SmartDiagnostics® Application Note
Pressure Sensor

Publication Date: August 10, 2015

KCF Technologies, Inc.

Background

KCF's SmartDiagnostics® Pressure Sensor Node is designed to provide DC or broadband pressure data on a miniscule power budget, allowing accurate wireless data collection with an extremely long battery life. Taking advantage of MEMs technology and KCF's circuit design expertise, the Pressure Sensor Node is capable of reproducing the function of a traditional wired pressure sensor in a much more convenient package which can be deployed and managed much more easily than wired sensors. This document details the functionality and usage of KCF SmartDiagnostics® Pressure Sensors.

Member of: Hydraulic INSTITUTE

Vibration Institute
SILVER sponsor

Overview and Installation Method

The KCF Pressure Sensor Node consists of two distinct parts:

- **Pressure Transducer:** this is a traditional industrial pressure transducer that would typically be hard-wired to a data collection box. Pressure transducers output either a voltage or a current proportional to the pressure their sensing element is exposed to. The pressure transducer must be plumbed into the fluid system, and exposed to the working fluid, e.g. via a "T" fitting in a pipe.

- **Wireless Pressure Sensor Node:** KCF's Pressure Sensor Node connects to the pressure transducer via a short cable and uses a wireless link to replace the traditional wired path back to the data collection unit, eliminating the need to run cables to every point where pressure is monitored. The wireless Node does not need to be exposed to the process fluid being measured. It can be mounted magnetically or with a threaded stud anywhere in the vicinity of the pressure transducer as allowed by the short transducer cable.
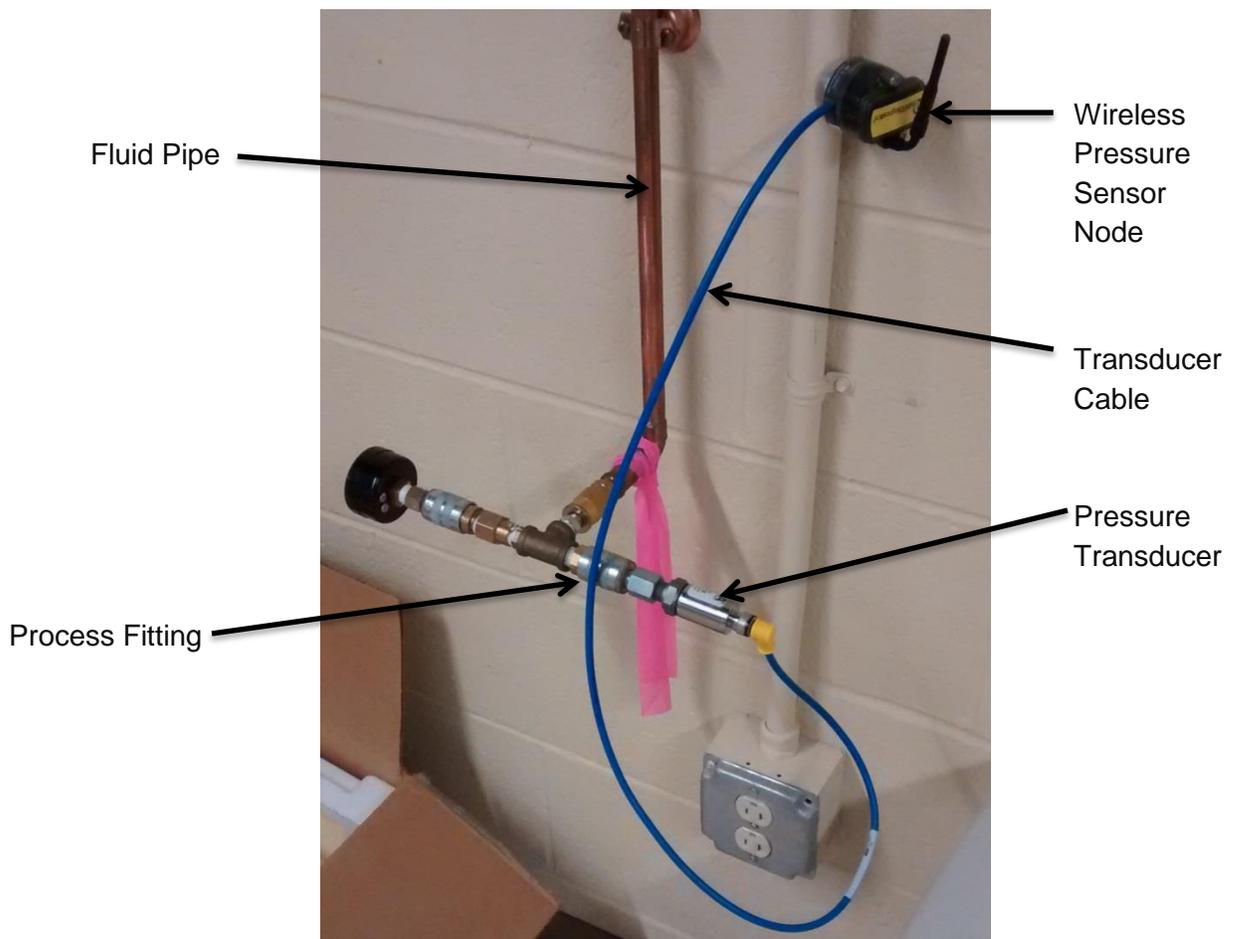
Sampling Modes

