

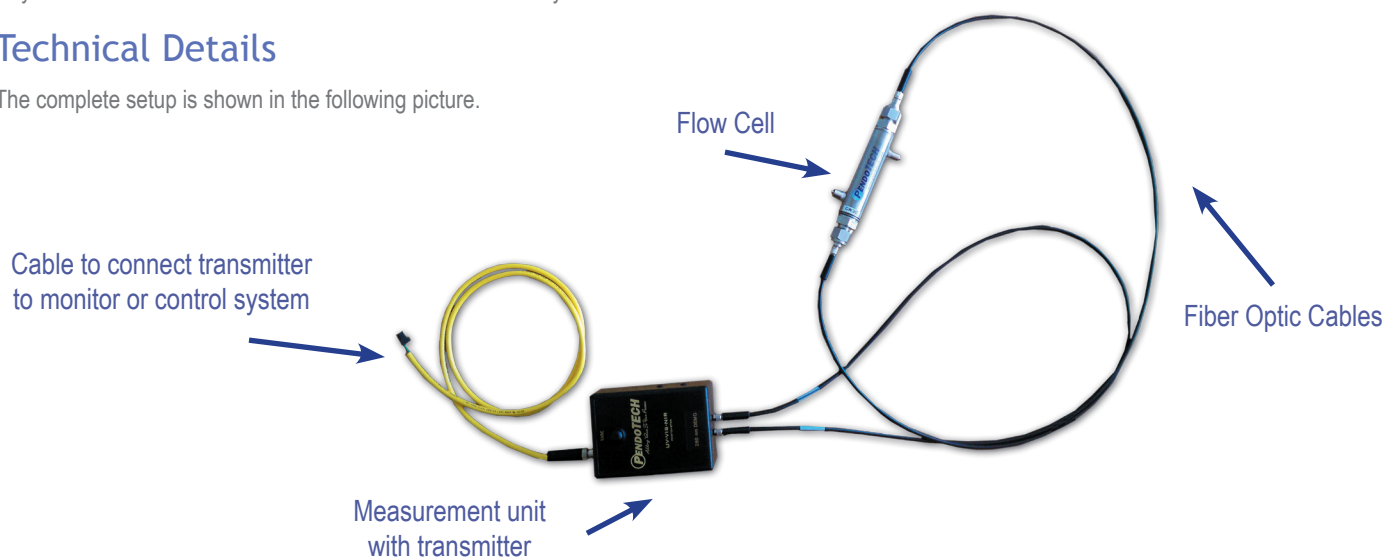
PendoTECH Turbidity Flow Cell & Measurement Unit

Background

In bioprocess operations, the turbidity of the liquid after a filter can be measured as an indication of filter performance. It can also be used to measure unclarified material such as directly from a bioreactor or fermentor. The measurement may indicate that undesired components are “breaking through” the filter meaning the filter is losing its capacity. The turbidity measurement at 880nm can be used in conjunction with pressure measurements in constant flow filtration processes to give an overall measurement of filter performance. To make a turbidity measurement, a sample may be drawn and measured off-line or an on-line measurement may be made with a device such as the PendoTECH Turbidity Flow Cell.

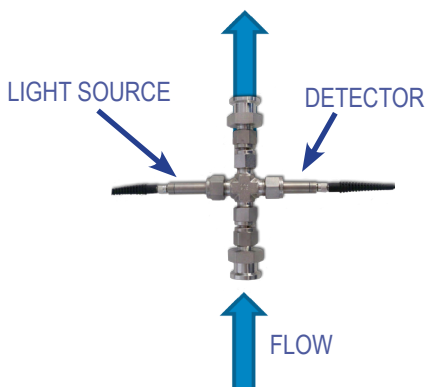
Technical Details

The complete setup is shown in the following picture.



There is no display or readout on the unit because the optical transmitter is designed to be integrated to a monitor with data acquisition capability or a control system. The raw output of the transmitter is a mA signal that is scaled from 0 to 2 absorptions units. Conversion to units such as NTUs can be made by the monitor or control system. For filter evaluation studies and filter screening with the PendoTECH Filter Screening System, one to four transmitters may be plugged directly into the system and the turbidity data can be collected with all of the other process data.

