

Smokerlyzer[®]



piCO⁺ Operating Manual



breath analysis is the new blood test

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Intended Use

The piCO⁺ Smokerlyzer[®] is a breath carbon monoxide monitor intended for multi-patient use by healthcare professionals in smoking cessation programmes and research.

Introduction

Carbon monoxide (CO) is a toxic, odourless, colourless, tasteless gas formed by incomplete combustion of organic material at high temperatures with an insufficient oxygen supply.

When inhaled, CO competes successfully with oxygen in the bloodstream to form carboxyhaemoglobin (COHb). This starves body tissues of the oxygen they need to function and repair themselves in day-to-day life. CO can remain in the bloodstream for up to 24 hours, depending on a range of factors including physical activity, gender and inhalation intensity. The half life is about 5 hours.

Correlation of CO (ppm) and carboxyhaemoglobin (%COHb)
Breath carbon monoxide is measured in parts per million (ppm CO) and blood carboxyhaemoglobin in percentages (%COHb). The two are compatible and convertible, and the piCO⁺ Smokerlyzer[®] displays both measurements. Clinical research has shown that a useful relationship between carbon monoxide and carboxyhaemoglobin can be identified after a short period of a person holding their breath. CO readings demonstrate the level of poisonous inhaled CO, while the COHb reading shows the percentage of oxygen that has been replaced in the bloodstream.

The cut-off point between smoker and non-smoker is regarded as 6ppm CO. The piCO⁺ Smokerlyzer[®] identifies a non-smoker as 0-6ppm, a low-dependence smoker as 7-15ppm, and strongly addicted smokers as over 15ppm.

The piCO⁺ Smokerlyzer[®] has been designed so that it can also be used with young smokers. As their smoking habits and views are generally different from adult smokers, the ranges can be altered to 0-4ppm for a non-smoker, 5-6ppm a light smoker and 7ppm+ a more frequent smoker.

Other cut-off points can be adopted as well as smoking classification at higher CO levels. The piCO⁺ has a third profile which can be set by the user with COdata⁺ software for complete flexibility to suit most circumstances.

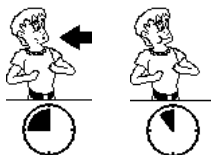
Quick Start Guide

- 1 Turn on the monitor by holding the button down for three seconds.
- 2 Attach the breath sampling D-piece and a new mouthpiece.



- 3 Inhale and double click the button to start a breath test.

- 4 The user should hold their breath for the 15-second countdown. If they are unable to hold their breath for the full countdown, see Operation – page 9.

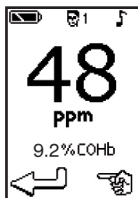


- 5 A beep will sound during the last three seconds of the countdown.

- 6 Blow slowly into mouthpiece, aiming to empty the lungs completely.



- 7 The carbon monoxide (ppm) and percentage carboxyhaemoglobin (%COHb) readings will rise and the peak values will remain on the screen. The coloured LEDs will light up accordingly – see the interpretation table on page 10.



- 8 Remove the D-piece between tests to allow fresh air to circulate around the sensor.

- 9 To repeat the breath test, double click the button to return to main display and continue from step 2.

- 10 To switch the monitor off, hold the button down for three seconds. The unit will auto power off after five minutes of inactivity.

Pack Contents and Specification

- 1 Instrument
- 2 Carry pouch
- 3 Operating Manual
- 4 Breath sampling D-piece
- 5 Disposable cardboard mouthpiece
- 6 2 × AA batteries

Infection control and maintenance guidelines (not shown)

