



Portable CO2 and O2-Analyser

BA 4S

Installation and Operation Instructions

Original instructions





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Read this instruction carefully prior to installation and/or use. Pay attention particularly to all advises and safety instructions to prevent injuries. Bühler Technologies can not be held responsible for misusing the product or unreliable function due to unauthorised modifications.

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1 Introduction

1.1 Intended Use

The BA 4S is a lightweight gas analyser used for field and laboratory analysis as well as light industrial applications where quick, precise, and reliable gas analysis is key. The BA 4S uses paramagnetic transmitters to determine the oxygen content in gas samples with concentrations of up to 100 % and uses infrared transmitters to determine the carbon dioxide (CO₂) in gas samples with concentrations of up to 50 % CO₂. The intuitive control panel makes the BA 4S easy to operate. Gas sample measurements are displayed on the display of the BA 4S and can also be transmitted to a serial device or optionally via mA outputs. The multi-purpose analyzer is low maintenance. It only needs to be calibrated (essential for gas sample measurement accuracy) and the inlet filter routinely checked.

1.2 Other Product Options

The BA 4S is available with the following options:

- integrated sampling pump
- front or rear sample gas port
- battery pack
- mA outputs
- flow meter

1.3 Scope of delivery

- Analyser
- Product documentation

1.4 Ordering instructions

Item no.	Description
55905260701	BA 4S O ₂ Pro without pump
55905260702	BA 4S O ₂ Pro including internal pump
55905260703	BA 4S O ₂ Premium without pump
55905260704	BA 4S O ₂ Premium including internal pump
55905260705	BA 4S O ₂ Pro + CO ₂ without pump
55905260706	BA 4S O ₂ Pro + CO ₂ including internal pump
55905260707	BA 4S O ₂ Premium + CO ₂ without pump
55905260708	BA 4S O ₂ Pro + CO ₂ including internal pump

2 Safety Notes

2.1 Important Information

Operation of the device is only valid if:

- the product is used under the conditions described in the installation- and operation instruction, the intended application according to the type plate and the intended use. In case of unauthorized modifications done by the user Bühler Technologies GmbH can not be held responsible for any damage,
- when complying with the specifications and markings on the nameplates.
- the performance limits given in the datasheets and in the installation- and operation instruction are obeyed,
- monitoring devices and safety devices are installed properly,
- service and repair is carried out by Bühler Technologies GmbH,
- only original spare parts are used.

This manual is part of the equipment. The manufacturer keeps the right to modify specifications without advanced notice. Keep this manual for later use.

Signal words for warnings

DANGER	Signal word for an imminent danger with high risk, resulting in severe injuries or death if not avoided.
WARNING	Signal word for a hazardous situation with medium risk, possibly resulting in severe injuries or death if not avoided.
CAUTION	Signal word for a hazardous situation with low risk, resulting in damaged to the device or the property or minor or medium injuries if not avoided.
NOTICE	Signal word for important information to the product.

Warning signs

These instructions use the following warning signs:

	Warns of a general hazard		Unplug from mains
	Voltage warning		Wear respiratory equipment
	Warns not to inhale toxic gasses		Wear a safety mask
	Warns of corrosive liquids		Wear gloves
	General information		

2.2 General Hazard Warnings

The equipment must be installed by a professional familiar with the safety requirements and risks.

Be sure to observe the safety regulations and generally applicable rules of technology relevant for the installation site. Prevent malfunctions and avoid personal injuries and property damage.

The operator of the system must ensure:

- Safety notices and operating instructions are available and observed,
- The respective national accident prevention regulations are observed,
- The permissible data and operational conditions are maintained,
- Safety guards are used and mandatory maintenance is performed,
- Legal regulations are observed during disposal.

DANGER

Toxic, corrosive gases



The measuring gas led through the equipment can be hazardous when breathing or touching it.

- a) Check tightness of the measuring system before putting it into operation.
- b) Take care that harmful gases are exhausted to a safe place.
- c) Before maintenance turn off the gas supply and make sure that it cannot be turned on unintentionally.
- d) Protect yourself during maintenance against toxic / corrosive gases. Use suitable protective equipment.



DANGER

Electrical voltage



Electrocution hazard.

- a) Disconnect the device from power supply.
- b) Make sure that the equipment cannot be reconnected to mains unintentionally.
- c) The device must be opened by trained staff only.
- d) Regard correct mains voltage.



3 Transport and Storage

3.1 Transport and Storage – Packaging Requirements

Transport

The unit is sensitive to shock and vibration. Therefore, where possible, transport in the original packaging or large, sturdy packaging at a minimum consisting of 3 layer carton, plastic or aluminium sheet. Line the inside of the packaging with padding at least 10 cm thick on all sides.

The unit should be marked fragile for shipping.

3.2 Transport and Storage – Removing From Service and Storage

Purge the device with dry nitrogen or dry air before removing from service for extended periods. Then close the gas inputs and outputs to prevent dirt, dust, and moisture from entering the device.

Store the device in a dry, ventilated, dust-free room. Do not expose the devices to extreme heat, cold or humidity. Reattach all plastic covers and store the BA 4S and accessories in the original packaging. The devices can also be sealed inside a waterproof plastic pouch, bag, or box.

NOTICE! For BA 4S with optional battery pack, charge the battery pack every two months.

4 Setup and Connection

4.1 Unpacking the BA 4S

4.1.1 Unpacking

1. Remove the BA 4S and accessories from the packaging.
2. Remove the plastic cover from the sample gas inlet at the front of the BA 4S.
3. Remove the plastic cover from the sample gas outlet (front or rear of the BA 4S).
4. Remove the plastic cover from the Bypass outlet (if applicable) at the back of the BA 4S.
5. Check the BA 4S and included accessories for damage. If the goods are damaged, please contact Bühler or your Bühler dealer immediately.
6. If the BA 4S will not be used immediately:
 - Re-attach the plastic covers to the sample gas inlet and outlet and the bypass outlet (if applicable).
 - Return the BA 4S and included accessories to the original packaging.
 - Store the BA 4S according to these operating instructions.

NOTICE



Shipping documents and packaging

Keep the shipping documents and packaging (e.g. to return to Bühler for maintenance or repairs).

CAUTION



Device damage

Before using the BA 4S, remove the plastic covers as specified in the above steps 3 and 4. The BA 4S may otherwise be damaged when introducing calibrating or sample gases.

4.2 Installation and Starting

Place the BA 4S in a location suitable for the operation which meets the technical data, near a power source.

If necessary (when using toxic or asphyxiating gases as the sample or calibrating gas) or required:

- Use a QuickConnect to connect a suitable hose to the sample gas outlet (front or rear of the BA 4S).
- Use a QuickConnect to connect a suitable hose to the bypass outlet (if applicable, back of the BA 4S – see drawing).

When connecting hoses to the outlets for sample and/or bypass gas, verify the gases discharged can be vented to the atmosphere without obstruction.

NOTICE! The two outlets can be vented to the atmosphere. When connecting hoses to the outlets, be sure the hoses used are large enough to allow discharging the gases without causing overpressure in the multi-purpose analyzer or the hoses.

If your BA 4S is configured for optional mA outputs, proceed as follows with each mA output:

- Connect the wires of your cable to the screw terminals of the included mA connector.
- Connect the connector to the respective mA output at the back of the multi-purpose analyzer and secure to the connector with the two screws

NOTICE! In the case of two mA outputs, be sure to connect the correct connector to the respective mA output at the back of the BA 4S.

Pin	Use	
1	+	1
2	-	2
3	Shielding	3



Connect the output connector of the power supply to the designated jack at the back of the BA 4S.

Connect the mains plug of the power supply to a suitable socket.

Press the power button on the front of the BA 4S and hold at least two seconds to switch on the device.

NOTICE! When switching on the BA 4S, the alarm LED, error LED and acoustic alarm will come on and off again for a few seconds to test the function.

CAUTION**Electric shock**

Be sure the electrical installation for the BA 4S and power supply meet all applicable safety regulations for electrical equipment.

**CAUTION****Poisoning/asphyxiation**

Sample and calibrating gases can be toxic or lead to asphyxiation. Before introducing sample or calibrating gases be sure all connections are tight at full operating pressure.

**CAUTION****Poisoning/asphyxiation**

Sample and calibrating gases can be toxic or lead to asphyxiation. Be sure the sample and bypass outlet as well as the calibrating T-piece (if applicable) on the BA 4S are vented in a manner so they do not pose a danger for people.

**CAUTION****Poisoning/asphyxiation**

Sample and calibrating gases can be toxic or lead to asphyxiation. Only use the BA 4S in well ventilated areas to prevent these gases from accumulating.

**CAUTION****Risk of falling**

Watch for tripping hazards when connecting cables and hoses to the BA 4S. avoid.

CAUTION**Measuring inaccuracy/device damage**

Do not use the BA 4S in areas exposed to strong vibration or shock. This can result in measuring inaccuracies or damage the BA 4S

4.3 Charging/Recharging the Battery Pack (BA 4S With Optional Battery Pack)

4.3.1 Charging

When using the BA 4S with optional battery pack for the first time you should connect the analyser to the mains for at least four hours to fully charge the battery pack.

When the battery pack is fully charged you can leave the BA 4S connected to the mains or disconnect it from the mains and use it on battery power.

4.3.2 Recharging

NOTICE! We recommend charging the battery pack as soon as possible when "Charge < 10 %" appears.

With regular use the status bar in the display will show the battery charge.

The battery pack can be charged during regular operation as needed. To recharge the battery pack, simply connect the BA 4S to the mains.

NOTICE! Whilst charging the status bar will successively show the charging symbols "Charge < 10 %", "Charge 10 to 32 %", "Charge 33 to 65 %" and "Charge 66 to 100 %".

NOTICE! The battery pack can be charged with the BA 4S on or off. However, it will take longer to charge if the analyser is on.

5 Operation and Controls

5.1 BA 4S Control Panel

5.1.1 Introduction

NOTICE



Special accessories

These instructions repeatedly refer to special accessories (e.g. battery pack), which must be specified at the time of purchase. If your BA 4S does not have the respective special accessories, the associated menus and menu options will not apply.

The BA 4S control panel includes:

Power button	This button switches the BA 4S on or off.
Display	Shows a number of screens.
Soft keys	The function of the different soft keys varies by screen.
Alarm LED	Lights up when an alarm condition is present.
Error LED	Lights up when an error condition is present.
Sampling pump key*	This key is used to switch the sampling pump on or off.
Sampling pump LED*	Flashes when the sampling pump is in operation.

* Key and the LED only applies with optional sampling pump installed.

The BA 4S has an acoustic alarm which sounds as follows:

- On initial startup.
- If a measurement alarm condition is detected (acoustic measurement alarm must be enabled).
- If an error is detected.

5.1.2 Starting and Measurement Value Screen

When starting the BA 4S for the first time, a "Start Screen" will appear and the analyser will perform a self-test.

- The screen will first read "System Check".
 - If your BA 4S is configured for use with IR sensors, the following messages will appear: "Initialising IR" and "Heating IR".
- After this the measurement value screen will appear.

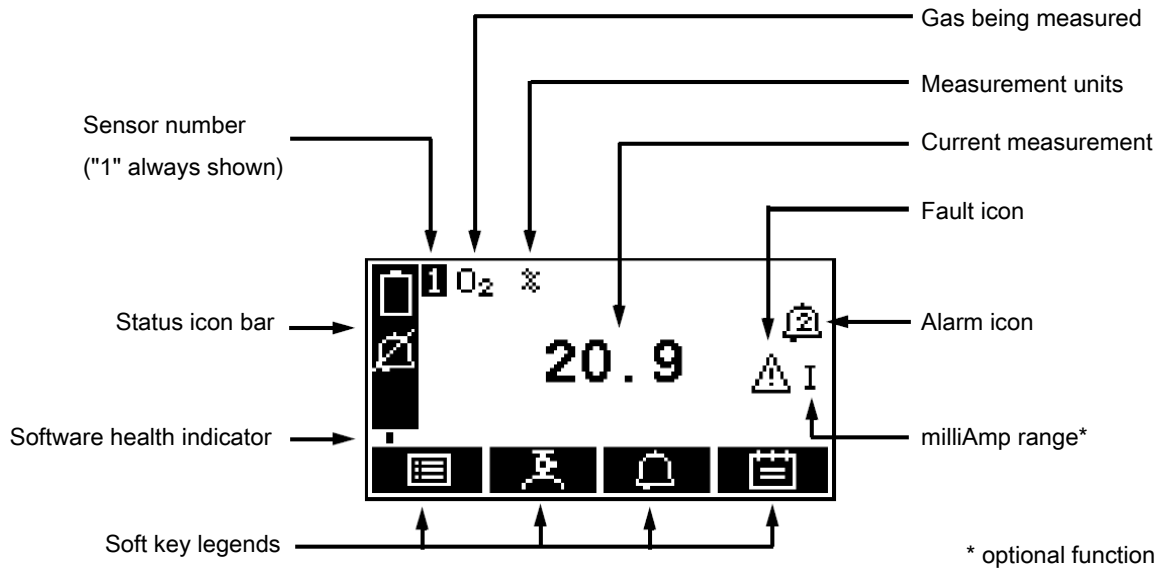


Fig. 1: (A) 1 measurement value screen

- If your BA 4S is configured for two sample gas measurements, the 2 measurement value screen will appear (see "B" below).

