



P499 Series Electronic Pressure Transducers

Product/Technical Bulletin

P499xxx-x

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The P499 Series Electronic Pressure Transducers are compact, economical, rugged, direct-mount pressure transducers designed for use in commercial refrigeration and air conditioning applications. These transducers produce an analog signal based on the sensed pressure.

The P499 Series transducers feature environmentally protected electronics with stainless steel construction. The digitally compensated P499 transducers are highly accurate over a broad temperature range, resisting the effects of wide ambient temperature swings, high humidity, condensation, and icing.

The pressure port is machined from a solid piece of 17-4PH stainless steel. No O-rings, organic materials, or welds are exposed to the pressure media, allowing for a leak-proof, all-metal, sealed pressure system.

The P499 Series transducers operate with any corrosive or non-corrosive pressure medium that is compatible with 17-4PH stainless steel, including water, condensate, carbon dioxide, glycol, most refrigerants (including ammonia), and many other compatible fluids and gases.



Figure 1: P499 Electronic Pressure Transducers; Style 47 Fitting Shown on the Left and Style 49 Fitting Shown on the Right

The P499 Series provides transducers in a variety of pressure ranges, covering most common refrigeration and air conditioning applications.

Table 1: Features and Benefits

Features	Benefits
Single-Piece Machined 17-4PH Stainless Steel Pressure Port	Provides a durable assembly that eliminates refrigerant loss due to O-ring or weld failures; resists damage due to physical shock, vibration, and pressure pulsations; enables use with non-corrosive or corrosive pressure media that is compatible with 17-4PH stainless steel.
Environmentally-Protected Electronics	Withstand the effects of adverse conditions associated with typical HVAC and Refrigeration applications, including freeze/thaw applications on suction lines.
Reliable, Repeatable Performance and Long Operating Life	Minimizes service and replacement costs.
Many Available Pressure Ranges	Provide a single line of transducers for all refrigeration and air conditioning application needs.
Slender Body Design	Facilitates use of deep-socket wrenches for ease of installation; requires zero turning radius.
1% Total Error Band	Provides high-accuracy performance.
CE and UL Agency Listings	Allow for global applications.

Application

IMPORTANT: The P499 Series Electronic Pressure Transducers are intended to provide an input to equipment under normal operating conditions. Where failure or malfunction of the P499 Electronic Pressure Transducer could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices, such as supervisory or alarm systems or safety or limit controls, intended to warn of or protect against failure or malfunction of the P499 Electronic Pressure Transducer.

P499 Electronic Pressure Transducers provide several output options:

- 0.5 to 4.5 VDC ratiometric
- 0 to 10 VDC
- 4 to 20 mA

Pressure connections are available in two standard styles:

- 1/4 in. SAE 45° flare (7/16-20 UNF) internal thread fitting with Schrader® valve depressor (Style 47)
- 1/8-27 NPT external thread fitting (Style 49)

Contact your local Johnson Controls/PENN® representative for more information on options available for high-volume orders with specific application requirements, including 316L stainless steel construction and pressure ranges up to 1,764 psi (120 bar).

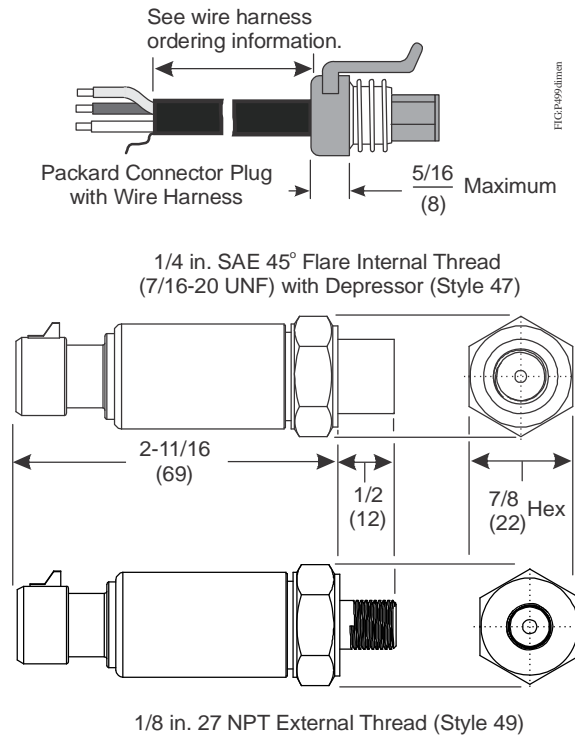
Typical applications include:

