

PendoTECH® UV-VIS-NIR Dual Wavelength Photometer

Background

Measuring the absorbance of the two UV/VIS/NIR wavelengths in the same sample simultaneously has many advantages in biopharmaceutical development and manufacturing. PendoTECH® is proud to offer its popular UV/VIS/NIR photometer in a two wavelength model. The PendoTECH Dual Wavelength UV/VIS/NIR Photometer can be equipped with 2 LED light sources from 255 to 1000nm with a reading from each wavelength rate.

There are several benefits to having two simultaneous absorbance measurements in the UV/VIS/NIR region using one photometer and one flow cell set-up. It allows the user to measure two potentially very different wavelengths within the most commonly used region of the electromagnetic spectrum of 255 to 1000nm. For example, at 280nm the user could detect protein, while at 880nm turbidity could be measured in the same sample at the same time. A two wavelength photometer can be used to detect binary mixtures if the products have different absorption spectra. Additionally, measuring the absorbance of a sample at 280nm for detecting proteins and at 260nm for detecting nucleic acids and taking the ratio provides an estimate of the purity of the solution.

Technical Details and Integration

Two versions of the monitor are offered: a lab version for benchtop usage, and a panel mount version designed for industrial cabinets and process skids. The Dual Wavelength Photometer is designed to be integrated to a monitor with data acquisition capability. PendoTECH offers solutions for using the photometer such as PressureMAT PLUS models (which can in turn be used with a PC for data logging) and PendoTECH Process Control Systems. The output of the transmitter is two 4-20mA signals each spanning 0 to 3AU; the transmitter does not have a local display. Other data acquisition devices with analog inputs may be used, as well as higher level control systems like PLCs and HMIs.

Single Use UV Flow Cell Technical Details

The flow cell is shown in the pictures below with the tubing and optical couplers installed as well as with the optional flow cell stand. There are multiple sizes available - including a 1/4inch hose-barb with a 0.5cm path length, a 1/2inch hose-barb with a 1cm path length, and a 1/8inch hose-barb with a 2mm path length. The optical interface couplers are inserted into the flow cell's receptacles so the measurement can be made on the sample flowing through the cell. All polymeric materials in fluid path meet USP Class VI standards and it is assembled in an ISO 13485 facility. The flow cell may be gamma and x-ray irradiated up to 50Kgy and also may be autoclaved up to 121°C. The optical couplers can be installed directly to the flow cell to receive the fiber optic connector. Optionally, the flow cell may be placed into the stand with integral couplers.

There is no display or readout on the compact photometer because via its transmitter function, it is designed to be integrated to a monitor with data acquisition capability or a control system.



Flow Cell



Flow Cell Installed with Tubing



Optical Couplers Installed
to Flow Cell



Flow Cell Installed in the
Optional Stand



Panel Version	Lab Version
<p>Screw Terminal connections for:</p> <ul style="list-style-type: none"> • Power • Baseline Tare • mA output (2 channels) • Diagnostic output signal (alarm) 	<p>Connectors for:</p> <ul style="list-style-type: none"> • Signal input/outputs (cable included with flying leads, length - 6feet) • Power Button for Tare
	

DIN Rail Adapter Mounting Plate

PART #: PHOTO-DR

The PendoTECH Photometer is available as a standalone bench top unit or in a panel mount model. When integrating the PendoTECH Photometer into an electrical cabinet there are several mounting options available (See Technical Note: PendoTECH Dual Wavelength Photometer Monitor/Transmitter Mounting Instructions). For mounting on a DIN rail installed in a cabinet there is a customized accessory available to streamline this process. It comes with the required hardware to mount the photometer:

