

# Pressure Transducers

## Ultrahigh-Purity



### PTU Series

- Single-end, flow-through, and modular surface-mount models
- Positive pressure ranges to 5000 psig, 400 bar, and 40 MPa; compound pressure ranges to 500 psig, 250 bar, and 25 MPa
- Excellent long-term stability and repeatability for reliability and low maintenance
- 316L VIM-VAR stainless steel and Elgiloy® wetted components
- VCR® metal gasket face seal, Micro-Fit® weld tee, tube butt weld, and modular surface-mount end connections

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The Swagelok® PTU series pressure transducer provides electronic monitoring of system pressure for ultrahigh-purity applications. The PTU series pressure transducer is available with a variety of pressure ranges, process connections, electrical connectors, and output signals. The configurable and renewable electronics allow the conversion of the output signal from voltage (dc) to milliamps (mA) without removing the unit from the system. In addition, a direct-mount digital display indicator is available to provide a visual display.

## Features

- Metal thin-film sensing technology, which consists of a metal thin film resistor bridge on an Elgiloy diaphragm, enables PTU series transducers to maintain reliable readings over a wide range of temperatures. The consistent, accurate performance minimizes routine maintenance and helps eliminate unplanned system shutdowns.
- Modular construction and configurable, renewable electronics that enable interchangeability of internal components provide flexibility, reduce inventory, and make any required maintenance quick and simple.
- All wetted components are 316L VIM-VAR stainless steel and Elgiloy to promote corrosion resistance and clean operation, minimizing component replacement costs through extended service life.
- Genuine Swagelok VCR face seal fitting end connections provide reliable, leak-tight performance, helping to eliminate leakage-related system shutdown.
- The standard transducer enclosure meets Ingress Protection IP65/NEMA4 or IP54/NEMA3, designed to protect internal electronics from moisture and dust.
- No span adjustment is required after zero-point correction, so installation of field-replaceable electronics is quick and simple.
- Low internal volume minimizes dry-down and purge time, helping reduce qualification time.

## Operation

The Swagelok PTU series pressure transducer uses metal thin-film sensing technology to measure system pressure. This sensing technology consists of a strain gauge formed on the Elgiloy diaphragm using semiconductor deposition and etching techniques.

As system pressure changes and deflects the sensor, the electrical resistance of the strain gauge changes. The change in resistance is detected, amplified, and converted to a usable electronic output signal. This signal is then sent to output devices that monitor or control system pressure.

## Performance Data

<b>Accuracy (Limit-Point Calibration)</b>	≤ 0.5 % of span, limit-point calibration, for pressure ≥ 0 psig (≤ 0.25 BFSL); ≤ 1.5 % of span for pressure ≤ 0 psig (≤ 0.75 BFSL)
<b>Linearity</b>	≤ 0.2 % of span
<b>Hysteresis</b>	≤ 0.03 % of span
<b>Repeatability</b>	≤ 0.05 % of span
<b>Reproducibility</b>	≤ 0.15 % of span
<b>Long-Term Stability</b>	≤ 0.2 % of span per year
<b>Zero Adjustability</b>	±5 % of span
<b>Response Time</b>	≤ 2 milliseconds
<b>Vibration Resistance</b>	10 g in accordance with IEC 770 (vibration under resonance)
<b>Shock Resistance</b>	500 g in accordance with IEC 770 (mechanical shock)
<b>Total Zero-Point Variation<sup>①</sup></b>	≤ 1.5 % of span

① Applies to 1.5 in. modular surface-mount model with W-seal.

## Temperature Effects

<b>Temperature Coefficient (TC) of Zero in Compensated Temperature Range</b>	≤ 0.3 % of span per 18°F (10°C)
<b>TC of Span in Compensated Temperature Range</b>	≤ 0.15 % of span per 18°F (10°C)
<b>Compensated Temperature Range</b>	−4 to 176°F (−20 to 80°C)
<b>Ambient Temperature Range</b>	−4 to 185°F (−20 to 85°C)
<b>Storage and Medium Temperature</b>	−40 to 212°F (−40 to 100°C)

