



## AccuSteer

Advanced MWD Measurement Suite

# AccuSteer™

## Advanced MWD Measurement Suite

Taking the guesswork out of wellbore placement  
in unconventional plays

The AccuSteer Suite provides accurate  
MWD measurements for:

- Continuous inclination
- Shock and vibration
- Azimuthal gamma
- Downhole pressure
- Resistivity
- Drilling dynamics

Today's unconventional wells can be challenging due to their increasing complexity, and require special technologies and techniques to adequately assess, plan, and execute. Unconventional well designs have shifted from simply keeping a wellbore vertical or hitting a "target" to efficient wellbore placement and remaining "in zone" for extended laterals. We continue to challenge drilling records for lateral lengths and average penetration rates in these basins. With these successes the requirement for further reduction in non-productive time, faster data throughput and higher accuracy has grown exponentially.

Understanding the move to efficient wellbore placement, Nabors introduces the new AccuSteer™ MWD Measurement Suite—a premier MWD/LWD system designed specifically for the unconventional market. The system has proven itself in the roughest drilling environments to reliably provide accurate data. The advanced measurements and survey information required to drill these wells have proven essential to create efficiency in directional drilling and geo-steering applications.



# AccuSteer Advanced MWD Measurement Suite

## Reduced set up time

The AccuSteer Advanced MWD Measurement Suite is a collar based tool that arrives to the rigsite fully assembled, by our highly trained technical staff, for faster utilization. It has been designed to operate directly above the mud motor for quick BHA makeup and optimal sensor placement. This feature reduces set-up time and eliminates the potential for assembly errors at the well site.

The surface system is compact, allowing for ease of assembly; and when operating with Nabors rigs, the system is already incorporated to eliminate set-up time and additional surface equipment.

## Modular Suite of Measurements

The AccuSteer MWD Measurement Suite sensors deliver accurate downhole measurements to optimize drilling. The advanced design allows you to choose what you need based on the varying levels of risks associated with your operation that need to be addressed.

The measurements enable directional drillers to optimize drilling parameters and minimize the risk of drillstring fatigue, stuck pipe, influx, lost circulation, and trips.

## So how do each of these measurements benefit your operation?

### Continuous Inclination

Your drilling decisions should be based on survey information you are receiving when you need it, as often as you need it. Existing systems, such as industry standard 90-ft. survey intervals, have proven to be far too sparse to give you an acceptable position calculation which can result in improper geological modeling of lithology data and complicate placement of current and subsequent wells.

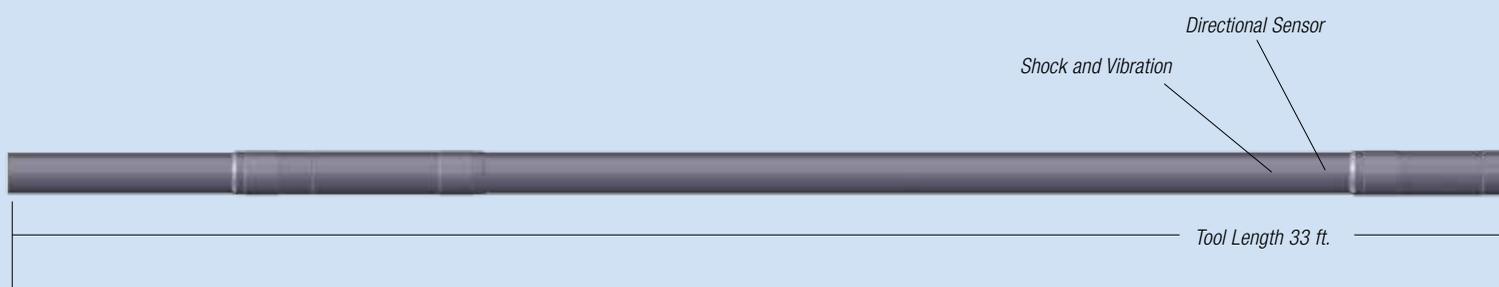
You do not have to sacrifice ROP for accurate and precise wellbore placement. Continuous inclination provides the data necessary for more accurate TVD calculation without the time and costs associated with more frequent surveying.

The continuous inclination sensor delivers near-bit measurements for enhanced navigation capabilities. This measurement increases in accuracy from 0-15 degrees at which time it is accurate to .1 degrees inclination. It provides early warnings of builds or drops in inclination, improves TVD calculations, and eliminates check shot survey NPT. In the curve, continuous inclination can be used to extend slide distances for increased build output.

