AEONMED VG70 Ventilator

Oxygen Usage Report

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The VG70 is a CE marked and FDA approved ventilator manufactured by Aeonmed in China. A number of units were purchased by the UK Department of Health and Social Care (DHSC) as part of its Ventilator Challenge programme launched in March 2020. The VG70 uses either 4bar oxygen from a wall outlet or can use up to 15lpm oxygen from a rotameter. Air is entrained by a small fan. The VG70 has the following modes available: VCV, PCV, PRVC, SIMV-V, SIMV-P, SIMV-PRVC, BIVENT, SPONT/PSV and non-invasive modes.

Studies outside of MD-TEC have suggested that the VG70 may be using considerably more oxygen than expected and that this is related to high bias flows when flow triggering is used. The following study was undertaken to investigate this during Pressure Support and Pressure Control Ventilation.
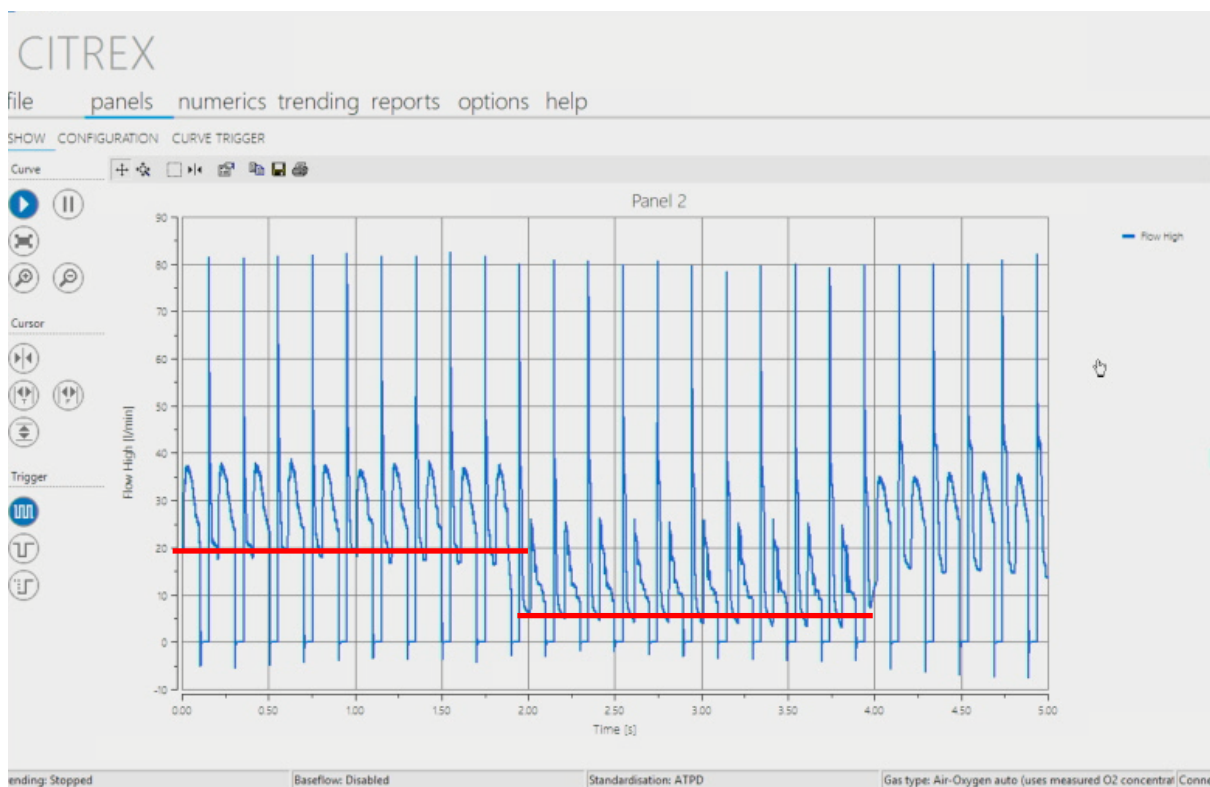
Set Up:

The VG70 was connected by a standard two hose breathing system with FHME and two bacterial filters to the inlet of a calibrated Citrex Ventest 800 analyser. The Ventest 800 was connected via a 2m length of 22mm hose to an Ingmar Medical ASL 5000. The ASL is controlled via LLEAP plugin and a SimMan 3G. The Ventest 800 was connected vis USB to FlowLab software running on an HP PC.