## Technical Data

<b>Overpressure Limit</b>	2 × full scale to 3000 psig, 250 bar, 25 MPa 1.25 × full scale > 3000 psig, 250 bar, 25 MPa
<b>Burst Pressure</b>	10 × full scale to 500 psig, 40 bar, 4.0 MPa 9 × full scale to 1000 psig, 60 bar, 6.0 MPa 7.2 × full scale to 1500 psig, 100 bar, 10 MPa 4.5 × full scale to 2000 psig, 160 bar, 16 MPa 2.8 × full scale to 3000 psig, 250 bar, 25 MPa 1.8 × full scale to 5000 psig, 400 bar, 40 MPa
<b>Wetted Surface Finish</b>	Electropolished 7 μin. (0.18 μm) $R_a$ avg
<b>Service</b>	Liquid, gas, and vapor
<b>Protection Class</b>	IP65 /NEMA4 or IP54/NEMA3

## Electrical and Electronic Data

<b>Dielectric Withstand</b>	500 V (dc) max
<b>Electromagnetic Capability</b>	CE-conformity, EN61326, SEMI E33-94
<b>Electrical Protections</b>	Reverse polarity, short circuit signal
<b>Load Capacitance</b>	0.1 $\mu$ F max
<b>Maximum Current Output</b>	< 30 mA (4 to 20 mA signal) < 1 mA (0.1 to 5.1 and 0.1 to 10.1 [dc] signals)

## Materials of Construction

Component	Material Grade/ASTM Specification
<i>End connections, body</i>	316L VIM-VAR SS/A479
<i>Diaphragm</i>	Elgiloy/AMS 5876
Housing	300 series stainless steel

Wetted components listed in *italics*.

## Models

### Modular Surface-Mount Model

#### Process End Connections

- 1.5 in. modular surface-mount C-seal (IGC® II-compatible)
- 1.125 in. modular surface-mount C-seal
- 1.5 in. modular surface-mount W-seal

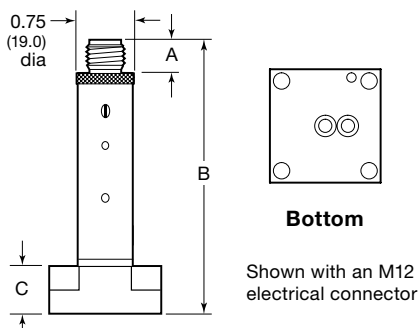
#### Electrical Connectors

- Bendix, 4-pin MIL plug (IP65/NEMA4)
- M12  $\times$  1, 4-pin circular connector (IP65/NEMA4)
- Direct wire, 1.5 or 3 m flying lead (IP65/NEMA4)
- 15-pin sub-D connector (IP54/NEMA3)
- Tajimi circular connector R03-R6F (IP54/NEMA3)

#### Output Signals

- 4 to 20 mA
- 0.1 to 5.1 V (dc)
- 0.1 to 10.1 V (dc)

#### Dimensions



See **Ordering Information**, page 6.

## Testing

Every Swagelok PTU series pressure transducer is factory inboard vacuum tested with helium to a maximum leak rate of  $2 \times 10^{-9}$  std cm<sup>3</sup>/s.

## Calibration

Every Swagelok PTU series pressure transducer receives a five-point pressure calibration to ensure proper operation over the designated pressure range. A certificate of calibration is supplied with each transducer.

## Cleaning and Packaging

Every Swagelok PTU series pressure transducer is assembled, cleaned, and packaged in a Class 100 cleanroom.

#### Input Power Supply (Excitation)

- 10 to 30 V (dc) (4 to 20 mA)
- 10 to 30 V (dc) (0.1 to 5.1 V)
- 14 to 30 V (dc) (0.1 to 10.1 V)

#### Internal Volume

- < 1.5 cm<sup>3</sup> (0.092 in.<sup>3</sup>)

#### Pressure Rating

- **Positive Pressure**
  - 0 to 500 psig
  - 0 to 40 bar
  - 0 to 4.0 MPa
- **Compound Pressure**
  - 30 in. Hg to 500 psig
  - 1 to 40 bar
  - 0.1 to 4.0 MPa

See page 7 for complete listing of available pressure ranges.



