# Pioneer Petrotech Services Inc.

Smart Gauges and Simple Software

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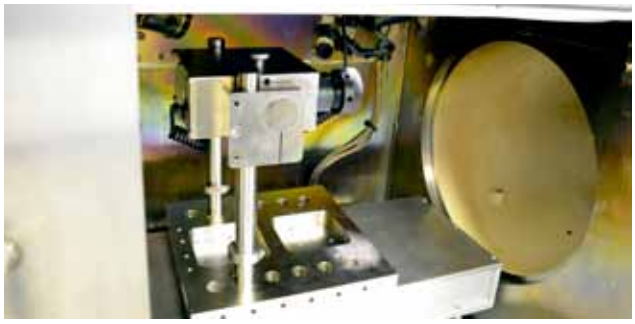
# Company Profile

Pioneer Petrotech Services Inc. (referred to as 'PPS') is headquartered in the beautiful city of Calgary, Alberta Canada. PPS also has regional offices in China, Indonesia, and Venezuela, as well as multiple international representatives. The company was first incorporated in 1999 as a manufacturer of downhole pressure and temperature measurement gauges. From this point forward PPS has become recognized as a global leader in research, development, and manufacturing of high quality downhole pressure and temperature gauges, surface data loggers, permanent downhole gauges, and geothermal logging tools.

## Investing in Technology

PPS's lab and calibration facilities have always been world class, and as part of PPS's commitment to innovation and quality, an Electron Beam Welding Machine has been acquired. EB Welding is one of the best controlled, most robust welding processes which produces the highest quality welds. The better welds translates to more reliable and robust downhole tools.



EB Welding Machine

## Quality Control

Recognizing the need for a comprehensive Quality System as part of all operations, PPS has established a program, which incorporates both a corporate Quality Manual and detailed quality control procedures. The quality system has been designed to comply with the requirements of the International Organization for Standardization ISO 9001, and PPS was certified in 2013

***"We strive to continually improve the effectiveness of our quality management system and our commitment to customer satisfaction by monitoring our performance against our established objectives and through leadership that promotes employee involvement."***

ISO 9001:2008 Certified / FM 589667

# Features of PPS Electronic Gauges

## Robust under High Temperature and Extreme Well Conditions

Based on state-of-the-art technologies and production engineering, PPS products can work consistently for long periods of time under sour or corrosive conditions, high working temperatures of up to 350°C and high pressure environments. The innovative mechanical and electronic design also makes the gauges resistant to vibration and interference.

## Ease of Operation with Simple-to-Use Software

PPS's proprietary software is very user friendly, whether your equipment needs SmartView, SmartLog or RemoteView. The user interfaces are very intuitive and makes interactions with the tool and data, from programming, downloading and reporting, seamless. The memory gauges contain large memory capacities so there is no need to reprogram the gauges after every run, unless you are using a different sample rate. All data files are in ASCII format.

## Low Power Consumption and Long Battery Life

PPS gauges will work continuously over a long period of time utilizing low power consumption. One single C size Lithium battery pack will power some models for over one year at a 30 second sampling rate.

## High Sensitivity

Piezo silicon-sapphire, piezo silicon on insultator or quartz crystal transducers provide high sensitivity for accurate data acquisition.

PPS Production Department

# PPS25 Silicon-Sapphire Memory Gauge

The **PPS25 Silicon-Sapphire Memory Gauge** measures bottomhole pressures and temperatures helping to evaluate productivity during many phases of well development including drilling, evaluation and production. One of the key advantages of the PPS25 is how easy it is to use from start to finish including programming, running a job and gauge maintenance. The SmartView software has a very user friendly interface, so operators with minimal experience can feel confident running the gauges and retrieving data. Also once the gauge is programmed with the desired sampling rates and durations, jobs can be run consecutively without needing to reprogram the gauge, saving time onsite.

PPS25 Gauge & Accessories

| Sensor Type | Silicon-Sapphire |
|---|---|
| **Pressure** | |
| Range–psi | 6K \| 10K \| 15K |
| Accuracy–psi full scale | ± 0.03% |
| Resolution–psi | 0.0003% |
| Drift–psi/year | <3 |
| **Temperature** | |
| Rating–°C | 125 (257 °F) \| 150 (302 °F) |
| Accuracy–°C | ± 0.5 |
| Resolution–°C | 0.01 |
| **Characteristics** | |
| Service | $H_2S$ Services |
| Power Source | Lithium Battery Pack |
| Communication | USB / RS232 |
| Data Set | Time / Pressure / Temperature |
| Max OD–inches | 0.75 (19 mm) \| 1.25 (32 mm) |
| Overall Length–inches | 9.8 (248 mm) \| 10.8 (274 mm) |
| Housing Material | Inconel 718 \| Stainless Steel 17-4 |
| Sampling Rate | 1 sec to 18 hours per sample |
| Memory Capacity | 2,000,000 data sets (4 million data sets optional) |

PPS25 Specifications (Rev. 03, 2015-02-27)

## Applications:

- **Pressure Build-up Tests**
- **Production Tests**
- **Pressure Gradients**
- **Pre/During/Post Stimulation Evaluation**
- **Interference Tests**
- **Fracturing Monitoring**
- **Injection Pressure Monitoring**
- **Coil Tubing Well Stimulation**

# PPS25XM Critical Memory Gauge

The **PPS25XM Critical Memory Gauge** features an advanced Piezo pressure transducer, high temperature electronics technology and welded housing in order to maximize the gauge's performance in hostile well conditions from high concentration $CO_2$ or $H_2S$, to high pressure and high temperature. Additionally there are reinforced metal to metal seals securing the parts which prevents leaks, creating long term stability and reliability even in corrosive environments.

PPS25XM Gauge

| Sensor Type | Piezo |
|---|---|
| **Pressure** | |
| Range–psi | 10K \| 15K \| 20K \| 25K \| 30K |
| Accuracy–psi full scale | ± 0.03% |
| Resolution–psi | 0.0003% |
| Drift–psi/year | <3 |
| **Temperature** | |
| Rating–°C | 177 (350 °F) \| 200 (392 °F) |
| Accuracy–°C | ± 0.5 |
| Resolution–°C | 0.01 |
| **Characteristics** | |
| Service | $H_2S$ Services |
| Power Source | Lithium Battery Pack |
| Communication | USB / RS232 |
| Data Set | Time / Pressure / Temperature |
| Max OD–inches | 1.27 (32 mm) \| 1.375 (35 mm) |
| Overall Length–inches | 17.8 (452 mm) \| 20 (508 mm) |
| Housing Material | Inconel 718 \| MP35N |
| Sampling Rate | 1 sec to 18 hours per sample |
| Memory Capacity | 2,000,000 data sets (4 million data sets optional) |

PPS25XM Specifications (Rev. 02, 2015-02-27)

## Applications:

- **Pressure Build-up Tests**
- **Pressure Gradients**
- **Pre/During/Post Stimulation Evaluation**
- **Interference Tests**
- **Fracturing Monitoring**
- **Drill Stem Tests**

# PPS28 Quartz Memory Gauge

The **PPS28 Quartz Memory Gauge** has an integrated quartz pressure transducer and high temperature electronics making it highly accurate and stable, perfect for critical well testing. It is designed for applications where high quality data is required from a high temperature environment. The SmartView software which accompanies the gauge has a very user friendly interface, so operators with minimal experience with memory gauges can feel confident programming the gauges and retrieving data.

PPS28 Gauge & Accessories

| Sensor Type | Quartz |
|---|---|
| **Pressure** | |
| Range–psi | 10K \| 16K \| 20K \| 25K |
| Accuracy–psi full scale | ± 0.015% (Typically), ± 0.02% |
| Resolution–psi | <0.01 |
| Drift–psi/year | <0.02% FS |
| **Temperature** | |
| Rating–°C | 150 (302 °F) \| 177 (350 °F) |
| Accuracy–°C | ± 0.2 |
| Resolution–°C | <0.005 |
| **Characteristics** | |
| Service | $H_2S$ Services |
| Power Source | Lithium Battery Pack |
| Communication | USB / RS232 |
| Data Set | Time / Pressure / Temperature |
| Max OD–inches | 0.75 (19 mm) \| 1.27 (32 mm) \| 1.375 (35 mm) |
| Overall Length–inches | 24.8 (629 mm) \| 25.2 (640 mm) |
| Housing Material | Inconel 718 \| Stainless Steel 17-4 \| MP35N |
| Sampling Rate | 1s – 18hrs/per sample (0.1s – 1.8hrs/per sample optional) |
| Memory Capacity | 2,000,000 data sets (4 million datasets optional) |

PPS28 Specifications (Rev. 03, 2013-05-10)

## Applications:

- **Pressure Build-up Tests**
- **Pressure Gradients**
- **Interference Tests**
- **Injection Pressure Monitoring**
- **Drill Stem Tests**
- **Production Tests**
- **Pre/During/Post Stimulation Evaluation**
- **Fracturing Monitoring**

# PPS28-200°C Quartz Memory Gauge

The **PPS28-200°C Quartz Memory Gauge** integrates a hybrid quartz pressure transducer with PPS's proprietary leading-edge hybrid high temperature electronics module and metal-to-metal and elastomer sealing technology for reliability in extreme conditions. Thanks to the latest innovations in hybrid electronic technology gauge life is greatly extended at extreme temperature, an advantage that allows the PPS28 gauge to dependably perform at a maximum temperature of 215 °C (419 °F).

