



OPENVENT-BRISTOL

OPENVENTBRISTOL.CO.UK

IN COLLABORATION WITH...



HELPFUL





LOWCOST

20x LOWER COST THAN TRADITIONAL VENTILATORS

OpenVent has cut-down simplified functionality tailored to emergency COVID-19 treatment, which means costs are lowered



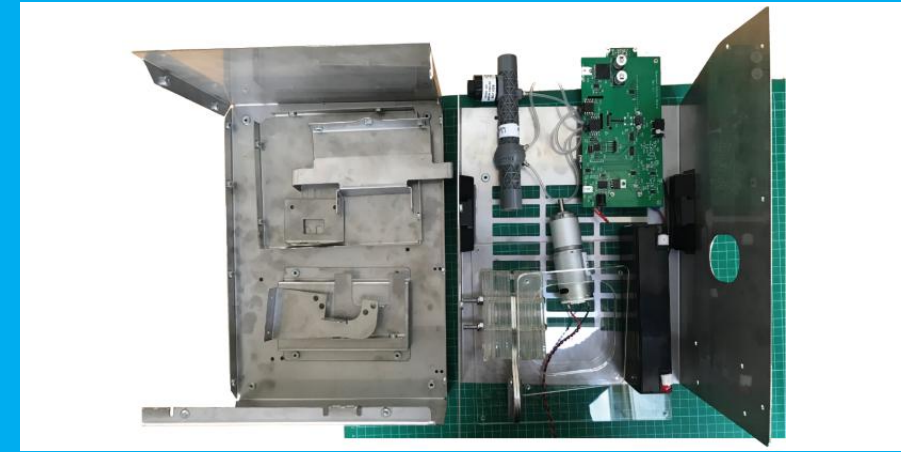
BASED ON AN AMBU BAG



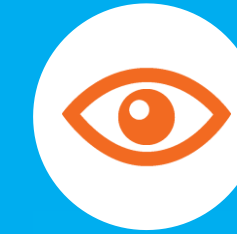
- Existing medical clearance
- Low cost
- Readily available



RAPID MANUFACTURE



Made from readily available materials and production processes to enable rapid manufacture at low cost



VISUAL MONITORING



Bag compression can be monitored through transparent panel for feedback



CAN BE USED ANYWHERE



Not dependent on compressed airline which may not be available in hospitals with less resources (oxygen supplied separately via cylinder)



AIMING FOR FDA EUA



Aiming toward FDA EUA in collaboration with ISO13485 manufacturer. Originally designed for MHRA RMVS

Advantages of our design

THE TEAM



DARREN LEWIS

Project Lead & Mechatronics
A Design Manager at Dyson with 10 years industry experience developing complex electro-mechanical systems into products.



ROSS GOODWIN

Mechanical
Ross is an Associate Principle Engineer working in Dyson's motor development team, with over 10 years of experience developing high speed Turbomachinery.



KIAN MING YAK

Mechanical
Yak is a mechanical engineer with 5 years of experience developing and launching products in multiple industries, including audio, AR and IOT..



DONALD ROBSON

Embedded Firmware
Donald is an Embedded Development Engineer at Graphcore, with a varied career encompassing mechanical design, mechatronics and firmware development.



CRISTIAN TARAN

Project Management
Cristian is a software engineer with more than 15 years of experience in developing software and managing software engineering teams in diverse industries.



DHEERAJ MENGHI

Public Relations
Dheeraj is a student of MBA Marketing. He has six years of experience in Sales and is certified in Google Analytics.



JONAS FEHR

Mechatronics & Software
A creative coder working mainly in the field of light- and media art. With a broad skill set including electronics, software and mechanical engineering.



JT MILLER

FPGA Engineer
20 years of embedded design experience spanning the Defense, Fintech, and Automotive industry. Specializing implementing DSP in FPGAs for real-time systems.



RICK COLLINS

Electronics
Rick studied electronics since the age of 15 resulting in an MSEE. Working for a number of companies his niche developed into board level design and programming FPGA devices.



Shrouk EL-ATTAR

Electronic Engineer
Working at Elvie. Recognised as top 6 young women engineers UK, by the BBC 100 most influential women of 2018, and United Nations Young Woman of the Year 2018.



Abu J. Ahad

Risk Management
A certified risk professional and Fellow of the Institute of Risk Management. 26-yrs in mega-construction programmes across multiple sectors, including real estate, infrastructure, renewable energy, self-driving vehicles, academia and corporate finance.



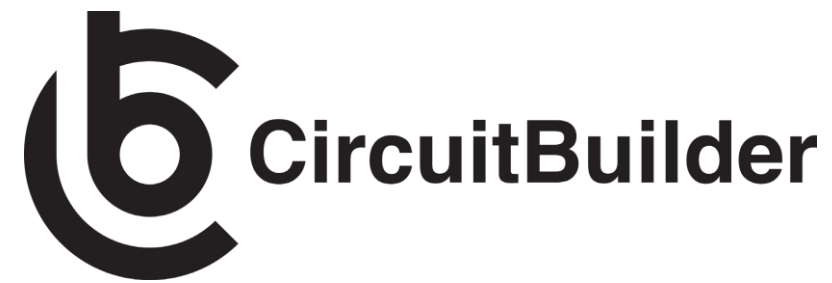
Jayesh BODKHEY

Mechanical Engineer
With 12 years of experience in various product design (electromechanical, machine design and Sanitary product design).

SPONSORS:



L.W. Jenkins Ltd



S Electronics LTD



Many thanks to...

