

Yield Master



Operating Manual Betriebsanleitung

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1 About this document

1.1 Function

This operating manual provides you with all of the necessary information for quick start-up and safe operation of the **Yieldmaster**. Therefore, please read this operation manual before starting operation.

1.2 Target group

This operating manual is intended for use by trained specialist personnel. The content of this manual must be made available to the corresponding personnel and followed by them.

1.3 Symbols used

DANGER



DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING



WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION



CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE



Notice about a harmful situation, possible consequences: the product itself or surrounding objects could be damaged.



This symbol indicates helpful, additional information.

1. Sequence of actions

Numbers indicate steps to be performed in a certain sequence.

2 For your safety

2.1 General information

The **Yieldmaster** system was tested and ready for operation when it left our plant.

Please read this operating manual carefully before installing the device and starting operation. The operating manual contains safety instructions that must be observed to ensure safe operation.

The system may never be operated in conditions that do not correspond to the specifications on the type plate.

Maintenance and servicing may only be performed by specially trained personnel who are familiar with the hazards inherent to the work as well as the guarantee terms.

2.2 Authorized personnel

All actions described in this operating manual may only be conducted by specialist personnel who have been authorized by the plant operator. Work on the device other than that described in this manual may only be performed by personnel of the BlueSens gas sensor GmbH company for safety reasons and to ensure compliance with the terms of the guarantee.

2.3 Proper use

The **Yieldmaster** is an analysis system for simultaneous gas concentration analysis (CH₄ and other gases like CO₂, O₂, EtOH, H₂ also addable) and volume determination in the specified concentration area and under the conditions described in the technical data. It is used to monitor metabolism in biological processes such as fermentation. The BPC-sensors of the Yieldmaster may only be used in well ventilated rooms.

DANGER



The sensor does not have an ATEX certificate and may therefore only be used in well ventilated rooms.

2.4 Misuse warning

Parts of the **Yieldmaster** system may not be used as a safety component for monitoring gasses in systems or as a gas warning device. It may also not be used in areas subject to explosion hazards.

2.5 General safety instructions

If the device is not used correctly, or used for its intended purpose, application-specific hazards may arise.

DANGER



If the device is incorrectly installed or set, there is a danger of explosions and poisoning.

After installation, check all connections for leaks.

NOTICE



Please note the safety instructions in all the following chapters.

2.6 CE conformity

The Yieldmaster conforms to the EMC Directive (89/336/EEC, 92/31/EEC and 93/68/EEC) when applying the harmonized standards EN50081–1, EN61000.

The low-voltage directive (72/23/EEC und 93/68/EEC) is not applicable as no voltage greater than 24 V is used. You can find the EC Declaration of conformity on one of the last page of this manual.

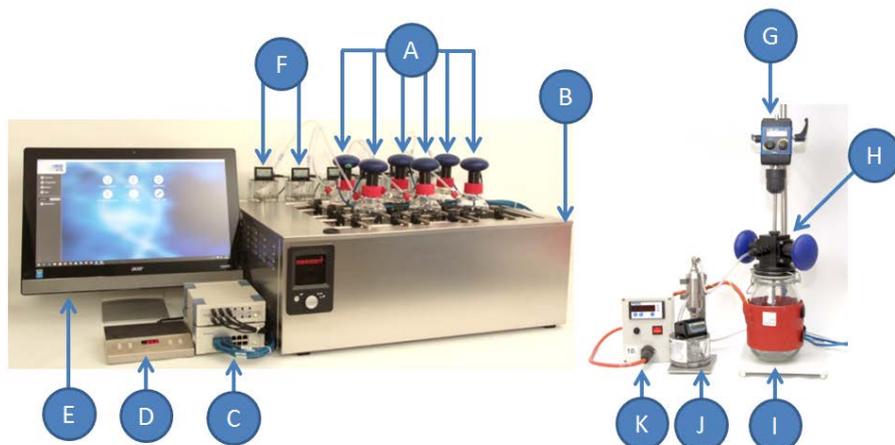
3 Product description

3.1 Yieldmaster

The **Yieldmaster** is an analysis system for the simultaneous methane (CH₄) and volume determination. The biogas analyzer Yieldmaster is a highly developed measuring system consisting of microprocessor controlled infrared-gas sensors, precision volumenometers (MilliGascounter®) and the related BlueVis bioprocessing software. It is consisting of up to 12 sets of BCP-CH₄ sensors (other sensors for CO₂, O₂, EtOH, H₂ also addable) and the same number of MilliGascounters. The CH₄ concentration will be detected by the BCP-CH₄ sensors and the produced volume will be detected by the MilliGascounter.

The CH₄ sensors BCP-CH₄ are connected to a multiplexer box BACCOM12 for the methane measurement inside the vessel. Alternatively, the sensors can be connected with power supply for each sensor and USB adapter. The MilliGascounter are connected to the CounterBox for the detection of the volume. The CounterBox will be connected to the BACCom12 for the power supply and the data transfer. Alternatively, the CounterBox can be connected with power supply and USB adapter directly to the PC. The BACCom12 will transfer the measurement data of the Methane and the volume to a PC. The BACCom12 can be connected to a PC via a serial connection or an Ethernet connection. The BACCom12 also can be integrated into your local area network (LAN) by the Ethernet connection.