PPS28-200°C Gauge & Accessories

| Sensor Type | Quartz |
|---|---|
| **Pressure** | |
| Range–psi | 16K \| 20K \| 25K \| 30K |
| Accuracy–psi full scale | ± 0.015% (Typically), ± 0.02% |
| Resolution–psi | <0.01 |
| Drift–psi/year | <0.02% FS |
| **Temperature** | |
| Rating–°C | 200 (392 °F) / 215 (419 °F) Typically |
| Accuracy–°C | ± 0.2 |
| Resolution–°C | <0.005 |
| **Characteristics** | |
| Service | $H_2S$ Services |
| Power Source | Lithium Battery Pack |
| Communication | USB / RS232 |
| Data Set | Time / Pressure / Temperature |
| Max OD–inches | 0.75 (19 mm) \| 1.27 (32 mm) \| 1.375 (34 mm) |
| Overall Length–inches | 24.8 (630 mm) \| 25.2 (640 mm) |
| Housing Material | Inconel 718 \| MP35N |
| Sampling Rate | 1s – 18hrs/per sample (0.1s – 1.8hrs/per sample optional) |
| Memory Capacity | 2,000,000 data sets (4 million datasets optional) |

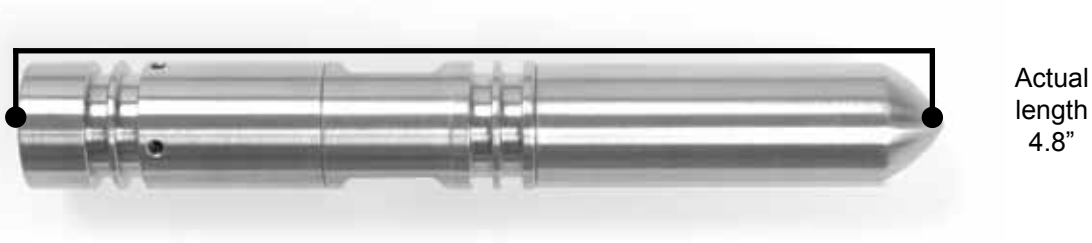
PPS28-200C Specifications (Rev. 03, 2013-05-10)

## Applications:

- **Pressure Build-up Tests**
- **Pressure Gradients**
- **Interference Tests**
- **Injection Pressure Monitoring**
- **Drill Stem Tests**
- **Production Tests**
- **Pre/During/Post Stimulation Evaluation**
- **Fracturing Monitoring**

# PPS51 Short Memory Gauge

The **PPS51 Short Memory Gauge** is designed for applications with length limitations. The most common usage is for building this gauge into other downhole tools, such as water injection and plunger lift equipment. It is also used for general pressure surveys for gradient or build up tests. The gauge length is only 4.8 inches, including one half AA lithium battery pack. The same user-friendly SmartView software is used for programming, downloading and processing data.




PPS51 Gauge

| Sensor Type | Silicon Sapphire |
|---|---|
| **Pressure** | |
| Range–psi | Up to 15 kpsi |
| Accuracy–psi full scale | ± 0.03% |
| Resolution–psi | 0.0003% |
| Drift–psi/year | <3 |
| **Temperature** | |
| Rating–°C | 150 (302 °F) |
| Accuracy–°C | ± 0.5 |
| Resolution–°C | 0.01 |
| **Characteristics** | |
| Service | $H_2S$ Services |
| Power Source | Lithium Battery Pack |
| Communication | USB / RS232 |
| Data Set | Time / Pressure / Temperature |
| Max OD–inches | 0.75 (19 mm) |
| Overall Length–inches | 4.8 (122 mm) |
| Housing Material | Inconel 718 \| Stainless Steel 17-4 |
| Sampling Rate | 1 sec. to 18 hours per sample |
| Memory Capacity | 1,000,000 data sets |

## Applications:

- **Stimulation Monitoring**
- **Pipeline Monitoring**
- **Fracture Monitoring**
- **Injection Pressure Monitoring**
- **Perforation Monitoring**
- **Workover Monitoring**

# PPS52 Skinny 1/2" OD Memory Gauge

The **PPS52 1/2" Outside Diameter Memory Gauge** is designed for applications with outside diameter challenges. The half inch outside diameter of this memory gauge allows users to run this tool in tight space conditions. The most common usage is for pressure and temperature measurement with small inner diameter coiled tubing.

PPS52 Gauge

| Sensor Type | Silicon Sapphire |
|---|---|
| **Pressure** | |
| Range–psi | Up to 10 kpsi |
| Accuracy–psi full scale | ± 0.03% |
| Resolution–psi | 0.0003% |
| Drift–psi/year | <3 |
| **Temperature** | |
| Rating–°C | 150 (302 °F) |
| Accuracy–°C | ± 0.5 |
| Resolution–°C | 0.01 |
| **Characteristics** | |
| Service | $H_2S$ Services |
| Power Source | Lithium Battery Pack |
| Communication | USB / RS232 |
| Data Set | Time / Pressure / Temperature |
| Max OD–inches | 0.50 (12 mm) |
| Overall Length–inches | 8.75 (222 mm) |
| Housing Material | Inconel 718 \| Stainless Steel 17-4 |
| Sampling Rate | 1 sec. to 18 hours per sample |
| Memory Capacity | 1,000,000 data sets |

## Applications:

- **Coiled Tubing Operations**
- **Drill Stem Tests**
- **Gradient Survey**
- **Pressure Build Up**
- **Workover Monitoring**
- **Stimulation Monitoring**

# PPS55 Fast Sampling Gauge

The **PPS55 Fast Sampling Gauge** offers a great opportunity to catch sharp pressure changes, such as the pressure breaking point for reservoir Fracture or perforation operations. The gauge can record up to 500 data points per second. The large memory capacity of four million data points, allows operators to have sufficient downhole running time during job operations.

PPS55 Gauge

| Sensor Type | Silicon Sapphire |
|---|---|
| **Pressure** | |
| Range–psi | Up to 15 kpsi |
| Accuracy–psi full scale | ± 0.01% |
| Resolution–psi | 0.01 |
| Drift–psi/year | <3 |
| **Temperature** | |
| Rating–°C | 150 (302 °F) \| 177 (351 °F) |
| Accuracy–°C | ± 0.5 |
| Resolution–°C | 0.05 |
| **Characteristics** | |
| Service | $H_2S$ Services |
| Power Source | Lithium Battery Pack |
| Communication | USB / RS232 |
| Data Set | Time / Pressure / Temperature |
| Max OD–inches | 0.75 (19 mm) \| 1.25 (31 mm) |
| Overall Length–inches | 9 (228 mm) \| 12 (304 mm) |
| Housing Material | Inconel 718 \| Stainless Steel 17-4 |
| Sampling Rate | Up to 500 data sets per second |
| Memory Capacity | 4,000,000 data sets |

## Applications:

- **Stimulation Monitoring**
- **Injection Pressure Monitoring**
- **Perforation Monitoring**
- **Workover Monitoring**

# PPS62 Pressure & External RTD Gauge

The **PPS62 Pressure & External RTD Gauge** combines a piezo sensor with a highly accurate RTD probe to allow users to obtain fast pressure and temperature responses. This product is primarily designed for detecting tubing and casing leakage problems. CCL can be added to the gauge for immediate measurement of temperature, pressure while locating casing collars. The gauge can be run in tandem with a depth measurement system, such as the PPS36 DepthWatcher which will enable the user to record line tension, speed and depth inconjunction with downhole data from the gauge.

PPS62 Gauge & Accessories

| Sensor Type | Peizo/RTD |
|---|---|
| **Pressure** | |
| Range–psi | 10K \| 15K \| 20K |
| Accuracy–psi full scale | ± 0.03% |
| Resolution–psi | 0.0003% |
| Drift–psi/year | <3 |
| **Temperature** | |
| Rating–°C | 150 (302°F) \| 177 (350°F) |
| Accuracy–°C | ± 0.2 |
| Resolution–°C | <0.01 |
| **Characteristics** | |
| Service | $H_2S$ Services |
| Power Source | Lithium Battery Pack |
| Communication | USB / RS232 |
| Data Set | Time / Pressure / Temperature |
| Max OD–inches | 1.27 (32 mm) |
| Overall Length–inches | 22.3 (566 mm) |
| Housing Material | Inconel 718 |
| Sampling Rate | 1s – 18 hrs/per sample (0.1s – 1.8 hrs/per sample optional) |
| Memory Capacity | 2,000,000 data sets |

PPS62 Specifications (Rev. 02, 2015-02-27)

## Applications:

- **Stimulation Monitoring**
- **Pressure Build-up Tests & Gradients**
- **Production Tests**
- **Tubing and Casing Leakage Checking**
- **Interference Tests**
- **Injection Pressure Monitoring**
- **Coil Tubing Operation**
- **Monitor Artificial Lift Valve Efficiency**

# PPS63 RTD-CCL Memory Gauge

The **PPS63 RTD-CCL Memory Gauge** with its highly accurate RTD probe measures immediate temperature gradients while also measuring pressure and locating casing collars by CCL (casing collar locator). The gauge can be run in tandem with a depth measurement system, such as the PPS36 DepthWatcher which will enable the user to record line tension, speed and depth inconjunction with downhole data from the gauge.

