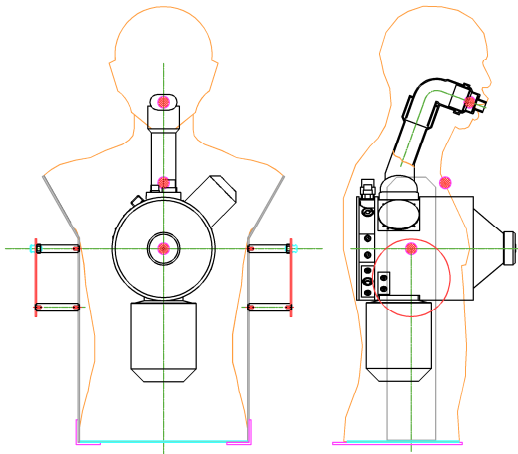


# DeepLife Respiratory Simulator MkII

## FEATURES

- The latest generation of portable in-chamber respiratory simulator
- Enables full CE respiratory equipment tests to be conducted in minimal time
- Real time Lissajou and results display
- Automatic generation of test reports for WOB, hydrostatics, scrubber endurance & PPO2 control.
- RMVs from 7.5lpm to 90lpm, or to 180lpm in tandem mode
- All parameters controlled via easy to use LabView interface, including stroke, waveform (sine, human, trapezoid) and temperatures
- Near-Vacuum to 400m depth
- Full immersion wet testing
- Offers full integrated respiratory mass spectrometer option, including synchronised in-mouth CO2 measurement.



## APPLICATIONS

- Certification testing to EN250, EN14143 and NORSOK U-101
- Rebreather characterisation
- Open Circuit breathing system test
- Saturation dive system testing
- Aeronautic bib testing

## DESCRIPTION

The DL Respiratory Simulator MkII provides the fastest test environment for respiratory testing of breathing equipment. It enables test sequences that hitherto have taken weeks, to be performed in hours, with unparalleled accuracy, flexibility and ease.

The simulator comprises a full 4 Quadrant CNC controlled breathing machine, respiratory monitor in Pelican case providing power and control, differential and absolute pressure sensors, gas heater, and laptop running a Labview compiled script with real time display of lissajous and all results. The simulator is fully CE certified, calibrated and results from it can achieve an ISO 17025 test traceability, accepted by even the most stringent Notified Bodies.

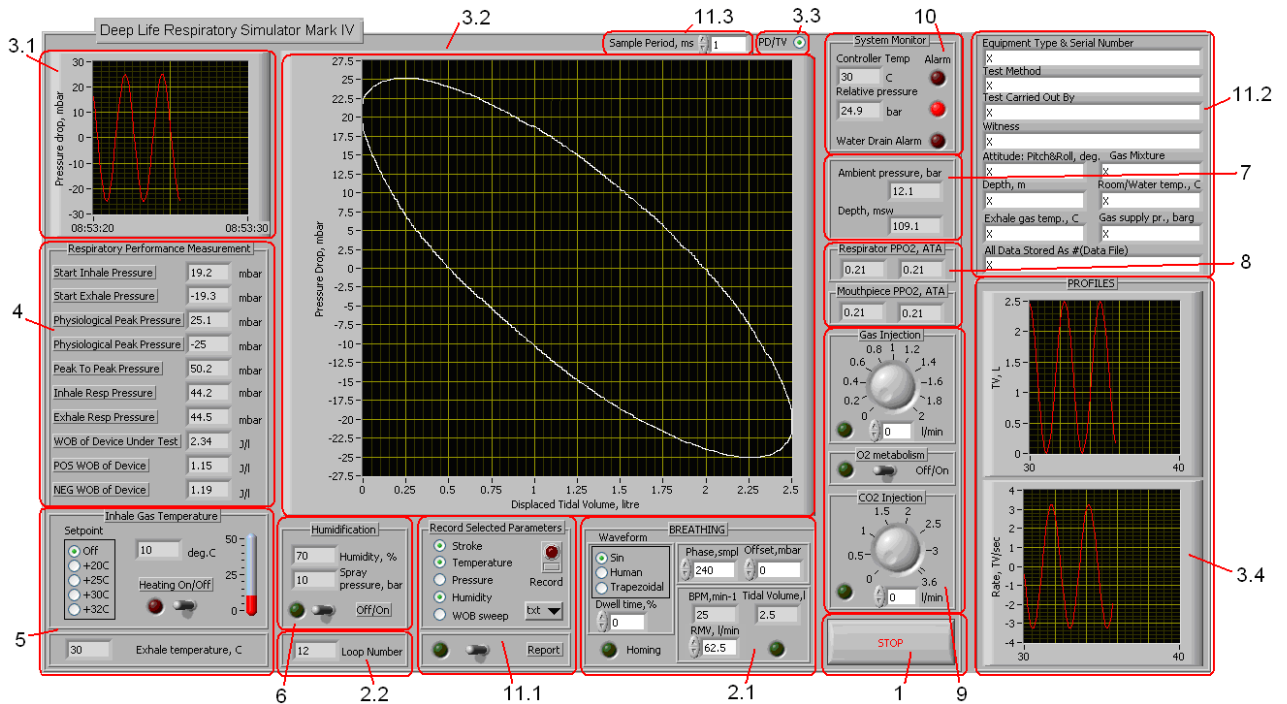
The breathing machine is designed to fit inside a mannequin, and may be immersed in water in test chambers, for pressure testing to depths of 400m / 1050ft. Total setup time is typically less than an hour including calibrations. The entire simulator is portable.

