MARS™ Optical Pressure and Temperature Sensor

Provides comprehensive multiparameter, rigless downhole sensing for conveyed remedial well surveillance and advanced reservoir management

Applications

- Multizone wells
- High-pressure, high-temperature (HPHT) and geothermal environments
- Wells without permanent fiberline or optical gauge installations
- Reservoir pressure determination during fiberline interventions
- Management and control of well ramp-up
- Satellite platforms and remote locations with crane or lifting limitations when run in combination with MARS
- Data gathering for pressure transient analysis (skin, permeability, and reservoir boundary determination)
- Interference testing and reservoir connectivity determination

Features and Benefits

- Optical pressure and temperature gauge delivers stable measurements with no measurable drift, reducing uncertainty of absolute pressure and temperature measurements over the life of the field.
- Extensive mechanical-shock and vibration survivability and highly accelerated life test (HALT) testing has proven the tool can withstand impact, vibration, and significant pressure surges.
- No downhole electronic gauges increase system reliability and stability.
- Real-time reservoir pressure data availability allows for informed decision making and efficient well interventions.
- Minimal number of components and no moving parts on the gauges reduces potential fail modes, increases tool life, and decreases maintenance costs.
- Improved cable-to-gauge integration exceeds the full strength of the downhole cable for continued data delivery in the harshest environments.
- Short-term operation at pressures up to 30,000 psi (206.8 MPa) allows for use during critical well-stimulation operations.
- Gauge protector with optional skate system available for deviated or extended reach fiberline intervention operations.

The MARS optical pressure and temperature sensor provides rigless downhole sensing and advanced reservoir management.

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Tool Description

The Weatherford MARS optical pressure and temperature (P/T) sensor provides temporary reservoir surveillance in moderate to ultra-extreme well conditions. The sensor can be combined with MARS Distributed Fiber Optic Sensing and Multiphase flow meter, providing comprehensive, multiparameter downhole sensing for well production, injection, storage, and monitoring. By using Weatherford optical-glass cane Bragg-grating sensors and glass-to-metal penetrator technologies, the sensors can be used in challenging well conditions. Minimal parts and no in-well electronics provide immunity to electromagnetic interference, enabling functionality while using other electrical completion components.

Options

Included with MARS as part of an advanced all-in-one remedial thru-tubing reservoir-surveillance system.

The MARS sensor is available in two configurations depending on the application pressure and temperature:

- Extreme pressure and temperature (XPXT)
- Extreme pressure and ultra-high temperature (XPUT)

Both configurations are suited for high-value wells. They deliver stable, reliable, high-resolution measurements with no measurable drift. The design has undergone extensive HALT testing to confirm continuous operation in harsh environments.

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Specifications

Operational Performance	**XPXT**	**XPUT**
Maximum temperature	392°F (200°C)	446°F (230°C)
Calibrated temperature	77 to 392°F (25 to 200°C)	77 to 446°F (25 to 230°C)
Calibrated pressure range	Atm to 20,000 psi (Atm to 137.9 MPa)	
Over pressure	24,000 psi at 392°F (165.5 MPa at 200°C)	
Collapse pressure at room temperature (RT)	>24,000 psi (>165.5 MPa)	
Burst pressure at RT	>30,000 psi (>206.8 MPa)	
Minimum storage temperature	-40°F (-40°C)	
Update rate	1 sec, no limit	
Pressure Metrology	**XPXT**	**XPUT**
Accuracy	± 3 psi (± 0.02 MPa)	
Resolution*	≤ 0.05 psi (≤ 0.0003 MPa)	
Long-term stability/yr	< 0.05 psi/yr at 392°F (< 0.003 MPa at 200°C)	
Temperature Metrology	**XPXT**	**XPUT**
Accuracy	± 0.18°F (± 0.1°C)	
Resolution, RMS	≤ 0.036°F (≤ 0.02°C)	
Long-term stability/yr	< 0.18 at 392°F (< 0.1 at 200°C)	
Mechanical	**XPXT**	**XPUT**
Material	Inconel® 718	
Outside diameter	0.875 in. (22.2 mm)	
Length	13 in. (330 mm)	
Shock and Vibration Data	**XPXT**	**XPUT**
Vibration	15 G_{rms} [20 to 2,000 Hz (NavMat)]	
Shock	100 g, 9 ms half sine	
Drop	500 g, 1 ms half sine	
Thermal shock/min	53.6°F (12°C)	

* Depends on update rate.

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Specifications (continued)

	Pressure			Temperature	
	Kpsi	Bar	MPa	°F	°C
Low	< 2	< 138	< 13.8	< 185	< 85
Moderate	2 to 10	138 to 689	13,8 to 69	185 to 302	85 to 150
High	10 to 15	689 to 1,034	69 to 103	302 to 356	150 to 180
Extreme	15 to 20	1,034 to 1,379	103 to 138	356 to 392	180 to 200
Ultra	> 20	> 1,379	> 138	392 to 482	200 to 250
Thermal I	–	–	–	482 to 572	250 to 300
Thermal II	–	–	–	> 572	> 300

Fiberline Gauge Protector Dimensions	
Length	36.25 in. (48.68 in. with high deviation skate system)
Outer diameter	1.63 in. (2.25 in. effective OD with high deviation skate system)