



Portable Oxygen Analyser

BA 4510

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 4510 analyser is used for continuous measurement of the oxygen concentration of industrial, laboratory and inert gases as well as in the process of mixing and manufacturing special forming gases. Here, in inert gases the concentration of free oxygen, and in gas mixtures the concentration of bonded oxygen can be measured. The oxygen content of sample gas is measured and displayed continuously. Deviations from the configurable set points are signalled. The purity and required protective effect of inert gases is monitored. So specific production processes under inert gas can be monitored.

1.2 Ordering instructions

Device model

ltem no.	Description
55 15 000	BA 4510
55 15 001	BA 4510 KIZ

1.3 Scope of delivery

- Analyser
- Product documentation
- Connection/mounting accessories (optional)

1.4 BA 4510 Layout

1.4.1 Principle of Measurement

Determining the oxygen concentration in gases is often an established requirement in gases in the industrial sector, but also in laboratories. Gases with an obvious oxygen concentration which fluctuates based on the temperature are most commonly measured. The BA 4510 uses the NERNST equation as the basis for determining the oxygen concentration in gases.

$$U = \frac{RT}{zF} ln \frac{p_{O_2,air}}{p_{O_2,sample gas}}$$

Where:

```
U: Cell voltage in mV
```

R: Molar gas constant, R=8.31441 J/mol*K

- T: Measuring temperature in K
- F: Faraday constant, F=9.6485*10⁴ C/mol
- z: Valency of involved ions
- Po_{2Air} . Partial pressure of oxygen on the reference electrode in dry air in Pa
- Po_{2samplegas}. Partial pressure of oxygen on the measuring electrode in sample gas in Pa

The BA 4510 has a sensor which uses the conductivity of oxide ions in zirconium dioxide ceramics with stabilising additives. The conductivity of the oxide ions of zirconium dioxide increases exponentially with the temperature and reaches adequate values above 600 °C (1112 °F).

The ceramic oxide ion conductor is used as a gas-tight tube through which gas to be measured is conducted. The ceramic tube is axially symmetrical inside a thermally well-insulated electric oven. The electrodes of the galvanic measuring cell are platinum. The electrode on the outside of the tube, surrounded by dry air, serves as a reference electrode with a constant, established electrode potential.

Provided the total pressures of the gasses are about equal at both electrodes, volume concentrations can be expected instead of partial pressures. After adding the numeric value for the constants in equation (I) results in the following conditional equation for the oxygen concentration.

 $\Phi_{O_2,\text{sample gas}} \phi_{O_2,\text{air}} \cdot e^{(\frac{zFU}{R})}$ $\phi_{O_2,\text{sample gas}} 20.64 \cdot e^{(-46.42) \frac{U}{T}}$ Where:

Φ oxygen concentration in the sample gas in Vol.%
U: Potential difference in mV
T: Measuring temperature in K
20.64 oxygen concentration in air with a relative humidity of 50 % in Vol.%

1.4.2 Measuring Requirements

1.4.2.1 General Information

Sample gas can have free or bonded oxygen. Without sufficient "**free oxygen**" in addition to combustible gas components, a chemical balance will occur on the hot board electrode. The cell then measures the concentration of the "**equilibrium oxygen**". (The basics are explained in the appendix <u>Basics of using potentiometric ZrO2 solid electrolyte sensors in optimal combustion</u> <u>processes</u> [> page 23].)

Here the following dependencies apply:

 $U \sim T$ Contains free oxygen $U \sim \frac{l}{T}$ Contains bonded oxygen

The conditional equation **(II)** applies to both sample gases with free oxygen as well as for reduced gas mixtures which only contain bonded oxygen, e.g. in H_2/H_2O or CO/CO_2 mixtures.

1.4.2.2 Sample Gas Flow Rate

The sample gas flow rate must be between 5 and 10 L/h to ensure exact measurement. If the low flow rate is too low, the contamination effects of the gas lines (leaks, permeabilities, desorptions) will cause reading errors. If the flow rate is too high, asymmetric cooling of the sensor can cause measurement errors.

A differential pressure sensor measures the gas flow. When over- or underrunning the limit, the device will output an error message yet continue measuring.

When operating the device with the internal gas pump, the flow rate controls the pump. The gas flow will always be set to an optimal flow rate of 7 L/h.

1.4.2.3 Measurement Accuracy

The manufacturer only guarantees a measuring error of < 5% (relative error) when measuring oxygen concentrations with an order of $2*10^5$...10 ppm (this manual uses the unit ppm is used in the sense of Vol.-ppm). When measuring oxygen concentrations of 10...1 ppm, the relative error is under 5% provided the gas supply has no leaks or permeabilities.

When measuring oxygen concentrations < 10 ppm, user must consider the following aspects when analysing the measured value:

- composition of the sample gas (e.g. presence of reducing gas components)
- special production process conditions (e.g. material components)
- sample gas temperature

BA 4510 NOTICE To minimise the measuring error when measuring minimal oxygen concentrations, ensure the following measurement and equipment requirements are met: a) Choose a location for extracting the sample gas to rule out any layers forming at the extraction site. b) The transport path for the sample gas to the measuring cell must be as short as possible to prevent a shift in the chemical balance along the way as best possible. c) All gas supply and discharge lines must be absolutely tight. d) Measuring oxygen concentrations < 1000 ppm requires stainless steel lines.</td> e) If the sample gas contains reducing components (e.g. alcohols), the concentration of free oxygen cannot be determined, as chemical reactions occur at the electrode. In these cases it is advisable to pass the sample gas through an activated carbon filter before the gas inlet.

1.4.3 General Design

1.4.3.1 General Overview

This device is available in a portable, compact laboratory design. The general structure of the device is shown in figure 1.



Fig. 1: General layout, components

The sample gas is pushed into the measuring cell at minimal overpressure or, on the version with pump, suctioned through the measuring cell. A needle valve and/or a pressure regulator can be installed before the gas inlet to control the flow rate. On the version with pump the flow rate is kept at a constant by regulating the pump output.