- 4x #6 - 32 x 3/8inch Philips pan head machine screws
- 4x #6 - 32 Hex nuts



Spring loaded latch for easy removal

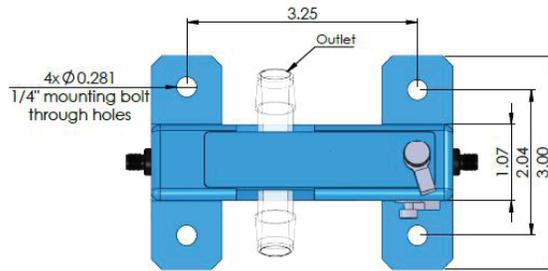
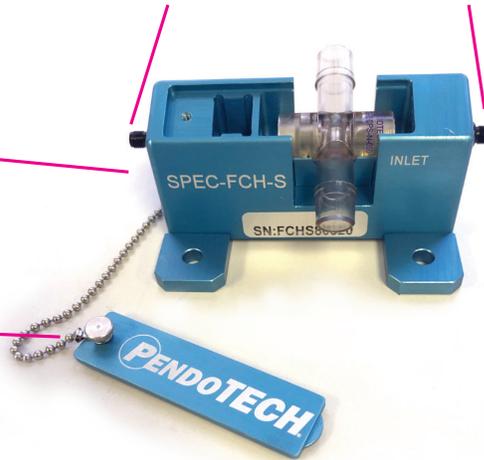


Flow Cell Stand Details:

Stand features a compartment to place light filters for photometer calibration verification

SMA905 connectors for connection of fiber optics

Removable cover with thumbwheel to secure to stand



*SPEC-FCH-S Panel Mounting
(all dimensions in inches)*

**Proper Orientation of Panel/Wall mount,
vertical liquid travel, outlet above inlet**

PART #: SPEC-FCH-S

UV/VIS/NIR Photometer Test Rig

The PendoTECH Photometer Test Rig and Standards (SPEC-280-TRS) is designed for quick and easy accuracy verification of PendoTECH's UV/VIS/NIR Photometers. The test kit includes one blank, and 5 NIST Traceable filters, a test rig for holding the filters and for connecting the photometer, and a convenient carrying case. See the datasheet for further details. (Click here for data sheet)



PART #: SPEC-280-TRS

Stainless Steel Flow Cell Options:

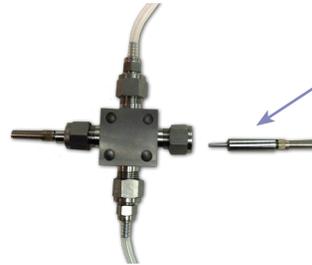
PART #: SPEC-880-1CM

Shown with Micro couplers installed; different inlet/outlet options available, sanitary flange shown. Path length from 5mm to 10mm.



PART #: SPECSS-N-ADJ-M

Nano coupler removed. With an included micrometer the path length can be adjusted, without obstructing the fluid flow, from 0.05 - 2mm.



PART #: SPEC-880-1CMLH SPEC-880-5MMLH



Low hold-up volume cell shown with 1/8inch hose-barb inlet and outlet and micro coupler installed. Available with 1cm and 0.5cm path length.

Photometer Specifications:

Optical Configuration	LED light source
Optical Connectivity	SMA-905
Mechanical	4inch (10.2cm) W x 4inch (10.2cm) L x 2.5inch (6.4cm) H Weight: ~1.5lbs.
Power Requirement	24VDC nominal, 2.7W max power
Output	4-20mA (Active/sourcing) spanned 0-3AU
Analog Loop Resistance	500ohms at 24VDC
Operating Temperature	41 to 122°F (5 to 50°C)
Storage Temperature	-4 to 122°F (-20 to 50°C)
Measurement Range	0.000-3.00AU
Response Time	1 second

Maximum Zero Shift	±0.1% full scale (±0.002AU)
Accuracy	0-2AU ±1%FS (±0.03AU) ; 2-3AU ±2%FS (±0.06AU)
Long Term Output Drift	±0.1% full scale (±0.002AU)
Repeatability	±0.5% full scale (±0.015AU)
LED Lifetime	> 2 years
Available Wavelengths	255-1000nm
Diagnostic Output Signal	The UV/VIS/NIR photometer's indicator LED will glow RED , indicating an alarm condition. For panel mounted units, 2 dedicated alarm contact pins will close during the alarm. The alarm will go off if: <ol style="list-style-type: none"> 1 - The measurement detector is saturated at 100% 2 - The reference detector is saturated at 100% 3 - The reference light and dark signals are too close together

The Photometer's LED provides a specific wavelength (or wavelengths for dual channel models) range for measurement, selected to coincide with analyte-specific molecular absorbance. Shown below are three example LED spectrum profile graphs, for typical LED light source wavelengths 260/280/880nm (Figures 1-3).