PPS63 Gauge

| Sensor Type | Peizo/RTD |
|---|---|

## Pressure

| | |
|---|---|
| Drift–psi/year | < ± 3 |
| Accuracy–psi full scale | ± 0.03% |
| Resolution–psi | 0.0003% |
| Range–psi | Up to 10 kpsi |
| Over Range | 110% FS |

## Temperature

| | |
|---|---|
| Rating–°C | 150 (302 °F) |
| Accuracy–°C | ± 0.5 |
| Resolution–°C | 0.01 |

## Characteristics

| | |
|---|---|
| Service | $H_2S$ Services |
| Power Source | 2.7 - 3.9 VDC, Lithium Battery Pack |
| Power Consumption | Operation current 2.5 mA |
| Communication | USB / RS232 |
| Data Set | Time / Pressure / Temperature / RTD / CCL |
| Max Outside Diameter–inches | 1.5 (38 mm) |
| Overall Length–inches | 33.5 (85 mm) |
| Housing Material | Inconel X-750 \| Inconel 718 |
| Sampling Rate | 0.1 second to 1.8 hours per sample |
| Memory Capacity | 1,000,000 data sets standard<br>Larger memory optional |

PPS63 Specifications (Rev. 00, 2015-07-31)

## Applications:

- **Locate tubing damage such as corrosion holes or leaks**
- **Locate small casing leaks**
- **Monitor the efficiency of artificial lift valve systems**
- **Record accurate static and flowing temperature readings**
- **Determine crossflow over multiple comingled intervals**

# Memory Gauge Accessories

High Temperature Batteries

USB Gauge Interface Cable

Battery Tester


SmartView Software

Gauge Carrier

O-ring Grease

Carrying Case

O-rings

Crossovers

# PPS26 Surface Read-Out Gauge

The **PPS26 Surface Readout (SRO) Gauge** is designed for real time sampling of pressure and temperature data for applications focused on production optimization, well stimulation or reservoir development. Due to the gauge's stability and strong transmission distance, the PPS26 can send data from downhole to surface through one single conductor wireline cable at well depths up to 7,000 meters.

PPS26 Gauge & Accessories

| Sensor Type | Silicon-Sapphire | Quartz |
|---|---|---|
| **Pressure** | | |
| Range–psi | Up to 20 kpsi | Up to 30 kpsi |
| Accuracy–psi full scale | ± 0.03% | ± 0.02% |
| Resolution–psi | 0.0003% | <0.01 FS |
| Drift–psi/year | <5 | ± 0.02% FS |
| **Temperature** | | |
| Rating–°C | 150 (302 °F) \| 177 (350 °F) | 177 (350 °F) \| 200 (392 ºF) |
| Accuracy–°C | ± 0.5 | ± 0.2 |
| Resolution–°C | 0.01 | <0.005 |
| **Characteristics** | | |
| Service | $H_2S$ Services | $H_2S$ Services |
| Power Source | +12 VDC/100 mA | +12 VDC/100 mA |
| Communication | USB / RS232 | USB / RS232 |
| Data Set | Time / Pressure / Temperature | Time / Pressure / Temperature |
| Max OD–inches | 1.44 (36 mm) | 1.44 (36 mm) |
| Overall Length–inches | 8.26 (209 mm) | 17.64 (448 mm) |
| Housing Material | Inconel 718 \| SS17-4 | Inconel 718 \| SS17-4 |
| Sampling Rate | 1 sec per sample | 1.5 sec per sample |

PPS26 Quartz SRO Specifications (Rev. 00, 2011-11-11)

## Applications:

- **Pressure Build-up Tests**
- **Pressure Gradients**
- **Interference Tests**
- **Injection Pressure Monitoring**
- **Drill Stem Tests**

# PPS58 Memory-SRO Combo Gauge

The **PPS58 Combo SRO-Memory Gauge** offers flexibility in gauge operations for customers who want to use the gauge in either memory working mode or surface read out mode. An SRO adapter is installed on the gauge to connect to a wireline cable head to be able to change the gauge from a memory tool to a surface read out tool. SmartView software is used for memory gauge applications and a PPS26 surface unit with PPS SRO software is used for SRO operations.

PPS58 Gauge & Accessories

| Sensor Type | Piezo | Quartz |
|---|---|---|
| **Pressure** | | |
| Range–psi | Up to 20 kpsi | Up to 20 kpsi |
| Accuracy–psi full scale | ± 0.03% | ± 0.02% |
| Resolution–psi | 0.0003% | <0.01 |
| Drift–psi/year | < 3 | < 0.02%FS |
| **Temperature** | | |
| Rating–°C | 150 (302 °F) \| 177 (350 °F) | 150 (302 °F) \| 177 (350 °F) \| 200 (392 °F) |
| Accuracy–°C | ± 0.5 | ± 0.2 |
| Resolution–°C | 0.01 | <0.005 |
| **Characteristics** | | |
| Service | $H_2S$ Services | $H_2S$ Services |
| Power Source | SRO mode: 12 VDC<br>MEM mode: Lithium Battery | SRO mode: 25VDC/30mA<br>MEM mode: Lithium Battery |
| Communication | SRO mode: PSK<br>MEM mode: USB / RS232 | SRO mode: PSK<br>MEM mode: USB / RS232 |
| Data Set | Time / Pressure / Temperature | Time / Pressure / Temperature |
| Working Mode | Memory or SRO | Memory or SRO |
| Max OD–inches | 1.44 (36 mm) | 1.44 (36 mm) |
| Overall Length–inches | 11.4 (290 mm) | 30.4 (772 mm) |
| Housing Material | Inconel 718 \| SS 17-4 | Inconel 718 |
| Sampling Rate | 1 sec to 18 hours per sample | 1 sec to 18 hours per sample |
| Memory Capacity | 2,000,000 data sets | 2,000,000 data sets |

## Applications:

- **Pressure Build-up Tests**
- **Production Tests**
- **Pressure Gradients**
- **Interference Tests**
- **Injection Pressure Monitoring**
- **Drill Stem Tests**
- **Pre/During/Post Stimulation Evaluation**
- **Fracturing Monitoring**
- **Coil Tubing Well Stimulation**

PPS58 Combo Gauge Specifications (Rev. 02, 2013-06-10)

# PPS27 Permanent Downhole Monitoring System

PPS27 Permanent Downhole Monitoring Systems include multiple types of gauges and surface data acquistion 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 [CO2] and/or hydrogen sulphide [H2S].

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.

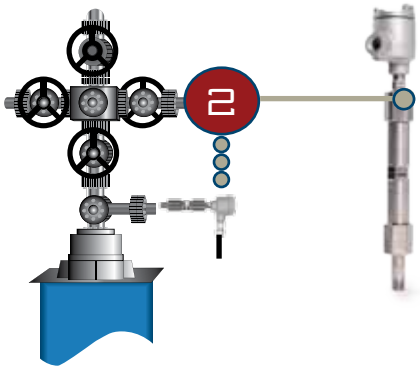
## Integrated Services

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.

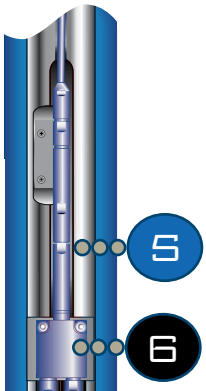
## System Applications

- Production optimization
- Injection monitoring
- $CO_2$ 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

# PPS27 Permanent Downhole Monitoring

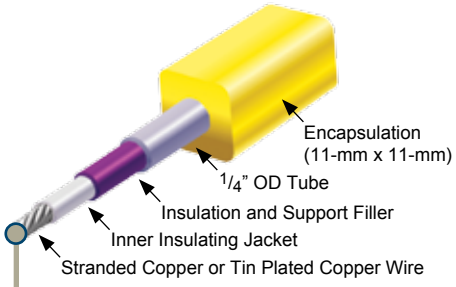


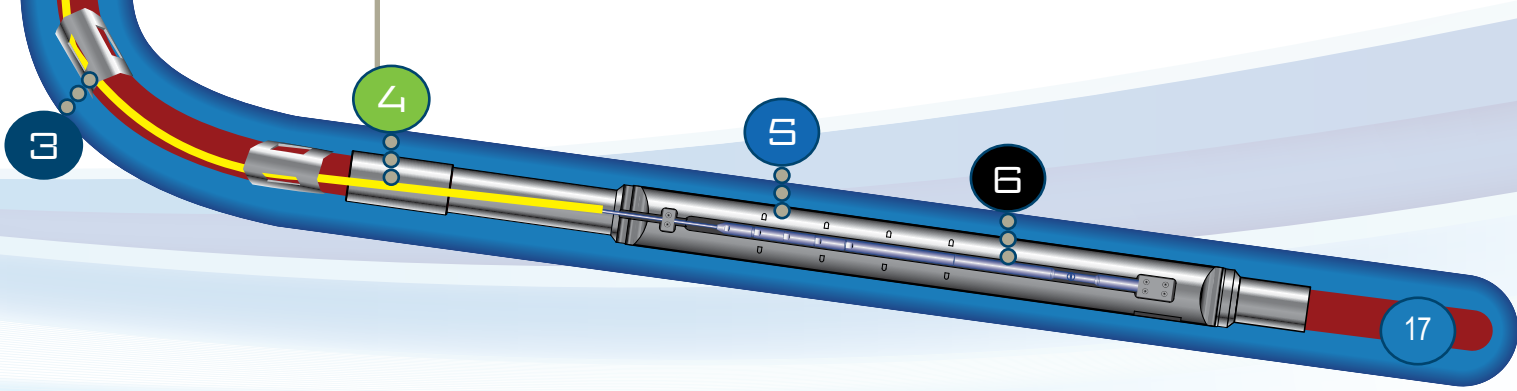





## System Components:

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



# PPS27 Permanent Downhole Monitoring

## 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 | $H_2S/CO_2$ 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 |

## 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 | $H_2S$ / $CO_2$ 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

# PPS27 Permanent Downhole Monitoring

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.

