![PENDOTECH® Adding Value To Your Process]

PendoTECH Data Acquisition System™

The PendoTECH DAQ System features the ability to read 14 sensors/devices. With its ease of use, any user will be up and running in minutes. The DAQ PC Software features the ability to trend the data real-time and collect the data to a file that can be opened by programs such as Excel. The software can optionally perform calculated values such as DeltaP and trans-membrane pressure that are used for certain filtration applications. There is an alarm output that can be connected to a pump for shut off in case of an alarm condition. All configuration of sensors for the inputs is done via the PC software, including the option to name them.
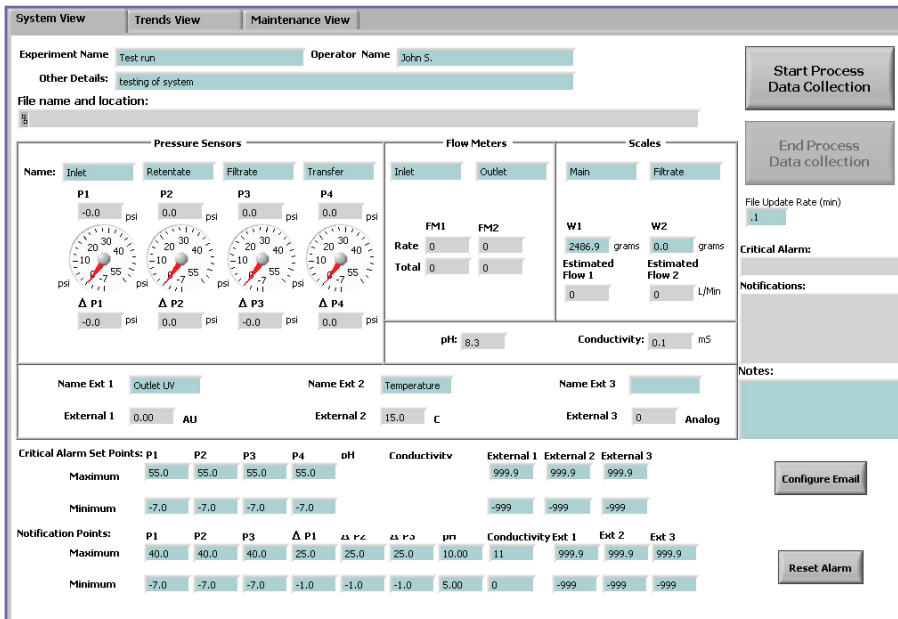
Collect All Sensor Data to a Central Interface. Optimized for Integration of Single Use Sensors.

Available inputs are:

- Four pressure measurements with PendoTECH Single Use Pressure Sensors™ which can be re-used extensively or with other pressure sensors/transducers
- Two Scales
- Two Flow meters
- One pH probe
- One PendoTECH Single Use Conductivity Sensor
- One Air in tube detector
- Three Analog inputs configurable for other sensors such as UV, temperature, and turbidity
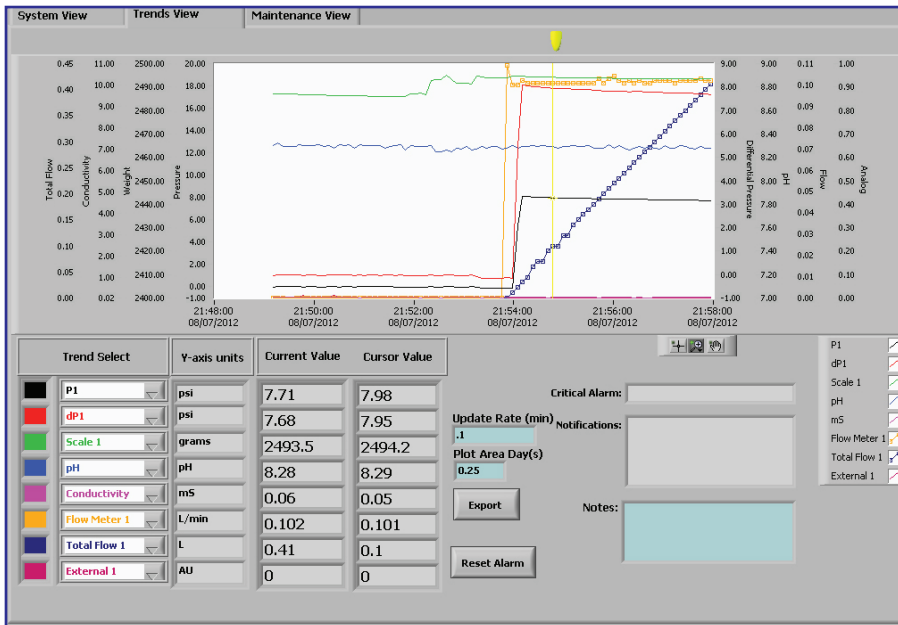
All data may be real-time trended and saved to an Excel file on the hard drive. The Trending Module has advanced features for scaling axes, viewing tools for zoom, and the ability to compare current and past values with the cursor value tool.

