Schlumberger

GyroSphere

MEMS gyro-while-drilling service

APPLICATIONS

- Offshore and onshore drilling
- Anticollision drilling
- Sidetracking
- High magnetic conditions, such as dense well clusters and high latitudes
- Extended-reach drilling
- Precise well placement from multiwell platforms or pads

FEATURES

- Microelectromechanical systems (MEMS) technology
- Single-sensor gyro
- Resistant to shock and vibration
- Survey during connections
- Autoinitiated surveys
- Minimized power requirements
- Self-monitoring and status reporting

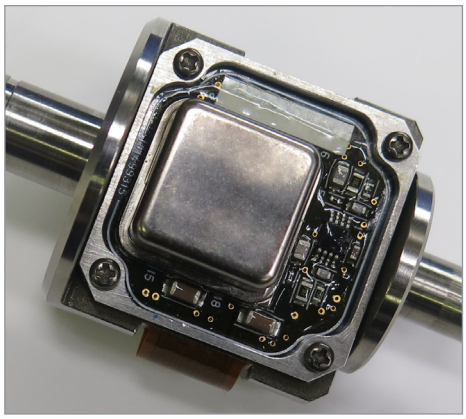
BENEFITS

- Reduces gyro-surveying time
- Enhances tool reliability
- Minimizes ellipse of uncertainty
- Improves access to small target reservoirs
- Performs surveys at any depth, at all inclinations, and at any latitude

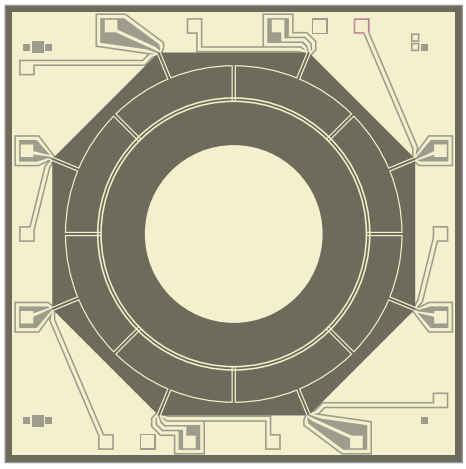
The GyroSphere* MEMS-gyro-while-drilling service incorporates MEMS technology for gyro surveys in the oil field. This significantly improves gyro-surveying efficiency and reliability, as well as reduces the ellipse of uncertainty by up to 45% and enables drilling smaller targets.

Gyroscopic surveys in the oil field have not changed much over the past 20 years. Most conventional systems are sensitive mechanical devices that can be compromised by shock and vibration, which means they must be recalibrated after every single run. The GyroSphere service features a unique sensor that adapts solid-state MEMS technology. Utilizing the Coriolis effect,† the MEMS gyro sensor uses an internal vibrating structure to determine the Earth's rotation with respect to the sensor. This enables the GyroSphere service to determine azimuth and inertial toolface orientation when sliding with a motor. Not only can MEMS technology withstand challenging downhole conditions, including severe shock and vibration, it means the sensor can be rerun without recalibrating the tool.

MEMS technology also results in faster gyro surveys because surveys can be made during connections, rather than up to 30 minutes later. In fact, the GyroSphere service can perform up to two surveys in the time conventional gyros take to spin up for just one, and without the need for recalibration between runs.



Solid-state MEMS technology means the GyroSphere service can withstand the rigors of drilling operations, including shock and vibration.



The GyroSphere service uses an internal vibrating structure to ascertain planetary rotation relative to the sensor.

The GyroSphere service also has capabilities that enable it to monitor and report its own status, while understanding when to initiate a survey. Conventional gyro systems require multiple tools dependent on well inclinations, whereas the GyroSphere service needs only this single sensor to survey at any inclination, at any depth, and any latitude.

Just like other MWD surveys, the GyroSphere service is transparent gyro-surveying-while drilling to provide access to reservoirs from existing structures and improve the precision placement of small targets.

† Coriolis effect is an inertial result that causes deflection of a moving object.

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Specifications				
		950	**900**	**825**
Mechanical	Collar OD, in	9½ normal flow	9 normal flow	8¼ high flow
	Overall length, ft	25.42	25.42	25.23
	Maximum rotating dogleg,† per 100 ft	10° to 3.5°	10° to 3.5°	12° to 4°
	Maximum sliding dogleg, per 100 ft	10°	10°	12°
	Equivalent bending stiffness, ft	26.2	28.0	26.2
	Maximum rotary torque, ft.lbf	35,000	35,000	23,000
	Maximum weight on bit,‡ lbf	$340{,}000/L^2$	$261{,}400/L^2$	$171{,}000/L^2$
	Maximum overpull, lbf	1,094,000	1,094,000	865,000
Hydraulics	Maximum flow range, galUS/min	1,600	1,600	1,600
	Pressure drop,§ psi	<60	<60	<60
Pressure and temperature	Maximum pressure, psi	20,000	20,000	20,000
	Maximum temperature, degF [degC]	302 [150]	302 [150]	302 [150]

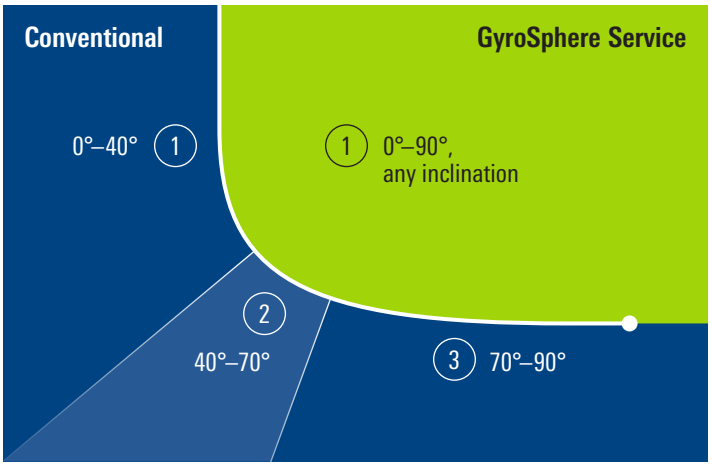
† Maximum rotating dogleg decreases with increasing rotary speed.

‡ The maximum allowable WOB is calculated from the supplied equation. The maximum WOB depends on the unsupported length of collar (referred to as *L*) and is the distance between the stabilizers above and below the sub.

§ Based on pressure drop constant = 228,000.

Directional Measurement	Range
Stationary azimuth accuracy† (rms)	1.0°
Stationary inclination accuracy (rms)	0.1°
Stationary survey latitude range	All latitudes
Stationary surveying time (including 30-s wait time before survey)	150 s
Inertial toolface accuracy (rms)	≤5° at 0° to 5° inclination
Inertial toolface update period	6 s
Temperature range	Up to 100 degC (150 degC survivability with calibrated error model)

† Range of accuracy varies with tool orientation and hole inclination.



At any angle or any depth—no recalibration is needed between runs.

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