## Single Pressure & Vibration Gauges

| | |
|---|---|
| Pressure Sensor | **Silicon-Sapphire** |
| Vibration Sensor | 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 | $H_2S/CO_2$ 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 | **Dual Silicon-Sapphire** |
| Vibration Sensor | 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 | $H_2S/CO_2$ Services upon request |
| Max OD–inches | 1.125 |
| Data Set | Time / Pressure 1 & 2 / Temp. / Vibration |
| Housing Material | Inconel 718 / SS316 |

Dual Pressure & Vibration Gauge

# PPS27-ESPLink Permanent Monitoring

The PPS electric submersible pump monitoring system can measure pressure, temperature, pump motor operating parameters, and vibration on the x, y and z axes. One of the key advantages of the PPS system is the high level of accuracy and resolution provided for all measurements.

A gauge is placed underneath the ESP motor in line with the completion string and can measure all or some of the following parameters depending on the gauge chosen; intake pressure and temperature, discharge pressure, motor y-point voltage, current leakage, motor winding/oil temperature and vibration (x, y, z). The discharge pressure is routed through a pressure tube.

Vibration analysis, properly done, allows the operator to evaluate the condition of pumps and avoid failures. By using three axes of vibration as a leading indicator of ESP health, operators can recognize issues and plan preventative maintenance before the pump is damaged beyond repair. This allows for accurate forecasting regarding preventative pump maintenance and helps increase ESP longevity.

Having the ability to control the pump is essential to maintaining optimum pump lifting efficiency. Using ESPLink operators can monitor intake and discharge pressure, as well as set parameters for the minimum and normal dynamic fluid level, and the critical and normal motor temperature. When these values are entered into the monitoring system, commands will be sent to the VFD to either stop or restart the pump when these specific levels are reached.

Accurate measurement of static and dynamic well parameters (intake pressure and temperature) on a multi-well reservoir can also enable reservoir engineers to update the reservoir model and perform transient analysis.

## Select your system

| | Intake Pressure | Discharge Pressure | Intake Temperature | Motor Temperature | Vibration X-Axis | Vibration Y-Axis | Vibration Z-Axis | Current Leakage | Y-Point Voltage | LCD Display | Touchscreen Display | AISI420 Housing |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ESPLink-4-SL | ☑ | ☐ | ☑ | ☑ | ☐ | ☐ | ☐ | ☑ | ☐ | ☑ | ☐ | ☑ |
| ESPLink-4-ST | ☑ | ☐ | ☑ | ☑ | ☐ | ☐ | ☐ | ☑ | ☐ | ☐ | ☑ | ☑ |
| ESPLink-7-SL | ☑ | ☐ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☐ | ☑ | ☐ | ☑ |
| ESPLink-7-ST | ☑ | ☐ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☐ | ☐ | ☑ | ☑ |
| ESPLink-9-SL | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☐ | ☑ |
| ESPLink-9-ST | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | ☐ | ☑ | ☑ |

Touch System (ST)

LCD System (SL)


ESPLink Gauge

# PPS27-ESPLink Permanent Monitoring

ESP Surface Units are available in two specifications:

## Surface Touch System (ST)

| | |
|---|---|
| Memory capacity | 8 GB |
| MODBUS RS485 | 3 Wire Standard |
| Operating System | 4.0 Android Operating System |
| Display | 10.1” Colour Touchscreen |
| Power | 110V to 240V AC |
| Operating Temperature | - 10 °C to 65 °C (14 °F to 149 °F) |

## Surface LCD System (SL)

| | |
|---|---|
| Memory capacity | 4 GB |
| MODBUS RS485 | 3 Wire Standard |
| Relay Output | 2 x Form C, 250V AC, 10A, Configurable |
| Display | 20 x 4 LCD character display |
| Power | 110V to 240V AC |
| Operating Temperature | - 40 °C to 85 °C (- 40 °F to 185 °F) |

ESP Downhole Gauges are available in three specifications:

## ESPLink-4 Downhole Gauge

| | Rating | Accuracy | Resolution |
|---|---|---|---|
| Pressure (Intake) | 6,000 psi | 0.05 % FS | 0.02 psi |
| Current Leak | 25 mA | 0.05 % FS | 1 uA |
| Temperature (Intake) | 150 °C (302 °F) | 0.67 % FS | 0.01 °C |
| Temperature (Motor) | 210 °C (410 °F) | 0.67 % FS | 0.01 °C |

## ESPLink-7 Downhole Gauge

| | Rating | Accuracy | Resolution |
|---|---|---|---|
| Pressure (Intake) | 6,000 psi | 0.05 % FS | 0.02 psi |
| Vibration (x) | 12 g | 0.5 % FS | 2 mg |
| Vibration (y) | 12 g | 0.5 % FS | 2 mg |
| Vibration (z) | 12 g | 0.5 % FS | 2 mg |
| Current Leak | 25 mA | 0.05 % FS | 1 uA |
| Temperature (Intake) | 150 °C (302 °F) | 0.67 % FS | 0.01 °C |
| Temperature (Motor) | 210 °C (410 °F) | 0.67 % FS | 0.01 °C |

## ESPLink-9 Downhole Gauge

| | Rating | Accuracy | Resolution |
|---|---|---|---|
| Pressure (Intake) | 6,000 psi | 0.05 % FS | 0.02 psi |
| Pressure (Discharge) | 6,000 psi | 0.05 % FS | 0.02 psi |
| Vibration (x) | 12 g | 0.5 % FS | 2 mg |
| Vibration (y) | 12 g | 0.5 % FS | 2 mg |
| Vibration (z) | 12 g | 0.5 % FS | 2 mg |
| Current Leak | 25 mA | 0.05 % FS | 1 uA |
| Y-Point Voltage | 1,000 V | 10 V | 5 V |
| Temperature (Intake) | 150 °C (302 °F) | 0.67 % FS | 0.01 °C |
| Temperature (Motor) | 210 °C (410 °F) | 0.67 % FS | 0.01 °C |

ESPLink Gauge

# PPS27XM Extreme Permanent Monitoring System

PPS27XM is a permanent monitoring system that measures temperature and pressure at extreme high temperature such as those experienced in thermal oil recovery, like Steam Assisted Gravity Drainage (SAGD) and Cyclic Steam Stimulation (CSS) as well as other geothermal applications.

During thermal operations real-time monitoring can provide clearer understanding of steam chamber development, identify thief zones and provide operators with data that helps maintain the injection and production wells at approximately reservoir pressure to increase stability.

The main components of the PPS27XM are a pressure sensor, thermocouple sensor(s), pressure chamber and surface unit. The system is very versatile and with no electronics downhole it is very robust and doesn't experience electromagnetic interference.

## Specifications

### Thermocouple Sensor(s)

| | |
|---|---|
| Temperature Range | 0 to 300 °C (or higher) |
| Accuracy | ±2.2 °C or 0.75% of FS |
| Material | SS316L |

### Pressure Sensor

| | |
|---|---|
| Sensor Type | Capillary pressure sensor |
| Pressure Range | 0 to 3 kpsi (up to 10kpsi if required) |
| Pressure Accuracy | <±1% (FS) |
| Pressure Chamber | Configurable to customer requirements |

### Surface Unit

| | |
|---|---|
| Operating Temperature Range | -40 °C to 65 °C |
| Power Supply | 100-240VAC or 24VDC |
| Enclosure | NEMA4 |
| Sampling Rate | 1s to 1hr/sample |
| On-Board Flash Memory Capacity | 8,000,000 max |
| Data Transfer | Modbus/RTU |

## System benefits:

- Versatility
- No Electronics Downhole
- Electromagnetic Interference Immunity
- Cost-Effectiveness
- Customizable
- Robust
- Reliable


PPS27XM SDAU

# PPS27 PDMS Surface Units

## 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 Transmission

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.

# PPS27 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 ¼-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:

- ¼" Tube cable with max OD 0.875"
- SS316 / Inconel 718
- 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.

