

PRODUCT/TECHNICAL BULLETIN

P399 Series Electronic Pressure Transducers

The P399 Series Electronic Pressure Transducers are compact, economical, rugged, direct-mount pressure transducers. The P399 transducers produce a low-voltage analog signal (nominal 0.5-4.5 VDC) based on the sensed pressure. They are designed for use in commercial refrigeration and air-conditioning applications.

The P399 transducers feature welded stainless steel construction with environmentally sealed electronics. They resist the effects of wide ambient temperature swings, high humidity, condensation, and icing. The transducers are suitable for use with all noncorrosive refrigerants as well as ammonia.

The P399 Series provides transducers in several pressure ranges (up to 750 psis [52 bar]), covering most common refrigeration and air-conditioning applications.



Figure 1: P399 Electronic Pressure Transducers, Style 47 (Left) and Style 49 (Right) Fittings

Features and Benefits	
<input type="checkbox"/> Rugged Stainless Steel Construction	Provides a durable assembly, eliminates potential of refrigerant loss due to O-ring failures; resists Electromagnetic Interference (EMI) and damage due to physical shock, vibration, and pressure pulsations
<input type="checkbox"/> Environmentally Sealed Electronics	Withstand the effects of adverse conditions associated with typical Heating, Ventilating, and Air-Conditioning/Refrigeration (HVAC/R) applications
<input type="checkbox"/> Reliable, Repeatable Performance and Long Operating Life	Minimizes service and replacement costs
<input type="checkbox"/> Available in Several Pressure Ranges (up to 750 psis [52 bar])	Provides a single line of transducers for most refrigeration and air-conditioning application needs

Application

IMPORTANT: P399 Series Electronic Pressure Transducers are intended to provide input to operating controls under normal operating conditions. Where failure or malfunction of a P399 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 P399 Electronic Pressure Transducer must be incorporated into and maintained as part of the control system.

P399 Electronic Pressure Transducers provide a ratiometric analog signal (0.5-4.5 VDC), based on the sensed refrigerant pressure, to a variety of pressure controls. P399 transducers are suitable for use with all noncorrosive refrigerants and may also be used with other noncorrosive fluid applications. They are also ammonia compatible.

Pressure connections are available in two standard styles:

- 1/4 in. SAE female flare fitting with Schrader® valve depressor (Style 47)
- 1/8 in.-27 NPT male fitting (Style 49)

Operation

Pressure applied to the P399 transducer transfers to a silicon oil-filled chamber. A micro-machined silicon pressure sensor translates this pressure into an electrical signal.

An Application-Specific Integrated Circuit (ASIC) conditions and amplifies the signal, producing a ratiometric output signal. The output signal voltage varies in direct linear proportion to the sensed pressure.

The P399 transducer receives a constant 5 VDC (nominal) supply voltage and varies the output signal voltage, based on the sensed pressure. The output voltage varies from 10% to 90% of the supply voltage, providing a 0.5-4.5 VDC (nominal) signal.

The P399 transducer measures pressure as psia (compared to a sealed reference of one standard atmosphere). The transducer compares sensed pressure to a sealed reference of 14.7 psia.

Use this equation to convert psia to psis:

$$\text{psis} = \text{psia} - 14.7$$

Note: If the transducer is used at an altitude above sea level, use the following equation to determine the pressure that the sensor is reading:

$$\text{Sensor reading} = A + B - 14.7$$

A = gauge reading
B = local atmospheric pressure

Dimensions

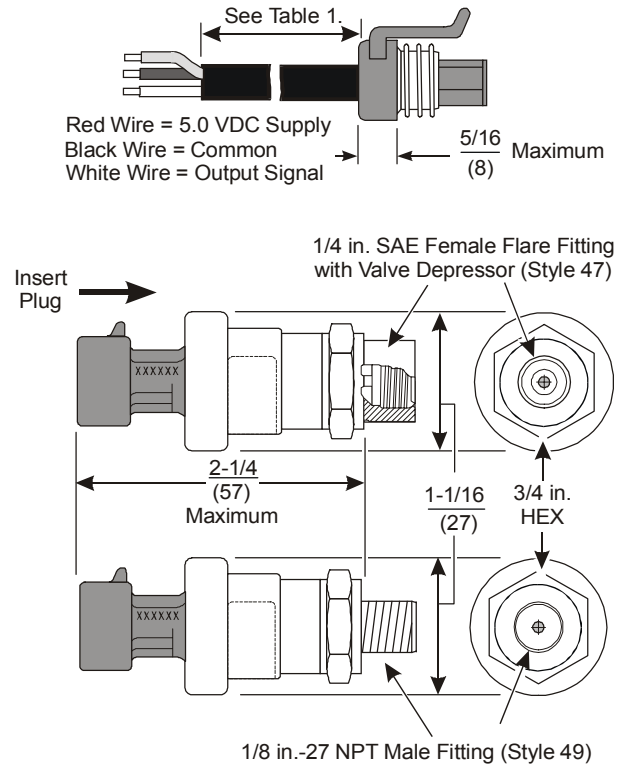


Figure 2: Wire Harness and P399 Electronic Pressure Transducers, in. (mm)

Installation

See *Mounting* and *Wiring* for information on installing the P399 Series Electronic Pressure Transducers.