1.4.3.2 Solid Electrolyte Measuring Cell Design Principle



- 1 Ceramic tube
- 2 Ceramic cover for the reference electrode
- 3 Measuring electrode
- 4 Reference electrode
- 5 Thermocouple
- 6 Reference electrode connecting wire
- 7 Measuring electrode connecting wire

The measuring cell is a zirconium dioxide ceramic tube with two electrodes made from platinum wire. Inside the tube the sample gas flows through is the measuring electrode. The electrode outside of the tube serves as reference electrode with constant electrode potential. The electrodes and the ceramic tube from a voltaic cell (solid electrolyte measuring cell).

For favourable oxide ions conductivity values of the zirconium dioxides and prevent interference reactions due to unbalance with flammable components in the sample gas, the measuring cell is heated to 750 °C. A thermocouple on the measuring cell determines the current measuring temperature T. An electronic control circuit ensures a constant measuring temperature.

CAUTION



Risk of overheating

Overheating will damage the device. Heating results in heat loss in the inert gas measuring device. Therefore do not place items on or in close proximity of the device.

The block diagram in the next chapter how measurements are processed electronically.

1.4.3.3 Electronic Processing of Measurements

The following block diagram outlines how signals are processed.



Fig. 2: BA 4510 block diagram

1.4.4 BA 4510 Layout

1.4.4.1 Mechanical Design

All components (main electronics, flow meter, pump, mains filter, measuring cell) are located inside a portable housing.

1.4.4.2 Electric Supply

The BA 4510 connects to the mains via fixed cord set.

The BA 4510 is designed as a tabletop device. The operating position is horizontal with a maximum tilt of 30°.

1.4.4.3 Front

The displays and controls are located in the front. A display shows the measured value in Vol.% or Vol.-ppm, depending on the value and programming.

1 Vol.% corresponds to 10⁴ Vol.-ppm, 1 Vol.-ppm corresponds to 0.0001 Vol.%.

A light diode serves as status light and indicates specific operating conditions or warnings in colour and possibly flashing (see Operation and Control)

On the right is the keyboard used to select the view or program the device.



1.4.4.4 Back panel

At the back of the device are the gas inlet and outlet, a d-sub port for the RS232 interface and the mains switch. The mains cable is fixed to the device.



1.4.4.5 Pin assignment

Serial port **RS232**

MD MD	Transfer rate	max. 19200 baud, adjustable
	Stopbits	1
	Data bits	8
	Parity	none
	Handshake	without

Serial interface protocol (CR= carriage return)

Input	Response	Parameter
M2CR	M2x.xxExxCR	Oxygen concentration in ppm
A1CR	A1xxxCR	Cell voltage in mV
A2CR	A2xxxCR	Measuring temperature in °C
Error messages:		
0	ERRORO	Transmission error
1	ERROR1	Warm up
2	ERROR2	Cell temperature too low
3	ERROR3	Thermocouple defect
4		
5		
6	ERROR6	System error
Analog output		



Pin 1,2 measurement signal output 4-20 mA

Pin 3,4 potential-free connections for limit relays:

Note:

If the limit is breached, the limit relay opens and triggers a general alarm.

2 Safety instructions

2.1 Important Information

Operation of the device is only permitted 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.

Please particularly note the following analyser instructions:

- Always transport the equipment diligently and carefully. Strong impact and shock may damage the measuring cells in the analyser or shorten their life!
- Disconnect from the mains before opening the device.

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

In this manual, the following warning signs are used:



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,
- compliance with national installation regulations.

Maintenance, Repair

Please note during maintenance and repairs:

- Repairs to the unit must be performed by Bühler authorised personnel.
- Only perform conversion-, maintenance or installation work described in these operating and installation instructions.
- Always use genuine spare parts.
- Do not install damaged or defective spare part. If necessary, visually inspect prior to installation to determine any obvious damage to the spare parts.

Always observe the applicable safety and operating regulations in the respective country of use when performing any type of maintenance.

DANGER	Electrical voltage	
4	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.	
DANGER	Toxic, acidic gasses	
	 Sample gas / calibrating gas can be harmful. a) If necessary, ensure a safe gas discharge. b) Switch off the gas supply before performing maintenance and protect from opening inadvertently. c) Protect yourself from toxic / corrosive gasses when performing maintenance. Wear suitable protective equipment. 	
DANGER	Potentially explosive atmosphere	
EX	Explosion hazard if used in hazardous areas. The device is not suitable for operation in hazardous areas with potentially explosive at- mospheres.	

Do not expose the device to combustible or explosive gas mixtures.

3 Transport and Storage

Transport

The device 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 device should be marked fragile for shipping.

Removal 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. Cover the device with suitable packaging to protect it from liquids and dirt.

Never place objects on top of the device during storage.

Storage temperature: -20 °C ... +50 °C (-4 °F ... +122 °F)

4 Installation and connection

4.1 Installation site requirements

The inert gas measuring device must be set up in a dry and mostly dust-free location on a sturdy, level surface.

- An earthed wall socket with 10 A fuse, preferably on a separate circuit, must be installed in the immediate vicinity of the installation site to connect to the mains.
- No heat sources or equipment emitting strong magnetic fields (e.g. motors and transformers) may be located near the installation site.
- The operating position of the device is horizontal.

CAUTION	Heat built-up	
	Insufficient ventilation will damage the device. Always install the device horizontal. Vertical installation is prohibited due to potential damage to the device from heat building up.	
CAUTION	Ingress of liquids	



Water entering the device can cause serious damage to the device, potentially beyond repair. Do not place objects containing water on or in the immediate vicinity of the device!

4.2 Preparing for Operation

NOTICE



When transporting from cold environments to the installation site with higher ambient temperatures or humidity, allow to sit for at least two hours to acclimate.

Install the device in the desired location.

- Install lines from the measuring point to the gas inlets and outlets. Ensure the lines are tight.
- If pressure limitation is required, install a pressure regulator with needle valve (available from the manufacturer of the device) before the gas inlet.
- If the sample gas contains water vapour which could condensate inside the cold connection lines, the condensate must be collected before the device. Water must not enter the hot measuring cell.
- An external flow meter should always be installed after the gas discharge (any leaks which may occur will not affect the measurements at this point).
- Connect the device to the mains.

