoxic atmosphere, in gases with polymers or silicon components or in gases with halogens (F, Cl, Br, etc.), CFC or SO_x and H_2S	High concentration of NH_3 or O_3 could minimize the lifetime of the O_2 sensor element

* FS= full scale ** depends on flow adapter dimension ***others on request

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