

## PendoTECH Bioreactor Sensor Transmitter

### Background

The Bioreactor Sensor Transmitter enables the seamless integration of specific non-invasive sensors that may be found on single use bioreactors to a bioreactor control system. The signals coming from the sensors are all conditioned within the transmitter box to signals that can be readily integrated to traditional control systems. The inputs to the transmitter include the Presens dissolved oxygen (dO<sub>2</sub>), pH, and CO<sub>2</sub> sensors and a PendoTECH Single Use Pressure Sensor. A temperature input via connection of a 100ohm platinum RTD or a 4-20mA signal is also available to enable automatic temperature compensation for the dO<sub>2</sub>, pH and CO<sub>2</sub> readings. Temperature compensation for the pressure sensor is handled directly on the pressure sensing chip. All sensor information is displayed on the touch-screen for easy viewing. Both analog and digital outputs from the transmitter are available for pressure, dO<sub>2</sub>, pH, and CO<sub>2</sub>. The dO<sub>2</sub> and pH sensors are critical for measurement of the process conditions so they can be controlled within the required range. CO<sub>2</sub> may also be useful as a measurement or also a control parameter.

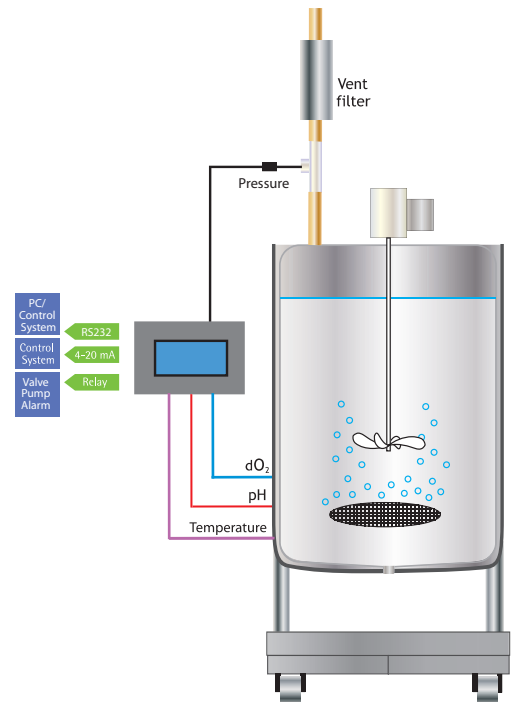
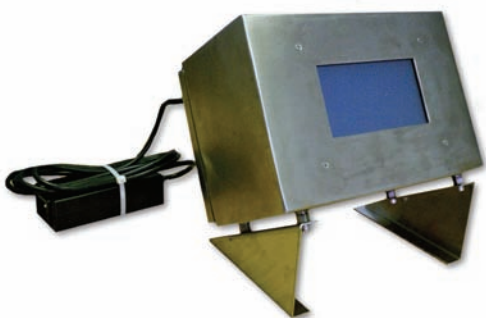


The pressure sensors are also frequently used on single use bioreactors to measure pressure in the bag or other vessel. The required resolution is often less than 1 psi. In bioreactors, gases are introduced to the sterile vessel to both the liquid phase of the media and the gas phase in the head space to both supply the cells with the required oxygen and to control process conditions. The exhausted gas exits via a vent filter from the head space and it is important to use a filter of adequate size and construction to prevent it from clogging or becoming occluded with water. Also, pressure is used as a means of influencing mass transfer and mitigating contamination. However, an over pressure situation in a glass or single use bioreactor can occur at rather low pressures and a clogged vent filter can cause a vessel to rupture, particularly on a single use bioreactor bag, spilling the contents of the reactor and exposing the operators to unprocessed bulk creating a potentially hazardous situation.

### Key Features:

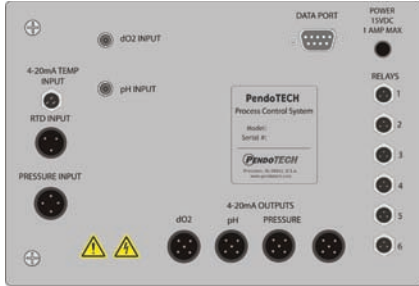
- Easy to use touch screen interface mounted in a stainless steel enclosure.
- Ability to monitor and display the pH, dO<sub>2</sub>, and CO<sub>2</sub> by communication with the Presens boards via RS232 communication. This includes the ability to send the current temperature to the boards so the temperature correction can be applied.
- Ability to enter a sensor lot number and to view this lot number along with calibration data
- Ability to input temperature via a 100ohm Pt RTD, a 4-20mA signal, or manual input
- Ability to measure bioreactor pressure and zero the pressure sensor at atmospheric pressure
- Transmitter function with 4-20 mA values for pH, dO<sub>2</sub>, CO<sub>2</sub> and pressure with panel mount screw terminal connectors for easy connection of field wiring.
- Six software configurable relay outputs (for alarms and future possibility of process control by turning on/off gases and pumps)
- Indication on display of an optical probe disconnected (or not installed properly), software will send 22mA from the output ports.