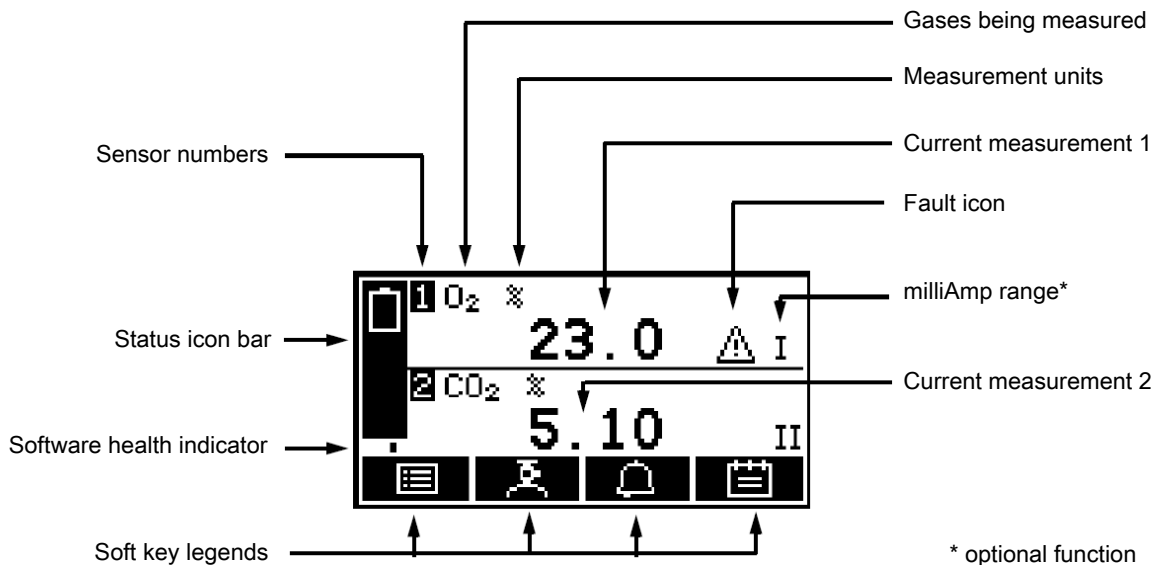


Fig. 2: (B) 2 measurement value screen





NOTICE! During normal operation of the BA 4S the software status below the status toolbar will continuously move back and forth between the left and right. If it stops, the BA 4S is not working properly.


NOTICE! If no soft key is pressed, after ten minutes the measurement value screen will automatically appear. (You will then need to enter your password again to access password-protected screens).

5.1.3 Soft Key Legends









The four soft key legends at the bottom of the measurement value screen correspond with the four soft keys at the front of the BA 4S. (The first legend corresponds to the function of soft key 1, the second to soft key 2, etc.)

The measurement value screen has the following soft key functions:

Legend	Meaning	Function (when pressing the soft key)
	Menu	Opens the menu screen
	Calibrate	Opens the "Calibrate" screen
	Alarm	Opens the "Alarm" option screen
	Acquire data	Opens the data acquisition screen







* These soft keys are "Shortcuts" to these menus which can also be selected by pressing the  soft key with the respective menu option selected in the menu screen.

Other soft key legends in different screens:

Legend	Meaning	Function (when pressing the soft key)
	Back	Exits the current screen and returns to the previous screen in the menu structure.
	Accept	Applies the selected option or data. (A new screen may appear.)
	Edit	Used to edit the selected data
	Batch	Starts a new batch (for data acquisition)
	Up	Moves the cursor up one list (or increases by one digit in edit mode)
	Down	Moves the cursor down one list (or decreases by one digit in edit mode)
	Left	Moves the cursor to the left
	Right	Moves the cursor to the right

5.1.4 Status Toolbar

Die status toolbar will appear on all screens. The following is a list of the symbols which may appear and what they mean:



Symbol	Function (when pressing the soft key)
	Indicates the BA 4S detected an error
	Indicates the acoustic alarm is disabled
	Charge < 10 %
	Charge 10 to 32 %
	Charge 33 to 65 %
	Charge 66 to 100 %

* These symbols will only appear on a BA 4S with optional battery pack.

NOTICE! If the "Charge < 10 %" symbol flashes, the battery pack is almost empty. The BA 4S will automatically switch off approx. 15 seconds after the symbol starts flashing.

5.1.5 Scrollbars

Some screens have more options than can be displayed. In this case you will need to scroll down to view all options. This is indicated by a scrollbar on the right of the screen.

The position of the wide part of the scrollbar indicates which part of the available options is being displayed on the screen. As you scroll through the options (using the soft keys  and ) the wide part of the scrollbar will also move along the screen, indicating approximately where in the complete list of options you are currently at.

5.1.6 Menu Options/Screens and Password Protection

The menu structure of the BA 4S shows that some of the options/screens are password protected.

This means the correct password needs to be entered before being able to access these options/screens.

How password protection works:

- When first accessing password protected options/screens you will be prompted to enter the respective password. You will need to enter the correct to view the option or screen.
- If you have already entered the respective password, you will immediately be able to access all of the options/screens protected by this password, i.e. you do not need to re-enter the password.

NOTICE! Once entered, the password will remain active up to ten minutes after last pressing a soft key. After that time you will need to re-enter your password to access password-protected options/screens.

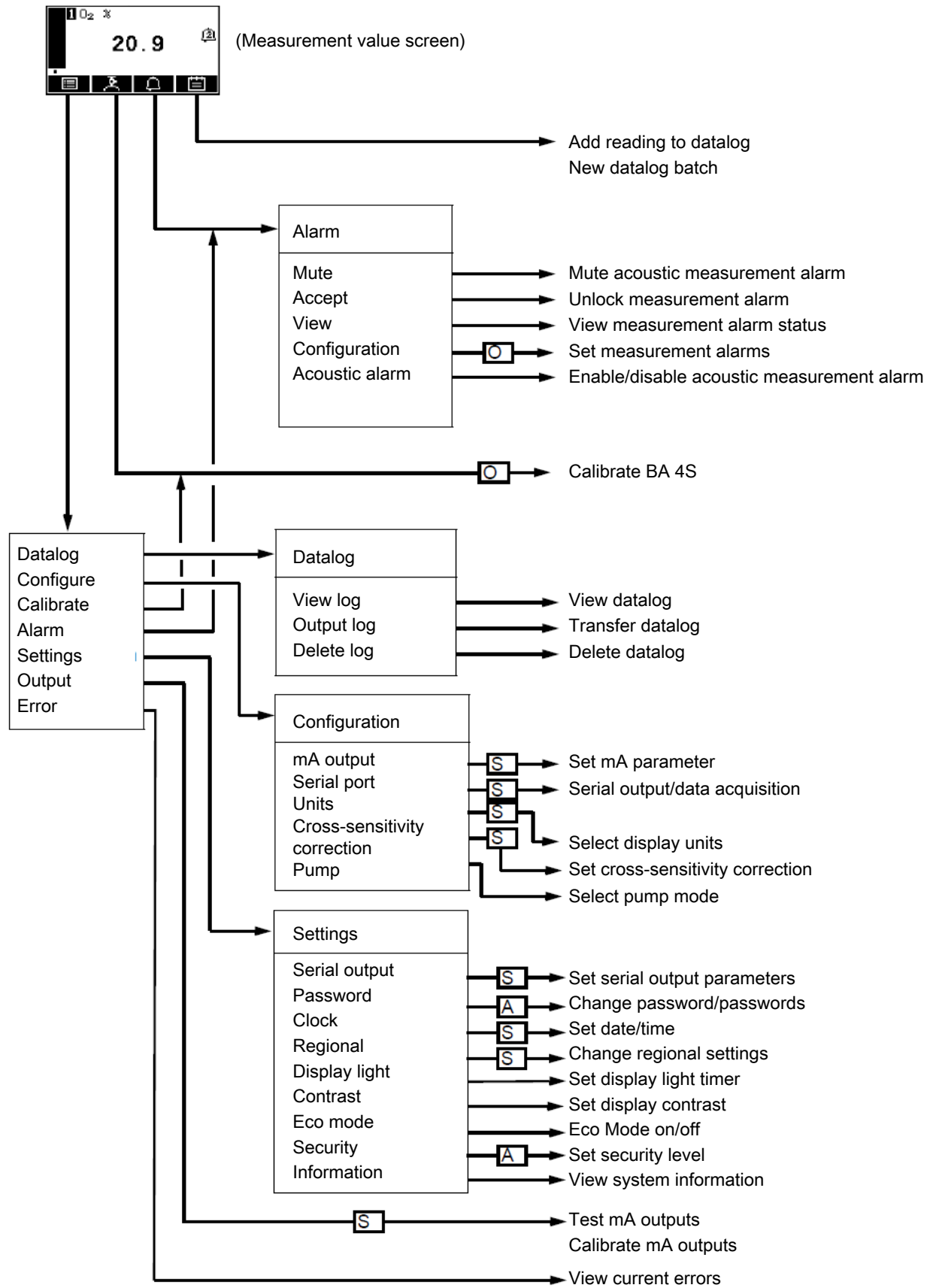

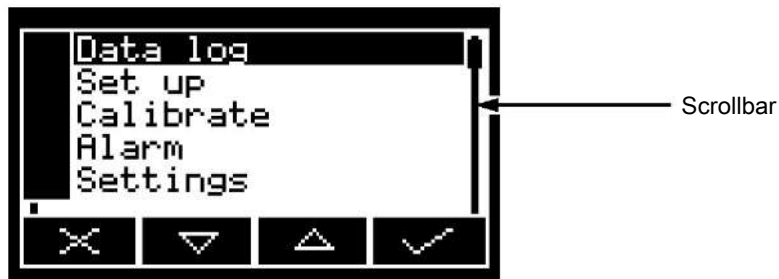





Fig. 3: BA 4S menu structure

5.1.7 Menu Screen

NOTICE! Not all of the following menu screens may appear.

From the menu screen you can access other screens in the menu structure. Pressing the  soft key in the measurement value screen will bring this up.






Use the  and  soft keys to select the desired screen option, and press the  soft key to open the selected screen:

Screen	Use
Datalog	Select this screen to view, output or delete the datalog.
Configuration	Select this screen to configure the (optional) mA outputs, select serial output, data acquisition or to print, to select display units or to enter a cross-sensitivity correction.
Calibrate	Select this screen to calibrate the BA 4S.
Alarm	Select this screen to set measurement alarms or to mute the acoustic measurement alarm.
Settings	Select this screen to change the BA 4S settings (password, display language, etc.).
Output	Select this screen to calibrate and test the (optional) mA outputs.
Error	Select this screen to view current errors.

Or use the  soft key to return to the measurement value screen.

5.1.8 "Settings" Screen


The "Settings" screen is shown on the right

Use the  and  soft keys to select the desired screen option, and press the  soft key to open the selected screen:



Screen	Use
Password	Change password.
Time	Set time and/or date.
Regional	Change regional settings (language, etc.).
Display light	Set display light timer.
Contrast	Adjust screen contrast.
Eco mode*	Switch Eco Mode on/off.
Security	Set security level.
Information	View multi-purpose analyzer system information.

*BA 4S with optional battery pack only



Or use the  soft key to return to the menu screen.

5.1.9 "Information" Screen

This screen displays information helpful to Bühler customer service (e.g. BA 4S serial number and operating software version).




Please note, the information displayed on the screen varies by BA 4S model.


After retrieving (and where applicable recording) the information on the screen use the  soft key to return to the "Settings" screen or hold the  soft key to return to the measurement value screen.





NOTICE! You may need information from this screen for Bühler customer service for e.g. troubleshooting purposes.


5.1.10 Edit Screen Data

All screens use the same method for editing the information displayed. Pressing the  soft key to edit data will open the respective edit screen, with the first digit selected. A typical edit screen



If the first digit is selected, press the  soft key to exit the menu without changing the data. Or use the following soft keys to edit the data:

Soft key	Function
	Increases the selected digit by 1.
	Reduces the selected digit by 1.
	Moves the cursor to the left, to the previous digit.
	Moves the cursor to the right, to the next digit.