The PC Software also includes a built-in data server to exchange data with OPC client software such as PI from OSI soft®.

The analog inputs are configured in software for name, range, units of measure, and digits of precision. To these inputs, different sensors such as the PendoTECH Temperature Sensor, UV Sensor, Turbidity Sensor or other sensors can be connected via their 4-20mA transmitter. This data can be trended and recorded with the other data.

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Overview

The DAQ System hardware includes 6 foot re-usable cables to connect the pressure sensors. Other sensors/devices include connection cables with the system. Reading of all sensors and monitoring of alarms is done within the system.

The DAQ System is connected to a PC's USB ports. The software has a System View tab to name the sensors, enter process details, and start a data file. The Trends View tab allows viewing of data real-time and is loaded with features to customize the data view or even export the subsets of data to a file that can be opened in Excel. There is also the ability to enter electronic notes which are logged to the data file. The Maintenance View is used to configure the sensors. There is a keypad/LCD on the front of the control system that is primarily reserved for initial system configuration and diagnostics.

DAQ System Hardware
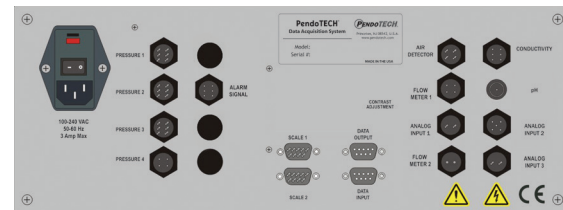
Back Panel Schematic
(Models with built in temperature sensor reading, the temperature input replaces with ANALOG INPUT 3)

System View

The System View can be used to enter sensor names. If nothing is entered, the default name will be shown in the data file. At the top, information can be entered that is specific to a process run/experiment. This data is written to the header of the data file when the .CSV data file is created. The data file location is also displayed. The data file may be updated at a rate of every 6 seconds or slower. All of the inputs to this view are locked out when the "Start Process Data Collection" button is clicked. Alarm setpoints are entered on this tab along with pre-alarm notification points which can be used to generate email alerts or text alerts using the built-in mail program. With pop-up key-pad entry of numbers, the software is convenient for mouse or touch-screen use.

Flow meters totalize flow in addition to display of flow rate

System

- Tab Navigation
- Enter information that is written to data file header
- Blue cells are used to name sensors
- Gauges are scaled to min/max pressures
- DeltaP calculations
- Configurable Analog Inputs
- Critical Alarm Points Entered
- Notification Points

- Start writing data to file
- Select file update rate
- A Critical Alarm and Notifications appear in these fields
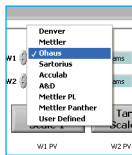- Estimated flow (by weight change can be activated)
- Electronic Notes Entry Field
- Opens email notification setup

System View | Trends View | Maintenance View

Experiment Name: Test run
Operator Name: John S.
Other Details: testing of system
File name and location:

Pressure Sensors

Name: Inlet | Retentate | Filtrate | Transfer

	P1	P2	P3	P4
	-0.0 psi	0.0 psi	0.0 psi	0.0 psi
ΔP	-0.0 psi	0.0 psi	-0.0 psi	0.0 psi

Flow Meters

Inlet | Outlet

	FM1	FM2
Rate	0	0
Total	0	0

Scales

Main | Filtrate

	W1	W2
	2486.9 grams	0.0 grams
Estimated Flow 1	0	Estimated Flow 2 0 L/Min

pH: 8.3   Conductivity: 0.1 mS

Start Process Data Collection
End Process Data collection
File Update Rate (min): .1
Critical Alarm:
Notifications:
Notes:

Name Ext 1: Outlet UV   Name Ext 2: Temperature   Name Ext 3:
External 1: 0.00 AU   External 2: 15.0 C   External 3: 0 Analog

Critical Alarm Set Points:

	P1	P2	P3	P4	External 1	External 2	External 3
Maximum	55.0	55.0	55.0	55.0	999.9	999.9	999.9
Minimum	-7.0	-7.0	-7.0	-7.0	-999	-999	-999

Notification Points:

	P1	P2	P3	Δ P1	Δ P2	Δ P3	pH	Conductivity	Ext 1	Ext 2	Ext 3
Maximum	40.0	40.0	40.0	25.0	25.0	25.0	10.00	11	999.9	999.9	999.9
Minimum	-7.0	-7.0	-7.0	-1.0	-1.0	-1.0	5.00	0	-999	-999	-999

Configure Email
Reset Alarm

Data Handling

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Trends View

The PendoTECH DAQ System has the flexibility to allow customization of the plot to meet your requirements. The pick lists allow you to display the data of interest and at any time items can be added and removed from the plot area. It features auto-scaling options for all axes or manual scaling by simply typing mix/max values at an axis scale. The cursor tool is useful to compare older data versus present values. The trends view or presentation features are highlighted below. The plot with legend may also be copied as a picture for immediate placement into a report.

Trends — Cursor value selector — Customize format of trend line — Trend view tools - zoom, etc — Ability to enter electronic notes to the data file — Set trend "FIFO" rate (up to 21 days) — Ability to export data on the trend only to a file — Cursor values are shown — Present values are shown — Units of measure are shown — Available values can be selected for trending — Axis for each unit appears and can be set to auto or manual scaling with one click — Set trend update rate

Data File

The file may be located in any directory and is created when the "Start Process Data Collection" button is clicked. The data written to this file is locked by the software until the "End Process Data Collection" button is clicked. The file format is .CSV and is set to automatically open with Excel. The Notes column will remain empty unless notes are entered by the user, allowing them to be easily identified.

Sample File

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Maintenance View

In the Maintenance View, all sensors can be setup. Some are one-time setup, while others may be accessed more frequently depending on changes in configuration.

Scale setup: For optimized and reliable communication, the scale is selected from a list. Most scales with RS232 cable can be connected.

The External Inputs are configured to match the external transmitter range, the units of measure, and decimal places. External 3 can be a generic 0-10V input, or when a system is ordered, configured to accept a direct plug-in of PendoTECH Single Use Temperature Sensor without the requirement of an external transmitter.

Configure Flow Meter by entering the K value for the flow meter

Maintenance

Pressure unit choices are psi/bar

If TFF is selected, the TMP value is calculated using P1, P2, & P3

Launches two point pH calibration which trends during calibration to visualize stability.
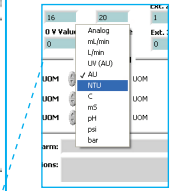
Units of measure are selected from a drop-down list

If the internal temperature sensor circuit is selected to Installed, the External 3 parameters are automatically configured and External 3 is no longer visible:

Installed is selected with the model ending in "-T"

Air Detector Configuration and Status Indicator

Turns on/off flow estimation feature
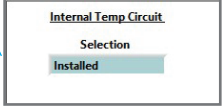
Enter pre-determined cell constant (K) from PendoTECH Conductivity Sensor for the sensor calibration
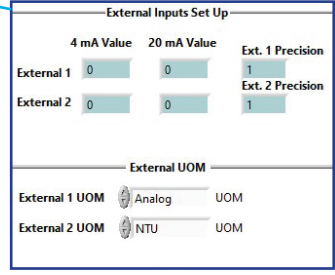
Pressure Sensors

Pressure sensor cables provided with the system accept the PendoTECH Pressure Sensors (below). Even though these are called single use, they are robust enough to be re-used for process development work where cross-contamination is not a concern. Sizes available luer, 1/8inch,1/4inch, 1/2inch, 3/8inch, 1/2inch, 3/4inch and 1inch hosebarb, as well as in sanitary flange sizes. Ultra secure tubing retainers are available for higher pressure operations.

Other sensors such as Stainless Steel transducers with full bridge - 4 wire output may be used.