Connection options

The device can be connected by bypass (internal pump suctions the sample gas!) or via direct gas inlet (limit 0.1 bar overpressure).

Piping material

Particularly for long transport paths and unfavourable conditions, select piping to rule out oxygen permeability. The manufacturer recommends the following materials depending on the measuring conditions:

Sample gas temperature low Higher sample gas temperature Oxygen concentration < 1000 ppm thick PVC tubing Tygon R 3603 (supplier, e.g. novodirect Kehl) Stainless steel lines

4 4510	
NOTICE	
	When installing connections for steel lines, the information in the appendix provided by the manufacturer must be observed. Silicone tubes can cause inaccurate measurements due to their oxygen permeability. The manufacturer therefore advises against using this type of tubing.
CAUTION	Water entering the hot measuring cell
	Water entering the hot measuring cell can damage it beyond repair and must therefore be avoided. If the sample gas contains so much water vapour there is a risk of water condensation, inside cold tubing, a water separator must be installed before the sample gas enters the device.
	The sample gas can also flow with the device switched off.

5 Operation and Parametrisation

5.1 Operation

5.1.1 Switching On and Measurement Display

After preparing the inert gas measuring device for operation and installing all lines, the device can be switched on. The measuring cell reaches its operating temperature of 750 °C (1382 °F) after approx. 10 minutes. The current measured value will be displayed but will not be within the specified error limits until the thermal conditions inside the measuring cell are completely balanced, after about one hour.

The device enters display mode after being switched on. The display shows the value programmed in the output (typically the current oxygen concentration) according to the selected dimension (Vol.% or ppm).

5.1.2 Setting the Sample Gas Flow Rate



To ensure exact measurements, set the flow rate to 5 ... 10 L/h. When measuring by bypass, the flow rate is controlled by the internal pump.

In the event of sample gas overpressure, the manufacturer recommends installing a high-quality needle valve directly at the gas inlet of the device. Suitable needle valves are available from the manufacturer of the device. If higher pressure occurs, a pressure regulator should be installed upstream to regulate its output pressure to approx. 100 kPa (1 bar) overpressure.

5.1.3 Measurement Monitoring

The device can be programmed for a limit, which sends alerts via relay output. The relay is open when active. (If a limit is activated this status will also appear in the status line). This signal is delayed. The response time for measurement monitoring (limit delay) can be set to 1 to 99 seconds.

5.1.4 Status/Error Messages

Measuring cell functions are monitored during the measuring process. In the event of a failure/error, error messages are output. At the same time the relay output is activated to indicate a fault.

Status	Display	Note
0	ОК	
1	LIMIT	
2	RANGE<<<	
3	RANGE>>>	
4	FLOW<<<	< 5 L/h
5	FLOW>>>	> 10 L/h
6		
7		
8		
9	WARM UP	Cell temperature too low (wait, after approx. 15 minutes 750 °C (1382 °F) must be reached)
10	CELL TEMP.<<<	Set temp -10° and >30 min
11	THERMOCOUP. ERROR	Thermocouple defect
12		
13		
14	SYSTEM ERROR	

Status 1...8: Warnings, only alarm relay active

Status 9...14: Error, alarm relay active and current signal zero

5.2 Parametrisation

5.2.1 Adjustable Parameters

Parameter	Section	Remarks
Display	O ₂ : 021 (100) Vol-% or in ppm	Measuring range 100 Vol.% on request
Analog output	020 mA or 420 mA	
	alternatively 010 V or 210 V	
Output scale	Linear	Logarithmic scale recommended if the meas-
	Logarithmic (base 10)	ured value spans several decades.
Suppressed zero point	0.0000121 Vol.% or	Advisable for optimal resolution in a certain
	0.121000.0 ppm	range
Maximum measured value	20.00021.000 Vol.% or 200000210000 ppm, higher values on request	This value corresponds to the respective end value of the analogue signal (e.g. 20 mA)
Measurement response time $t_{\scriptscriptstyle 90}$	1 99 s	Formed from arithmetical average of the measured value
Limit	099.99 Vol.%	Set as lower or upper limit with the symbol
	or 0999999 ppm	">" or "<"
Limit delay	1 99 s	Time which must have been exceeded before the alarm is signalled.
Transfer rate of the RS-232 port	4800, 9600, 19200 baud	
Measuring gas flow rate	Internal pump, switch on or off via keyboard	The pumping capacity is regulated via flow measurement

5.2.2 Programming Menus

Use the keys below the display to access the following menus (the display shows the current key configuration). Here you can always use the 🕶 key to select specific parameters, which can be changed with the various keys, then press the 🕶 key again to confirm.

A main display



An LED indicates the following statuses Flashing red: Error Green: OK Yellow: Limit Flow

Status line Pump status (on/off via key) and cell temperature

BA 4510

B settings

SETTINGS
GENERAL
LIMIT
ANALOG OUTPUT
CALIBRATION
RETURN

B.1 Base settings

GENERAL SET	TINGS
LANGUAGE:	ENGLISH
BAUD RATE:	9600
CONTRAST:	0
BEEP:	ON
RETURN	

English, German	
4800, 9600, 19200	
+-9	
OFF	

B.2 limit

LIMIT VALU	JE	
VALUE:	> 206	400 ppm
DELAY TIN	IE:	1sec
RETURN		

B.3 Analog Output

ANALOG OUTPUT		
VALUE:	ppm O2	
RANGE:	0-10 V	
ZERO POINT:	0 ppm	
END MARK:	210000 ppm	
AVERAGE FAC	TOR: 1sec	
RETURN		

0	.9999999	ppm	or	09	9.99	Vol.%

0...99s

Vol% O2, ppm O2, O2[log10] Optional:O2 NGW, H20/H2 0-20 mA or 4-20mA Optional: 0-10V or 2-10V