Jeff Sutherland	Electronics
Chris Sam	FPGA
Alex Luisi	Firmware
Thomas Lee Vories	Electronics
Malcolm Lewis	Graphics
Daniel Dineen	Requirements
Sam Grisa	Materials

Steve Kempin
Chris Wise
Laura Williams
Lucie Williams
Tom Breddal
Kinneir Dufort
Sam Riley
Kordell Tan

Website
Website
Accounts
Graphics
Rig builds
Industry advice
Verification
Electronics





**EXPERT
ADVISORY
BOARD**



**listening to &
learning from
the experts**

CONSULTANTS/DOCTORS



- Lead consultant anesthetist working in a UK Intensive Care Unit
- Manager of Respiratory Care and Interventional Pulmonary Services, California
- ICU consultant anaesthetist, Brisbane



NURSES

2 nurses who are working to treat COVID patients in Intensive Care



INDUSTRY

P3 Medical; manufacturers of ventilator intubation parts

TIMELINE

2020



Our first open source basic mechanical design concept is published March 2020



Version 2.0 design is tested at National Physical Laboratory April & May



Version 2 open source design is published



Build final prototypes using 3D printed flow sensors and custom circuit board



Software written for PCV and spontaneous ventilation mode



Testing of the final design at NPL to MHRA requirements



Build 10 prototypes & receive CNC machined prototype flow sensor



Begin 24/7 life test on prototypes, document design and post PR/press articles to gather interest in final design



ONGOING PROCESSES

We continue seeking investment, ISO13485 manufacturers & medical device authorisation. Once these are established the next phase can begin.



OpenVent-Bristol Version 3.0

CONSTRUCTION

Laser cut sheet stainless steel for good strength, water drip resistance, bio compatibility and quickly scalable

LCD USER INTERFACE

To display measured values and set values for example; airway pressure, tidal volume, I:E ratio & ventilation mode

VISUAL AIRWAY PRESSURE MONITOR

Airway pressure displayed with horizontal bar graph

MEMBRANE BUTTON PANEL

To minimise crevices for germs to hide

AMBU BAG / BVM

Based on an Ambu bag which has existing medical device approval for manual ventilation and availability worldwide



VISUAL MONITORING

For visual feedback of bag compression

SIMPLE MECHANISM

1 moving part, simply an arm mounted to a motor

PEEP VALVE

Adjustable PEEP valve, to maintain positive pressure at all times

AIR OUTLET

Standard 22mm tapered push-fit air outlet, compatible with existing tubing

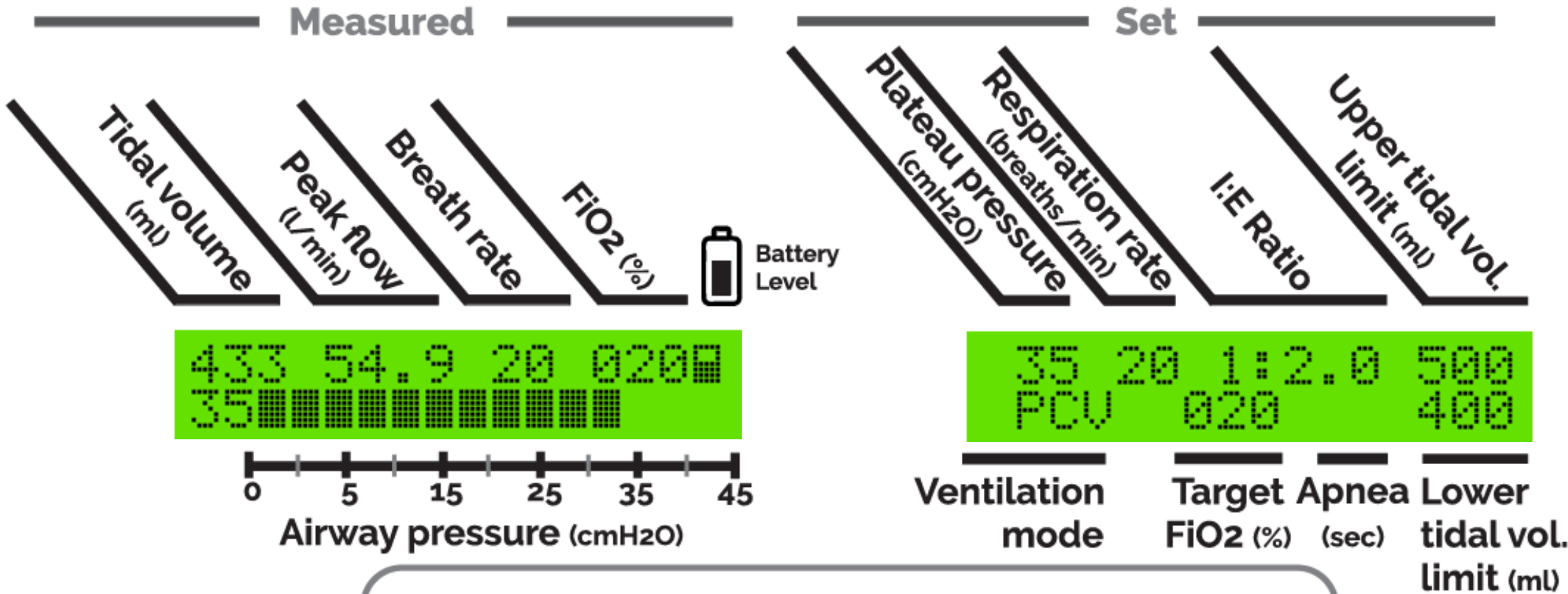


USER INTERFACE:

- Measured display on left
- Set parameters on right
- 4 button inputs

ALARMS:

- Visual LED indicators & audible tones
- LED colours according to alarm priority