Please note, the numbers above and below the selected digit are the next higher and lower digits from the currently selected value. If the last digit is selected, press the  soft key to enter the new data.

NOTICE! When editing numerical values the decimal mark will appear between digits "9" and "0".

5.2 Configure BA 4S

When switching on the BA 4S you will first see a "Start Screen", then the measurement value screen.

When the measurement value screen appears you can configure the BA 4S as follows.

5.2.1 Selecting the Security Level and Changing Password(s)

Security Levels/Passwords – Introduction

You can configure the BA 4S for three security levels:

Security level	Function
Ni	No options/screens password protected.*
Standard	Some options/screens are protected with a supervisor password.
Ho	Some options/screens are protected with a supervisor password, some with an operator password. †

*Except the "Change password" and "Security" screens with options (see notes below).

† The supervisor password also allows access to the options/screens protected with the operator password (see notes below).

NOTICE! The "Change Password" and "Security" screens with options are always protected with a supervisor password, regardless of the security level setting. This prevents unauthorised changes to the security level or passwords, thus locking other users out of the BA 4S

NOTICE! The supervisor password grants access to all password protected options/screens, i.e. after selecting security level "Ho" and being prompted to enter the operator password you can also access the options/screens by entering the supervisor password.




NOTICE! Password protection can e.g. be used to prevent unauthorised changes to the clock, guarantee the validity of measurement times and the time elapsed since the last calibration.


Select security level

NOTICE! The security level factory setting is "Ho", the supervisor password is "2000" and the operator password is "1000". For security reasons we recommend selecting the respective security level and changing the passwords as described below.

Before using the BA 4S we recommend selecting the security level ("Ni", "Standard" or "Ho") best suited for BA 4S operation by you and/or your employees.




How to select the desired security level:

In the "Settings" screen, use the  and  soft keys to select menu option "Security", and press the  soft key. This will open the "Security/Level" showing the current security level

Press the  soft key to change the security level. You will then be prompted to enter the supervisor password.



After entering the correct supervisor password the "Security" selection screen with the current security level will appear.

To change the security level, use the  and  soft keys to select the desired option, and press the  soft key. The "Security/Level" will appear again, showing the new security level.





Press the  soft key twice to return to the menu screen.






Change passwords

NOTICE! When changing passwords, be sure to write it down and keep it in a safe location. If you forget your password you will need to contact Bühler or your Bühler dealer.




How to change the supervisor and operator password:



From the measurement value screen, use the  soft key to open the menu screen, use the  and  soft keys to select menu option "Settings", and press the  soft key. The "Settings" screen will appear




Use the  and  soft keys to select the "Password" menu option, and press the  soft key. This will open the "Change Password/Supervisor" with the supervisor password




To change the supervisor password, press the  soft key and enter the new password.

After entering the last digit the  soft key will change to the  soft key. Press the  soft key to enter the new supervisor password.





To change the operator password, use the  soft key to open the "Change Password/Operator" screen, press the  soft key, then enter the new password.




After entering the last digit the  soft key will change to the  soft key. Press the  soft key to enter the new operator password.

Use the  soft key to return to the "Settings" screen.





5.2.2 Setting the Clock

How to set the date and time:


Use the  soft key to open the menu screen, use the  and  soft keys to select menu option "Settings", and press the  soft key to confirm. The "Settings" screen will appear.

Use the  and  soft keys to select menu option "Time", and press the  soft key. The "Clock (Time)" screen will appear.





NOTICE! The time is always displayed in 24-hour format

Press the  soft key and change the time displayed. After changing the last digit the  soft key will change to the  soft key. Use the  soft key to return to the "Clock (Time)" screen.



Use the  soft key to open the "Clock (Date)" screen.

NOTICE! You can change the format from Day/Month/Year to Month/Day/Year

To change the date, press the  soft key and change the date displayed as described in section 4.10. After changing the last digit the  soft key will change to the  soft key. Use the  soft key to return to the "Clock (Date)" screen.



Press the  soft key twice to open the menu screen.

NOTICE! The date can be set to Day/Month/Year or Month/Day/Year




NOTICE! BA 4S without optional battery pack: Once set, the system will remember the date and time for up to one week after disconnecting the BA 4S from the mains/battery pack. When keeping the BA 4S connected to power the date and time will be remembered permanently, even if the device is off.





5.2.3 Changing Regional Settings

You can configure the following regional settings for the BA 4S to adjust the information on the screens to the formats your are familiar with:



Settings	Available options
Language	Several languages are supported
Date format	Day/Month/Year* and Month/Day/Year
Decimal format	Using [.] (dot) or [,] (comma) as the decimal mark
*Preset	

How to change the regional settings:




In the "Settings" screen, use the  and  soft keys to select menu option "Regional", and press the  soft key. The first screen in the "Regional" settings will appear.

This screen shows the first regional option (language). If necessary, press the  soft key, use the  and  soft keys to select the desired display language, and press the  soft key.

If necessary, proceed as follows for the other two options (date and decimal format):

Use the  and  soft keys to select the respective options screen.

Press the  soft key.






Use the  and  soft keys to select the desired option, and press the  soft key.



5.2.4 Select Eco Function (BA 4S With Optional Battery Pack)

If your BA 4S is equipped with the optional battery pack you can select Eco Mode to use less battery power. With Eco Mode enabled the BA 4S will automatically switch off if no key has been pressed for 30 minutes.

How to enable/disable Eco Mode:

In the "Settings" screen, use the  and  soft keys to select menu option "Eco Mode", and press the  soft key. This will open the "Eco Mode" screen. The selection "No" or "Yes" in this screen indicates if Eco Mode is enabled or disabled. If necessary, use the  soft key to select the other option, then press the  soft key.






NOTICE! Eco Mode is automatically disabled when connecting the BA 4S to the mains.

5.2.5 Selecting the Pump Mode (BA 4S With Optional Sampling Pump)




If your BA 4S is equipped with optional sampling pump, you will need to select the pump mode prior to sample measurements. The pump has two operating modes:





Operating mode	Pump operation
Manual	Pressing the pump key on the front of the BA 4S will start the pump. You will need to press the key again to switch the pump off.
Schedule	After pressing the pump key on the front of the BA 4S the pump will start and run for a set time, then switch off. When selecting this mode you will need to set a operating period for the pump.

To select the desired sampling pump mode:

In the "Settings" screen, use the  and  soft keys to select menu option "Configure", and press the  soft key. The "Configuration" screen will appear.





Use the  and  soft keys to select menu option "Pump", and press the  soft key. The "Pump/Mode" screen will appear.

To change the sampling pump mode, press the  soft key, use the  and  soft keys to select the other menu option, then press the  soft key.



When selecting schedule mode, proceed with the following steps to set the pump operating time.

In the "Pump/Mode" screen which appears (see description above), with "Schedule" mode selected, use the  or  soft key to open the "Pump/Duration" screen.

This screen shows the current pump operating time (i.e. the amount of time the pump will operate for when pressing the pump key).

To change it, press the soft key and change the amount of time displayed.



NOTICE! The pump operating period can be set to 1 to 999 seconds.

5.3 Calibrating the BA 4S

NOTICE! The pressure of the calibrating gas supply must be identical with the sample gas to be used. A pressure difference can result in measuring inaccuracies in the sample gas.

NOTICE! Failure to allow calibrating gas to flow through the BA 4S for 3-5 minutes before starting the calibrating process, it is possible not all of the residual gases have been purged from the system and the calibration could be inaccurate.

NOTICE! Do not bump or move the BA 4S during the calibration process, as this may affect the accuracy of the calibration measurements.

NOTICE! The following calibration assumes, you have selected a BA 4S with sampling pump and manual operation. In schedule mode you will need to ensure the pump operating time setting is adequate for passing calibrating gas through the BA 4S.

NOTICE! The calibrating process covered in this section applies to a BA 4S without optional flow meter or sample conditioning kit. If your BA 4S is equipped with one of these options, please refer to the appendix for additional calibration information.

The BA 4S needs to be calibrated during the initial setup and any time the device is moved to different surroundings. We recommend calibrating the Multi-Purpose Analyzer every time you start it. A calibration will minimise measuring errors due to changes in ambient conditions.

How to calibrate the BA 4S:


For BA 4S without sampling pump:

- Connect the calibrating gas supply to the sample gas inlet at the front of the BA 4S.

- Allow calibrating gas to flow through the BA 4S for 3-5 minutes, then continue.

For BA 4S with sampling pump:

- Connect the branch of the calibrating T-piece to the sample gas inlet at the front of the BA 4S.
- Connect a suitable vent line to one end of the calibrating T-piece or leave the end of the T-piece open to vent into the atmosphere where permissible under safety aspects.
- Connect the calibrating gas supply to the other end of the T-piece.
- Switch on the sampling pump. Allow calibrating gas to flow through the BA 4S for 3-5 minutes, then continue.

Use the  soft key in the measurement value screen (or select option "Calibrate" from the menu screen) to open the "Calibrate" screen (see Figure 20).

NOTICE! With a 2-reading BA 4S this screen will show a low (Ni) and high calibration (Ho) for the two gases.



Please note, the field "9999t" in the screen shows the time elapsed since the last calibration and may use the following format:

9999t – period in days

9999m – period in minutes


9999h – period in hours

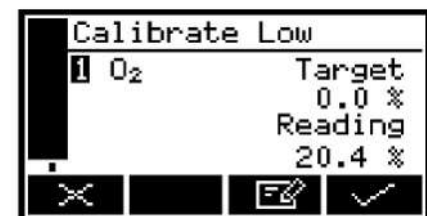
A combination of the preceding formats.

Use the  and  soft keys to select the respective calibration:

"Ni" (zero point gas, e.g. nitrogen for an oxygen sensor).

"Ho" (span gas, e.g. oxygen for an oxygen sensor).

Press the  soft key. The "Calibrate/Concentration Setpoint" with the setpoint and current reading will appear



Change the setpoint if it does not apply to the calibrating gas being used.

NOTICE! Please refer to the Technical Data for the settings for pressures, flow rates (if applicable) and calibrating gas concentrations.

If the current measurement reading is stable, press the  soft key. The BA 4S will then perform the respective calibration.


If you have a BA 4S with sampling gas pump, switch off the pump.

Disconnect the calibrating gas supply from the sample gas inlet or calibrating T-piece.

Repeat steps 1 to 9 for the second calibration of the respective sample gas.

If your BA 4S is configured for two sample gas measurements, repeat steps 1 to 10 in this section to perform the "Ni" and "Ho" calibration for the second sample gas.

If your BA 4S is equipped with optional sampling pump, disconnect (if applicable) the vent line from the calibrating T-piece, then the T-piece from the sample gas inlet.

Use the  soft key to return to the measurement value screen.

5.4 Measuring Samples

NOTICE! Depending on how your measurement alarms are configured and how the sample gas is connected to your BA 4S, changing the sample gas may trigger a measurement alarm as described below.

NOTICE! If your sample gas is not dry, you will need to connect the drying tube (included) to the sample gas inlet of the BA 4S, then your sample gas supply to the drying tube.

NOTICE! The procedure covered in this section applies to a BA 4S without optional flow meter, sample conditioning kit or gas probe. If your BA 4S has at least one of these options, please refer to the appendix for additional information about sampling.

1. If necessary, calibrate the BA 4S.
2. Be sure the measurement value screen is open.
3. Use the included QuickConnect to connect the sample gas supply to the sample gas inlet at the front of the BA 4S.
4. If your BA 4S is equipped with sampling pump, switch it on.
5. Wait for the reading displayed to stabilise and write it down.
6. If your BA 4S is equipped with sampling pump and manual pump operation is selected, switch off the pump.
7. Disconnect the sample gas supply or pull it off the sample gas inlet at the front of the BA 4S

If necessary, repeat steps 3 to 7 to measure different gas samples.

5.5 Correcting Oxygen Measurements for Different Background Gases

NOTICE! When measuring oxygen amidst nitrogen or air, the readings do not need to be corrected.

5.5.1 Overview of Measurement Errors

On an oxygen sensor the composition of a typical background gas in the gas sample only affects the measurement of the BA 4S minimally. Below is a list of cross-sensitivity errors (i.e. oxygen measurement error) in gases containing 100 % of a specific background gas with BA 4S's calibrated low with nitrogen and high with oxygen:

Background gas	Error	Background gas	Error
Argon	-0.22%	Krypton	-0.49%
Carbon dioxide	-0.26%	Neon	-0.15%
Halothane	-1.93%	Nitrous oxide	-0.20%
Helium	-0.29%	Xenon	-0.92%

Please note, the error is not directly proportional to the concentration of the background gas in the measuring sample and in most cases can be ignored.

If the error cannot be ignored, you can enter a correction for the error.




5.5.2 Entering Cross-Sensitivity Correction




NOTICE! Cross-sensitivity correction can only be used with oxygen sample measurements. The correction must not be used with IR gas measurements.