- HVAC and refrigeration applications
- chillers
- fan speed controls
- pumps and compressors
- agricultural applications
- industrial process control

Operation

Pressure applied to the P499 transducer acts on a piezoresistive strain gauge, which is bonded with high-temperature glass onto a stainless steel diaphragm. The strain gauge translates media pressure into an electrical signal. An Application-Specific Integrated Circuit (ASIC) conditions and amplifies the signal. The output signal varies in direct linear proportion to the sensed pressure.

Dimensions



Note: Transducer shown with Packard connectors.

Figure 2: Dimensions for P499 Electronic Pressure Transducers and Wire Harness with Packard Connectors, in. (mm)

Installation

See *Mounting* and *Wiring* for information on installing the P499 Series Electronic Pressure Transducers.

Parts Required

P499 transducers require wire harnesses for all models that do not have an integral cable. Use Table 2 to select a wire harness.

Table 2: Wire Harnesses with Packard Connectors

Product Code Number ¹	Length
WHA-PKD3-200C	6-1/2 ft (2.0 m)
WHA-PKD3-400C	13 ft (4.0 m)
WHA-PKD3-600C	19-5/8 ft (6.0 m)

1. Wire harnesses for P399 transducers and P499 transducers are interchangeable.

Mounting

The P499 transducer mounts directly to most refrigeration equipment pressure tap ports.



CAUTION: Risk of Property Damage.

Mount the pressure control separately from the electrical cabinet and seal all electrical piping to prevent ammonia from migrating to the electrical components. Where there may be exposure to ammonia, use only ammonia compatible control modules and pressure connections. System shutdown due to improper adjustment may cause property damage.

IMPORTANT: When installing the P499 transducers, observe all regulations governing the handling and containment of hazardous or regulated materials (refrigerants or lubricants).

IMPORTANT: Locate pressure tap points on the top side of the refrigerant lines to reduce risk of equipment damage or malfunction caused by accumulation of oil, liquids, or sediment in the pressure chamber.

IMPORTANT: Avoid severe pressure pulsations on high-side pressure connections by positioning the transducer away from compressor discharge.

To mount the P499 transducer:

1. Hand thread the P499 transducer to the pressure tap point.
2. Tighten the connection using the wrench flats provided to avoid damaging the transducer.
3. Perform a leak test on fittings and connections before putting the system into operation.

Wiring



CAUTION: Risk of Electric Shock.

Disconnect the power supply before making electrical connections to avoid electric shock.

Follow the wiring guidelines given to avoid causing damage to the P499 transducer and improper equipment operation:

- Ensure wiring conforms to the National Electrical Code and local regulations.
- Do not apply more than the maximum supply voltage to the transducer. See *Technical Specifications*.
- Do not extend the wiring harness leads more than 250 ft (76 m). Use 22 AWG, 3-wire, shielded cable to extend wiring harness leads.
- Do not run low-voltage cable in conduit or wiring troughs with high-voltage wires.
- Ensure that the shielded cable is terminated according to code and the control's instructions.

Wiring in Hazardous Locations

P499 transducers are UL Recognized for use in Class I, Division 2 hazardous locations. Follow these additional guidelines when wiring or servicing a P499 transducer in a hazardous location.

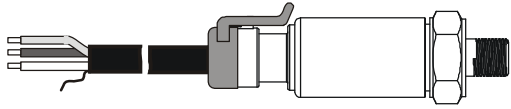
- P499 Series Pressure Transducer models do not have provisions for field wiring. They are suitable for factory installation only. P499 transducers must be installed in a suitable enclosure.



