



# GRADIAN UAM BMET TRAINING



# Welcome!



- Agenda:
  - Welcome and Sign-in sheet
  - Introductions
  - UAM Animation
  - Bio Med Overview presentation
  - UAM Care and Maintenance Video
  - Common Repair Videos
  - Hands on practice completing a full Preventive Maintenance



# Gradian Health Systems



- Based in the United States.
- Equips hospitals around the world to deliver anaesthesia safely and economically.
- The mission is to improve access to safe surgery and perioperative care by providing technology, service and training to strengthen anaesthesia capabilities.



# Universal Anaesthesia Machine



- Is a state-of-the-art inhalation anaesthesia workstation that creates its own oxygen using electricity yet transitions seamlessly to room air as the carrier gas if no power or compressed oxygen is available.
- It was developed by Dr. Paul Fenton who was working as an anaesthetist in Malawi.
- The UAM is manufactured in the UK and has a CE mark.



UAM is in 23 Countries throughout  
Africa, Asia, Europe and the  
Caribbean



# Animation Video: How The UAM Works



<http://www.gradianhealth.org/universal-anaesthesia-machine/>

# Integrated Oxygen Concentrator



How the Oxygen Concentrator works:

1. Air filters clean room air
2. Compressor pressurizes room air
3. Zeolite towers remove nitrogen from the air and produces 95% oxygen
4. Storage tank for oxygen to maintain 10 L/minute



# UAM Provides 5 Sources of Oxygen:



## 1. Oxygen Concentrator



## 2. Pipeline inlet



# UAM Provides 5 Sources of Oxygen:



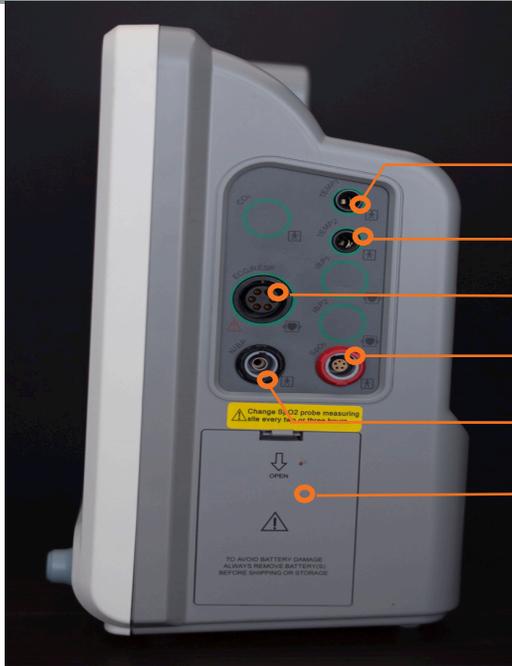
3. Pin-index cylinder

4. Inlet for O<sub>2</sub> from external flow meter



5. Emergency draw over

# UAM Patient Vital Signs Monitor



- Temp 1 probe connector
- Temp 2 probe connector
- ECG/ RESP cable connector
- SpO2 probe connector
- NIPB hose connector
- Battery compartment

- The Monitor is securely attached to the UAM's top shelf.
- Has a re-chargeable internal battery that lasts for 4-6 hours.
- Removing it for use without the UAM will void its warranty
- Consumables are not replaced by Gradian



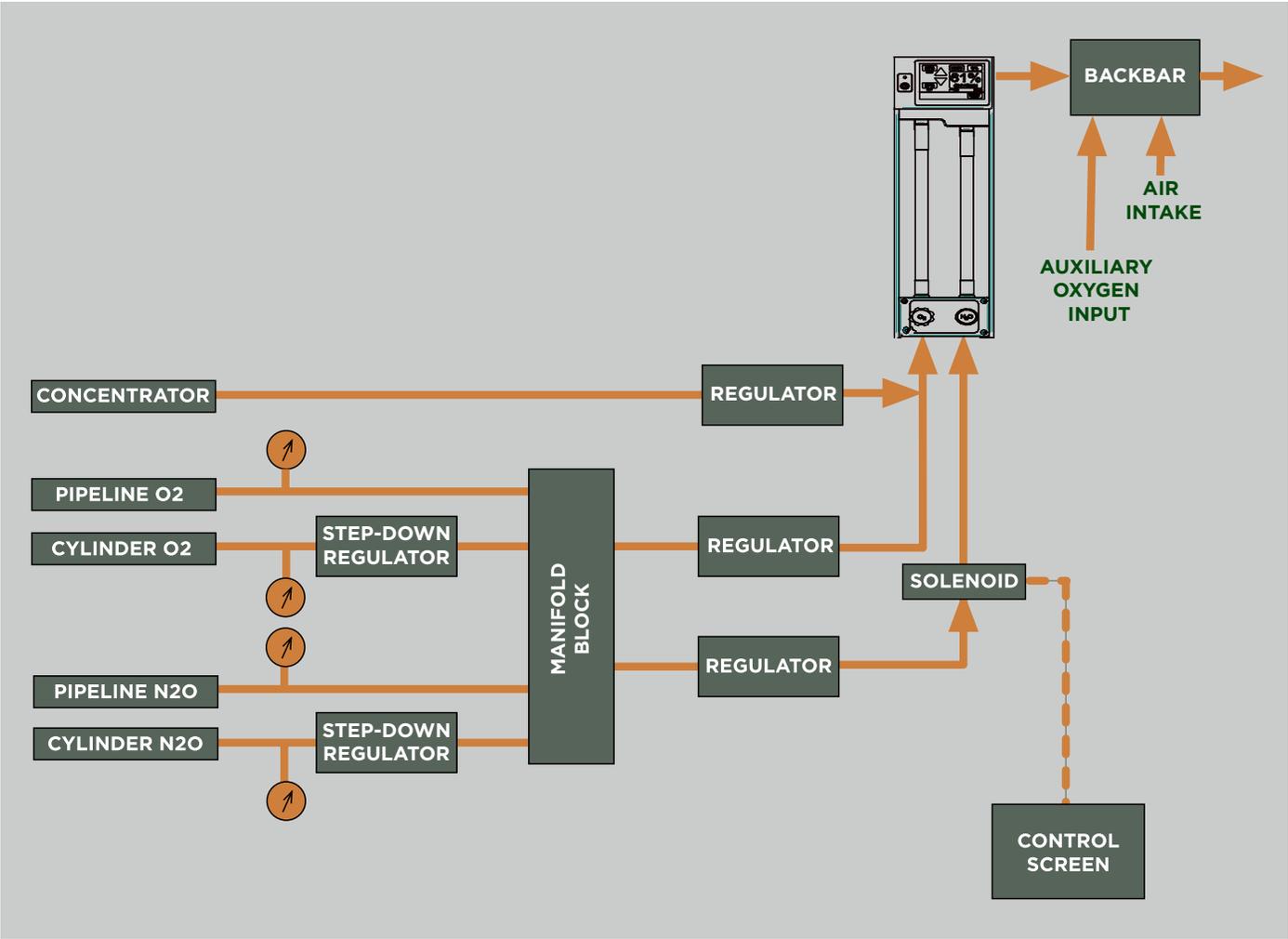
# Overview



1. General description of the UAM
2. Gas Sources
3. Breathing System
4. Electrical System
5. How to obtain Maintenance Support
6. Preventive Maintenance Schedule
7. Common Maintenance Procedures



