

# P499 Series Electronic Pressure Transducers

## Product/Technical Bulletin

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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 transducers operate with all pressure media compatible with 17-4PH stainless steel, including most non-corrosive refrigerants. They are also suitable for use with ammonia.

The P499 Series provides transducers in numerous pressure ranges, covering most common refrigeration and air conditioning applications. These transducers may also be used in other non-corrosive fluid applications.



**Figure 1: P499 Electronic Pressure Transducers, Style 47 Fitting (Left) and Style 49 Fitting (Right)**

**Table 1: Features and Benefits**

Features	Benefits
<b>Single-Piece Machined Stainless Steel Pressure Port</b>	Provides a durable assembly, eliminates potential of refrigerant loss due to O-ring or weld failures; resists damage due to physical shock, vibration, and pressure pulsations.
<b>Environmentally-Protected (IP67) Electronics</b>	Withstand the effects of adverse conditions associated with typical Heating, Ventilating, and Air Conditioning (HVAC) and Refrigeration applications, including freeze/thaw applications on suction lines.
<b>Reliable, Repeatable Performance and Long Operating Life</b>	Minimizes service and replacement costs.
<b>Available in Numerous Pressure Ranges</b>	Providing a single line of transducers for all refrigeration and air conditioning application needs.
<b>Slender Body Design</b>	Facilitates use of deep-socket wrenches for ease of installation; requires zero turning radius.
<b>1% Total Error Band</b>	Provides high-accuracy performance.
<b>CE and UL Agency Listings</b>	Allow for global applications.

## Application

**IMPORTANT:** P499 Series Electronic Pressure Transducers are intended to provide a signal to operating controls under normal operating conditions. Where failure or malfunction of a P499 Electronic Pressure Transducer could lead to an abnormal operating condition that could cause personal injury or damage to the equipment or other property, other devices (limit or safety controls) or systems (alarm or supervisory systems) intended to warn of, or protect against, failure or malfunction of a P499 Electronic Pressure Transducer must be incorporated into and maintained as part of the control system.

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 1764 psi (120 bar).

Typical applications include

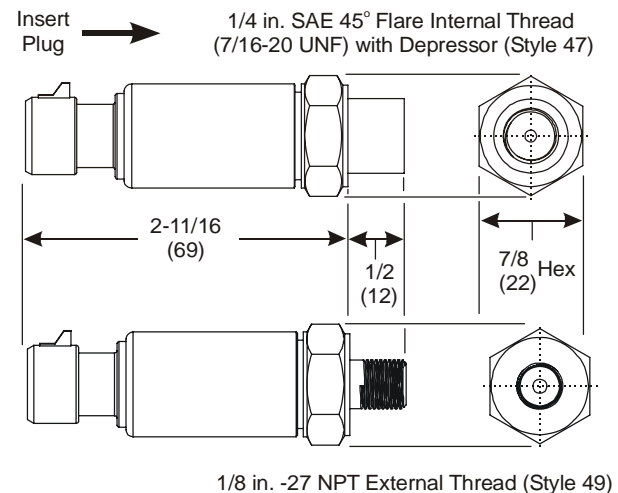
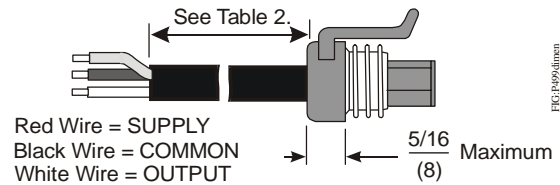
- HVAC and refrigeration applications
- chillers
- fan speed controls
- pumps and compressors
- agricultural applications
- industrial process control

## 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.

**Note:** The environmentally-protected (IP67) P499 transducer measures pressure as psig.

## Dimensions



Note: Packard connectors shown

**Figure 2: Wire Harness and P499 Electronic Pressure Transducers 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 <sup>1</sup>	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 power supply before making electrical connections to avoid electrical shock.

