

Lightning II®

Electro-Magnetic Wave Measurement While Drilling System (EM-MWD)

The Lightning® EM-MWD uses a di-pole electromagnetic wave propagation methodology to transmit the data from the downhole MWD tool to surface. Electromagnetic wave propagation tools do not rely on the mud system for signal generation - this potentially minimizes survey wait times and allows for under-balanced drilling where the drill fluid has been aerated. It is also extremely efficient in areas of lost circulation systems where LCM causes problems with traditional Mud Pulse MWD systems.

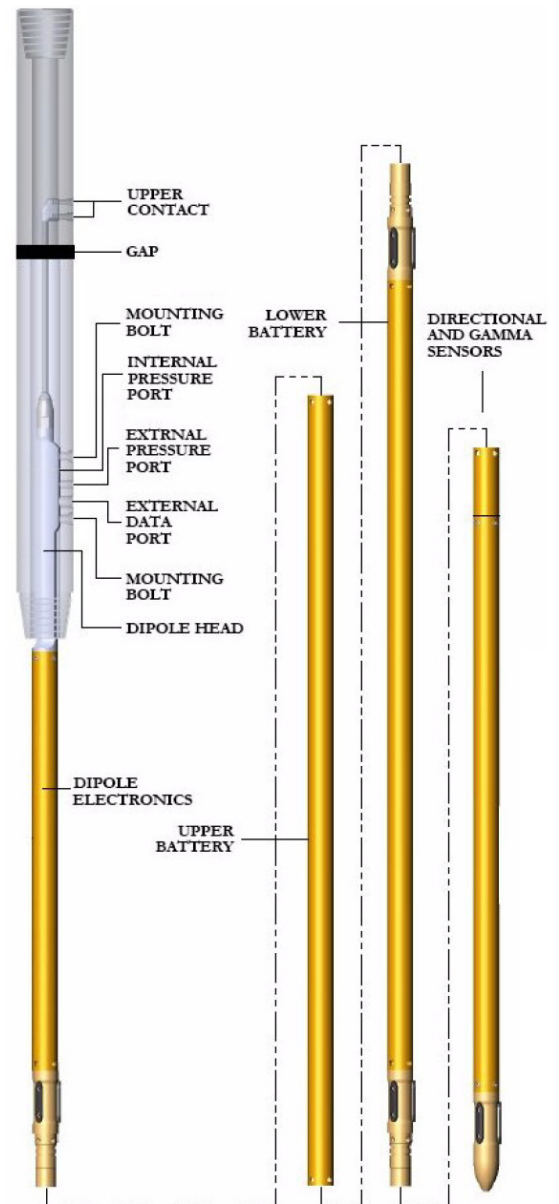
The surface system retains the capability to talk to the downhole tool, allowing configuration of the downhole tool on the fly to tailor the system to current drilling demands. Improvements with additional DSP algorithms combined with sophisticated "brick wall" filters enable signal detection in the presence of high ambient noise. The data acquisition software transmits detected data into a subset Windows-based program which performs the log plotting and database functions. It is also passed through to the LCD Rig Floor Display which can be readily viewed in normal rig operating conditions. Depth inputs can come from either a standalone system or through standard WITS interfaces from most EDRs. The electrical signal is received at surface from 2 pickups with one pickup typically placed at the BOP and the 2nd at the lease's edge.

The Directional Module is an industry standard tri-axial magnetometer and accelerometer package. As EM-MWD systems rely solely on battery power, the downhole hardware has been chosen with power efficiency in mind. The software and firmware routines have also been written to conserve energy and to extend useful battery life. In addition, a natural Gamma Probe can be added to the downhole toolstring providing real time, recorded and hardcopy logs. The Pressure Module is built into the Transmitter section and is configurable on surface if pressure information is required.

The Downhole Assembly consists of:

- Upper/Lower Contact, Gap Sub
- Transmitter & Pressure Module Assembly
- Battery Module (s)
- Directional Sensor
- Gamma Sensor

Departure Energy Services' introduces our 2nd generation EM-MWD - the Lightning II®.



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LIGHTNING II® Downhole System Specifications	
Frequencies	2 - 10 Hz, user selectable
Baud Rate	One half of the transmission frequency.
Power	Batteries typically consist of two Double D stacks of 8 moderate rate cells each, producing 29V at 29 ampere-hour capacity. Battery lifetime depends upon transmit power selected. - At 10 Watts power level, battery life is 80. - At 20 Watts power level, battery life is 40 hours. - At the maximum power level of 40 Watts, battery life is 20 hours.
Mechanical	
Gap Sub Sizes	4¾" OD X 67.375 L; 3½ IF pin at bottom, box at top 6½" OD X 72.0" L
Tool string approximate length with two (2) batteries	222"
750 Directional Sensor	
Angular accuracy (0-150°C) - Azimuth (latitude <55°C) - Toolface (roll) - Inclination	±0.3° ±0.1° ±0.1°
Operating Temperature Range	0 to 150°C (0°F to 300°F)
Shock	1000G 1ms half sine wave
Vibration	20G rms 5-1000Hz
751 Gamma Sensor	
Scintillation Crystal	1" diameter X 5" long mounted SST Case
Sensitivity (in a 1-7/8" BeCu pressure barrel)	1 Count per API
Accuracy	±5%
Thin Bed Resolution (8" hole diameter) - Operating Temperature Range - Storage Temperature Range	6" (236mm) Temperature Range 0°C to 150°C (0°F to 300°F) -25°C to 160°C (-13°F to 320°F)
Shock	1000 G 1ms half sine wave
Vibration (random)	10 G rms, 50-250 Hz



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