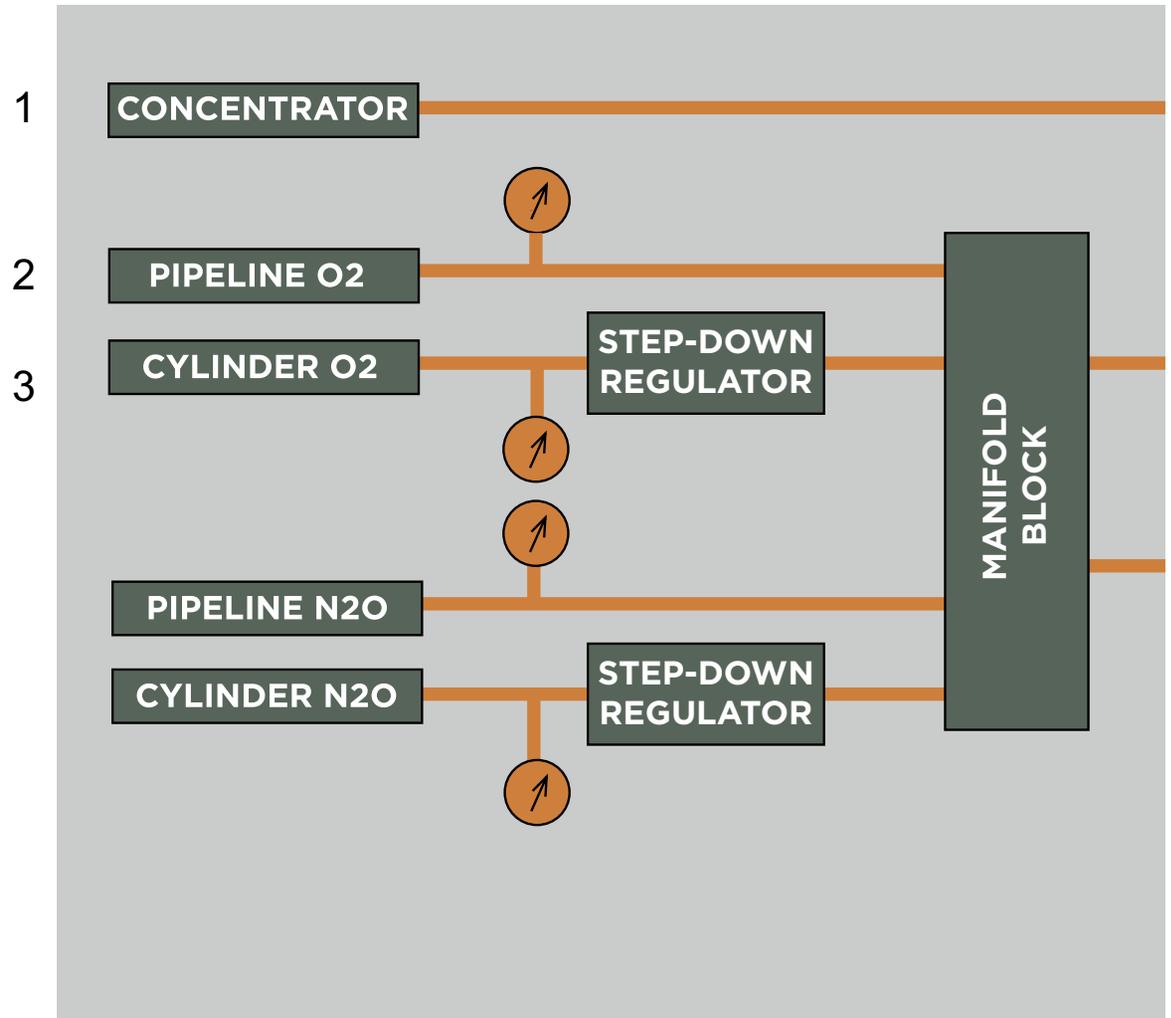
# Gas Sources



# Gas Sources



- Oxygen sources should be selected in the following order:
  1. Concentrator
  2. Pipeline
  3. Cylinder
- All backup gas sources should be shut when not being used, otherwise they will slowly deplete.



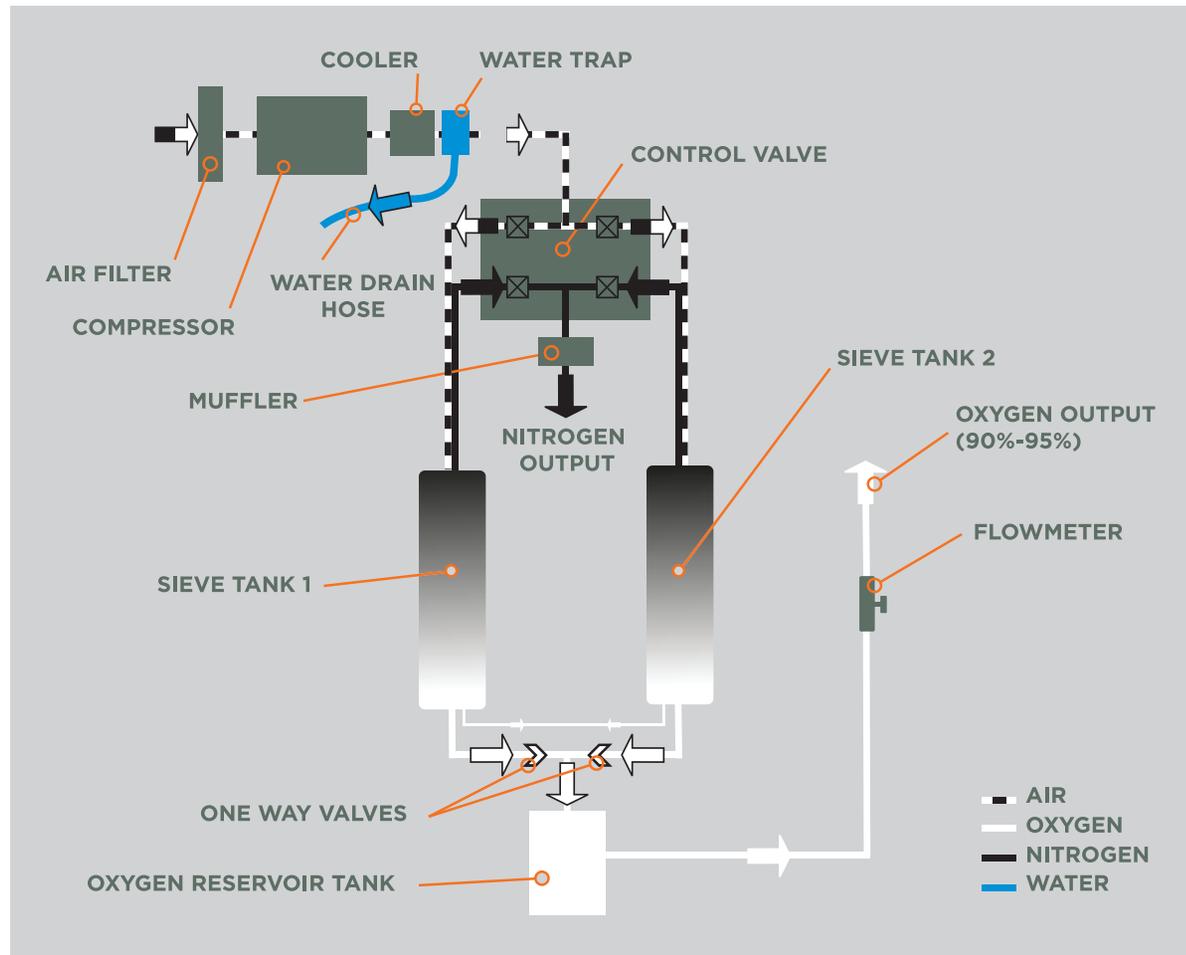
# *Color Identification for Medical Gases*