1-99s

B.4 calibration

CALIBRATION

CALIBR. ZERO POINT CALIBR. SPAN GAS

RETURN

B.4.1 zero gas calibration

CALIBR. ZERO POINT	
MEAS. VALUE: 206400 ppm	Current measured value
ZERO GAS: 206400 ppm CALIBR: ZERO: WAIT 5 CALIBR. VALUE: - 4.5	Zero gas always 20.64 % Status Calibration value ¹⁾
RETURN	

¹⁾ with this line activated, press the **Enter** key for approx. 3 s to set the calibration value to 0.0 **Range calibration**

CALIBR. SPAN GAS	
MEAS. VALUE: 206400 ppm	Current measured value
SPAN GAS: 1000 ppm	
CALIBR. SPAN: WAIT 5	Calibration status
CALIBR. VALUE: 1.00	Calibration value *2
RETURN	

*2 with this line activated, press the Enter key for approx. 3 s to set the calibration value to 1.00

B.4.4 Saving

Г

SAVE VALUES ?	
YES	
NO	

5.3 Calibration

Since the measuring system is linear, two calibration points will suffice for the check:

-Zero point

The zero point corresponds with the measurement if there is no oxygen in the measuring cell and there is neutral gas such as nitrogen in the unit.

-Measuring range (sensitivity)

The sensitivity for the measuring range is set with span gas or ambient air (~20.9 % O₂).



The device must be in operational state for at least 1 hour before calibrating.

5.3.1 Zero Gas Calibration

Checking this is particularly important when measuring near 20 Vol.%. Minor mechanical instabilities or ageing can change, resulting in minor changes in the temperature difference between the electrodes, thus the cell voltage. Zero point calibration compensates this false voltage. Zero point calibration requires ambient air to flow through the cell at the speed sample gas will later flow. This condition is either implemented by the internal pump (ambient air suction) or external pump (e.g. aquarium pump).

First use the keyboard to open "Calibration", then "Zero gas calibration". After selecting "Calibr. zero:", press the **Enter** key to start the calibration. The calibration takes approx. 5 s. Now press "Back" and press the Enter key to close the menu. Click "yes" to save.

5.3.2 Span Gas Calibration

For this, certified test gas will be passed through the device (preferably with the same concentration which will later be measured). The process is determined by the menu.

Use the keyboard to first open "Calibration", then "Span gas calibration". The O_2 concentration of the test gas must be entered via keyboard. After selecting "Cal. span:", press **Enter** to start calibration.

The stability of the measured value (O_2 concentration) is checked during calibration. The actual calibration does not start until the signal generated by the test gas is stable. The amount of time required for calibration can therefore vary (the fluctuation range must be less than 1% within 4 s).

If it does not stabilise, calibration is cancelled after 60 s.

This process further evaluates the deviation of the measured value from the set point. Zero gas calibration allows ± 20 mV (cell voltage), span gas calibration allows ± 20 % from the measured value (cell voltage).

The following formula is used for correction:

	With the values
U _{cu} (corr)=(U _{cu} +A)*B	U _{cell} = measured cell voltage
	A= cell voltage at zero point
	B= value for end value correction

After calibration has completed, select "Back" with the keyboard and press Enter to close the menu. Click "yes" to save. Calibration status message:

OK< (1.5)	OK (1.5)	last calibration OK (calibration value)
WARTEN! 5	WAIT! 5	Calibrating
ABBRUCH	BREAK	Press key to cancel
FEHLER STABIL.	TIME OUT	Not stable after 60 s
FEHLER BEREICH	OUT OF RANGE	Out of range
FEHLER SENSOR	FAILED	Device error
START<	START	Start calibration

6 Maintenance

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	_
	a) Disconnect the unit from the mains when performing any maintenance.	
$\overline{7}$	b) Secure the equipment from accidental restarting.	
	c) The unit may only be maintained and opened by instructed, competent personnel.	
DANGER	Toxic, acidic gasses	
	Sample gas / calibrating gas can be harmful.	
	a) If necessary, ensure a safe gas discharge.	
	b) Switch off the gas supply before performing maintenance and protect from opening inadvertently.	F
	c) Protect yourself from toxic / corrosive gasses when performing maintenance. Wear suitable protective equipment.	

The electronics, measuring cell and, if applicable, the built-in sample gas pump, are maintenance free except for occasional calibration. The built-in protective filter in the puncture device must be checked regularly and replaced if dirty.

If the measuring cell or the thermocouple is defective, return the device to the manufacturer for repair.

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6.1 Replacing the Fuse

WARNING

Electrical voltage



Risk of electric shock Switch off the device and disconnect from the mains before replacing the fuse.



WARNING





Risk of burns

The measuring cell housing will have an excess temperature of approx. 60 °C (140 °F) for some time after being switched off. Wait for the device to cool down before starting maintenance.



The fuse (1AT) is located near the back wall inside the device (see arrow). Replace with the same type of fuse

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 attach 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 Troubleshooting

	Problem/Failure	Possible Cause	Solution
_	Display doesn't light up	 Device off 	 Switch on device
		– Power outage	 Check power supply
			- Check the connection of the mains supply
		 Fuse tripped 	 Replace fuse
_	Error "Low flow"	 Gas supply clogged, too long for the cross-section used or leaking 	 Check lines, clear clogs, seal leaks
		– Pump failure	 Have replaced by manufacturer
-	Relatively high measured value,	 Gas flow too low 	 Increase flow rate
	despite low oxygen concentration expected	 Micro-leak in gas supply 	 Tighten screw connections
_	The measured value varies by flow rate (the lower the flow rate, the higher the measured value or vice versa)	 Sample gas supply leaking 	 Check sample gas supply and screw con- nections for leaks, tighten
_	Measured value substantially lower than expected	 The sample gas has components which react with oxygen at high temperatures (e.g. hydrocarbons) 	 Pass the sample gas through activated carbon filter, if necessary check satura- tion of activated carbon filter
-	Warning: Warm up	 Measuring cell has not yet reached the operating temperature 	 Wait 5 minutes, then monitor current temperature in the display
		 Heater fuse tripped 	 Switch off device and after restarting check if the error occurs again - if so, con- sult Service
		 Heater or controller failure 	 Contact service
-	Error: Thermocouple defect	 Thermocouple defective 	 Contact service
-	Error: System error	 Program or memory error 	 Contact service



8 Disposal

The applicable national laws must be observed when disposing of the products. Disposal must not result in a danger to health and environment.