NOTICE! The cross-sensitivity correction is disabled during calibration and was not applied to the values. All other outputs (i.e. serial and mA outputs) will be corrected.

To correct a an oxygen measurement error proceed as follows:

Use the  soft key to open the menu screen, use the  and  soft keys to select menu option "Configure", then press the  soft key. The "Set Up" screen will appear

Use the  and  soft keys to select menu option "X-Ref. Corr." and press the  soft key. If your multi-purpose analyzer is configured for two gas sample measurements, the "X-Ref. Corr." selection screen will appear. If your multi-purpose analyzer is only configured for one gas sample measurements, the "X-Ref. Corr./Offset" screen will appear.

In the "X-Ref. Corr." screen, use the  and  soft keys to select the desired measurement, and press the  soft key. The "X-Ref. Corr./Offset" screen will appear.



The offset value in the "X-Ref. Corr./Offset" screen is the correction applied to the oxygen sample measurement values before these are displayed (or applied).



To change the offset value, press the  soft key and change the value shown.

5.6 Selecting Display Units

You can change the units for the display (and transfer during data acquisition, etc.). The following display units are supported:



Unit	Meaning
%	Volume percent
ppm	parts per million
vpm	volume parts per million
mg/m ³	mg m ⁻³ (milligrams per standard cubic metre)
mol/mol	Mole per mole
% LEL	Volume percent of the lower explosion limit




NOTICE! When selecting non-standard display units you will also need to enter the units for the conversion factor (see appendix A5 for the conversion factor for your application).

NOTICE! When selecting option "Off" in the "Units" screen, the units will be reset to their defaults.




NOTICE! Converting units may reduce the resolution of the readings shown.

Use the following procedure to select units and change their conversion factor:

Use the  soft key to open the menu screen, use the  and  soft keys to select menu option "Configure", then press the  soft key. The "Set Up" screen will appear


Use the  and  soft keys to select menu option "Units", and press the  soft key.




On a 1 reading BA 4S the "Units" screen will appear, showing the current units.

On a 2 readings BA 4S, use the  and  soft keys to select the respective gas sensor, then press the  soft key. The "Units" screen showing the current units (for the gas selected) will appear.




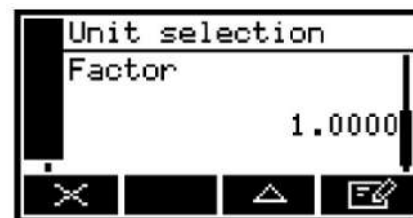
To change the conversion factor for units, press the  soft key and change the value shown.

To change the current units displayed, press the  soft key. The "Units" screen will appear.

Use the  and  soft keys to select the respective units and select with the  soft key. The "Units" screen with the current units will appear again.



Press the  soft key in the "Units" screen with the current units. The "Units/Factor" screen will appear.



On a 2 readings BA 4S, if necessary repeat these steps to change the units for the second gas measurement.

5.7 Configuring Measurement Alarms

5.7.1 Alarm Modes and Levels

There are two measurement alarms for each sample gas measurement the BA 4S is configured for. Each alarm can be configured for one of the following three operating modes:

Alarm mode	Effect
N/A	Alarm not used (i.e. an error condition will never be triggered).
Low alarm	An error condition will be triggered if a sample measurement is below one of the set alarm levels.
High alarm	An error condition will be triggered if a sample measurement is above one of the alarm levels.

When activating a measurement alarm condition:

An alarm symbol will appear in the measurement value screen. The number ("1" or "2") in the symbol indicates which alarm was triggered. If the acoustic measurement alarm is enabled, it will sound. The alarm LED on the front of the BA 4S flashes. You can retrieve information about the activated alarm.

5.7.2 Locked/unlocked alarms

You can separately lock or unlock both measurement alarms.

Alarm setting	Meaning
Locked	When activating an alarm condition it remains active (even if subsequent sample measurements do not trigger the alarm) until the alarm is opened manually
Unlocked	When activating an alarm condition it only remains active until a subsequent sample measurement is performed which does not trigger the alarm. This will disable the alarm condition

5.7.3 Hysteresis Level

The hysteresis level associated with a measurement alarm determines when an alarm condition (once activated) is disabled, which in turn depends on the alarm mode as follows:

Alarm mode	Hysteresis effect
Low alarm	When activating the low alarm condition, it will only be disabled when a sample measurement is higher than {alarm level + hysteresis level}.
High alarm	When activating the high alarm condition, it will only be disabled when a sample measurement is lower than {alarm level – hysteresis level}.

Example:

If a low alarm is at 18 % alarm level and 1 % hysteresis level, it will be activated when a sample measurement amounts to < 18 %. It will not be disabled until a sample measurement amounts to > 19 %.


If a high alarm has a 20 % alarm level and a 2 % hysteresis level, it will be activated if a sample measurement amounts to > 20 %. It will not be disabled until a sample measurement amounts to < 18 %.


5.7.4 Setting Measurement Alarm Levels and Modes




NOTICE! Be sure the measurement alarm and hysteresis levels are not too close to the expected sample readings. (Otherwise minor – and acceptable – deviations in the sample gas concentrations will trigger "false" alarms.)





NOTICE! If you configure one measurement alarm as "low" and the other as "high" configure, be sure the alarm and hysteresis levels of the high alarm are higher than the level of the low alarm. (Otherwise the BA 4S may encounter a continuous alarm condition until the level is corrected.)



Before taking sample measurements you will need to ensure the measurement alarms for your sample gases are configured correctly.

In the measurement value screen press the  soft key. The "Alarm" option screen will appear.

Select menu option "Configure" and press the  soft key. The "Configure/Alarm" screen will appear.

Use the  and  soft keys to select the respective alarm, and press the  soft key. The "Alarm/Mode" screen will appear.




If the alarm is not in the desired mode, press the  soft key, use the  and  soft keys to select the respective mode (none, low or high), then press the  soft key


In the "Alarm/Mode" screen, use the  and  soft keys to select each of the following options and select the desired option or enter the respective levels: Locked/Level/Hysteresis






5.7.5 Enable/Disable Acoustic Measurement Alarm

The options for the acoustic alarm are "Yes" (activate) and "No" (disable).

In the "Alarm" options screen, use the  and  soft keys to select menu option "Acoustic Alarm", and press the  soft key.

If the alarm setting shown does not have the desired setting, press the  soft key. The "Acoustic Alarm" screen will appear

Use the  and  soft keys to select the desired option ("Yes" or "No"), and press the  soft key.




5.7.6 Mute Acoustic Measurement Alarm

NOTICE! The acoustic alarm will only be triggered if a measurement triggers a measurement error condition and the acoustic measurement alarm is activated.

If the acoustic alarm sounds due to a measurement error condition you can temporarily mute it as follows:

In the measurement value screen, use the  soft key to open the "Alarm" option screen.

Select option "Mute" and press the  soft key. The acoustic alarm will be muted and the measurement value screen will appear again.

NOTICE! The muted acoustic alarm will again sound under the following conditions:


- When enabling a new measurement alarm condition.
- If the measurement error conditions triggering the acoustic alarm has been disabled and enabled again.

In this case you will need to mute the acoustic measurement alarm again.

5.7.7 Open Measurement Alarms

If necessary, use the following steps to open locked measurement alarms.

In the measurement value screen, use the  soft key to open the "Alarm" option screen.

Select option "Unlock" and press the  soft key. This will unlock all locked alarms and the measurement value screen will appear again.

5.7.8 View Measurement Alarm Status

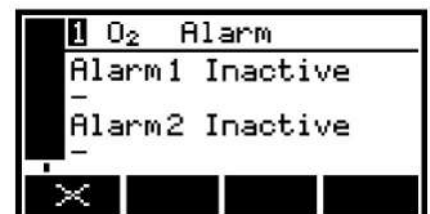
In the measurement value screen, use the  soft key to open the "Alarm" option screen.

Select option "View" and press the  soft key. The "Alarm" status screen will appear.

NOTICE! If your BA 4S is configured for two sample gas measurements you will see a vertical scrollbar at the right and the soft key. Use the soft key to open the measurement alarm status for the second sample measurement.

In the "Alarm" screen both measurement alarms are "Disabled", i.e. either the modes of both alarms are set to "None" or there currently is no alarm condition. If a measurement alarm condition is present when opening this screen, the screen will show:

- the alarm number ("1" or "2")
- the reading of the sample triggering the error condition
- the Alarm mode (with "<" meaning low alarm and ">" meaning high alarm)
- the alarm level



5.8 Configuring and Using mA Outputs (Optional)

5.8.1 Overview

The BA 4S is available with one mA output per configured sample gas measurement. Each mA output provides a continuously measured output value (at the port/ports on the back of the BA 4S) with the current representing the value of the sample gas measurement.

With the BA 4S you can use two separate output configurations per mA output: Range 1 and Range 2. The range for the respective measurement is shown in the measurement value screen:

- appears when selecting range 1.
- appears when selecting range 2.

Each mA output has one of the following output current range options for sample gas measurements:

- 0 to 20 mA, with 0 mA representing a sample reading of 0 (zero) and 20 mA a selectable sample maximum (measuring range).
- 4 to 20 mA, with 4 mA representing a sample reading of 0 (zero) and 20 mA a selectable sample maximum (measuring range).

You can further define the function of the mA outputs during calibration, with an error condition present, and with a below range condition present.

When configuring, calibrating and using the mA outputs use the description

5.8.2 mA Output Parameters - Introduction





You can configure the following parameters for the mA outputs:




Parameter	Values/Options
Range 1 High Level	Sample maximum within range 1 (measuring range).
Range 2 High Level	Sample maximum within range 2 (measuring range).
During calibration	The selected option determines the function of the mA output during calibration: <ul style="list-style-type: none"> – Freeze / When displaying the calibration screen the mA output will immediately be "frozen" at its last output value. It will not be refreshed to include the following measurements until calibration is complete. – Follow / The mA output value refreshes the reading, even during calibration.
If blocked	This option determines the function of the mA output when an error condition is present: <ul style="list-style-type: none"> – Ho / The output value is held at 21.5 mA. – Ni / The output value is held at 0 mA. – None / The output values continue to be derived from the sample gas measurements, even if the output values are false.
mA output area	0-20 mA or 4-20 mA – configurable as follows: <ul style="list-style-type: none"> – 0-1 % to 0-100 % O₂ (pro or premium oxygen sensor) – 0-10 % to 0-100 % of the full selection range (infrared sensor)
Low range	Any value below 4 mA#

For output range 4-20 mA only. Sets the lowest output current in normal operating mode and allows monitoring negative gas concentrations via the mA outputs. Example: At a low range setting of 3.8 mA the mA outputs can be less than 4 mA (zero gas concentration), i.e. up to 3.8 mA (minimum), with an output signal of 3.8 to 4 mA indicating a negative gas concentration.




5.8.3 Setting mA Output Parameters

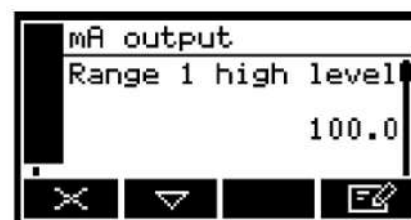
How to configure the mA output parameters:

Use the  soft key to open the menu screen, use the  and  soft keys to select menu option "Configure", and press the  soft key. The "Set Up" screen will appear

Use the  and  soft keys to select menu option "mA output", and press the  soft key. The "mA output" configuration screen will appear.








Use the  and  soft keys to select option "Configure", and press the  soft key. The respective screen "mA output/high level" will appear.



If necessary, change the parameters shown.




For other mA parameters:



- Use the  and  soft keys to select the respective parameter screen.
- Change the parameters as necessary: Press the  soft key, use the  and  soft keys to select the desired option, or edit the data.




NOTICE! You cannot enter a Ho level value (measuring range) higher than the maximum detected by the respective gas sensor.

5.8.4 Selecting the Measurement Range

Use the following procedure to change the range for a gas measurement during sampling at any time.

Use the  soft key to open the menu screen, use the  and  soft keys to select menu option "Configure", then press the  soft key. The "Set Up" screen will appear

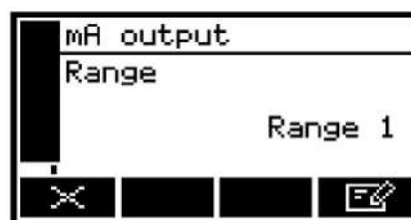
Use the  and  soft keys to select menu option "mA output", and press the  soft key. The "mA output" configuration screen will appear.

Use the soft keys  and  to select the respective "Range" option, and press the  soft key. The "mA output/Range" screen will appear.

How to change the selected range:





Press the  soft key, then use the  and  soft keys to select a different range option (range 1 or 2).