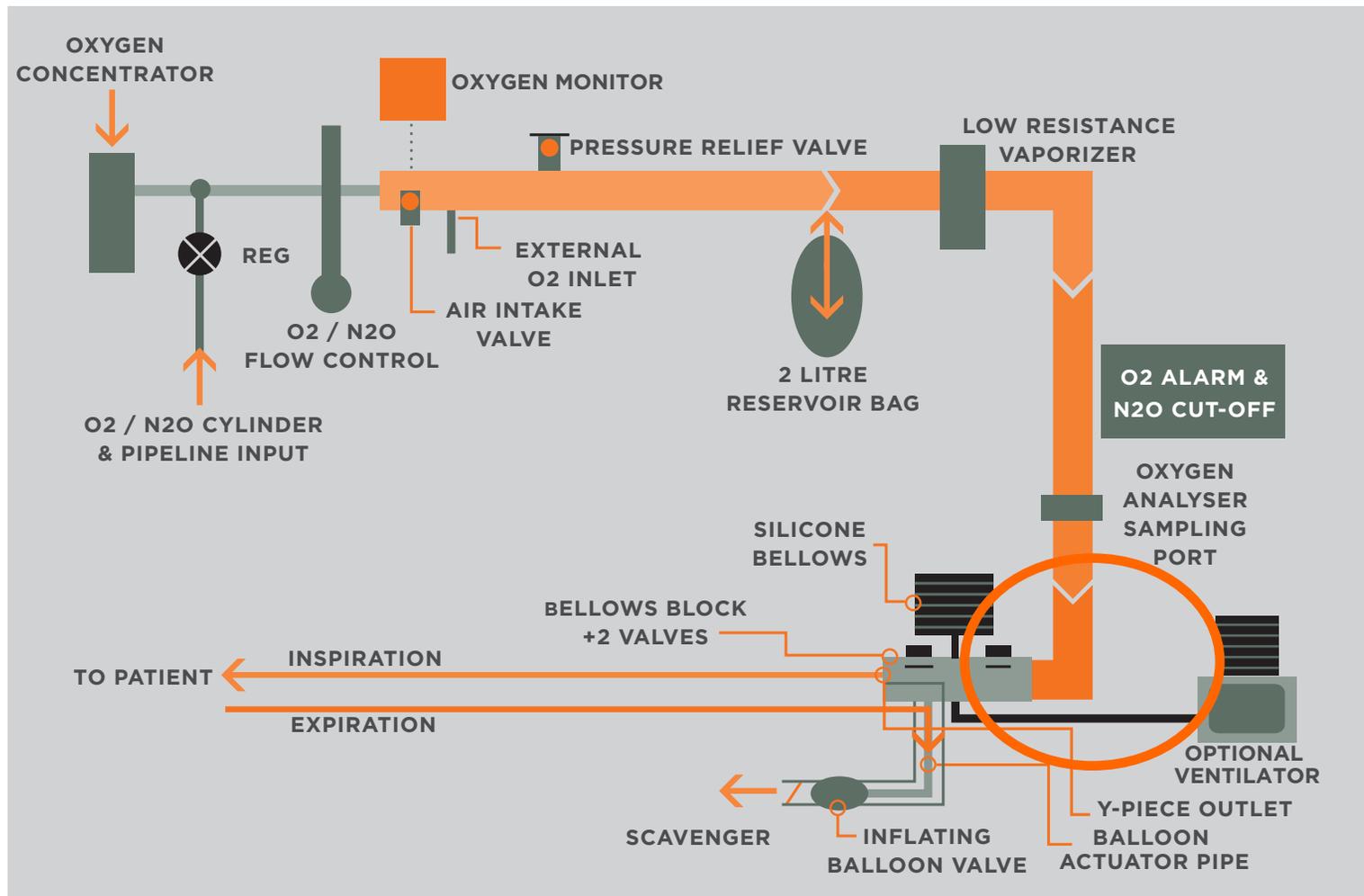
<b>GAS</b>	<b>ISO</b>	<b>USA</b>
<b>OXYGEN</b>	White	Green
<b>NITROUS OXIDE</b>	Light Blue	Light Blue
<b>MEDICAL AIR</b>	Black and White	Yellow
<b>SUCTION</b>	Yellow	White