Proactive use of continuous inclination reduces tortuosity resulting in smoother wellbores which reduces torque and drag, improves the casing run process, and improves production.



*The continuous inclination measurements offers greater resolution to optimize wellbore placement.*



*The AccuSteer MWD Measurement Suite*

### Shock and Vibration

Events of shock and vibration can wreak havoc on downhole components through cumulative effects in the downhole drilling environment. By monitoring shock and vibration on real-time tool measurements, along with surface indicators, timely changes can be made in drilling parameters to mitigate the accumulation of shock and vibration damages seen by the BHA.

### Azimuthal Gamma

The AccuSteer azimuthal gamma image ensures accurate geosteering when drilling in the lateral. The image provides a definitive answer as to whether a change in gamma came from moving up or down geologic structure so that appropriate geosteering decisions can be made, thus landing more of the wellbore in the target zone. Continuous inclination, when combined with the azimuthal gamma image, has proven to be especially powerful for determining bed dip and identifying geologic structures.

### Downhole Pressure Sensors

In extended reach wells and in areas where gas influx and drilling fluid loss is of concern, it is imperative that downhole pressure be measured and monitored to minimize risks. For this reason, annular and bore pressure sensors provide real-time measurements of ECD and the true differential pressure seen across the mud motor.

Accurate measurements of downhole differential pressure allows for adjustments to be made for peak motor power output to optimize ROP, while maximizing equipment longevity through maintaining safe drilling parameters.

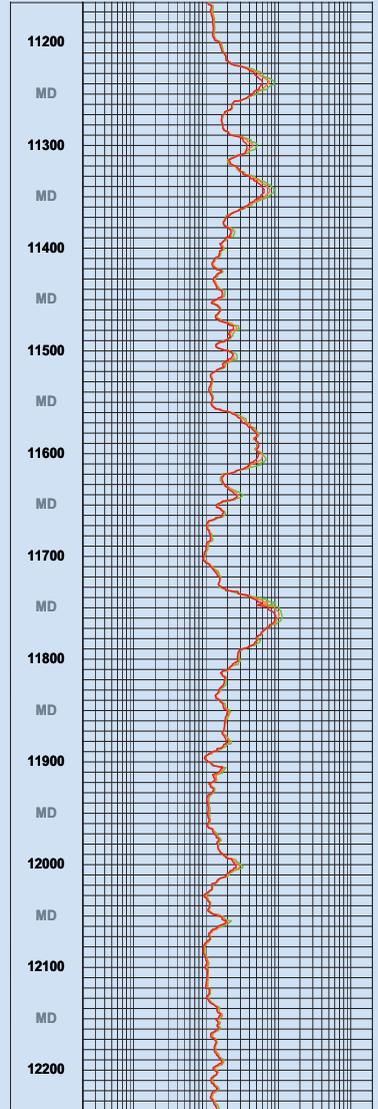
ECD provides early detection of cuttings buildup, gas influx, lost circulation, and delivers the necessary information for over- and under-balanced drilling.

### Resistivity

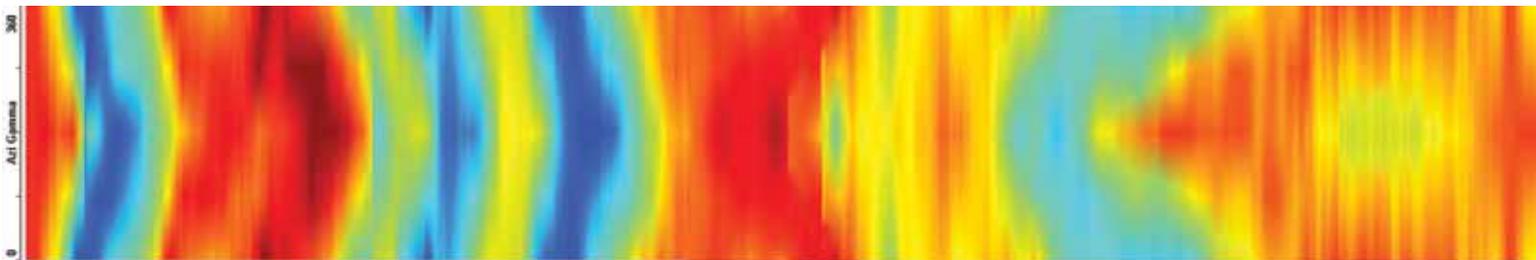
The AccuSteer unique deep reading state-of-the-art propagation resistivity measurements allow for early detection of approaching bed boundaries which aids in geosteering applications. Its unique design utilizes 48-, 28-, and 18-in. spacings transmitting at 2 MHz, 400 kHz, and 152 kHz frequencies. With 16 independent resistivity curves, the tool offers the standard resistivity measurements and one of the deepest reading measurements in the industry. These measurements are also useful for pore pressure prediction, identification of hydrocarbons in conventional reservoirs, and accurate casing and TD selection.