ALARMS

- ▣ Tidal Volume Out of Bounds
- ▣ Inspiratory Pressure Exceeded
- ▣ Inspiratory Pressure Not Achieved
- ▣ PEEP Not Achieved
- ▣ FiO₂ Not Achieved
- ▣ Apnea Alarm
- ▣ Technical Fault

▣ Battery In Use
▣ / ▣ Battery Low

Hold **SELECT** to turn on
 Mute alarm 2 min

- Hold **SELECT** (3 sec) to exit/enter **EDIT** mode
- Click **SELECT** to toggle editing or select values
- Hold **STANDBY** (3 sec) to start/stop ventilation
- Ventilation mode change in **STANDBY** only

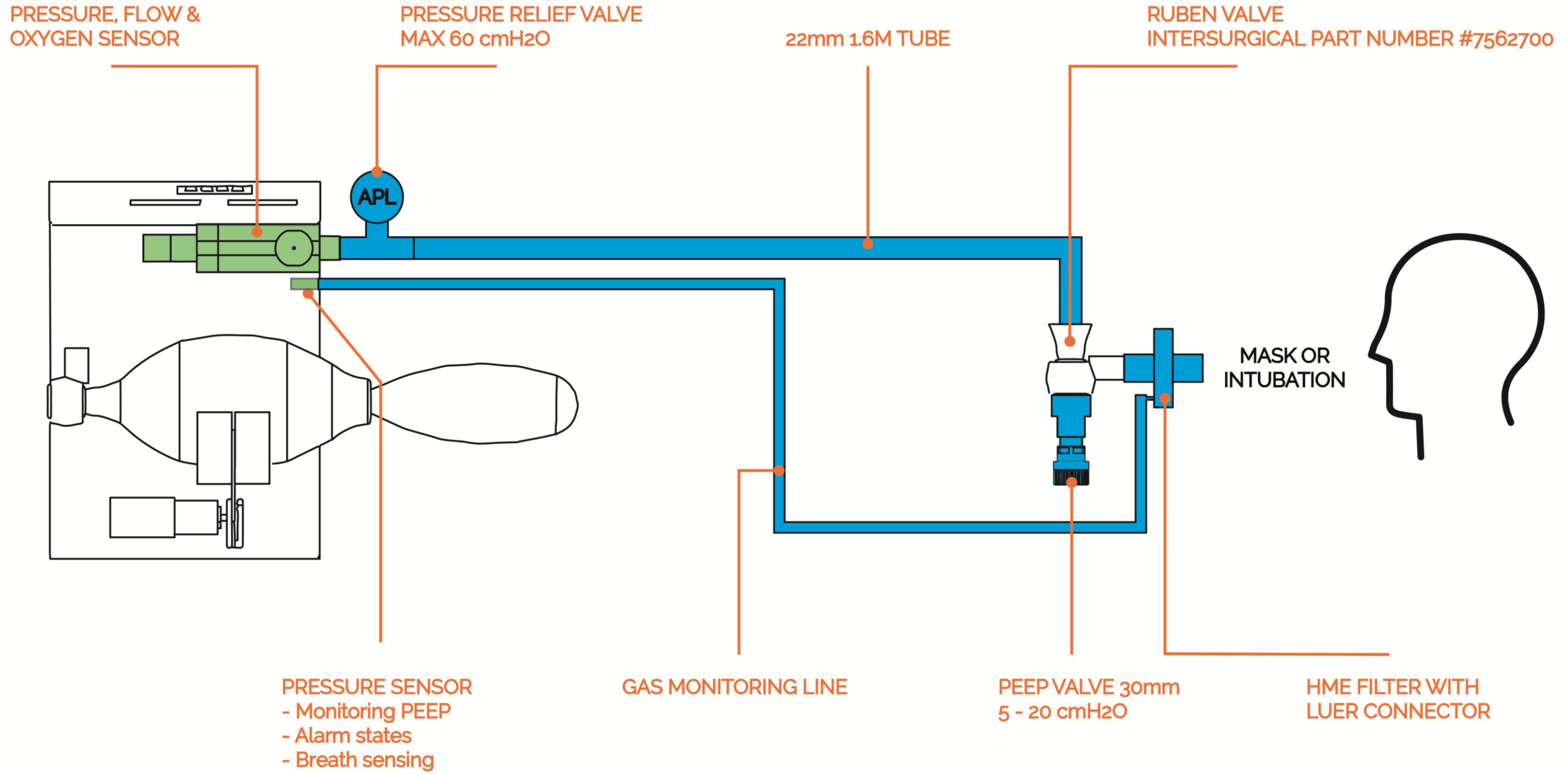
Default Settings:

- Inspiratory plateau pressure 35 cmH₂O
- Breath rate 20 per minute
- PEEP set using adjustable PEEP valve
- FiO₂ adjusted with oxygen supply valve

Must be used with adjustable PEEP Value & HME Filter. See Instructions For Use for airway circuit diagram



AIRWAY CIRCUIT



VENTILATION

MODES:

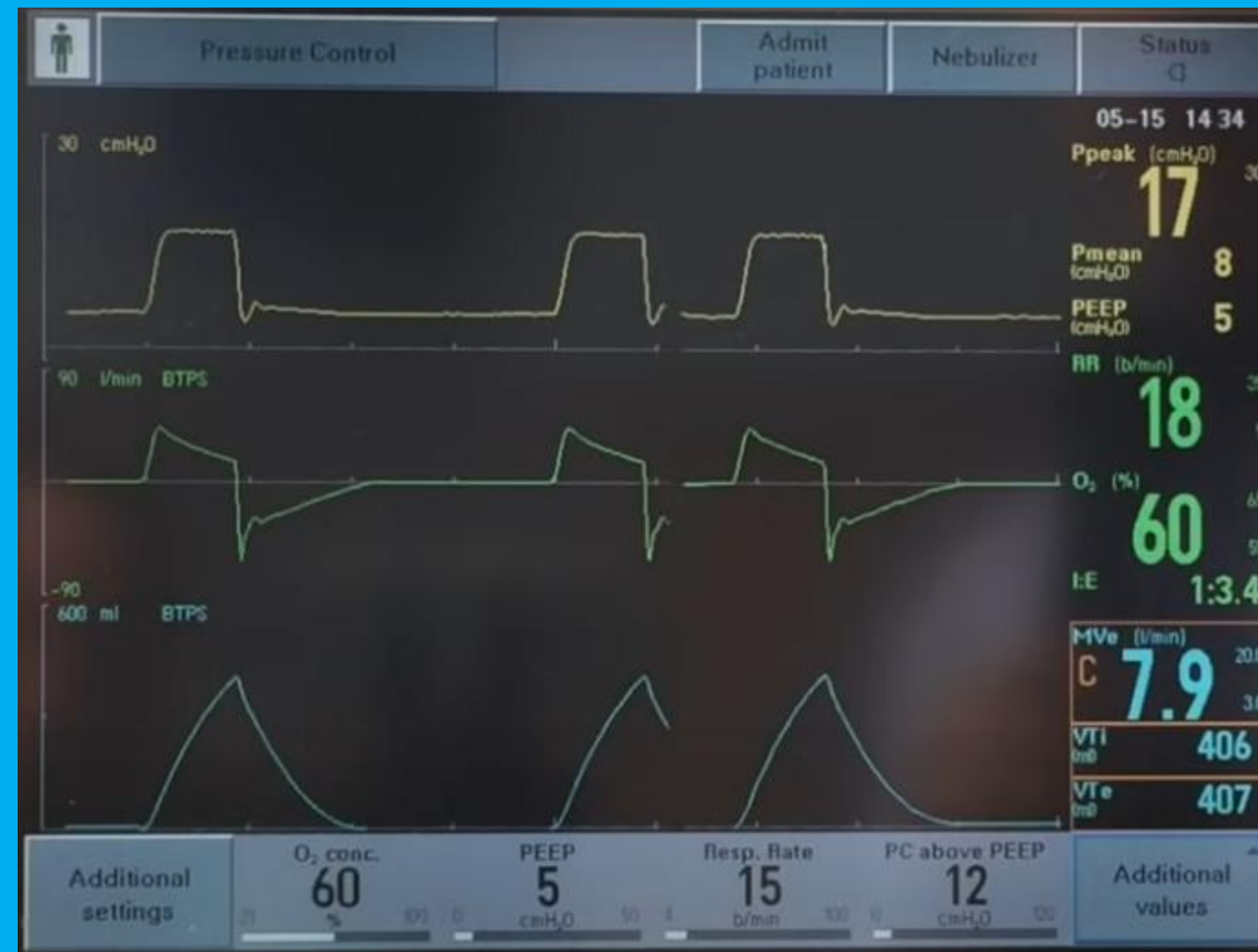
- PCV: Pressure Controlled Ventilation
- PSV: Pressure Support Ventilation mode (patient breath triggered)

MAXIMUM SAFE OUTPUTS:

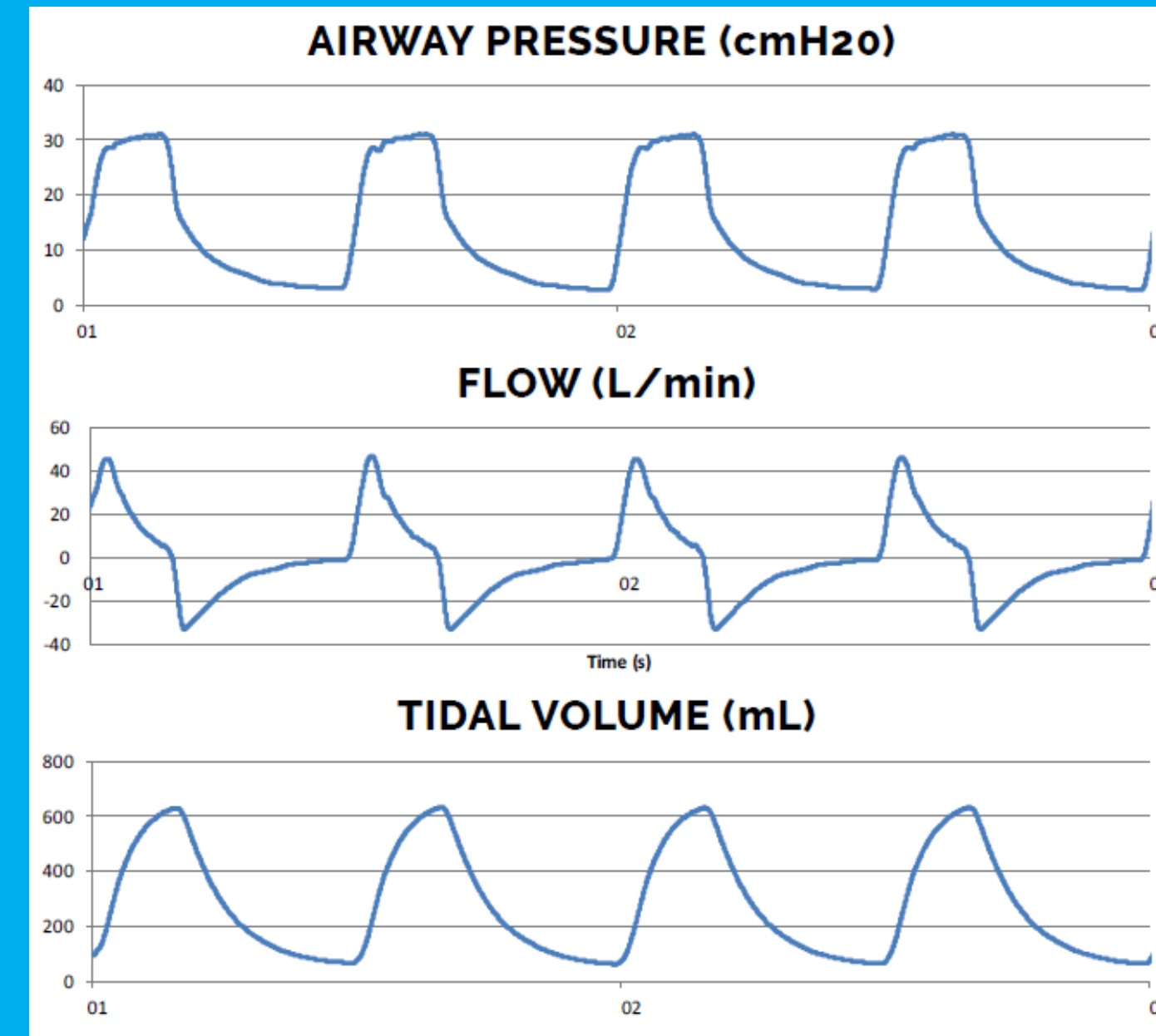
- 45 cmH₂O pressure
- 800 ml tidal volume