WARNING: Risk of Explosion or Fire

Do not disconnect the P499 pressure transducer while its circuit is energized, unless the area is known to be nonhazardous. Disconnecting the P499 transducer in a hazardous area while its electrical circuit is energized may result in an explosion or fire, and may cause serious injury or death.

Figure 3 shows the wire designations for a P499 transducer used in 0.5 to 4.5 VDC and 0 to 10 VDC applications.



Red Wire = Supply (+)
 Black Wire = Common (-)
 White Wire = Output

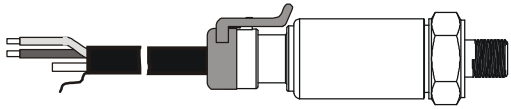
P499 Transducer
 for 0.5 to 4.5 VDC
 and 0 to 10 VDC
 Applications

FIG: P499_vdc_wires

Connect cable shield lead at one point only; typically to Common (or ground) at the control.

Figure 3: Wire Designations for 0.5 to 4.5 VDC and 0 to 10 VDC Transducer Applications

Figure 4 shows the wire designations for a P499 transducer used in 4 to 20 mA applications.



Red Wire = Supply (+)
 Black Wire = Output (-)
 White Wire = Not Used

P499 Transducer
 for 4 to 20 mA
 Applications

FIG: P499_4-20ma_wires

Connect cable shield lead at one point only; typically to Common (or ground) at the control.

Note: The white wire is not used with 4 to 20 mA transducer models. Isolate and insulate the white wire in 4 to 20 mA transducer applications.

Figure 4: Wire Designations for 4 to 20 mA Transducer Applications

Figure 5 shows the wire colors for the wire terminations in the Packard connector plug.

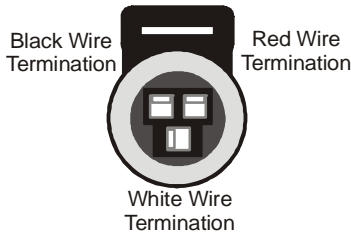


Figure 5: Wire Terminations by Wire Color at Packard Connector Plug on Wire Harness

Figure 6 shows the pins in the Packard connector socket on the P499 transducer and the associated wire color the pins are connected to when the Packard connector plug is connected to the socket.

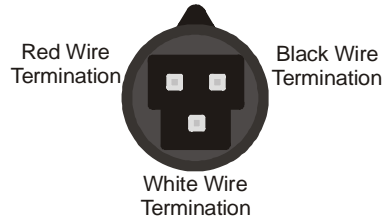


Figure 6: Pin Terminations at P499 Packard Connector Socket by Wire Color

Checking Transducer Operation

IMPORTANT: The P499 transducer is a precision sensing device and testing accuracy is typically beyond the capability of field diagnostic tools.

Before applying power, check all wiring connections. After applying power, operate controlled equipment under normal conditions and use a reliable set of pressure gauges to verify that the transducer and the associated control are operating properly.

0.5 to 4.5 VDC Ratiometric Versions

The ratiometric versions of the P499 transducer receive a constant 5 VDC (nominal) supply voltage and vary the output signal voltage, based on the sensed pressure. The output voltage varies from 10% to 90% of the supply voltage, providing a 0.5 to 4.5 VDC (nominal) signal.

IMPORTANT: The 0.5 to 4.5 VDC Ratiometric Transducers are rated for 5.0 ±0.25 VDC, Safety Extra-Low Voltage (SELV) or Class 2. Exceeding the supply voltage rating can damage the transducer and void any warranties.

To verify that the transducer is working properly:

1. With the transducer in place and the controlled system pressure stabilized, measure the pressure at the transducer with an accurate and reliable gauge. This is the **measured pressure (P)**.
2. Determine the maximum (**Pmax**) and minimum (**Pmin**) pressure values for the transducer's pressure range. (See Table 3, Table 4, or Table 5.)
3. Measure the voltage between Supply (red) wire and Common (black) wire. (See Figure 3.) Use this in Step 3 as the **measured supply voltage, Vs**.

