UNITRONICS®

Partnering to Combat the Global Medical Ventilator Shortage

One Integrated Solution for Precise Medical Ventilator Control & Automation

Rapidly achieve CONTROL of any Ventilator requirement with Unitronics

PLC
+HMI
ALL IN ONE™

Clear Status View | Color TOUCH Displays | Flexible & Customizable | Alarms: Audible & Visual | Compact & Low Weight | Easy to Use | Operate Panel while Gloved

Proven High Performance | Immediate Product Supply | 24/7 Technical Support | Easy Integration with Any CPR System | Notifications sent to Mobile

Global Challenge: Rapid Ventilator Production

Ventilators save lives—and there is a world-wide shortage. The global pandemic crisis is creating a vast surge of severely ill patients whose only hope for survival is mechanical ventilation. Medical procurement agents are in fierce competition to purchase ventilators, factories are retooling to produce them, and grassroots engineering initiatives are in full swing.

Never before has the global village been so united against a common threat.

Unitronics Meets the Challenge: Easy Automated Ventilator Control

The requirements of ventilator control are complex.

Note that any ventilation mode, invasive or non-invasive, can be easily automated with Unitronics PLCs in order to comply with changes in recommended treatment.

In this document, we provide general examples and guidelines for achieving Continuous Pressure Control using Unitronics PLCs, HMIs, and related components.

Unitronics: Medical Device Benefits

Our Operating Panels display clear, waveform displays of patient status—and reduce risk to your staff:

- ✓ Gloving: TOUCH Panels may be operated by gloved personnel
- ✓ Quarantine: Access and control the Ventilator remotely, via mobile phone or tablet
- ✓ Built-in Alarm system: set Alarms, send Alarm notifications to staff's mobile phones
- ✓ Manage Staff Access: easily set access levels, for example nurse, respiratory therapist, physician
- ✓ Easy Integration: integrate with any CPR System

Our PLCs are 21 CFR Part 11 READY!

Ventilator, Pressure Control, and Pressure Support Modes

General Example

This example is based on a UniStream PLC & HMI, controlling a Ventilator operating in Continuous Pressure Control mode.

The Ventilator application shown below is displayed on the HMI screen—and may also be displayed on a mobile phone screen or tablet.