Filtrate Flow Meter Options

For flow measurement, flux calculation, and total flow measurement, there are two Flow Meter inputs on the back panel. This reads a digital pulse/frequency input signal that is an available output on many flow meters. Basic flow meter measurement technology can be used to measure clean, filtered material with relatively consistent viscosity. Ultrasonic flow measurement is available with the Leviflow® Sensor. Five models are available, covering the range from 5mL/min to 80L/min. These can be used on a single use mode or re-used and have high accuracy of +/- 1%. There is also a Low Flow Ultrasonic Flow Meter capable of measuring flows in a range of 5 to 100mL/minute. This model has a low hold-up volume, an 1/16inch ID x 1/8inch OD, and a luer fitting inlet fitting for easy connection. The rotary flow meters have a 1/4inch hose barb and can measure flows from about 0.1 to 2L/min or a 1/2inch barb that can measure flows from 1.0 to 20L/min. These rotary flow meters can be used in a single use mode or re-used.

Rotary Flow Meter

Leviflow® Sensor Monitor with Sensor

Low Flow Ultrasonic

More advanced flow measurement technology is required for applications where there may be a shift in viscosity such as a Coriolis Flow Meter or magnetic flow measurement technology. There are 2 models of the PendoTECH Coriolis Flow Meter covering the range from 5 to 4,000g/min and a range of models of the BH-Coriolis available for up to 1 to 5,000g/min (NOTE: the BH Coriolis is only available with an analog output therefore can only be connected to Analog Input 1 or 2). For higher flow rates there are two mag flow meters available. The Krohne FLEXMAG 4050 offers a single use option and a wide range of flow rates that can be measured. Click here for product data sheet. The E+H Promag can measure from 2 to 45L/minute.

PendoTECH Coriolis

BH Coriolis

Krohne FLEXMAG 4050

E+H Mag Flow Meter

Integration Options

Air Detector Option

The non-invasive ultrasonic air detector senses air in a tube placed into the detector. There is an integral LED that indicates liquid presence. The tube can be opaque because the sensing mechanism is sound waves. The software has a user entered detection delay to prevent false endpoints.

The Air Detector which detects the difference between air and liquid in a tube, is integrated into the software as an alarm or indicator only. This can be used in different ways. One example is to run a fed-batch process where liquid is continuously fed to allow a batch to be continuously added to the vessel which simultaneously concentrates. Another example is for chromatography to prevent air from being pumped into column.

Air Detector Option: the non-invasive PendoTECH air-in-tube detector can be used as an indicator only or an alarm selectable between liquid to air or air to liquid. This could be used to shut off the pump via the alarm output signal at the end of a process step.
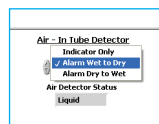
Conductivity Sensors

The system measures conductivity via the PendoTECH Single Use Conductivity Sensor which is also robust enough for cleaning and extensive reuse. The sensors are available in a range of sizes. All sensors have a pre-determined cell constant that is printed on their tag which is entered into the software. Temperature compensation performs normalization to 25°C and have a measurement range of 0 to 100mS.

pH

Single Use Probe inserted into the 2 flow cells

pH measurement is integrated to the system. The probe can be removed from the cell for calibration with buffers using the software's pH calibration wizard. The PendoTECH Single Use pH Probe may be re-used, however, in applications where cross contamination is desired to be avoided, it can be easily replaced with a new one. The probe must be calibrated before use, then inserted into the flow cell and hand tightened. The flow cell is available in two sizes: 1/4inch hose barb and 3/4inch sanitary flange.
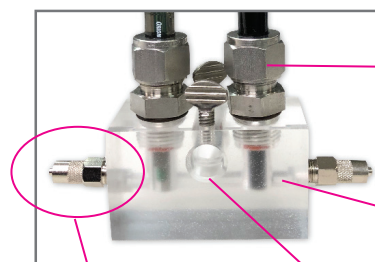
WARNING: Maximum pressure of 15psi/1 bar

Lab Scale Flow Cell for a Variety of 12mm OD Probes

PendoTECH has available lab scale flow cell made of acrylic material. It could be used to make measurements from 12mm OD probes and features a low hold-up volume. It can be used with a pH probe that connects directly to the pH input on the rear panel of the system. And additionally it can be used for probes connected to 3rd party transmitters that are connected to one of the analog inputs. For example, this could be used to measure a second conductivity, dissolve oxygen or other. If only one probe is to be used there is a blank available to seal the second probe port. The probe port blank can also be used to seal the port during cleaning if the probe is removed.