- Use the equation in Figure 7 to determine the **calculated output voltage** for the ratiometric transducer.

$$V_o = V_s \left[0.1 + 0.8 \left(\frac{P - (P_{min})}{P_{max} - (P_{min})} \right) \right] \text{ VDC}$$

V_o = Calculated Output Voltage
 V_s = Measured Supply Voltage
 P = Measured Pressure
 P_{max} = Maximum Pressure Value
 P_{min} = Minimum Pressure Value

FIG9:ratimetric

Figure 7: Voltage Calculation for 0.5 to 4.5 VDC Ratiometric Transducers

- Using your multimeter, measure the DC voltage between the transducer Output (white) wire and Common (black) wire. (See Figure 3.) This is the **measured output voltage**.
- Compare the calculated output voltage (Step 4) and the measured output voltage (Step 5). If the measured output voltage differs greatly from the calculated output voltage, replace the transducer.

Note: It is normal for the transducer reading to differ somewhat from pressure gauge readings due to voltmeter and gauge tolerances, and other factors.

0 to 10 VDC Versions

To verify that the transducer is working properly:

- With the transducer in place and the controlled system pressure stabilized, measure the pressure at the transducer with an accurate and reliable gauge. This is the **measured pressure (P)**.
- Determine the maximum (**P_{max}**) and minimum (**P_{min}**) pressure values for the transducer's pressure range. (See Table 6.)
- Use the equation in Figure 8 to determine the **calculated output voltage** for the 0 to 10 VDC transducers.

$$V_o = 10 \left(\frac{P - (P_{min})}{P_{max} - (P_{min})} \right) \text{ VDC}$$

V_o = Calculated Output Voltage
 P = Measured Pressure
 P_{max} = Maximum Pressure Value
 P_{min} = Minimum Pressure Value

FIG8:0-10VDC

Figure 8: Voltage Calculation for 0 to 10 VDC Transducers

- Measure the voltage between the transducer Output (white) wire and Common (black) wire with a multimeter set to measure DC voltage. (See Figure 3.) This is the **measured output voltage**.
- Compare the calculated output voltage (Step 3) and the measured output voltage (Step 4). If the measured output voltage differs greatly from the calculated output voltage, replace the transducer.

Note: It is normal for the transducer reading to differ somewhat from pressure gauge readings due to voltmeter and gauge tolerances, and other factors.

4 to 20 mA Versions

To verify that the transducer is working properly:

- With the transducer in place and the controlled system pressure stabilized, measure the pressure at the transducer with an accurate and reliable gauge. This is the **measured pressure (P)**.
- Determine the maximum (**P_{max}**) and minimum (**P_{min}**) pressure values for the transducer's pressure range. (See Table 7.)
- Use the equation in Figure 9 to determine the **calculated output current** for the 4 to 20 mA transducers.

$$I = 4 + 16 \left(\frac{P - (P_{min})}{P_{max} - (P_{min})} \right) \text{ mA}$$

I = Calculated Output Current
 P = Measured Pressure
 P_{max} = Maximum Pressure Value
 P_{min} = Minimum Pressure Value

FIG9:4-20mA

Figure 9: Current Calculation for 4 to 20 mA Transducers

- Measure the P499 transducer output current. To measure the P499 Output current: Disconnect the P499 Output (black) wire from the control input terminal. Set your multimeter to milliamperes (mA). Then connect the multimeter's red test-lead to the P499 Output (black) wire and the multimeter's black test-lead to the control input terminal. The milliamperes (mA) reading on your multimeter is the **measured output current**.
- Compare the calculated output current (Step 3) to the measured output current (Step 4). If the current from measured output current differs greatly from the calculated output current, replace the transducer.

Note: It is normal for the transducer reading to differ somewhat from pressure gauge readings due to multimeter and gauge tolerances, and other factors.

Repair Information

Do not attempt to repair or recalibrate the P499 Series Electronic Pressure Transducers. If a transducer does not perform according to specifications, contact your nearest Johnson Controls/PENN authorized distributor or sales representative for a replacement.