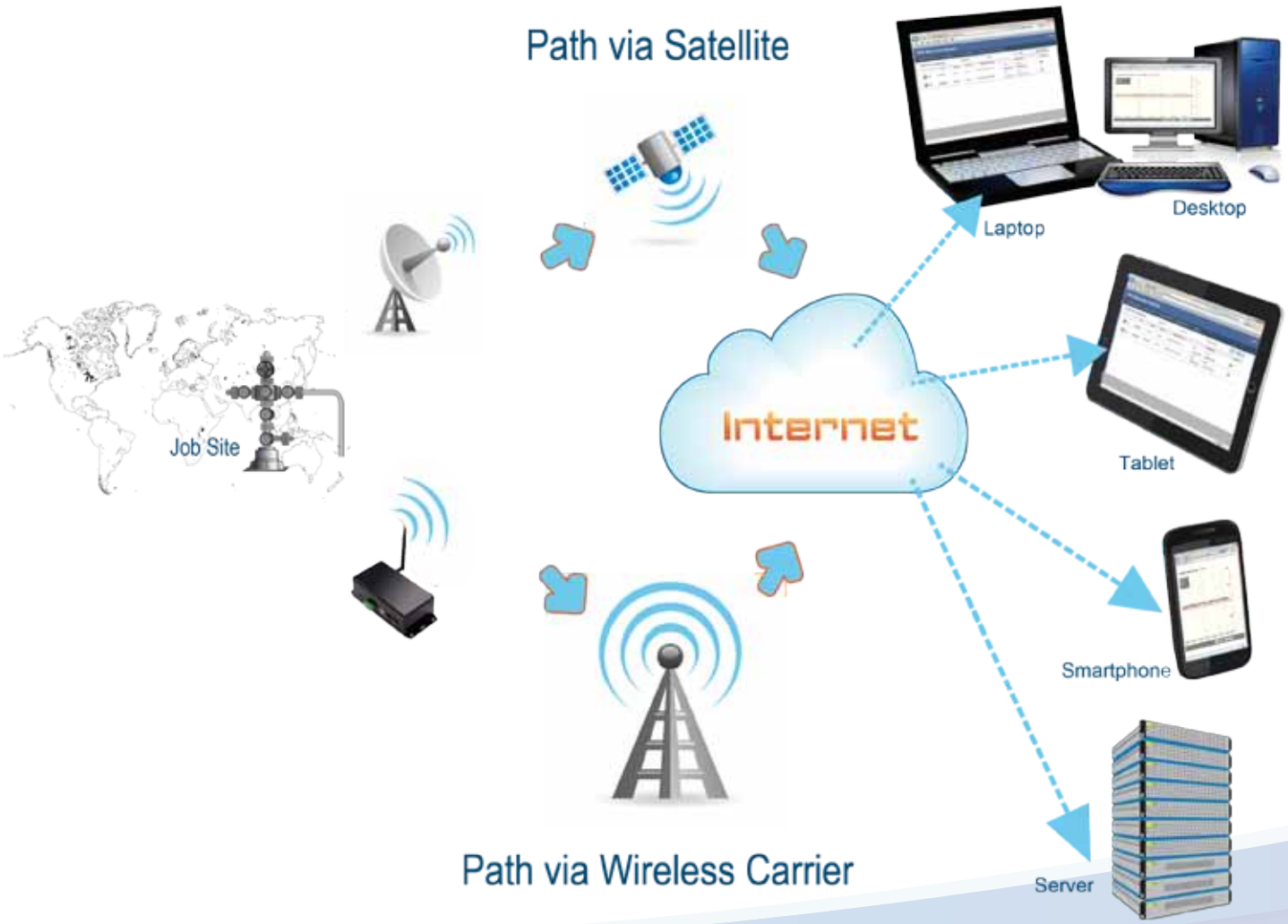
## PPS Software

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..

# SmartGate Remote Data Monitoring System

At the job site a surface unit with a wireless internet gateway is setup to communicate with SDAUs or surface loggers. When the initial communication link is made in SmartGate's web-based platform, each tool is given a Device ID number for easy identification. Data from the tools is stored in the SDAU's or logger's memory and will also be received and stored on secured servers at the PPS headquarters in Calgary, designated solely for PPS clients.

The SmartGate system is capable of sending alert emails and text messages to registered users, if the data received from the tools moves outside of the acceptable parameters created on setup. Users can also change the alarm settings and sampling rates of the connected device, if changes need to be made to ensure optimum operations. This gives client's peace of mind knowing their job site is being monitored day and night.



# PPS31 Wellhead Pressure Logger

The **PPS31 Wellhead Pressure Logger** is a programmable gauge that samples pressure and temperature providing real time monitoring. The logger has a highly viewable LCD display where data can be read and also has built in memory. The intrinsically safe design means this logger can be used in critical environments.

PPS31 Logger & Accessories

| Sensor Type | Silicon-Sapphire |
|---|---|

## Pressure

| | |
|---|---|
| Range–psi | Up to 15 kpsi |
| Accuracy–psi full scale | ± 0.03% |
| Resolution–psi | 0.0003% |
| Drift–psi/year | <3 |

## Temperature

| | |
|---|---|
| Rating–°C | -20 (-4 °F) to 70 (158 °F) By Special Order -40 (-40 °F) to 80 (176 °F) |
| Accuracy–°C | ± 0.5 |
| Resolution–°C | 0.01 |
| Operating Temperature–°C | -40 (-40 °F)~55 (131 °F) |

## Characteristics

| | |
|---|---|
| Service | $H_2S/CO_2$ Services (available upon request) |
| Power Source | Lithium Battery Pack |
| Data Set | Time / Pressure / Temperature |
| Data Receiving Mode | Wireless (915 MHz, ISM) |
| Wireless Transmission Distance | 328' (100 m) |
| Transmission Power | +10 dbm |
| Overall Length–inches | 10 (254 mm) |
| Work Mode | MRO / SRO |
| Sample Rate | 1 sec to 18 hours per sample |
| Memory Capacity | 2,000,000 data sets |
| Connection | 1/2" NPT/Autoclave |
| Safety Rating | Class I, Division 1, Exia IIC T4, CE Marking |

PPS31 Specifications (Rev. 01, 2011-01-20)

## Applications:

- **Gas Wellhead Build-up Tests**
- **Stimulation Monitoring**
- **Pipeline Monitoring**
- **Fracture Monitoring**
- **Wellhead Monitoring**
- **Injection Pressure Monitoring**
- **Perforation Monitoring**
- **Workover Monitoring**

# PPS33 RemoteWatcher

PPS33 RemoteWatcher is a low-power multi-sensor monitoring system designed for applications that require simultaneous multipoint pressure, differential pressure, temperature and/or flow monitoring. The system is highly adaptive and cost effective. Customers can choose from multiple sensor and surface unit configurations based on the number of sensors needed and the transmission distance required.

## Wireless Systems

The logger–sensor configuration allows customers to use one logger and up to six sensors as a network. The logger acts as a central stand-alone node, receiving data from the sensors. The logger is capable of displaying real-time data on an LCD screen, storing data into an SD card plus internal memory, and supporting MODBUS communication.

The router–sensor solution, on the other hand, allows customers to use a router and up to 60 sensors as a network. The router is capable of transferring data to a computer and other devices, through USB and RS232/485 communication.

The Gateway–sensor configuration allows customers to use the PPS Gateway and up to 16 sensors as a network. The Gateway is capable of transferring data to a computer and other devices, through USB and and RS232/485 communication. The Gateway also has a 2 GB (15,000,000 samples at 60 sec/sample) SD memory card as backup in the unlikely event of a power interruption.

The Gateway–sensor surface unit configuration allows customers to use the PPS Gateway and up to 16 sensors as a network, with the key difference being the LCD display with keypad and 16 real time status indicators. This allows customer to easily monitor sensor readings from the display panel, as well as check each sensor's signal strength and battery remaining. The status indicators clearly show which sensors are online or offline.

## Data Transmission

Any of the PPS33 RemoteWatcher configurations can work with customer SCADA or satellite and cellular phone transmission systems to offer real-time information to clients working off site. PPS has also designed its own proprietary data transmission service, which transmits data to a secure server via a GSM network. Clients can now view, download and chart their data 24 hours a day, seven days a week.

# PPS33 RemoteWatcher

## ZigBee® Protocol

ZigBee® is a low-power, wireless networking standard. The ZigBee® protocol is designed to transmit data through volatile radio frequency environments. With an enhanced multi-channel configuration there is a low probability of interference. ZigBee® is typically used in low data rate applications that require long battery life and secure networking. The technology defined by the ZigBee® protocol is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or Wi-Fi.

## 900 MHz Frequency Protocol

The PPS Gateway is typically tuned to operate using 900 MHz (902-928MHz) radio frequency. However alternative frequency bands are available upon request making PPS33 RemoteWatcher globally compatible. Usually the distance over which data can be transmitted depends significantly on things such as transmitter power, receiver quality, type, size, and height of antenna, mode of transmission, noise, and interfering signals.