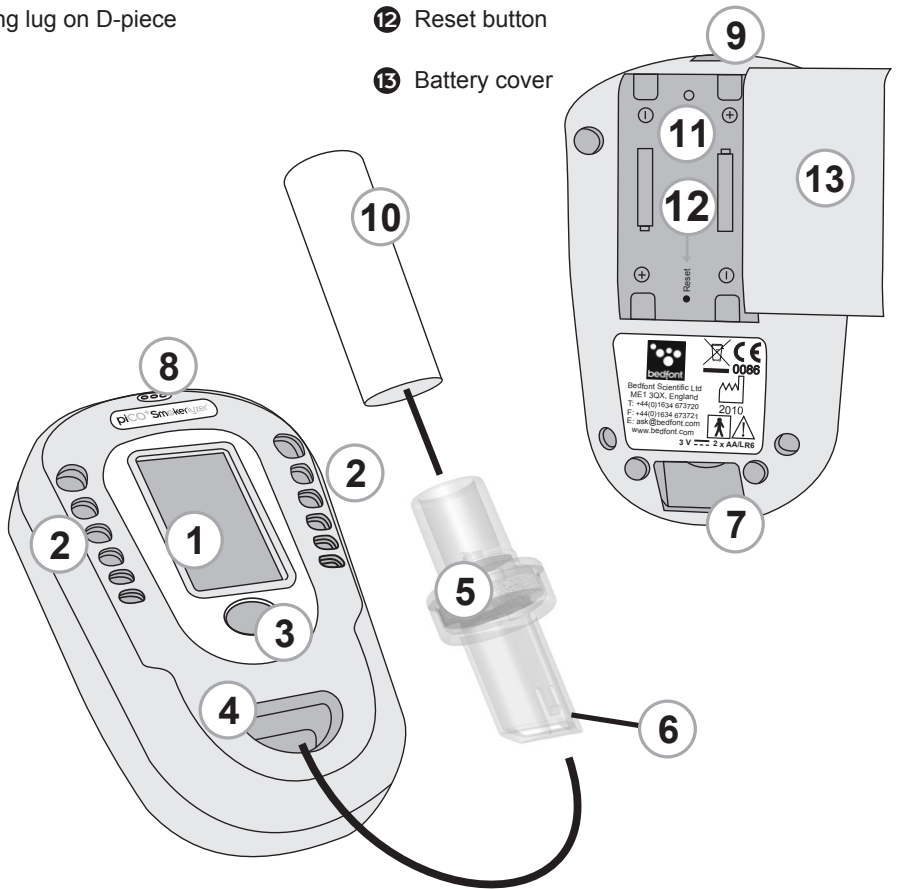


Specification



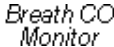




















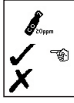









Concentration range:	0-100ppm
Display:	LCD with 1ppm increments
Detection principle:	Electrochemical sensor
Accuracy (repeatability of readings):	±2%
H ₂ cross-interference:	<10%
Power:	2 × AA (LR6 or equivalent) alkaline batteries
Response time:	Typically <30 seconds to 90% FSD
Operating temperature range:	0-40°C (storage 0-50°C)
Operating humidity:	10-90% (storage 0-95%) non-condensing
Sensor operating life:	Approx. 5 years, 2-year warranty
Sensor sensitivity:	1ppm
Dimensions:	Approx. 45 × 75 × 120 mm
Weight:	Approx. 200g including batteries
Monitor construction:	Body: Polycarbonate/ABS blend with elastomeric overmould. D-piece: Polypropylene

Instrument Layout

- 1 Display
- 2 Coloured LEDs
- 3 Button
- 4 Aperture for D-piece
- 5 Breath sampling D-piece
- 6 Securing lug on D-piece
- 7 Exhaust port for breath sample
- 8 Sounder
- 9 USB connector
- 10 Cardboard mouthpiece
- 11 Battery compartment
- 12 Reset button
- 13 Battery cover



Display Symbols

- 1 Start-up screens:  →  → 
- 2 Battery condition: OK:  Flat:  Dead: 
- 3 User profile: Adult:  1 Adolescent:  2 Custom:  3
- 4 Sounder: On:  Mute: 
- 5 Pointer: 
- 6 Start breath test: 
- 7 Enter calibration mode: 
- 8 Enter set-up mode: 
- 9 Inhale: 
- 10 Breath-hold and countdown: 
- 11 Exhale for breath test: 
- 12 Peak CO reading (ppm and %COHb): 
- 13 Set instrument zero in fresh air: 
- 14 Apply calibration gas at 20ppm: 
- 15 Calibration pass/fail: Pass:  Fail: 
- 16 Calibration reminder: 
- 17 User profile selection: 
- 18 Select adult user profile:  1
- 19 Select adolescent user profile:  2
- 20 Select custom user profile (if set via COdata⁺ software on PC):  3
- 21 Contact Bedfont or distributor for help:   
- 22 D-piece reminder: 
- 23 Return: 

Warnings and Maintenance

Warnings

People with lung disease or chest ailments may not be able to achieve the 15-second breath hold. In such cases, the user should inhale and hold their breath when the breath test is started, and exhale, if necessary, before the countdown has completed.

