

*Pioneer Petrotech Services Inc.*

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# PPS27

## Permanent Downhole Monitoring Systems

[www.pioneerpps.com](http://www.pioneerpps.com)

# Permanent Monitoring

**PPS27 Permanent Downhole Monitoring Systems** include multiple types of gauges and surface data acquisition units for customers to choose from. There are viable solutions for diverse applications from low pressure wells to extremely corrosive wells with high concentration carbon dioxide [CO<sub>2</sub>] and/or hydrogen sulphide [H<sub>2</sub>S].

Customers can also choose from single to multi-drop permanent gauge completions with an option of gauge reading tubing pressure or annulus pressure. All of PPS's state-of-the-art downhole tools incorporate industry leading sensors, innovative electronic components, and an electron beam welded housing design.

The link between the user and the downhole gauges is created by the Surface Data Acquisition Unit (SDAU). There are multiple configurations to choose from, including SmartWatcher Touch (for PPS27 vibration gauges) that provides instant data trending and charting to SmartWatcherII which makes it possible to connect up to four wells—with a maximum of four gauges per well—and therefore a total of 16 gauges communicating to the surface unit.

The SDAU can be powered by AC/DC power, or optional solar panel and battery power.

SmartWatcher software is used to configure the SDAU and download data to a computer via USB port. Customers can also connect to the SDAU using its Modbus (RS232 / 485 or fibre optic) interface.

PPS can also provide accessories necessary for intelligent well completions. This includes gauge carriers, downhole cable, cable protectors, cable head and wellhead outlets.

## Qualification Testing

PPS has a standard process for qualification testing of downhole pressure and temperature systems to ensure long-term reliability. Every gauge is calibrated to industry standards. Accurate measurement of static and dynamic well parameters is core to PPS's quality management.

## Integrated Services

PPS's ability to design and manufacture every part of the system means the ability to accommodate a huge range of technical requirements. The company is pleased to offer integrated services including design, mechanical engineering, installation and data management at the customer's request. 🍁

## System Applications

- Production optimization
- Injection monitoring
- CO<sub>2</sub> injection monitoring
- Observation well monitoring
- Pump system monitoring
- Well testing without additional equipment
- Intelligent completions
- Pressure build-up surveys without additional equipment
- High pressure and high temperature monitoring



# Premium Gauge Series

Sensor

Piezo

## Pressure

Pressure Ranges\*–psi

6K | 10K

Accuracy–full scale

± 0.03%

Resolution–psi @ 1sec

0.02 | 0.03

## Temperature

Temperature Range\*–°C

20 to 125

Accuracy–°C

± 0.5

Resolution–°C @ 1sec

0.01

## Characteristics

Service

H<sub>2</sub>S / CO<sub>2</sub> Services upon request

Communication

USB / RS232 / RS485 (Modbus / RTU)