The crossed out wheelie bin symbol on Bühler Technologies GmbH electrical and electronic products indicates special disposal notices within the European Union (EU).



The crossed out wheelie bin symbol indicates the electric and electronic products bearing the symbol must be disposed of separate from household waste. They must be properly disposed of as waste electrical and electronic equipment.

Bühler Technologies GmbH will gladly dispose of your device bearing this mark. Please send your device to the address below for this purpose.

We are obligated by law to protect our employees from hazards posed by contaminated devices. Therefore please understand that we can only dispose of your waste equipment if the device is free from any aggressive, corrosive or other operating fluids dangerous to health or environment. **Please complete the "RMA Form and Decontamination Statement", available on our website, for every waste electrical and electronic equipment. The form must be applied to the packaging so it is visible from the outside.**

Please return waste electrical and electronic equipment to the following address:

Bühler Technologies GmbH WEEE Harkortstr. 29 40880 Ratingen Germany

Please also observe data protection regulations and remember you are personally responsible for the returned waste equipment not bearing any personal data. Therefore please be sure to delete your personal data before returning your waste equipment.

9 Appendix

9.1 Technical Data

Technical Data			
Measuring components			
Measuring component:	Oxygen		
Measuring range	0 Volppm 20.9 Vol% O ₂		
Measuring principle:	Zirconium dioxide		
Measuring Data			
Accuracy:	< 5 % (from measured value)		
Reproducibility:	< 1.5 % O ₂		
Detection limit:	0.1 vpm O ₂		
Response time (T ₅₀)	< 5 s		
Linearity deviation	< 0.4 vpm O ₂		
Zero drift	< 0.2 vpm O ₂ per week		
Sensitivity drift	< 0.02 % from measured value per week or 200 vpb per week, whichever is higher		
Gas inlet conditions			
Gas temperature:	+5 °C to 80 °C		
Gas overpressure.	max: 20 mbar		
Gas flow without pump:	5 10 L/h (regulated to 7 L/h when using the internal pump)		
Sample gas conditioning			
Dew point:	at least 5 °C below ambient temperature		
Climatic conditions			
Ambient temperature:	+10 °C to 45 °C		
Transport and storage temperature:	-20 °C to 60 °C		
Relative humidity:	< 80 % at 20 °C		
Signal outputs			
Current signal:	0/4 20 mA (on error near 0 mA); scalable		
Alarm relay:	1x limit, 200 VDC, 0.5 A, 10 W		
Serial port:	RS 232		
Keyboard and displays			
Measurement display:	LCD plain text display		
Keyboard:	3 keys		
Power supply			
Voltage:	100 - 240 V AC, 47 - 63 Hz		
Power input:	20 VA		
Construction			
Housing:	Aluminium housing with handle		
Dimensions (h x w x d):	135 x 100 x 240 mm		
Sample gas inlet:	3 mm screw-in connection		
Sample gas outlet:	Stainless steel hose nipple for hose with 4 mm inside diameter		
Housing protection class:	IP40		
Weight:	approx. 3 kg		

9.2 Basics of using potentiometric ZrO2 solid electrolyte sensors in optimal combustion processes

Many technological processes require optimising and reproducible combustion processes (e.g. production of glass or ceramic fibres, firing porcelain, generating energy or crude gas from solid or liquid fuels, etc.) for consistent product quality and use of resources. Quality assurance standards such as ISO 9000 require acquisition and documentation of process-related data for ensure product quality. Monitoring and controlling these systems requires variables which are preferably acquired in real time within a wide gas composition range and are clearly assigned to fully balanced gases.

In practice, these measured values are generally acquired using potentiometric ZrO_2 solid electrolyte sensors. These (unheated or electrically heated) probes can be short or very long, which are used in various types of combustion systems, technical furnaces or in flames in situ, and supply the required signals. There further are devices with electrically heated sensors to analyse external premixed fuel-air mixtures or flue gases.

The following outlines the chemical, thermodynamic and electrochemical bases for using potentiometric solid electrolyte sensors (= galvanic solid electrolyte cells) in combustion processes.

Oxygen concentration and air number lambda

The exchange of gaseous, liquid or solid fuels with air is best described using the air number lambda. These parameters specify the ratio of air supplied during combustion and the air required for the stoichiometric conversion of the fuel used. Air can be specified in volumes, masses or quantities (which are proportional according to the ideal gas law, as commonly known) (units such as m³, kg or mol will be reduced when determining the ratio). With volumes, v is

 λ = v(supplied air volume) / v(stoichiometric air volume required).

If too much air is supplied (excess air), $\lambda > 1$, when not supply enough air (lack of air), $\lambda < 1$. In the case of exact stoichiometric combustion $\lambda = 1$.

(Only automotive engineering uses a different definition, as engine test stations weigh the amount of fuel used and convert the supplied air volume into mass. Dividing the air mass by the fuel mass, e.g. with pure octane at exact, stoichiometric conversion, then equals 15.3.)

The combustion of hydrocarbon (in engine fuel, natural gas, liquid gas) using a molecular formula of $C_n H_m$, with full combustion at excess oxygen, λ then provides the reaction equation

$C_nH_m + \lambda (n + m/4) O_2 => n CO_2 + m/_2 H_2 + (\lambda - 1) \cdot (n + m/4) O_2$.

In combustion with a lack of air (oxygen shortage), if the temperature is high enough and, if necessary, using catalysts to produce total gas balance, all organic substances will essentially turn into a mixture of nitrogen and hydrogen, water vapour, carbon monoxide and carbon dioxide, the so-called water gas (which can be produced from carbon and water). The reaction equation for conversions under oxygen shortage can not only be formulated with λ , n and m. Rather,

 $C_{n}H_{m} + [(1-a/2) \cdot n + (1-b) \cdot m/4] O_{2} => (1-a) \cdot n CO_{2} + a \cdot n CO + (1-b) \cdot m/2 H_{2}O + b \cdot m/2 H_{2},$

with a and b divided by $\boldsymbol{\textbf{\textbf{A}}}$ and the state of the temperature-sensitive water gas balance

$$\mathsf{CO} + \mathsf{H}_2\mathsf{O} = \mathsf{CO}_2 + \mathsf{H}_2$$

being specific quantities.