A new mouthpiece should be used for each test.

Hands should be washed regularly in accordance with infection control practice.

Cleaning



Wipe the instrument and the external surfaces of the D-piece with a product specifically developed for the purpose. Suitable Instrument Cleansing Wipes are available from Bedfont.

NEVER USE ALCOHOL, cleaning agents containing alcohol or other organic solvents to clean the monitor. Long-term exposure to such vapours will damage the internal CO sensor.

Under no circumstances should the monitor be immersed in or splashed with liquid.

Routine Maintenance

When the calibration reminder prompt is displayed (see page 11), the instrument should be calibrated using Bedfont 20ppm CO in air calibration gas. Once calibration has been carried out a reminder will recur in six months.

Replace batteries when the battery symbol resembles  or .

Replace the breath sampling D-piece when prompted by the unit (every 30 days) or if it is visibly soiled or contaminated.



The D-piece cannot be cleaned or sterilised.

Batteries

Batteries should be removed if the instrument is not likely to be used for some time.

Additional technical information is available on request from Bedfont or your local distributor.

Operation

Ensure that two AA batteries are correctly inserted in the battery compartment.

The single button controls all functions:

- One long button press (>3 seconds) turns the unit on.
- A single click scrolls the pointer through the list of options.
- A double click selects the required option.
- One long button press (>3 seconds) turns the unit off.

Press and hold the button for three



seconds until the display becomes active. Release the button. After a 10-second warm-up period, during which a start-up screen is displayed, the main menu will appear.

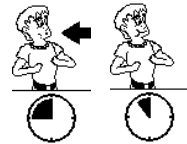
If a **X** appears instead of the main menu, it means

that the instrument has failed to set a fresh air zero during start-up, perhaps because the ambient air was not free of carbon monoxide. Ensure that the instrument is in fresh air and then double click the button to repeat the start-up test. If it fails again, please see Troubleshooting – page 15.

When the pointer is opposite the picture of an exhaling face, the piCO⁺ is ready to start a breath test. The green LEDs will flash twice to indicate that the instrument is ready.

Attach a breath sampling D-piece and a new cardboard mouthpiece to the piCO⁺. Check that all connections are pushed firmly together.

To start a breath test, the patient should inhale and hold their breath. Double click the button to initiate the 15-second countdown display.



Operation (continued)

Ensure that the breath is held throughout the countdown. The beep will sound during the last three seconds of the countdown. Once the countdown reaches zero, exhale slowly but gently into the mouthpiece. Aim to empty the lungs as much as possible.

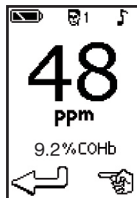


If the patient cannot hold their breath for the full 15 seconds, they should commence exhalation at a comfortable point, but still exhale completely.

The display will show a rising ppm value alongside an equivalent %COHb reading. The coloured LEDs will light up according to the selected user profile.

The sounder will beep at an increasing frequency, according to the concentration of CO measured. To temporarily mute the sounder, single click the button.

The peak reading during the breath exhalation will remain on the display. The test is complete when the pointer and 'return' symbols appear at the bottom of the display.



At this point, a single click of the button will temporarily silence the sounder, if it is on.

To start another breath test, double click the button to return to the main display. A new mouthpiece should be used with every test.

Removing the D-piece between tests will allow fresh air to circulate around the sensor. It is good practice to wash your hands after removing the D-piece.

If no further tests are required, the piCO⁺ should be turned off by holding the button down for three seconds. If left on, the piCO⁺ will automatically turn off after five minutes of inactivity.