An additional 50cm length of 22mm hose was connected from the exhaust port to a calibrated Citrex H4 flow analyser (as in the image below). The output from the H4 was collected via USB into a Dell PC running a second version of FlowLab. Flow from the valve is displayed as upwards in the following plots
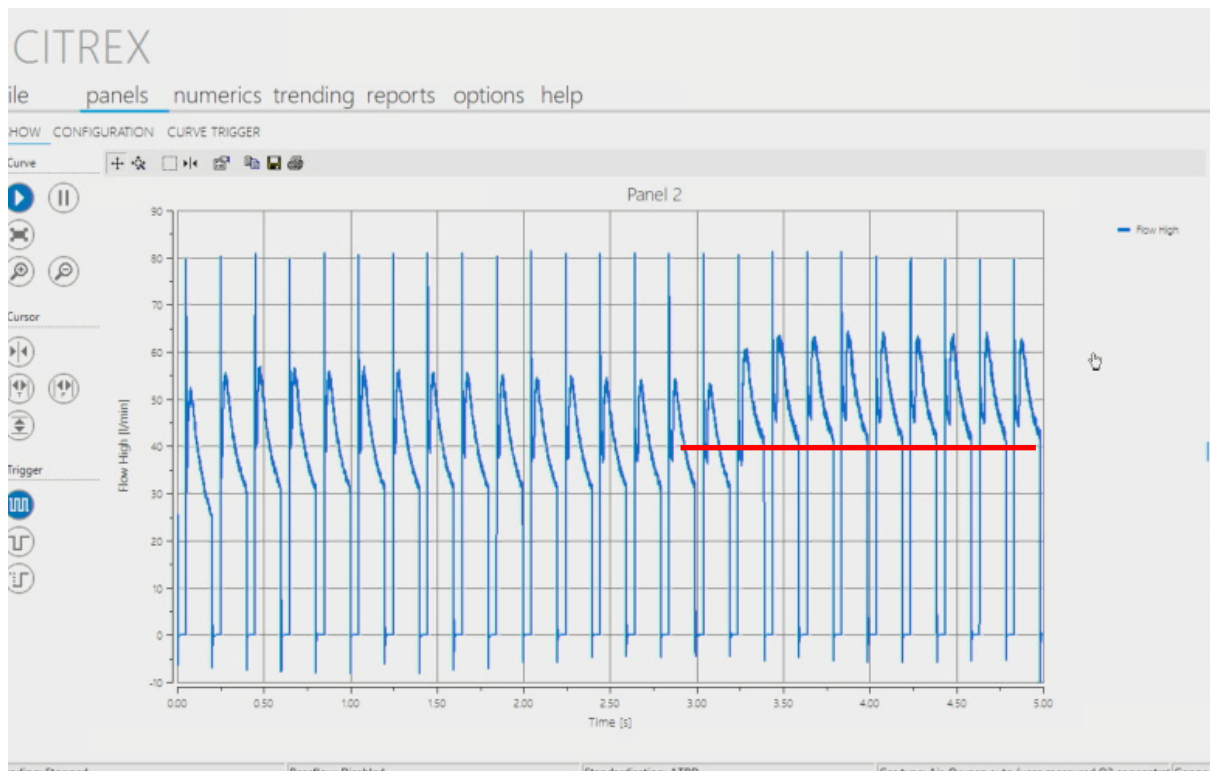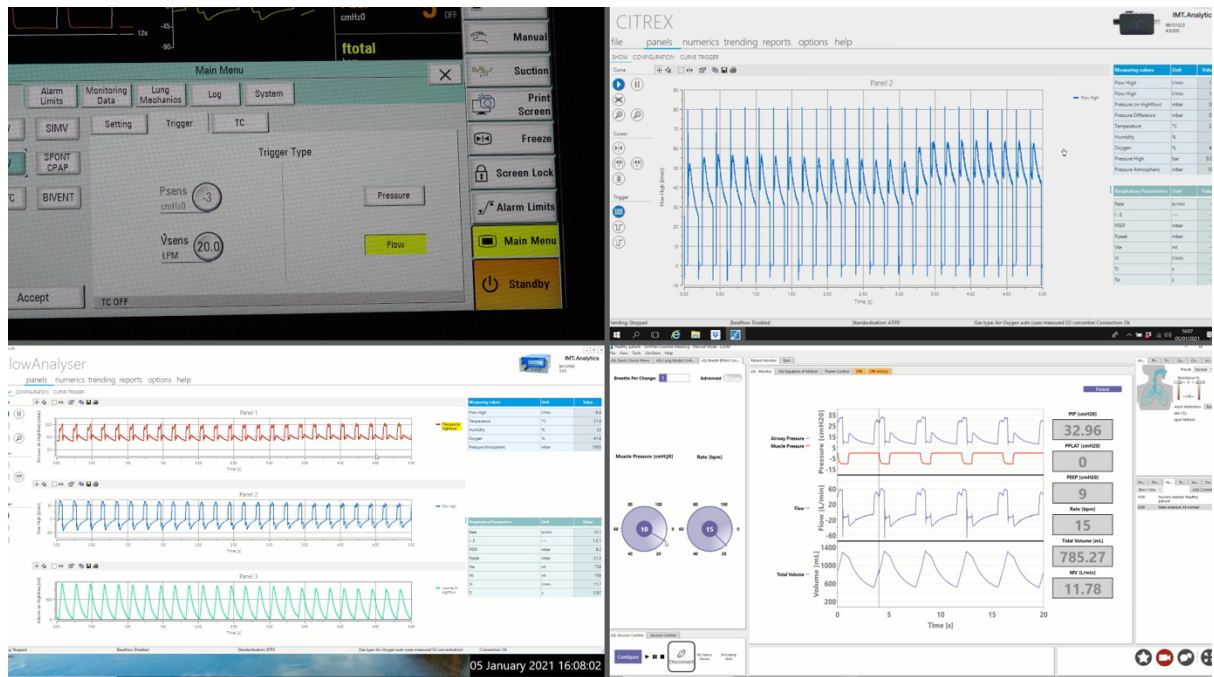
Spontaneous (Pressure Support):