Every MilliGascounter is protected by a one-way valve. This device secures that no fluid from the MilliGascounter could be sucked into the fermentation vessel due to change of pressure during longer experiments. During the experiment, Methane is produced inside of the fermentation vessel.



- | | |
|--|---|
| <p>A Up to 12 CH₄-sensors, other sensors (CO₂, O₂, EtOH, H₂) also addable</p> <p>B Water bath with integrated thermostat and water compensation</p> <p>C Multiplexer BACCom12 with integrated pressure sensor and CounterBox with integrated temperature sensor</p> <p>D Control unit for magnetic stirrer plate (water resistant magnetic stirrer plate is inside the water bath and not shown on image)</p> <p>E BlueVis Software for data logging and process management</p> | <p>F MilliGascounter® with one-way valve</p> <p>G Stirrer</p> <p>H Special flow adapter POM with two gas sensors for use with preserving jars</p> <p>I Heating jacket for preserving jars</p> <p>J MilliGascounter® with compensating reservoir device</p> <p>K Control unit for heating jacket</p> |
|--|---|

3.2 BCP-CH4 sensor

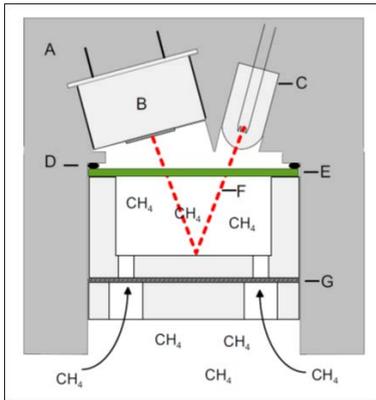
For the CH₄-measurement BCP-CH₄ sensors are included in the Yieldmaster analysis system. The BCP-CH₄ is designed for a particular mechanical connection that can only be altered subsequently at the plant for a certain fee. Please note the respective instructions if you are using additional sensors for other gas components (such as O₂, H₂, CO₂ etc).



3.2.1 Measuring principle CH₄ sensor

The sensor contains the IR light source, the detector and the evaluation electronics.

The infrared light beam is reflected by the gas-filled measuring adapter and the light weakened by the analyte gas is measured by the detector. The light-permeable sapphire disc prevents the sample atmosphere from escaping and contaminating the optical components. The sensor head heats the measuring adapter so that no moisture can condensate. The heating time lasts about 1 hour both during initial start-up and after each time the device is disconnected from the power supply. The sensor does not output any measurement values during the heating-up period.



- | | |
|---|-----------------|
| A | Sensor head |
| B | Detector |
| C | Light source |
| D | Seal |
| E | Sapphire window |
| F | Light beam |
| G | Sterile filter |

4 Installation

4.1 General information

The Yieldmaster is protected by packaging on its way to its application location. This secures it against the usual transport strains. However, before installation, check whether the device has been damaged due to improper transport or improper storage. If the device is damaged in any way, operation without hazards is not possible and the device may not be installed and taken into operation.

Check whether the enclosed materials such as seals and screw-caps are suitable for your process conditions (pressure, temperature, etc.).

The installation should only be performed under supervision by a specialist and in compliance with all applicable work safety rules. After the installation check the system for gas tightness.

CAUTION



The sterile filter is not intended for repelling fluids. Never install the sensor such that fluid can run into the measuring adapter. If water has penetrated the measuring adapter, allow it to dry out for at least 12 hours at max. 80 °C in a drying cabinet or on a hot plate. Protect the measuring adapter from penetration by liquids. After installation, check that the system is gas-tight.

CAUTION



Read the installation instructions carefully to prevent damage to the device. Proceed step-by-step. Only use the original plugs, cables and power adapters. Never connect or disconnect plugs when the device is connected to the power supply. The device does not have an on/off switch; it starts operation as soon as it is connected to the power supply. Improper operation can result in damage to the device.

4.2 Connecting the BCP-sensors and CounterBox to a PC

The Yieldmaster is a modular system with various types of mechanical and electronic connections. In the first step the BCP-sensors and the CounterBox are connected to the PC .

4.3 Preparing CounterBox

It is possible to connect the CounterBox to the BACCom12 with a M12 to BACCom connection cable. In that case the CounterBox is supplied with power from the BACCom and the data is transferred via the BACCom as well. The other option is to connect the CounterBox directly to the PC via the Aadapter cable M12 5pin to USB (RS232) (Article number Z-KA-00032). In the latter case, the CounterBox needs a separate power supply. See the following chapters for details about the preparing the CounterBox.



The CounterBox could be used with a Lithium battery, to avoid the loss of data during a blackout. The measured volume will be stored for about 10 days. See "Exchange of the Battery of the CounterBox" on page 48 for details about the use of the battery. The installation of a battery is recommended before measuring.

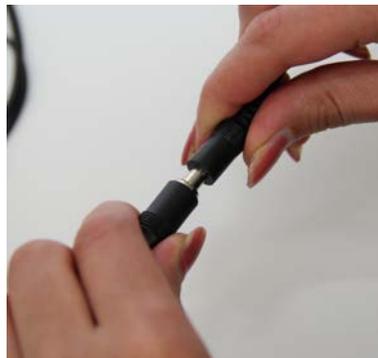
4.3.1 Option 1: connect the CounterBox to the BACCom12

If you want to connect the CounterBox to the BACCom12 connect both devices via connection cable BACCom CouterBox M12M8 (article Number Z-KA-00049). The CounterBox will send all the data to the BACCom12 . For this connection type the CounterBox will get the power from the BACCom12 an will not need a separate power supply.