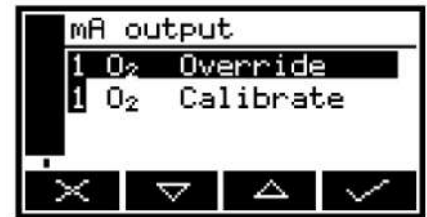
Press the  soft key. The "mA output/Range" will appear again, showing the new range.




5.8.5 Calibrating the mA Output

When calibrating an mA output, proceed as follows:



Use the  soft key to open the menu screen, use the  and  soft keys to select menu option "Output", then press the  soft key. The "mA output" service screen will appear



Select the desired "Calibrate" option and press the  soft key. The "mA output/ Calibrate" screen will appear.



When the "mA output/Calibrate" screen appears, the mA output rated value will be set to 20 mA:





- Use the measuring device connected to the respective mA output at the back of the BA 45 to monitor the actual output value.
- Use the  and  soft keys to increase or lower the actual output value until your measuring device shows 20 mA.

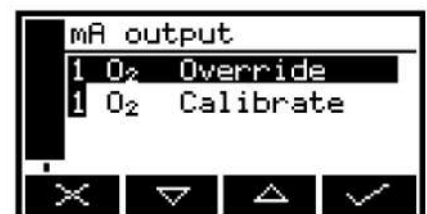
After correctly calibrating the mA output, press the  soft key. The "mA output" service screen will appear again.


NOTICE! The actual mA output value is controlled by the "mA output/ Calibrate" screen as long as the screen is open. Once the "mA output" service screen appears the mA output value will be refreshed and will then correspond to the respective gas reading.

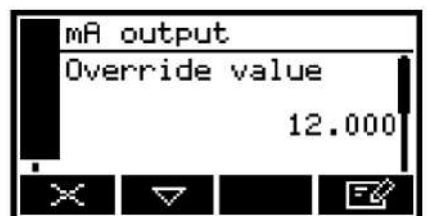
5.8.6 mA Output Test

If necessary, proceed as follows to conduct a test on an mA output:

Use the  soft key to open the menu screen, use the  and  soft keys to select menu option "Output", then press the  soft key. The "mA output" service screen will appear.







Select the desired "Skip" option and press the  soft key. The "mA output/Skip" screen will appear.




Change the Skip value shown.

Press the  soft key. An Accept screen with the option "No" will appear.

To confirm skipping, press the  soft key. The "Skip" screen will appear. Use the  and  soft keys to select option "Yes", and press the  soft key.

The mA output will be set to the selected Skip value. Use the measuring device connected to the respective mA output at the back of the multi-purpose analyzer to check if the output is correct.

If necessary, repeat the steps above to check other mA output values, or use the  soft key to open the "mA output" service screen again.

NOTICE! As long as the "Skip" screen is open, the mA output will freeze the skip value. When opening a different screen the mA output value will refresh and then correspond with the respective gas reading.

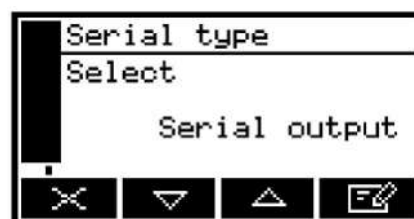
5.9 Data Acquisition and Serial Output


5.9.1 Data Acquisition/Serial Output




You can configure the BA 4S for data acquisition, serial output.


- When selecting serial output, data will continuously be transferred to your PC (or other device) via the serial port at the back of the BA 4S.
- When selecting data acquisition, measured data will be saved to the BA 4S. You will need to manually start the data transfer to a connected device.
- How to select the desired option:

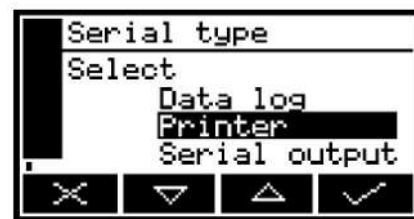
In the menu screen use the  and  soft keys to select menu option "Configure", and press the  soft key. The "Bus Type" screen will appear.



If the option "Serial Port" on the screen is not the desired option, use the  soft key to open the "Serial Port/Select" screen.

Use the  and  soft keys to select the desired option, and press the  soft key.

Use the  soft key to open the menu screen.



5.9.2 Configuring Serial Output Parameters




NOTICE! The serial output parameters apply to both data acquisition and serial output.

If you selected data acquisition or serial output you will need to configure the serial output parameters to the requirements of the PC (or other device) connected to the serial port at the back of the BA 4S. You can configure the following output parameters:

Parameter	Valid settings
Period*	0 to 999 seconds
Baudrate	Supports 2400, 4800, 9600, 19200 and 38400
Stop bits	1 or 2
Data bits	7 or 8
Parity	Without, odd or even parity

* Refresh intervals: Not applicable for data acquisition.





How to configure the parameters:

In the "Settings" screen use the  and  soft keys to select menu option "Serial Output", and press the  soft key. The first parameter screen will appear. When selecting serial output, the "RS232/Period" screen will appear; when selecting data acquisition the "RS232/Baudrate" screen will appear.



If necessary, change the parameters shown.

For other configurable parameters (above):

- Use the  and  soft keys to select the respective parameter screen.
- Change the parameters as necessary: Use the  and  soft keys to select the desired option or change the data.

5.9.3 Data Acquisition - Introduction

You can save datalogs for sample gas measurements conducted to the BA 4S memory. A datalog consists of at least one "batch" of readings and you can save up to 200 measurements total.

Every sample measurement in the datalog includes:

- a batch number
- a consecutive number for the sample measurement in the batch
- measurement date and time
- an alarm note (whether the measurement triggered a measurement alarm)
- an error note (whether an error was present when the measurement was carried out)


The measurements need to be transferred to the datalog manually, define the start of a new batch in the datalog, and delete the log as necessary.

You can view the data currently stored on the BA 4S display at any time or transfer it to a external device (e.g. PC) connected to the serial port of the BA 4S.

NOTICE! The BA 4S cannot be programmed automatically store log data for a specific period. If this function is needed, we recommend selecting serial output in place of data acquisition and connecting a PC or standard datalogger to the serial port.

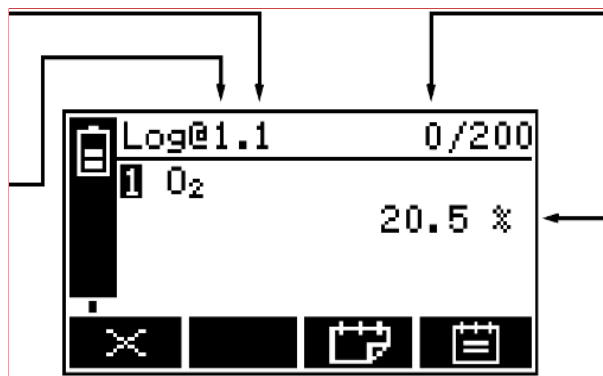
5.9.4 Entering Measured Data in the Datalog

Sample measurements from the measurement value screen can be entered in the datalog as follows:

Press the  soft key. When pressing the soft keys the current sample measurement at the time the key is pressed will be "recorded" (saved to internal memory) and the data acquisition screen will appear.

Consecutive number of the last measurement* in the current batch

Current batch number



Total number of measurements currently stored in the datalog*

Gas sample measurement detected

*Or reading sets on a BA 4S configured for two sample gas measurements

To save measured data to the datalog, press the  soft key.


The "Log Recorded" screen will appear for a few seconds, confirming the data has been saved to the datalog. Then the measurement value screen will appear again.



NOTICE! To return to the measurement value screen without saving the sample measured data acquired to the datalog, press the "Return" soft key when the data acquisition screen appears.




5.9.5 Adding a Datalog Batch




In the measurement value screen press the  soft key. The data acquisition screen will appear.

Press the  soft key. A new batch will be added to the datalog (and the consecutive batch number for the next measurement will be reset to "1").

NOTICE! When pressing the "batch" soft key, new measured data will not be added to the datalog. To enter data in a new batch you will need to press the "Data Acquisition" soft key again.

5.9.6 Transfer Datalog




In the menu screen, use the  and  soft keys to select menu option "Datalog", and press the  soft key. The "Datalog" option screen will appear.




Use the  and  soft keys to select option "Output Log", and press the  soft key. This will start the datalog transfer and the measurement value screen will appear again.





NOTICE! The datalog will only be transferred if the serial port parameters are configured correctly.

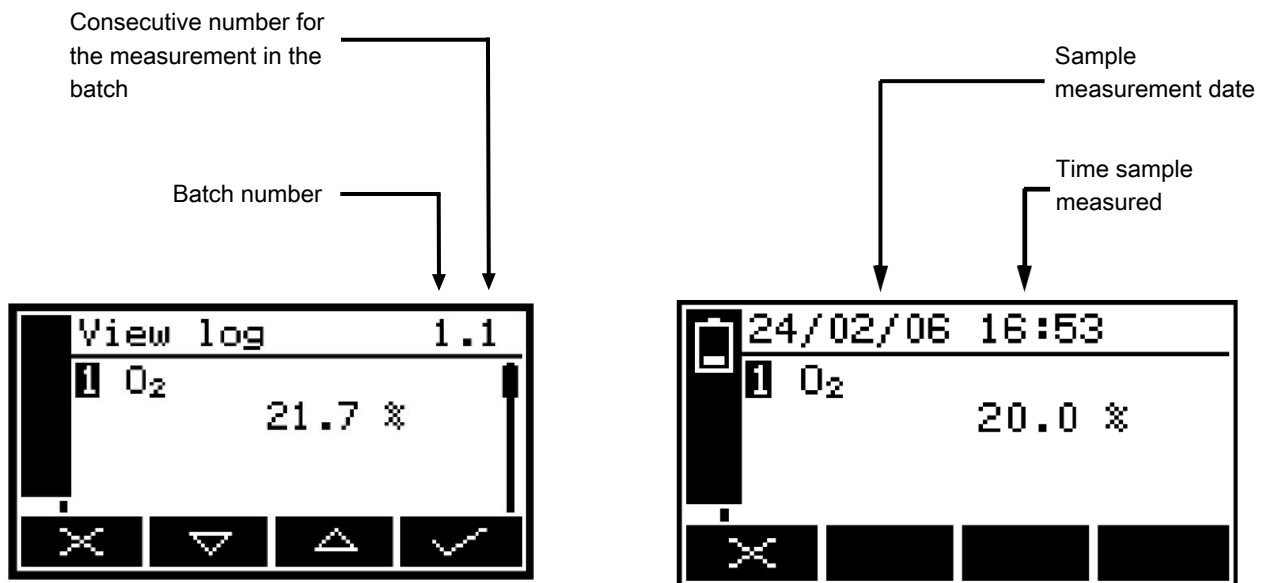
5.9.7 View Datalog

In the menu screen, use the  and  soft keys to select menu option "Datalog", and press the  soft key. The "Datalog" option screen will appear

Use the  and  soft keys to select option "View Log", and press the  soft key. The screen will now alternate between "View Log (Batch)" and the "View Log (Date)"

Use the  and  soft keys to scroll through all of the readings saved to the datalog.




After reviewing the datalog, use the  or  soft keys to open the "Datalog" option screen again.








5.9.8 Delete Datalog

NOTICE! Be sure to open or transfer the datalog before deleting it.

NOTICE! Individual batches or measurements cannot be deleted from the datalog.

In the menu screen, use the  and  soft keys to select menu option "Datalog", and press the  soft key. The "Datalog" option screen will appear.

Use the  and  soft keys to select option "Delete Log", and press the  soft key. The message "Are you sure?" will appear.


- Use the  soft key to delete the datalog. The "Datalog" option screen will appear again.
- Use the  soft key to return to the "Datalog" option screen without deleting the datalog.


5.10 Configure Display

The display can be adjusted to suit ambient light.

5.10.1 Set Display Light Timer

Switching on the BA 4S will also switch on the display light. If no soft keys are pressed, the display light will stay on for a set period, then switch off. Pressing a soft key resets the timer for the display light (i.e. the light stays on for the set period after a soft key was last pressed). How to set the display light time:


In the "Settings" screen, select option "Display Light", and press the  soft key. The "Display Light/Duration" screen will appear.




Change the display light time as needed, then press the  soft key.

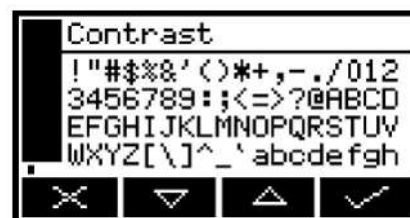


NOTICE! The display light timer can be set to any number from 0 and 999 seconds. Set the display light timer to 0 seconds for the display light to stay on.

5.10.2 Adjust Contrast

In the "Settings" screen, select option "Contrast", and press the  soft key. The "Contrast" screen will appear.