## TECHNICAL SPECIFICATION

Parameter	Min	Max	Units	Note
Supply voltage	110V	240	VAC	Single phase
Supply power		400	W	Without 1KW (max) gas heater.
Weight		23 x 2	kg	Shipping weight packed in air freight containers supplied.
Size		Two 80 litre containers		Includes entire system.
Storage temperature range	-40	+85	°C	
Operating temperature range	0.1	+40	°C	
Operating ambient pressure	0	80	bar	Breathing equipment shall be connected and qualified to ambient.
Operating environment		Water, Air, Heliox, Pure oxygen, with CO2		Pure oxygen limit of 9 bar in water, and 3 bar in gas environment.
RMV	7.5	90	lpm	To 180lpm when used in tandem
Stroke	0.1	3.0	litre	To 6lpm when used in tandem
Respiratory Rate	0	36	bpm	
Respiratory Waveform		Sine Human Trapezoid 0% to 95%		
Gas heating	+0	36	C	Several options available. Compact option described.
Humidification		Atomising Spray		Combined with heater head.

## Graphical User Interface

A laptop computer provided with the equipment runs a LabView compiled script offering control and real time display of test parameters and results.



The user interface includes the following sections, labelled in red above:

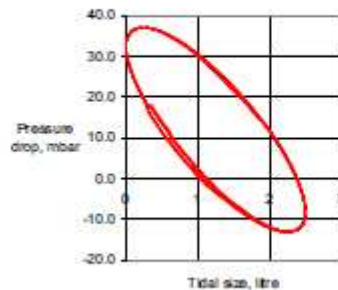
1. Start/Stop control: stop button
2. Breathing control parameters and waveforms set
  - 2.1. Setting of Breathing parameters and waveforms: CE and NORSOK tables preprogrammed
  - 2.2. Count of the number of breathing cycles in the current test

3. Respiratory charts
  - 3.1. Real time pressure plots
  - 3.2. Real time Lissajous plot of respiratory pressures
  - 3.3. Selector of actual and simulated pressure drop signals to compare measured with expected
  - 3.4. Profile charts of the tidal volume and the tidal volume rate
4. Respiratory parameter monitoring, with CE results displayed in real time
5. Breathing Gas temperature control
6. Humidification measurement and control
7. Ambient pressure monitor
8. PPO2 monitor, for use with mass spectrometer
9. CO2 Gas injection, for direct control of mass flow controllers
10. System monitor
11. Data record and storage
  - 11.1. Record selected parameters and report generation into Microsoft Excel and Word
  - 11.2. Manual input to report generator to identify the test, witnesses etc
  - 11.3. Setting of the data capture sample period for report and storage