Follow the wiring guidelines given to avoid causing damage to the 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 instruction sheets.

## Checkout

**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.

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. Use this in Step 3 as the measured pressure, **P**.
2. Measure the voltage between SUPPLY (red wire) and COMMON (black wire). Use this in Step 3 as the measured supply voltage, **Vs**.
3. Use the equation in Figure 3 to calculate the **ideal output voltage** for the ratiometric transducers.

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

$V_o$  = Ideal Output Voltage  
 $V_s$  = Measured Supply Voltage  
 $P$  = Measured Pressure  
 $P_x$  = Full Range Pressure of Sensor

FIG:ill\_03mre

**Figure 3: Ideal Voltage Calculation for 0.5 to 4.5 VDC Ratiometric Transducers**

4. Measure the voltage between the transducer OUTPUT (white wire) and COMMON (black wire) with a multimeter set to measure DC voltage. This is the **measured output voltage**.
5. Compare the ideal output voltage (Step 3) and the measured output voltage (Step 4). If the measured output voltage differs greatly from the ideal 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:

1. With the transducer in place and the controlled system pressure stabilized, measure the pressure at the transducer with an accurate and reliable gauge. Use this in Step 2 as the measured pressure, **P**.

2. Use the equation in Figure 4 to calculate the **ideal output voltage** for the 0 to 10 VDC transducers.

$$V_o = 10 \left( \frac{P}{P_x} \right) \text{ VDC}$$

$V_o$  = Ideal Output Voltage  
 $P$  = Measured Pressure  
 $P_x$  = Full Range Pressure of Sensor

FIG:ill\_04v

**Figure 4: Ideal Voltage Calculation for 0 to 10 VDC Transducers**

3. Measure the voltage between the transducer OUTPUT (white wire) and COMMON (black wire) with a multimeter set to measure DC voltage. This is the **measured output voltage**.
4. Compare the ideal output voltage (Step 2) and the measured output voltage (Step 3). If the measured output voltage differs greatly from the ideal 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:

1. With the transducer in place and the controlled system pressure stabilized, measure the pressure at the transducer with an accurate and reliable gauge. Use this in Step 2 as the measured pressure, **P**.
2. Use the equation in Figure 5 to calculate the **ideal output current** for the 4 to 20 mA transducers.

$$I = 4 + 16 \left( \frac{P}{P_x} \right) \text{ mA}$$

$I$  = Ideal Output Current  
 $P$  = Measured Pressure  
 $P_x$  = Full Range Pressure of Sensor

FIG:ill\_05mA

**Figure 5: Ideal Current Calculation for 4-20 mA Transducers**

3. Measure the current between the transducer SUPPLY (red wire) and COMMON (black wire) with a multimeter set to measure milliamperes (mA). This is the **measured output current**.
4. Compare the ideal output current (Step 2) to the measured output current (Step 3). If the current from measured output current differs greatly from the ideal 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

