



# Process Downstream Analytics

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## For Biopharmaceutical Applications

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# Single-Use Pressure Sensor

## Simplify Your Pressure Measurements

**PENDOTECH has developed a line of Single-Use Pressure Sensors that offer an accurate and cost-effective solution for measuring pressure in biopharmaceutical processes.**

### Reliable Cost-effective Pressure Measurement

PENDOTECH's Single-Use Pressure Sensors measure static and dynamic pressure of gases and liquids in your bio-pharmaceutical processes – accurately and cost effectively.

### Simplified Maintenance

Robust enough to be repeatedly cleaned and inexpensive enough to be utilized in single-use applications, our Single-Use Pressure Sensors deliver a dependable alternative to stainless steel pressure transducers.

### High Measurement Stability

The sensors feature PENDOTECH High Accuracy Pressure (MEMS-HAP) Chips and are perfect for filtration and chromatography processes as well as monitoring of single-use bioreactors, filling operations and more. They are available in caustic-resistant polysulfone to withstand sanitization processes.

### Versatile

PENDOTECH's pressure sensors, which are qualified for use up to 5.17 bar (75 psi), are compatible with PENDOTECH's PressureMAT monitor/transmitter, PendoTECH's Process Control Systems or other pre-qualified third-party monitors.

Application	Description
Filtration system pressure monitoring	Single-Use Pressure Sensors can be used to monitor the TMP pressure in filtration systems to detect filter plugging and automatically adjust flow rates.
Chromatography system pressure monitoring	Single-Use Pressure Sensors can be used to monitor the pressure in chromatography systems, which is important to detect over pressurization and ensure optimal performance of the column.
Filling operations pressure monitoring	Single-Use Pressure Sensors can be used to monitor the pressure in filling operations, which is important for ensuring that the filling process is operating effectively.
Bioreactor pressure monitoring	Single-Use Pressure Sensors are crucial for monitoring pressure in bioreactors. They help detect over-pressurization due to plugged vent filters which can lead to hazardous situations and loss of product.
Other bioprocess applications	Single-Use Pressure Sensors can also be used in other bioprocess applications, such as centrifugation, virus inactivation and diafiltration.

### Transmitter selection

PENDOTECH PressureMAT transmitters are available to work with our Single-Use Pressure Sensor including the Pressure Sensor Transmitter (known as the PT card).

### Sensor selection:

#### Hose barb connections

These connections are quick and easy to make, making them a good choice for applications where frequent connections and disconnections are required. They are also recommended for pre-assembled, pre-sterilized, single-use tubing and bag assemblies.

#### Sanitary flange connections

These connections are more secure than hose-barb connections, and they are less likely to leak. They are also easier to clean and sterilize, which is important in the biopharmaceutical industry. However, they are more expensive and time-consuming to install.

#### Luer connections

These connections are the smallest and most compact of the three types. They are often used in applications where space is limited. However, they are not as secure as other types of connection.

### Validation

100% tested for accuracy and leaks during manufacturing. Available in polycarbonate or caustic resistant polysulfone materials. Certificate of Quality included with lot certification; individual NIST Certificates are optional.

### Integration flexibility

The PENDOTECH Single-Use Pressure Sensors can be integrated with a variety of systems, including: The PENDOTECH PressureMAT monitor/transmitter PendoTECH Process Control Systems and Third-party monitors.



PREPS-N-050



PREPS-N-1-1



PressureMAT Monitor



Single-Use Pressure Sensors come in a variety of sizes starting at 1/8 inch hose barb to 1 1/2 inch sanitary flange



**Features Overview**

- Available in hose-barb connections, sanitary flange & luer connections
- Can be cleaned and re-used
- Unobstructed flow path provide reduced hold-up volume
- Available in polycarbonate or caustic resistant polysulfone materials
- Certificate of Quality included with lot certification; individual NIST Certificates are optional
- Can be non-invasively tested in-place via test port

PENDOTECH Single-Use Pressure Sensors measure static and dynamic pressure of gases and liquids in your processes accurately and cost effectively. They are perfect for filtration and chromatography processes, monitoring of gases and single-use bioreactors, filling operations and more. They feature the PENDOTECH High Accuracy Pressure (MEMS-HAP) chips inside. The sensors connect to monitors via an integral connector. Suitable monitors include PENDOTECH PressureMAT monitor/transmitter, a PENDOTECH Process Control System, or other pre-qualified third party monitors. They can be non-invasively tested in-place with the PENDOTECH PressureChecker. They are the alternative cost effective solution for use with

tubing to the existing stainless steel pressure transducers on the market.

**Specifications**

Accuracy	Positive Range	Specification
	0 to 0.41 bar (0 to 6 psi)	±2% of reading
	0.41 to 2.07 bar (6 to 30 psi)	±3% of reading
	2.07 to 4.14 bar (30 to 60 psi)	±5% of reading
Vaccum Range	Specification	
	0 to -0.48 bar (0 to -7 psi)	±3% of reading
	-0.48 to -69 bar (-7 to -10 psi)	±5% of reading
Pressure Range	- 0.79 to 5.2 bar (- 11.5 to 75 psi)	
Biocompatibility	All materials in contact with product fluid path meet USP Class VI requirements, both pre and post irradiation	
Regulatory and Compliance Testing	• USP Class VI	• USP 661
	• ISO 10993-5	• Bioburden
	• ADCF	• REACH Compliant
	• Particulates	• Endotoxin
	• Bacteriostatis and Fungistatis (B&F)	• RoHs Compliant
Manufacturing Environment	ISO 9001 certified facility, Class 7 clean room	
Gamma Irradiation	Up to 50 kiloGrays	
X-ray Irradiation	Up to 50 kiloGrays	
Operating Temperature	2°C to 40°C (5.6°F to 104°F) other ranges with process qualification	
Storage Temperature	-25°C to 65°C (-13°F to 149°F)	
Input/Output Impedence	270 Ohms to 400 Ohms	
Excitation Voltage	2.5 to 10 volts DC (for best long term stability, use a lower excitation voltage)	
Sensor Output	0.2584 mV/Volt/psi	
Connector	Rating: IP67 when connected to reusable cable	
Shelf Life	5 years	
Packaging	White Tyvek and clear pouch with easy-open chevron seal; box of 25 sensors in polyethylene bags (except sterile sensors are not in polybags)	

▶ [www.pendotech.com/pressure](http://www.pendotech.com/pressure)

**Ordering Information**

Luer Sensors	Order Number
Single-Use Pressure Sensor, polycarbonate, with luer – Sterile	PRESS-S-000
Single-Use Pressure Sensor, polysulfone, with luer – Non-sterile	PREPS-N-000
0.64 × 0.64 cm (¼ in × ¼ in) polycarbonate adaptor tee with luer port	PDKT-103-03
0.95 × 0.95 cm (3/8 in × 3/8 in) polycarbonate adaptor tee with luer port	PDKT-104-03
1.28 × 1.28 cm (½ in × ½ in) polycarbonate adaptor tee with luer port	PDKT-105-03
Polysulfone 3-way stopcock with M/F luer inlet / outlet F branch	PDKT-V3PS-000