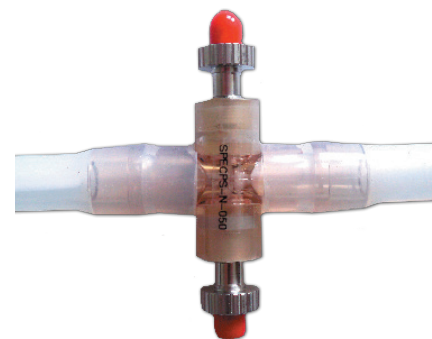
1 cm path length with TC fitting
(other inlet/outlet options available)



6.5 cm path length with luer fitting



1 cm Single Use Flow Cell

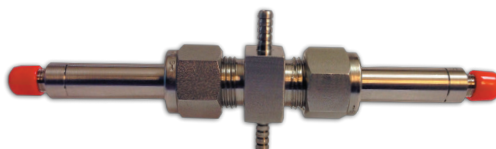


Optical Couplers Installed to Flow Cell



(Available inlet/outlet options)

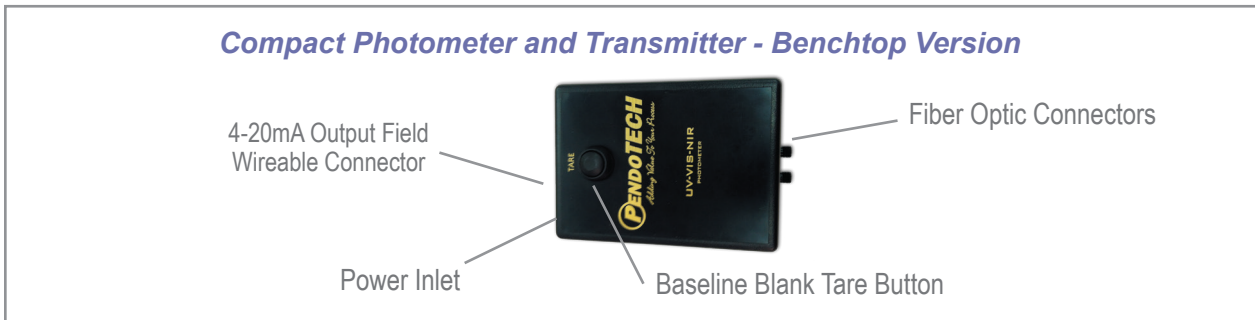
Low hold-up absorbance flow cell



6.5 cm Single Use Turbidity Flow Cell



Transmitter Details



Measuring Turbidity

The PendoTECH turbidity system operates on the principal of light scattering of particles at 880nm, which is the traditional wavelength for turbidity measurements. The raw reading of the instrument is absorption units (AUs). This can be directly correlated to NTUs that are the typical units of measurement for turbidity. The correlation of AUs to turbidity is based on the path length.

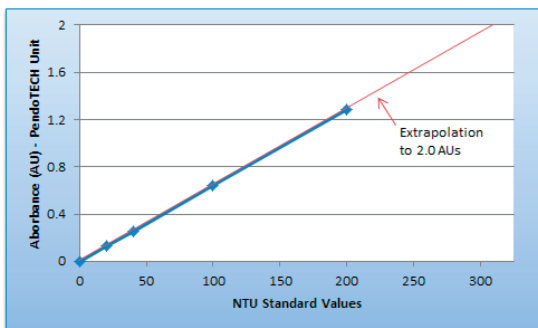
NTU Standard Measurement	With 6.5 cm path length: With turbidity standards correlation range = approximately 300 NTUs With 1 cm path length: With turbidity standards correlation range = approximately 1900 NTUs
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However, the correlation may vary between samples from different processes. For best results a product specific correlation from AUs to NTUs may be determined with two offline measurements.

Instrument Resolution

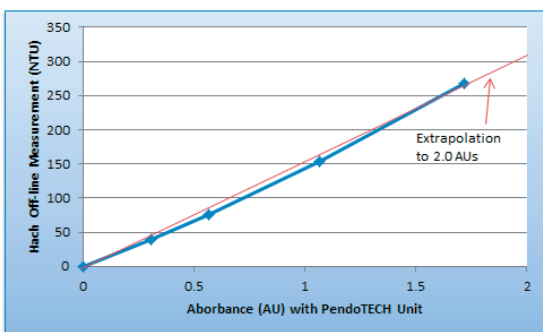
Due to the compact low hold-up design of the PendoTECH flow cells only forward scattering of light is measured. This results in a repeatability of +/- 1% of full scale measurement. For 1 cm path length the instrument can achieve +/- 20 NTUs repeatability, while the 6.5 cm path length results in approximately +/- 3 NTUs. The instrument is ideal for measuring process trends but cannot measure fine changes beyond the capabilities of the unit.

Application Detail



6.5 cm Flow Cell Comparison with NTU Standards

Commercially available NTU standards at 20, 40, 100 and 200 NTUs were circulated through the flow cell and AU values are measured from the PendoTECH unit. The results demonstrate the correlation between the standards and the results from the PendoTECH unit. The extrapolation to 2 AUs correlates to an NTU value of approximately 310 NTUs.