Gas potentiometry with solid electrolyte cells first only provides the oxygen concentration $\phi(O_2)$ in the respective sample gases. However, the goal is often to determine λ . This can be calculated based on the following equations:

$$\lambda_{m} = \frac{1 + \frac{\varphi(O_{2})}{1 + 2V}}{1 - \frac{\varphi(O_{2})}{\varphi(O_{2})_{Air}}} \lambda_{f} = 1 - \frac{1}{1 + 2V} \left(\frac{V}{1 + \frac{\varphi(O_{2})^{0.5}}{K_{c}}} + \frac{1}{1 + \frac{\varphi(O_{2})^{0.5}}{K_{H}}} \right)$$

These equations for some hydrocarbons with $\lambda > 1$ (lean) and with $\lambda < 1$ (rich) include the carbon/hydrogen ratio of the hydrocarbon, V = 2 n/m, and the thermodynamic equilibrium constants for the reactions

$$CO_2 = CO + 1/2 O_2 \log K_c = 4.505 - 14700 \text{ K / T},$$

$$H_2O = H_2 + 1/2 O_2 \log KH = 2.947 - 13008 K / T.$$

Practice, however, usually sees mixtures of different hydrocarbons, fuel gases can further contain hydrogen, carbon monoxide and nitrogen, and the humidity and carbon dioxide content of the air used contributes to the gas equilibriums. Equations modified accordingly must use average V. Thinning with nitrogen slightly affects δ in the lean range, but not in rich, as the balance between the water gas components is not affected by pressure, thus the water gas concentration.

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One specific problem is changing the form of equation to calculate λ when switching between an excess and shortage of oxygen. The exact solution is to calculate the concentrations of the water gas components at every measuring point and using either equation, depending on whether $\varphi(CO) + \varphi(H_2)$ is greater or less than 2 $\varphi(O_2)$ (DE 43 23 879). The software and electronics developed by GO Messtechnik for this purpose provides results with virtually no delay.

Gas potentiometry with solid electrolyte sensors

Crystals of mixed oxides from ZrO_2 and CaO or Y_2O_3 have vacancies in the oxygen ion sublattice, through which oxygen ions can migrate at high temperatures. Thus, they are solid electrolytes (i.e. solid ion conductors). At platinum layers on ceramic bodies of stabilized ZrO_2 (stabilized against breaking), electrode reactions with the oxygen ion vacancies V_0 are possible:

 $1/2 O_2(gas) + 2 e^{-1}(platinum) + V_0(solid electrolyte) = O_2^{-1}(solid electrolyte),$

 $H_2O(gas) + 2e^{-1}(platinum) + V_0(solid electrolyte) = O_2^{-1}(solid electrolyte) + H_2(gas)$

Oxygen atoms which are splitted off from molecular oxygen or water vapour, take up electrons at the surface of the platinum and move to oxygen vacancies of the solid electrolyte where they form oxide ions. This process however quickly comes to a stand-still if the electrode is in an open circuit, and neither electrons nor oxygen ions can flow. In this state, the output of chemical work from the particle transfer equals the effort that has to be made in terms of electric work. An electrochemical equilibrium exists in this case, which is a dynamic equilibrium. The electrode reactions still occur, but equally fast in both directions. The larger the so-called exchange current density, the less sensitive the electrode is against disturbances.

At electrochemical equilibrium, the platinum has either given off electrons and is positively charged, or it has taken up electrons and is negatively charged. The first can be expected in oxygen, the second in hydrogen.

If two oxygen electrodes are exposed to different oxygen concentrations, on opposite sides of a gastight sintered ZrO_2 solid electrolyte, then the electrode exposed to the higher oxygen concentration will be charged more positively than the electrode exposed to the lower oxygen concentration if the system is in electrochemical equilibrium. A cell potential can be measured between the electrodes, that is higher the more the oxygen concentrations at the two electrodes differ.

In 1889 NERNST was the first to describe the quantitative connection between the cell potential and the particle concentrations at the electrodes with the so-called NERNST-equation. In electrochemical thermodynamics, this equation can be deduced from the chemical potentials (consisting of energy and entropy components) of the particles participating in the cell reaction (i.e. sum of the electrode reactions). The chemical potential of the oxygen is given by

 $\mu(O_2) = \mu(O2) + R \cdot T \cdot \ln p(O_2)$

For a solid electrolyte cell with two oxygen electrodes, the cell reaction is merely the transfer of oxygen from higher to lower partial pressure. The chemical work in cell reactions is described with the molar free reaction enthalpy (Gibbs free energy) $\Delta_R G$, which equals the difference in chemical potentials:

$\Delta_{R}G = \mu(O_{2})' - \mu(O_{2})'' = R \cdot T \cdot \ln [p(O_{2})'/p(O_{2})''].$

In isotherm cells, the standard potentials $\mu(O_2)$ on both sides are equally high, and thus drop out. $\Delta_R G$ equals the maximum work that can be won for an infinitely slow reaction, i.e. at extremely slow current flowing through the external circuit. It can be calculated using the equilibrium cell voltage U_{eq} the molar charge F (Faraday's constant), and the amount of electrons that are exchanged in the cell reaction (4 electrons in case of O_2):

$W_{electric} = 4 \cdot F \cdot U_{eq}$.