**Hose Barb & Sanitary Flange (non-sterile)**

Polysulfone	
0.318 cm (1/8 in) hose barb	PREPS-N-012
0.64 cm (¼ in) hose barb	PREPS-N-025
0.95 cm (3/8 in) hose barb	PREPS-N-038
1.28 cm (½ in) hose barb	PREPS-N-075
2.54 cm (1 in) hose barb	PREPS-N-100
1.28 cm (½ in) sanitary flange	PREPS-N-5-5
2.54 cm (1 in) sanitary flange	PREPS-N-1-1
3.81 cm (1 ½ in) sanitary flange	PREPS-N-15-15
2.54 cm (1 in) sanitary flange to 2.54 cm (1 in) hose barb	PREPS-N-1-100
1.28 cm (½ in) sanitary flange to 0.95 cm (3/8 in) hose barb	PREPS-N-5-038
1.28 cm (½ in) sanitary flange to 1.28 cm (½ in) hose barb	PREPS-N-5-050

**Polycarbonate**

0.64 cm (¼ in) hose barb	PRESS-N-025
0.95 cm (3/8 in) hose barb	PRESS-N-038
1.28 cm (½ in) hose barb	PRESS-N-050
1.91 cm (¾ in) hose barb	PRESS-N-075
2.54 cm (1 in) hose barb	PRESS-N-100

**Reusable Cable**

Cable Adapter for PendoTECH Single-Use Pressure Sensor – 3.657 m (12 ft)	PDKT-650-298
Cable Adapter for PendoTECH Single-Use Pressure Sensor – 7.31 m (24 ft)	PDKT-650-298-24
Cable Adapter to Minim 2 for Single-Use Pressure Sensor – 0.3 m (1 ft)	PDKT-650-298M2
Cable Adapter with RJ12 phone connector to Midgee Monitor for Single-Use Pressure Sensor – 2 m (6 ft)	PDKT-650-298MG
Cable Adapter with RJ12 phone connector to Pall Minim for Single-Use Pressure Sensor – 2 m (6 ft)	PDKT-650-298MN

**Test Cable**

Single-Use Pressure Sensor with 0 to 0.41 bar (0 – 6 psi) NIST certificate	PMAT-TCA
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**Did You Know**

The Pressure Sensors are 100% tested for critical quality attributes.

- Each sensor is leak tested on the liquid side at 60 psi to confirm integral assembly
- Sensors with a test port are leak tested on the test port side to confirm proper atmospheric reference
- Each sensor is tested electrically to confirm proper electrical performance
- Each sensor is tested to be accurate at 4.14 bar (60 psi) within ±5% of reading (±0.21 bar/-3.0 psi)



Flange to Hose Barb Sensor

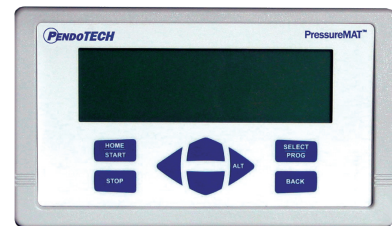


Luer Sensor



## PressureMAT Sensor Transmitter

### Designed for Single-Use Pressure Sensors



#### Features Overview

- Portable and lightweight
- Interfaces with pumps, valves, and PCs
- Displays Delta-Pressure or TMP (PMAT3 and PMAT4)
- Measures total flow volume (PressureMAT PLUS)
- Interfaces with other sensors with a 4–20 mA output (PressureMAT PLUS)
- Transmitter function delivers a 4–20 mA output signal
- RS-232 data output for data collection

#### Other Highlights

- Perfect for use with filtration and chromatography processes, as well as bioreactor pressure monitoring
- Data output capability to a PC or control system
- User configurable min/max set-points with alarm output signal
- Panel mount option with IP66 NEMA4X Front Panel
- High Resolution (HR) model available for low pressure applications that achieves 10x the accuracy of the standard unit
- IQ/OQ Protocol available

The PressureMAT (PMAT) and the PressureMAT PLUS are both monitor, alarm, and transmitter units designed for use with the PENDOTECH Single-Use Pressure Sensors. These lightweight, portable units can easily be moved around a lab or pilot plant to the location where pressure measurement is required. The transmitters use state of the art, solid state electronics, which require no calibration or maintenance. The output options simplify integration to PCs or higher level control systems and a relay switch enables interfacing with pumps and valves. Options include models with up to four pressure sensor inputs. The PMAT3 and PMAT4 models can optionally display Delta-Pressure of P1-P2 or trans-membrane pressure (TMP) for filtration processes. These calculated values can also have alarm set-points and the values can be transmitted.

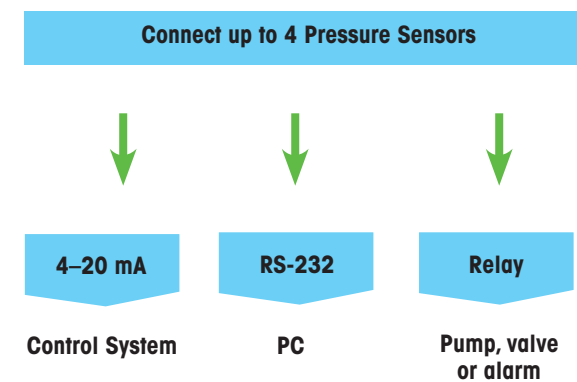
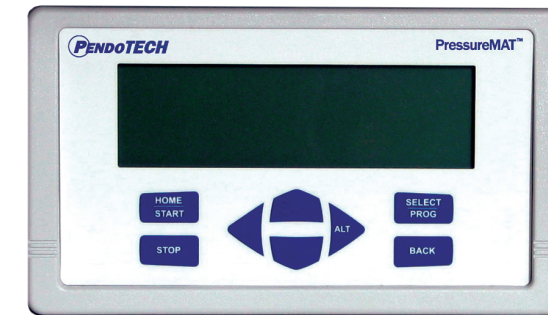
The PressureMAT PLUS system is comprised of the monitor with user interface, and connectors on the back panel where input and output components can be interfaced. It has the ability to measure total flow volume in addition to flow rate. The models with an analog input can be used to interface other sensors with a 4–20 mA output, such as temperature, UV, conductivity, pH and turbidity.

Both systems have an alarm function where minimum and maximum values are entered on the key pad and if the process value goes below the minimum setting or above the maximum setting, the system will go into an alarm state. The alarm state may be tied to the relay output to help safeguard the integrity of a process. The transmitter function delivers a 4–20 milliamp output signal corresponding to the process values on the display. The RS-232 data output to a PC is available for data collection to the PendoTECH PMAT Data Acquisition Software.