Use the  and  soft keys to increase/reduce the contrast as desired, then press the  soft key.



NOTICE! To adjust the contrast faster, hold the "Up" or "Down" soft key.

5.11 Switching Off the BA 4S After Use

After using the BA 4S:

Switch off the BA 4S as follows: Hold the power button for approx. two seconds and release when the acoustic alarm sounds.

If the BA 4S will not be used for several days:

- Disconnect all tubes from the sample gas outlet (front or back of the BA 4S) and the bypass outlet (if applicable) at the back of the BA 4S.
- Attach the plastic cover to the sample gas outlet (front or back of the BA 4S), the bypass outlet (if applicable) at the back of the BA 4S, and the sample gas inlet (on the front of the BA 4S).

If applicable, disconnect the BA 4S from the mains.

NOTICE! On a BA 4S with optional battery pack we recommend fully charging the battery pack before disconnecting the device from the mains.

NOTICE! On a BA 4S with optional battery pack you can leave the device connected to the mains. This will not affect the life of the battery pack.

6 Service

6.1 General Information

During maintenance, remember:

- The equipment must be maintained by a professional familiar with the safety requirements and risks.
- Only perform maintenance work described in these operating and installation instructions.
- When performing maintenance of any type, observe the respective safety and operation regulations.

DANGER

Electric voltage

Risk of electric shock



- Always disconnect the unit from the mains before performing work.
- Secure the equipment from accidental restarting.
- The equipment may only be installed, maintained and put into operation by instructed, competent personnel.
- Always observe the applicable safety regulations for the operating site.



DANGER

Toxic, corrosive gases

The measuring gas led through the equipment can be hazardous when breathing or touching it.



- Check tightness of the measuring system before putting it into operation.
- Take care that harmful gases are exhausted to a safe place.
- Before maintenance turn off the gas supply and make sure that it cannot be turned on unintentionally.
- Protect yourself during maintenance against toxic / corrosive gases. Use suitable protective equipment.



6.2 Cleaning the BA 4S

Routinely wipe down the outside of the BA 4S with a damp (not wet) cloth to prevent dust and other particles from entering the sample gas inlet or the inside of the device.

6.3 Checking the Inlet Filter Element

NOTICE! The filter element is made from Borosilicate glass, the O-ring in the filter cover is made from Viton® (fluoroelastomer).

NOTICE! Filter elements and O-rings in the filter cover are available as spare parts.

When using the BA 4S for applications with clean, dry bottled gases the filter element only needs to be checked every three months. For other applications we recommend checking the filter element more frequently.

Verify the BA 4S is off.

Unscrew the filter cover.

Check the condition of the white filter element (on the tap at the back of the filter cover). If the filter element is dirty or wet:

- Remove the old filter element from the filter cover and discard.
- Slide a new filter element over the tap inside the filter cover.

Check the O-ring inside the filter cover. If the O-ring is twisted or damaged:

- Remove and discard the O-ring.
- Install a new O-ring in the filter cover.

Be sure the O-ring is correctly seated in the groove inside the filter cover, reattach the filter cover and tighten slightly.

WARNING

Device damage



Do not use the BA 4S without filter element. Otherwise particles can cause severe damage to the device.

6.4 Preventive Maintenance

To prevent downtimes and to ensure the BA 4S is operating correctly and to comply with all applicable directives we recommend a Bühler annual preventive maintenance program for the BA 4S.

The preventive maintenance program includes an annual inspection of the BA 4S by Bühler customer service and any necessary repairs to ensure the device meets the original specifications. After the inspection or repair your BA 4S will be returned to you with a dated service certificate.

Note:

- We offer loaner analysers to use whilst your device is out for preventive maintenance.
- We will always notify you of any necessary BA 4S repairs and the required spare parts in advance.

Please contact Bühler or your Bühler dealer for a preventive maintenance agreement.

7 Service and repair

This chapter contains information on troubleshooting and correction should an error occur during operation.

Repairs to the unit must be performed by Bühler authorised personnel.

Please contact our Service Department with any questions:

Tel.: +49-(0)2102-498955 or your agent

If the equipment is not functioning properly after correcting any malfunctions and switching on the power, it must be inspected by the manufacturer. Please send the equipment inside suitable packaging to:

Bühler Technologies GmbH

- Reparatur/Service -

Harkortstraße 29

40880 Ratingen

Germany

Please also attached the completed and signed RMA decontamination statement to the packaging. We will otherwise be unable to process your repair order.

You will find the form in the appendix of these instructions, or simply request it by e-mail:

service@buehler-technologies.com.

7.1 Errors and Error Messages - Introduction

If the integrated self-test device on the BA 4S detects an error, the following will occur:




- The acoustic alarm will emit a brief signal.
- The yellow error LED will light up.
- The measurement value screen will show an error symbol.
- A corresponding error message will be saved.



You can view current errors. Possible error messages (and recommended actions) are listed below in alphabetic order:

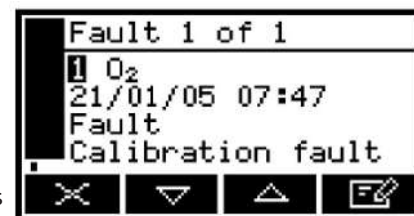
Battery problem	Recommended actions
Battery pack error	(This message only applies to the BA 4S with optional battery pack.) Unplug the mains plug, wait 30 seconds, then reconnect. If the error remains, please contact Bühler.
Code error	Please contact Bühler.
Database error	Please contact Bühler.
Calibration error	Recalibrate the device (low and high calibration). If the error remains, please contact Bühler.
No mA	(This error message only applies to BA 4S with optional mA outputs.) Please contact Bühler.
No sensor	Please contact Bühler or your Bühler dealer.
Critical error	Please contact Bühler.
Charging problem	(This message only applies to the BA 4S with optional battery pack.) Check if the ambient temperature is within a range suitable for charging the battery pack and try to charge the battery pack again. If the error remains, please contact Bühler.
mA error	(This error message only applies to BA 4S with optional mA outputs.) Check for breaks in the electrical wiring in the BA 4S. Restart the BA 4S. If the error remains, please contact Bühler.
mA reset	(This error message only applies to BA 4S with optional mA outputs.) Please contact Bühler Technologies
Pump error	(This error message only applies to BA 4S with optional sampling pump.) Check if the sample gas inlet, sample gas outlet and bypass outlet and the connected tubes and hoses are clogged or blocked.

	After checking the inlet, outlets and tubes/hoses restart the sampling pump. If the error remains, please contact Bühler.
Sensor error	Verify the BA 4S is being used under the required operating conditions. If the error remains, please contact Bühler.
Incorrect sensor type	Please contact Bühler.
Sensor service	Verify the sample gas concentration is not higher than the full selection range of the sensor. Recalibrate the device (low and high calibration). If the error remains, restart the BA 4S. If the error message appears again, please contact Bühler.
Memory error	Restart the BA 4S. If the error message appears again, please contact Bühler.
Current config.	Please contact Bühler.
Invalid day/time.	This message typically appears if a BA 4S without optional battery pack was disconnected from the mains for more than a week. On a BA 4S with optional battery pack this may occur if the battery pack is drained (completely discharged). Connect the BA 4S to power and set the date/time. If the error remains, please contact Bühler.
Connection error	Restart the BA 4S. If the error message appears again, please contact Bühler.

7.2 View Error Messages

To view details about errors currently detected by the BA 4S, use the  and  soft keys to select option "Error" in the menu screen, then press the  soft key. The "Error" status screen will appear

If more than one error is currently detected, the screen title and the scrollbar on the right of the screen will indicate this. If necessary, use the  and  soft keys to scroll through and view all current errors.



Every error status screen contains the following information:

- Date and time of error
- Error display
- Error message

7.3 General Error Diagnostics

Please see the chart on the following pages for general error diagnostics on the BA 4S.

If you are unable to correct the error or determine its cause using the information in the chart, please contact Bühler or your Bühler dealer.

Error indication	Recommended actions
Error LED on.	Check the current error messages and take the recommended action. If no corresponding error messages are stored or the error cannot be resolved with the recommended action, proceed as follows: <ul style="list-style-type: none"> – Restart the BA 4S. – If the error remains, please contact Bühler.
The software status indicator in the display does not move.	Take the recommended action under symptom "Error LED on".
" - - - - " appears in place of a sample measurement (or appears in the datalog).	This indicates a possible measuring error or a connection error between the sensor and control unit of the BA 4S. Check if the BA 4S is bumped or moved or exposed to strong vibration during sample measurement. If the BA 4S is not being bumped or moved or exposed to strong vibration, please contact Bühler.
BA 4S response too slow.	Check if the sample gas inlet is clogged and the sample gas supply to the BA 4S is blocked.

	<p>Check if the sample gas and bypass outlet are clogged and connected tubes and hoses are blocked.</p> <p>If necessary, check and replace the filter element.</p> <p>Check the sample gas supply pressure.</p>
The BA 4S readings are not as expected.	<p>Check if the correct units are selected and whether the conversion factor for the units were entered correctly.</p> <p>Verify the cross-sensitivity corrections entered are correct.</p>
BA 4S readings are unstable.	<p>Check the sample gas supply pressure.</p> <p>Check if the BA 4S is exposed to strong vibration.</p> <p>Check if the sample gas inlet is clogged and the sample gas supply to the BA 4S is blocked.</p> <p>Check if the sample gas and bypass outlet (if applicable) are clogged and connected tubes and hoses are blocked.</p> <p>If necessary, check and replace the filter element.</p>
The BA 4S will not calibrate.	<p>Check if the correct gases are being used for low and high calibration.</p> <p>Check if the sample gas inlet is clogged and the sample gas supply to the BA 4S is blocked.</p> <p>Check if the sample gas and bypass outlet (if applicable) are clogged. For a BA 4S with optional sampling pump, check if the calibrating T-piece is clogged. Check if the tubes and hoses connected to the outlets (or calibrating T-piece) are blocked.</p> <p>If necessary, check and replace the filter element.</p>
The BA 4S does not come on.	<p>If the green LED on the power supply is on, proceed as follows:</p> <ul style="list-style-type: none"> – Check if the power supply is properly connected to the BA 4S. – If the power supply is properly connected to the BA 4S, please contact Bühler. <p>If the green LED on power supply is not on, proceed as follows:</p> <ul style="list-style-type: none"> – Check if the power supply is properly connected to the mains socket and your external power supply is working properly. – Check the fuse inside the mains plug. If the fuse is burnt, replace with a new fuse with the correct rating. – If the power supply is properly connected to the mains socket and your external power supply is working properly, the power supply may be faulty. Please contact Bühler. <p>If your BA 4S is equipped with optional battery pack and the power supply is not connected to the mains socket and the BA 4S, the battery pack may be drained. Connect the power supply and charge the battery pack.</p>
Display off or dark.	<p>Check if the ambient temperature is within the acceptable operating range for the BA 4S.</p> <p>Check if the contrast setting is correct and whether it has been changed.</p>
The measurement alarm frequency is higher than expected.	<p>Check if the BA 4S is bumped or moved or exposed to strong vibration during sample measurement.</p> <p>Verify the settings of alarm modes and the alarm and hysteresis levels are correct.</p>
The connection via the BA 4S serial port is not working properly.	<p>Verify the refresh rate setting is correct.</p> <p>Check if data acquisition is enabled, and if applicable disable this option. (Enabling data acquisition disables continuous serial data output.)</p> <p>Check if the serial output parameters on the BA 4S are correct for the system connected to the serial output.</p> <p>Check if the external device is properly connected to the serial port on the BA 4S.</p> <p>If the serial output is connected to a PC, verify it has the correct serial port selected. (Please note, you will need to restart the PC after connecting a serial cable.)</p>
An mA output value is 0 or 21.5 A.	<p>If you configured the mA output to be "blocked" on high or low level (if blocked), check if an error condition is present. Otherwise please contact Bühler.</p>
Unexpected mA output value.	<p>Check for breaks in the electrical wiring in the BA 4S.</p> <p>Check if the mA output is calibrated correctly.</p> <p>Check if the correct range is selected.</p>

7.4 Spare Parts

The following is a list of standard spare parts for the BA 4S. These can be ordered from Bühler or your dealer.

Spare part	Part number
Inlet filter element	823773608
Filter cover O-ring	55052323-7029
QuickConnect for inlet/outlet	5505202517
Power supply	5505202578
Integrated sampling pump	550505200930
Battery pack	55055200931
Desiccant (silica gel with indicator)	5505203742

NOTICE! We recommend always using extra filter elements and filter cover O-rings to have these on hand when needed.

8 Disposal

Dispose of the BA 4S, power supply and related devices properly and in compliance with applicable environmental and other regulations.