From this follows the NERNST-equation for the equilibrium cell voltage:

$U_{eq} = (R \cdot T / 4 \cdot F) \cdot \ln [p(O_2)'/p(O_2)''].$

In gas potentiometry, one of the electrodes is fed with a gas of known composition (reference electrode), and by measuring U_{eq} and T the gas at the measuring electrode is analysed. For dry air at normal pressure at the reference electrode, inserting the values for R and F into the equation above and converting it into the lg-form, the following equation is obtained

 $U_{eq}/mV = 0.049606 \cdot T/K \cdot lg [0.2093 \cdot 1013.25 mbar / p(O_2)].$

In practice often the oxygen concentration (O_2) in vol.% is used for calculations. This relates to the partial pressure as $p(O_2) = \phi(O_2) \cdot p / 100$. If the total pressure does not vary much from the normal pressure (1013.25 mbar), the following equations are used for calculations

Ueq/mV = $0.049606 \cdot T/K \cdot lg [20.93 Vol.% / \phi(O2)]$

 $\phi(O_2)/Vol.\% = 20.93 \cdot 10^{(Ueq/mV)/(0.049606 \cdot T/K)}$.

If a gas is present at the measuring electrode that mainly consists of reducing components, the chemical standard potentials do not drop out in deducing the cell voltage equation. In this case one obtains a NERNST-equation for reaction cells with concentration-independent terms, for example for cells with hydrogen and water vapour at one of the electrodes and air at the other electrode the equation, valid in the range 400 to 1000 °C

 $U_{ea}(H_2, H_2O\text{-air})/mV = -1280.6 + \{ 0.3165 + 0.0992 \cdot \log [\phi(H_2O)/\phi(H_2)] \} \cdot T/K \pm 1.$

In several technical processes the quotient $Q = \phi(H_2O)/\phi(H_2)$ has to be known, which can be calculated from this equation. If the measuring electrode is the negative pole of the cell, the cell voltage is given a negative sign.

In the diagram plotted below the dependence of the equilibrium cell voltage on λ , the oxygen concentration, and an excess CH₄in methane combustion is shown.



The cell voltages calculated with the above-mentioned equations and presented in the diagram are only valid for isotherm cells, with equal temperature at both electrodes. Such isotherm cells have been realized very carefully in the products. Unlike these, the well-known lambda probes used in cars with catalysts in the exhaust pipe, are not isotherm. Their main purpose is indicating λ > or < 1, and they are less suited for precise gaspotentiometric analysis.

9.3 Activated Carbon Filter: Description and Use





9.3.1 Filter Design

The activated carbon filter (ACF) in the drawing consists of a tubular vessel. The ends are closed by caps with connections for tubes. Both caps are pressfit into the tube and glued. The tube connections are 3 mm with stoppers to prevent activated carbon from falling out. The connections to the caps are sealed with special gaskets. The ACF output has a pre-filter and a fine filter to prevent fine dust from entering the gas path. It is filled with activated carbon granules.

9.3.2 Filter use and functionality

The activated carbon filter retains and adsorbs organic residue (e.g. alcohols) from the gas to be analysed.

After some time of use, if the cell voltage increases unexpectedly or the oxygen concentration drops considerably on the inert gas measuring device, one can assume the filter is saturated with organic components, thus ineffective. The filter or activated carbon must be replaced.

When consecutively using the filter in different measurement setups, ensure the direction of flow of the sample gas is the same. Otherwise the previously collected organic compounds can desorb, falsifying measurements. The sample gas should therefore always flow in the direction of the arrow on the filter housing.

9.3.3 Replacing the Activated Carbon

If the filter is saturated, it must be replaced. To replace the activated carbon yourself, disconnect the gas connection at the filter INLET (spanner width 19) and empty the activated carbon. Use a small funnel to add fresh activated carbon and compact by tamping the wall with a plastic or wooden object. Then reconnect the screw-in connection and gaskets. The filter is then again ready for use.



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10 Attached Documents

- Declaration of Conformity KX550011
- RMA Decontamination Statement



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

2014/35/EU (Niederspannungsrichtlinie / low voltage directive)

in ihrer aktuellen Fassung entsprechen.

in its actual version.

Folgende Richtlinien wurden berücksichtigt:

The following directives were regarded:

2014/30/EU (EMV/EMC)

Produkt / products:	Sauerstoffanalysator / Oxygen analyser	
Typ / type:	BA 4510	

Das Betriebsmittel dient zur kontinuierlichen Messung der Sauerstoffkonzentration. The equipment is s designed for continuous measuring of oxygen concentration.

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 61000-6-3:2007/A1:2011 EN 61000-3-2:2014 EN 61000-3-3:2013 EN 61000-6-2:2005/AC:2005 EN 61010-1:2010/A1:2019/AC:2019-04

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 17.02.2023

Stefan Eschweiler Geschäftsführer – Managing Director

Frank Pospiech Managing Director Geschäftsführer -

Bühler Technologies GmbH, Harkortstr. 29, D-40880 Ratingen, Tel. +49 (0) 21 02 / 49 89-0, Fax. +49 (0) 21 02 / 49 89-20 Internet: www.buehler-technologies.com

KX 55 0011

UK Declaration of Conformity



The manufacturer Bühler Technologies GmbH declares, under the sole responsibility, that the product complies with the requirements of the following UK legislation:

Electrical Equipment Safety Regulations 2016

The following legislation were regarded:

Electromagnetic Compatibility Regulations 2016

Product: Oxygen analyser Type: BA 4510

The equipment is s designed for continuous measuring of oxygen concentration.

The object of the declaration described above is in conformity with the relevant designated standards:

EN 61000-6-3:2007/A1:2011 EN 61000-3-2:2014 EN 61000-3-3:2013 EN 61000-6-2:2005/AC:2005 EN 61010-1:2010/A1:2019/AC:2019-04

Ratingen in Germany, 17.02.2023

Stefan Eschweiler Managing Director

Frank Pospiech

Frank Pospiech Managing Director

RMA-Formular und Erklärung über Dekontaminierung **RMA-Form and explanation for decontamination**



RMA-Nr./ RMA-No.

Die RMA-Nr. bekommen Sie von Ihrem Ansprechpartner im Vertrieb oder Service. Bei Rücksendung eines Altgeräts zur Entsorgung tragen Sie bitte in das Feld der RMA-Nr. "WEEE" ein./ You may obtain the RMA number from your sales or service representative. When returning an old appliance for disposal, please enter "WEEE" in the RMA number box.

