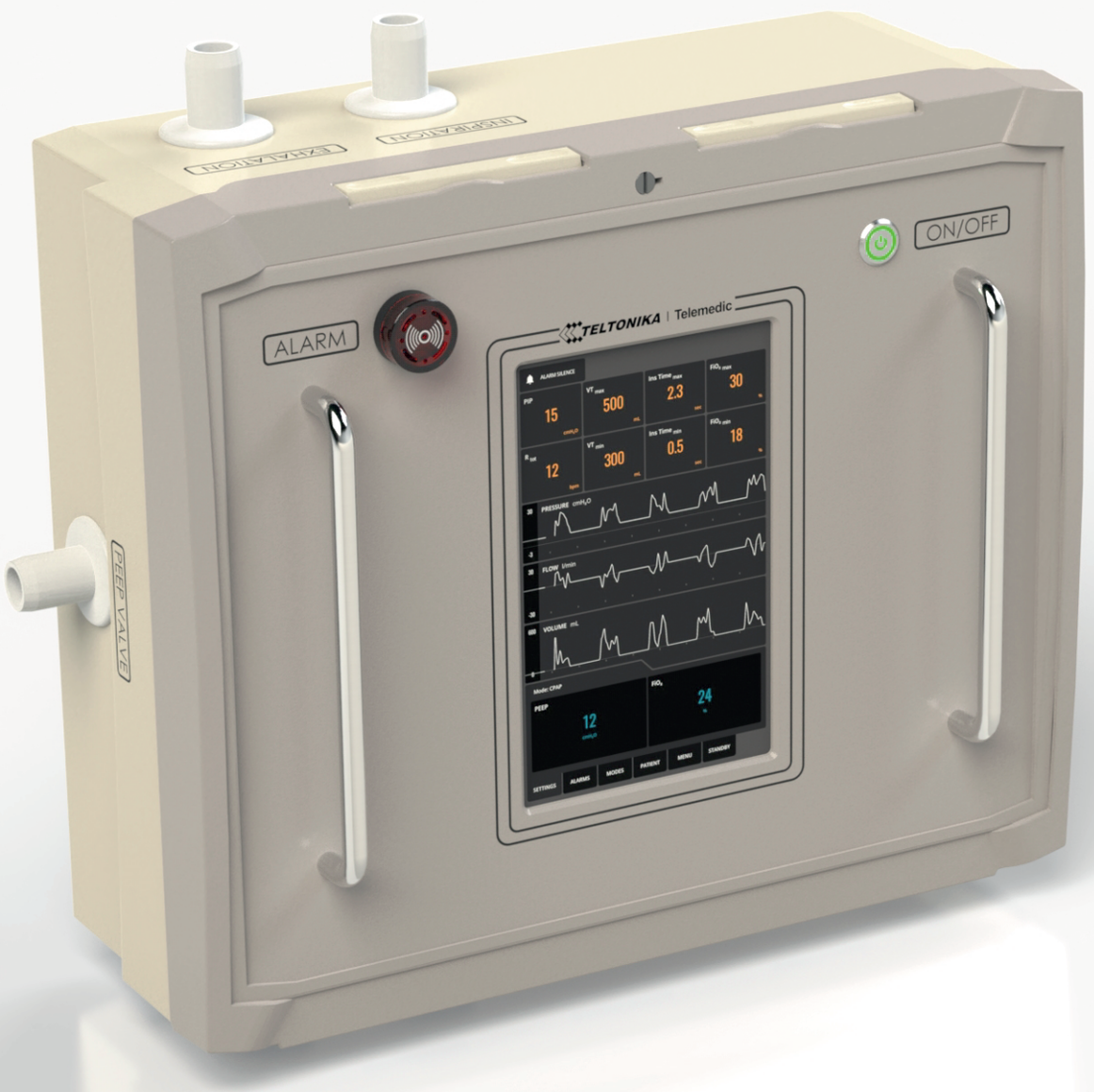
DPV100

ARTIFICIAL LUNG VENTILATOR

Artificial lung ventilator for patients and hospitals for professional use. Combining the key components required for complex pulmonary ventilators together with our knowledge in Telemetry which allows us to deliver data remotely and help save lives all over the world.



Hardware

Technology	GSM / HSPA / LTE
GNSS	A-GPS, GLONASS, GALILEO, BDS
Input voltage range	100 - 220 V AC
Internal back-up battery	10 Ah Lithium Batteries*
Dimensions	400 mm x 344 mm x 160 mm
Weight	To be defined (expected up to 10kg)
Integrated Buzzer	For alarm notifications in case of emergency
Bluetooth	4.0 BLE Optional (depending on requirements)
Flash memory	16 / 32 MB (To be defined)
Firmware updates	Optional cloud-based solution
Interface	1 x RS232 1 x USB 1 x Emergency Call button (optional)
Microcontroller	STM High-performance Arm® Cortex®-M4 32-bit RISC core

Display

Resolution	1280 x 800 pixels
Contrast ratio	16:10 ratio (~189 ppi density)