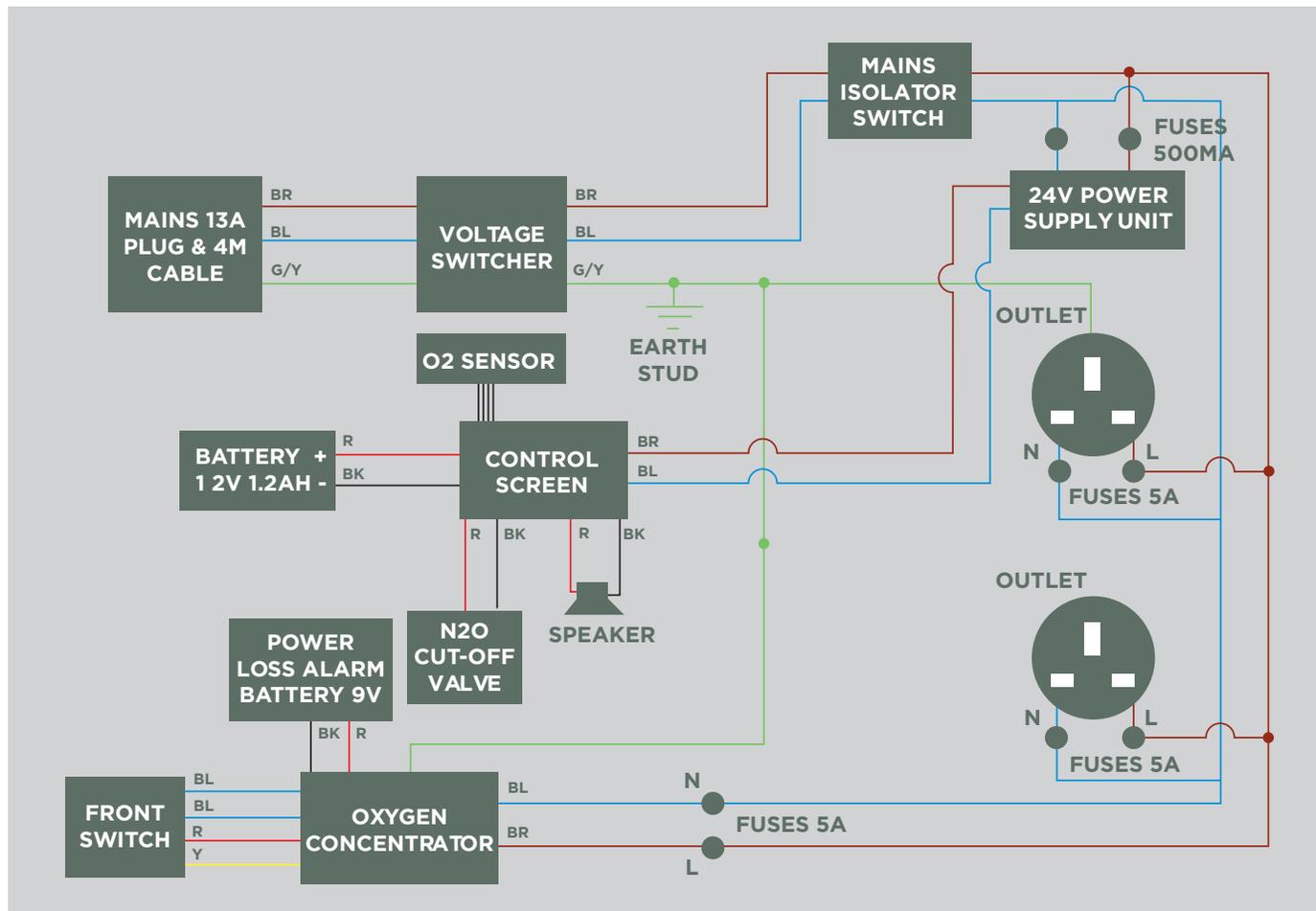
# Oxygen Concentrator Flow Diagram



# Breathing Circuit Diagram



# Electrical Diagram



# Electrical Supply



Separate fuses for O2 monitor and for O2 concentrator



2 fused receptacles in the back



# *Internal Automatic Voltage Switcher*



*Protects the UAM from extreme low and high voltages*

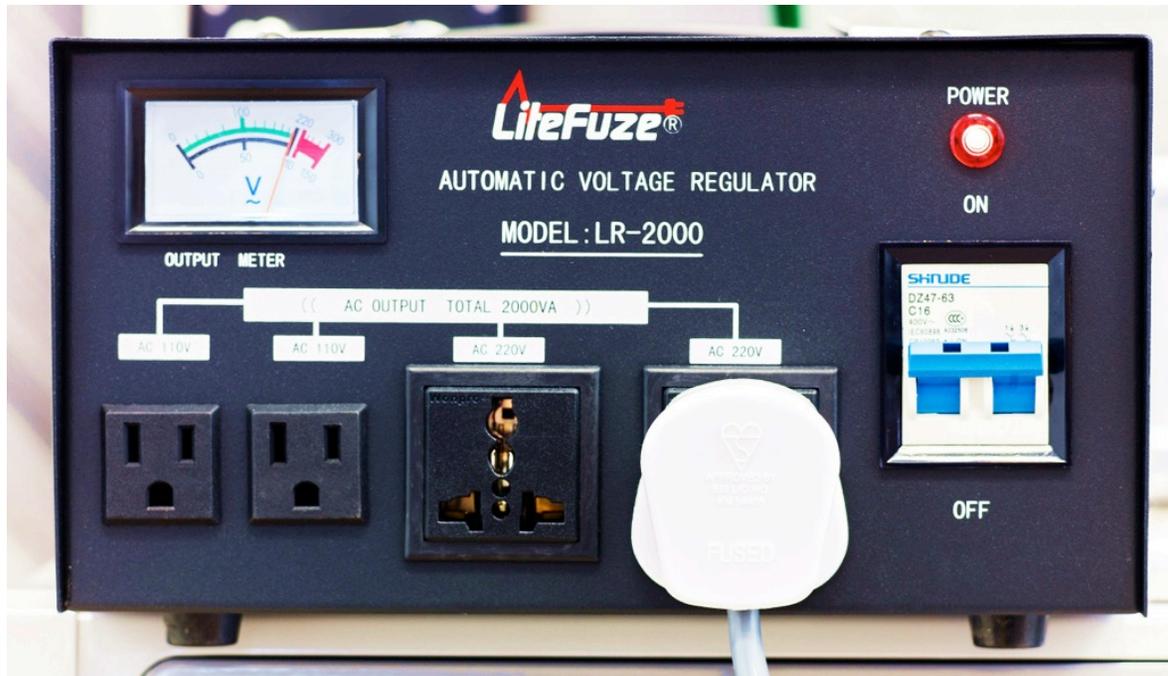


Low Voltage Cut-off:	180 V
High Voltage Cut-off:	260 V
Blind:	3 seconds
Wait:	10 seconds

Blind: if voltage falls below cut-off the switch watch for this period to see if this is a momentary brownout.

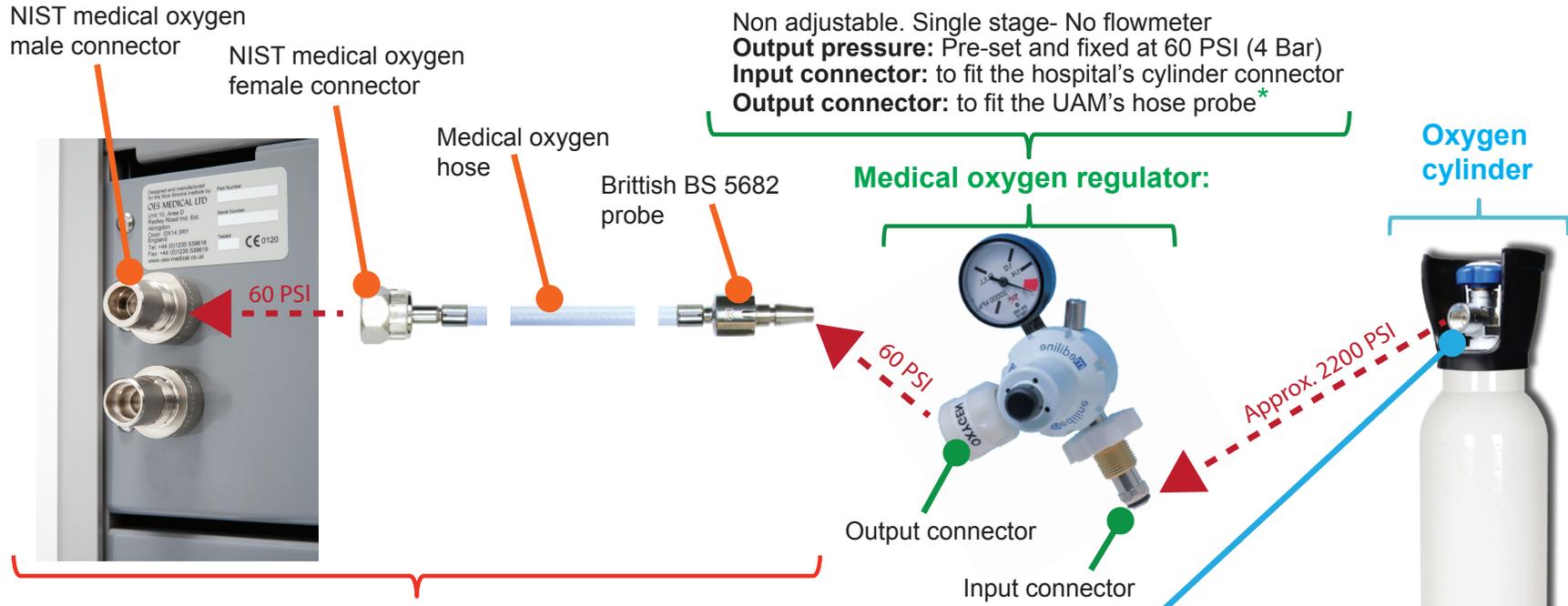
Wait: Minimum period of time voltage is cut off during an event.