End Connection	Dimensions, in. (mm)										
	Electrical Connectors										C
	Bendix		M12		Direct		15-pin sub-D		Tajimi		
	A	B	A	B	A	B	A	B	A	B	
1.5 in. modular surface-mount	0.39 (9.9)	3.62 (91.9)	0.43 (10.9)	3.66 (93.0)	0.63 (16.0)	3.85 (97.8)	1.20 (30.5)	4.44 (113)	0.35 (8.9)	3.59 (91.2)	0.63 (16.0)
1.125 in. modular surface-mount		3.44 (87.4)		3.48 (88.4)		3.68 (93.5)		4.25 (108)		3.40 (86.4)	0.44 (11.2)

## Flow-Through Model

### Process End Connections

- 1/4 in. integral male VCR fitting
- 1/4 in. rotatable male VCR fitting
- 1/4 in. female VCR fitting
- 1/4 in. integral male VCR fitting to female VCR fitting
- 1/4 in. rotatable male VCR fitting to female VCR fitting
- 1/4 × 0.035 in. tube butt weld

### Electrical Connectors

- Bendix, 4-pin MIL plug (IP65/NEMA4)
- M12 × 1, 4-pin circular connector (IP65/NEMA4)
- Direct wire, 1.5 or 3 m flying lead (IP65/NEMA4)
- Tajimi circular connector R03-R6F (IP54/NEMA3)

### Output Signals

- 4 to 20 mA
- 0.1 to 5.1 V (dc)
- 0.1 to 10.1 V (dc)

### Input Power Supply (Excitation)

- 10 to 30 V (dc) (4 to 20 mA)
- 10 to 30 V (dc) (0.1 to 5.1 V)
- 14 to 30 V (dc) (0.1 to 10.1 V)

### Internal Volume

- < 1.0 cm<sup>3</sup> (0.06 in.<sup>3</sup>)

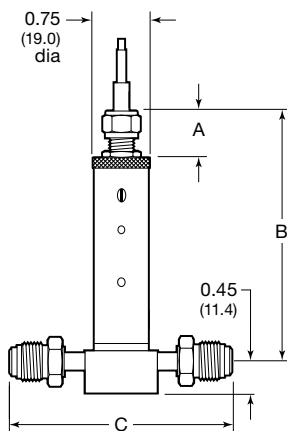
### Pressure Rating

- **Positive Pressure**  
0 to 5000 psig  
0 to 400 bar  
0 to 40 MPa
- **Compound Pressure**  
-30 in. Hg to 500 psig  
-1 to 250 bar  
-0.1 to 25 MPa



See page 7 for complete listing of available pressure ranges.

## Dimensions



Shown with direct wire (flying lead) electrical connector and 1/4 in. rotatable male VCR end connection.

End Connection (Inlet and Outlet)		Dimensions, in. (mm)								
		Electrical Connectors								
		Bendix		M12		Direct		Tajimi		C
Size	Type	A	B	A	B	A	B	A	B	
1/4 in.	Integral male VCR	0.39 (9.9)	3.30 (83.8)	0.43 (10.9)	3.34 (84.8)	0.63 (16.0)	3.54 (89.9)	0.35 (8.9)	4.65 (118)	2.24 (56.9)
	Rotatable male VCR		3.14 (79.8)		3.18 (80.8)		3.38 (85.9)		4.25 (108)	3.05 (77.5)
	Female VCR		3.30 (83.8)		3.34 (84.8)		3.54 (89.9)		4.05 (103)	2.65 (67.3)
	Integral male VCR to female VCR		3.14 (79.8)		3.18 (80.8)		3.38 (85.9)		4.62 (117)	3.05 (77.5)
	Rotatable male VCR to female VCR		3.14 (79.8)		3.18 (80.8)		3.38 (85.9)		4.62 (117)	3.05 (77.5)
	Tube butt weld		3.14 (79.8)		3.18 (80.8)		3.38 (85.9)		4.62 (117)	1.85 (47.0)

See **Ordering Information**, page 6.