Ordering

Figure 10 is a type identification matrix that identifies all of the **potential** P499 Series electronic pressure transducer types and product code numbers.

Note: Not all of the product code number combinations (transducer types) that are possible in Figure 10 are manufactured or available.

Contact your local Johnson Controls/PENN representative for more information on options available for high-volume models with specific application requirements.

Table 3 through Table 7 provide ordering information for standard P499 transducer models available through most Johnson Controls/PENN authorized distributors.

See Table 2 on page 3 for ordering information for wire harnesses with Packard connectors.

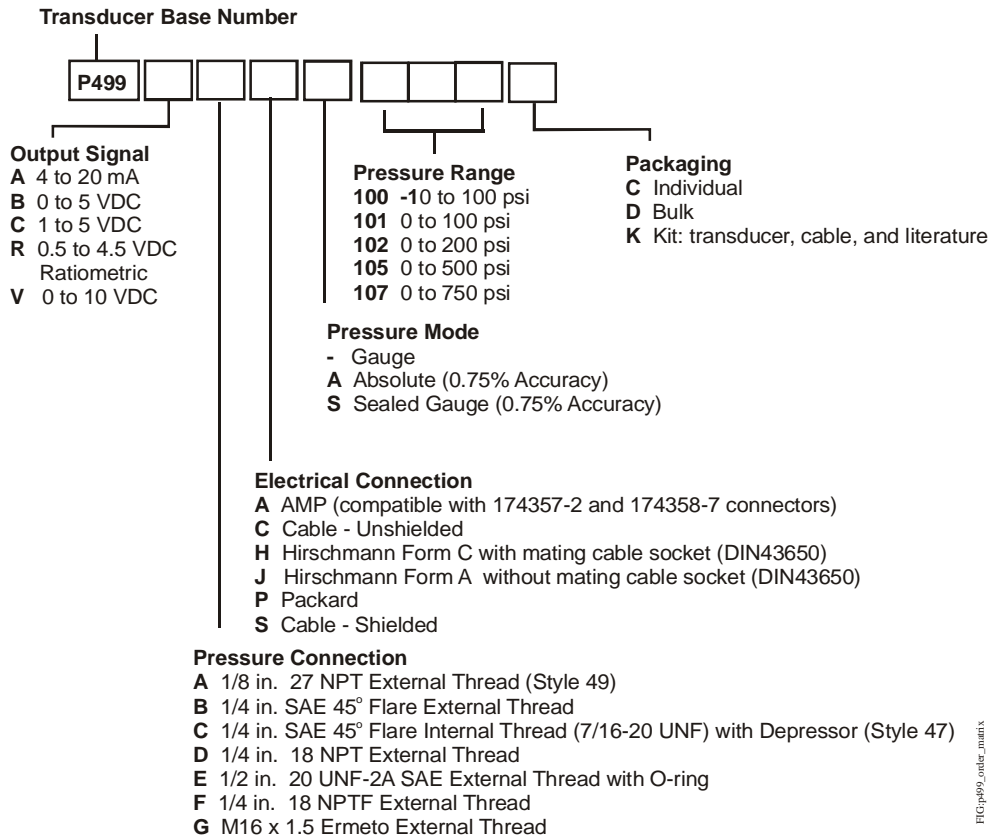


Figure 10: P499 Series Electronic Pressure Transducer Type Identification Matrix

Table 3: 0.5 to 4.5 VDC Ratiometric P499 Transducer Models with Packard Electrical Connections, PSIG

Product Code Number	Pressure Connection	Pressure Range		Individual or Kit ¹
		Minimum Pressure (Pmin)	Maximum Pressure (Pmax)	
P499RAP-101C	1/8 in. 27 NPT External Thread (Style 49)	0 psig (0 bar)	100 psig (6.9 bar)	Individual
P499RAP-101K				Kit
P499RAP-102C		0 psig (0 bar)	200 psig (13.8 bar)	Individual
P499RAP-105C		0 psig (0 bar)	500 psig (34.5 bar)	Individual
P499RAP-105K				Kit
P499RAP-107C		0 psig (0 bar)	750 psig (51.7 bar)	Individual
P499RAP-107K				Kit
P499RCP-101C	1/4 in. SAE 45° Flare Internal Thread (7/16-20 UNF) with Depressor (Style 47)	0 psig (0 bar)	100 psig (6.9 bar)	Individual
P499RCP-101K				Kit
P499RCP-105C		0 psig (0 bar)	500 psig (34.5 bar)	Individual
P499RCP-105K				Kit
P499RCP-107C		0 psig (0 bar)	750 psig (51.7 bar)	Individual
P499RCP-107K				Kit

