**Open Source Ventilator**

Controller Module

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This module is essentially a timer that turns two valves on or off. When the inspiratory valve is open, the exhalation valve is closed and vice versa.

Respiratory rate (RR) = Number of breaths per minute (bpm)

Breath duration = 60 s/RR; e.g., for 10 bpm, breath duration = 60/10 = 6 s

Inspiratory:Expiratory time ratio (I:E ratio) = 1:2 (usually)

Inspiratory time (Ti; time in seconds spent in inspiration phase) = breath duration / (1 + I:E) = 6/(1+2) = 6/3 = 2 seconds

Expiratory time (Te; time in seconds spent in exhalation phase) = breath duration – inspiratory time = 6 - 2 = = 4 seconds

Tidal volume (VT) = volume of gas (ml) delivered during inspiration

For a constant flow inspiration, the flow rate to the patient is VT/(inspiratory time)

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| --- | --- | --- | --- |
| **Input** | **Data Output** | **Physical output** | **Status** |
| User selects tidal volume (see General Engineering Specifications) |  | Gas flows towards patient during the selected inspiratory time |  |
|  |  | In constant flow design, gas flows to patient at a flow rate of VT/ |  |
|  |  |  |  |
| User selects respiratory rate (see General Engineering Specifications) | Time when inspiration starts and ends | Time when gas starts flowing to patient  Time when gas stops flowing to patient | Not claimed; No one working on it yet |
|  | Time when exhalation starts and ends | Time when gas starts flowing from patient  Time when gas stops flowing from patient | No one working on it yet ; No one working on it yet |
|  |  |  |  |
| **Electromechanical design (no software)** |  |  |  |
| User selects respiratory rate (see General Engineering Specifications) | Time when inspiration starts and ends | 12 V delivered to inspiratory valve  0 V to exhalation valve | No one working on it yet ; No one working on it yet |
|  | Time when exhalation starts and ends | 12 V delivered to exhalation valve  0 V to inspiratory valve | No one working on it yet ; No one working on it yet |
|  |  |  |  |
|  |  |  |  |
| **Electromechanical design (software)** |  |  |  |
| User selection for tidal volume and respiratory rate (see General Engineering Specifications) | Variable “INSPIRATORY\_VALVE\_ON” is true when inspiration starts  “INSPIRATORY\_VALVE\_ON” is false when inspiration ends | 12 V delivered to inspiratory valve  0 V to exhalation valve | No one working on it yet ; No one working on it yet |
|  | Variable “EXHALATION\_VALVE\_ON” is true when exhalation starts  “EXHALATION\_VALVE\_ON” is false when exhalation ends | 12 V delivered to exhalation valve  0 V to inspiratory valve | No one working on it yet ; No one working on it yet |
|  |  |  |  |
| **Pneumatic Design – May require specialized parts that may be out of stock** |  |  |  |