

NOxBOX[®] Range

Nitric Oxide Monitors and Delivery Systems



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Inhaled Nitric Oxide (INO) Therapy

Nitric Oxide (NO) is a recognised and selective pulmonary vasodilator in adults and neonates, and used in the treatment of pulmonary hypertension. NO is added to ventilator circuits in the treatment of patients with severe breathing difficulties. It is used to improve gas exchange and reduce pulmonary arterial pressure in neonate, paediatric and adult intensive care units.

NO delivery and monitoring

The use of NO demands precise monitoring and management to avoid causing unnecessary pain and suffering to the patient, this can occur in the following cases:

- NO has a very short duration of action and on its sudden withdrawal, for example the cylinder runs out, there can be rapid pulmonary vasoconstriction and hypoxaemia ² (rebound).
- Inhalation circuits to deliver NO must ensure the accurate continuous delivery of NO while minimizing levels of NO₂ ³.
- Mechanical or human error may produce inadvertently low or high NO concentrations. Therefore it is essential to monitor NO and O₂ concentrations ³.
- Both NO and NO₂ have the potential for toxicity in clinical use ³. Nitrogen dioxide (NO₂) is formed rapidly from combining oxygen and NO, the rate depends on the concentration of oxygen and square of NO concentration ⁴. Approximately 50% of inhaled NO₂ is retained within the lung and once absorbed it remains there for prolonged periods, reacting with water to form nitric and nitrous acids which are responsible for the pulmonary toxicity of NO₂ ⁵.

In summary the use of accurate, real-time NO and NO₂ monitors is essential in order to ensure the correct dosage, reduce side effects of INO therapy and ultimately improve the patients' quality of life.

Sources

1. Nitric Oxide, available at: http://en.wikipedia.org/wiki/Nitric_oxide
2. Frostell C. Nitric oxide inhalation – future drug or an invitation to disaster? Paediatr Anaesth 1194; 4: 147-50.
3. Body S. C. et al (1995) Nitric Oxide: Delivery, Measurement, and Clinical Application. Journal of Cardiothoracic and Vascular Anaesthesia, Vol 9 No 6 pp748-763.
4. Austin AT. The chemistry of the higher orders of nitrogen as related to the manufacture, storage and administration of nitric oxide. BR J Anaesth 1967; 39: 345-50.
5. Greenough A. Nitric Oxide – clinical aspects. Care of the Critically Ill, July/August 1995; Vol 11 No 4 pp. 143-46

NOxBOX_i[®]

Intelligent INO delivery and monitoring system

Portable head unit for restricted space or transfer of patients.

Custom trolley for 2 NO cylinders and 1 O₂ cylinder.



Manual bagging unit ability to provide blend of O₂ and NO.

Colour touch screen making it easy to use and fully interactive.

Applications

- Persistent pulmonary hypertension in newborn babies
- Acute post operative cardiac patients
- Acute respiratory distress syndrome (ARDS)



The NOxBOX₁ delivers and monitors Nitric Oxide (NO) for use in Inhaled Nitric Oxide (INO) Therapy. Encompassing both continuous and synchronous NO delivery modes for use with adult, paediatric and neonatal patients. The NOxBOX₁ is the ideal product for all your INO needs. The system has a step by step, guided interface to enable ease of use. The NOxBOX₁ is designed primarily for use in hospitals with a portable, detachable head unit to provide continuous treatment for transit and transfer conditions.

The NOxMixer is intended to deliver a continuous flow of Nitric Oxide (NO) from the NOxBOX₁, mixed in line with oxygen (O₂) for use in Inhaled Nitric Oxide (INO) Therapy. The NOxMixer will be used in conjunction with

