

# OP-Vent 3.0 User Manual

Bill Dally

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## 1. Prepare Op-Vent for Use

1. Plug in the 12V power supply
2. Attach an air or blended air/O<sub>2</sub> supply to the input port (30-120PSI). Use of a hose clamp or an air quick-connect is recommended. The input should be connected directly to a source of air pressure – do not place a flow regulator between the pressure source and the input.
3. Attach a two-limb breathing circuit to the “To Patient” and “From Patient” ISO 5356 connectors.
4. Attach a ¼ inch OD tube from the “Pressure Monitor” port on Op-Vent to a pressure monitor fitting at the patient end of the breathing circuit.
5. Attach the patient end of the breathing circuit to the patient or lung simulator

DO NOT ADJUST THE PRESSURE REGULATORS. The unit will need to be recalibrated if the pressure regulators are adjusted.

## 2. Set The Ventilation Parameters

Turn the left encoder knob to select a parameter. Turn the right encoder knob to select a value for the parameter. Settable parameters are:

| Parameter                    | Range                                | Units               |
|------------------------------|--------------------------------------|---------------------|
| Mode                         | Vol, Press, Vol Assist, Press Assist |                     |
| Tidal Volume                 | 50-800                               | mL                  |
| Respiratory Rate             | 5-40                                 | Breaths/minute      |
| I:E Ratio                    | 2:1 to 1:4                           | Ratio               |
| Maximum Pressure             | 100-600                              | mm H <sub>2</sub> O |
| PEEP                         | 0-200                                | mm H <sub>2</sub> O |
| Press Assist Flow Fraction   | 1/8-7/8                              | Fraction            |
| Spontaneous Trigger Pressure | 5-50                                 | mm H <sub>2</sub> O |
| Alarm Maximum Pressure       | 100-700                              | mm H <sub>2</sub> O |
| Alarm Low Minute Volume      | 0-30000                              | mL                  |
| Alarm High Minute Volume     | 0-30000                              | mL                  |
| Alarm Disconnect PIP         | 0-200                                | mm H <sub>2</sub> O |

In addition, the following variables can be observed, but not set.

| Parameter      | Units  | Description                            |
|----------------|--------|----------------------------------------|
| Tidal Volume   | mL     | Delivered on last breath               |
| Minute Volume  | mL     | Volume delivered over last minute      |
| PIP            | mm H2O | Peak pressure on last breath           |
| PEEP           | mm H2O | End expiratory pressure on last breath |
| Input Pressure | PSI    |                                        |
| Input Voltage  | Volts  |                                        |

### 3. Run Op-Vent

Press the left knob to turn Op-Vent on. Pressing this knob a second time turns Op-Vent off. Turning Op-Vent off while in a mandatory ventilation mode will sound a half-second alarm.

### 4. Operating Modes

Op-Vent has four operating modes that are selected via the dials.

#### 4.1. Volume (V)

In Volume or Volume Control mode, Op-Vent regulates air flow to deliver the requested volume while monitoring pressure and ensuring that pressure does not exceed the specified pressure. If the maximum pressure is reached pressure will be regulated until the end of the inspiratory period. The end of the inspiratory period is timed with the time computed based on the respiratory rate and I:E ratio. In this mode all breaths are mandatory and triggered by timing – no spontaneous breathing.

#### 4.2. Pressure (P)

In Pressure or Pressure Control mode, Op-Vent regulates pressure at the requested pressure setting while monitoring volume to ensure that the tidal volume does not exceed the specified amount. If the maximum volume is reached, flow will be stopped until the end of the inspiratory period. The end of the inspiratory period is timed with the time computed based on the respiratory rate and I:E ratio. In this mode all breaths are mandatory and triggered by timing – no spontaneous breathing.

#### 4.3. Volume Assist (v)

In Volume Assist mode breathing is triggered by the patient with mandatory backup. The trigger sensitivity is set by the spontaneous trigger pressure setting. The respiratory rate specifies the delay until a backup mandatory breath is delivered. As in Volume mode flow is regulated to deliver the specified tidal volume during the inspiratory period and pressure is monitored to ensure that the pressure does not exceed the specified maximum pressure. The end of the inspiratory period is timed with the time computed based on the respiratory rate and I:E ratio.

#### 4.4. Pressure Assist (p)

In Pressure Assist mode breathing is triggered by the patient with mandatory backup. The trigger sensitivity is set by the spontaneous trigger pressure setting. The respiratory rate

specifies the delay until a backup mandatory breath is delivered. As in Pressure mode pressure is regulated to the specified pressure and volume is limited to ensure that the tidal volume does not exceed the specified amount. If the maximum volume is reached, the inspiratory period is ended. If the maximum volume is not reached, the inspiratory period is ended when the flow decreases to a specified fraction of the maximum flow.

## 5. PEEP

PEEP can be set either by using a mechanical PEEP valve on the exhaust port or electronically via the PEEP setting (sixth selection option). Electronic PEEP uses an adaptive algorithm to determine when to turn the exhale valve off during the expiratory period. It may take up to 10 breaths for it to converge on the desired PEEP value. The actual PEEP on each breath is reported on line 3 of the display (see below).

## 6. Alarms

Persistent alarms are triggered on:

| Condition          | Description                                                                  |
|--------------------|------------------------------------------------------------------------------|
| Disconnect         | PIP below disconnect threshold for 3 breaths                                 |
| Pressure           | Alarm pressure threshold exceeded                                            |
| Low Minute Volume  | Minute volume below set threshold                                            |
| High Minute Volume | Minute volume exceeds set threshold                                          |
| Apnea              | Two breaths are triggered by mandatory backup in spontaneous breathing modes |
| Low Input Voltage  | Supply voltage below threshold                                               |
| Low Input Pressure | Input pressure below threshold                                               |

In addition, a transient alarm for a half-second is triggered on stopping ventilation when in a mandatory ventilation mode.

To reset an alarm, press the right knob.

## 7. The Display

### Line 1: Current ventilation parameters

Vvvv Rrr E:I.a.b Ppp M

|     |                        |             |
|-----|------------------------|-------------|
| vvv | Requested tidal volume | mL          |
| rr  | Respiratory rate       | Breaths/min |
| a.b | E:I ratio              |             |
| pp  | Maximum pressure limit | cm H2O      |
| M   | Mode (V, P, v, p)      |             |

Here V and P indicate volume and pressure modes. Uppercase is mandatory ventilation and lower cases is assist.

**Line 2: Parameter currently being set and its value**

**Line 3, vent stopped: Computed Values**

Ffff tbb oo Mmmmm

|      |                        |       |
|------|------------------------|-------|
| fff  | Computed flow rate     | mL/s  |
| bb   | Breath time            | 0.1 s |
| oo   | Inspiratory period     | 0.1s  |
| mmmm | Computed minute volume | mL    |

**Line 3, vent running: Measured Values for last breath**

TVvvv Ppp Eee Mmmmm

|      |                                |        |
|------|--------------------------------|--------|
| vvv  | Actual delivered tidal volume  | mL     |
| pp   | PIP                            | cm H2O |
| ee   | PEEP                           | cm H2O |
| mmmm | Actual delivered minute volume | mL     |

**Line 4, vent running: Instantaneous Values**

Rx taa Ppp Fff

|    |                        |                                  |
|----|------------------------|----------------------------------|
| x  | I or E                 | Inspiratory or Expiratory period |
| aa | Time in current breath | 0.1s                             |
| pp | Current pressure       | cm H2O                           |
| ff | Current flow           | mL/s                             |

In addition, the highest priority current alarm – if any – is displayed on line 4, overwriting the values normally displayed.