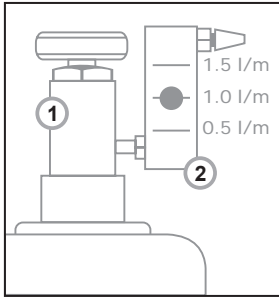
To re-calibrate the instrument, follow the instructions on page 11.

To change the user profile from adult to adolescent (or a custom profile if one has been set using the COdata⁺ user software), see the instructions on page 13.

To permanently silence the sounder during the breath test, follow the instructions on page 14.

LED colour	Description	User Profile 1: Adult (ppm)	User Profile 2: Adolescent (ppm)
Green	Non-smoker	0-6	0-4
Yellow	Danger zone	7-10	5-6
1 Red	Smoker	11-15	7-10
2 Reds	Frequent smoker	16-25	11-15
3 Reds	Addicted smoker	26-35	16-25
4 Reds	Heavily addicted smoker	36-50	26-35
4 Reds flashing	Dangerously addicted smoker	51+	36+

Calibration

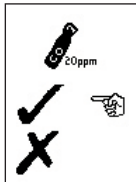


Bedfont Calibration Kit

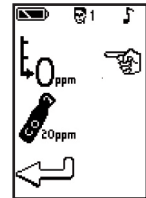
1. Fine control valve
2. Flow indicator
3. Gas cylinder, 20ppm CO in air
4. Calibration adapter and tube



- Instruments are calibrated before leaving Bedfont.
- Calibration reminders will prompt the user to calibrate the unit every six months
- The calibration gas required is Bedfont 20ppm carbon monoxide in air.
- Ensure the fine control valve is in the 'off' position.
- Screw the fine control valve and flow indicator assembly to the gas can. This is best done by screwing the gas can into the valve.



- Ensure that the instrument is surrounded by fresh air. With the pointer now opposite the 'zeroing' symbol, double click the button to set the instrument to zero. If the zeroing has been successful, a tick ✓ will be displayed. If the zeroing fails, a X will be displayed (see Troubleshooting – page 15). Double click the button to return to the calibration menu.



- Turn the instrument on in the normal way. When the main menu appears, scroll down to the symbol of the gas cylinder with a single click of the button. Double click the button to select the symbol.



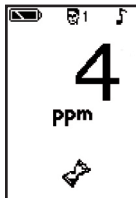
Calibration (continued)

- Single click the button to scroll down to the 20ppm gas cylinder symbol. Double click the button to select the symbol.



- Immediately open the fine control valve and allow the gas to flow at 1 litre per minute.
- To maintain this rate, adjust the flow so that the ball in the flow indicator remains at the middle line.
- Allow the gas to flow through the instrument for up to 1 minute and 30 seconds to ensure accurate calibration, again monitoring the rate of flow.

- As the 20ppm CO calibration gas is applied, the displayed ppm reading will rise. After 1 minute and 30 seconds, or when no further increase in the reading occurs, the final reading will be shown and sampling will cease.



- If the reading is between 15 and 25ppm, the calibration value will be automatically set in the instrument as 20ppm and a tick ✓ will be displayed to show a successful calibration. If the reading is outside these limits, calibration fails, and a ✗ is displayed (see Troubleshooting section – page 15).
- The pointer and 'return' symbol re-appear at the bottom of the display to indicate that the process is complete and to allow the user to double click the button to return to the previous menu page.
- Turn off the gas flow, remove the D-piece sampling system and disconnect the calibration adapter from the D-piece sampling system.
- Unscrew the fine control valve and flow indicator from the gas can and store them safely. If the valve is left attached to the can, gas could escape.
- The piCO+ is now calibrated and ready for use.
- The piCO+ will prompt the user to calibrate the unit again in six months.

Set-up: User Profiles

In the set-up mode, the user can change the selected user profile from adult to adolescent (or to a third custom profile, if one has been set).


The user profiles determine which coloured LEDs are lit during a breath test. The default values for adults and adolescents are shown in the table in the Operation section on page 10. The selected user profile is indicated by a small symbol on the top line of the display:


Adult 1 

Adolescent 2 

or

Custom 3 

To change the selected profile, scroll the pointer to the set-up symbol  on the main display using single clicks of the button. Double click the button to select the set-up mode.