### Single-End Model

#### Process End Connections

- 1/4 in. rotatable male VCR fitting
- 1/4 in. female VCR fitting
- 1/4 × 0.035 in. tube butt weld
- 1/4 in. Micro-Fit tee

#### Electrical Connectors

- Bendix, 4-pin MIL plug (IP65/NEMA4)
- M12 ×1, 4-pin circular connector (IP65/NEMA4)
- Direct wire, 1.5 or 3 m flying lead (IP65/NEMA4)
- Tajimi circular connector R03-R6F (IP54/NEMA3)

#### Output Signals

- 4 to 20 mA
- 0.1 to 5.1 V (dc)
- 0.1 to 10.1 V (dc)

#### Input Power Supply (Excitation)

- 10 to 30 V (dc) (4 to 20 mA)
- 10 to 30 V (dc) (0.1 to 5.1 V)
- 14 to 30 V (dc) (0.1 to 10.1 V)

#### Internal Volume

- < 1.5 cm<sup>3</sup> (0.092 in.<sup>3</sup>)

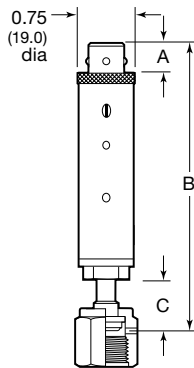
#### Pressure Rating

- **Positive Pressure**  
0 to 5000 psig  
0 to 400 bar  
0 to 40 MPa
- **Compound Pressure**  
-30 in. Hg to 500 psig  
-1 to 250 bar  
-0.1 to 25 MPa



See page 7 for complete listing of available pressure ranges.

### Dimensions



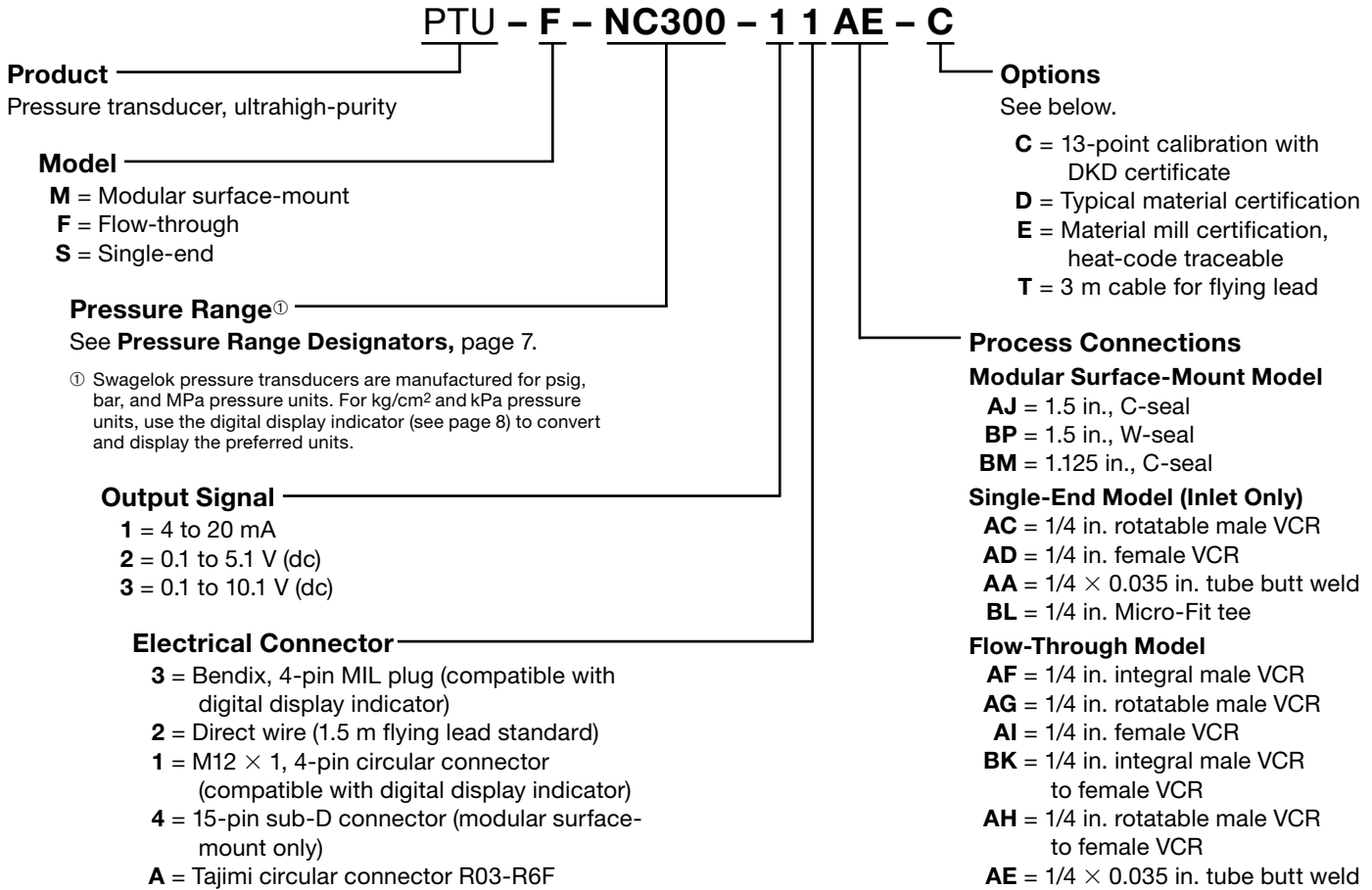
Shown with Bendix electrical connector and 1/4 in. female VCR fitting end connection.