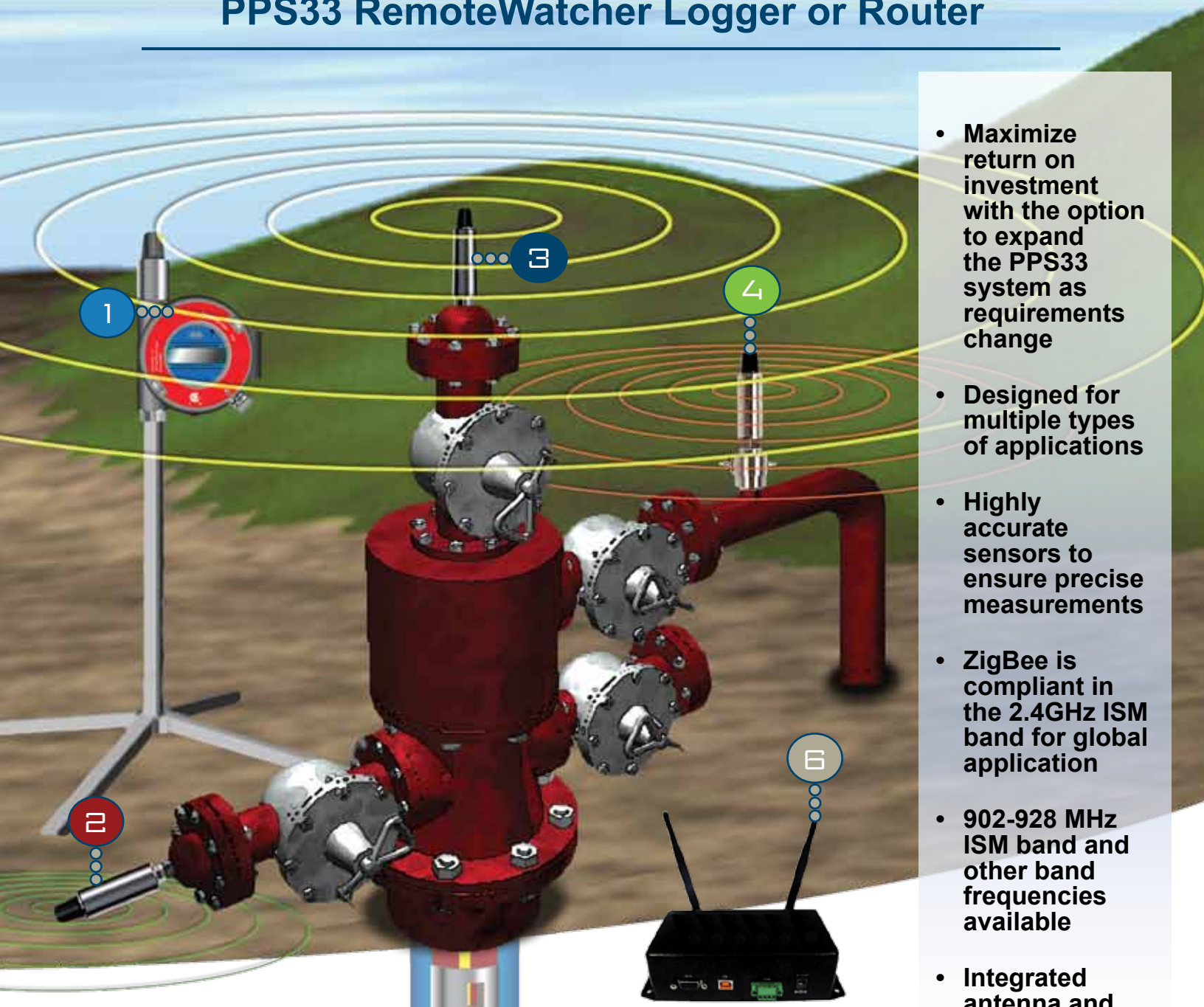
With PPS's high performance design for the wireless transceiver and antenna, there is a reduction in noise and interference allowing for greater distances to be achieved. With an unobstructed line of sight data can be received up to seven kilometers (4.4 miles) away, and by adding a high gain antenna the distance can be increased up to 15 km (9.3 miles). Gateway provides reliable, long range, wireless data transmission.

* Range up to and over one km requires an unobstructed line of sight

## Select your system

| | System Configuration | Sensors Supported | Transmission Distance | Transmission Power | Power Source | Memory | Safety Rating | Interface | Sample Rate |
|---|---|---|---|---|---|---|---|---|---|
| PPS33 | Sensors + Logger | 6 | 100 m Zigbee® Standard or 1.1 km Zigbee® Pro* | +1 dBm Zigbee® Standard or +10 dBm Zigbee® Pro | Two lithium size D batteries | 2 GB SD card & 4Gbits Flash memory | Class I Div 2 Grp ABCD, T4 (-40 °C to 60 °C) | USB/RS485 | 1 to 120 sec/sample |
| | Sensors + Router | 60 | 100 m Zigbee® Standard or 1.1 km Zigbee® Pro* | +1 dBm Zigbee® Standard or +10 dBm Zigbee® Pro | DC 9-32 V | N/A | N/A | USB/RS232 /RS485 | 1 to 120 sec/sample |
| PPS33LR | Sensors + Gateway | 16 | 7 km* | +24 dBm (250mW) | 5V(USB) or 9-28VDC | 2 GB SD card | Designed for Class I Division 2 | USB/RS232 /RS485 | 1 to 60 sec/sample |
| | Sensors + Gateway Surface Unit | 16 | 7 km* or 15 km with high gain antenna * unobstructed line of sight | +24 dBm (250mW) | 9-28VDC, 90-260VAC optional solar power station | 2 GB SD card | Designed for Class I Division 2 | MODBUS TCP/IP \| PPS Remote Data Access \| Wireless Repeater | 1 to 60 sec/sample |

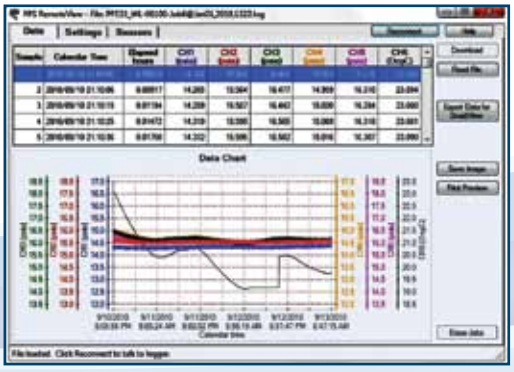
# PPS33 RemoteWatcher Logger or Router




- **Maximize return on investment with the option to expand the PPS33 system as requirements change**
- **Designed for multiple types of applications**
- **Highly accurate sensors to ensure precise measurements**
- **ZigBee is compliant in the 2.4GHz ISM band for global application**
- **902-928 MHz ISM band and other band frequencies available**
- **Integrated antenna and battery**

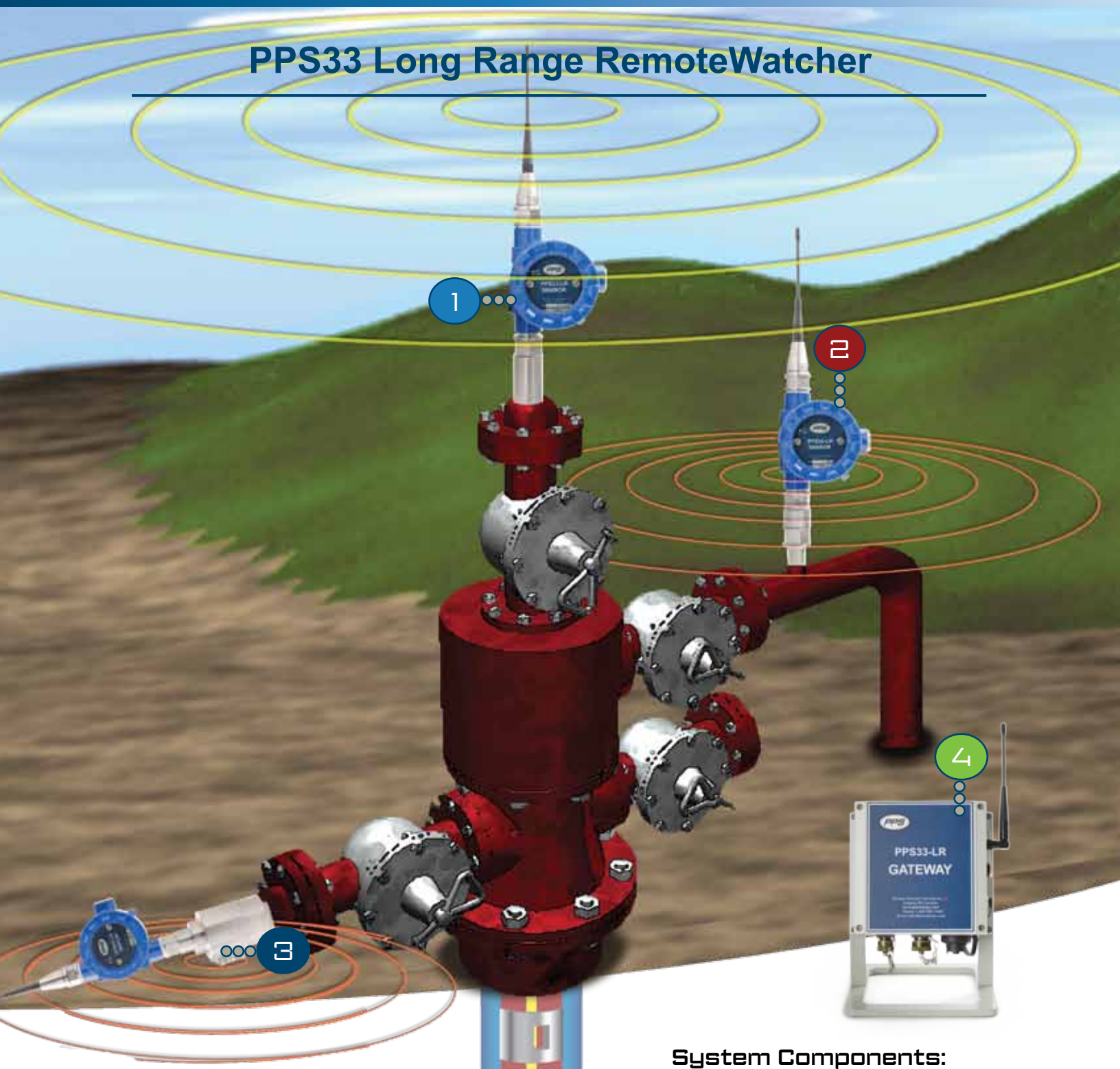
## System Components:

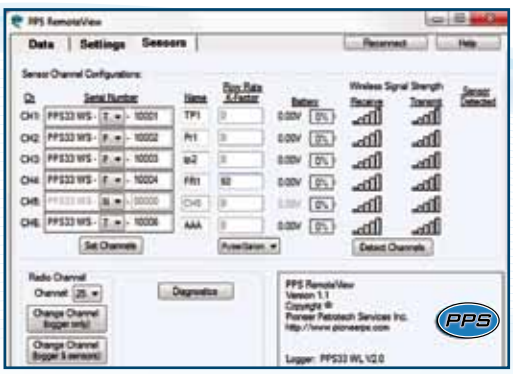
1. Wireless Logger
2. Temperature Sensor
3. Pressure Sensor
4. Differential Sensor
5. Flow Sensor (Not Shown)
6. Router (Optional)