Trigger left at default setting of Vsens 2.0 lpm. ASL 5000 set to "breathe" at 15 bpm, 20 cmH$_2$O assist, PEEP = 5 cmH$_2$O.

Vsens at 2.0 lpm switched to Psens -3 cmH$_2$O and back to Vsens 2.0lpm. Bias flow at red line
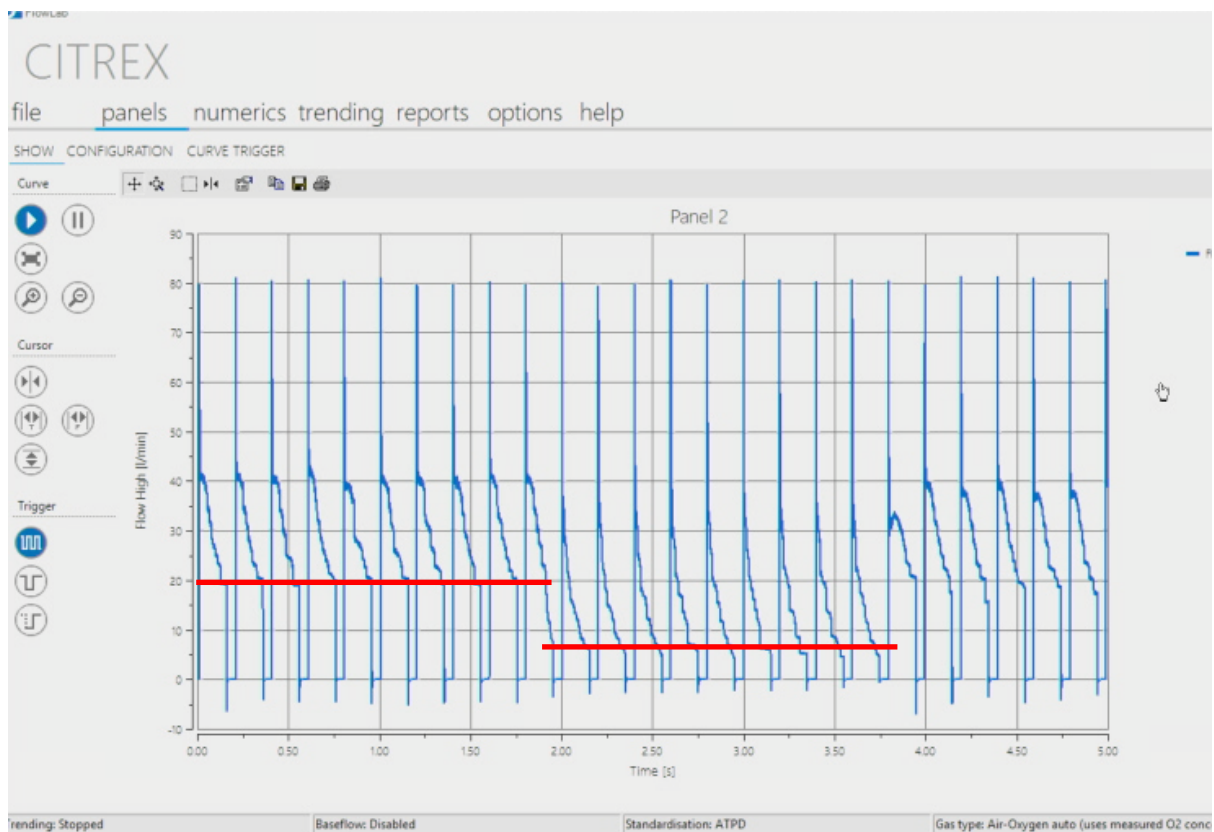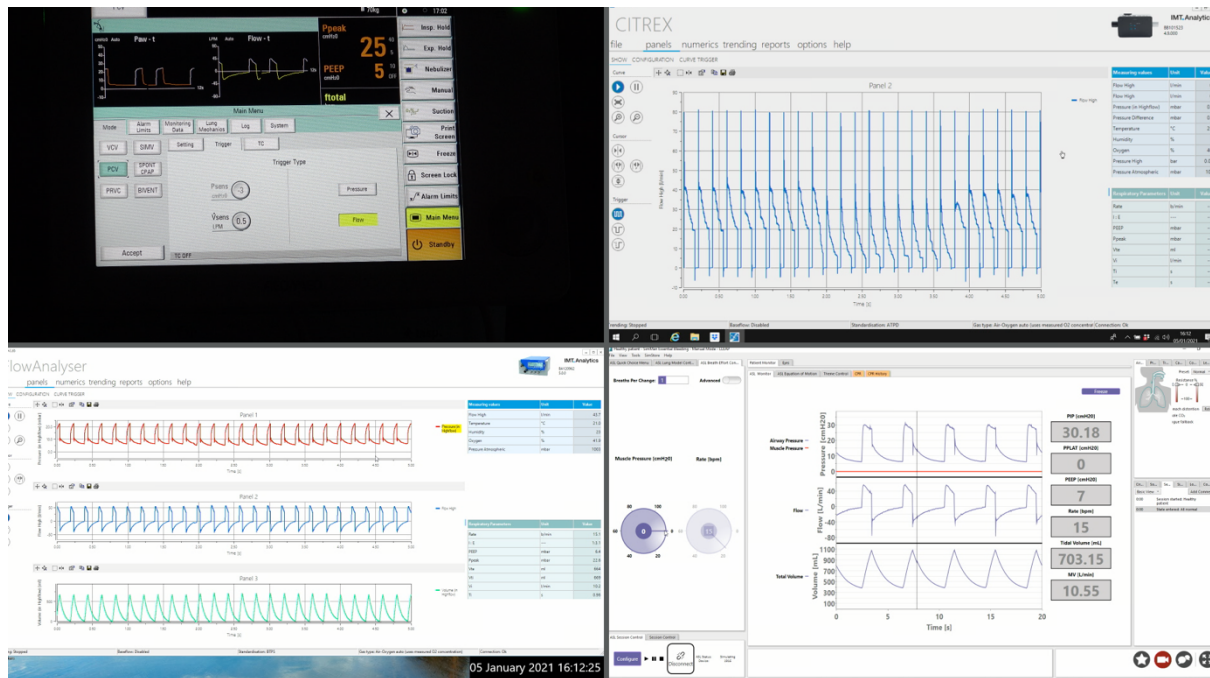
Same set up with Vsens set to 20.0 lpm.