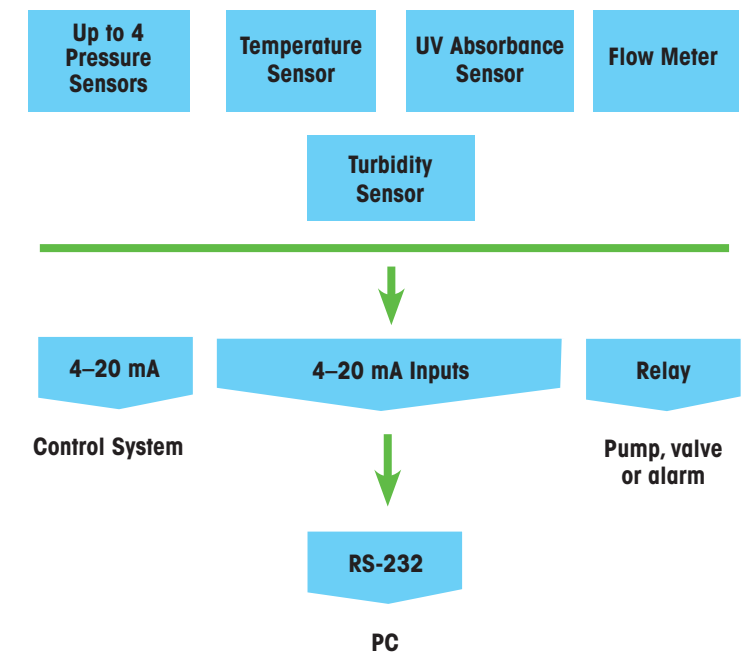
There are numerous applications in biopharmaceutical production processes where these units can be used to monitor pressure, including filtration, chromatography, bioreactor monitoring, perfusion, and fill finish operations.

► [www.pendotech.com/pressuremat](http://www.pendotech.com/pressuremat)

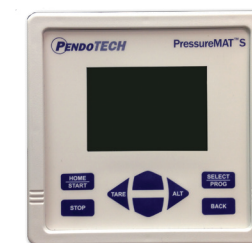
### PressureMAT



### PressureMAT PLUS



**Did You Know**  
The PressureMAT-S is a portable monitor, alarm, and transmitter ideal for application which are space limited and require for only 1 sensor. The PressureMAT-S also provides the option for remote tare.



**Did You Know**  
PressureMAT Sensor Transmitter, with a DIN rail mounting design, connects to the PENDOTECH Pressure sensor and produces a 4–20mA signal linear with pressure, offering five options for optimal performance based on pressure range.



**Specifications**

Enclosure (PMAT)	WXDXH 19.96 × 11.35 × 5.72 cm (7.86 × 4.47 × 2.25 in) Approx Weight: 0.65 kg (1.3 lbs) Material: ABS Plastic IP66/NEMA 4X front panel; panel and wall mount optional
Enclosure (PMAT-S)	11.94 × 11.94 × 5.72 cm (4.70 × 4.70 × 2.25 in) Approx Weight: 0.39 kg (0.86 lbs)
Keypad	8 button keypad with LEXAN® overlay
Display	8 line LCD backlit blue, pressure displayed as X.XX bar/X.X psi; PMAT2HR & PMAT-SHR X.XXX bar/X.XXX psi
Power Inlet	2.5 mm (0.04 in) Circular Power Jack (center post positive) or D9 12–24 VDC, 4 watts (powered by wall supply)
Pressure Sensors Input (s) Models offered with 1-4 inputs	Range of –0.793 bar to 5.171 bar (–11.5 to 75.0 psi) PMAT2HR & PMAT-SHR –0.0483 bar to 0.510 bar (–0.7 to 7.5 psi) Configured for PENDOTECH Single Use Pressure Sensors™, Connector: DA15 (includes 3.657 m (12 ft) reusable cables)
Relay Outputs(s) [Up to 4 outputs available as a combination of Relay and Analog outputs]	Specifications for relay used for the alarm output: <ul style="list-style-type: none"> <li>• Normally CLOSED or OPEN via wiring</li> <li>• 28 Volt AC/DC Maximum</li> <li>• 1 amp closure, 2 amps maximum current</li> <li>• 20 millisecc max turn on/off time</li> </ul> Configured for PENDOTECH Single Use Pressure Sensors, Connector: DA15 (includes 3.657 m (12 ft) reusable cables)
Analog Output(s) [4–20 mA] [up to 4 outputs available as a combination of Relay and Analog outputs]	Screw terminal connector 4–20 mA Range: –0.689 bar to 5.171 bar (–10 to 75 psi) PMAT2HR & PMAT-SHR –0.069 bar to 0.207 bar (–1 to 3 psi) Accuracy: 0.1% of full scale Sourcing with Maximum Load: 400 ohms Load Impedance: Zero Ohm minimum resistance, 22 mA maximum output
RS232 Output	Data output to a PC at frequency up to approx every 2 seconds Optional Internal Data Logger: Part# PDKTP-DLOG (logger not available with PMAT-S)
Regulatory Compliances	CE Mark EN61326-1:2021; EN61010-1:2010/A1:2016/C2019; EN/ISO13849-1:2015; EN60204:2018 FCC Part 15 Class B verified RoHS and REACH Compliant

**Ordering Information**

PressureMAT		
Number of Inputs	Number of Outputs	Order Number
1	2 (1 Relay/1 Analog)	PMAT-S
1	2 (1 Relay/1 Analog)	PMAT-SHR
2	4 (2 Relays/2 Analogs or 4 Relays)	PMAT2
2	4 (2 Relays/2 Analogs or 4 Relays)	PMAT2HR
2 Pressure Sensor/1 Flow Meter/1 4–20 mA	4 (4 Analogs)	PMAT2P
2 Pressure Sensor/2 4–20 mA	4 (4 Analogs)	PMAT2A
2 Pressure Sensor/2 Flow Meters	4 (4 Analogs)	PMAT2F
3	4 (3 Analogs/1 Relay - for all sensors)	PMAT3
3 Pressure Sensor/1 Flow Meter	4 (4 Analogs)	PMAT3P
3 Pressure Sensor/1 4–20 mA	4 (4 Analogs)	PMAT3A
4	4 (4 Analogs)	PMAT4A
4	4 (4 Relays)	PMAT4R

**Ordering Information**

Software	Order Number
Data Acquisition and Trending Software for PressureMAT and CMONT with 2 USB/serial cables to connect to a PC	PMATP-GUI
PressureMAT Internal Data Logger (not available with PMAT-S)	PDKTP-DLOG

**Stands/Cart**

PressureMAT Benchtop Stand for all models	PMAT-STND
PressureMAT water-tight box (PMAT NOT included) with water-tight cable connections and cart with power strip & filter holder with optional touch-screen PC with Data Acq Software	PMAT-CART4