**PPS33 RemoteView Software**

# PPS33 Long Range RemoteWatcher




## System Components:

1. Temperature Sensor
2. Pressure Sensor
3. Differential Sensor
4. PPS Gateway
5. Flow Sensor (Not Shown)
6. PPS Gateway System (Not Shown)

# PPS33 RemoteWatcher Sensors

## Metrology

| Sensor | Pressure (P+T) Sensor | Temperature Sensor | Turbine Flow Sensor** | Differential Pressure Sensor |
|---|---|---|---|---|
| Type | Silicon-Sapphire | RTD | Turbine | Silicon-Sapphire |
| Range | 5K \| 10K \| 15K psi* | -50°C (-59°F) to 200°C (392°F) | 15-1500 pulse/sec | Line: 2.9kpsi; Diff: 290 psi |
| Accuracy | ±0.03% full scale | ±1 ˚C | ±1% | 1.5 psi |
| Resolution | 0.0003%FS | 0.01˚C | One Pulse | 0.01 psi @ 1sec |
| Drift-psi/yr | <±3 psi/year | N/A | N/A | <±3 psi/year |

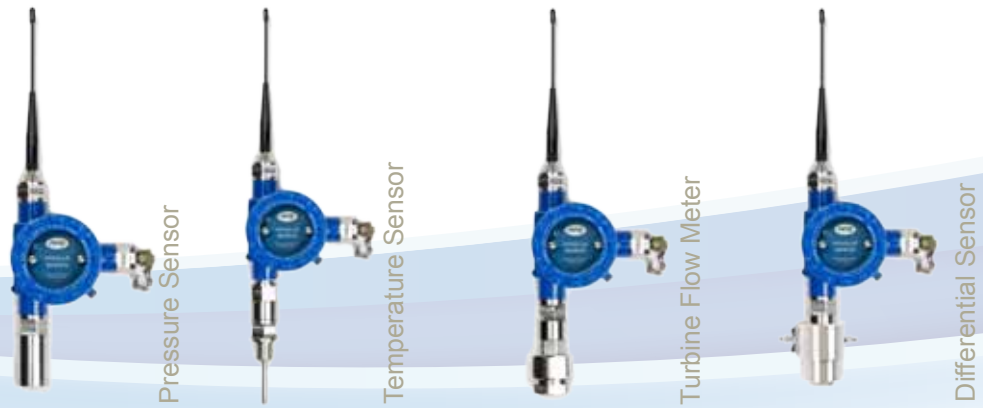
## Characteristics

| | | | | |
|---|---|---|---|---|
| Service | | $H_2S/CO_2$ Services | | |
| Environmental Temperature | | -40 °C (-40 °F) to 70 °C (158 °F) | | |
| Humidity | | 0-100% | | |
| Battery Type | | Lithium Size D 3.6V | | |
| Battery Life | | Up to 1.4 years @ 25 °C | | |
| External Power | | 9-28VDC (Optional) | | |
| Sample Rate | | 1 sec to 60 sec/sample | | |
| Dimension–inch | 15 x 4 x 3.75 | 17.5 x 4 x 3.75 | 15.5 x 4 x 3.75 | 18 x 4 x 3.75 |
| Weight | 3.3 lbs (1.5 kg) | 3.5 lbs (1.6 kg) | 3.5 lbs (1.6 kg) | 9.3 lbs (4.2 kg) |
| Housing Material | | Aluminum (copper free) or SS316 | | |
| Other Material | | SS17-4 \| Inconel718 | | |
| Transducer Material | Hastelloy | N/A | N/A | Hastelloy |
| Safety Rating | | Designed for Class I Div1 (Ex ia IIB T4 Ga) | | |
| Connection | 1/2" NPT (others by request) | | 1" NPT | 1/8" NPT Female |

## Communication

| Data Set | Time / Pressure | Time / Temperature | Time / Flow Rate | Time / Differenial Pressure |
|---|---|---|---|---|
| Method | 902-928MHz (Other frequency available upon request) | | | |
| Wireless Transmission Distance | 7 km Line of Sight | | | |
| Antenna | 2.5dB Whip (Standard), other options available upon request | | | |
| Transmission Power | +24dBm (250mW) Software selectable | | | |

*Other pressure ranges available upon request
**Transmitter limits only



# PPS33 RemoteWatcher Surface Units

## Specifications

| | Logger | Router | Gateway | Gateway Surface Unit |
|---|---|---|---|---|
| **Data Storage** | | | | |
| SD Card | 2 GBytes (23,000,000 data sets) | N/A | 2 GBytes (approx. 9,000,000 samples w/16 wireless sensors connected to 89,000,000 samples w/one wireless sensor connected) | 2 GBytes (approx. 9,000,000 samples w/16 wireless sensors connected to 89,000,000 samples w/one wireless sensor connected) |
| Flash Memory | 4 Gbits (16,000,000 samples) | N/A | N/A | N/A |
| **Characteristics** | | | | |
| Environmental Temperature | -40°C to 55°C | -40°C to 80°C | -40°C to 70°C | -40°C to 70°C |
| Power Source | Two size D Lithium batteries | DC 9-32 V | DC 9-32 V | DC 9-32 V |
| Battery Life–@ 60 sec sample rate | Up to 2 years | N/A | N/A | N/A |
| Sample Rate | 1 sec to 120 sec/sample | 1 sec to 120 sec/sample | 1 sec to 120 sec/sample | 1 sec to 120 sec/sample |
| Dimension–inch | 5.7 X 4.625 (OD) | 5.9 x 3.2 x 2 | 6.3 x 6.2 x 3.19 | 6.3 x 6.3 x 3.19 |
| Safety Rating | Class I Div 2 Grp ABCD, T4 (-40°C to 60°C) | N/A | N/A | Class I Div 2 Grp ABCD, T4 (-40°C to 60°C) |
| **Communication** | | | | |
| Data Set | Time/Pressure/ Temperature/Flow Rate | Time/Pressure/ Temperature/Flow Rate | Time/Pressure/ Temperature/Flow Rate | Time/Pressure/ Temperature/Flow Rate |
| Interface Types | USB/RS485 | USB/RS232/RS485 | USB/RS232/RS485 | USB (RemoteView Software) RSRS232/RS485 (Modbus/Push) |
| Wireless Transmission Distance | 100m ZigBee® Standard or 1.1km ZigBee® Pro | 100m ZigBee® Standard or 1.1km ZigBee® Pro | 7 km (unobstructed line of sight) | 7 km (unobstructed line of sight) or 15 km with high gain antenna |
| Transmission Power | +1 dBm ZigBee® Standard or +10 dBm ZigBee® Pro | +1 dBm ZigBee® Standard or +10 dBm ZigBee® Pro | LR* +24 dBm (250 mW) | LR* +24 dBm (250 mW) |

*LR - stands for PPS33 long range sensors


Gateway Surface Unit


Gateway

Router

Logger

# PPS36 DepthWatcher

The **PPS36 DepthWatcher** is a portable depth recorder that runs on batteries or external power and has an LCD display that an operator can use to see the actual depth, speed, and tension during a slickline job. The recorder can be set up using a very simple menu or by connecting to a PC. It can be operated on a stand alone mode (Memory) or on a real time mode (SRO) with the use of a PC to display depth, speed, tension and two additional channels. It is also equipped with three additional 4-20mA channels for measuring other wellhead parameters.

PPS36 DepthWatcher

## Characteristics

| | |
|---|---|
| Depth Accuracy | ±0.3 ft. (0.1 m) |
| Display | LCD Graphic Display (320 x 240) |
| Memory | 48 MBytes |
| Power Input Voltage | 6 - 28 VDC, 200 mA at 12 VDC or Lithium Battery Pack |
| Sampling Rate | 0.1 second to 1.8 hours |
| Encoder | +5 V Optical Encoder (512 pluses per rev. or better) |
| External Channels | 3 × 4 - 20 mA |
| Depth Alarm | Up to 8 w/Close to Surface Alarm |
| Speed Alarm | One |
| Tension Alarm | One |
| Dimensions–inches | 4.30 (H) × 7.90 (W) × 9.10 (L) |
| Weight | 8 lbs |
| Operating Temperature | -20 °C (-4 °F) to 70 °C (158 °F) |
| Communication | USB 2.0 (Type–B Port) |
| Data Transfer Rates | Up to 1.8 MBits/second |
| Enclosure Type | NEMA 4 |

## Applications:

- **Slickline Depth Recorder**
- **Coiled Tubing Depth Recorder with Customized Adapter**
- **Wireline Depth Recorder**

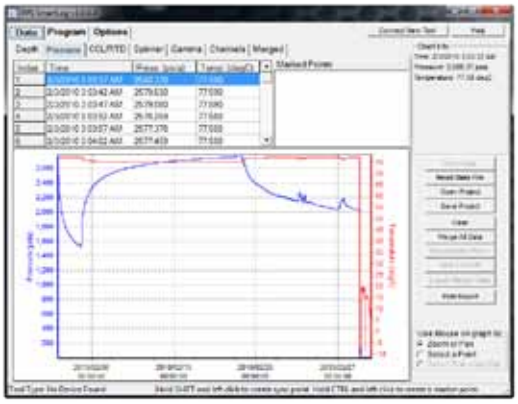
# PPS71 Geothermal Tools

The PPS71 is designed for extreme, high temperature downhole conditions. The robust electronics combined with vacuum flask technology allow this product to perform at 350 °C (662 °F) continuously, for four hours.