4.3.2 Option 2: connect the CounterBox directly to the PC

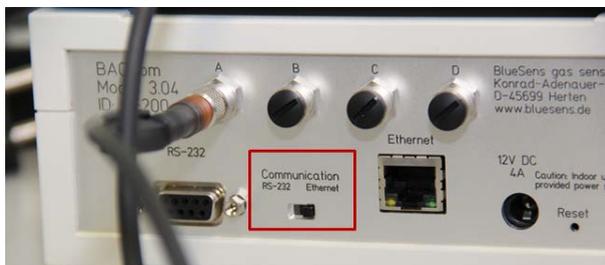
The second option is to connect the CounterBox directly to the PC. In that case connect the adapter cable M12 5pin to USB (RS232) (Article number Z-KA-00032) to the BACComCB and connect the power supply to the cable. Use original equipment only to prevent damages to the device.



Connect the adapter cable M12 5pin to USB (RS232) to the PC.

4.3.3 Connect the BACCom12 to the PC

Select the communication type with the “Communication” switch on the back of the BACCom 12. If you would like to use the RS-232 via USB serial connection, select “RS-232” or select “Ethernet” if you would like to use a connection via Ethernet.



Plug in the Ethernet cable into the Ethernet-port or the RS-232 connector to the RS-232-port (RS-232 connection not shown).



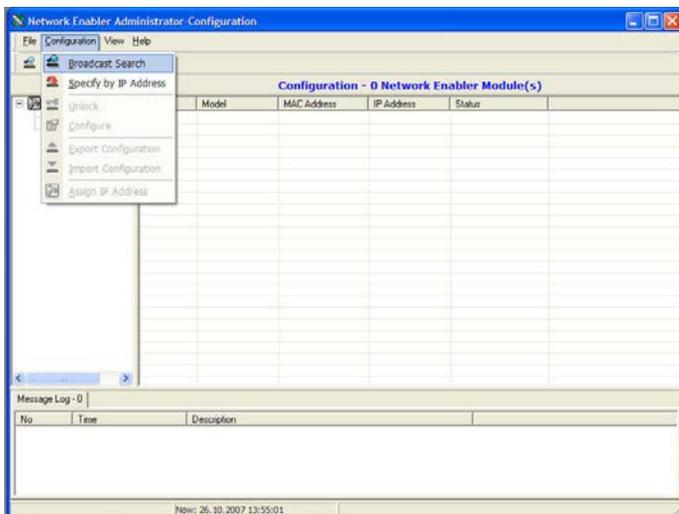
Connect a PC to the Ethernet cable or to the RS-232 connection (not shown on image).



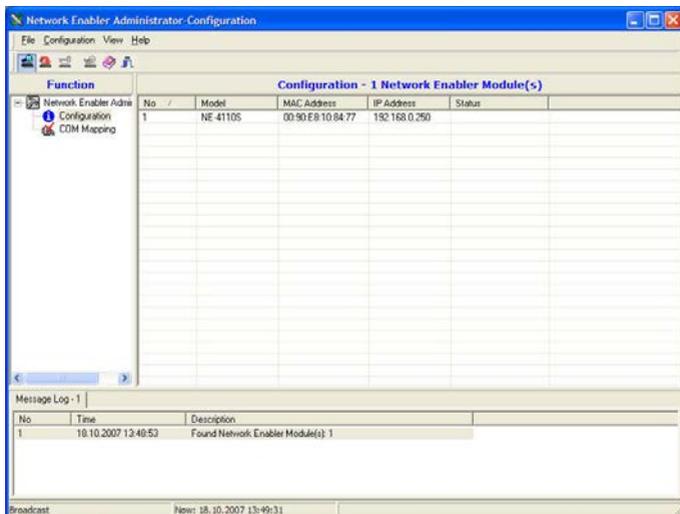
4.3.4 Settings of the Network Enabler Administrator for the BACCom

In the first step, install the Network Enabler Administrator (NEA). Run program "neadm_setup_Ver2.10_Build_07072710.exe" and follow the instructions.

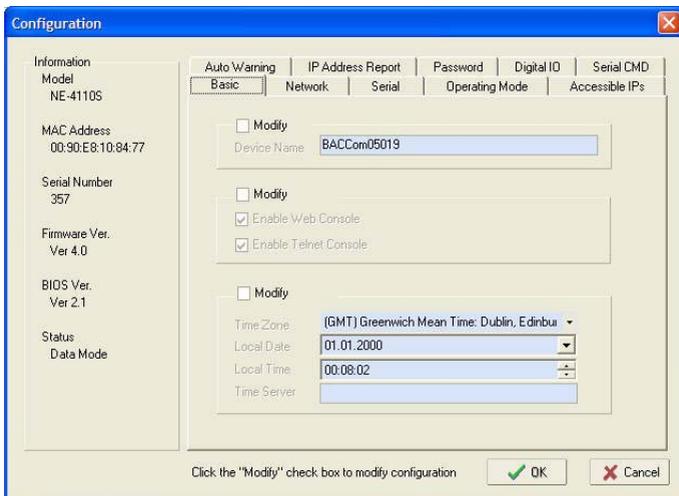
After that, open NEA, set IP address and COM port. After opening the program the BACCOM has to be searched first. Run a Broadcast Search (Menu: Configuration/Broadcast Search).