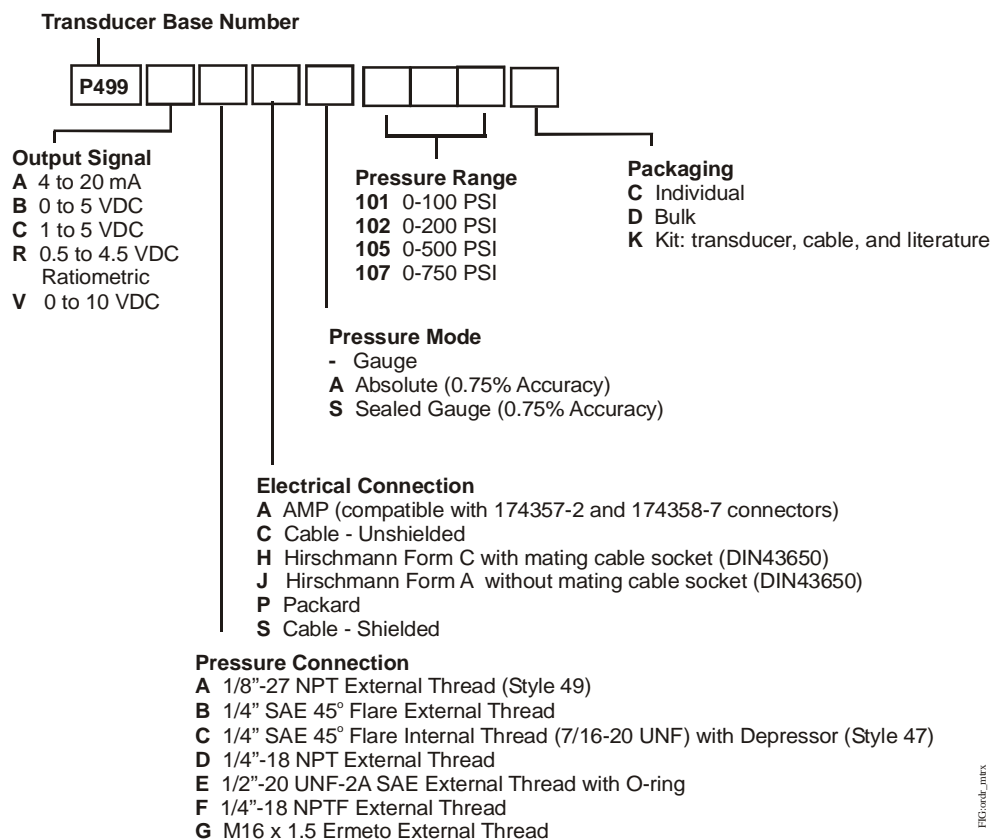
Do not attempt to repair or recalibrate the P499 Series Electronic Pressure Transducers. If repair or replacement is needed, contact your nearest Johnson Controls/PENN authorized distributor or sales representative.

### Ordering

Figure 6 is a type identification matrix that identifies all the potential P499 Series electronic pressure transducer types. Not all combinations in Figure 6 are manufactured and 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 5 list the features on standard P499 transducer models available through most Johnson Controls/PENN authorized distributors.

See Table 2 for information on wire harnesses.



**Figure 6: P499 Series Electronic Pressure Transducer Type Identification Matrix**

**Table 3: Standard 0.5 to 4.5 VDC Ratiometric P499 Transducer Models with Packard Electrical Connections**

Product Code Number	Pressure Fitting	Pressure Range <sup>1</sup>	Individual or Kit <sup>2</sup>
P499RAP-101C	1/8"-27 NPT External Thread (Style 49)	0 to 100 psi (0 to 6.9 bar)	Individual
P499RAP-101K			Kit
P499RAP-102C		0 to 200 psi (0 to 13.8 bar)	Individual
P499RAP-105C		0 to 500 psi (0 to 34.5 bar)	Individual
P499RAP-105K			Kit
P499RAP-107C		0 to 750 psi (0 to 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 to 100 psi (0 to 6.9 bar)	Individual
P499RCP-101K			Kit
P499RCP-105C		0 to 500 psi (0 to 34.5 bar)	Individual
P499RCP-105K			Kit
P499RCP-107C		0 to 750 psi (0 to 51.7 bar)	Individual
P499RCP-107K			Kit

1. The P499 transducer measures pressure as psig.
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 literature.

**Table 4: Standard 0 to 10 VDC P499 Transducer Models with Packard Electrical Connections**

Product Code Number	Pressure Fitting	Pressure Range <sup>1</sup>	Individual or Kit <sup>2</sup>
P499VAP-101C	1/8"-27 NPT External Thread (Style 49)	0 to 100 psi (0 to 6.9 bar)	Individual
P499VAP-101K			Kit
P499VAP-105C		0 to 500 psi (0 to 34.5 bar)	Individual
P499VAP-105K			Kit
P499VAP-107C		0 to 750 psi (0 to 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 to 100 psi (0 to 6.9 bar)	Individual
P499VCP-101K			Kit
P499VCP-105C		0 to 500 psi (0 to 34.5 bar)	Individual
P499VCP-105K			Kit
P499VCP-107C		0 to 750 psi (0 to 51.7 bar)	Individual
P499VCP-107K			Kit