Technical Specification for NOxBOX₁

Measuring range:	NO: 0-99.9 ppm NO ₂ : 19.9 ppm O ₂ : 0-99.9%
NO delivery range:	0.6 - 80 ppm synchronous mode (Note the system allows setting at <= 0.5 ppm, accuracy figures below are for >= 0.6 ppm, use of a lower setting is at customer responsibility)
Standby Mode:	Set 0 ppm
Vent flow range:	0.5 - 50 L/min
Sample line flow rate:	Approx. 225 ml/min
Detection principle:	Sealed electrochemical sensor
Accuracy:	NO & NO ₂ : +/- 3% or 0.3 ppm whichever is greater plus the accuracy of the calibration gas O ₂ : +/- 3.5%
Resolution:	NO & NO ₂ : 0.1 ppm O ₂ : +/- 3.5%
Display:	7" Full colour touch screen LCD
Alarms:	Audible and visible
Set-up time:	<10 minutes
Response time:	<10 seconds to 90% FSD NO <40 seconds to 90% FSD NO ₂ <15 seconds to 90% FSD O ₂
Operating temperature:	10 - 35°C
Storage temperature:	0 - 40°C
Operating Humidity:	15 - 85% RH non-condensing
Sensor operating life:	2 years
Battery life (approx.):	min. 4 hours (operational, excluding alarms)
Power input:	100 - 240VAC, 50/60Hz, 1.3-0.6 A
Head unit dimensions:	108 (D) x 330 (W) x 250 (H) mm
Head unit weight:	Approx. 6kg
Construction:	Rigid polyurethane (PU)

Technical Specification for NOxMixer

NO Dose Delivery Range ¹	0-231ppm
NO Dose Delivery accuracy ²	± 30% or 3 ppm, which ever is the greater.
NO Dose Delivery response time ³	Target < 2 minutes
NO Dose Delivery Over/Undershoot Transient on dose set point change.	± 25% or 2.5 ppm, whichever is the greater.
Input NO Flow Range	50 - 600 ml/min @ 1.65bar (23.9psi)
Continuous Supply	Supply of 1.65bar from manual control valve (23.9psi)
O ² Flow Range	2 - 25 l/min @ 4 - 7bar (58.0 - 101.5psi)
	Safety notice: NO drug in N2 balance is supplied as a dry gas and is non-oxygenated. It is important to ensure that the volume of this dry gas introduced into the ventilator lines is limited to prevent reducing oxygen supply to the patient or reduction in humidity conditions of ventilated supply.
Dimensions:	H185 X W65 X D60.8mm
Weight:	~0.3kg
Construction:	Rigid polyurethane (PU)

¹ 231ppm achieved by using 1000ppm cylinders, range lowered to 23ppm if used with 100ppm cylinders.

² The overall delivery range and accuracy is subject to the constraints of the NOxBOXi Needle valve, ventilator and circuits setup.

³ The time between setting a new NO set point and the patient receiving it.

NOxBOX[®]O₂

The next generation in NO monitoring

Large LCD display making it easy to instantly see changes in concentration of NO, NO₂ and O₂.

Auto zeros on power up to save time and improve ease of use.



On screen visual and audio warning of unacceptable gas levels, water trap full, pump failure and battery low.

Built in pump, exposing the sensor to constant pressure and flow rate.

The NOxBOXO₂ is the flagship of NO monitoring, allowing accurate, real-time monitoring of not only NO and NO₂ but also Oxygen (O₂) levels. This additional feature enables the user to monitor the exact concentration of O₂ entering the patient, as this is often different from that indicated on the ventilator once dilution with NO has occurred.

The internal pump ensures that the sensor is constantly exposed to constant gas pressure and flow rate, enabling the NOxBOXO₂ to be used with all ventilators and spontaneous breathing patients.

The NOxBOXO₂ features alarms that can be adjusted to suit the range being used, these alarms include:

- Low NO – to prevent sudden cessation of NO delivery
- High NO – warning for potential over dosage of NO
- High NO₂ – avoiding NO₂ poisoning
- Low O₂ – to ensure correct concentration of O₂

Compatible with all ventilators, using a low cost connection kit (NOXKIT-V)