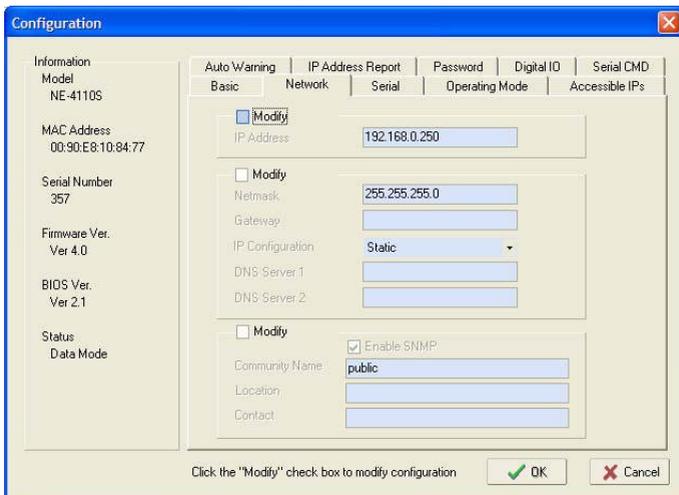
If the BACCom is correctly connected a Model NE-4110S will be found.



A configuration mask is opened by a double-click on the line with the corresponding module.

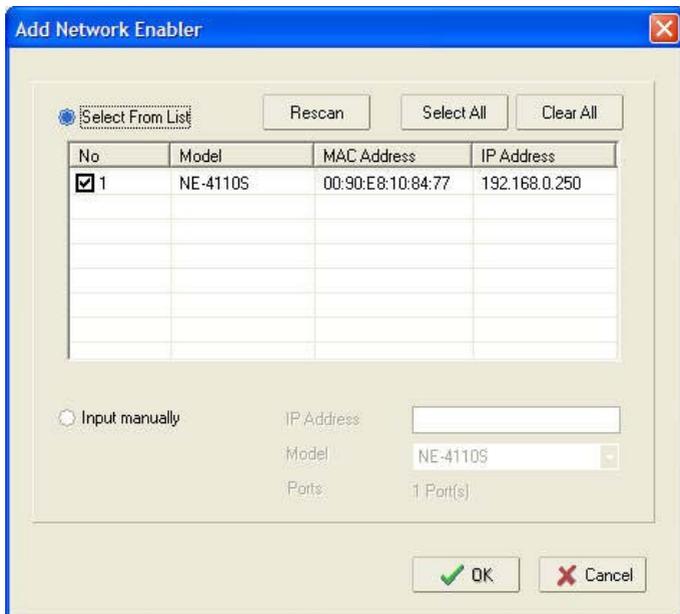


To set the network parameters go to the tab Network and click the check box Modify.

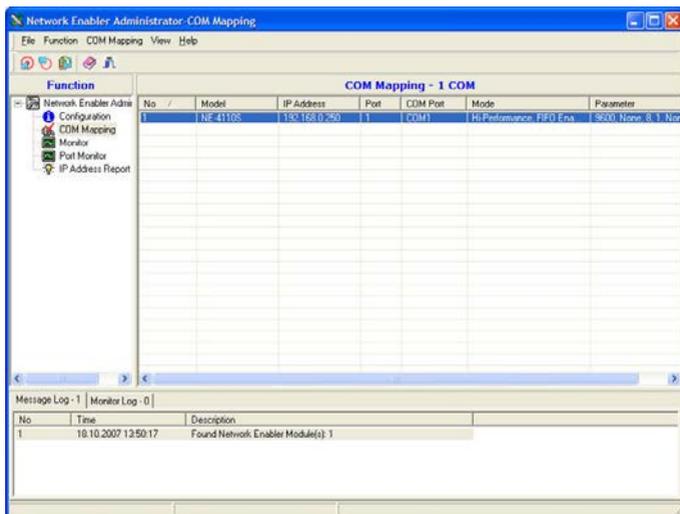


Then the network address can be changed. Should other network parameters have to be changed also click on the corresponding Modify checkbox and enter the desired values. Leave the configuration mask with OK; the new network parameters are transferred.

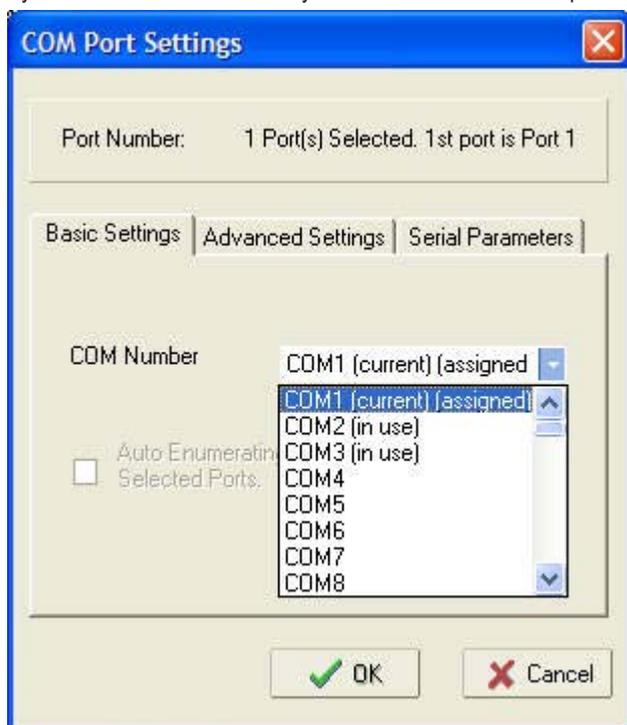
A window opens in which you select the module shown.