Bias flow now at 40 lpm

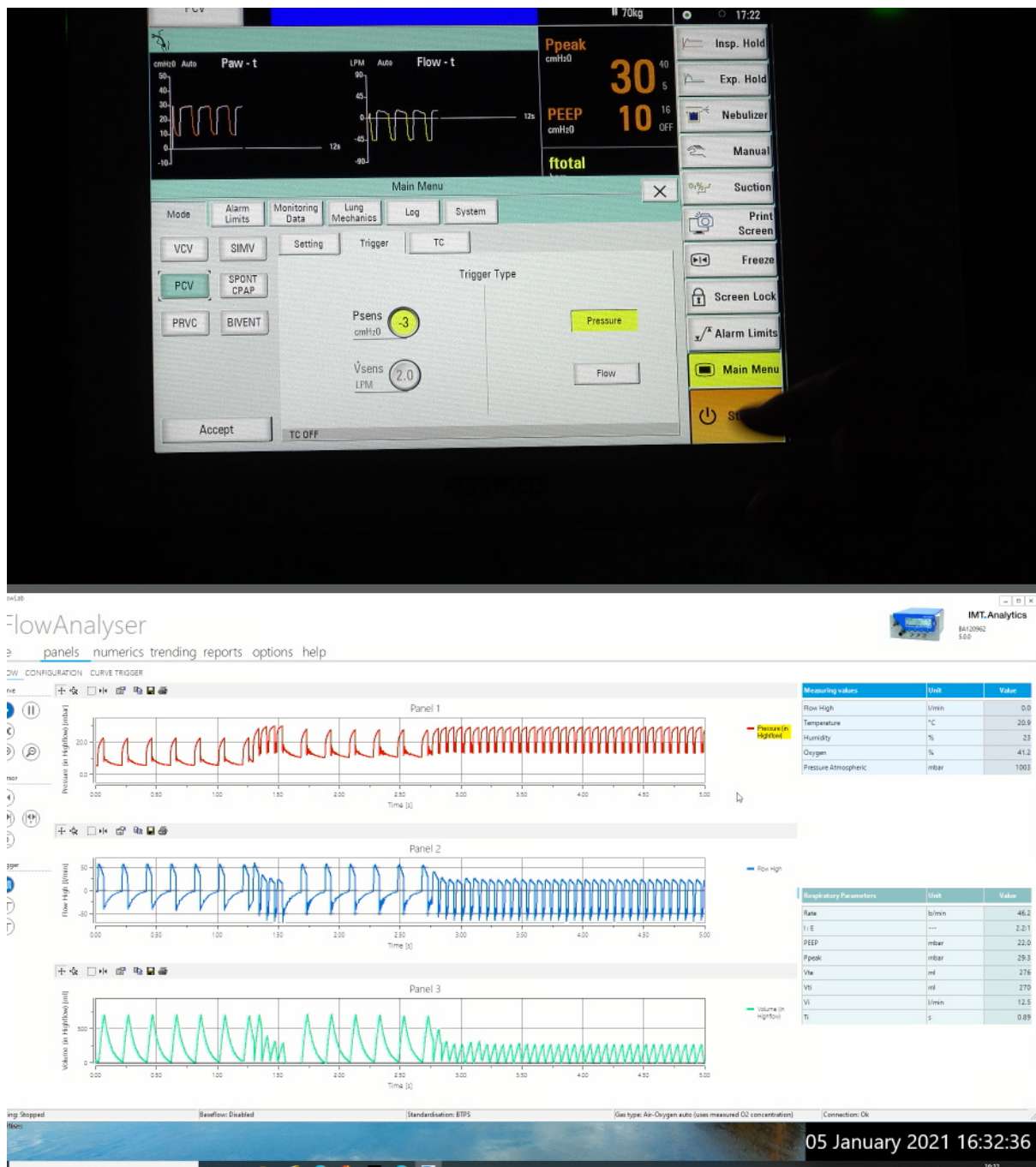**Pressure Control Ventilation (no spontaneous breaths):**
Trigger left at default setting of Vsens 2.0 lpmRate 15 bpm, 20 cmH$_2$O assist, PEEP = 5 cmH$_2$O.

Vsens at 2.0 lpm switched to Psens -3 cmH$_2$O and back to Vsens 2.0lpm. Bias flow at red line

Auto Triggering:

PCV as before, rate 15 with trigger set to Psens -3 (Default Psens level). Auto-triggering apparent.

Conclusions:

Using flow triggering (the default on start-up) bias flows of 20 lpm are present during both pressure controlled and pressure support ventilation. These increase to 40 lpm if Vsens is increased to 20.0 lpm. This will lead to excess usage of oxygen, increasing as FiO_2 is increased.