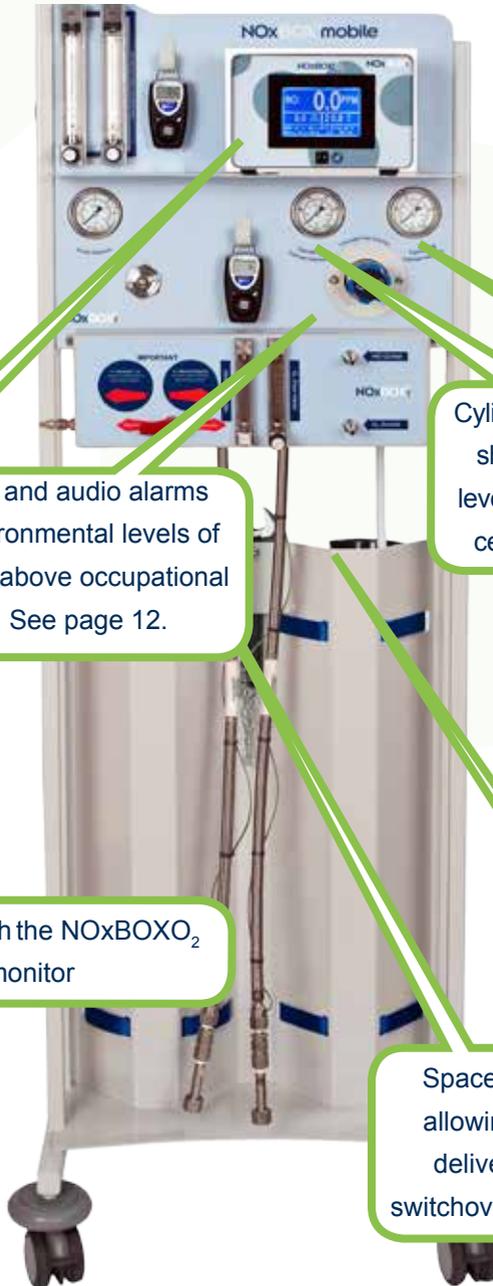
Order Code – NOXBOXO₂

Technical Specification

Measuring Range:	0-99.9ppm NO 0-19.9ppm NO ₂ 0-100% O ₂
Sample Flow Rate:	Approx. 250 ml/min
Mode of operation:	Continuous
Detection Principle:	Sealed Electrochemical Sensor
Accuracy:	<5% of reading
Display:	Graphical LCD
Alarms:	Audible and visible
Warm Up Time:	<2 minutes
Response Time:	<10 secs to 90% FSD NO <30 secs to 90% FSD NO ₂
Operating Temperature:	10-40°C
Operating humidity:	30-75%
Transport/Storage temperature:	10-40°C
Transport/Storage humidity:	30-75%
Sensor Operating Life:	1-2 years
Sensor Resolution:	0.1ppm NO and NO ₂
Power input:	230v, 50Hz/60Hz, 110mA (optional)115v, 60Hz, 220mA
Battery Life (approx.):	4-6 hours (operational, no alarms) 1 Year (storage)
Dimensions:	240(D) x 210(W) x 140(H) mm
Weight:	Approx 4kg including batteries
Construction:	Aluminium

NOxBOX® mobile

Complete NO delivery and monitoring system



Portable, visual and audio alarms warn staff if environmental levels of NO and NO₂ rise above occupational safety limits. See page 12.

Cylinder pressure gauges showing constant gas levels, to prevent sudden cessation of treatment

Can be used with the NOxBOXO₂ INO monitor

Space for dual cylinders, allowing for constant NO delivery with automatic switchover when one is empty

The NOxBOX[®]mobile is a completely self contained NO delivery and monitoring system. Allowing NO to be deployed, monitored quickly and used easily close-by the patient's ventilator, as research shows that hoses containing NO/O₂ mixtures must be kept as short as possible ³ in order to limit the build up of NO₂. NOxBOXLtd recommend 1m from dose.

We recommend the use of NOxBOXO₂ with NOxBOXmobile due to the extra advantage of O₂ monitoring. The monitors are both mains powered with back up batteries for emergencies or transportation.

The NOxBOXmobile can be used with different suppliers of NO medical gas products to suit preferences.

Compatible with all continuous flow ventilators and spontaneous breathing patients if NOxBOXO₂ is used.

The use of environmental NO and NO₂ monitors are recommended when delivering NO. See page 12.