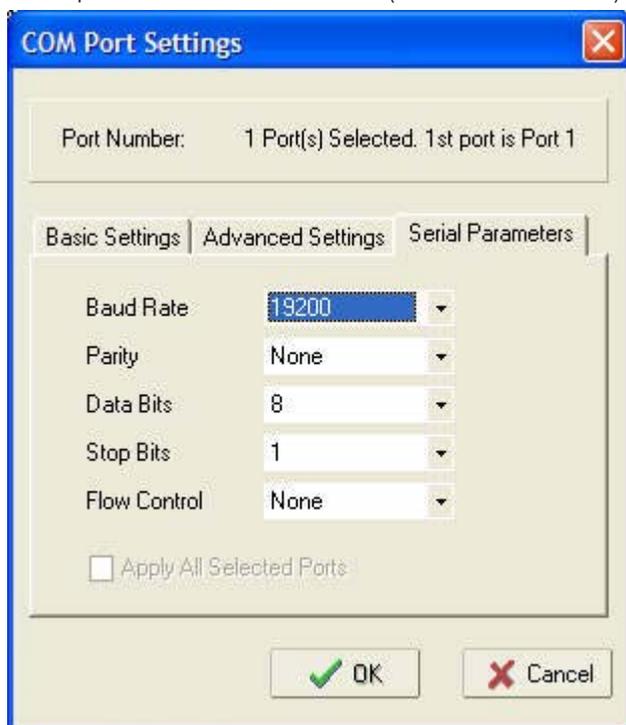
When you close the window with OK the module is shown in the NEA.



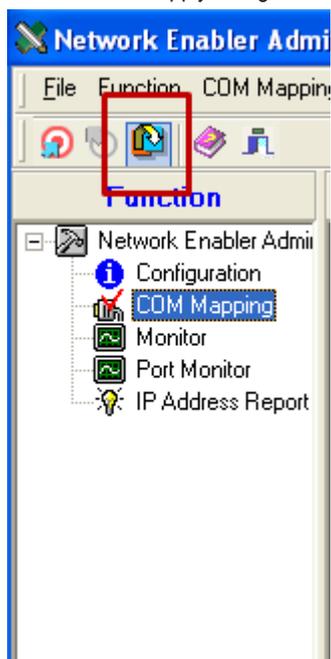
By a double-click on the module you can now select the COM port number.



Set the parameters of the serial interface (Tab: Serial Parameters) as shown:



Accept the settings just made with OK and you can now close the NEA. Hereby the new virtual interface is created in your system. To apply all the changes please select COM Mapping then on the icon apply changes to save the new settings.



If you set the Communication switch on the BACCom to Ethernet you can now use the software as accustomed with the new interface.

4.3.5 Connecting the sensors: option 1: connecting the BCP- sensors to the BACCom12

Connect the BCP-sensor to the BACCom12. Always proceed in numerical order. Connect the first BPC-sensor to port 1 at the front of the BACCom12 and continue with port 2, 3, 4 and so on if you are using more than just one BCP-sensor.

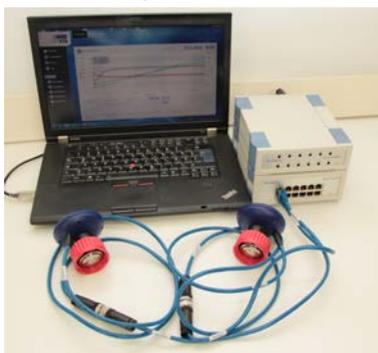


Plug in the power supply into the BACCom12 and plug the power plug into the power connector.



If you have connected the CounterBox via the BACCom to the PC, the CounterBox will be supplied with power by the BACCom. If you have connected the CounterBox directly to the PC you will need a separate power supply.

The sensors will now heat up for 60 Minutes. In this time no measurements will be possible. In the meantime, you can continue with the rest of the set-up.



4.3.6 Connecting the sensors: option 2: connecting the BCP-sensors directly to the PC via USB

If you are not using a BACCom12 for the connection of the BCP-sensors you have the option of a direct connection of the BCP-sensors via USB-connection. For this connection type you will need a adapter cable M12 8pin to USB (RS232) 1,8meters. Connect the adapter to the BCP-Sensor, connect the power-supply included and connect the USB connector to your PC. It is important to use the correct power supply. Wrong specifications of the power supply will damage the sensor. Use original equipment only. The sensors will now heat up for 60 Minutes. In this time no measurements will be possible. In the meantime, you can continue with the rest of the set-up.