• **CWL (Center Wavelength):**

The wavelength of an optical source that is considered its' middle. The wavelength of the peak of the spectral density curve.

• **Important:**

If measurements are attempted on a shoulder/slope of the molecule's absorption profile, the absorbance measurement can change dramatically over the span of a few nanometers. Absorbance may never saturate as a portion of the LED's output is outside of the molecule's absorbance profile. Minute Photometer unit-to-unit absorbance variations exist due to CWL tolerance.

• **FWHM (Full Width Half Maximum):**

A measure of the range of light the LED generates. The width of an optical signal at half its maximum intensity.

• **Important:**

If the light source FWHM width is wider than the molecule's absorption peak, that will produce false, low absorption values.

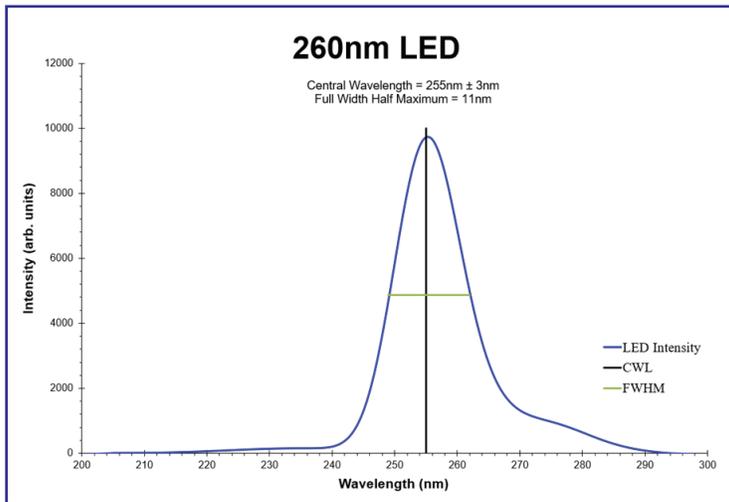


Figure 1 - LED wavelength spectrum example for 260nm UV-VIS-NIR Photometer.

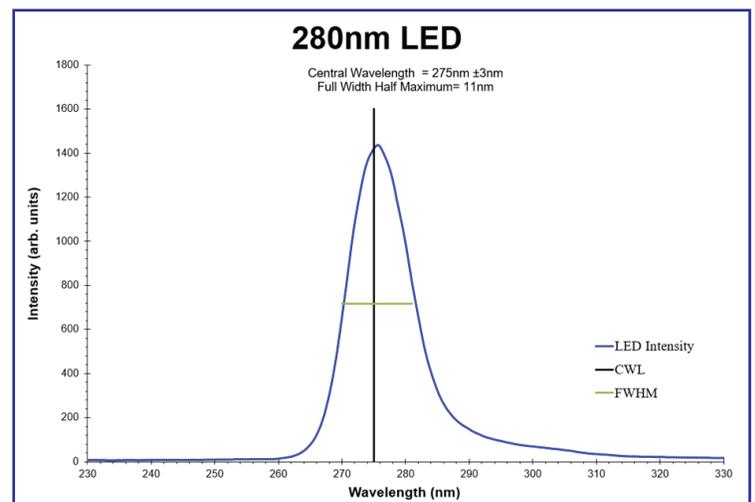


Figure 2 - LED wavelength spectrum example for 280nm UV-VIS-NIR Photometer.

