



## *Electronic Quartz Gauge*

Weatherford's electronic quartz permanent monitoring system is a proven value-adding production optimization solution for superior permanent, real-time reservoir pressure and temperature monitoring. The Weatherford quartz gauge (WQG) is used in zonal-isolation, intelligent-completion and artificial-lift applications to acquire pressure and temperature (P/T) data that will enable production optimization and reservoir management decisions.

Weatherford incorporates state-of-the-art technology in order to ensure that the gauge is designed with a rigorous operating envelope to cover extreme environmental, handling and wellbore conditions. The implemented design specifications provide the WQG with superior performance in terms of accuracy, resolution, low drift and long term stability. Manufacturing quality control and assurance, plus high-integrity design and reduced electronic component count, minimizes the risk of infant mortality. The gauge undergoes strict calibration verification on certified test equipment assuring accuracy and operational performance.

### *Applications*

The WQG's high reliability accommodates a wide range of subsurface monitoring capacities throughout the expected well/field life.

- **Pressure/temperature:** Electronic systems are an economical solution when operators are faced with moderate to high P/T applications. Systems are rated to 302°F (150°C) to meet this demanding environment with exceptional accuracy and resolution.
- **Zonal isolation monitoring and pressure transient analysis:** The WQG provides robust longevity for a variety of applications, from basic land to complex offshore completions. Communications or commingling of the slightest amount can be detected with the accuracy and resolution of the WQG.
- **P/T applications and reservoir pressure monitoring:** In horizontal or vertical applications, provision of in-well quartz P/T eliminates wireline intervention or production downtime for pressure surveys.
- **Artificial lift:** Monitoring P/T data for automation and analysis for all forms of artificial lift applications. With permanent monitoring, proactive decisions are facilitated to reduce production downtime.





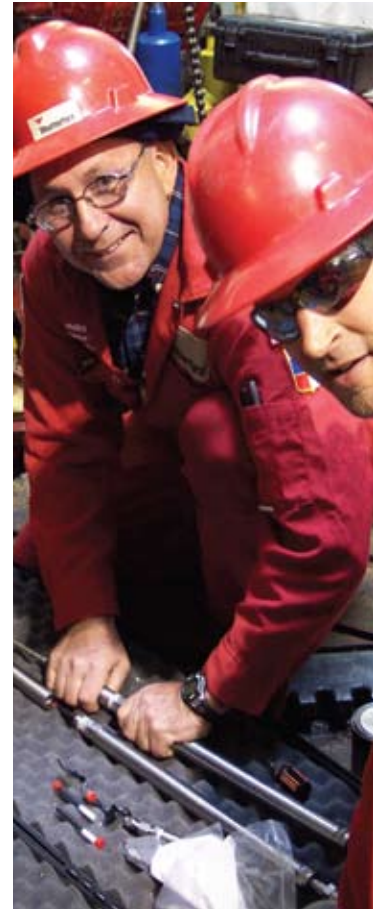
## *Electronic Quartz Gauge*

### *Features, Advantages and Benefits*

- Weatherford's subsurface gauges have consistently proven operation and longevity for periods exceeding ten years in continuous applications at temperatures up to 302°F (150°C) and pressures up to 16,000 psi (1103.16 bar)
- The WQG is a fully welded assembly with a gauge-to-mandrel pressure testable sealing interface (no elastomer seals)
- Incorporates a fully pressure testable metal-to-metal sealing cablehead
- Shear quartz-mode resonator transducer provides stability and repeatability, binary frequency shift-keyed (BFSK) signal transmission ensures no data corruption when installed with other well bore electrical signal sources such as electronic submersible pumps (ESPs)
- In addition to electronic quartz gauges, Weatherford offers a complete range of permanent monitoring systems based on silicon-on-insulator (SOI), electronic or fiber optics technology for the following applications:
  - Electronic pressure and temperature (plus vibration)
  - Optical pressure and temperature
  - Downhole flow metering
  - Distributed and array temperature sensing
  - Permanent 4D seismics

### *Options*

- Available alloys—stainless steel and Inconel®
- Multi-gauge configurations



Inconel is a registered trademark of the Special Metals Corporation group of companies.



# Electronic Quartz Gauge

## Specifications

General	
Overall Length, in. (cm)	24.0 (61)
Weight, lb. (kg)	1.9 (0.86)
Diameter, in. (mm)	0.75 (19)
Mechanical seals	EB weld
Supply voltage ( $V_{cc}$ )	Up to 60 $V_{cc}$
Operating current ( $I_{cc}$ )	40 mA
Maximum cable length, ft. (m)	35,960 (10960), single gauge
Storage/functional temperature, °F (°C)	-49 to 302 (-45 to 150)
Gravity/orientation effect	Negligible
Temperature	
Calibrated range, °F (°C)	77 to 302 (25 to 150)
Accuracy, °F (°C)	±0.188 (±0.10)
Resolution, °F (°C)	0.01 (0.005)
Repeatability, °F (°C)	<0.018 (<0.01)
Drift	<0.18°F/yr (<0.1°C/yr) @ 302°F (150°C)
Pressure	
Sensor type	Quartz resonator
Calibrated range, psi (MPa)	0 to 10,000 (0 to 68.9)      0 to 16,000 (0 to 110.3)
Accuracy	0.02% FS
Resolution	0.0001% FS
Repeatability	<0.01% FS
Normal sensitivity	0.0001% FS
Drift	<0.5 psi/yr (<0.034 bar/yr) @ 212°F (100°C)
Shock and Vibration Specifications	
Vibration (random) $G_{RMS}$	10 G Navmat
Shock	500 g 1 mS half Sine: all axis
Frequency	10 to 2000 cycles per second (Hz)