4.4 Installation of the Yieldmaster with one way valve and vessel

For the installation of the Yieldmaster system the set-up of a single vessel together with a MilliGascounter® and BCP-sensors will be explained as example for the installation of all vessels. For the other vessels continue accordingly. After the set-up the vessels can be placed in a water bath and on a stirrer. For the set-up you will need the following equipment:



	Description	Article number
A	MilliGascounter® V.3 PMMA	Z-FM-00021
B	Cable 3,5mm connector - connector 2m	Z-KA-00042
C	BCP sensor	Various types possible
D	Vessel	Various types possible
E	BACCom12 multiplexer	K-00001
F	CounterBox (standalone) with pressure sensor	K-00008
G	2 x power supply for BACCom12, use original equipment only	Z-NT-00003
H	Adapter cable M12 5pin to USB (RS232)	Z-KA-00032
I	Gasket for GL45 screwed connections/sealing	Z-OR-00004
J	Non return valve for MGC	4mm ID: Z-FM-00028, 6mm ID: Z-KM-00028

	Description	Article number
K	Nozzle with gasket GL 14	Z-ST-00021
L	Sealing silicone GL 14	Z-OR-00005
M	Screw cap GL 14 Schott, Bore 9,2mm	Z-MA-00001
N	Connection hose for Milligascounter	Various types possible
	Ethernet cable for BACCom (not shown on image)	Z-KA-00041
	Adapter cable M12 8pin to USB (RS232) 1,8meters (optional equipment, not shown on image)	Z-KA-00014
	Connection cable BACCom CouterBox M12M8 (optional equipment, not shown on image)	Z-KA-00049

For this kind of set-up you can find an explanatory video on youtube:

<https://www.youtube.com/watch?v=vSPWiwc8puU>

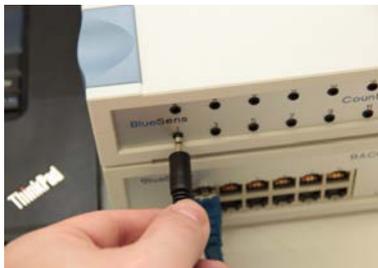


You 

In the first step, the MilliGascounter® is prepared. The cable 3,5mm connector - connector 2m is plugged into the MilliGascounter®.



The cable is plugged into the CounterBox.



CAUTION



Caution! Please see the manual for the MilliGascounter® for the preparation of the MilliGascounter® with the oil. It is important that the MilliGascounter is filled with the right amount of this special oil. The screw on top of the MilliGascounter® is a leveler meter. The oil must only just touch the tip of the screw. It is also very important that the MilliGascounter® is placed on an absolutely flat surface during the measurement.

The screwed cap of the inlet of the MilliGascounter® (MGC) is fitted to the connection hose for the non return valve. Note that you can use the pre-installed hose of the MGC for this step, too.



The connection hose is screwed on the MGC.



The non return valve is connected to the connection hose now. Note the flow direction of the non return valve.



The hose for the off gas is connected to the outlet of the MGC. The off gas must be depolluted according to the local laws and security regulations. The hose for the off gas should have the length of 2-3 meters.



Insert the connection hose through the screw cap GL 14.



After that, put the connection hose on the nozzle



Place the nozzle on the connection GL14 of the vessel and tighten the screw cap GL14.



The spare GL14 connection on the vessel needs to be sealed so that all the produced gas will be measured. Place the sealing silicone GL14 into the screw GL14 with bore 9,2mm. Put the screw cap GL14 together with the sealing on the on the GL4 thread of the vessel and tighten the connection so that it is gas-tight.



After the heat-up time the BCP-sensor can be screwed on the fermenter vessel. To have a gas tight connection, place the gasket for GL45 on the GL45 connection of the vessel.



Put the BCP-CH4 on the GL45 thread of the vessel and tighten the screw ring so that the connection becomes gas tight .



Put the connection hose on the non return valve. Check for gas tightness after installation.



For the other vessels continue accordingly. To start a measurement, see the handbook for BlueVis for the calibration and the installation of the MGCs and sensors.

4.5 Installation with the preserving jar

For the use of preserving jars as fermenters there is an optional flow adapter made out of POM available.

DANGER



Damaged heating sleeves must not be used. The heating sleeve must not come into contact with liquids.



In the following steps the installation with this set-up will be explained.

4.5.1 Preparations for the measurement in the preserving jar

First the preserving jar will be prepared for installation. Therefore please remove the glass lid from the jar and also the rubber seal from the lid. Remove the metal clamp from the lid, too. The flow adapter will be delivered with the preinstalled sensors.



For the installation of a flow adapter a jar, the metal clamp, the rubber seal and the flow adapter is required.



Put the rubber seal on the sealing surface on the flow adapter.



Put the metal clamp from the glass lid around the flow adapter and hook it back into the holder of the jar.



Additional probes can be attached via the screwed connection on top of the flow adapter. The cap can be screwed off with a coin (a 50 Euro-cent coin or a Quarter for example). Check the measurement system for gas tightness after the installation. Skip to the next step if you do not want to install additional probes.

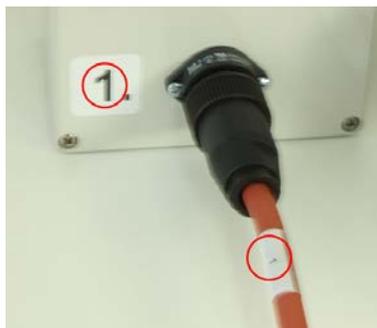


Now the heating sleeve is attached. Place the sleeve around the jar and fasten the Velcro straps. Make sure that the sleeve fits tight.