Acrylic Flow Cell shown with 12mm OD epoxy conductivity probe & 12mm OD polysulfone pH probe.

Compression fitting to secure probe

Low hold-up volume fluid path

Available with different fitting options

1/2inch hole for mounting

WARNING: Maximum pressure of 15psi/1 bar

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Integration Options

Temperature

Temperature is displayed in the software system view and recorded in the data file. There are several options to measure temperature - either a luer fitting for small scale, and in-line hose barb sensors, and a dip probe.

Hose Barb   *Dip Probe*   *Luer Sensor*

UV Absorbance & Turbidity

Background

In bioprocess operations, the UV absorbance of a liquid solution can identify the absence or presence of the molecule of interest. The measurement, typically at 280nm, is made by a spectrophotometer or photometer either in-line or off-line in a cuvette. A collimated beam of light passes through a sample with a defined path length and the absorbance is determined as the ratio of the light applied from the source to what passed through the sample. The PendoTECH Single Use UV Flow Cell enables the measurement to be made non-invasively and in-line. The flow cell is connected to tubing, and the measurement is made by using a compact photometer with fiber optic cables. This flow cell contains a special silica glass lens on the wall and compartments to attach the light source and detector. The stream to be measured flows between the lenses by way of tubing attached to the hose barb ends of the flow cell. The flow cell is low cost for single use applications and may be repeatedly cleaned and re-used. Additionally, stainless steel flow cell options are available.

PendoTECH's Single-Use UV Absorbance and Turbidity measurement units can measure from the bioprocess fluid streams while it is processing, resulting in less disruption to bioprocessing operations compared to off-line measurements. PendoTECH's Single Use UV Flow Cells, coupled with a unit's compact photometer with fiber optic cables, can measure the UV absorbance at 280nm without product contact. Additionally, the single wavelength LED light source in the unit is available in other popular wavelengths of 300nm and 260nm and most other wavelengths in the UV-VIS-NIR range. Our Turbidity Flow Cells and 880nm photometer can measure the turbidity of a liquid as it flows through a tube in a process. The single use cells are cost-effective for disposable applications, but also may be repeatedly cleaned and reused. The photometer has no display so via their transmitter feature they integrate to the analog input on the DAQ System to display the measured value. On the Maintenance View of the software the range of measurements and units of measure are configured. An alarm can be set to stop a pump when a certain absorbance is reached. Concentration measurement may or may not be possible because saturation may occur quickly during the concentration process because the flow cell has a fixed path length.

UV Flow Cells

Photometer   *Turbidity Flow Cell*   *Flow Cell Stands*

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Detail	Specifications
Dimensions (HxWxD)	6.125inch x 16inch x 11.5inch (15.5575cm x 40.64cm x 29.21cm)
Weight	20lbs. (9.1kgs.)
Enclosure Material	304 Stainless Steel
Power Requirements	100 - 240Volts, 50 - 60Hertz, 2amp max
Pressure Sensor Inputs	PendoTECH Pressure Sensors default configuration- other full-bridge type sensors optional
Alarm Output	Dry Contact Relay 3 - 48VDC, up to 3A continuous
AIr Detector Input	Digital input with 24VDC supply
Flow Meter Input	5V Digital pulse input with 5VDC or 24VDC supply
External Inputs	External 1 and 2: Analog Signal: 4-20mA External 3: 0-10V (External 3 can be a generic 0-10V input, or when a system is ordered, configured to accept a direct plug-in of PendoTECH Single Use Temperature Sensors without the requirement of an external transmitter). NOT LOOP POWERED, DO NOT APPLY 24VDC
pH Input	Standard probe input via BNC connector
Conductivity Input	Specifically designed to read the PendoTECH Single Use Conductivity Sensor with the K input via the software
Scale Inputs	Settings: 1200 Baud, 7 data bits, Odd parity, 1 stop bit, manual print
PC Requirements	Windows 7 or 10, 2GHz or faster, 4GB of RAM or more