Data Set

Time / Pressure / Temperature

Sampling Rate

1 sec to 18 hrs/sample

Max OD–inches

0.875

Housing Material

Inconel 718

\* Additional pressure and temperature ranges available upon request

Single Gauge

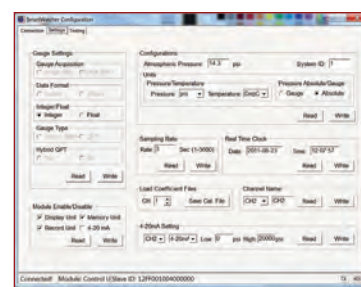
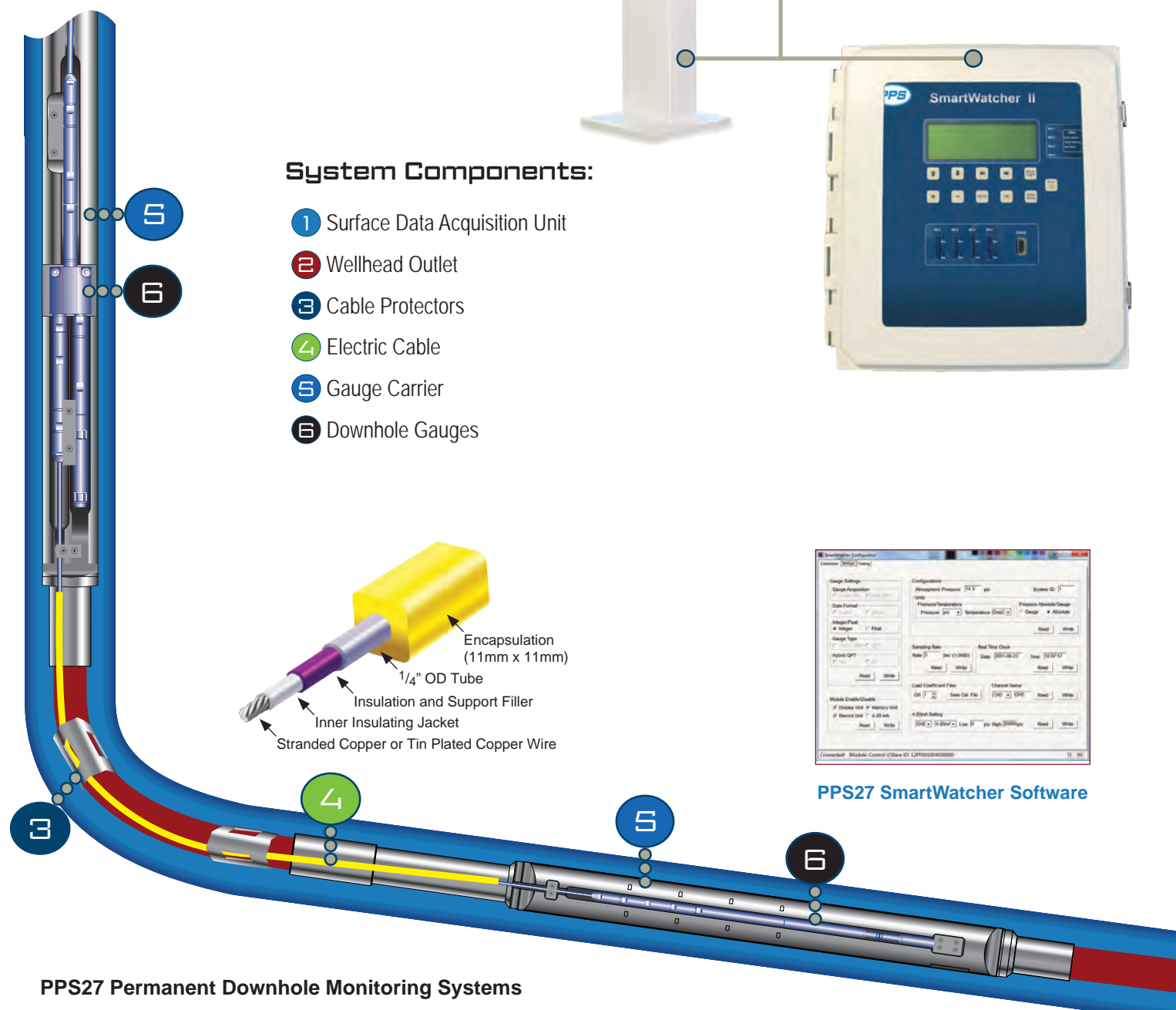






### System Components:

- 1 Surface Data Acquisition Unit
- 2 Wellhead Outlet
- 3 Cable Protectors
- 4 Electric Cable
- 5 Gauge Carrier
- 6 Downhole Gauges



PPS27 SmartWatcher Software

PPS27 Permanent Downhole Monitoring Systems



# Elite Gauge Series

Sensor Quartz | Quartz Hybrid

Pressure	
Pressure Ranges*–psi	5K   10K   16K   25K
Accuracy–full scale	± 0.02%
Resolution–psi @ 1sec	<0.006   <0.01

Temperature	
Temperature Range*–°C	150 (302 °F)   177 (350 °F)   200 (392 °F)
Accuracy–°C	± 0.3
Resolution–°C @ 1sec	<0.005

Characteristics of All Elite Gauges	
Service	H2S/CO2 Services
Communication	USB / RS232 / RS485 (Modbus / RTU)
Data Set	Time / Pressure / Temperature
Sampling Rate	1 sec to 18 hrs/sample
Max OD–inches	0.875
Housing Material	Inconel 718