1. The P499 transducer measures pressure as psig.
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 literature.

**Table 5: Standard 4 to 20 mA P499 Transducer Models with Packard Electrical Connections**

Product Code Number	Pressure Fitting	Pressure Range <sup>1</sup>	Individual or Kit <sup>2</sup>
P499AAP-101C	1/8"-27 NPT External Thread (Style 49)	0 to 100 psi (0 to 6.9 bar)	Individual
P499AAP-101K			Kit
P499AAP-105C		0 to 500 psi (0 to 34.5 bar)	Individual
P499AAP-105K			Kit
P499AAP-107C		0 to 750 psi (0 to 51.7 bar)	Individual
P499AAP-107K			Kit
P499ACP-101C	1/4 in. SAE 45° Flare Internal Thread (7/16-20 UNF) with Depressor (Style 47)	0 to 100 psi (0 to 6.9 bar)	Individual
P499ACP-101K			Kit
P499ACP-105C		0 to 500 psi (0 to 34.5 bar)	Individual
P499ACP-105K			Kit
P499ACP-107C		0 to 750 psi (0 to 51.7 bar)	Individual
P499ACP-107K			Kit

1. The P499 transducer measures pressure as psig.
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 literature.

## Technical Specifications

### P499 Series Electronic Pressure Transducers

<b>Pressure Ranges</b>		0 to 100 psi, 0 to 200 psi, 0 to 500 psi, 0 to 750 psi
<b>Maximum Working Pressure</b>		2x Pressure Range; short duration; infrequent, abnormal condition
<b>Burst Pressure</b>		5x Pressure Range
<b>Vacuum</b>		30 microns (0.03 mm Hg); short term
<b>Media Compatibility</b>		All media compatible with 17-4PH stainless steel, including ammonia
<b>Output Signal</b>		0.5 to 4.5 VDC, 0 to 10 VDC, or 4 to 20 mA
<b>Supply Voltage</b>	<b>0.5 to 4.5 VDC Ratiometric Output</b>	5.0 ±0.25 VDC, Safety Extra-Low Voltage (SELV) or Class 2
	<b>4 to 20 mA Output</b>	9 to 32 VDC, SELV or Class 2
	<b>0 to 10 VDC Output</b>	12 to 30 VDC, SELV or Class 2
<b>Direct-Mount Pressure Connections</b>		1/8"-27 NPT External Thread (Style 49), 1/4 in. SAE 45° Flare Internal Thread (7/16-20 UNF) with Depressor (Style 47)
<b>Temperature and Humidity</b>	<b>Storage</b>	-40 to 257°F (-40 to 125°C)
	<b>Operating</b>	-40 to 257°F (-40 to 125°C)
	<b>Compensated Range</b>	-4 to 185°F (-20 to 85°C)
	<b>Humidity</b>	0 to 100% RH
<b>Accuracy</b>		±0.25% Full Span Best Fit Straight Line
<b>Total Error Band</b>		±1% Full Span (maximum) over compensated temperature range
<b>Materials</b>	<b>Pressure Port</b>	17-4PH stainless steel construction
	<b>Packard Connector</b>	40% glass-filled Polyetherimide (PEI)
<b>Vibration</b>		20G, 20 to 200 Hz
<b>Shock</b>		200G / 11 ms
<b>Compliance</b>	<b>United States</b>	UL Listed, File E29374, CCN NKPZ
	<b>Canada</b>	UL Listed, File E29374, CCN NKPZ7
	<b>Europe</b>	CE Mark, EMC Directive 86/336/EEC
	<b>Australia/ New Zealand</b>	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 1-800-274-5676. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.



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