PCV (Pressure Controlled Ventilation) MODE PERFORMANCE

Existing ventilator



OpenVent-Bristol



Data above recorded from IngMar Medical ASL 5000 test lung in Pressure Controlled Ventilation mode, with set pressure of 30 cmH₂O and PEEP of 5cmH₂O.



Ingmar Medical ASL 5000 test lung

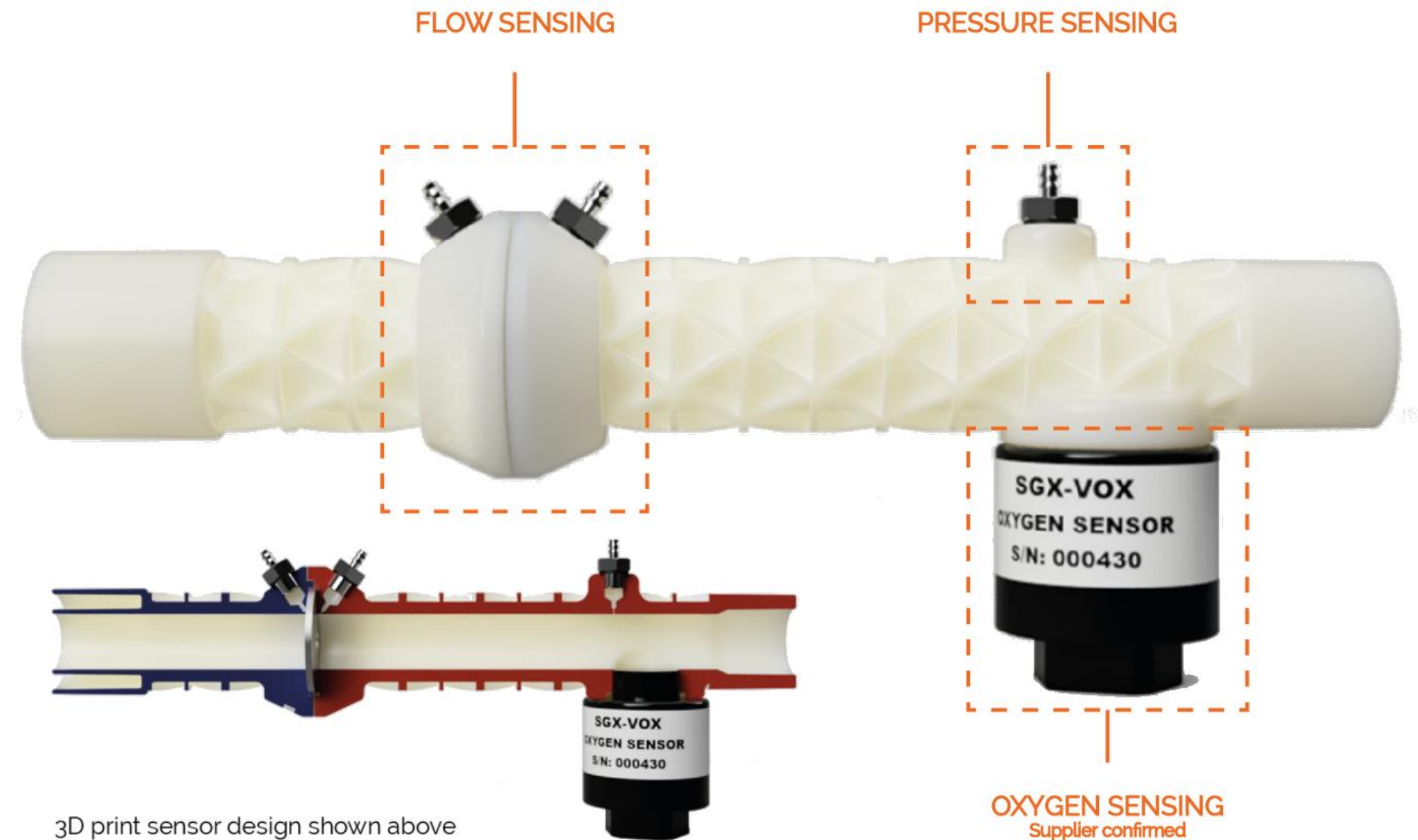