By combining the downhole measurements with a depth recorder, such as PPS's DepthWatcher (PPS36), customers have the capability to create synchronized profile logs.

SmartLog, PPS's proprietary software, creates temperature and pressure profiles based on depth that can be opened in any commercial logging software.

For more information on the PPS71 Tools, and to discover the best configuration of this tool for specific applications, please contact PPS.



PPS SmartLog Software


## Components:

1. Casing Collar Locator
2. Gamma Ray Detector
3. Temperature Sensor
4. Pressure Sensor
5. Spinner
6. Bowspring Centralizer (Optional)
7. Flask Housing (Regular housing is also available)
8. SRO interface between the tool and the field laptop
9. SRO module
10. Depth Recorder (PPS36 for example - optional)

PPS36 DepthWatcher
(Depth, Speed, Time, Tension Recorder)

# PPS71 Geothermal Tools

## Specifications

### Pressure Measurement

| | |
|---|---|
| Sensor Type | Piezo Silicon-Sapphire |
| Pressure Range | Up to 10,000 psi |
| Accuracy | ± 0.03% FS |
| Resolution | 0.0003% FS |

### Temperature Measurement

| | |
|---|---|
| Sensor Type | RTD (Pt1000; 4-wire) |
| Temperature Range | 0 to 350 °C (662 °F) |
| Accuracy | ± 0.5 °C |
| Resolution | 0.01 °C |

### Flow Profile

| | |
|---|---|
| Sensor Type | Reed switch/magnetic |
| Spinner Range | 5 – 7,000 RPM |
| Accuracy | ± 0.5 revolution - ± 0.25 revolution |
| Resolution | 0.5 RPS - 0.1 RPS |

### Gamma Measurement

| | |
|---|---|
| Sensor Type | Crystal, NaI |
| Sensitivity | 1 CPS/API |

### Data Store

| | |
|---|---|
| Sampling Rate | 0.1 s – 1.8 hrs/per sample |
| Datasets | Time/Pressure/RTD/Flow Profile/CCL/Gamma Ray |
| Memory Capacity | 1,000,000 datasets |

### SRO Module

| | |
|---|---|
| Sampling Rate | 0.1 s – 1.8 hrs/per sample |
| Communication Distance | 7000 meters |

### Surface SRO Interface

| | |
|---|---|
| Temperature Range | -40 °C (-40 °F) to 85 °C (185 °F) |
| Power Source | 100 – 240VAC |
| Interface | USB 2.0 |

# PPS71 Geothermal Logging Tool

## Environmental

| | |
|---|---|
| Temperature Rating | 177 °C (350 °F) Standard<br>350 °C (662 °F) Flask |
| Electronics Rating | 177 °C (350 °F) |
| Downhole Time | 4 hours at 350 °C (662 °F)<br>6 hours at 300 °C (572 °F)<br>8 hours at 250 °C (482 °F)<br>10 hours at 200 °C (392 °F)<br>12 hours at 180 ºC (356 °F) |

## Power supply (Tool Configuration without Gamma Module)

| | |
|---|---|
| Operation Voltage | 2.7 – 3.9 VDC |
| Battery | 180 °C (356 °F) C Li-battery (5 A hr/3.6 V) |

## Power supply (Tool Configuration with Gamma Module)

| | |
|---|---|
| Operation Voltage | 5.5 – 7.2 VDC |
| Battery | Two 165 °C (329 °F) C Li-battery (5 A hr/7.2 V) |

## Communication

| | |
|---|---|
| Interface | USB |
| Rate | 115,200 bits/s |

## Mechanical and Material

| | |
|---|---|
| Service | $H_2S$ |
| Outside Diameter | 1.56” (39 mm) / 1.75” (44 mm) |
| Overall Length | 67.0” (1,702 mm) - 109.5” (2,781mm) |
| Material | Inconel 718/BeCu |

- **Fast data transfer @10samples/sec**
- **Features robust electronics and vacuum flask technology for outstanding performance at 350°C (662°F)**
- **Creates complete profile logs when used in conjunction with PPS36 DepthWatcher**
- **Performs as an exceptional pressure and temperature tool when ordered without gamma and spinner**
- **Advanced customer support with online maintenance and software tutorials are available**
- **Can be used as regular temperature tool with regular housing (up to 177°C)**
- **Data is always saved in downhole tool as backup when running in SRO mode**
- **The tool automatically recognizes bidirectional flow**

# PPS PulseLink MWD Tool

The PPS positive mud pulse MWD tool was developed by Pioneer Petrotech in order to address the needs of customers engaged in horizontal and directional drilling. It provides the following survey/directional measurements: inclination, azimuth, dip angle, high-side/ magnetic tool face, earth gravity and magnetic field.

Other measurements; gamma ray and PVT (pressure, vibration, temperature), come in compact modules that can be added or subtracted from the tool as needed.

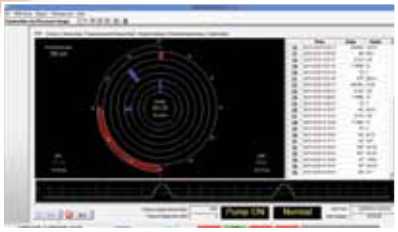
PPS's unique down-hole coding and surface detection methods ensure the integrity of the real-time data from loss and disruption. A downhole vibration detection circuit provides real time data to the surface, visually displaying vibration levels for the operator, so they can change drilling parameters to protect the MWD tool. Also the overcurrent monitor will shut the pulser down if any overcurrent conditions are detected.

The retrievable and reseatable MWD tool can be operated over a wide flow rate range in collar sizes from 3-¾" (95.2 mm) outside diameter (OD) to 9-½" (241.3 mm) OD. If operations require, the tool can be retrieved and replaced by wireline due to its small diameter, allowing for cost-effective tool replacement.

The robust and ultra-compact design of the Driller Display Unit makes for easy placement on the drill floor. The transflective display screen and LED backlighting provide excellent viewability under all ambient light conditions.

The powerful and easy to use surface software provides MWD tool configuration, tests, diagnosis and data management. Digital signal processing in the software ensures that pulse detection is efficient over a wide range of drilling conditions.

# PPS PulseLink MWD Tool



MWD Software

## Technical Specifications

| | | | | | |
|---|---|---|---|---|---|
| Tool OD–inches | | | | | 1.875 |
| Collar OD–inches | 3.75 (95.20-mm) | 4.5 (114.30-mm) | 6.5 (165.10-mm) | 8 (203.20-mm) | 9.5 (241.30-mm) |
| Tool Connections–inches | 3.5 IF (88.90-mm) | 4.0 IF (101.60-mm) | 4.5 IF (114.30-mm) | 6.625 Reg (158.80-mm) | 7.625 Reg (197.17-mm) |
| Shock | | | | | 1,000 g, 0.5 mSec, half-sine |
| Vibration | | | | | 20 g RMS, 15-500 Hz |
| Pressure Rating | | | | | 20,000 psi @ 150 °C (137,900 kPa @ 300 °F) |
| Temperature Rating | | | | | 150 °C (302 °F); 175 °C (347 °F) available upon request |
| Lost Circulation Material (LCM) | | | | | Up to 50 lbs/bbl (23 kg/bbl) evenly mixed medium nut plug |
| Maximum Sand Content | | | | | 1.0% |
| Tool Length | | | | | At least 19.1 ft (5.82 m); dependent on configuration |
| Flow Rate Range | | | | | 130 to 1060 Gallons/Minute |
| Power Source | | | | | Lithium Battery |
| Operating Time | | | | | 200+ hours; dependent on configuration |

## Survey/Directional Measurement Parameters

| | |
|---|---|
| Tool Face Update Rate | 9 seconds |
| Short Survey Time | Minimum 95 seconds |
| Long Survey Time | Minimum 120 seconds |
| Measurement State | No sliding or rotation allowed when taking measurements |
| Survey While Drilling | Sliding - Yes / Rotating - Yes |

## Surface System Specifications

| | |
|---|---|
| Driller Display Unit Operating Range | -30 °C to 75 °C (optional -40 °C to 50 °C) |
| Display Unit Screen | Viewable in direct sunlight and dim evening light<br>8” (w) x 13” (h) x 2-1/2” (d) |
| Pressure Detector Range | 0 ~ 6,000 psi |
| Pressure Detector Data Transmission | CAN bus |
| Operating System | Windows XP/Windows 7 |

## Directional Specifications

| | Range | Sensor Accuracy | Resolution |
|---|---|---|---|
| Inclination | 0 ~ 180 ° | ± 0.1 ° | 0.04 ° |
| Azimuth | 0 ~ 360 ° | ± 0.5 ° | 0.09 ° |
| Tool Face | 0 ~ 360 ° | ± 1 ° | 0.70 ° |
| TMF | 0 ~ 76 µT | ± 0.003 µT | 0.074 µT |
| GT | 0 ~ 1.100 g | ± 0.003 g | 0.001 g |
| Dip | -90 ° ~ +90 ° | 0.3 ° | 0.1° |
| Gamma Ray | 0 ~ 300 API | ± 5% | 1.53 API |
| Pressure | 0 ~ 20,000 psi | ± 0.05%FS psi | 0.61 psi |
| Temperature | 0 ~ 175 °C | ± 1 °C | 0.59 °C |

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Smart Gauges and Simple Software



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