**Water Tight Enclosures**

PressureMAT water-tight wall mount box with water-tight cable connections	PMAT-WALL
PressureMAT water-tight bench top stainless steel box with water-tight cable connections for PMAT on left side	PMAT-BNCH-IP-L
PressureMAT water-tight wall mount box with water-tight cable connections – holds 2 PressureMATs	PMAT-WALL2
PressureMAT-S single channel water-tight wall mount box with water-tight cable connections for PMAT	PMAT-WALL-S
PressureMAT, CMONT with UV Optional water-tight bench top stainless steel box with water-tight cable connections on left side	PMAT-BNCH-COMBO
PressureMAT UL Type 4X Deep-Hinged window kit with a viewing area of 20.32 cm × 22.86 cm (8 in × 9 in) (UL)	PMAT-ULT4X-W1
PressureMAT Silicone Sealant cartridge, clear, 10.1 oz for panel mount installation	PDKT-SIL-SEAL1

**Cables**

RS232 Cable for PressureMAT data output (2 m/6 ft) for USB input to PC	PDKTP-RS232U
Cable adaptor with D15 for Single Use Pressure Sensor for PMAT (4 m/12 ft)	PMAT-650-298
Cable Adapter with D15 for Single Use Pressure Sensor for PressureMAT (7 m/24 ft)	PMAT-650-298-24F
Pressure Sensor Extension Cable (4 m/12 ft)	PMAT-EXT-12F
RS232 Serial to USB adapter, for PMAT Wall/ Benchtop box (2.13 m/7 ft)	PMAT-WALL-RS232USB
PMAT Enclosure Box replacement power supply, 12VDC w/ global plug blades	PMAT-PWR-WALL-24VDC

**Accessories**

Pressure Checker pressure sensor and monitor verification tool, psi	PDKT-650-950
Pressure Checker pressure sensor and monitor verification tool, millibar	PDKT-650-950B
Test cable assembly for PressureMAT accuracy check	PMAT-TCA
Pressure sensor cable dust cover /zero simulator for PressureMAT	PDKT-650-298CVR
DIN rail mounting kit for PMAT-S	PMAT-S-DIN
Installation qualification/operation qualification protocol documentation	PMAT-IQ/OQ
PMAT Panel mount kit – 2 gaskets, 4 mounting brackets, 2 sensor cables, and input connectors for sensors and power	PMAT-PANEL-2-C
PMAT Panel mount kit – 2 gaskets, 4 mounting brackets, 3 sensor cables, and input connectors for sensors and power	PMAT-PANEL-3-C
PMAT Panel mount kit – 2 gaskets, 4 mounting brackets, 4 sensor cables, and input connectors for sensors and power	PMAT-PANEL-4-C
PMAT Panel mount kit – 2 gaskets, 4 mounting brackets, 1 sensor cable, and input connectors for sensor and power	PMAT-PANEL-S-C
PMAT2 Panel mount kit UPGRADE – 2 gaskets, 4 mounting brackets, 2 sensor cables (in replacement of standard cable), and input connectors for sensors and power	PMAT-PANEL-2-U
PMAT3 Panel mount kit UPGRADE – 2 gaskets, 4 mounting brackets, 3 sensor cables (in replacement of standard cable), and input connectors for sensors and power	PMAT-PANEL-3-U
PMAT4 Panel mount kit UPGRADE – 2 gaskets, 4 mounting brackets, 4 sensor cables (in replacement of standard cable), and input connectors for sensors and power	PMAT-PANEL-4-U
PMAT-S Panel mount kit UPGRADE – 2 gaskets, 4 mounting brackets, sensor cable (in replacement of standard cable), input connectors for sensor and power	PMAT-PANEL-S-U
PENDOTECH PressureMAT Power supply with circular barrel connector, 12VDC, 1amp with plugs blades for destination	PMAT-PWR
Pinch Valve Pair – 24VDC supply & relay input for each normally closed valve – Small for 0.318 cm (1/8 in) ID	PDKT-PVE2-PMAT-S
Pinch Valve Pair – 24VDC supply & relay input for each normally closed valve – Medium for 0.64 cm (1/4 in) ID	PDKT-PVE2-PMAT-M
Pinch Valve- 24VDC supply & relay input for normally closed valve- Small for 0.318 cm (1/8 in) ID	PDKT-PVE-PMAT-S
Pinch Valve- 24VDC supply & relay input for normally closed valve- Medium for 0.64 cm (1/4 in) ID	PDKT-PVE-PMAT-M

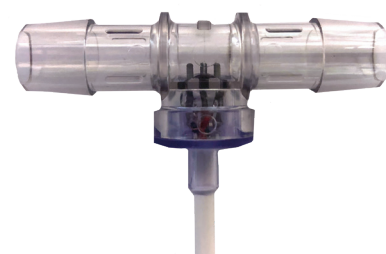
**Pressure Sensor Transmitters 4-20 mA output**

0.138 bar (0-2 psi) DIN Rail mount, 24VDC, with reusable sensor cable installed	PT-2
0.69 bar (10 psi) DIN Rail mount, 24VDC, with reusable sensor cable installed	PT-10
2.07 bar (30 psi) DIN Rail mount, 24VDC, with reusable sensor cable installed	PT-30
4.14 bar (60 psi) DIN Rail mount, 24VDC, with reusable sensor cable installed	PT-60
Cable Adapter for PendOTECH Single-Use Pressure Sensor 7 m (24 ft)	PDKT-650-298-24



## Single-Use Conductivity Sensor

### Simple, Accurate, Reliable



#### Features Overview

- Pre-determined cell constant
- Optional one-point calibration
- Range: 0.1 to 100 mS/cm
- Accuracy: ±0.1 mS/cm from 0.1 to 2 mS/cm
- Built-in temperature compensation
- Easy to use and maintain
- Affordable and cost-effective

#### Efficient and Affordable Conductivity Measurement

PENDOTECH's Single-Use Conductivity Sensors provide precise and cost effective measurement of the conductivity of liquids in your biopharmaceutical processes.

#### Ease of Maintenance

Our Single-Use Conductivity Sensors are sturdy enough to withstand repeated cleaning, yet affordable enough to be used in single-use applications. They offer a reliable alternative to stainless steel conductivity sensors, simplifying maintenance and reducing costs.

The PENDOTECH Single Use Conductivity Sensor is a reliable and accurate tool for measuring conductivity in a variety of applications. It is designed for single-use, which eliminates the need for calibration and maintenance. This makes it a cost effective and convenient solution for biopharmaceutical manufacturing and chemical processing.

The sensor has a pre-determined cell constant, which means that it is ready to use immediately. It also has an optional one-point calibration feature, which allows users to calibrate the sensor for specific applications. The sensor has a range of 0.1 to 100 mS/cm and an accuracy of ±0.1 mS/cm from 0.1 to 2 mS/cm. It also has built-in temperature compensation to ensure accurate readings over a wide range of temperatures.

The sensor is easy to install and use, even in harsh or corrosive environments. It is also durable and sterile, making it ideal for use in biopharmaceutical and other sterile applications. The sensor is also affordable, making it a cost-effective solution for a variety of applications.