Order Code – NOXDCO2

Technical Specification

Dimensions:	1590(H) x 500(W) x 528(D) mm
Weight:	approx. 40kg complete trolley and cylinders
Construction:	Powder coated steel
Wheels:	75mm anti-static castors, with kick-stop lock
Flow meters:	10-100cc/min and 60-600cc/min
Regulators:	Single stage, stainless steel, 2 bar max. outlet
Changeover:	Regulator stainless steel
Storage Conditions:	Dry, clean atmosphere, between 0 and 40°C
Dynamic bend radius:	200mm

Simple Inhaled Nitric Oxide (INO) Delivery System for Transport



The NOxBOX_{lite}[™] is an extremely easy to use, simple inhaled nitric oxide (INO) delivery system. Using state-of-the-art digital, mass flow technology the NOxBOX_{lite}[™] can be used accurately in any orientation, with over 2 years replaceable, battery life. High precision, adjustable needle valves are used to ensure far superior accuracy compared to traditional flow meters. This all makes the NOxBOX_{lite}[™] perfect for emergency and transport situations where space and time are in short supply.

In addition to the digital flow meter, NOxBOXLtd have specifically designed a compact, hand tighten regulator, reducing up to 200bar (2900.7psi) of pressure down to 4bar (58.0psi) ensuring safety for both the user and the patient.

It is mandatory to monitor INO delivery to safely treat patients so used with the NOxBOXLtd NOxBOX₂™ the NOxBOX_{lite}™ becomes a simple but effective INO delivery and monitoring system.

Intended Use

The NOxBOX_{lite}™ is intended to be used for emergency or transport purposes, when the delivery to a patient is limited to a short time. The NOxBOX_{lite}™ is intended to administer Nitric Oxide (NO) to the breathing circuits of patients undergoing Inhaled NO Therapy. The NOxBOX_{lite}™ is intended to be used in conjunction with an Inhaled NO Therapy monitor.

Nitric Oxide (NO) is administered as a selective pulmonary vasodilator for conditions such as;

- Persistent pulmonary hypertension in new-born babies
- Adult respiratory distress syndrome (ARDS)
- For acute post-operative cardiac patients

Equipment should only be used by suitably trained and qualified health professionals

Technical Specification

Flow Range:	25 – 2000 cc/min
Accuracy 25 – 2000 cc/min:	±5% of full scale
Response time:	from 500 ms
Repeatability:	±5% from measurement value
Power:	Lithium Battery
Battery Life:	2 years
Operating pressure:	0.2 to 11bar (2.9 to 159.5psi)
Regulator inlet pressure:	Max 200bar (2900.7psi) min 20bar(290.7psi)
Regulator outlet pressure:	4bar (58.0psi)
Operating temperature:	10 – 35°C
Storage temperature:	0 – 40°C
Storage humidity:	15 - 85%
Warm-Up time:	<1sec for full accuracy
Display:	6-digit LCD in engineering unit's and bar graph
Weight:	Approx. 1.25kg
Dimensions:	85(H) x 220 (W) x 80 (D) mm

Note: Specification details may still be subject to some changes. Overall operation character should be similar to above, but design is not fixed and final.

Optional Extras

Manual Bagging System

at the turn of a switch the NOxBOX mobile can be switched from the ventilator to manual bagging for emergency transportation situations or other non-ventilated procedures.

Order Code - NOXBAG

NOxAIR Portable, visual and audio alarms warn staff if environmental levels of NO and NO₂ rise above occupational safety limits and detect leaks.

Order Codes – NOxAIR-NO-V

NOxAIR-NO2-V

Soft carry case for transportation of up to 2 high capacity calibration cylinders used for NOxBOX calibration.

Order Code – SCCG

034-18-00520-V (Calibration gas - 25ppm NO in N₂. 34ltr disposable cylinder, filled with 27ltr gas).

034-20-01010-V (Calibration gas - 10ppm NO₂ in Air. 34ltr disposable cylinder, filled with 27ltr gas).

REGSS-1.0-V (Gas regulator stainless steel for calibration gas 1ltr/min flow)

NOX-Y-CAL (Calibration tubing and Y-Piece)

NOxBOX® Range & Order Codes

NOxBOX_i
Head unit



Order Code -
NOXBOX-I

NOxBOX_i
Trolley



Order Code -
NOXDC-I1

NOxBOX[®]O₂



Order Code -
NOXBOXO2

NOxBOX mobile



Order Code -
NOXDCO2

NOxBOX_{lite}



Order Code -
NOXBOXLITE

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