PendoTECH Virus Filtration-Depth Filtration Process Control & Data Acquisition System

- Adds automation and data collection to your process
- Complete process control with pre-programmed functions for different process steps including filter flush and automated process endpoints
- System interaction via a PC-based Graphical User Interface
- Features use of PendoTECH Pressure Sensors that are available from a luer size to 1 inch inner diameter
- No limitation on process scale - from milliliters and up
- Integrates with different types of pumps and different brands of scales

Product Overview:
- Completely and efficiently automates your Virus Filtration-Depth (VF-DF) Filtration Process
- 3 pressure measurements with PendoTECH Pressure Sensors which can be re-used extensively or other pressure sensors
- Functions that automate all process steps include:
  1. Manual - control valves and pump manually by clicking on the GUI graphic
  2. Run Pump (pump runs but no endpoint with valves in default positions)
  3. Prefilter Flush with Total Flow Endpoint
  4. Second Filter (Virus Filter) Timed Flush
  5. Product Filtration with Air Detector Endpoint
  6. Product Filtration with Filtrate Scale Endpoint
  7. Recovery with Filtrate Scale Endpoint
- Engineered system uses an optionally interchangeable fluid path that may be project/product dedicated to prevent cross contamination
- Interact with the system via an easy to use graphical user interface (GUI) that includes a trending module with many advanced features
- Alarms for process parameters that shuts-down the pump
- Alarm features include a delayed detection on the minimum inlet pressure that can stop the system if the inlet pressure drops due to a flow path problem
- Pre-alarm setpoints for notifications and email alerts
- Automation and alarm features allow the system to be operated with minimal user interaction
- Completely sealed front panel for use in clean environments where frequent wipe-down is required.
- Process control via integration of industry standard scales and pumps
- Can be used at different process scales by entering the pump set-up in the software

- pH probe input via a BNC connector that can accommodate standard pH probes and the GUI includes an easy to use probe calibration wizard
- Conductivity probe/flow cell input to embedded conductivity transmitter with temperature display and compensation
- Non-invasive Air detector with delay time programmable, can be used as a product filtration end-point
- Filtrate flow meter input for optional rotary flow meter, ultrasonic flow meter, or other that includes the ability to totalize flow
- Two inputs available for other sensors with 4 - 20 milliamp outputs to enable collection of additional process data that can be configured for decimal places and alarms points
- CE tested for EMC and LVD
**Process Overview**

The system functions are controlled by the tubing pinch valves and via pump control and sensor & scale monitoring. There are 3 pairs of valves in which one valve is normally closed and the other is normally open. The pair is always actuated in sync so the open valve closes and the closed valve opens which serves to re-direct flow. The available functions are:

1. Manual- control valves and pump manually by clicking on the GUI graphic
2. Run Pump (pump runs but no endpoint with valves in default positions)
3. Prefilter Flush with Total Flow Endpoint
4. Second Filter (Virus Filter) Timed Flush
5. Product Filtration with Air Detector Endpoint
6. Product Filtration with Filtrate Scale Endpoint
7. Recovery with Filtrate Scale Endpoint

Selectively, the system can be custom-configured in the software to remove Filter 3 or any pair of valves if not required for a specific process. The pH, conductivity and external sensors can also be optionally selected for display on the system view.

The process is represented in the following schematic:

**Graphical User Interface - Simplifies Control System Interaction**

The GUI is designed for use with a mouse or touch-screen operation. Clicking a numeric field is followed by appearance of a pop-up key pad for data entry. Values entered that are out of range are rejected with a message. There are four tabs for easy navigation:

1. Setup View- used to enter experiment information, function selection, set alarms and to create a data file where all process data will be stored
2. System View- used to view current process values and change pump flow rate
3. Trends View- ability to trend process variables that is loaded with features to dynamically view the data of interest, ability to quickly auto-scale or manually scale the axes, and ability to export a trend of interest either as data or a graphics file
4. Maintenance View- used to set up pump, calibrate pH and conductivity via easy to use wizards, select units of measure, configure flow meter and more. The system can be customized to remove Filter 3 or any pair of valves if not required for a specific process. The pH, conductivity and external sensors can also be optionally selected for display on the system view.
System

Functions Include:

- Zero pressure sensors
- Select conductivity range
- Calibrate pH
- Set units of measure
- Set-up pump
- Customize system view for specific processes
- Configure the flow meter
- Zero flow meter total
- Set range of external signals
- Exit program

Setup

- Estimated flow rate can be calculated by an algorithm based on the change in filtrate scale rate.