\* Additional pressure and temperature ranges available upon request



PPS27 Y-splice gauge with swellable packer



# Single Pressure & Vibration Gauges

Vibration analysis, properly done, allows the user to evaluate the condition of pumps and avoid failures. By using vibration as a leading indicator of equipment health, operators can recognize issues and plan preventative maintenance. PPS vibration gauges display the full vibration spectrum of three axes simultaneously—providing a snapshot of whether machinery is tuned to operate in an energy-efficient manner.🍁

## Pressure Sensor Vibration Sensor

**Silicon-Sapphire**  
MEMS Accelerometer

### Pressure

Pressure Range*—psi	6K
Accuracy Range—full scale	± 0.03%
Resolution Range—psi @ 1sec	0.02

### Temperature

Temperature Range—°C	20 to 125
Accuracy Range—°C	± 0.5
Resolution Range—°C @ 1sec	0.01

### Vibration

Measurement Range	± 12g
Resolution	2.9 mg

### Characteristics

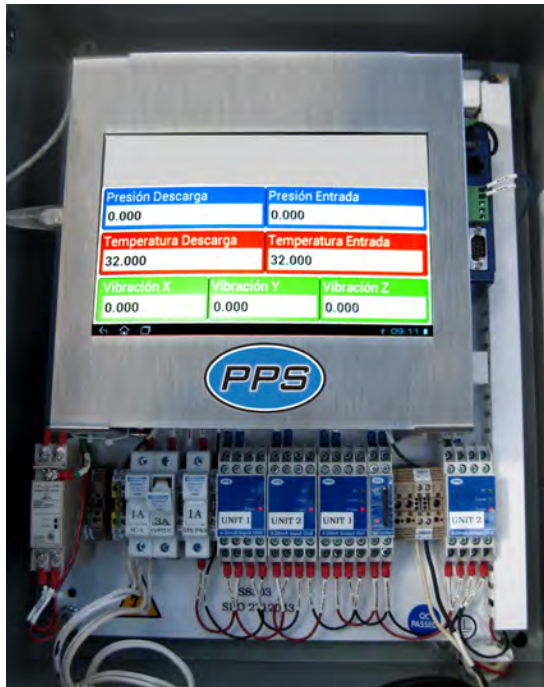
Service	H <sub>2</sub> S/CO <sub>2</sub> Services upon request
Max OD—inches	0.875
Data Set	Time / Pressure / Temperature / Vibration
Housing Material	Inconel 718 / SS316

\* Other pressure ranges available upon request





# Dual Pressure & Vibration Gauges



Pressure Sensor  
Vibration Sensor

**Dual Silicon-Sapphire**  
MEMS Accelerometer

## Pressure

Pressure Range—psi	6K
Accuracy—full scale	± 0.03%
Resolution—psi @ 1sec	0.02

## Temperature

Temperature Range—°C	20 to 125
Accuracy—°C	± 0.5
Resolution—°C @ 1sec	0.01

## Vibration

Measurement Range	± 12g
Resolution	2.9 mg

## Characteristics

Service	H <sub>2</sub> S/CO <sub>2</sub> Services upon request
Max OD—inches	1.125
Data Set	Time / Pressure 1 & 2 / Temp. / Vibration
Housing Material	Inconel 718 / SS316





# Field Services

Our Field Service Technicians are highly trained on-site instrumentation technicians, who utilize their skills and experience in electronics, mechanical and/or cased-hole services to provide electronic data capture solutions, for our domestic and international clients.

Working in highly technical team environments and using electronic data capture solutions that are highly portable, PPS can access various locations, some inaccessible by conventional modes of transportation. 🍁





# Surface Data Acquisition Units

## Surface Readout Box

A basic SRO unit that is hard wired to permanent gauges through encapsulated electric cable allows for transmission of bottom hole pressure and temperature data to surface in real time. Having access to SRO data can help in the planning of well operations, identify the need for performance improvement and generally confirm the reservoir is producing as expected.