6.5 cm Flow Cell Used in a Fermentation/Centrifugation Process

From a fermentation process, after a centrifuge, the following results were determined comparing process data from the flow cell to samples taken and measured off-line with a HACH Turbidimeter. The performance clearly demonstrates the correlation of AUs to NTUs with a maximum value of approximately 310 NTUs.

Models Available:

SPEC-880L

Field wireable connector for mA output



SPEC-880P

Screw Terminal Connect For:

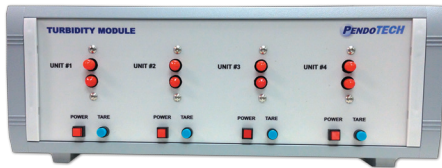
- Power
- Baseline Tare
- mA Output



Flange for Panel Mount

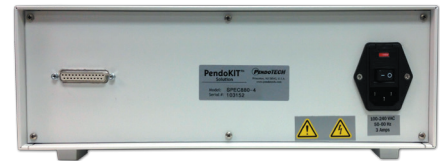
Specifications

Optical Configuration:	880nm LED Light Source and UV Silicone Photodiode; Internal Source Reference (other wavelengths available from contact PendoTECH for details) LED lifetime > 5 years	
Stainless Steel Flow Cell Properties	316 Stainless Steel with Teflon ferrules for easy removal of optical couplers for cleaning	
Single Use Flow Cell Properties:	Material: Polysulfone and fused silica with silicone - O-ring Tubing fittings: 1/2 inch hose barb	Absorbance Path length: 1cm Rated for pressure up to 75psi (5bar)
Transmitter Box	Optical connectivity via SMA905 Dimensions (WxDxH): L version 3.25 x 4.51 x 2.69 inch (not including connectors/buttons) - 82.55 x 114.55 x 68.33 mm P version 3.25 x 5.51 x 2.71 inch (not including connectors/buttons) - 82.55 x 139.95 x 68.83 mm Weight: .75 lbs (340 g)	
Power requirement	20-30 Volts DC (100-250VAC to 24VDC supply included with bench top unit)	
Output signal	4-20mA sourcing with 400ohm maximum at 24VDC via screw terminals (panel mount) or field wireable connector (bench top) Scaled to 0-2 AU with repeatability of 1% of full scale (0.02 AU) Maximum Zero Shift: < 2% of full scale (<0.040AU) Typical Response Time: 1 second Long Term Output Drift: <5% per month of full scale (<0.100 AU)	
NTU Standard Measurement	With 6.5 cm path length: With turbidity standards correlation range = approximately 300 NTUs With 1 cm path length: With turbidity standards correlation range = approximately 1900	



Four Channel Unit:

- Front Panel: Power indicator
- Back Panel: fiber optic connectors; output signals on D25 connector
- Power inlet and power switch



Ordering Information

SPEC-880L	Photometer with 880nm light source, 4-20mA output, 2 fiber optic cables, 2 optical couplers to connect to flow cell, 24VDC power supply
SPEC-880P	Photometer with 880nm light source, 4-20mA output, 2 fiber optic cables, 2 optical couplers to connect to flow cell, panel mount
SPEC-880-4	Model for 4 station unit
SPEC-880-1CM	Absorbance flow cell, stainless steel with 1 cm path length (with path length adjustable down to 0.5cm)- inlet / outlets must be specified (3/4" sanitary flange, hose barb in sizes: 1/8, 1/4, 3/8, 1/2 inch)
SPEC-880-6CM	Turbidity flow cell, stainless steel with 6.5 cm path length - inlet / outlets must be specified
SPEC-880-6CM-L	Turbidity flow cell, stainless steel with 6.5 cm path length - inlet / outlets Luer
SPECPS-N-025	Single Use Flow Cell, 1cm path length, non-sterile, polysulfone, 1/4 inch hose barb
SPECPS-N-050	Single Use Flow Cell, 1cm path length, non-sterile, polysulfone, 1/2 inch hose barb
SPEC-OC-SUT	One Replacement Optical Coupler for Single Use Flow Cell
SPEC-OC-MICRO	One Replacement Optical Coupler for Stainless flow cell
SPEC-880-1CMLH	Low hold-up Absorbance flow cell, stainless steel with 1 cm path length, 0.75ml hold up. 1/8 inch barb inlet / outlets
SPEC-880-5MMLH	Low hold-up Absorbance flow cell, stainless steel with 0.5cm path length, 0.75ml hold up, 1/8 inch barb inlet / outlets
SPECPS-880-6CM	Single Use Turbidity Sensor, 6.5cm path length, non-sterile, polysulfone, 3/4 inch Sanitary Flange Inlet/Outlet
PMAT-DAQ	Analog display with 4 inputs with alarm inputs and serial port for data collection

For warranty information see our website at <http://www.pendotech.com/warranty>