Trends

- Slide to change cursor value
- Options to select Auto-scale or Manual scale on all axes
- Powerful tools to zoom, export an image of the current trend and much more
- Quickly compare current values to cursor value
- Ability to change plot update rate
- Export the current trend only to open in software such as Excel

Precision and Accuracy

- Filter names appear above
- pH, conductivity, analog 1 & 2 appear here if enabled on the Maintenance Tab
- Flow only appears if flow meter configured
- Estimated flow rate can be calculated by an algorithm based on the change in filtrate scale rate.

Maintenance

- Customized System View
  Example with all options selected as NO:
Technical Details

The system comes with the required cables to enable the system to be quickly up and running. All the connections are keyed to prevent connection of a cable to the wrong connector. The pump and scale may be delivered with the system or existing equipment or self-procured equipment may be used. A scale selection menu on the process control system is used to quickly configure the RS232 parameters for the different scale brands. The pump cable is supplied to interface to the remote control connector on the user selected pumps as shown in the example below.

Pressure sensor cables provided with the system accept the PendoTECH Single Use Pressure Sensors (below). Even though these are called single use, they are robust enough to be cleaned and re-used for process development work or dedicated campaigns where cross-contamination is not a concern.

### PendoTECH Single Use Pressure Sensors

<table>
<thead>
<tr>
<th>Detail</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (HxWxD)</td>
<td>6.125” x 16” x 11.5” (15.5975cm x 40.64cm x 29.21cm)</td>
</tr>
<tr>
<td>Weight</td>
<td>8 lbs (3.6 kg)</td>
</tr>
<tr>
<td>Enclosure Material</td>
<td>304 Stainless Steel</td>
</tr>
<tr>
<td>Power Requirements</td>
<td>100 - 240 Volts, 50 - 60 Hertz, 2 amp max</td>
</tr>
<tr>
<td>Pressure Sensor Inputs</td>
<td>PendoTECH Pressure Sensors default configuration- other full-bridge type sensors optional</td>
</tr>
<tr>
<td>Pump Control</td>
<td>Speed Control: 4 - 20mA</td>
</tr>
<tr>
<td></td>
<td>Start/Stop: Relay 3 - 48VDC, up to 3A continuous</td>
</tr>
<tr>
<td>Air Detector Input</td>
<td>5V Digital input with 24VDC supply</td>
</tr>
<tr>
<td>Flow Meter Input</td>
<td>5V Digital pulse input with 5VDC or 24VDC supply</td>
</tr>
<tr>
<td>Spare Inputs</td>
<td>Two - both 4-20mA</td>
</tr>
<tr>
<td>pH Input</td>
<td>Standard probe input via BNC connector</td>
</tr>
<tr>
<td>Conductivity Input</td>
<td>4 wire input (2 wires for 100 ohm Pt RTD)</td>
</tr>
<tr>
<td></td>
<td>K=1 or K=10 with range selectable for either 0-19.99mS or 0-199.9mS</td>
</tr>
<tr>
<td>Scale Inputs</td>
<td>RS232 Communication</td>
</tr>
<tr>
<td>PC Requirements</td>
<td>Windows XP, Windows 7 or Vista, 2 GHz or faster, 2 GB of RAM</td>
</tr>
<tr>
<td>Cart</td>
<td>2 Standard Designs, contact PendoTECH for details</td>
</tr>
</tbody>
</table>

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