# *Important! Use an External Voltage Stabilizer*



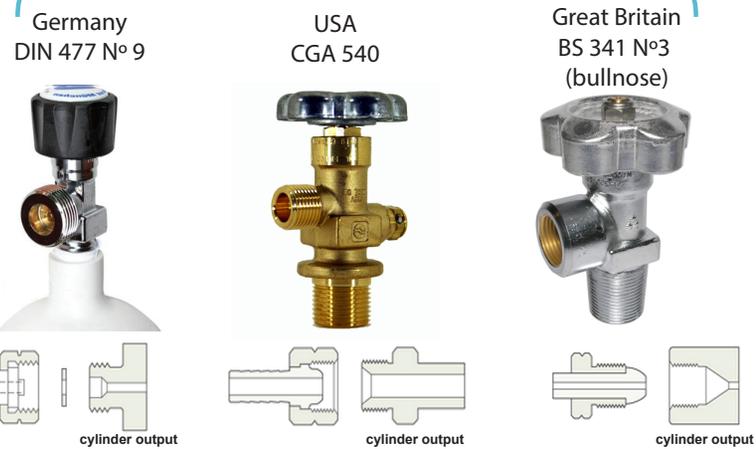
- 2000VA
- Use only for UAM and attached monitor

# CONNECTING THE UAM'S OXYGEN PIPELINE INPUT TO AN OXYGEN CYLINDER



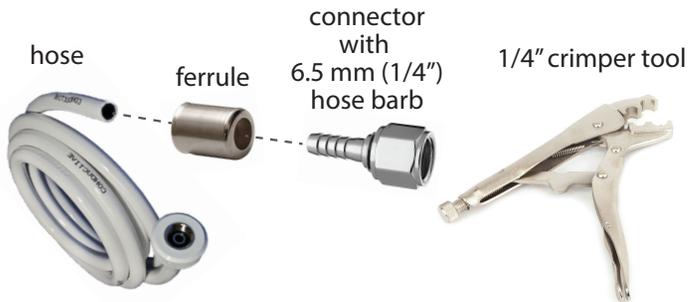
**UAM oxygen pipeline input connector and supplied hose**

## Cylinder connectors- Common standards

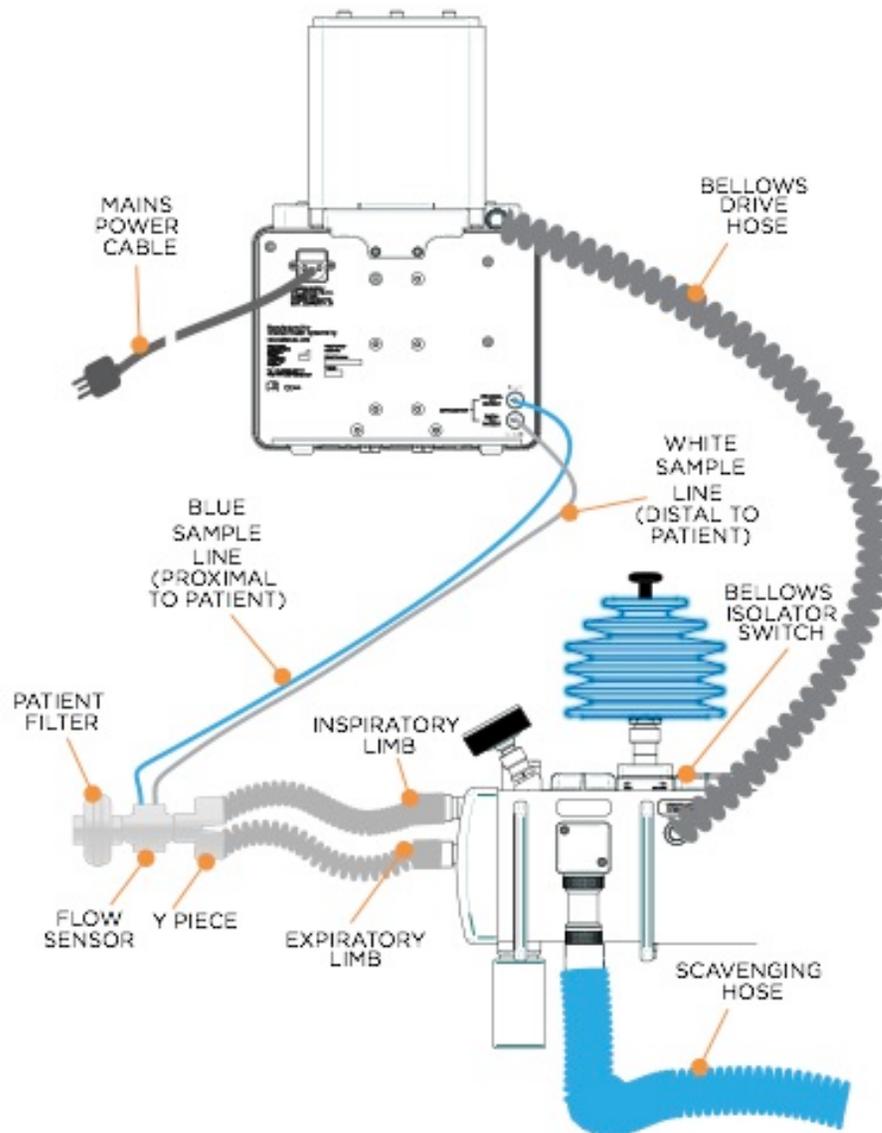


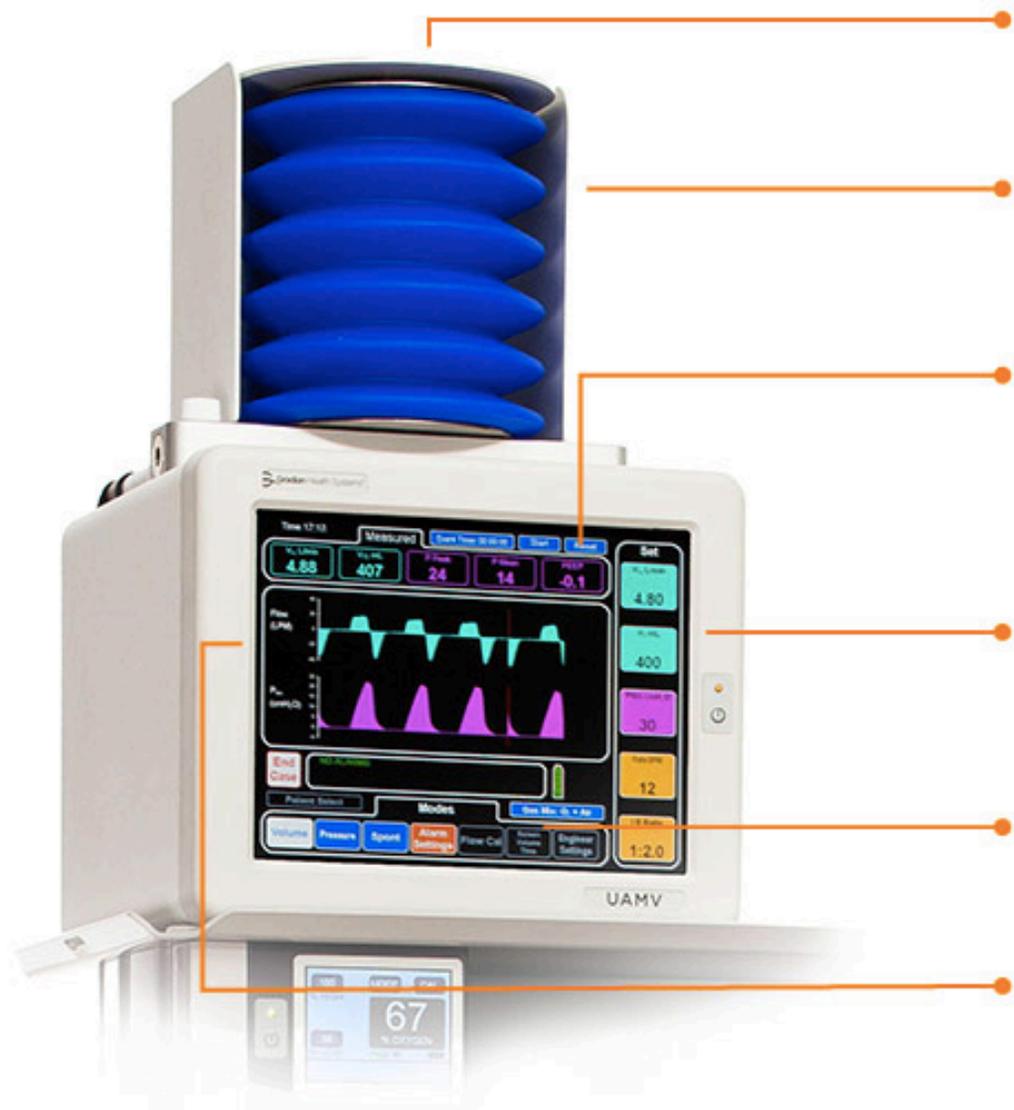
Others: France: NF F, Italy: UNI 4406, Netherlands: NEN RF 13, and many more