#### Calibration-Free Conductivity Measurement

No calibration required because of predetermined cell constant and also optional one-point calibration by user

#### Compatibility and Resistance

Measure conductivity and temperature.

- Fluid path materials
- Gamma & X-ray irradiation compatible
  - NaOH resistant
  - USP Class VI

Application	Description
Buffer Preparation	Monitor the conductivity to ensure that the final buffer solution meets specification.
Chromatography	Monitoring buffer conductivity prior to the chromatography column to protect the product by diverting out of specification product.
UF/DF	Monitor the diafiltration process to ensure buffer exchange endpoints are met.



#### Did You Know

The CT-2 Conductivity Sensor Transmitter is a DIN rail mounted device that connects to a PENDOTECH Single Use Conductivity Sensor and produces a 4–20 milliamp signal that is linear with conductivity. It calculates the normalized value at 25°C (77°F) and transmits it via the 4–20 mA signal in the range of 0–150 mS.



#### Sensor Specifications

Accuracy	From 0.1 to 2mS/cm ±0.1 mS/cm; 2 to 50mS/cm ±5% of reading; 50 to 100mS/cm typically ±5% of reading
Pressure Range	75 psi max
Biocompatibility	All materials in contact with product fluid path meet USP Class VI requirements, both pre and post gamma exposure
Manufacturing Environment	ISO 9001 certified facility; Class 5
Operating Temperature	2°C to 50°C (35.6°F to 122°F) - other ranges with process qualification because thermistor reads to 70°C (158°F)
Temperature Accuracy	Better than 0.2°C (0.36°F) - typical better than 0.1°C (0.18°F)
Temperature Element	Thermistor with resistance @ 25°C (77°F) of 2252 ohm
Gamma Irradiation	Up to 50 kiloGrays
X-ray Irradiation	Up to 50 kiloGrays
ADCF Status	All fluid path materials are animal derived component free
Connector	Custom molded water-tight 4 pin connector Rating: IP67 when connected to reusable cable and dust cover
Shelf life	3 years
Packaging	Sealed in vapor barrier bag inside polybag

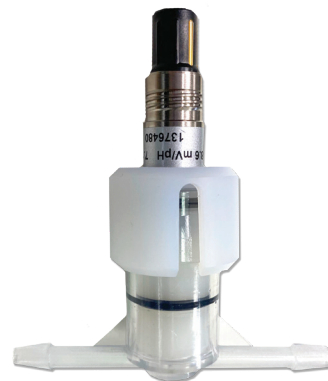
#### Ordering Information

	Order Number
Single-Use Conductivity Sensor, non-sterile, polysulfone 0.318 cm (1/8 in) hose barb	CONDS-N-012
Single-Use Conductivity Sensor, non-sterile, polysulfone 0.64 cm (1/4 in) hose barb	CONDS-N-025
Single-Use Conductivity Sensor, non-sterile, polysulfone 1.28 cm (1/2 in) hose barb	CONDS-N-050
PENDOTECH Conductivity Monitor test kit for conductance and temperature verification	CMONT-TKS
Individual Certificate of Analysis for single use conductivity sensor (ea.)	CONDS2-COA
PENDOTECH Conductivity Sensor Transmitter with 4–20mA output, 0–100mS operating range, 24 VDC, with quality certificate and 3.05 m (10 ft) sensor cable	CT-2



## Single-Use In-line pH Sensor

### Hassle-free pH measurement



1/4 inch Hose barb



3/4 inch Sanitary Flange



#### Features Overview

Single-use pH sensor combining METTLER TOLEDO InSUS 307 pH probe technology with single use flow cell designed by PENDOTECH

- Designed for applications where in-line sensing is necessary
- Compatible with gamma irradiation
- No process calibration required
- Designed for use with existing METTLER TOLEDO transmitters

In downstream bioprocessing operations, monitoring and controlling the pH of a solution is critical to maintaining the stability and efficacy of large biomolecules. A pH sensor is a valuable tool used to determine the acidity or alkalinity of a solution. The electrochemical pH probe is a widely used method for measuring pH in these types of operations.

The electrochemical pH sensor uses two electrodes, a pH sensitive electrode and a reference electrode, and a temperature probe to determine the pH value of a solution. The potential difference between the two electrodes is measured and used to determine the number of hydrogen ions in the solution, which provides the pH value. Real-time measurement of pH is necessary in product purification operations, as solutions are flowing dynamically through a tube. The electrochemical pH probe offers accuracy and rapid response time, making it ideal for capturing rapid shifts in pH due to valve position changes or process changes.

To ensure accurate pH measurements, electrochemical pH sensor must be calibrated with accurately defined buffer standard solutions. Calibration values include both the zero point and the slope of the calibration line. The zero point is the point at which the pH electrode delivers zero potential, and the slope of the calibration line determines the accuracy of the sensor over its measuring range.

#### Sensor Performance Specifications

pH Range	pH 3 to pH 10
Slope (pH 7 to pH 4 buffer)	Min -57.8 mV/pH (98%)
Zero-point (In pH 7 buffer)	7.20 ± 0.25pH
Accuracy under defined laboratory conditions	± 0.10 pH for ± 1.50 pH units around the calibration point after 1-point process calibration (adjustment of inline reading to an offline pH measurement of a grab sample)
Response Time	190% < 20s between pH 4 to 7
Operating Temperature Range	5 to 60°C (41 to 140°F)
Operating Pressure Range	4 Barg at 25°C (77°F)* 2 Barg at 40°C (104°F)** 1 Barg at 60°C (140°F)**
Membrane Glass Resistance	300...900 MOhm
Glass Type	pH-Sensitive glass membrane
Temperature Compensation (T.C.)	Via built-in Pt 1000
Shelf life	12 months PT-PH-S-5-5, PT-PH-S-025 24 months with available coating on the reference system PT-PH-L-5-5, PT-PH-L-025

\* This specification was determined and validated by PENDOTECH. PENDOTECH testing and validation data regarding this claim are on file.

\*\*This specification is provided by the original manufacturer (PT-PH1 pH Sensor).

#### Benefits

- Provides accurate and reliable pH measurement in downstream bioprocessing operations
- Real-time measurement of pH helps to maintain stability of large biomolecules in a specific pH range
- Rapid response time helps to capture rapid shifts in pH due to process changes
- Calibration values printed on probe for easy entry into pH monitor, eliminating need for calibration with buffers
- Closed system operation is not impacted, as there is no need to expose pH sensor to buffer standards
- It may be re-used, however, in applications where cross contamination is desired to be avoided.

#### The sensor/flow cell combination is designed specifically and optimized for in-line measurements:

- It is ideal for processes where cleaning the probe is not practical post use
- Has a rapid response to change in pH conditions



Application	Description
Upstream processing	Monitoring and control of pH in fermentation and cell culture processes, viral inactivation, and media/buffer preparation.
Downstream processing	Monitoring and control of pH in purification and product recovery processes, viral inactivation, buffer preparation, and protein refolding.
Quality control	Testing of the final product to ensure that it meets pH specifications.
Research and development	Development of new biopharmaceutical products and processes.

