



# Electromagnetic MWD (E-Field MWD)

## Lightning-Fast Data Transmissions

Scientific Drilling's Electromagnetic Measurement-While-Drilling (MWD) (E-Field) uses electromagnetic wave propagation to transmit downhole data to surface at greater than four times the speed of conventional positive pulse mud pulse MWD systems.

E-Field data rates are so fast a survey can be performed during pipe connections, and toolface updates received, in as little as four seconds.

## Multi-Faceted Drilling Applications

E-Field has many uses in the oil and gas industry, in addition to general drilling applications. Advanced digital signal processing techniques allows operation with up to four systems on the same location.

E-Field is used for:

- Normal mud drilling
- Under-balanced drilling with air/aerated mud, nitrogen, air, gas, diesel, or oil
- River crossings
- Coal bed methane

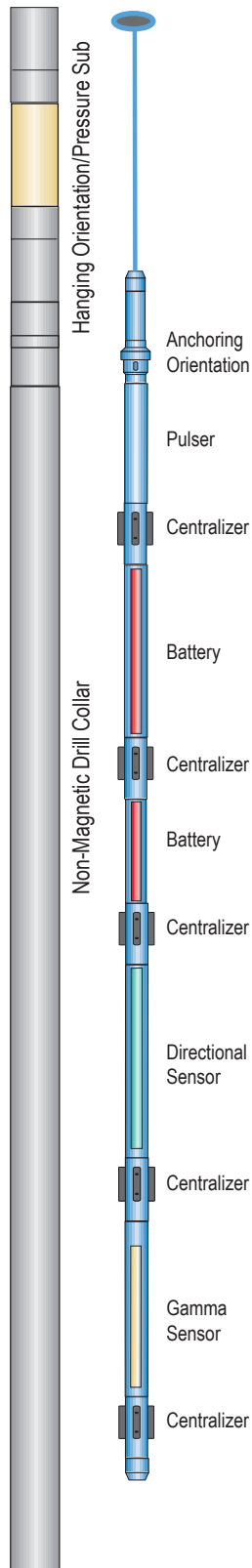
## Exceptional Feature Versatility

E-Field's outer diameter is 1.75 inches (44.5 mm) and can be configured for collar sizes 3.125 inches (79.4 mm) to 9.5 inches (241.3 mm). E-Field's length varies from 27 ft (8 m) to 32 ft (9.75 m). The survey probe sensing point is three to four feet from the bottom of the tool. E-Field can be used with "long wire" (upper gap) technology to increase depth capability to 13,000 feet. The downhole sensor package includes:

- Inclination
- Azimuth
- Toolface (gravity & magnetic)
- Vibration & Shock (peak & average)
- Gamma Options: Logging Gamma Ray (Radial AAPL) and Geosteering Azimuthal Gamma Ray & Azimuthal Gain (optionally extended for near-bit)

### Additional optional sensors:

- Pressure While Drilling (PWD)
- Propagation Resistivity Tool (PRT)
- Gain (near-bit inclination/gamma)
- Smart Motor
- gMWD



## ADVANTAGES

- Operates with conventional mud even when lost circulation material is pumped
- Operates with no returns
- Operates when drilling with aerated mud (gas, nitrogen, air)
- Saves approximately 70% connection time while drilling in any medium
- Uses bidirectional communications
- Has no moving parts
- Maintains minimal pressure drop
- Can be used for ranging projects
- Retrieval - optional

## TECHNICAL SPECIFICATIONS

|  |   |                   |
|--|---|-------------------|
| <b>Tool Collar Sizes</b>               | 3.125 in (79.4 mm)  | 6.5 in (165.1 mm) |
|  | 3.5 in (88.9 mm)  | 8 in (203.2 mm)   |
|  | 4.75 in (120.7 mm)  | 9.5 in (241.3 mm) |
| <b>Dog Leg Degree per 100 ft O.D.</b>  | <b>Sliding:</b>   | <b>Rotating:</b>  |
|  | 12° (9.5 in)  | 5° (9.5 in)       |
|  | 12° (8 in)  | 7° (8 in)         |
|  | 20° (6.5 in)  | 10° (6.5 in)      |
|  | 28° (4.75 in)   | 12° (4.75 in)     |
|  | 60° (3.5 in)  | 20° (3.5 in)      |
| 65° (3.125 in)                         | 20° (3.125 in)  |                   |
| <b>Pressure Rating</b>                 | 20,000 psi (30,000 available)<br>(137,900 kPa)                                  |                   |
| <b>Temperature Rating</b>              | 302°F (150°C)   |                   |
| <b>Lost Circulation Material (LCM)</b> | No Limit  |                   |
| <b>Sensor Accuracy*</b>                | Toolface: ±0.15° > 3°<br>Azimuth: ±0.25° < 3°<br>Inclination: ±0.15° all angles |                   |
| <b>Data Rate</b>                       | As fast as 14 bits per second   |                   |

\*SPE WPTS compliant error ellipses are available upon request for individual well profiles.