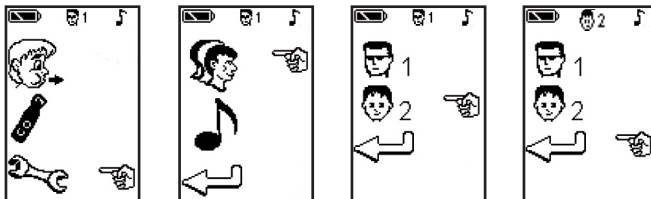
Scroll the pointer until it is opposite the user profile selection symbol . Double click to select this function.

Move the pointer until it is opposite the desired profile and double click the button to select.

The symbol on the top line of the display will change to show the selected profile.


The custom profile will only be available on the display if it has been previously set using the COdata⁺ software on a PC.






Return to the previous menu by pointing at the 'return' symbol and double clicking.





Set-up: Sounder Operation

The set-up mode allows the sounder to be turned off during the breath test, although the piCO⁺ will still beep during the breath hold countdown.

The operation of the sounder during the exhalation phase of a breath test is indicated by the small symbol  on the top line of the display.

- To turn the sounder settings on or off, scroll the pointer to the set-up symbol  on the main display using single clicks of the button. Double click to select the set-up mode – see page 13.
- Scroll the pointer until it is opposite the sounder symbol,  then double click to switch the sounder on  or off . The large sounder symbol and the small symbol on the top line of the display will change to show whether the sounder is on or off.
- Even if the sounder has been turned off, it will continue to operate during the last three seconds of the breath hold countdown.
- To return to the previous menu by pointing at the 'return' symbol  and double clicking the button.
- If the sounder is left on but needs to be temporarily silenced during or just after the breath test, single click the button.

Troubleshooting

- If the unit fails to turn on properly, or if either low battery symbols  or  are showing, replace the 2 × AA batteries. Ensure that the batteries are inserted the correct way around, matching the symbols moulded into the plastic.
- If a breath test on a non-smoker gives an indication of CO being present, it may be because of a high ambient level of CO (possibly due to a faulty combustion appliance or exhaust fumes), or due to the effects of passive smoking. A false reading can be obtained when there is alcohol on a person's breath, or from the presence of hydrogen, which can be generated in the human digestive system.
- If a **X** appears after zeroing, a second attempt can be made to zero the unit in fresh air. Check that the unit is in fresh air and double-click the button to restart the zero process. If, after a third zeroing attempt, the display shows a **X** again, the unit will have to be reset or restored using the reset button located in the battery bay. If the problem persists, please return the piCO⁺ to Bedfont or its distributor for investigation and repair. In this case, the display shows a telephone and envelope symbol. The unit can be turned off by pressing the button for three seconds. It is then possible to re-start the unit and attempt the zeroing process again.
- If, after attempting to calibrate with 20ppm CO gas, the display shows a **X**, it means that the gas value was not within the permitted limits. The reading achieved is displayed underneath the **X**. If the value is much lower than 20ppm, there may have been a problem with the supply of gas from the cylinder during the calibration process. If the value is much higher than 20ppm, it is possible that the wrong concentration of calibration gas is being used. In either case, check the cylinder, connections and flow-rate before double clicking the button to repeat the gas calibration process. If, after a third repeated attempt to calibrate the instrument, the display shows a **X** again, the unit will have to be reset or restored using the reset button located in the battery bay. If the problem persists please return the unit to Bedfont or your local distributor for investigation and repair. In this case, the display shows a telephone and envelope symbol. The unit can be turned off by pressing the button for three seconds. It is then possible to re-start the unit and use it with the previous calibration settings, or to attempt the complete calibration process again.

COdata⁺ Software

Connecting to the PC

- Place one end of the connection lead into the mini USB socket on the top of the piCO⁺. Connect the other end to the USB port on the PC.
- Before starting the software, ensure that the piCO⁺ is connected to the PC and switched on. Once the sensor has stabilised, double click the COdata⁺ icon on the PC to start the programme.
- Refer to the supplied documentation for information on how to operate the COdata⁺ software.
- The custom user profile can only be accessed from COdata⁺.