#### Ordering Information

Monitors	Order Number
Dual pH Bench-Top monitor/transmitter for the interface of 2 PENDOTECH Single-Use pH sensors.	MT-30280773
Cable from single wavelength photometer to PENDOTECH TFF/DAQ, 2 m (6 ft)	PDKT-UV-PCS
Cable from single wavelength photometer to PMAT analog input, 2 m (6 ft)	PDKT-UV-PMAT
M8 3 pin male cordset, 2 m (6 ft), flying leads	1406281
M300 Transmitter Stand Kit 1/2 DIN	MT-58083319
Probes/Flow Cells	
PENDOTECH Single-Use pH In-Line pH Sensor - 1.91 cm (3/4 in) sanitary flange, polysulfone. 1-year Shelf-Life	PT-PH-S-5-5
PENDOTECH Single-Use In-Line pH Sensor - 0.64 cm (1/4 in) hose barb, polysulfone. 1-year Shelf-Life	PT-PH-S-025
PENDOTECH Single-Use pH In-Line pH Sensor - 1.91 cm (3/4 in) sanitary flange, polysulfone. 2-years Shelf-Life	PT-PH-L-5-5
PENDOTECH Single-Use In-Line pH Sensor - 0.64 cm (1/4 in) hose barb, polysulfone. 2-years Shelf-Life	PT-PH-L-025
Cables	
Cable VP6 ST/1m, for Mettler INSUS 307 Probe	MT-52300107
Cable VP6 ST/3m, for Mettler INSUS 307 Probe	MT-52300108
Cable VP6 ST/1m/BNC	MT-52300210
Cable VP6 ST/3m/BNC	MT-52300211

▶ [www.pendotech.com/ph](http://www.pendotech.com/ph)



## Single-Use UV Flow Cells & PM2 Photometer

### Ensuring Accuracy, One Measurement at a Time



The PM2 Photometer is a versatile tool for both lab and process applications, available in benchtop and panel mount versions for easy integration into various systems. It comes with seven factory-configurable wavelength combinations, including 260nm, 280nm, 300nm, 880nm, 260–280nm, 280–300nm, and 280–880nm.

Designed to work with a monitor possessing data acquisition capabilities, the PM2 Photometer can be used with PENDOTECH solutions like PressureMAT PLUS models for data logging via a PC, or PENDOTECH Process Control Systems.

The photometer provides two 4–20mA signals spanning 0 to 3AU as output, allowing for continuous monitoring. It also features a local display for direct reading. The output signals can be connected to other data acquisition devices or higher-level control systems like PLCs and HMIs for data collection and integration into larger control systems.

The PM2 Photometer supports digital communication protocols such as Modbus over RS485 and Modbus-TCP over Ethernet for device monitoring, control, and network communication. This makes the PM2 Photometer a flexible solution for bioprocess monitoring due to its adaptability and compatibility with various systems.



#### Features Overview

- Dual functionality for lab and panel mount
- Versatile instrument for lab and process applications
- Factory configured with seven different wavelength combinations
- Designed to be integrated into a monitor with data acquisition capability
- Two 4–20mA output signals spanning 0 to 3AU
- Local display for viewing readings directly from the instrument
- Compatible with a variety of data acquisition devices and control systems
- Supports digital communication protocols

#### Photometer Specifications

Optical Configuration	LED light source
Optical Connectivity	SMA-905
Mechanical	10.2 cm (4 in) W × 10.2 cm (4 in) L × 6.4 cm (2.5 in) H
	Weight: ~0.68kg (~1.5 lbs)
Max. supply voltage fluctuations	±10% of DC supply voltage
Overvoltage Category	Category I
Power Requirement	24VDC nominal, 2.7W max power
Output	4-20mA (Active/sourcing) spanned 0-3AU
Analog Loop Resistance	500ohms at 24VDC
Alarm Relay	Max. 48VDC, Max. 1A
Operating Temperature	5 to 50°C (41 to 122°F)
Storage Temperature	-20 to 50°C (-4 to 122°F)
Operating Altitude	Max. 5000m above sea level
Humidity	20–80% relative humidity, non-condensing
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)
Precision/Repeatability	±0.5% full scale (±0.015AU)
LED Lifetime	> 5 years
Emission Range	240–1000 nm
Regulatory	RoHS3, REACH, CE, UKCA

\* Accuracy is dependent on system arrangement and proper tare



Flow Cell Shown 1/2 inch hose barb with 1 cm path length



Flow Cell Installed with Tubing



Optical Couplers Installed to Flow Cell



6.5 cm Single-Use Turbidity Flow Cell

#### Other Highlights

- Non-invasive measurement
- Real-time monitoring
- Cost-effective
- Durable
- Versatile
- Easy to use

PENDOTECH's Single-Use Flow Cells allow non-invasive measurements using a unique silica glass lens. The fluid to be measured flows between the lenses via tubing attached to the flow cell ports. They come in various sizes and path lengths, with the largest recommended for turbidity applications. The 6.5 cm flow cell is ideal for turbidity measurements below 400 NTU, while the 1cm flow cell is suitable for applications above 400 NTU. These low-cost flow cells are perfect for single-use applications but can be cleaned and reused. They meet USP Class VI standards and can be gamma and x-ray irradiated up to 50K Gy and autoclaved up to 121°C (249°F).

#### UV Absorbance

In bioprocess operations, UV absorbance is used to detect specific molecules, typically at 280nm, using a spectrophotometer or photometer. The PENDOTECH Single Use UV Flow Cell and UV PM2 Photometer offer a non-invasive method for this. The flow cell, connected to the PM2 system with fiber optic cables, uses special silica glass lenses to pass light through the sample. The sample flows between the lenses via tubing attached to the flow cell. This low-cost flow cell is ideal for single-use applications but can also be cleaned and reused.