NOTICE! Never dispose the BA 4S in household waste (landfills, collection stations, etc.).

9 Appendix

9.1 Technical Data

9.1.1 General Information

CAUTION



The BA 4S must be installed and used as specified in this and the following sections of the manual. Otherwise the protective functions on the BA 4S may malfunction, sample gas measurements be inaccurate, or the device be damaged.

Dimensions (H x W x D)	300 x 150 x 260 mm (12 x 6 x 10.5 inch)
Weight	2.6 to 3.9 kg (max.) (5.7 to 8.6 lb (max.))
Power supply	
Power supply	100 to 240 V~, 47 to 63 Hz (nominal value)
BA 4S	12 to 24 V–, 20 W (max.)*

* Based on the power supply (via centre positive terminal).

9.1.2 Sample Gas

WARNING

Poisoning/asphyxiation



When sampling carbon monoxide the amount of gas sampled may exceed the temporary limit for carbon monoxide and the sample should therefore be classified as toxic. Other sample and calibrating gases used can also be classified as toxic. Before using the BA 4S with these types of gases you will therefore need to perform your own risk assessment. The maximum inlet pressure for these types of toxic gases is 0.35 bar (34.5 kPa, 5 psig).

Pressure range	
without optional sampling pump	6.9 to 68.9 kPa (1 to 10 psig)
(see WARNING above)	(0.07 to 0.69 bar)
with optional sampling pump	-3.4 kPa to 3.4 kPa (max)
	-0.5 to 0.5 psig
	-0.03 to 0.03 bar
Dew point	Below ambient temperature
	negative 10 °C
	Below ambient temperature
	negative 50 °F
Particle size	Less than 2 µm
Minimum flow rate*	700 ml min ⁻¹ (0.025 ft ³ min ⁻¹)

* with optional sampling pump

9.1.3 Calibrating Gases

Zero point gas	Oxygen-free, 99.9 % pure nitrogen
Span gas	
Oxygen sensor	Certified oxygen supply*, instrument quality air† or other supply (with > 1 % oxygen)
Infrared sensor (IR sensor)	Certified gas supply with a concentration of 80 to 100 % of the respective maximum reading of the IR sensor (see section 2.8)
Calibrating gas flow rate (with optional sampling pump)	
Minimum	1 l min ⁻¹ (0.035 ft ³ min ⁻¹)
Maximum	2.5 l min ⁻¹ (0.088 ft ³ min ⁻¹)

* > 99.2 % pure oxygen with nitrogen as balance gas.

† The air supply must be clean, dry and oil-free.

NOTICE! For the oxygen sensor the difference between the zero and span gas in the oxygen concentration must be at least 1 %.

9.1.4 Environmental Data

Ambient temperature range	
Operation (analyser)	-10 to +50 °C (14 to 122 °F)
Operation (power supply)	0 to 50 °C (32 to 122 °F)
Charge	+10 to +40 °C (50 to 104 °F)
Storage*	-20 to +60 °C (-4 to 140 °F)
Ambient pressure range (operation)	1.013 x 102 kPa ±10 % (1.013 bar ±10 %) (14.69 psi ±10 %)
Humidity (operation)	0 to 95 % rel. humidity, non-condensing
Operating altitude	-500† to 5000‡ m (-1640† to 16400‡ feet)
Housing protection	IP40

* To ensure an optimal battery pack life we recommend storing the device at < 21 °C (70 °F).

† Below sea level.

‡ Above sea level.

9.1.5 Specifications: Pro Oxygen Sensor

NOTICE



Factory setting

The follow display is the factory setting. The BA 4S can also be configured for other display options.

Display indication	Volume percent of oxygen measured
Full selection range	0 to 100 % oxygen
Resolution	0.1 % oxygen
Linearity	± 0.1 % oxygen
Inherent error (accuracy)	± 0.1 % oxygen* or ± 0.2 % oxygen†
Zero drift/week	± 0.2% oxygen
Output fluctuations	± 0.1 % oxygen
Response time*	
Without drying tube	15 seconds

With drying tube	25 seconds
Flow effect†	± 0.1 % oxygen
Temperature coefficient (zero point)	± 0.2 % oxygen per 10 °C (18 °F)
Temperature coefficient (measuring range)	± 0.3 % oxygen per 10 °C (18 °F)
Tilt effect	± 0.15% oxygen per 22.5 ° tilt
Pressure effect	Directly proportional to the ambient air pressure#

* T90 at a supply pressure of 68.9 kPa (0.69 bar, 10 psig). On a BA 4S with sample conditioning kit the response time will increase.

† Within gas supply pressure range.

Some 1% changes in the ambient air pressure will result in a 1% change in the sample reading.

9.1.6 Specifications: Premium Oxygen Sensor

NOTICE



Factory setting

The follow display is the factory setting. The BA 4S can also be configured for other display options.

Display indication	Volume percent of oxygen measured
Full selection range	0 to 100 % oxygen
Resolution	0.01 % oxygen
Linearity	± 0.01 % oxygen
Inherent error (accuracy)	± 0.02 % oxygen* or ± 0.05 % oxygen†
Zero drift/week	± 0.2% oxygen
Output fluctuations	± 0.01 % oxygen
Response time#	
Without drying tube	15 seconds
With drying tube	25 seconds
Flow effect‡	± 0.1 % oxygen
Temperature coefficient (zero point)	± 0.2 % oxygen per 10 °C (18 °F)
Temperature coefficient (measuring range)	± 0.3 % oxygen per 10 °C (18 °F)
Tilt effect	± 0.15 % oxygen per 15° tilt
Pressure effect	Directly proportional to the ambient air pressure§

* High calibration with certified oxygen supply.

† High calibration with Instrument air or other oxygen supply.

T90 at a supply pressure of 68.9 kPa (0.69 bar, 10 psig). On a BA 4S with sample conditioning kit the response time will increase.

‡ Within gas supply pressure range.

§ A 1% change in the ambient air pressure will result in a 1% change in the sample reading.

9.1.7 Specifications: Infrared Sensors (IR Sensors)

NOTICE



Factory setting

The follow display is the factory setting. The BA 4S can also be configured for other display options.

NOTICE



Warm up time

Please allow the device to warm up for about one hour to attain the specified accuracy.

Display indication

Carbon dioxide sensors	Volume percent measured
Full selection range*	
Carbon dioxide sensors	0 - 25 %
Resolution	< 0.1 % full selection range*
Linearity	± 1 % full selection range*
Inherent error (accuracy)	± 2 % full selection range*
Zero drift/week	± 4 % full selection range*
Output fluctuations	± 0.05 % full selection range*
Response time†	< 10 seconds
Flow effect‡	± 0.5 % full selection range*
Temperature coefficient (zero point)#	± 1 % full selection range per 10 °C (18 °F)
Temperature coefficient (measuring range)#	
All other IR measurements	±5% full selection range per 10°C (18°F)
Tilt effect	± 1 % full selection range* per 15° tilt
Pressure effect	< 0.2 % reading per 1 mbar (0.1 kPa, 1.45 x 10 ⁻² psi) change in the ambient pressure

* The measuring ranges listed determine the available IR sensors.

† T90 at a supply pressure of 68.9 kPa (0.69 bar, 10 psig). On a BA 4S with sample conditioning kit the response time will increase.

‡ Within gas supply pressure range per section 2.2.

Within 5 to 45 °C (41 bis 113 °F) range.

9.1.8 Battery Pack

Battery type	Lithium-ion battery pack
Charging time (when completely discharged)	4 hours*
Operating period (fully charged)	8 to 35 hours†
Life	About 300 to 500 charging cycles (varies by ambient conditions)

* Charging time with BA 4S off. With the BA 4S switch on the charging time varies by ambient conditions and the analyser configuration and application.

† Battery operating time varies by BA 4S configuration (i.e. operational equipment) and the application of the analyser.

NOTICE

Lithium-ion battery packs



Lithium ion batteries have no "memory effect", i.e. they can be charged at any charge level, for any amount of time, and any number of times without affecting their life. For optimal battery life we recommend charging the battery pack after every use and storing the BA 4S in a cool location when not in use.

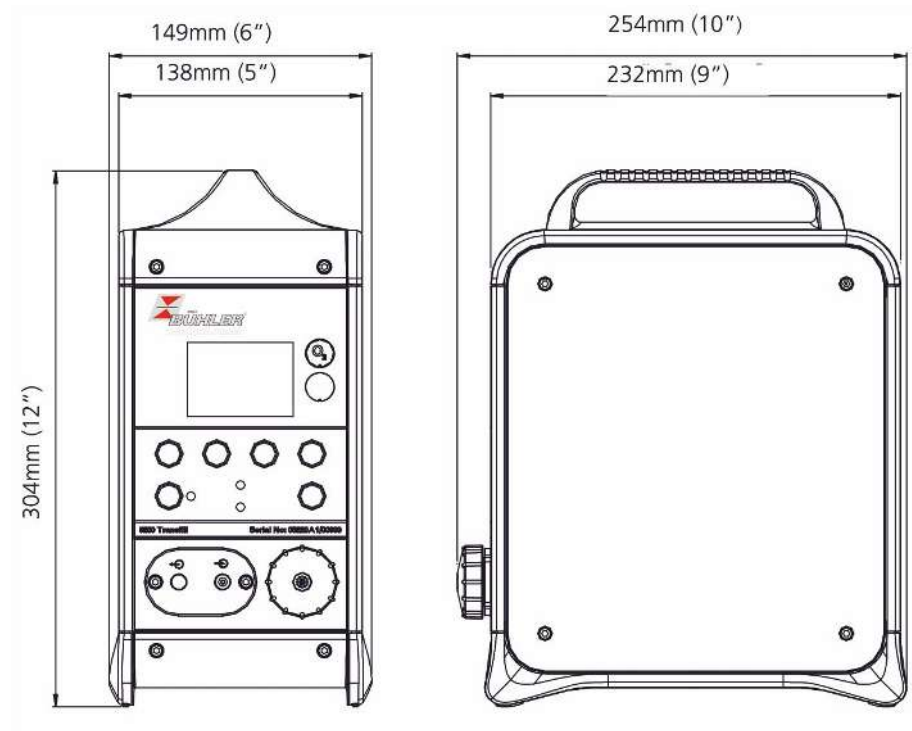
9.1.9 mA Outputs

Maximum charging resistance	1 kΩ
Minimum isolation voltage	500 V
Output range	
Normal gas sample measurement	0 to 20 mA or 4 to 20 mA*
Error condition	0 mA or 21.5 mA*
Low range†	< 4 mA
Cable	
Type	Shielded twisted pair multi-core
Maximum thickness	1.5 mm ² (16 AWG)

* Selectable.

† 4 to 20 mA output range only.

9.2 Dimensions



9.3 Datalog Output Formats

The datalog is transferred as an identification line followed by a number of log lines (one line per datalog entry).

The identification line uses the following format: "Bühler <Serial Number> ; <Gas>", with <Serial Number> being the BA 4S serial number from the "Information" screen and <Gas> the respective defined gas.

Each log line consists of a number of elements separated by a series of identifiers [;] (space, semicolon, space) in the following format:

<Log ID>; <Date> ; <Time> ; <Gas> ; <Measurement> ; <Unit> ; <Error Status> ; <Alarm Status>

[; <Gas> ; <Measurement> ; <Unit> ; <Error Status> ; <Alarm Status>]

with:

<Log ID>	In the format "X.Y", with "X" being the single or multi-digit batch number, and "Y" being the single or multi-digit number of measurements in the batch.
<Date>	The date the entry was added to the datalog.
<Time>	The time when the entry was added to the datalog.
<Gas>	The sample gas measured
<Measurement>	The sample reading shown in the measurement value screen.
<Unit>	The unit from the measurement value screen.
<Alarm Status>	Either blank or "Alarm" if a measurement alarm condition was present at the time it was added to the log.
<Error Status>	Either blank or "Error" if an error condition was present at the time it was added to the log.
"[" and "]"	Elements in these brackets are only transferred if the BA 4S is configured for two sample measurements. The brackets do not appear in the output

An example of a typical extract from the BA 4S datalog:

```
Bühler 05123A1/45678 ; O2
1.1 ; 19/01/05 ; 14:57:04 ; O2 ; 14.8 ; % ; Alarm ;
1.2 ; 19/01/05 ; 14:57:09 ; O2 ; 14.8 ; % ; Alarm ;
1.3 ; 19/01/05 ; 14:57:16 ; O2 ; 14.8 ; % ; Alarm ; Error
2.1 ; 19/01/05 ; 14:57:36 ; O2 ; 14.8 ; % ; Alarm ;
2.2 ; 19/01/05 ; 14:57:42 ; O2 ; 14.8 ; % ; Alarm ;
2.3 ; 19/01/05 ; 14:57:58 ; O2 ; 14.8 ; % ; Alarm ; Error
3.1 ; 19/01/05 ; 14:58:13 ; O2 ; 14.8 ; % ; Alarm ;
3.2 ; 19/01/05 ; 14:58:46 ; O2 ; 20.5 ; % ; ;
3.3 ; 19/01/05 ; 14:58:51 ; O2 ; 20.5 ; % ; ;
3.4 ; 19/01/05 ; 14:58:55 ; O2 ; 20.5 ; % ; ; Error
4.1 ; 19/01/05 ; 14:59:03 ; O2 ; 20.5 ; % ; ; Error
4.2 ; 19/01/05 ; 14:59:08 ; O2 ; 20.5 ; % ; ;
```

9.4 Serial Output Formats

The serial output consists of a number of measurement lines, always one line per update.