Switching to pressure triggering these bias flows are reduced to approximately 5 lpm. As with other pressure triggered modes auto-triggering will occur if Psens is too low.

Unless flow triggering is essential then the VG70 should be switched to Psens at every start-up. Alarm volume should be adjusted at the same time.

VG70 Ventilator Test Setup (Bias Flow)

MD-TEC — Medical Devices Testing and Evaluation Centre

- 4 bar Oxygen
- 240v AC
- Test Device
- Bacterial Filter
- Bacterial Filter
- Breathing System
- FHME
- Ventest 800
- ASL 5000
- LLEAP/ASL
- HDMI-SDI
- FlowLab
- HDMI-SDI
- Citrex H4
- FlowLab
- HDMI
- Sony Z150 (1080p)
- BMD Multiview
- BMD SSD Recorder
- BMD Multiview
- BMD SSD Recorder

Data Storage
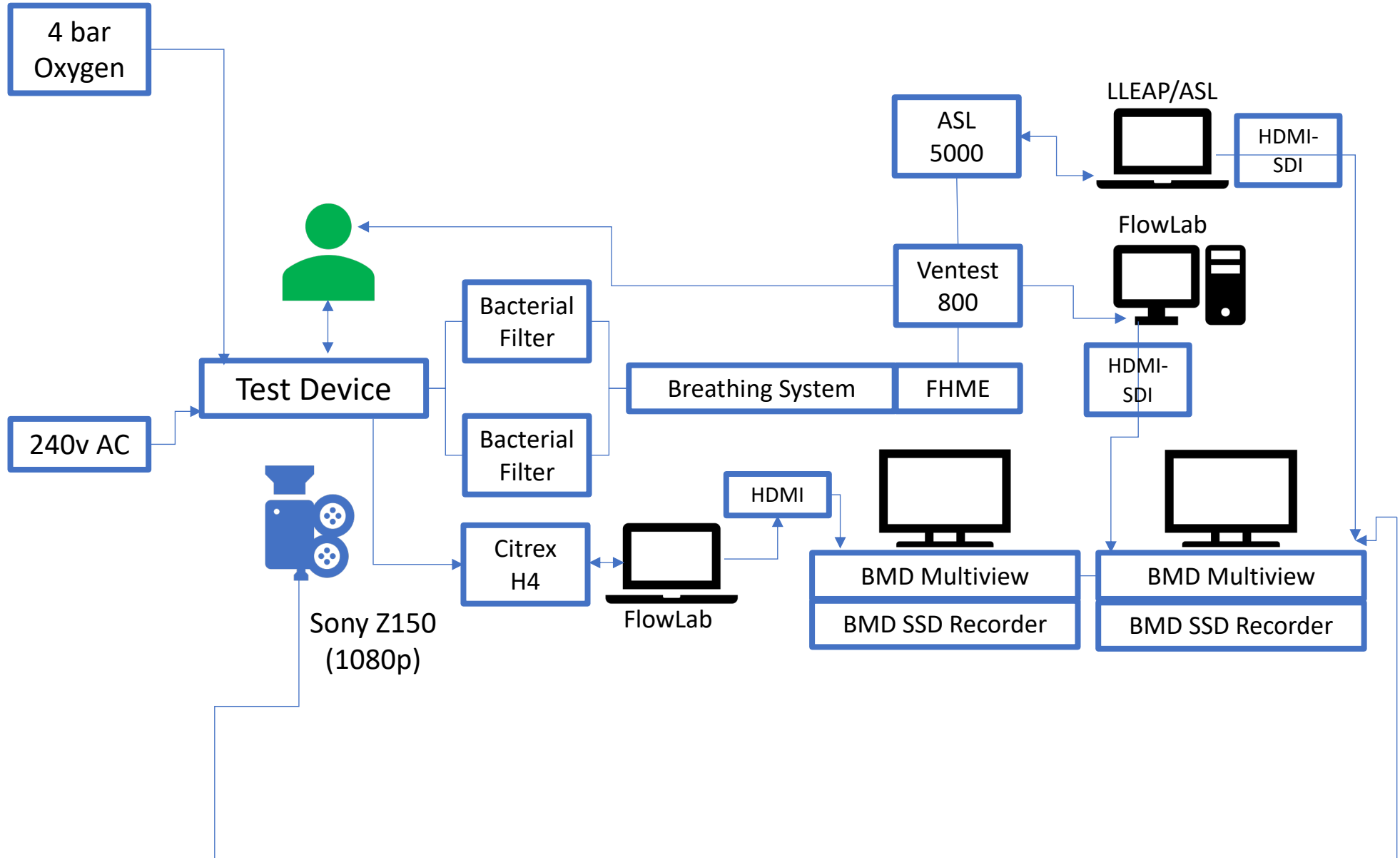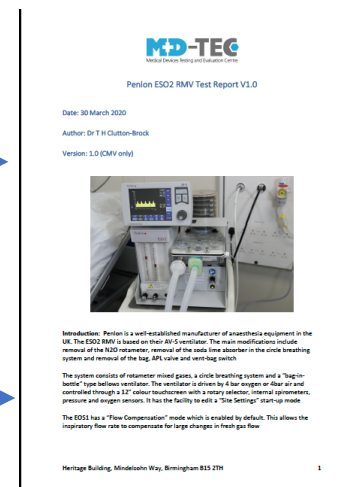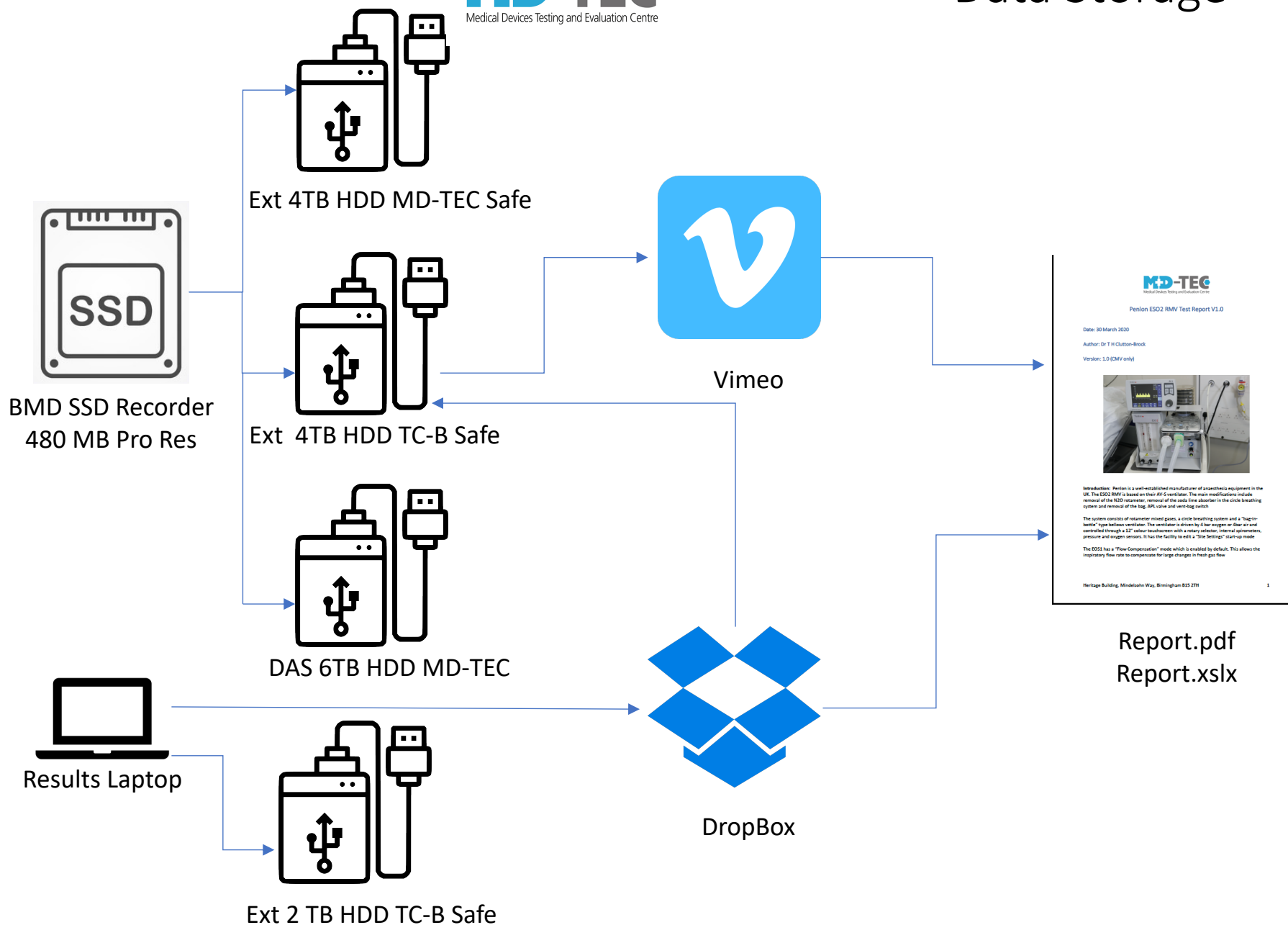
IMT Medical VenTest 800
PF-300
SN: BA120962
Calibrated April 2020
Calibration Due April 2021