1. The **Individual** pack comes with a transducer only - you must order the wire harness separately (see Table 2). The **Kit** is packaged with a transducer, 6-1/2 ft (2 m) wire harness, and technical documentation.

Table 4: 0.5 to 4.5 VDC Ratiometric P499 Transducer Models with Packard Electrical Connections, PSIS

Product Code Number	Pressure Connection	Pressure Range ¹		Individual or Kit ²
		Minimum Pressure (Pmin)	Maximum Pressure (Pmax)	
P499RAPS100C	1/8 in. 27 NPT External Thread (Style 49)	-10 psis (-0.7 bar) [20 in. Hg]	100 psis (6.9 bar)	Individual
P499RAPS100K				Kit
P499RAPS102C		0 psis (0 bar)	200 psis (13.8 bar)	Individual
P499RAPS102K				Kit
P499RCPS100C	1/4 in. SAE 45° Flare Internal Thread (7/16-20 UNF) with Depressor (Style 47)	-10 psis (-0.7 bar) [20 in. Hg]	100 psis (6.9 bar)	Individual
P499RCPS100K				Kit
P499RAPS102C		0 psis (0 bar)	200 psis (13.8 bar)	Individual
P499RAPS102K				Kit

1. Transducer sealed and rated for IP67 harsh environments.
2. The **Individual** pack comes with a transducer only - you must order the wire harness separately (see Table 2). The **Kit** is packaged with a transducer, 6-1/2 ft (2 m) wire harness, and technical documentation.

Table 5: 0.5 to 4.5 VDC Ratiometric P499 Transducer Models with Integral 2 m (6-1/2 ft) Shielded Cable, PSIS

Product Code Number	Pressure Connection	Pressure Range ¹	
		Minimum Pressure (Pmin)	Maximum Pressure (Pmax)
P499RCSS101C	1/4 in. SAE 45° Flare Internal Thread (7/16-20 UNF) with Depressor (Style 47)	0 psig (0 bar)	100 psig (6.9 bar)

1. Transducer sealed and rated for IP67 harsh environments.

Table 6: 0 to 10 VDC P499 Transducer Models with Packard Electrical Connections, PSIG

Product Code Number	Pressure Connection	Pressure Range		Individual or Kit ¹
		Minimum Pressure (Pmin)	Maximum Pressure (Pmax)	
P499VAP-101C	1/8 in. 27 NPT External Thread (Style 49)	0 psig (0 bar)	100 psig (6.9 bar)	Individual
P499VAP-101K				Kit
P499VAP-105C		0 psig (0 bar)	500 psig (34.5 bar)	Individual
P499VAP-105K				Kit
P499VAP-107C		0 psig (0 bar)	750 psig (51.7 bar)	Individual
P499VAP-107K				Kit
P499VCP-101C	1/4 in. SAE 45° Flare Internal Thread (7/16-20 UNF) with Depressor (Style 47)	0 psig (0 bar)	100 psig (6.9 bar)	Individual
P499VCP-101K				Kit
P499VCP-105C		0 psig (0 bar)	500 psig (34.5 bar)	Individual
P499VCP-105K				Kit
P499VCP-107C		0 psig (0 bar)	750 psig (51.7 bar)	Individual
P499VCP-107K				Kit

1. The **Individual** pack comes with a transducer only, you must order the wire harness separately (see Table 2). The **Kit** is packaged with a transducer, 6-1/2 ft (2 m) wire harness, and technical documentation.