**\* NOTE:** if the available regulators cannot connect to the UAM's BS 5682 oxygen hose probe, then the hose can be cut and fitted with the appropriate connector (with a 6.5 mm (1/4") hose barb) using a crimper tool and a hose ferrule.



# Ventilator Connections





**Electrically Driven Bellows**

Requires no compressed gas and consumes little power

**Battery Backup**

Operates on rechargeable batteries for up to 6 hours

**Measurements**

Real time measurement of Minute Volume, Tidal Volume, Peak Pressure, Mean Pressure, and PEEP

**Settings**

Easy to change ventilation parameters

**Ventilation Modes**

Volume Controlled, Pressure Controlled and Spontaneous

**Waveforms**

Real-time displays of pressure vs. time, flow vs. time, and compliance loops in all ventilation modes

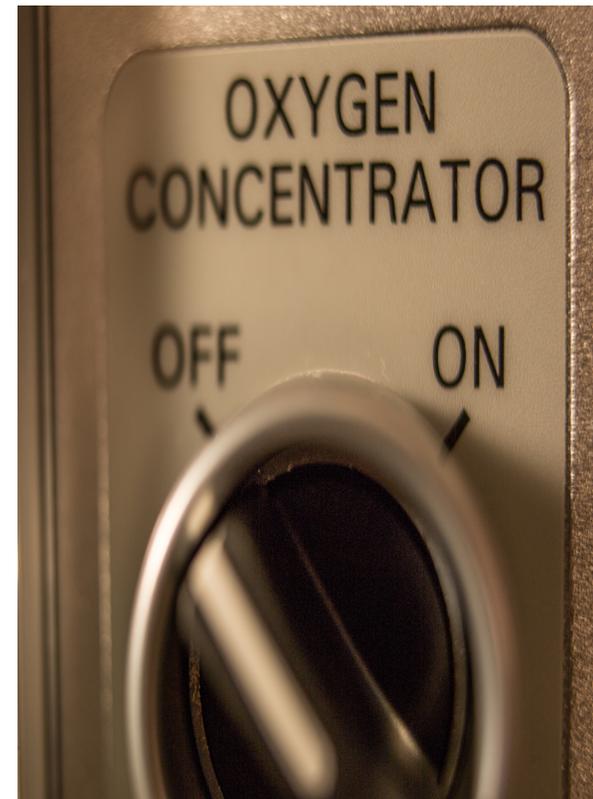
# UAM Daily User Maintenance Video



# Tips to Preserve the Life of the UAM



- We highly recommend a **voltage stabilizer** between the UAM and the electrical outlet to guard against spikes and brownouts.
  - If you don't use a voltage stabilizer the UAM will shut off to protect itself against power outage as well as fluctuation in the electricity.
- Leave the UAM on (green main isolator switch on the back) to trickle charge the patient monitor, oxygen monitor, and ventilator.
- Every 3 months perform full function tests and preventive maintenance procedures as described in the UAM maintenance manual on page 43.



# Service and Preventive Maintenance



- All UAMs come with at least a 2-year warranty that includes:
  - Every 6 months one of our technicians will conduct an in-depth preventative maintenance check.
  - Provide any spare parts needed
    - Consumables not included
- Gradian Service team is always available to assist you!



# How to Get Maintenance Support



1. If you have a distributor in your country contact them first
2. If there is no distributor in your country then send an email to: [service@gradianhealth.org](mailto:service@gradianhealth.org) or WhatsApp: +1929-280-0210

Please supply the following information:

1. Serial number of UAM
2. Detailed description and pictures of problem
3. Actions taken to try to solve the problem

*Important!*



*The Warranty offered by Gradian will only be valid if the maintenance checks and procedures are performed in accordance to the schedule and instructions contained in the **UAM Maintenance Manual.***



# Resources



## Universal Anaesthesia Machine PRE-OPERATIVE CHECKLIST

### I. Perform at the START of every OPERATING session

#### INSPECT & TEST

1. Check stability: casters OK, brakes function
2. Connect and check available gas sources: correct pressure, no leaks, tug test on pipelines
3. Check bellows OK: move up and down and observe balloon moves freely
4. Check breathing system: use bellows to inflate 2-litre bag or dummy lung. Check action of balloon while bag inflates/deflates. (If no dummy lung is available, proceed to 5)
5. Check resistance by pushing bellows with patient Y piece blocked (maximum pressure should be 55 cms water)
6. Check the water trap and empty if necessary
7. Check the gas scavenging is configured correctly, if available

#### VAPORISER

1. Check the volatile agent level in the vaporiser and fill as necessary
2. Check the operation of the vaporiser selector wheel (press silver button to unlock)

#### POWER

1. Switch on green mains isolator switch on the UAM back (there will be a delay while the system inspects the quality of the electrical power)
2. Press and hold 'On/Off' button next to the oxygen monitor screen until it lights up

#### OXYGEN MONITOR

1. Using 100% cylinder/pipeline oxygen, set oxygen flow meter to 6 L/minute and wait for maximum reading on monitor
2. Press 'CAL', then 'O2', then 'GO'. When the calibration is finished, press 'EXIT' two times.
3. Turn off the oxygen. Draw room air through the system with the bellows until the reading reaches its lowest setting
4. Press 'CAL', then 'AIR', then 'GO'. When the calibration is finished, press 'EXIT' two times.

