DATA SHEET

HALLIBURTON

LOW CARBON SOLUTIONS | CCUS

DataSphere® CS permanent downhole monitoring systems

Modern downhole sensor technology for low-carbon solutions

FEATURES

- Flexible electronic and fiber solutions – hybrid or standalone
- Designed to monitor in harsh environments down to -35°C with survivability down to -80°C
- Demonstrated downhole gauge reliability 10 years at 185°C
- Onboard intelligent quartz gauge diagnostics
- Simplified systems with multiple sensor options
- Field-testable dual metal-to-metal (MTM) seal
- Fault-tolerance features for maximum reliability

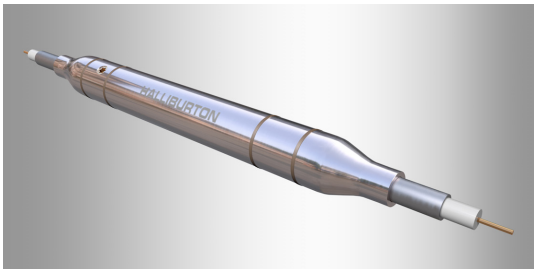
BENEFITS

- Continuous and reliable pressure and temperature data without the need for well intervention
- Enhanced reservoir management – Pressure, Temperature, DTS, DAS, DSS, VSP, MSM, MIT
- Increased system reliability using stable pressure/ temperature measurements
- Quartz-based sensor for high accuracy, low drift
- Regulatory compliance
- Operational efficiency
- Integrated data visualization via Clariti® platform and -Visum® service

APPLICATIONS

- Riser/umbilical monitoring
- VSP
- MSM
- Caprock integrity
- Out of zone injection
- Well monitoring
- Stimulation operation monitoring
- Cement evaluation (MIT)
- Subsidence monitoring
- Leak detection

Overview



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The DataSphere® Array system is comprised of multiple ultra-slim, highly accurate quartz-based temperature and pressure sensors

The Halliburton commitment to robust CO_2 well design includes in-well sensing technology and continuous parameter collection. Downhole sensors address conformance and containment risks using the Opsis® and LinX® electric and fiber-optic technology portfolios. The combination of fiber-optic technology and electronic gauges are commonly employed to mitigate CO_2 injection uncertainties and ensure regulatory compliance. Opsis® CS and LinX® permanent downhole gauges provide reliable in wellbore and behind casing, real-time, long-term data for reservoir characterization. Fully customizable, the gauges are essential to monitor injection and help verify CO_2 containment.

The Array CS system provides a slimline electronic gauge design for distributed pressure and temperature sensing. Sensors are embedded into the TEC during manufacturing to provide the customer with a seamless and customizable solution. Using industry-proven resonating quartz crystal sensors, Opsis, Array, and LinX systems provide long-term monitoring for low-carbon solutions. These systems use the latest generation of ASIC electronics to provide highly accurate pressure and temperature data calibrated down to -35°C and proven survivability to -80°C.

Fiber-optic monitoring allows vertical seismic profiling (VSP), micro-seismic monitoring (MSM), and the assessment of external and internal mechanical integrity testing (MIT) of wellbores. Trigger events that indicate containment risk are derived in real time from distributed acoustic sensing (DAS), distributed temperature sensing (DTS), and distributed strain sensing (DSS).

Opsis® CS and Array CS temperature performance

Accuracy (°C)	0.5
Typical Accuracy (°C)	0.15
Achievable Resolution (°C/sec)	<0.005
Repeatability (°C)	<0.01
Drift at 177°C (°C/year)	<0.1
Survivability (°C)	-80
Operating Range (°C)	-40 to 150

Opsis® CS and Array CS pressure performance

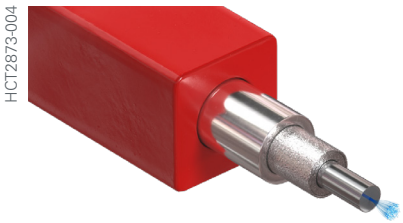
PRESSURE RANGE PSI/BAR	ACCURACY* PSI	TYPICAL ACCURACY* PSI	ACHIEVABLE RESOLUTION PSI/SEC	DRIFT AT 14 PSI AND 25°C*	MAXIMUM DRIFT AT MAXIMUM PRESSURE AND TEMPERATURE** PSI
200 to 10,000 13.8 to 690	0.015 (1.5)	0.012 (1.2)	<0.006	Negligible	0.02 (2.0)

*% FS, ** %FS/Year

Opsis® permanent downhole single sensor gauge

Fiber performance

PRESSURE RATING PSI/BAR	NUMBER OF FIBERS	MINIMUM OPERATING TEMPERATURE (°C)	MAXIMUM OPERATING TEMPERATURE (°C)	PARAMETERS AVAILABLE	ANSWER PRODUCTS
20,000	Up to 10	-82	150	DAS/DTS/DSS	MSM/VSP/ MIT



DataSphere® CS permanent monitoring system with fiber-optic cable detail

For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com

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