End Connection (Inlet and Outlet)		Dimensions, in. (mm)								
		Electrical Connectors								C
		Bendix		M12		Direct		Tajimi		
Size	Type	A	B	A	B	A	B	A	B	C
1/4 in.	Rotatable male VCR	0.39 (9.9)	4.25 (108)	0.43 (10.9)	4.29 (109)	0.63 (16.0)	4.48 (114)	0.35 (8.9)	4.65 (118)	1.06 (26.9)
	Female VCR		3.85 (97.8)		3.88 (98.6)		4.08 (104)		4.25 (108)	0.66 (16.8)
	Tube butt weld		3.65 (92.7)		3.69 (93.7)		3.89 (98.8)		4.05 (103)	0.46 (11.7)
	Micro-Fit tee		4.06 (103)		4.10 (104)		4.30 (109)		4.62 (117)	1.03 (26.2)

See **Ordering Information**, page 6.

## Transducer Ordering Information

Build a Swagelok pressure transducer ordering number by combining the designators in the sequence shown below.



### Options

- 13-point pressure calibration traceable to Deutscher Kalibredienst (DKD), German Calibration Service.
- Typical material certification (part number and purchase order number specific).
- Material Mill 3.1B Certification, which provides heat traceability and verifies the chemical and mechanical properties of the wetted components, is available.

## Pressure Range Designators

psig

Minimum	Maximum	Designator
Vacuum -30 in. Hg	45	NC45
	60	NC60
	100	NC100
	160	NC160
	250	NC250
	300	NC300
	500	NC500
0	60	NG60
	100	NG100
	160	NG160
	250	NG250
	300	NG300
	500 <sup>①</sup>	NG500 <sup>①</sup>
	1000	NG1000
	1500	NG1500
	2000	NG2000
	3000	NG3000
5000	NG5000	

<sup>①</sup> Maximum pressure rating for modular surface-mount model.

MPa

Minimum	Maximum	Designator
Vacuum -0.1 MPa	0.3	MC.3
	0.4	MC.4
	0.6	MC.6
	0.9	MC.9
	1.5	MC1.5
	2.5	MC2.5
	4.0 <sup>①</sup>	MC4 <sup>①</sup>
	6.0	MC6
	10	MC10
	16	MC16
0	25	MC25
	0.4	MG.4
	0.7	MG.7
	1.0	MG1
	1.6	MG1.6
	2.5	MG2.5
	4.0 <sup>①</sup>	MG4 <sup>①</sup>
	6.0	MG6
	10	MG10
	16	MG16
25	MG25	
40	MG40	

<sup>①</sup> Maximum pressure rating for modular surface-mount model.

bar

Minimum	Maximum	Designator
Vacuum -1 bar	3	AC3
	6	AC6
	9	AC9
	15	AC15
	25	AC25
	40 <sup>①</sup>	AC40 <sup>①</sup>
	60	AC60
	100	AC100
	160	AC160
	250	AC250
0	4	AG4
	7	AG7
	10	AG10
	16	AG16
	25	AG25
	40 <sup>①</sup>	AG40 <sup>①</sup>
	60	AG60
	100	AG100
	160	AG160
	250	AG250
400	AG400	

<sup>①</sup> Maximum pressure rating for modular surface-mount model.