#### OXYGEN SUPPLY

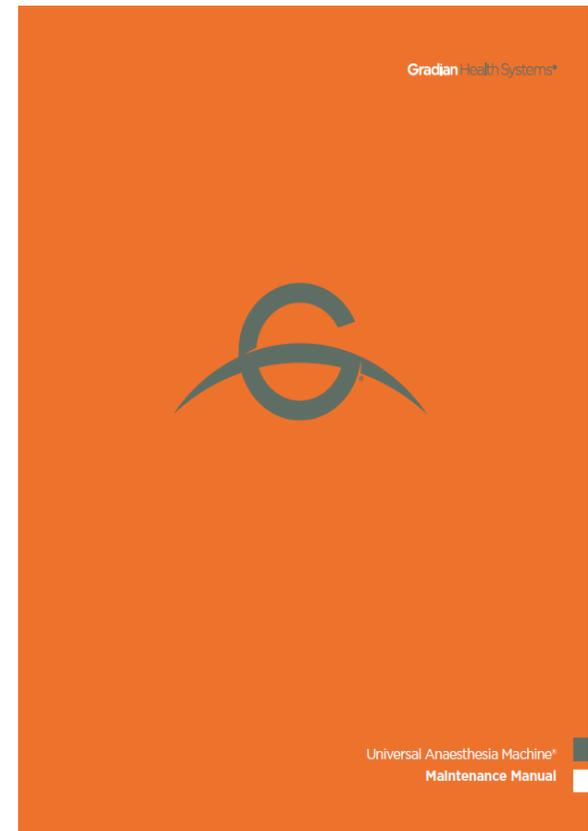
1. Turn on the oxygen concentrator by using the switch on the front of the machine
2. Set oxygen flow to 8 L/minute, wait 1-3 minutes. Oxygen % should be greater than 90%

#### NITROUS OXIDE

1. Set oxygen flow to 6 litres per minute
2. Set Nitrous Oxide flow to 4 litres per minute
3. Gradually turn down the oxygen flow to reduce FIO<sub>2</sub> to 25% and lower-- nitrous oxide flow should cut off when oxygen concentration is <25%

OVER →

For service issues, please contact **Gradian Health Systems** at [service@gradianhealth.org](mailto:service@gradianhealth.org)



A full list of resources is available at: <http://www.gradianhealth.org/resources/>



# UAM Resources Page

www.gradianhealth.org/resources/



The screenshot shows a web browser window displaying the 'Resources' page of the Gradian Health Systems website. The browser's address bar shows 'www.gradianhealth.org/resources/'. The website header includes the Gradian Health Systems logo, navigation links for 'THE CHALLENGE', 'UNIVERSAL ANAESTHESIA MACHINE', 'CASE STUDIES', 'COMPANY', 'BLOG', and 'RESOURCES', and a 'CONTACT US' button. The main content area is titled 'Resources' and contains a paragraph describing the collection of articles and other resources. Below this, there is a section for 'Gradian/UAM Resources' with a list of links to various documents and videos. Another section, 'UAM Service Notes', lists four specific service notes. The page is clean and professional, with a white background and orange accents.

Resources

A collection of articles and other resources that we find valuable with topics ranging from safe anesthesia and surgery, global health policy, technology and innovation, healthcare and upcoming events.

Please [email us](#) any articles, links or resources that you might find useful for this page.

### Gradian/UAM Resources

- [UAM User Guide](#)
- [UAM Maintenance Manual](#)
- [Gradian Health Systems \(UAM\) Brochure](#)
- [UAM Service Record](#)
- [Video: An Animation of the UAM](#)
- [EDAN Monitor specifications](#)
- [UAM Spec Sheet](#)
- [Photo: The Universal Anaesthesia Machine](#)

### UAM Service Notes

- [Service Note #1: New UAM Maintenance Manual](#)
- [Service Note #2: Checking and cleaning the air filter and after-cooler](#)
- [Service Note #3: Pre-Operative Checklist](#)
- [Service Note #4: UAM Preventative Maintenance and Inspection Schedule](#)

### Articles and documents

# Service Notes

Sign up to receive them via email by emailing [service@gradianhealth.com](mailto:service@gradianhealth.com)  
Archive: [www.gradianhealth.org/resources/](http://www.gradianhealth.org/resources/)



## UAM Service Note (#2)

Dear UAM User,

It is very important to check the condition of the air filter in your UAM every 6 months, and more often if the environment is very humid. If the air filter is dirty then it must be cleaned with a vacuum cleaner and if necessary, it should be replaced with a new filter. This procedure is described on pages 17 and 18 of the [Maintenance Manual](#).

When checking the air filter, the after-cooler coil should also be checked for any dust it should be cleaned off with a vacuum cleaner or wiped clean. When cleaning it make sure not to bend the metal fins.

**Failure to perform these checks and cleaning procedures will result in low oxygen levels and overheating of the concentrator.**

The picture below on the left shows a dirty filter on the top and a clean filter on the bottom. The picture on the right shows a dirty after-cooler coil on the top and a clean after-cooler coil after being cleaned on the bottom.



[View this email in your browser](#)



Gradian Health Systems

## UAM Service Note (#3)

Dear UAM User,

It is extremely important to perform checks on the UAM prior to every operating session, before each case, at the end of each case, and at the end of every operating session by using the checklist included with the UAM. Make sure that the checklist is kept attached to the UAM at all times for easy access.

Download here: [UAM Pre-Operative Checklist](#)



## UAM Service Note (#4)

Dear UAM User,

To ensure optimal performance of your UAM it is essential to follow the on and preventive maintenance schedule described in the table on page 15 of the [Maintenance Manual](#).

[click on image for larger view](#)

### COMMENDED UAM MAINTENANCE SCHEDULE

FREQUENCY	ACTION
Daily or prior to use (user)	Perform operational check (see UAM User Manual and Checklist on the UAM)
Every 3 months	Perform full function test
Every 6 months	Perform full function test Check air filter- clean or replace if needed
Every 12 months	Perform full function test Check air filter- clean or replace if needed Replace oxygen sensor Replace oxygen concentrator loss of power battery (9V) Remove and inspect Fenton balloon
Every 3 years	Replace oxygen monitor battery
Every 5 years	Contact Gradian Health Systems for a complete maintenance check <a href="mailto:service@gradianhealth.org">service@gradianhealth.org</a>   +1.212.537.0340

The checklist on page 41 of the maintenance manual serves as a guide for making sure that all the checks are performed and should be filled out and saved in your equipment records.

[click on image for larger view](#)

UAM SERVICE RECORD

# Recommended Maintenance Schedule



<b>FREQUENCY</b>	<b>ACTION</b>
Daily or prior to use (user)	Perform operational check (see UAM User Manual and Checklist on the UAM)
Every 3 months	Perform full function test
Every 6 months	Perform full function test Check air filter- clean or replace if needed
Every 12 months	Perform full function test Check air filter- clean or replace if needed Replace oxygen sensor Replace oxygen concentrator loss of power battery (9V) Remove and inspect Fenton balloon
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# *Common Maintenance Procedures*



1. Cleaning and replacing the air filter
2. Calibrating and replacing the oxygen sensor
3. Removing and replacing the Fenton Balloon
4. Removing and replacing the circuit board
5. Replacing the concentrator power loss battery
6. Replacing control screen (oxygen monitor) battery
7. Removing and replacing the concentrator
8. Removing and replacing the vaporizer