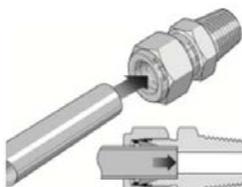
The plug of the heating sleeve is connected to the heating control unit. Each sleeve belongs to one control unit to guaranty highly precise heating results. Please make sure to connect the matching numbers only.



Now the MilliGascounter will be connected to the flow adapter. For this step you need a completely assembled MilliGascounter with the compensating reservoir MGC, a complete preserving jar with the flow adapter and the (optional) heating sleeve and a hose with an outer diameter of 6mm. For the set-up of the MilliGascounter together with the compensating reservoir MGC please note "The compensating reservoir" on page 42.



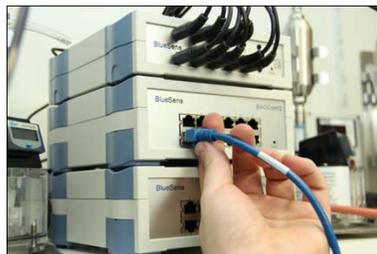
Press the hose firmly into the Swagelok®-connection and the nut is tightened afterwards.



The flow adapter is equipped with a quick connector for hoses with 6mm outer diameter. The hose can be easily plugged to the quick connector.



The sensors and MilliGascounters can be connected to the BACCom respectively the CounterBox now. The set-up is complete and the BACVis or BlueVis software can be started. See the corresponding manuals.



4.6 1-point calibration with the use of jars

When using jars for Yieldmaster system, we recommend a special approach for the implementation of the 1-point calibration. This must be done once a month. Remove the caps on top of the flow adapter with a 50-cent coin or a Quarter.



Open up the jars and turn the flow adapters to the side. If the sensors have been exposed to high concentrations of CO₂, leave the sensors aired overnight.



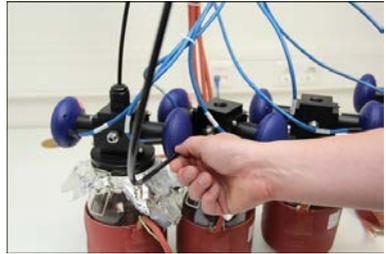
The sensors must be flushed with nitrogen (N₂) or with a gas containing no CO₂, and no hydrocarbons (other specifications possible, please refer to the data sheets of your sensors). The flow rate must be 200ml per minute or higher. To ensure that the flushing volume is kept to a minimum, put aluminum foil on the glass and put on the flow adapter again and close the shutter again.



To be able to flush all sensors with just one gas connection, additional connectors with hoses with an outer diameter of 6mm will be screwed in the top of the flow adapters.



The free end of the hose is connected to the quick connector of the next flow adapter.



Connect the other jars accordingly so that the calibration gas can flow from jar to jar.



The calibration gas is conveyed through the quick connector of the first bottle. The gas flows through all the jars. After the last jar the gas must be disposed of in accordance with the local safety regulations.



See "1-point calibration" on page 44 for the calibration.

4.6.1 Dismounting the flow adapter for preserving jars

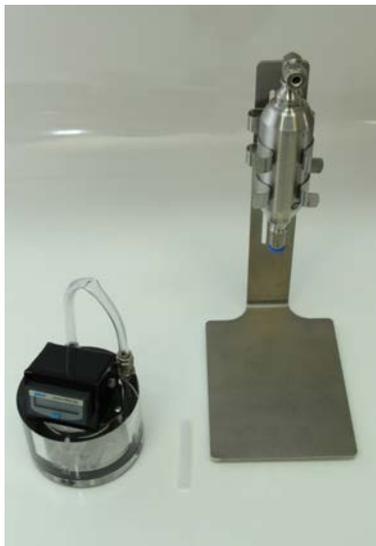
The flow adapter is delivered fully assembled. Generally, the flow adapter should not be dismantled. If the disassembling still is necessary, e.g. to change the filter in the sensors loosen the screws carefully. Disconnect the sensor from the flow adapter. When refitting the flow adapter to the sensors make sure that the screws do not tilt. Tighten the screws hand-tight. Also pay attention to the correct positioning of the sealing rings.



4.7 The compensating reservoir

The compensating reservoir secures that no fluid from the MilliGascounter could be sucked into the fermentation vessel due to change of pressure during longer experiments.

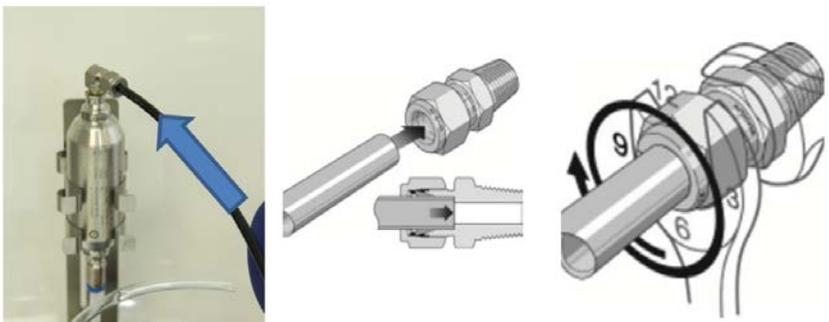
For the set-up of the MilliGascounter (MGC) together with the compensating reservoir place the MGC under the reservoir.