## Accessories

### Replaceable Electronics

The complete electronic module of the Swagelok PTU series pressure transducer is field-replaceable to extend the service life or to change the output signal. Kit includes the electronic module and installation instructions.



Output Signal	Kit Ordering Number
4 to 20 mA	PTU-EM-1
0.1 to 5.1 V (dc)	PTU-EM-2
0.1 to 10.1 V (dc)	PTU-EM-3

### Replacement Electrical Connectors

Connectors	Ordering Number
Male Bendix	PTU-RC-2
Flying lead with 2 m cable	PTU-RC-3
Male M12 × 1	PTU-RC-1

### Mating Connectors

Mating Connector	Ordering Number
Bendix, 3 m cable, 4-wire, UL listed <sup>①</sup>	PTU-MC-1
Bendix, no cable, 4-pin	PTU-MC-2
M12 × 1, 2 m cable, straight, 4-wire	PTU-MC-3
M12 × 1, 5 m cable, straight, 4-wire	PTU-MC-4
M12 × 1, 2 m cable, 90° angled, 4-wire	PTU-MC-5
M12 × 1, no cable, straight, 4-pin	PTU-MC-6
M12 × 1, no cable, 90° angled, 4-pin	PTU-MC-7
M12 × 1, 2 m cable, straight, 5-wire, UL listed <sup>②</sup>	PTU-MC-8
M12 × 1, 5 m cable, straight, 5-wire, UL listed <sup>②</sup>	PTU-MC-9
M12 × 1, 2 m cable, 90° angled, 5-wire, UL listed <sup>②</sup>	PTU-MC-10
M12 × 1, 5 m cable, 90° angled, 5-wire, UL listed <sup>②</sup>	PTU-MC-11
M12 × 1, no cable, straight, 5-pin	PTU-MC-12
M12 × 1, no cable, 90° angled, 5-pin	PTU-MC-13
M12 × 1 male, no cable, 90° angled, 4-pin,	PTU-MC-14
M12 × 1, 10 m cable, 90° angled, 4-wire, UL listed <sup>②</sup>	PTU-MC-15

<sup>①</sup> UL style 2164/1061, temperature rating 80°C.

<sup>②</sup> UL style 20549/1061, temperature rating 80°C.

## Digital Display Indicator

A digital display indicator is available to mount directly to the Swagelok PTU series pressure transducer for local and remote indication of pressure.



### Features

- Provides LED display of pressure in user-configurable units including psig, bar, kg/cm<sup>2</sup>, kPa, and MPa
- Offers display accuracy of 0.5 % to  $\pm 1$  digit to match transducer accuracy
- Uses input signals of milliamps or volts
- Includes two programmable set points (one programmable set point with Bendix connector)
- Displays up to four digits
- Offers choice of front or top display window for viewing flexibility
- Meets Ingress Protection IP65/NEMA 4
- Is loop powered, no extra power supply required

### Electrical and Electronic Data

#### Input Signal

- 4 to 20 mA
- 0.1 to 5.1 V (dc)
- 0.1 to 10.1 V (dc)

#### Electrical Connectors to Transducer

- Female M12  $\times$  1, 4-pin circular connector
- Female Bendix, 4-pin MIL plug

#### Output Signal

- 4 to 20 mA
- 0.1 to 5.1 V (dc)
- 0.1 to 10.1 V (dc)
- Display (LED red), 4 digit, 7 mm digit height
- High and low set points

#### Power Supply

- 16 to 30 V (dc) for 4 to 20 mA
- 10 to 30 V (dc) for 0.1 to 5.1 V (dc)
- 15 to 30 V (dc) for 0.1 to 10.1 V (dc)

#### Electrical Protection

- Reverse polarity

#### Protection Class

- IP65/NEMA 4

#### Output Electrical Connector

- M12  $\times$  1, 5-pin circular connector
- Bendix, 4-pin MIL plug
- Direct wire (flying lead)

#### Cleaning and Packaging

Every Swagelok PTU series digital display indicator is packaged in a Class 100 cleanroom.