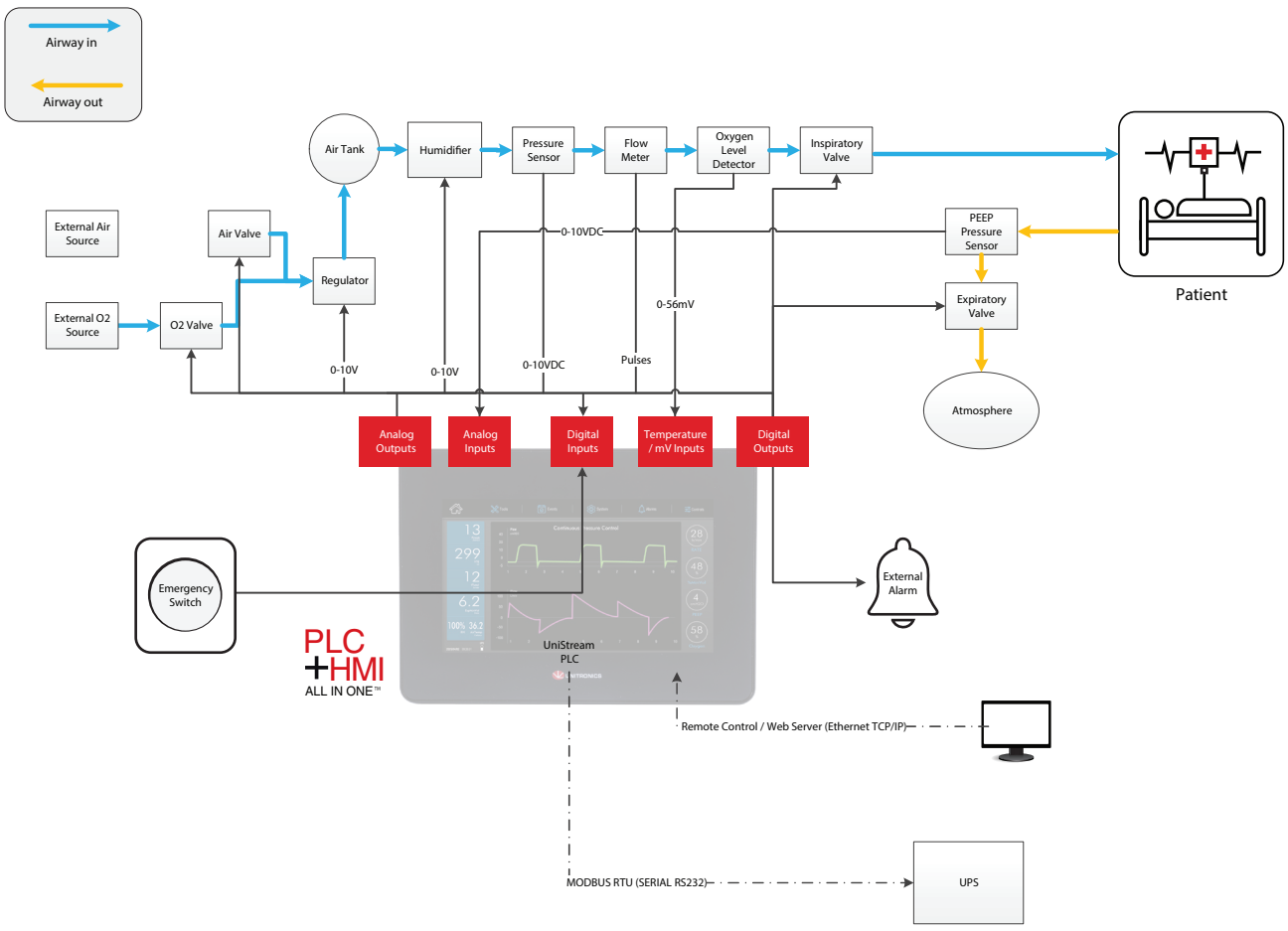
Unitronics HMI

Via the HMI, medical staff can:

- ✓ **Access and change settings for:**
  - Breathing Rate
  - Inspiratory / Expiratory Rate
  - Supplied Pressure
  - Positive End-Expiratory Pressure (PEEP) control
  - Oxygen level
- ✓ **View flow and pressure graphs**
- ✓ **View and respond to Alarm notifications, via HMI screen or mobile**
- ✓ **View ventilator and patient's vital data, including:**
  - Actual Pressure
  - Lungs Volume
  - Actual PEEP

Ventilator Application: General Functional Design

This diagram shows the general design and parameters of a typical Continuous Pressure system.



*UniStream PLC is available in two modes:
UniStream PLC+HMI All-In-One, and also UniStream PLC with a virtual HMI and UniStream display, to allow PLC mounting separately.

Functional Diagram

User Input Parameters

- Rate [breath / min]
- Inspiratory / Expiratory rate [% of breath cycle]
- Airway Pressure [cm H_2O]
- Positive End-Expiratory Pressure (PEEP) [cm H_2O]
- Fraction of Inspired Oxygen (FiO_2) [%]
- Operational mode: Pressure Support / Pressure Control
- Minimal volume alarm set-point [%]
- Supplied air temperature and RH [%]

System Monitored Parameters (basic)

- Actual Pressure [cm H_2O]
- Exhaled Tidal Volume [ml]
- Actual PEEP pressure [cm H_2O]
- Graph - PEEP pressure
- Graph - Airflow

Operation Principles

This section covers the main principles of ventilation: Continuous Pressure mode and Pressure Support mode.

- Manage Oxygen % levels using both Air and O_2 proportional valves
- Manage the breath cycle, according to defined rate and inspiratory / expiratory rate defined during the setup process
- Stop ventilator operation in case of emergency input

Inspiratory management

Continuous Pressure Mode (Does not allow for patient-initiated breaths.)

- During the inspiratory cycle, the system keeps the inspiratory valve open, and the expiratory valve closed
- The system tracks the inspired air volume using the airflow sensor

Pressure Support mode (Allows the patient to breathe spontaneously)

- When both inspiratory and expiratory valves are closed and pressure drops to "0" (during spontaneous breathing), the system opens the inspiratory valve to support the inspiratory process
- The system tracks the inspired air volume using the airflow sensor

Expiratory management

- During the expiratory cycle, the system keeps the expiratory valve open and the inspiratory valve closed, **as long as the measured PEEP pressure is higher than the configured PEEP set-point value**

Pressure Support mode

- If the expiratory valve is closed and PEEP pressure raised, the system keeps the expiratory valve open until the pressure reduces (during spontaneous breathing)

Alarms: General Principles

These are examples of situations that can trigger Alarms. Alarms will be displayed on the HMI screen, CRP recorded, and notifications can be sent to staff's mobile.

- Inspiratory volume must be above the minimal volume defined
- Leakage Detection - If tank output pressure does not reach the set airway pressure
- During the expiratory process, PEEP pressure must fall. If there is no change during the minimal timeout period, set alarm (Valve Fault)
- During the inspiratory cycle, airflow pressure must fall (timeout delay). If it does not, set alarm (inspiratory valve fault)
- Supplied air temperature low
- Supplied air temperature high
- Filters replacement

How to Select your Unitronics PLC Controller

Unitronics offers a broad range of PLCs for your specific application requirements—the choice is yours.

- PLC series—UniStream, Vision or Samba series
- HMI color TOUCH display: screen sizes range from 3.5 to 15.6”
- I/Os – Built-in I/Os and I/O expansion modules
- Powerful Data Capabilities—log, manipulate, and export patient data

Unitronics also offers full lines of Servos and VFDs for mechanical application aspects.

Unitronics' PLCs are field-proven in control applications worldwide and have won a number of industry awards. Easy to use, dynamic and economical, Unitronics’ controllers have been automating processes, systems, and stand-alone applications in diverse fields for over 30 years. With Unitronics’ controllers, customers can better optimize their processes and improve control of site electricity consumption, thereby using less energy and contributing to a greener & healthier world.

Unitronics is an award-winning market leader that has earned the respect and admiration of industry experts and customers around the world, and is the clear choice for innovation, quality and service. For more information, visit **https://unitronicsplc.com/**

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INTEGRATED
SOLUTION
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• PRECISE MEDICAL VENTILATOR CONTROL & AUTOMATION •

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