Ordering Information

SYSTEM	
PDKT-PCS-DAQ	PendoTECH Sensor Data Acquisition System with alarm functions for 14 sensors/devices & PC Software
PDKT-PCS-DAQ-T	PendoTECH Sensor Data Acquisition System with alarm functions for 14 sensors/devices & PC Software with External 3 configured for PendoTECH Single Use Temperature Sensor Input

AIR DETECTOR					
Part Number	AD-16-P	AD-17-P^	AD-36-P	AD-73-P	AD-82-P
Tubing OD**	1/4inch	3/8inch	9/16inch	5/8inch	3/4inch

**Other sizes available, for more information contact PendoTECH   ^ Also works with Size 24 tubing

Ordering Information

FLOW METERS

BASIC FLOW METERS

FM-22WV	Rotor for Disposable PVDF Turbine Flow Meter 1/4inch, 0.1-1.0LPM, clip mount. With individual calibrations.
FM-22WV-E	Electronic Assembly for one PVDF rotor with 1/4inch hose barb (includes one rotor), 0.1-1.0LPM clip mount. With individual calibrations.
FM-23WV	Single Use Rotary Flow Meter, non-sterile, PVDF, 1/2inch hose barb, 0.3-20.0LPM, clip mount. With individual calibrations.
FM-23WV-E	Electronic Assembly for one PVDF rotor with 1/2inch hose barb (includes one rotor), 0.3-20.0LPM, clip mount. With individual calibrations.
FM-US-LF-C	Low Flow Ultrasonic Benchtop Flow Meter (1/16inch ID), flow range 2-200mL/min (with 24VDC power supply & output signal connector)
FM-LFS-03SU	Leviflow single use flow sensor to 0.8LPM
FM-LFS-06SU	Leviflow single use flow sensor to 8LPM
FM-LFS-10SU	Leviflow single use flow sensor to 20LPM
FM-LFS-15SU	Leviflow single use flow sensor to 50LPM
FM-LFS-20SU	Leviflow single use flow sensor to 80LPM
FM-LFS	PendoTECH Leviflow Sensor Monitor

ADVANCED FLOW METERS

PCFM-31	PendoTECH Coriolis Mass Flow Meter with 0.25inch /6.35mm ID (range 5 - 1,500grams/min)
PCFM-32	PendoTECH Coriolis Mass Flow Meter with 0.25inch /6.35mm ID (range 5 - 4,000grams/min)
FM-EH-MAG-53H15	E + H Promag 53H15, DN15 1/2inch Electromagnetic Flow Meter, 2-50LPM, 120V plug installed, 4-20mA output for integration, 1/2inch ID, 316L TC inlet/outlet, integral display with touch control - includes bracket & mount
FM-BC-14-100	Bronkhorst M14 Coriolis Mass Flowmeter with 1/2inch SF connections; flow rate range 1 - 100 grams/min
FM-BC-14	Bronkhorst M14 Coriolis Mass Flow Meter with 1/4inch SF connections; flow rate range 15 - 500grams/min
FM-BC-15	Bronkhorst M15 Coriolis Mass Flow Meter with 1/2inch SF connections; flow rate range 80 - 5,000grams/min

CONDUCTIVITY

CONDS-N-012	Single Use Conductivity Sensor, non-sterile, polysulfone 1/8inch hose barb
CONDS-N-025	Single Use Conductivity Sensor, non-sterile, polysulfone 1/4inch hose barb
CONDS-N-050	Single Use Conductivity Sensor, non-sterile, polysulfone 1/2inch hose barb

pH

PT-PH1	PendoTECH Single Use pH probe with BNC connector for Single Use Cell
PT-PH1-CELL	Flow Cell for PendoTECH Single Use pH Probe, 3/4inch SF inlet/outlet, PA12 Nylon
PT-PH1-CELL-025	Flow Cell for PendoTECH Single Use pH Probe, 1/4inch hosebarb inlet/outlet, PA12 Nylon
PT-PH1-L	PendoTECH Single Use pH probe with Single Use Cell- 1/4 inch hosebarbs, Group of 1x PT-PH1, 1x PT-PH1-CELL-025
PT-PH1-P	PendoTECH Single Use pH probe with Single Use Cell- 3/4 inch sanitary flange, Group of 1x PT-PH1, 1x PT-PH1-CELL

FOR PENDOTECH PRESSURE SENSORS	http://www.pendotech.com/pendotech-products/sensors-and-monitors/single-use-pressure-sensors/
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