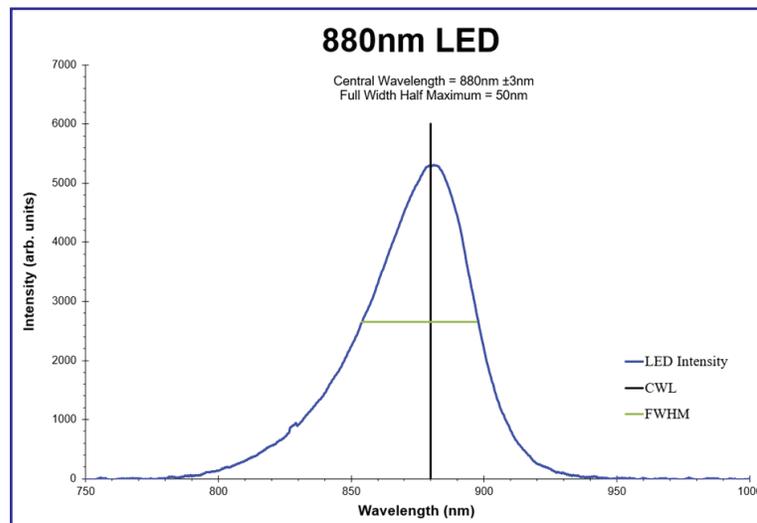


Figure 3 - LED wavelength spectrum example for 880nm UV-VIS-NIR Photometer.

Single Use Flow Cell Specifications:

Material	Polysulfone and fused silica with silicone O-ring
Pressure Range	Rated for pressure up to 75psi (5bar)
Biocompatibility	All materials in contact with product fluid path meet USP Class VI requirements
Manufacturing Environment	FDA Registered, ISO 13485 certified facility; ISO 7 clean room
Gamma Irradiation	Up to 50kiloGrays
X-ray Irradiation	Up to 50kiloGrays
Operating Temperature	2°C to 50°C (other ranges with process qualification)
Storage Temperature	-25°C to 65°C
Shelf Life	5 years

Complete System Ordering Information

Generic PendoTECH Part #: SPEC-(L,P,N)-(1,2)-(SU,RU,SU1)-XXX-YYY*	
Specify L or P	L = Lab P = Panel with flange on box base
Specify 1 or 2	1 = Single wavelength unit 2 = Dual wavelength unit
Specify SU or RU or SU1	SU = Optical couplers for use with single use flow cell RU = Optical couplers for use with reusable flow cell SU1 = Flow Cell Stand
Specify XXX and YYY (if applicable)	XXX = Wavelength # 1, i.e. 280nm YYY = Wavelength # 2, i.e. 880nm
For example, a panel mount, dual wavelength unit, measuring 280nm and 880nm with single use couplers would be ordered with the following part number: SPEC-P-2-SU-280-880.	

Each lab version photometer comes with a universal power supply



* Require separately selected flow cell. If SPECSS-N-ADJ-M is purchased, only photometer and fiber optics are necessary because integral couplers are included.

NOTICE: Each prospective user must test the sensor for its proposed application to determine its suitability for the purpose intended prior to incorporating the sensor to any process or application. The sensors are not intended for use as components in life support. The sensors are not designed for any application in which the failure of the product could result in personal injury or death or property damage. Proper safeguards must be put into place for the process in which the sensors are used.