# Required Tools and Materials



Metric hex wrenches:  
3 mm, 4 mm,  
6 mm, 8 mm



Needle nose pliers

Medium Phillips screwdriver

Multimeter

Pry bar

Adjustable wrench



# *Access Panels*



# *Cleaning and Replacing the Air Filter*



# *Cleaning the After-Cooler*



# *Replacing the Oxygen Sensor*



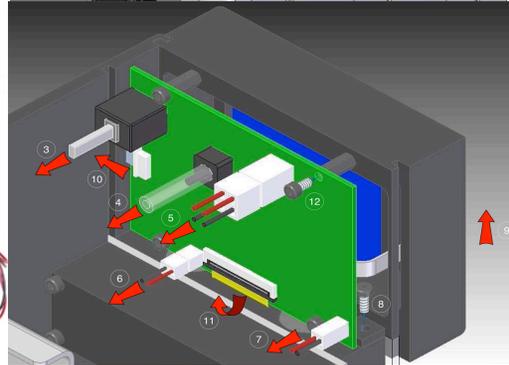
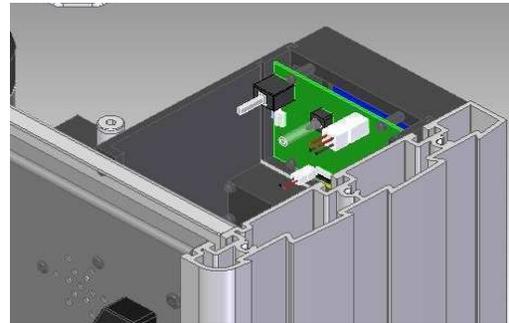
# Calibrating the Oxygen Sensor



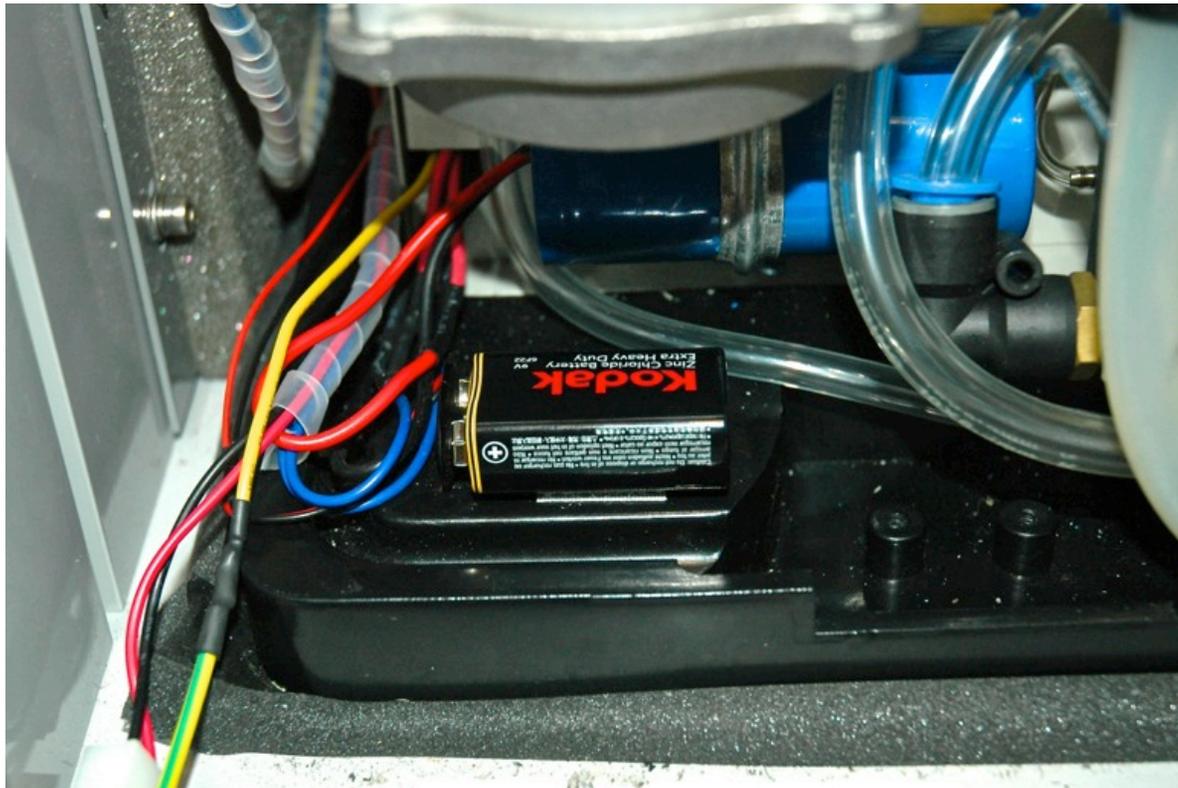
# *Removing and Replacing the Fenton Balloon*



# Removing and Replacing the Circuit Board



# *Replacing the loss of power battery*



# Replacing the control screen battery

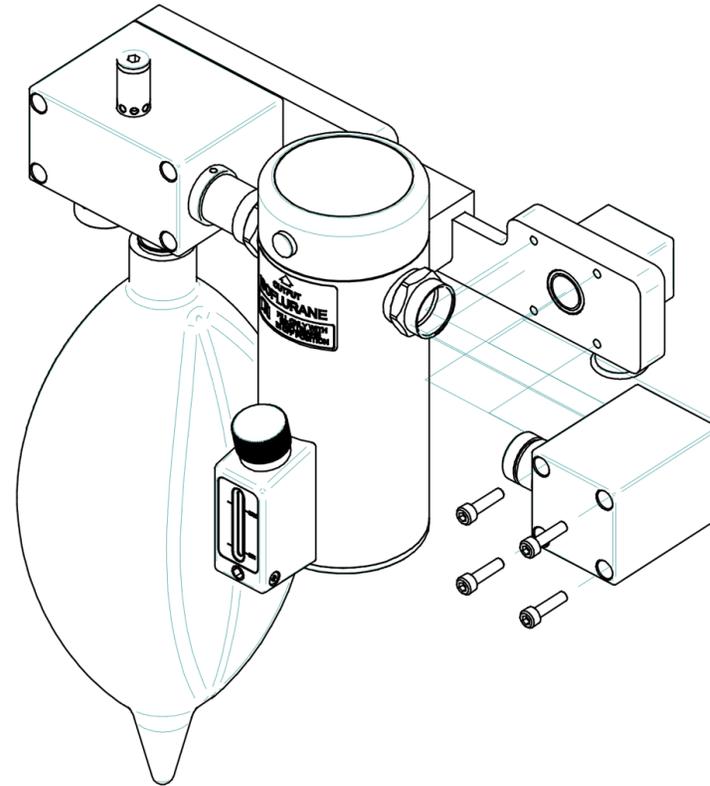


YUASA NP1.2-12  
12V, 1.2 Ah

# *Removing and replacing the Oxygen Concentrator*



# Removing and replacing the Vaporizer



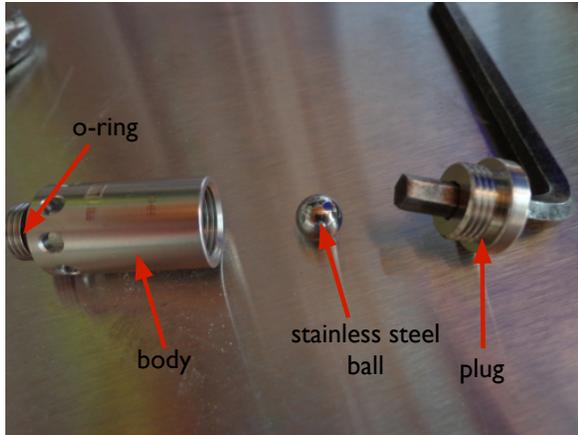
# *Cleaning the Positive Pressure Relief Valve (PPRV)*



# *Cleaning the Positive Pressure Relief Valve (PPRV)*



# *Cleaning the Positive Pressure Relief Valve (PPRV)*



# Gradian Health Systems



For comments or questions about service or training please contact us at:

[service@gradianhealth.org](mailto:service@gradianhealth.org)

Or

WhatsApp: +1929-280-0210