Put the compensating reservoir on the inlet of the MGC using a connection hose. Check for gas tightness after installation.



Press the hose from the fermentation vessel firmly into the Swagelok®-connection and the nut is tightened afterwards. Check for gas tightness after installation.

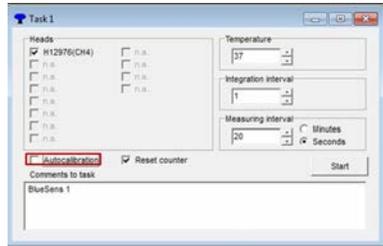
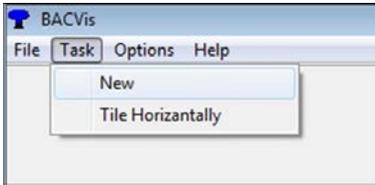


5 Maintenance

We recommend you send the sensors to BlueSens for annual maintenance, inspection and calibration.

5.1 1-point calibration

The adjustment can be made using the BACVis software. After the 30 minutes select “Task” and “New” in the BACVis software. In the new window select the sensors (Heats) and check the “Autocalibrate” box and select “Start” after that. If you perform a 1-point-calibration with the wrong gas, wrong measurement results will occur. Use the “Autocalibrate”-checkbox with caution. You also can run the calibration in BlueVis as well. See the handbook for BlueVis for details.



5.2 Recalibration

The sensor should be sent back to the manufacturer or an authorized dealer for annual recalibration.

5.3 Filter change – coarse filter

The filter may be changed if it was polluted during an experiment.

CAUTION



The integrated filter is not intended to repel fluids. Never install the sensor so that fluid can run into it.

If water penetrates the flow adapter, it must be rinsed with a sufficient amount of dry air.

5.3.1 Removing the filter cover

Hold the sensor head and screw off the lower cover counterclockwise using the clamping ring tongs.



If your filter-cover is already equipped with notches you can use a big coin (like a 2-Euro-coin or a quarter) to remove the cover, too.



5.3.2 Changing the filter and seals (Z-XX-00052)

1. Remove the filter from the recess.
2. Insert a new filter.
3. Check the seals for damage and replace as required.
4. Screw on the lower cover using the clamping ring tongs respectively using the coin.



5.4 Minimization of dilution effects

The dilution effect due to moistening of dry gas will be compensated by the BACVis software. To do this, you need to know the lowest temperature in the fermenter vessel (where the humidity condensates). Enter this temperature into the box "Temperature".

In the table you can see the dilution factor that is used by BACVis.

Temperature [°C]	Dilution factor
-10	0.9972
0	0.9940
5	0.9914
10	0.9879
15	0.9831
20	0.9769
25	0.9687
30	0.9580
35	0.9444
40	0.9270
45	0.9052
50	0.8779

5.5 Exchange of the Battery of the CounterBox

The CounterBox could be used with a Lithium battery, to avoid the loss of data during a black-out. The measured volume will be stored for about 10 days.

After 10 days without power the battery must be changed.

Use only batteries of the written type. (AA 3.6 V LiOCl2).



**EG-Konformitätserklärung
EC Declaration of conformity**

Hiermit erklären wir, dass unser Produkt, Typ:

We hereby declare that our product, type;

Yieldmaster

folgenden einschlägigen Bestimmungen entspricht:

complies with the following relevant provisions:

Niederspannungsrichtlinie (72/23/EWG und 93/68/EWG) findet keine Anwendung, da keine Spannung größer 24 V genutzt wird.

Low voltage guideline (72/23/EEC and 93/68/EEC) is not applicable as no voltage higher than 24 V is used.

EMV-Richtlinie (89/336/EWG, 92/31/EWG und 93/68/EWG)

EMC guideline (89/336/EEC, 92/31/EEC and 93/68/EEC)

Angewendete harmonisierte Normen, insbesondere:

Applied harmonized standards, in particular:

EN50081-1

EN61000

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Herten, 17.04.2014

BlueSens
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Dr. Udo Schmale

7 Technical data

See enclosed datasheet.

Blue4Care - The maintenance service by BlueSens

BlueSens' gas sensors are high quality measuring devices. To ensure accurate operation and to extend the guarantee for one year we recommend annual maintenance in our factory.

Blue4Care is a full service package for your BlueSens gas sensors. It's not necessary to order and pay for the service directly with your sensor order. Within one year after the sale of the sensor we will inform you and offer the service to you.

If you decide for Blue4Care, we will book a date for the maintenance and calibration of your sensors. The typical timeframe to complete the service will be one week exclusive shipping time.

If you service your sensor annually using Blue4Care, the devices will remain in our extended guarantee scheme. This means that, excluding user damage, your sensor will keep its original guarantee for years with significantly reduced maintenance costs.

You may also request at any time "maintenance on demand". BlueSens will repair or replace broken parts and calibrate the sensor as required by the user. Maintenance on demand does not extend the guarantee

Advantages:

- Maintenance administration by BlueSens
- Payment and Order one year after purchase
- Reduce Rate compare to "Maintenance on demand"
- Fixed cost per year
- Annual extension of guarantee for one year after maintenance (up to 6 years)

Cost:

Please visit the service-area on our homepage for prices:

www.bluesens.com → Service