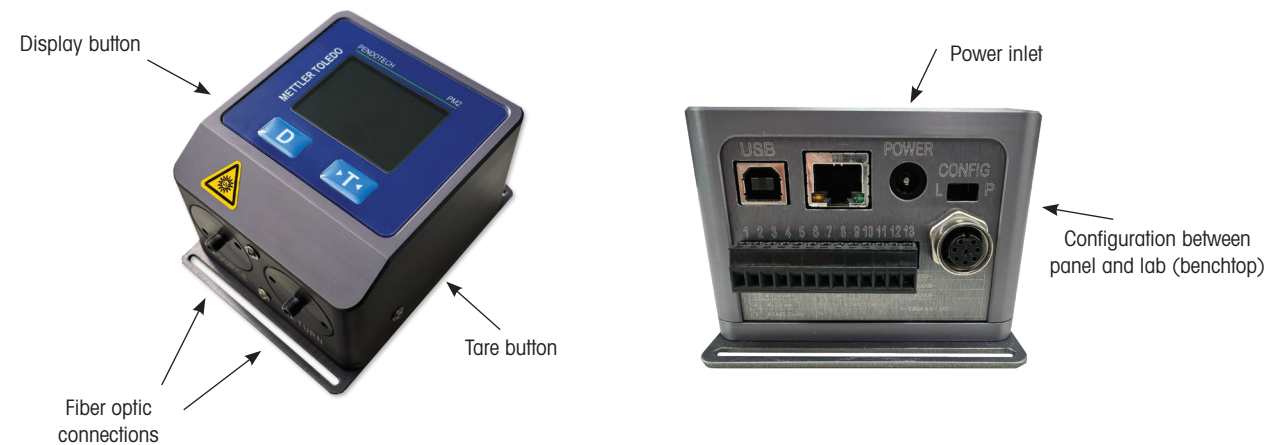
#### Turbidity

Turbidity, the relative clarity of a liquid, is caused by suspended solids scattering light. It's measured by the difference in light emitted from a source and received by a detector, typically using near-infrared light at 880 nm. The standard unit is the Nephelometric Turbidity Unit (NTU). In bioprocess operations, turbidity post-filtration indicates filter performance on unclarified material from a bioreactor. The PENDOTECH Turbidity System, which includes a photometer, flow cells, and cables, can measure turbidity online. The PendoTECH Single Use Flow Cell eliminates the need for cleaning.

#### Single-Use Flow Cell Specifications

Material	Polysulfone and fused silica with silicone O-ring
Pressure range	Rated for pressure up to 5 bar (75 psi)
Biocompatibility	All materials in contact with product fluid path meet USP Class VI requirements
Manufacturing Environment	ISO 7 clean room
Gamma Irradiation	Up to 50 kiloGrays
X-ray Irradiation	Up to 50 kiloGrays
Operating temperature	2°C to 50°C (35.6°F to 122°F) (other ranges with process qualification)
Storage temperature	-25°C to 65°C (-13°F to 149°F)
Shelf Life	>5 years

Photometer / Transmitter Details



Flow Cell Stands



Flow cell stand for 6.5 cm turbidity flow cell



Flow cell stand for single-use UV flow cell

**Did You Know**  
 PM2 Test Rig Photometer Test Rig and Standards is designed for quick and easy accuracy verification of PendoTECH's PM2 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 holder.



Ordering Information

Photometers	Order Number
Photometer PM2 260 nm	30 849 447
Photometer PM2 280 nm	30 849 498
Photometer PM2 300 nm	30 849 499
Photometer PM2 880 nm	30 849 500
Photometer PM2 260–280 nm	30 849 501
Photometer PM2 280–300 nm	30 849 502
Photometer PM2 280–880 nm	30 849 503

Single-Use Flow Cells

Single-use UV flow cell, 2 mm (0.08 in) path length, non-sterile, polysulfone, 0.318 cm (1/8 in) hose barb	SPECPS-N-012
Single-Use UV Flow Cell, 0.5 cm (0.2 in) path length, non-sterile, polysulfone, 0.64 cm (1/4 in) hose barb	SPECPS-N-025
Single-Use UV Flow Cell, 1 cm (0.4 in) path length, non-sterile, polysulfone, 1.28 cm (1/2 in) hose barb	SPECPS-N-050
Single-Use Flow Cell, 6.5 cm (2.5 in) path length, non-sterile, polysulfone, 1.90 cm (3/4 in) Sanitary Flange Inlet/Outlet	SPECPS-880-6CM

Couplers, Cables & Power Cords

Optical Coupler Single Use Flow Cell	30 849 506
Optical Fiber Photometer 0.5 m (1.64 ft)	30 830 317
Optical Fiber Photometer 0.7 m (2.30 ft)	30 919 657
Optical Fiber Photometer 1 m (3.28 ft)	30 830 318
Optical Fiber Photometer 2 m (6.56 ft)	30 830 319
Optical Fiber Photometer 3 m (9.84 ft)	30 830 320
Panel mount SMA-905 connector (for pass through)	SPEC-OC-PANEL
Power Cord CN 3 Prong	30 305 179
Power Cord EU 3 Prong	30 305 178
Power Cord UK 3 Prong	30 305 174
Power Cord US 3 Prong	30 305 173

Accessories

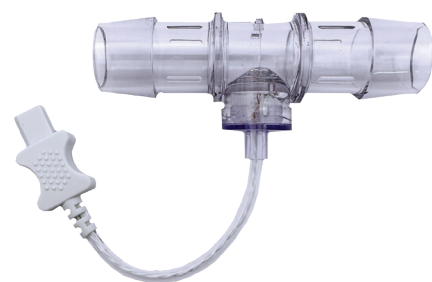
Calibration Kit with Standards 3AU	30 849 507
Replacement Standards for Calibration Kit	30 849 508
SU Flow Cell Stand 6.5 cm (2.5 in) path length	30 849 504
SU Flow Cells Stand 1 cm (0.4 in) path length	30 849 505
Analog display with 4 inputs with alarm inputs and serial port for data collection	PMAT-DAQ
Analog display with 4 inputs, 4 analog outputs, alarms, and serial port for data collection	PMAT-DAQ-A
PENDOTECH Photometer DIN Rail mounting kit, includes mounting plate and mounting hardware	PHOTO-DR
Photometer Panel Mount Support Bracket, with 2 × 1.28 cm (1/4 in) - 20 × 1.28 cm (1/2 in) bolts	PHOTO-PNL

Interface Cables

Cable from single channel PM2 photometer to PENDOTECH PressureMAT analog input, 2 m (6 ft)	PDKT-PM2-1-PMAT
Cable from dual channel PM2 photometer to PENDOTECH PressureMAT analog input, 2 m (6 ft)	PDKT-PM2-2-PMAT
Cable from single channel PM2 photometer to PENDOTECH PCS Control System (DAQ/TFF), mA, 2 m (6 ft)	PDKT-PM2-1-PCS
Cable from dual channel PM2 photometer to PENDOTECH Gen 2 TFF Control System, mA, 2 m (6 ft)	PDKT-PM2-2-PCS
Cable from single channel PM2 photometer to PDKT-BOX-NFFSS breakout box, M8 male, mA signal, 2 m (6 ft)	PDKT-PM2-1-NFFSSB
Cable from dual channel PM2 photometer to PDKT-BOX-NFFSS breakout box, 2 m (6 ft)	PDKT-PM2-2-NFFSSB
Cable from dual channel/turbidity photometer to flying leads, 2 m (6 ft)	PDKT-PM2-FL
Mains Cable CH, 3P – For PM2 Photometer (Swiss Power Cord)	87920

## Single-Use Temperature Sensors

### Accurate Temperature Measurement



PENDOTECH Single-Use Temperature Sensor measure temperature in your processes accurately and cost effectively. They are low cost for single use applications where elimination of cross-contamination is required yet robust enough to be repeatedly cleaned and re-used. They are designed for in-line use and perfect for filtration and chromatography processes, filling operations, and general process monitoring. These sensors connect to monitors via a re-usable cable. Suitable monitors include the handheld unit TEMP-340, a PENDOTECH Process Control System, or other pre-qualified third party monitors. Also, a stand-alone transmitter is available with a 4 to 20mA analog output. They are the alternative solution for

use with tubing to the existing temperature measurements devices on the market.