Frequently Asked Questions (FAQ)

Frequently asked questions about breath carbon monoxide (CO) monitoring in smoking cessation:

Q What is carbon monoxide?

A Carbon monoxide (CO) is a poisonous gas that you cannot smell or see. When smoke is inhaled from a cigarette, CO is absorbed into the blood through the lungs. CO is dangerous because it binds with haemoglobin in the red blood cells about 200 times more readily than oxygen, depriving the body of vital oxygen.

Q What does a breath CO test show?

A It shows the amount of carbon monoxide in a person's breath (ppm CO), which is a measure of blood carboxyhaemoglobin (%COHb). It acts as an indicator of the possible level of some 4,000 toxic substances in cigarette smoke, 60 of which can cause cancer.

Q What does ppm and COHb mean?

A Ppm means parts per million, i.e. one part of CO in one million parts of air (breath). This might not seem like very much, but ppm has a direct correlation with %COHb – the percentage of CO combined with haemoglobin in the blood. If a patient gives a reading of 20ppm (that of a frequent adult smoker), it means that their oxygen carrying capacity is reduced by 5%. It also indicates a high level of addiction to nicotine.

Q How quickly does CO disappear from the body when someone stops smoking?

A It takes about 5-6 hours for the original level to reduce by half. Usually, an ex-smoker will show the level as a non-smoker living in the same environment after a maximum of 48 hours.

Q How long after a cigarette should the test be conducted?

A After a minimum of 10 minutes.

Q What is the best time to take a CO reading?

A The best time to take a CO reading is as late as possible in the day.

Q What levels of breath CO do you expect to see?

A A guideline based on clinical research is shown in the table on page 10.

Returns Procedure

If your equipment requires servicing, please contact Bedfont's Customer Repairs Department before returning any goods. If you did not purchase your monitor directly from Bedfont, please contact your local distributor or supplier.

- When you have supplied the Customer Repairs Department with the monitor serial number and description of the fault, you will be issued with a Returns Number.
- Please state the Returns Number on a compliment slip or headed paper when returning the monitor, ensure that your full contact details, including telephone and fax numbers, are clearly stated.
- Bedfont advises that you use a courier service when returning monitors, to enable you to insure goods for loss or damage in transit.
- When your goods are received by Bedfont, you will be sent an Order Acknowledgement.
- The monitor will be examined and you will be sent an Engineer's Report and a quotation for the repair, including an Authorisation Form.
- If your monitor is still in warranty, Bedfont will repair it and return it to you with an Engineer's Report free of charge. If the monitor is found to simply require calibrating, you will be charged a fee for this service if you wish Bedfont to carry the process out for you.
- If the monitor is out of warranty and you wish to proceed with the repair or calibration, please complete the Authorisation Form included with the quotation, ensuring that you include the Official Purchase Order Number, and return the monitor to Bedfont. If you are unable to supply an Official Purchase Order Number, please contact the Customer Repairs Department.
- If you choose not to proceed with the repair, a handling fee will be charged. Ensure that you return the completed Authorisation Form with an Official Purchase Order Number.
- Your equipment will be returned to you as soon as Bedfont have received all of the relevant paperwork. A carriage fee will be charged if the monitor is no longer in warranty.

Spares and Warranty

Spares:

D-pieces

Disposable cardboard mouthpieces

Calibration gas and kits

Instrument cleansing wipes

AA alkaline batteries

Warranty:

Bedfont Scientific Limited warrants the piCO⁺ (excluding batteries) to be free of defects in materials and workmanship for a period of two years from the date of shipment. Bedfont's sole obligation under this warranty is limited to repairing or replacing, at its choice, any item covered under this warranty when such an item is returned intact, prepaid, to Bedfont Scientific Ltd or your local representative.

Warranties are automatically invalidated if products are repaired, altered or otherwise tampered with by unauthorised personnel, or if they have been subject to misuse, neglect or accident.

Never dispose of any electronic instrument in the domestic waste. At the end of the product's life, contact Bedfont or your local distributor for disposal instructions.

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