KCF's Pressure Sensing Nodes can be used in four different sampling modes:

A) **32 samples at 1024 Hz (0.31s duration):** This extremely short burst data collection is essentially a DC measurement. By taking very few samples over a brief period and averaging them, an accurate DC measurement is obtained while expending the minimum possible energy from the battery. This is the best sampling method if frequent DC measurements are desired but there is little value in seeing high-frequency fluctuations in pressure.

B) **1650 samples at 1024 Hz (1.6s duration):** This high-frequency data collection is tailored to measuring extremely fast fluctuations in pressure, for instance to diagnose fluid hammer issues in a piping system.

C) **1650 samples at 256 Hz (6.4s duration):** This medium-frequency data collection is a compromise between extended battery life and extended recording length to look for cyclical phenomena.

D) **1650 samples at 64 Hz (25.8s duration):** This extremely long data collection is useful for checking pressure cycling phenomena that happen over a slower time scale, where a longer recording length is required to "catch" the a pressure phenomenon that may only be happening every few seconds. Because of the long duration over which the sensor is powered, this sampling method will have a severe impact on battery life, particularly if a short collection interval is selected.

Battery Life:

As mentioned above, battery life is highly dependent on sampling mode. For current-output sensors, battery life is also dependent on the pressure reading; as pressure approaches the top end of the sensor's range, current draw from the sensor increases and battery life decreases. For a mid-range nominal pressure, the following are typical battery life values that may be expected with various collection intervals.

Table 1: Battery Life estimates for different sampling methods; 10-minute collection interval

Sampling Method	Battery Life for Given Collection Interval		
	10 Minutes	**1 Minute**	**12 Seconds**
A	5 years	1 year	2 months
B	1 years	2 months	Not Recommended
C	6 months	Not Recommended	Not Recommended
D	1 month	Not Recommended	Not Recommended

Pressure Transducers Characteristics:

Parameter	Description
Pressure Port	1/4-18 MNPT
Gage Pressure Ranges Available:	0-1 psig through 0-10,000 psig
Absolute Pressure Ranges Available:	0-5 psia through 0-300 psia
Materials	All Stainless Steel Construction
Measurement Technology	State-of-the-art Silicon Technology
Temperature Compensation	>5 psi range: -20 to 85 °C (-4 to 185 °F) ≤5 psi range: 0-50 °C (-18 to 122 °F)
IP Protection	IP 65
Accuracy	±0.25% FS BSL at 25°C; includes linearity, hysteresis and repeatability
Zero Offset	±2% FSO; ±4% for 1 and 2 psi ranges
Span Setting	±2% FSO; ±4% for 1 and 2 psi ranges
Total Error Band	±2% FSO, includes linearity, hysteresis, repeatability, thermal hysteresis and thermal errors (except 1 psi = ±4.5% and 2 psi = ±3%)
Long-Term Stability (1 Year))	±0.25% typical
Typical Life	10 million cycles
Operating Temperature	-40 to 85°C (-40 to 185°F)
Burst Pressure	5x capacity or 25 psi, whichever is greater
Response Time	<1 ms
Shock	50 g, 11 ms half-sine shock
Vibration	±20 g

Sensor Calibration

Wireless Pressure Sensor Nodes ordered via KCF with a matching pressure transducer will come pre-assembled with the wireless sensor and pressure sensor wired together and calibrated as a unit.

For customer-matched Pressure Sensor Node/transducer pairings, field calibration is possible by accessing the Node Settings menu in the SmartDiagnostics® software either from the Edit page for an indicator, the Network Manager page, or directly from an indicator trend page by clicking on the Node/serial number icon. From the Node Settings menu, a user may enter a Sensitivity and Offset of the transducer (e.g. from a transducer manufacturer's calibration sheet or data sheet), as well as the correct units label that should be applied to the measurement (e.g. psi, kPa, etc.).

To ensure compatibility and reduce setup time, KCF STRONGLY recommends purchasing pre-calibrated Node/transducer pairs directly from KCF. This ensures the unit will be correctly configured for your application directly out of the box and field setup and calibration will not be required.