Due to its unique design, AccuSteer is able to offer the resistivity logging service without adding additional BHA components or moving other sensors excessive distances from the bit.

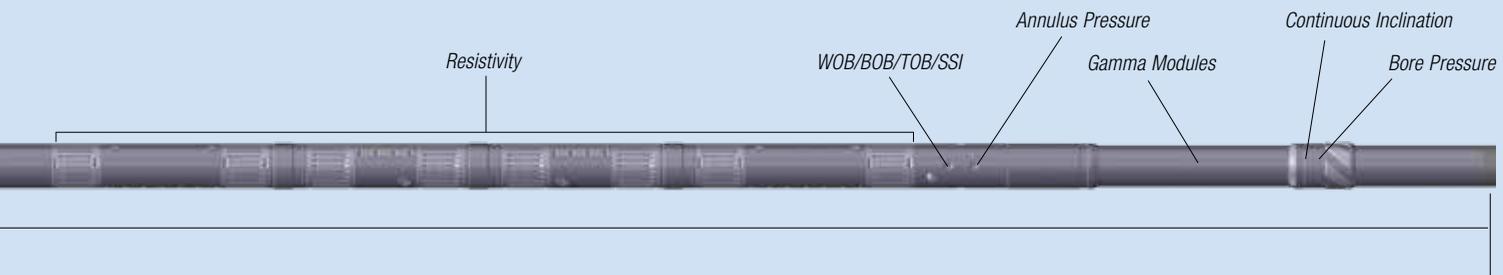
0.2	RPL48CX	2000
0.2	RPL28CX	2000
0.2	RPM18CX	2000



AccuSteer with resistivity provides the standard measurements, as well as a deep reading measurement, at 48-in. spacing, transmitting at 152 kHz.



An example of an azimuthal gamma image showing a transition from moving up or down structure in the lateral portion of the well.



## So why use AccuSteer?

- Improved overall ROP
- Reduced tortuosity
- Improved wellbore placement precision
  - Azimuthal gamma
  - Propagation resistivity
  - Continuous inclination
- Risk Avoidance
  - Hole collapse
  - Stuck pipe
  - Formation fluid influx
  - Buckling
  - BHA damage
  - Bit failure
- Improved BHA performance

### Drilling Dynamics

To aid in directional drilling and ROP optimization, AccuSteer is engineered with drilling dynamics measurements for enhanced efficiency and hazard mitigation. These drilling measurements include: realtime weight on bit, torque on bit, and bending moment. Downhole dynamics data provides the information necessary to optimize weight transfer, and calculate maximum specific energy, all while optimizing mud motor and drill bit longevity.

- **Weight-on-bit** – Allows for surface weight to be optimized, preventing over-stacking of surface weight that can cause buckling, and can break free, damaging the mud motor and drill bit

- **Torque-on-bit** – Helps identify formation changes and diagnose bit and ROP problems
- **Bend-on-bit** – Allows for calculation of effective dogleg severity to identify problematic casing areas and stressed drill collar connections
- **Stick Slip Index** – (torsional vibration) Can lead to reduced ROP, premature bit failure, downhole tool failure, and BHA failure. Identification of stick slip is critical for implementing the proper corrective action to get the greatest energy transfer to the formation.

# Optimize wellbore placement with accurate downhole measurements

AccuSteer has the industry's shortest overall length, 30 ft. (33 ft. with resistivity), and it offers improved wellsite handling and BHA control. Both transmitted and additional data are stored in memory for quality control and redundancy. AccuSteer comes with smart telemetry enabling data sequence changes while rotating and sliding, so that only the necessary and pertinent information is sent to maximize log quality and maintain a high degree of steerability. The AccuSteer Suite provides fast, accurate downhole data between the BHA and the surface.

The AccuSteer MWD Measurement Suite provides all the measurements you need for accurate wellbore placement and maximum payzone contact, increasing production rates and extending the life of the well.

Contact Ryan Directional Services.  
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