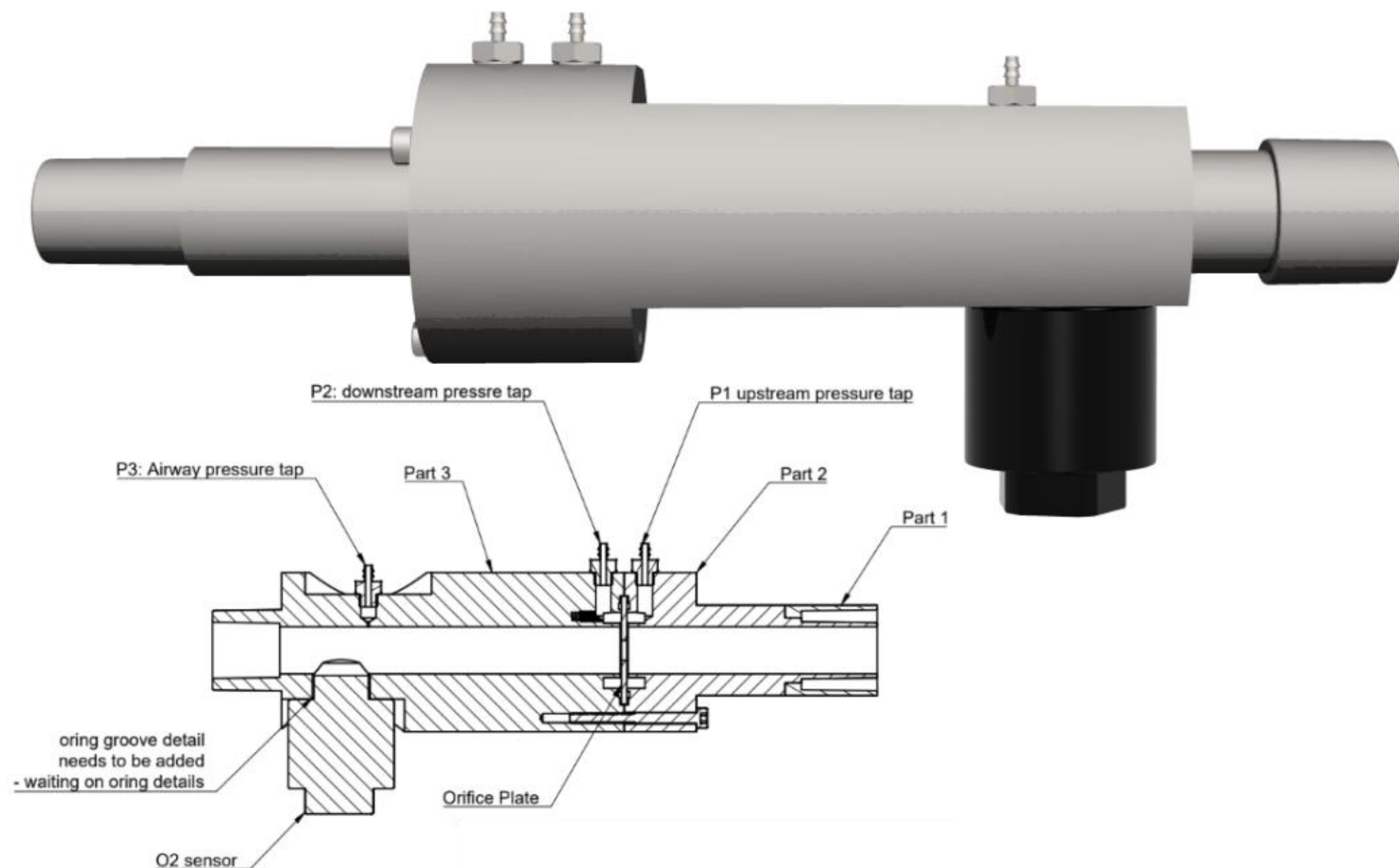
FLOW SENSOR MANUFACTURE

CNC MACHINING DESIGN:

- No tooling production costs
- No pre-production lead times
- High accuracy and repeatability
- Cost scales with volumes

3D PRINTING DESIGN:

- Fast prototyping
- Low volume production (e.g. <50 units)