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./ 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 employee health.

Firma/ Company		Ansprechpartner/ Person in charge	
Firma/ Company		Name/ Name	
Straße/ Street		Abt./ Dept.	
PLZ, Ort/ Zip, City		Tel./ Phone	
Land/ Country		E-Mail	
Gerät/ Device		Serien-Nr./ Serial No.	
Anzahl/ Quantity		Artikel-Nr./ Item No.	
Auftragsnr./ Order No.			
Grund der Rücksendung/ Reason fo	or return	bitte spezifizieren/ please specify	
Kalibrierung/ Calibration Reklamation/ Claim	Modifikation/ Modification Report ur/ Repoir		

- Reklamation/ Claim
- Elektroaltgerät/ Waste Electrical & Electronic Equipment (WEEE)
- andere/ other

Ist das Gerät möglicherweise kontaminiert?/ Could the equipment be contaminated?

Nein, da das Gerät nicht mit gesundheitsgefährdenden Stoffen betrieben wurde./ No, because the device was not operated with hazardous substances.

Nein, da das Gerät ordnungsgemäß gereinigt und dekontaminiert wurde./ No, because the device has been properly cleaned and decontaminated.

Ja, kontaminiert mit:/ Yes, contaminated with:



Bitte Sicherheitsdatenblatt beilegen!/ Please enclose safety data sheet!

Das Gerät wurde gespült mit:/ The equipment was purged with:

Diese Erklärung wurde korrekt und vollständig ausgefüllt und von einer dazu befugten Person unterschrieben. Der Versand der (dekontaminierten) Geräte und Komponenten erfolgt gemäß den gesetzlichen Bestimmungen.

Falls die Ware nicht gereinigt, also kontaminiert bei uns eintrifft, muss die Firma Bühler sich vorbehalten, diese durch einen externen Dienstleister reinigen zu lassen und Ihnen dies in Rechnung zu stellen.

Firmenstempel/ Company Sign

This declaration has been filled out correctly and completely, and signed by an authorized person. The dispatch of the (decontaminated) devices and components takes place according to the legal regulations.

Should the goods not arrive clean, but contaminated, Bühler reserves the right, to comission an external service provider to clean the goods and invoice it to vour account.

Datum/ Date

rechtsverbindliche Unterschrift/ Legally binding signature

Bühler Technologies GmbH, Harkortstr. 29, D-40880 Ratingen Tel. +49 (0) 21 02 / 49 89-0, Fax: +49 (0) 21 02 / 49 89-20 E-Mail: service@buehler-technologies.com Internet: www.buehler-technologies.com



Vermeiden von Veränderung und Beschädigung der einzusendenden Baugruppe

Die Analyse defekter Baugruppen ist ein wesentlicher Bestandteil der Qualitätssicherung der Firma Bühler Technologies GmbH. Um eine aussagekräftige Analyse zu gewährleisten muss die Ware möglichst unverändert untersucht werden. Es dürfen keine Veränderungen oder weitere Beschädigungen auftreten, die Ursachen verdecken oder eine Analyse unmöglich machen.

Umgang mit elektrostatisch sensiblen Baugruppen

Bei elektronischen Baugruppen kann es sich um elektrostatisch sensible Baugruppen handeln. Es ist darauf zu achten, diese Baugruppen ESD-gerecht zu behandeln. Nach Möglichkeit sollten die Baugruppen an einem ESD-gerechten Arbeitsplatz getauscht werden. Ist dies nicht möglich sollten ESD-gerechte Maßnahmen beim Austausch getroffen werden. Der Transport darf nur in ESD-gerechten Behältnissen durchgeführt werden. Die Verpackung der Baugruppen muss ESD-konform sein. Verwenden Sie nach Möglichkeit die Verpackung des Ersatzteils oder wählen Sie selber eine ESD-gerechte Verpackung.

Einbau von Ersatzteilen

Beachten Sie beim Einbau des Ersatzteils die gleichen Vorgaben wie oben beschrieben. Achten Sie auf die ordnungsgemäße Montage des Bauteils und aller Komponenten. Versetzen Sie vor der Inbetriebnahme die Verkabelung wieder in den ursprünglichen Zustand. Fragen Sie im Zweifel beim Hersteller nach weiteren Informationen.

Einsenden von Elektroaltgeräten zur Entsorgung

Wollen Sie ein von Bühler Technologies GmbH stammendes Elektroprodukt zur fachgerechten Entsorgung einsenden, dann tragen Sie bitte in das Feld der RMA-Nr. "WEEE" ein. Legen Sie dem Altgerät die vollständig ausgefüllte Dekontaminierungserklärung für den Transport von außen sichtbar bei. Weitere Informationen zur Entsorgung von Elektroaltgeräten finden Sie auf der Webseite unseres Unternehmens.

Avoiding alterations and damage to the components to be returned

Analysing defective assemblies is an essential part of quality assurance at Bühler Technologies GmbH. To ensure conclusive analysis the goods must be inspected unaltered, if possible. Modifications or other damages which may hide the cause or render it impossible to analyse are prohibited.

Handling electrostatically conductive components

Electronic assemblies may be sensitive to static electricity. Be sure to handle these assemblies in an ESD-safe manner. Where possible, the assembles should be replaced in an ESD-safe location. If unable to do so, take ESD-safe precautions when replacing these. Must be transported in ESD-safe containers. The packaging of the assemblies must be ESD-safe. If possible, use the packaging of the spare part or use ESD-safe packaging.

Fitting of spare parts

Observe the above specifications when installing the spare part. Ensure the part and all components are properly installed. Return the cables to the original state before putting into service. When in doubt, contact the manufacturer for additional information.

Returning old electrical appliances for disposal

If you wish to return an electrical product from Bühler Technologies GmbH for proper disposal, please enter "WEEE" in the RMA number box. Please attach the fully completed decontamination declaration form for transport to the old appliance so that it is visible from the outside. You can find more information on the disposal of old electrical appliances on our company's website.