Each measurement line consists of a number of elements separated by a series of limiters [;] (space, semicolon, space) in the following format:

<Date> ; <Time> ; <Gas> ; <Measurement> ; <Unit>[; <Gas> ; <Measurement> ; <Unit>]

with:

<Date>	The date the entry was added to the datalog.
<Time>	The time when the entry was added to the datalog.
<Gas>	The sample gas measured.
<Measurement 1> and <Measurement 2>	A sample gas reading from the measurement value screen.
<Unit>	The unit from the measurement value screen.
"[" and "]"	Elements inside these brackets are only transferred if the BA 4S is configured for two sample measurements. The brackets do not appear in the output.

An example of a typical excerpt from a serial output for a 1-reading BA 4S:

```
19/01/05 ; 14:50:25 ; O2 ; 20.3 ; %
19/01/05 ; 14:50:35 ; O2 ; 20.3 ; %
19/01/05 ; 14:50:45 ; O2 ; 20.3 ; %
19/01/05 ; 14:50:55 ; O2 ; 20.3 ; %
19/01/05 ; 14:51:05 ; O2 ; 20.3 ; %
```

NOTICE! A serial output does not include alarms and error information.

9.5 RS232 Port

WARNING



Electric shock

Verify the electrical installation of all devices connected to the BA 4S complies with all applicable safety regulations for electrical systems.

9.5.1 Overview

The serial port at the back of the BA 4S is a 9-pin RS232-D port for ± 5.5 V.

Please see the figure below for the pin assignment

Pin(s)	Use	
1	N/C	
2	Rx (to BA 4S)	
3	Tx (from BA 4S)	
4	N/C	
5	0 V	
6, 7, 8, 9	N/C	

9.5.2 Connect BA 4S to PC

The BA 4S can be directly connected to the 9-pin serial D-port on your PC (typically marked "COM1" or "COM2"). We recommend using the included serial cable. If you choose not to use the included cable, you should use a compatible "null modem cable" with connector at both ends.

If your PC only has serial USB ports, use a standard adapter (serial/USB) to connect the BA 4S to a serial port.

9.5.3 Data Acquisition in Windows with HyperTerminal

If you are running a Windows operating system, HyperTerminal is probably already installed on your PC. For detailed instructions on installing and using HyperTerminal please refer to the help files on your PC or your PC documentation. The following information are only a summary:

Install HyperTerminal (if not already installed).

Start HyperTerminal. To do so, you will typically click the "Start" button, then "Programs", "Accessories", "Communication" and "HyperTerminal".

Enter a suitable name and click "Connect" to connect.

NOTICE! You can drag the HyperTerminal icon to your desktop for quick access.

Look for the COM port you used for the connection between the BA 4S and PC.

Configure the port settings according to the parameters of the BA 4S serial output. The following settings are recommended:

Parameter	Recommended settings
Baudrate	38400
Data bits	8
Parity	N/A
Stop bits	1
Flow control	N/A

* This option is not available on the BA 4S.

Click the "Connect" icon to connect.

- If the BA 4S is configured for serial output, the data will be displayed on your PC.
- If the BA 4S is configured for data acquisition, data will only be sent to the PC when transferring the datalog.

You can save the BA 4S data output using the HyperTerminal command "Capture Text" (as text file). You can then import this text directly into programs such as e.g. Excel®.

9.6 Display Unit Conversion Factors

When selecting display units, be sure to enter the correct conversion factors for the units (see chart below):

Convert from*	To†	Conversion factor for units	Gas affected
%	ppm	10000	all
ppm	%	0.0001	all
ppm	vpm	1	all
ppm	mg/m ³	1.2492	CO
ppm	mg/m ³	1.9631	CO ₂
ppm	mg/m ³	1.4277	O ₂
%	mg/m ³	12492	CO
%	mg/m ³	19631	CO ₂
%	mg/m ³	14277	O ₂
ppm	% LEL	0.0008	CO
%	% LEL	8	CO
%	mol/mol	0.01	all
ppm	mol/mol	#	#

*Standard units

† Display units selected

This conversion is not supported.

NOTICE! To return to the standard units, under unit selection select the option "Off" and set the conversion factor to "1".

9.7 Optional Flow Meter

9.7.1 BA 4S With Sampling Pump

NOTICE! The flow rate for the calibrating gas supply must be identical with the sample gas to be used. Otherwise sample gas measurements may be inaccurate.

Calibrate the BA 4S, remembering:

- Connect the calibrating gas supply to the sample gas inlet on the flow meter (3), not the BA 4S!
- Use the flow control valve (4) to set the calibrating gas flow rate into the BA 4S to the desired speed.

Perform the sample measurements, remembering:

- Connect the sample gas supply to the sample gas inlet on the flow meter (3), not the BA 4S!
- Use the flow control valve (4) to set the sample gas flow rate into the BA 4S to the desired speed.

9.7.2 BA 4S Without Sampling Pump

Calibrate the BA 4S, but connect the branch on the calibrating T-piece to the sample gas inlet on the flow meter (3), not the BA 4S!

Perform the sample measurements, but connect the sample gas supply to the sample gas inlet on the flow meter (3), not the BA 4S!

9.8 Materials in Contact With Sample and Calibrating Gas

The materials of analyser components in contact with sample gas and calibrating gas are listed below. These are corrosion-resistant and compatible with a number of chemicals.

Line for common gases in the BA 4S:

- Nickel
- Viton®
- Stainless steel (302)*
- Carbon fibre reinforced PPS (polyphenylene sulphide)
- PPS (polyphenylene sulphide)†
- Borosilicate glass
- Kynar® (PVDF: polyvinylidene fluoride)
- Polysulphone

Pro or premium oxygen sensor:

- Stainless steel (316)
- Borosilicate glass
- Platinum
- Platinum-iridium alloy
- Chemical nickel
- Viton®

*BA 4S without optional sampling pump only

†BA 4S with optional sampling pump only

Infrared sensor (IR sensor):

- Stainless steel (316)
- Gold
- Nickel
- Sapphire
- Epoxy resin adhesive (EPO-TEK H72)
- Viton®

10 Attached documents

- Declaration of Conformity KX550015
- RMA - Decontamination Statement

EU-Konformitätserklärung
EU-declaration of conformity



Hiermit erklärt Bühler Technologies GmbH,
dass die nachfolgenden Produkte den
wesentlichen Anforderungen der Richtlinie

*Herewith declares Bühler Technologies GmbH
that the following products correspond to the
essential requirements of Directive*

2014/30/EU
(EMV/EMC)

in ihrer aktuellen Fassung entsprechen.

in its actual version.

Produkt / products: Tragbarer O₂- und CO₂-Analysator / *Portable O₂ and CO₂-Analyser*
Typ / type: BA 4S

Das Betriebsmittel dient zur Messung von Sauerstoff- und Kohlendioxidkonzentrationen in Gasen.
The device is used to measure oxygen and carbon dioxide concentrations in gases.

Das oben beschriebene Produkt der Erklärung erfüllt die einschlägigen
Harmonisierungsrechtsvorschriften der Union:
*The object of the declaration described above is in conformity with the relevant Union harmonisation
legislation:*

EN 61326-1:2013

Die alleinige Verantwortung für die Ausstellung dieser Konformitätserklärung trägt der Hersteller.
This declaration of conformity is issued under the sole responsibility of the manufacturer.

Dokumentationsverantwortlicher für diese Konformitätserklärung ist Herr Stefan Eschweiler mit
Anschrift am Firmensitz.

*The person authorized to compile the technical file is Mr. Stefan Eschweiler located at the company's
address.*

Ratingen, den 20.09.2017



Stefan Eschweiler
Geschäftsführer – *Managing Director*



Frank Pospiech
Geschäftsführer – *Managing Director*

RMA - Dekontaminierungserklärung

RMA - Decontamination Statement



DE/EN Gültig ab / valid since: 2014/11/01 Revision / Revision 1 ersetzt Rev. / replaces Rev. 0

Um eine schnelle und reibungslose Bearbeitung Ihres Anliegens zu erreichen, füllen Sie bitte diesen Rücksendeschein aus. Eine genaue Fehlerbeschreibung ist für die Ursachenanalyse nötig und hilft bei der schnellen Bearbeitung des Vorgangs. Die Aussage „Defekt“ hilft bei der Fehlersuche leider nicht.

Die RMA-Nummer bekommen Sie von Ihrem Ansprechpartner im Vertrieb oder Service.

Zu diesem Rücksendeschein gehört eine Dekontaminierungserklärung. Die gesetzlichen Vorschriften schreiben vor, dass Sie uns diese Dekontaminierungserklärung ausgefüllt und unterschrieben zurücksenden müssen. Bitte füllen Sie auch diese im Sinne der Gesundheit unserer Mitarbeiter **vollständig** aus.

Bringen Sie den Rücksendeschein mit der Dekontaminierungserklärung bitte zusammen mit den Versandpapieren in einer Klarsichthülle außen an der Verpackung an. Ansonsten ist eine Bearbeitung Ihres Reparaturauftrages nicht möglich!

Angaben zum Absender:

Please complete this return form to ensure your claim is processed quickly and efficiently. An accurate description of the problem is necessary for cause analysis and will help processing the claim quickly. Unfortunately, stating "defective" will not help us troubleshoot the issue.

You may obtain the RMA number from your sales or service representative.

*This return form includes a decontamination statement. The law requires you to submit this completed and signed decontamination statement to us. Please complete the **entire** form, also in the interest of our employees' health.*

Attach the return form including decontamination statement along with the shipping documentation to the outside of the package, inside a clear pouch. Otherwise we are unable to process your repair order!

Sender information:

Firma / Company		Ansprechpartner / Contact person	
Anschrift / Address		Abteilung / Department	
		E-Mail / E-Mail:	
		Tel. / Phone	
		Fax / Fax:	
Artikelnummer / Item number		RMA-Nr. / RMA no.	
Auftragsnummer / Order number			
Anzahl / Quantity			
Rücksendegrund / Return reason	Reparatur / Repair	Vorgangsnummer des Kunden / Customer transaction number::	
	Garantie / Warranty		
	Zur Prüfung / For inspection		
	Rückgabe / Return		
Fehlerbeschreibung / Description of the problem:			

Ort, Datum / Place, Date

Unterschrift / Stempel / Signature / Stamp:

RMA - Dekontaminierungserklärung

RMA - Decontamination Statement



DE/EN Gültig ab / valid since: 2014/11/01 Revision / Revision 1 ersetzt Rev. / replaces Rev. 0

Bitte füllen Sie diese Dekontaminierungserklärung für jedes einzelne Gerät aus.

Please complete this decontamination statement for each individual item

Gerät / Device		RMA-Nr / RMA no:	
Serien-Nr. / Serial no.			

[] Ich bestätige hiermit, dass das oben spezifizierte Gerät ordnungsgemäß gereinigt und dekontaminiert wurde und keinerlei Gefahren im Umgang mit dem Produkt bestehen.

I herewith declare that the device as specified above has been properly cleaned and decontaminated and that there are no risks present when dealing with the device.

Ansonsten ist die mögliche Gefährdung genauer zu beschreiben:

In other cases, please describe the hazards in detail:

Aggregatzustand (bitte ankreuzen):

Aggregate state (please check):

☐ Flüssig / Liquid ☐ Fest / Solid ☐ Pulvrig / Powdery ☐ Gasförmig / Gaseous

Folgende Warnhinweise sind zu beachten (bitte ankreuzen):

Please note the following warnings (please check):

Explosiv Explosive	Giftig / Tödlich Toxic / lethal	Entzündliche Stoffe Flammable substances	Brandfördernd Oxidizing
Komprimierte Gase Compressed gasses	Gesundheitsgefährdend Hazardous to health	Gesundheitsschädlich Harmful to health	Umweltgefährdend Harmful to the environment

Bitte legen Sie ein aktuelles Datenblatt des Gefahrenstoffes bei!

Please include an updated data sheet of the hazardous substance!

Ort, Datum /
Place, Date: _____

Unterschrift / Stempel
Signature / Stamp: _____