#### Specifications

Accuracy	Hose-barb and flange sensors: Better than $\pm 0.2^{\circ}\text{C}$ ( $0.36^{\circ}\text{F}$ ) (typical better than $0.1^{\circ}\text{C}$ ( $0.18^{\circ}\text{F}$ )) Luer: Better than $\pm 0.4^{\circ}\text{C}$ ( $0.72^{\circ}\text{F}$ ) (typical better than $0.2^{\circ}\text{C}$ ( $0.36^{\circ}\text{F}$ ))
Temperature range	0 to $70^{\circ}\text{C}$ (0 to $158^{\circ}\text{F}$ )
Biocompatibility	Hose-barb and flange sensors: all polymeric materials in contact with product fluid path meet USP Class VI requirements
Manufacturing environment	ISO 9001 certified facility; Class 5
Gamma irradiation	Up to 50 kiloGrays <sup>^</sup>
X-ray irradiation	Up to 50 kiloGrays <sup>^</sup>
Resistance @ $25^{\circ}\text{C}$	2252ohm
Connector	Custom molded 2 contact connector (different versions for luer and hose-barb versions)
Pressure range	Up to 5.2 bar (75 psi)
Shelf life	5 years
Monitor Cable	Hose-barb: 3 m (10 ft) with 0.64 cm ( $1/4$ in) headphone plug to connect to monitor receptacle

<sup>^</sup> At this gamma dose there is a shift in the accuracy in the range of 0 to  $2^{\circ}\text{C}$  to  $\pm 0.5^{\circ}\text{C}$  and in the range of 50 to  $70^{\circ}\text{C}$  to  $\pm 0.5^{\circ}\text{C}$ .

#### Features Overview

- Adaptable Fittings
- No Obstruction
- Luer Fitting
- Temperature Sensing Element
- No Calibration Required

#### Sensor Features

To optimally adapt to tubing the sensors are available with either a hose-barb fitting, a 1 inch sanitary flange, or a luer fitting. The hose-barb and flange sensor designs imparts no obstruction on the fluid path that can cause a pressure drop. There is no dead-leg at the point where the temperature is measured. The luer fitting can be connected to a variety of fittings that can securely adapt to tubing or other devices. The temperature sensing element is a thermistor. No calibration is required because the temperature versus resistance for the thermistor element is well-defined within the specified accuracy range. Within the electrical instrument, the measured resistance is converted to the temperature. A disposable dip probe is also available to measure temperature within a vessel.

#### Connection to Monitors

The hose-barb and flange sensors and dip probe connect to the monitor via a 3 m (10 ft) long re-usable cable. One end has a molded connector to connect to the sensor connector and the other end has a  $1/4$  inch headphone plug commonly used by many commercially available monitors. The luer sensor has a custom molded connector on the 2.1 m (7 ft) long re-usable monitor cable that is quickly secured to the temperature sensor. There is an alignment guide on the sensor that prevents it from being connected improperly. Disconnection of the cable connector from the sensors is quick and easy and the monitor indicates the sensor has been disconnected.



TEMP-340 Handheld Monitor

#### Ordering Information

Sensors	Order Number
Single-use temperature sensor, non-sterile, polysulfone, stainless steel sensor, 0.318 cm ( $1/8$ in) hose barb	TEMPS-N-012
Single-use temperature sensor, non-sterile, polysulfone, stainless steel sensor, 0.64 cm ( $1/4$ in) hose barb	TEMPS-N-025
Single-use temperature sensor, non-sterile, polysulfone, stainless steel sensor, 0.95 cm ( $3/8$ in) hose barb	TEMPS-N-038
Single-use temperature sensor, non-sterile, polysulfone, stainless steel sensor, 1.28 cm ( $1/2$ in) hose barb	TEMPS-N-050
Single-use temperature sensor, non-sterile, polysulfone, stainless steel sensor, 1.90 cm ( $3/4$ in) hose barb	TEMPS-N-075
Single-use temperature sensor, non-sterile, polysulfone, 2.54 cm (1 in) sanitary flange	TEMPS-N-1-1
Single-use temperature sensor with luer fitting	TEMPC-N-999

#### Accessories for Sensors

3 m (10 ft) re-usable temperature sensor cable with $1/4$ phone jack term. for hose barb sensors	PDKT-650-TEMPB
2.1 m (7 ft) re-usable temperature sensor cable with $1/4$ phone jack term. for luer sensors	PDKT-650-TEMPPL
30.48 cm (12 in) re-usable temperature sensor cable with M8 termination for hose barb sensors	PDKT-TEMPB-PNL
Temperature sensor monitor for 1 sensor with built-in data logger and RS-232 data output	TM-TEMP-340
Temperature Sensor Transmitter	TT1
Temperature Sensor Transmitter DIN Rail Mounting Kit	TT1-DR
Temperature Sensor Benchtop Transmitter with 4-20mA output in ABS plastic box with 24 VDC wall supply (for 1 sensor)	PDKT-TT1
Temperature Sensor Benchtop Transmitter with 4-20mA output in ABS plastic box with 24 VDC wall supply (for 2 sensors)	PDKT-TT2
Temperature Sensor Benchtop Transmitter with 4-20mA output in ABS plastic box with 24 VDC wall supply (for 4 sensors)	PDKT-TT4
Cable from PDKT-TT1 temperature transmitter to PressureMAT analog input, 2 m (6 ft)	PDKT-TT1-PMAT
Cable from PDKT-TT2 temperature transmitter to PressureMAT analog input (2x), 2 m (6 ft)	PDKT-TT2-PMAT
Analog display with 4 inputs with alarm inputs and serial port for data collection	PMAT-DAQ
Analog display with 4 inputs, 4 analog outputs, alarms, and serial port for data collection	PMAT-DAQ-A
Cable from PDKT-TT4 to PMAT-DAQ, 4 analog signals, 1.2 m (4 ft)	PDKT-TT4-PDAQ
0.64 x 0.64 cm ( $1/4$ in x $1/4$ in) polycarbonate straight connector with luer port	PDKT-103-03
0.95 x 0.95 cm ( $3/8$ in x $3/8$ in) polycarbonate straight connector with luer port	PDKT-104-03
1.27 x 1.27 cm ( $1/2$ in x $1/2$ in) polycarbonate straight connector with luer port	PDKT-105-03
Male x female x female luer tee, polycarbonate	PDKT-000-03
Male x female x female luer tee, polypropylene	PDKT-000-04





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