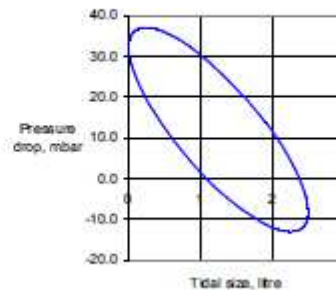
## Report Generation

RESPIRATORY WORK AND RESISTANCE MEASUREMENT			
EQUIPMENT TYPE & SERIAL NUMBER	:	Xaaa	
TEST METHOD	:	Xbbb	
DATE AND TIME	:	2/1/2013	1:11 PM
TEST CARRIED OUT BY	Xccc	WITNESS:	Xddd
<b>CONDITIONS OF TEST</b>			
ATTITUDE: PITCH & ROLL	:	X1111 Deg.	
GAS MIXTURE	:	X2222	
DEPTH	:	X3333 m	
ROOM / WATER TEMPERATURE	:	X4444/4444 deg. C	
EXHALE GAS TEMPERATURE	:	X5555 deg. C	
GAS SUPPLY PRESSURE	:	X6666 barg	
TIDAL VOLUME / RESP RATE / RMV	:	2.5L / 25.0 bpm / 62.5 lpm metric	
<b>RESULTS</b>			
PRESSURE@START INHALE / EXHALE	=	32.1 / -8.0 mbar	
PHYSIOLOGICAL PEAK PRESSURES	=	-13.0 / 37.0 mbar	
PEAK TO PEAK PRESSURE	=	50.0 mbar	
EN14143 RELATIVE PEAK PRESSURES	=	45.1 / 45.0 mbar	
TOTAL POS / NEG WORK	=	1.16L / 1.14 J/l	
TOTAL WORK OF BREATHING (WOB)	=	2.3 J/l	
ALL DATA STORED AS #(DATA FILE):		X777-7777	

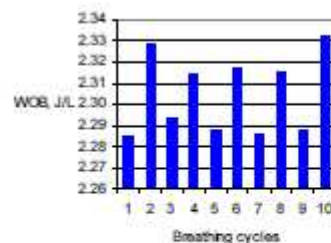
Overlaid Lissajous



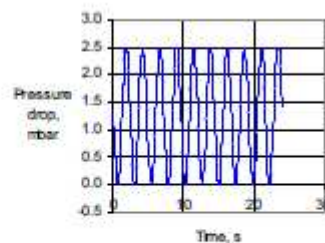
Average Lissajous



WOB with swept loop volume



Resistance with swept volume



Reports are generated in MS Word at a press of a button. Subsequent reports can be appended to the same file, automatically. A selection of user editable templates are provided, an example report is shown

above. Fields stating X are entered by the user into the Labview graphics interface at the start of the test sequence and may be any text string.

## **CALIBRATION**

A full calibration report is provided on delivery, demonstrating compliance to CE and NORSOK requirements for respiratory simulators, and a certificate of conformance. A calibration kit comprising calibration orifices and fixtures is supplied with each system.

## **TRAINING**

A full user manual is provided in English. Example test processes for all CE EN14143 and EN250 respiratory tests are also provided, including operational checklists. One day of on-site training is provided, and application or further support is available at a standard rate.

## **OPTIONS AND ANCILLIARY EQUIPMENT**

### **Mass Spectrometer**

A compact respiratory mass spectrometer with 1ms sampling period covering all normal respiratory gases is available as an additional cost option. A further LabView interface is supplied with the mass spectrometer, for real time viewing of CO<sub>2</sub>, including breath by breath, synchronised with the Respiratory Simulator. A full datasheet is available on request.

### **Hydrostatic Test Fixture**

A Stainless Steel 316 (A4) hydrostatic test tank with glass front, with gimbal mounted mannequin fixture is available as an additional cost option. The tank has 2.4KW of cooling and full water treatment. The cooling can be switched to a pressure chamber cooling function. Datasheet available on request.

### **Compact Test Chambers**

A compact 160mm I.D. test chamber is available as an additional cost option, for mounting differential pressure sensors within saturation diving complexes, or where ambient pressures on the differential pressure sensor are required. A full datasheet is available on request.

### **Primary Test Chambers**

Suppliers of primary pressure chambers depend on the application and can be introduced on request.

## **WHAT IS DELIVERED**

1. Respiratory Monitor in compact Pelican case
2. Respiratory Simulator (Breathing Machine)
3. High performance differential pressure sensor, 0 to 200mbar
4. All cables and connectors, with USB and Power cables to breathing machine having wet mateable connectors
5. USB hub
6. SubCompact Gas Heater unit
7. Laptop configured with Windows XP, Labview script, MS Office, running Intel i5, 4GB RAM, 700GB disk.
8. Data acquisition Module, USB interface
9. Fixture kit comprising P-ports, rigid tube.
10. NEDU and CE calibration orifices
11. Spares kit
12. User Manual and Quick Start Manual
13. CE Test Process and Checklist manual
14. Certificate of Conformity
15. Calibration Certificate and results
16. Air shipment boxes (2 off, 80 litre)
17. On-site training, one day
18. Three month warranty, extendable to annual support
19. One year telephone support, up to 20 hours.

## **ORDERING**

Deep Life Ltd (IBC) is represented in the UK by Open Safety Equipment Ltd, EMA Building, 30-32 Earl Haig Road, Glasgow, Scotland. G52 4JU. Tel: 0141 883 4875. Email: [support@opensafety.eu](mailto:support@opensafety.eu)

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