### Performance Data

Accuracy Display	$< \pm 0.5$ % of span, $\pm 1$ digit
Accuracy Switching Point	$\leq \pm 0.5$ of span $\pm 1$ digit
Zero Adjustment	$\pm 10$ % of span
Switching Point Number	2 $\times$ NPN open-collector 1 $\times$ NPN open collector for Bendix MIL plug
Switching Point Function	Normally open/normally closed
Switching Point Adjustment	1 to 99 % of span
Response Time Switch	$< 15$ milliseconds
Influence of Supply Voltage	$< 0.1$ % per 10 V
Switching Current	300 mA max
Thermal Error Display	$< 0.1$ % of span per 18 °F (10°C)
Thermal Error Switches	
Dielectric Withstand	500 V (dc) max
Electromagnetic Capability	CE-conformity, EN 61326, SEMI E33-94; CE declaration of conformity available on request.
Vibration Resistance	5 g: 10 to 2000 Hz
Shock Resistance	No damage up to 100 g

### Temperature Rating

Ambient	-22 to 185°F (-30 to 85°C)
Storage	
Compensated Range	-4 to 176°F (-20 to 80°C)

### Display

Type	LED, 4 digits
Units	psig, bar, kg/cm <sup>2</sup> , MPa, kPa
Refresh Rate	3 times per second
Digit Range	-999 to 6000

### Programming

Type	Menu-driven programming via external pushbuttons
Programmable Parameters	Change of measuring units, setting switching points, adjustable decimal point, adjustable measuring range, adjustable zero point

### Housing

Material	ABS plastic
Housing Dimensions	1.5 by 1.2 by 1.5 in. max (38 by 29 by 38 mm max)
Top View Model with Electrical Connector	1.5 by 2.0 by 2.6 in. max (38 by 51 by 66 mm max)
Front View Model with Electrical Connector	1.5 by 3.1 by 1.5 in. max (38 by 77 by 38 mm max)

See **Ordering Information**, page 9.

**Digital Display Indicator Ordering Information**

Select an ordering number.

Electrical Connections		Output Signal	Ordering Number
Input (to Transducer)	Output		
<b>Front Display Window</b>			
M12 × 1, 4-pin	M12 × 1, 5-pin	4 to 20 mA	PTU-DF-111
		0.1 to 5.1 V (dc)	PTU-DF-211
		0.1 to 10.1 V (dc)	PTU-DF-311
Bendix, 4-pin MIL plug	Bendix, 4-pin MIL plug	4 to 20 mA	PTU-DF-133
		0.1 to 5.1 V (dc)	PTU-DF-233
		0.1 to 10.1 V (dc)	PTU-DF-333
	3 m flying lead, 5-wire	4 to 20 mA	PTU-DF-132
	M12 × 1, 5-pin		PTU-DF-131
<b>Top Display Window</b>			
M12 × 1, 4-pin	M12 × 1, 5-pin	4 to 20 mA	PTU-DT-111
		0.1 to 5.1 V (dc)	PTU-DT-211
		0.1 to 10.1 V (dc)	PTU-DT-311
Bendix, 4-pin MIL plug	Bendix, 4-pin MIL plug	4 to 20 mA	PTU-DT-133
		0.1 to 5.1 V (dc)	PTU-DT-233
		0.1 to 10.1 V (dc)	PTU-DT-333
	3 m flying lead, 5-wire	4 to 20 mA	PTU-DT-132
	M12 × 1, 5-pin		PTU-DT-131

**Safe Product Selection**

**When selecting a product, the total system design must be considered to ensure safe, trouble-free performance. Function, material compatibility, adequate ratings, proper installation, operation, and maintenance are the responsibilities of the system designer and user.**

**Caution: Do not mix or interchange parts with those of other manufacturers.**

**Warranty Information**

Swagelok products are backed by The Swagelok Limited Lifetime Warranty. For a copy, visit [swagelok.com](http://swagelok.com) or contact your authorized Swagelok representative.

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