Ingmar Medical ASL 5000
3100150. SN:1916
Calibrated April 2020
Calibration Due April 2025

VenTest Series Technical Specifications

Flow & Pressure Measurements		Range	Accuracy	800
Flow	Measuring Direction	Bidirectional		■
	Temperature Compensated	Yes		■
	Pressure Compensated	Yes		■
	Humidity Compensated	Yes		■
	O_2 Compensated	Yes		■
	High	± 300 L/min	± 1.75%* or ± 0.1L/min**	■
	Low	± 20L/min	± 1.75%* or ± 0.04L/min**	■
Pressure	High	0 - 10bar	± 1%* or ± 10mbar**	■
	Average	± 150mbar	± 0.75%* or ± 0.1mbar**	Difference
	Low	0 - 5mbar	± 1%* or ± 0.01mbar**	
	High in Flow Canal	0 - 150mbar	± 0.75%* or ± 0.1mbar**	■
	Barometer	0 - 1150mbar (abs)	± 1%* or ± 5mbar**	■
	Vacuum Pressure	± 1000mbar	± 0.5%* or ± 2mbar**	
Measuring Unit	Flow	L/min, L/s, cfm, mL/min, mL/s		■
	Pressure	bar, mbar, cmH₂O, inH₂O, Torr, inHg, hPa, kPa, mmHg, PSI		■

Additional Measuring Values		Range	Accuracy	
Oxygen	Concentration	0 - 100%	±1% O_2**	■
	Pressure Compensated	Yes		■
Temperature	High in Flow Canal	0 - 50°C	± 1.75%* or ± 0.5°C	■
Dew Point	High in Flow Canal	-10 - 50°C	± 2%* or ±1°C	■
Humidity	High in Flow Canal	0 - 100%	± 3%**	■
CO_2, N_2O, HAL, ISO, ENF, SEV, DES	Concentration	See MultiGasAnalyser™ OR-703 specification for details		With OR-703
Gas Types		Air, Air/O_2, N_2O/O_2, Heliox (21% O_2) He/O_2, N_2, CO_2, customized gas types		■
Gas Standardisation		ATP, ATPD, ATPS, AP21, STP, STPH, BTPS, BTPS-A, BTPD, BTPD-A, 0/1013, 20/981, 15/1013, 25/991, 20/1013, NTPD, NTPS		■

Respiratory Parameters [1]		Range	Accuracy	
Rate		1 - 1000bpm	±1bpm or ±2.5%**	■
Time	T_I, T_E	0.05 - 60s	±0.02s	■
I:E Ratio		1:300 - 300:1	±2.5%	■
Ti/Ttotal		0 - 100%	±5%	■
Breath Volumes	Vti, Vte (@FlowLow)	± 10L	±1.75% or ±0.10mL (>2.4L/min)	■
	Vti, Vte (@FlowHigh)	± 10L	±1.75% or ±0.20mL (>6.0L/min)	■
Minute Volumes	Vi, Ve	0 - 300L/min	±2.5%*	■
Pressure	Ppeak, Pmean, PEEP, Pplateau, Delta P	0 - 150mbar	±0.75%* or ±0.1mbar**	■
Peakflow	Peakflow Insp./Exp.	± 300L/min	±1.75%* or ±0.1L/min**	■
Compliance	Cstat	0 - 1000mL/mbar	±3%* or ±1mL/mbar**	■
Trigger		Adult, Pediatric, HFO Adjustable on flow or pressure curves with user-defined limits.		■