Parts Required

Unless purchased as a kit (see Table 2), P399 transducers require wire harnesses for all applications. Use Table 1 to select a wire harness.

Table 1: Wire Harnesses

Product Code Number	Length with Pigtail Leads
WHA-P399-200C	6-1/2 ft (2.0 m)
WHA-P399-400C	13 ft (4.0 m)
WHA-P399-600C	19-5/8 ft (6.0 m)

Mounting

The compact, lightweight P399 transducer mounts directly to most refrigeration equipment pressure tap ports.



CAUTION: Risk of Equipment Damage.

Accumulation of oil, liquids, or sediment in the pressure chamber can cause transducer malfunction. Locate pressure tap points on the top side of the refrigerant lines to reduce risk of equipment damage or malfunction.

IMPORTANT: When installing the P399 transducers, observe all regulations governing the handling and containment of hazardous or regulated materials (refrigerants or lubricants).

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

To mount the P399 transducer:

1. Hand thread the P399 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



WARNING: Risk of Electrical Shock.

Disconnect power supply before making electrical connections to avoid possible electrical shock or equipment damage.

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 6 VDC to the transducer.
- 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 P399 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.

To verify if 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.
2. Measure the voltage between the transducer OUT and COMMON with a DC voltmeter.
3. Use the equation in Figure 3 to calculate the ideal output voltage.
4. Compare the voltages in Steps 2 and 3. If the voltage from Step 2 deviates substantially from the value calculated in Step 3, replace the transducer. It is normal for the transducer reading to differ somewhat from pressure gauge readings due to voltmeter and gauge tolerances, and other factors.

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

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

Figure 3: Ideal Voltage Calculation

Repairs and Replacement

Do not attempt to repair or recalibrate the P399 Series Electronic Pressure Transducers. In case of problems, contact your nearest Authorized Johnson Controls/PENN™ Distributor or Sales Representative.

Ordering

Table 2: P399 Pressure Transducer Standard Models

Connector Style	Sold As	Pressure Range			
		0-100 psis (0-6.9 bar)	0-200 psis (0-13.8 bar)	0-500 psis (0-34.5 bar)	0-750 psis (0-51.7 bar)
1/8 in.-27 NPT male (Style 49)	Transducer	P399AAA-1C	P399GAA-1C	P399BAA-1C	P399CAA-1C
	Kit*	P399AAA-1-200C	—	P399BAA-1-200C	P399CAA-1-200C
1/4 in. female flare with Schrader valve depressor (Style 47)	Transducer	P399AAC-1C	—	P399BAC-1C	P399CAC-1C
	Kit*	P399AAC-1-200C	—	P399BAC-1-200C	P399CAC-1-200C

* Kits contain transducer packaged with 6-1/2 ft (2.0 m) length wire harness with pigtail leads (WHA-P399-200C). See Table 1 for information on wire harnesses.

Technical Data

Product	P399 Series Electronic Pressure Transducers	
Pressure Ranges	See Table 2.	
Overpressure	3x Pressure Range Maximum; short duration; infrequent, abnormal condition	
Burst Pressure	5x Pressure Range Maximum	
Vacuum	30 microns (0.03 mm Hg) maximum; short term	
Media Compatibility	Noncorrosive refrigerants, lubricating oils, ammonia	
Supply Voltage	5.00 ±0.25 VDC ratiometric range, 6.00 VDC maximum	
Current Draw	5 mA maximum at 5.0 VDC	
Output Signal	Ratiometric, 10% to 90% of supply voltage (0.5 to 4.5 VDC nominal)	
Direct-Mount Pressure Connections	1/8 in.-27 NPT male (Style 49), 1/4 in. SAE female flare with Schrader valve depressor (Style 47)	
Temperature and Humidity	Storage	-40 to 257°F (-40 to 125°C)
	Operating	-40 to 158°F (-40 to 70°C)
	Refrigerant	-40 to 300°F (-40 to 149°C)
	Humidity	0 to 100% RH
Accuracy	±1.5% Span, -4 to 158°F (-20 to 70°C); ±2.0% Span, -40 to -4°F (-40 to -20°C)	
Materials	Connector - Nylon, 30% glass filled Main Body - Stainless steel all welded construction (304L)	
Vibration	10G, 20-2000 Hz maximum	
Agency Listings	UL Recognized: File Number SA516; CCN's SDFY2 (US), SDFY8 (Canada)	

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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