Ordering Information



Photometers	
SPEC-L-2-XXX-YYY-PHOTO	UV Photometer w/XXX nm Light Source, 4-20mA Output, benchtop model, with 24VDC Supply. XXX = 280nm, 260nm or other, YYY = 880nm or other
SPEC-P-2-XXX-YYY-PHOTO	UV Photometer w/XXX nm Light Source, 4-20mA Output, panel model. XXX = 280nm, 260nm or other, YYY = 880nm or other
Single Use Flow Cells	
SPECPS-N-012	Single use UV flow cell, 2mm path length, non-sterile, polysulfone, 1/8inch hose-barb
SPECPS-N-025	Single Use UV Flow Cell, 0.5cm path length, non-sterile, polysulfone, 1/4inch hose-barb
SPECPS-N-050	Single Use UV Flow Cell, 1cm path length, non-sterile, polysulfone, 1/2inch hose-barb
SPECPS-880-6CM	Single Use Flow Cell, 6.5cm path length, non-sterile, polysulfone, 3/4inch Sanitary Flange Inlet/Outlet
Couplers & Cables	
SPEC-OC-SUT	One Replacement optical coupler for Single Use Flow Cell
SPEC-FCH-S	Stand for PendoTECH Single Use Flow Cells, up to 1cm path length
SPEC-OC-FIBER	One Replacement Fiber Optics Cable (3ft / 1M)
SPEC-OC-FIBER-2M	One Replacement Fiber Optics Cable (6ft / 2M)
SPEC-OC-FIBER-3M	One Replacement Fiber Optics Cable (9ft / 3M)
SPEC-OC-FIBER-T	One Replacement Fiber Optics Cable with tether (3ft / 1M)
SPEC-OC-FIBER-2M-T	One Replacement Fiber Optics Cable with tether (6ft / 2M)
SPEC-OC-FIBER-3M-T	One Replacement Fiber Optics Cable with tether (9ft / 3m)
SPEC-OC-MICRO	One Replacement Micro optical coupler for Stainless flow cell
SPEC-OC-PANEL	Panel mount SMA-905 connector (for pass through)
PDKT-UV2-FL	Cable from dual channel/turbidity photometer to flying leads, 6ft
PDKT-UV1-PMAT	Cable from channel 1 of a single or dual channel photometer to PMAT analog input, 6ft
Stainless Steel Flow Cells	
SPEC-880-1CM	Absorbance flow cell, stainless steel with 1cm path length (with path length adjustable down to 0.5cm) - inlet / outlets must be specified (3/4inch sanitary flange, hose-barb in sizes: 1/8, 1/4, 3/8, 1/2inch)
SPEC-880-1CMLH	Low hold-up Absorbance flow cell, stainless steel with 1cm path length, 0.75ml hold up. 1/8inch barb inlet / outlets
SPEC-880-5MMLH	Low hold-up Absorbance flow cell, stainless steel with 0.5cm path length, 0.75ml hold up, 1/8inch barb inlet / outlets
SPECSS-N-ADJ-M	Stainless steel UV Flow Cell, with nano couplers 0.05 to 2mm path length; inlet outlet fittings to be specified by user (3/4inch sanitary flange, hose barb in sizes: 1/8, 1/4, 3/8, 1/2inch); fibers ordered separately
SPEC-880-6CM	Turbidity flow cell, stainless steel with 6.5cm path length - inlet / outlets must be specified
SPEC-880-6CM-L	Turbidity flow cell, stainless steel with 6.5cm path length - inlet / outlets luer
Accessories	
SPEC-280-TRS	Test Rig for UV-VIS-NIR photometer
SPEC-TRS-FILT	Set of Neutral Density Standards (blank and 5 filters), 0-3AU, carrying case, with NIST certificates for each
PMAT-DAQ	Analog display with 4 inputs with alarm inputs and serial port for data collection
PMAT-DAQ-A	Analog display with 4 inputs, 4 analog outputs, alarms, and serial port for data collection
PHOTO-DR	PendoTECH Photometer DIN Rail mounting kit, includes mounting plate and mounting hardware
PHOTO-PWR	PendoTECH photometer power supply with circular barrel connector, 24VDC, 0.75amp with plugs blades for destination
PHOTO-PNL	Photometer Panel Mount Support Bracket, with 2x 1/4inch-20 X 1/2inch bolts
Interface Cables	
PDKT-UV1-PMAT	Cable from channel 1 of a single or dual channel photometer to PMAT analog input, 6ft
PDKT-UV1-PCS	Cable from channel 1 of a single or dual channel photometer to PendoTECH PCS Control System (DAQ/TFF), mA, 6ft
PDKT-UV2-1-NFFSS	Cable from channel 1 of a single or dual channel photometer to Filter Screening System train 1, analog 1 via 25 pin analog input connector
PDKT-UV2-1-NFFSSB	Cable from channel 1 of a single or dual channel photometer to PDKT-BOX-NFFSS breakout box, M8 male, mA signal, 2m
PDKT-UV2-FL	Cable from dual channel/turbidity photometer to flying leads, 6ft
PDKT-UV1-PMAT-ENC	Cable from channel 1 of dual wavelength photometer to PMAT in stainless enclosures, PMAT analog input, 2m