Table 7: 4 to 20 mA P499 Transducer Models with Packard Electrical Connections, PSIG (Part 1 of 2)

Product Code Number	Pressure Connection	Pressure Range		Individual or Kit ¹
		Minimum Pressure (Pmin)	Maximum Pressure (Pmax)	
P499AAP-101C	1/8 in. 27 NPT External Thread (Style 49)	0 psig (0 bar)	100 psig (6.9 bar)	Individual
P499AAP-101K				Kit
P499AAP-105C		0 psig (0 bar)	500 psig (34.5 bar)	Individual
P499AAP-105K				Kit
P499AAP-107C		0 psig (0 bar)	750 psig (51.7 bar)	Individual
P499AAP-107K				Kit

Table 7: 4 to 20 mA P499 Transducer Models with Packard Electrical Connections, PSIG (Part 2 of 2)

Product Code Number	Pressure Connection	Pressure Range		Individual or Kit ¹
		Minimum Pressure (Pmin)	Maximum Pressure (Pmax)	
P499ACP-101C	1/4 in. SAE 45° Flare Internal Thread (7/16-20 UNF) with Depressor (Style 47)	0 psig (0 bar)	100 psig (6.9 bar)	Individual
P499ACP-101K				Kit
P499ACP-105C		0 psig (0 bar)	500 psig (34.5 bar)	Individual
P499ACP-105K				Kit
P499ACP-107C		0 psig (0 bar)	750 psig (51.7 bar)	Individual
P499ACP-107K				Kit

1. The **Individual** pack comes with a transducer only, you must order the wire harness separately (see Table 2). The **Kit** is packaged with a transducer, 6-1/2 ft (2 m) wire harness, and technical documentation.

Technical Specifications

P499 Series Electronic Pressure Transducers

Pressure Ranges		-10 to 100 psi, 0 to 100 psi, 0 to 200 psi, 0 to 500 psi, 0 to 750 psi
Maximum Working Pressure		2x Pressure Range; short duration; infrequent, abnormal condition
Burst Pressure		5x Pressure Range
Vacuum		30 microns (0.03 mm Hg); short term
Media Compatibility		All media compatible with 17-4PH stainless steel, including ammonia
Output Signal		0.5 to 4.5 VDC, 0 to 10 VDC, or 4 to 20 mA
Supply Voltage	0.5 to 4.5 VDC Ratiometric Output	5.0 ±0.25 VDC, Safety Extra-Low Voltage (SELV) or Class 2
	4 to 20 mA Output	9 to 30 VDC, SELV or Class 2
	0 to 10 VDC Output	12 to 30 VDC, SELV or Class 2
Direct-Mount Pressure Connections		1/8in. -27 NPT External Thread (Style 49), 1/4 in. SAE 45° Flare Internal Thread (7/16-20 UNF) with Depressor (Style 47)
Temperature and Humidity	Storage	-40 to 257°F (-40 to 125°C)
	Operating	-40 to 185°F (-40 to 85°C)
	Compensated Range	-4 to 185°F (-20 to 85°C)
	Humidity	0 to 100% RH
Linearity		±0.25% Full Span Best Fit Straight Line
Accuracy		±1% Full Span (maximum) over compensated temperature range
Materials	Pressure Port	17-4PH stainless steel construction
	Packard Connector	40% glass-filled Polyetherimide (PEI)
Vibration		20G, 20 to 200 Hz
Shock		200G / 11 ms
Compliance	United States	UL Listed, File E29374, CCN NKPZ UL Recognized for Use in Class I, Division 2 Hazardous Locations, File E322274
	Canada	UL Listed, File E29374, CCN NKPZ7 UL Recognized for Use in Class I, Division 2 Hazardous Locations, File E322274
	Europe	CE Mark – Johnson Controls, Inc., declares that this product is in compliance with the essential requirements and other relevant provisions of the EMC Directive 2004/108/EC
	Australia/ New Zealand	C-Tick Mark, Emissions Compliant

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult Johnson Controls/PENN Refrigeration Application Engineering at 1-800-275-5676. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.



Building Efficiency

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