- Set-up mode for required functions including calibration which includes the ability to enter standard calibration values that are provided with the Presens sensor or the ability to do a manual calibration

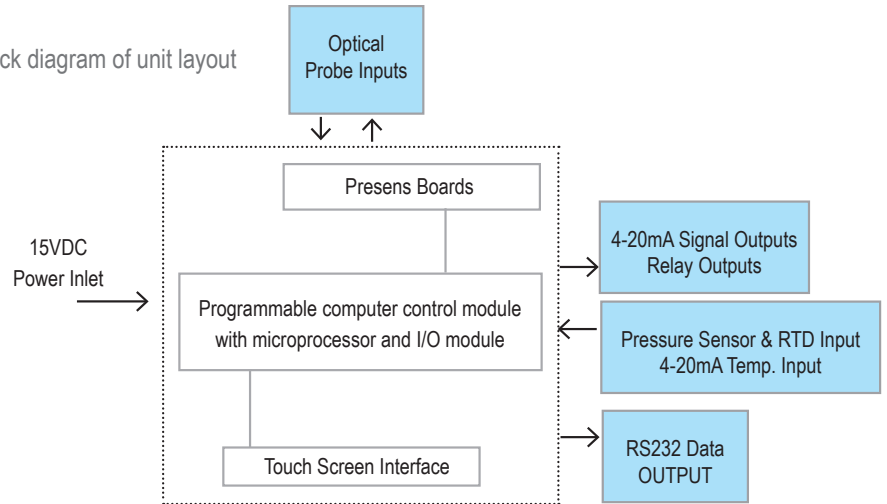


## How It Works

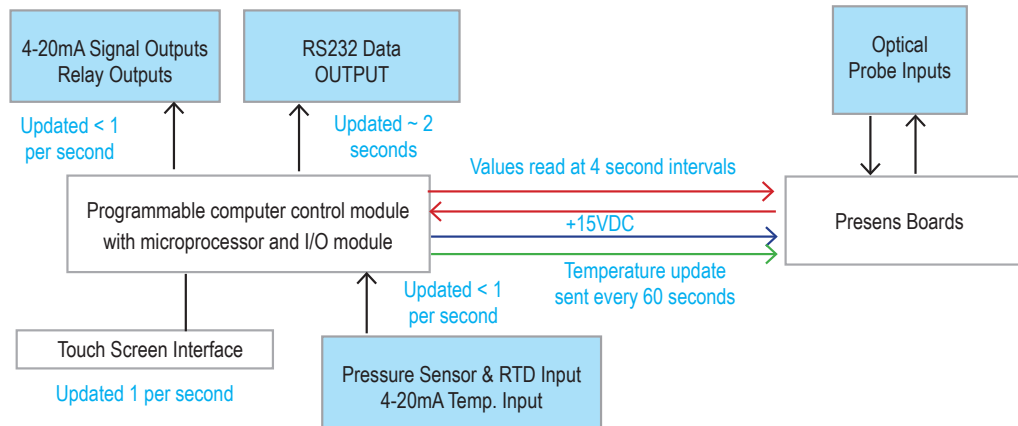
Back panel schematic is as follows  
(CO2 not shown on back panel):



Block diagram of unit layout



The PendoTECH embedded computer control module microcontroller is used to manage the activity of all the inputs and outputs as shown in the following diagram:



Detail	Specifications
Enclosure Dimensions and Materials	H x W x D: 6.23" x 9" x 5.69", 304 stainless steel, NEMA4 Design (if proper connectors used) 3/8 inch stand-offs on base with mounting hole size for 10-32 screw
Weight	Approx 8 lbs
Touch screen user interface	Bright white-on-blue cold-cathode fluorescent (CCFL) backlit touch screen-operated graphical user interface on a high-contrast 128x240 pixel display with a size of 5" x 4"
Power Supply	15 VDC supply with IEC 320 cord connection, for 100 – 240 Volts AC, 50 – 60 Hertz, 2 amp max
Temperature Humidity Operating Range	All components rated to a temperature range of 0 to 40- C and 0 to 95% relative humidity, no condensation
Presens Optical Sensing Inputs	Fiber optic probes connected to the sensors are read by the Presens mini boards by RS232
Pressure Sensor Input	Configured for PendoTECH Single Use Pressure Sensors
RTD Input	3 wire 100ohm Pt RTD input to PendoTECH Temperature RTD Module, better than +/- 0.1C accuracy in the range of 2-50C.
Analog Input Temperature	200Ω (to 50 mA input, dynamic resistance drops toward 100Ω for greater currents), Protected to -30V, +15V, or +100mA steady state input, 16-bits ( 0 - 65,535 counts)
Relay Outputs	Control loads requiring 3 to 48 VDC, Switches up to 3 Amps, Max surge current: 12 A for 10 msec, Optically isolated to 2500 Vrms, Max turn on/off time: 50 /300 us
Integration: Analog Signal Outputs	Output compliance up to 10V, Any resistance ≤ 500Ω, 12-bits ( 0 - 4095 counts) DO NOT APPLY 24VDC (LOOP POWER) TO THE SYSTEM. THE SYSTEM SOURCES THE REQUIRED VOLTAGE TO PROVIDE THE mA SIGNALS
Integration: Data Output	RS232: Serial communication Ethernet: CONTACT US FOR MORE DETAILS



*Non-invasive probe shown next to traditional probes in single use bioreactor*



*Picture of back panel*