## SmartWatcher

SmartWatcher has a modular structure that is available in multiple configurations for downhole data interfacing, processing and logging. This system connects to a maximum of four gauges with a single cable and supports MODBUS/RTU communication. The modular structure provides flexibility for unit expansion based on the application, enhanced reliability in harsh environments, independent mobility for unit improvement, upgrades, certifications, and convenience for unit maintenance.

## SmartWatcher II

This advanced SDAU is able communicate with up to four wells on a pad. Each well can have a maximum of four gauges connected for a total of 16 gauges communicated to the SmartWatcher II unit. Other features include internal memory, MODBUS/Push data port via RS485 or RS232, AC/DC power entries, and solar station availability. The electronics are enclosed in a NEMA-4 box with a large viewing window for easy data monitoring without opening the door.

## SmartWatcher Touch

The SmartWatcher Touch system measures two channels of pressure, one channel of temperature and reads the vibration accelerometer which measures three axes. Upon request the system can include 4-20 outputs for these data channels as well as generic configurable 4-20 inputs. The data channels are displayed on a touch screen display which provides a convenient interface for viewing real time numeric data or graphical representations of the data. The samples that are displayed are simultaneously saved to text files which can later be extracted to a standard USB memory drive.

## SmartGate Remote Data Access

For clients with operations in remote, unpopulated areas, PPS remote monitoring is an excellent way to monitor equipment and view data as needed. Rather than manually getting information at the jobsite, these measurements are accessible in real time using an onsite modem with wireless serial communication.

Data from the tools is stored in the surface unit's memory and also received and stored on secured servers, designated solely for PPS clients. The system can receive periodic data updates and trigger alarms when certain parameters are met. 🍁







- Depend on the PPS27 system's exceptional reliability and stability developed by rigorous qualification testing
- Analyze draw-down and build-up pressure transients to enhance production
- Increase asset management by enabling a deeper understanding of reservoir performance and optimization
- Acquire pressure and temperature information without requiring well intervention
- Permanent gauges are installed in tubing in the well and can measure the tubing pressure, annulus pressure or both
- PPS permanent gauges provide long-term monitoring with high measurement accuracy, less drifting and high resolution
- Optimize artificial lift and extend the run life of pcg pumps by using vibration measurements to monitor pump integrity



# PDMS Accessories

## Gauge Carrier

PPS gauge carriers are designed for long term reliability with pressure testable metal to metal seals and can be configured for single, dual and Y-splice gauges. Materials are available to meet any type of downhole environment, such as 4140, 4150, 13CrL80, SN95, 1925 or Super 13 Chrome. The carrier is machined from one solid block of material and complies with API 5CT guidelines.

## Permanent Downhole Cable

The standard cable that PPS uses is suitable for high pressure, high temperature environments. The cable has 1/4-inch outside diameter steel outer cable and can be either SS316 or Alloy825.

Other features of this cable include:

- Maximum pressure up to 20,000 PSI
- Temperature rating up to 150°C or 200°C based on material and environment
- Tensile rating >1 tonne typical
- Conductor 18AWG stranded wire

## Cable Protectors

Cable protectors are used across the tubing joints to protect the cable from mechanical damage. Customers can choose from iron cast or cannon style protectors. Iron cast protectors are recommended due to their exceptional longitudinal and rotational slippage resistance (Longitudinal > 5 tonnes, Rotational > 3 tonnes), and crush resistance (~4 tonnes).

## Cable Head & Cable Splice

The cable head and cable splice have multiple metal to metal seals and are pressure testable in the field. The cable head has rotation and vibration protection built in. The specifications are:

- 1/4" tube cable with max OD 0.875"
- SS316 / Inconel718
- Pressure Rating 25,000 PSI
- Temperature Rating 0 to 200 °C

## Wellhead Outlet

The wellhead outlet is a device that is used to connect downhole cable to the surface data acquisition system. Its primary purpose is to provide wellhead pressure control upon cable termination. It has metal to metal seals, accepts one conductor and can accommodate most flanged connections.

## PPS Software

SmartWatcher software allows for system configuration and diagnostics. It has full Modbus support and displays data in real time as needed. Data can also be downloaded from an SD card and flash memory. 🍁



## Smart Gauges and Simple Software



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