FLOW SENSOR PERFORMANCE

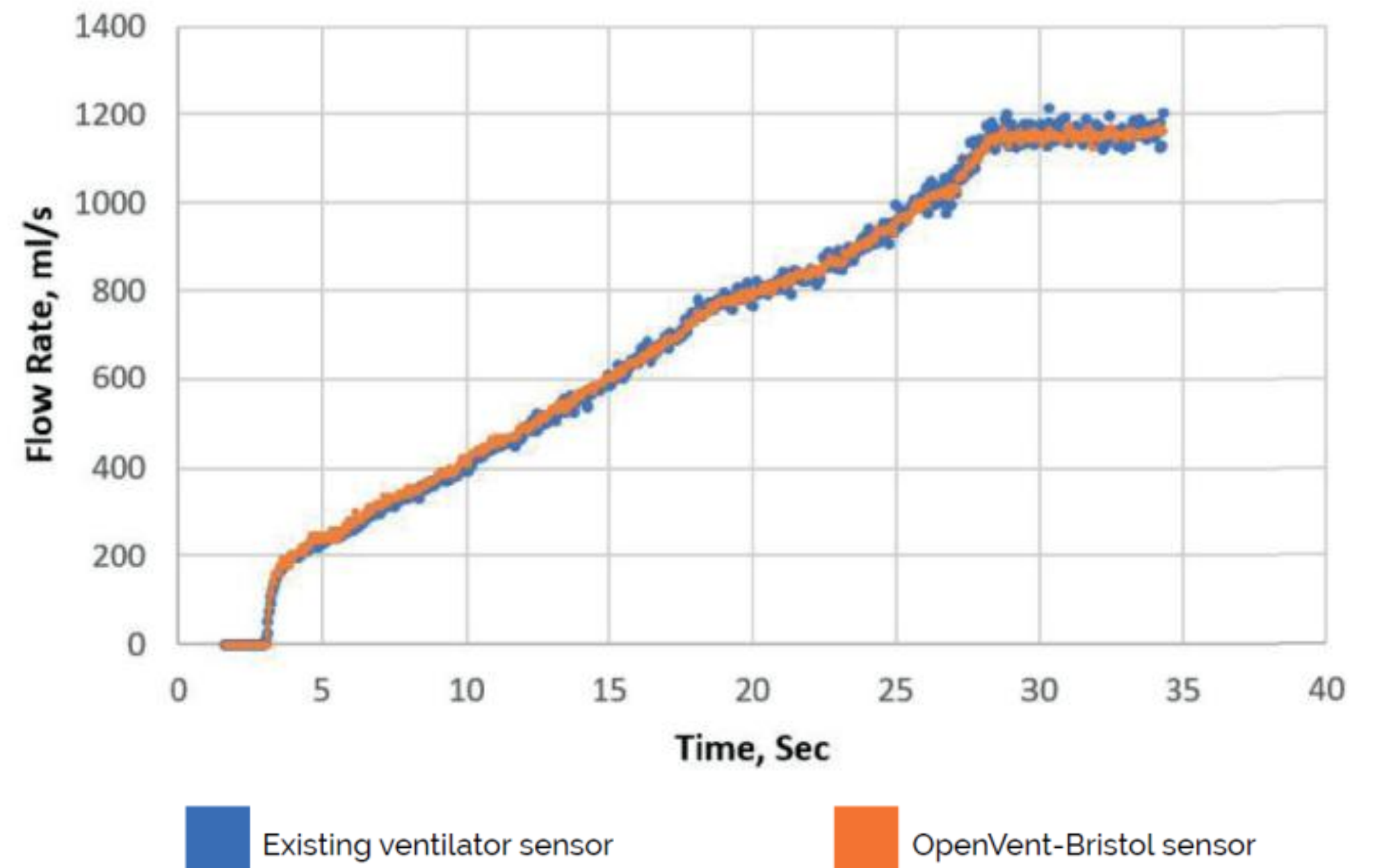
Manufactured in house to control the supply chain and maintain availability during the pandemic.

Designed simply using just 2 parts & a metal washer

Made from medically approved materials and finishes

OpenVent-Bristol is also compatible with an off the shelf flow sensor

COMPARATIVE PERFORMANCE



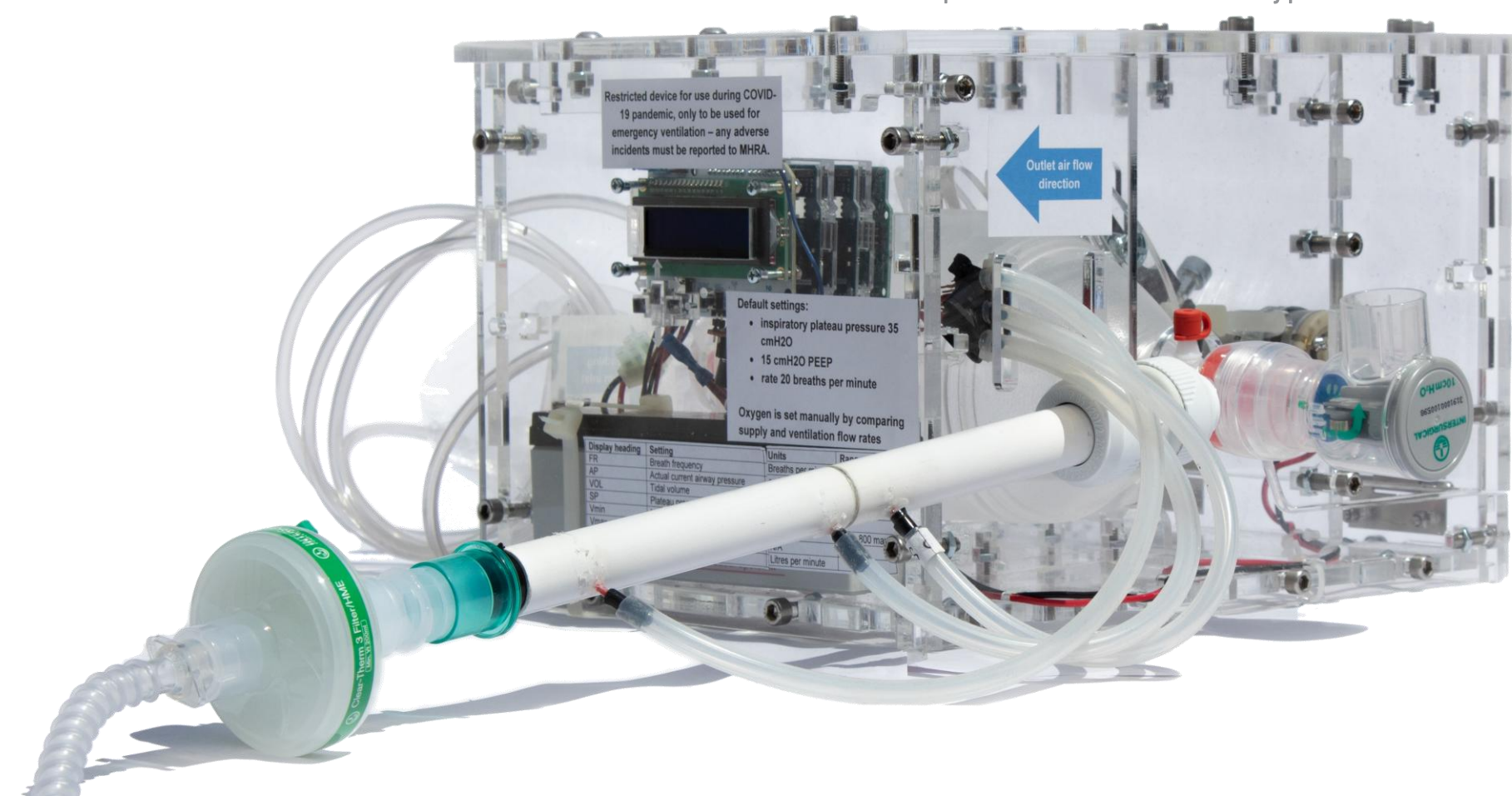
Funding our project.