Monitoring parameters

Pressure[1]	Inspiratory and Expiratory pressure (cmH_2O)
Flow[2]	Inhale and Exhale flow (l/min)
Volume[3]	Tidal Volume (lung Volume, ml)
PIP[4]	Peak Inspiratory Pressure (cmH_2O)
R_{tot}[5]	Total Respiratory Rate (1 bpm)
VT_{max}[6]	Maximum Tidal Volume (ml)
VT_{min}[7]	Minimum Tidal Volume (ml)
Ins. $Time_{min}$[8]	Minimum Inspiratory Time (sec)
Ins. $Time_{max}$[9]	Maximum Inspiratory Time (sec)
FiO_{2max}[10]	Maximum Fraction of Inspired Oxygen 30% to 100%
FiO_{2min}[11]	Minimum Fraction of Inspired Oxygen 18% to 90%
FiO_2[12]	Fraction of inspired oxygen (FiO_2)
Alarms[13]	Pre-set alarm settings
Modes[14]	Choose different modes - CPAP, PC-SIMV, BiPAP, PC-CMV
Patient[15]	Patient information, Body Index data, patient history, actions that have been done
Menu[16]	Set up of the display, server information, connection information, alarm settings
Standby[17]	Explanations and instructions on step by step patient disconnection from the ventilator
Alarm Silence[18]	Possibility to silence the alarm for 120s
Settings[19]	Configuration of current active mode parameters

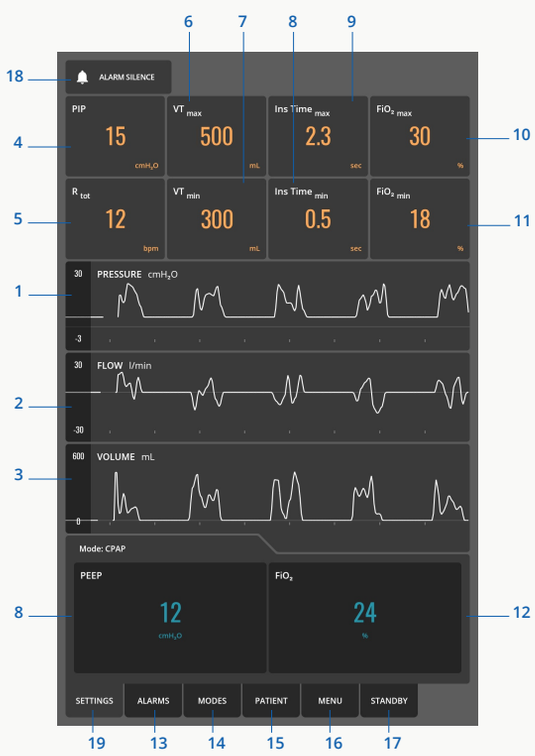


Figure 1. User Interface Display

Supported ventilation modes

CPAP	Continuous positive airway pressure
PC-SIMV	Pressure Controlled Synchronized Intermittent Mandatory Ventilation
BiPAP	Two level positive airway pressure
PC-CMV	Pressure Controlled Continuous Mandatory Ventilation

Alarms

Low VT	Range: 30 to 2000ml Resolution: 10 ml Default: 300 ml (Lower threshold for breath cycle volume)
High VT	Range: 80 to 3000ml Resolution: 10 ml Default: 2000 ml (Upper threshold for breath cycle volume)
High RR	Range: 10 to 70 bpm Resolution: 1 bpm Default: OFF
Ambient air pressure sensor	If the ambient air pressure sensor malfunctions, notification is displayed on the screen and sound alarm is being activated
Inhale/Exhale pressure sensor	In case of malfunction in inhale/exhale pressure sensors the notification is displayed on the screen and sound alarm is being activated
Oxygen flow sensor	If the ventilator detects oxygen flow sensor failure, it still can work, but FiO2 parameter is not allowed to changed. Notification is displayed on the screen and sound alarm is being activated
Inspiratory/Expiratory air flow sensor	If the sensor has failed while the ventilator was working, ventilator still works according to valves control commands which were previously set. In case of failure notification is displayed on the screen and sound alarm is being activated
Oxygen proportional valve	If an oxygen proportional valve failure is detected. Notification is displayed on the screen and sound alarm is being activated
PEEP control	If the PEEP control solenoid failed, ventilator may still work without PEEP pressure maintenance. Notification is displayed on the screen and sound alarm is being activated
Electricity shutdown	In case when there is unexpected electricity shut down, the ventilator can still operate up to 2-4 hours from internal batteries. Notification is displayed on the screen and sound alarm is being activated

General settings
*Values are subject to change

PIP	Range: 0 to 20 cmH2O Resolution: 1 cmH2O
Min. VT	Range: 30 to 2000ml Resolution: 10 ml
Max. VT	Range: 80 to 3000ml Resolution: 10 ml
Min. Ins. Time	Range: 0.1 to 2.8 s Resolution: 0.1 s
Max. Ins. Time	Range: 0.8 to 3 s Resolution: 0.1 s
Min. FiO_2	Range: 18 to 90% Resolution: 1%
Max. FiO_2	Range: 30 to 100% Resolution: 1%
R_{tot}	Resolution: 1 bpm

Certification
*In progress

Regulatory	CE, E-mark ISO16750-2:2012 ISO 80601-2-84:2018 LST EN ISO 80601-2-12:2011 EN 794-3;2002+A2;2009

Security

1	Upon turning on the ventilator all system, sensors and valves functionality are being checked. If malfunction has been detected, notification is displayed on the screen and sound alarm is being activated.
2	In case of electricity shutdown, internal batteries will allow to operate from 2 to 4 hours. It is designed in such way that even if a short electricity shutdown occurs, it would not affect any operations of ventilator.
3	Additional air pressure, air flow and oxygen sensors double check the pressure of supplied air and oxygen mixture as well as volume and concertation. Even if one of the primary valves or sensors fails – ventilator ensures that patient would be supplied with oxygen.
4	DPV100 always performs self-check procedure and checks the parameters. In case of failure of any sensor, valve or other component will result alert notification and sound alarm will be activated.