"So far we have been relying on funding from family and friends via our [GoFundMe](#) page, however funds from this have dried up and I am now funding the project myself, however I am unable to continue doing this."

DARREN LEWIS
Project Lead

Our lack of financial support is restricting our progress from Version 2.0 to Version 3.0. We require funds to produce our next - and likely final - batch of prototype ventilators, and to get these further tested at NPL.

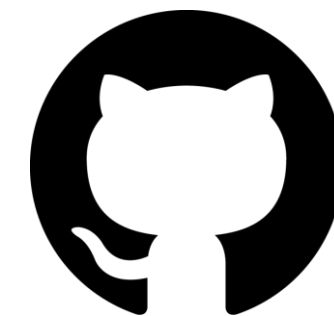
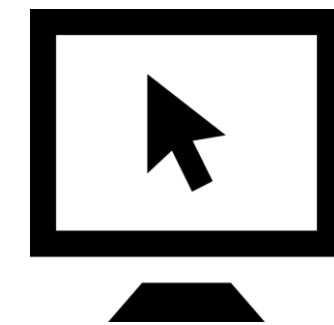
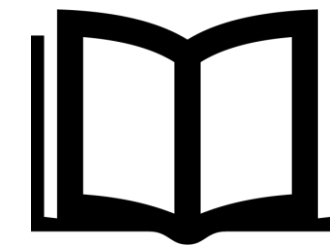
OpenVent - Bristol Prototype Version 2.0



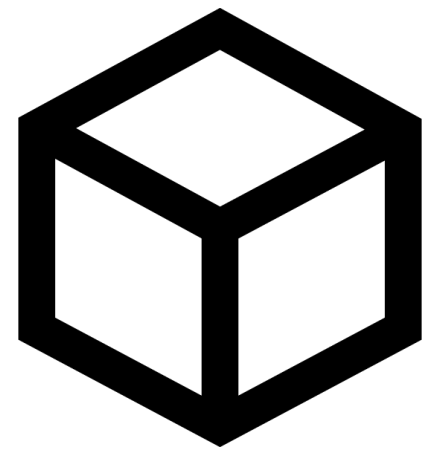
With your support your organisation can benefit from

Part of the OpenVent-Bristol website
dedicated to you including logo and
brand message

Special thanks in publications of
the open source design, including
web based documentation, GitHub,
youtube videos and any future
academic conference papers



Sponsorship can consist of



PARTS

to help us build our ventilators



SERVICES

to aid and advise our work

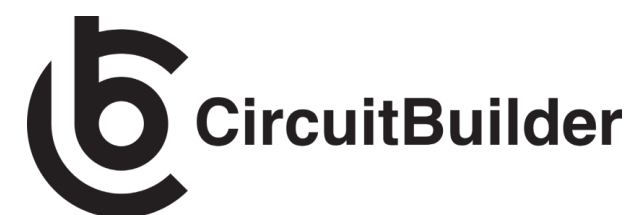


FUNDING

to financially support our project

CURRENT SPONSORS

We are looking to bring more companies on board with us. Sponsorship is really important to us as it can help in so many different ways, and is never a 'one-size-fits-all' relationship.



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COMPETITIVE



There are many great engineering teams out there working on open source ventilators. This is a huge positive for example:

- To increase chances of success
- To provide buyers with more choice
- Component availability will limit how far one design can be deployed

INTELLIGENT



There is an increasing need for an adaptive ventilation mode where the system senses the person trying to breath before delivering air

SAFETY MEASURES



PCV (Pressure Controlled Ventilation) mode is recognised as safer than VCV (Volume Control Ventilation) mode, reducing likelihood of lung damage through over pressure.

ONE VENTILATOR
DESIGN IS NOT
THE SOLUTION

A large graphic on the right side of the slide. It consists of several concentric circles. The innermost circle is a solid blue circle containing the text 'ONE VENTILATOR DESIGN IS NOT THE SOLUTION' in white, uppercase letters. This is surrounded by a white ring, then an orange ring, and finally a larger, thin white ring. The background of the slide is split vertically: the left half is blue and the right half is white.

Open source V3.0 design release coming soon on GitHub
Meanwhile contact us for any questions



OPENVENT-BRISTOL

openventbristol.co.uk | contact@openventbristol.co.uk