

Centerfire LWD with MicroPulse 3 & Eclipse Touch

Demonstrating its commitment to driving operational excellence Black Diamond presents the next generation in cost-effectiveness and reliability in LWD operations. By fully integrating the proven performance of the Centerfire LWD system with the market leading reliability of the Eclipse Touch Surface System and the trusted capability and range of measurements of the MicroPulse 3 Directional Module Black Diamond delivers a step change in LWD success.

Features and Benefits

Centerfire LWD

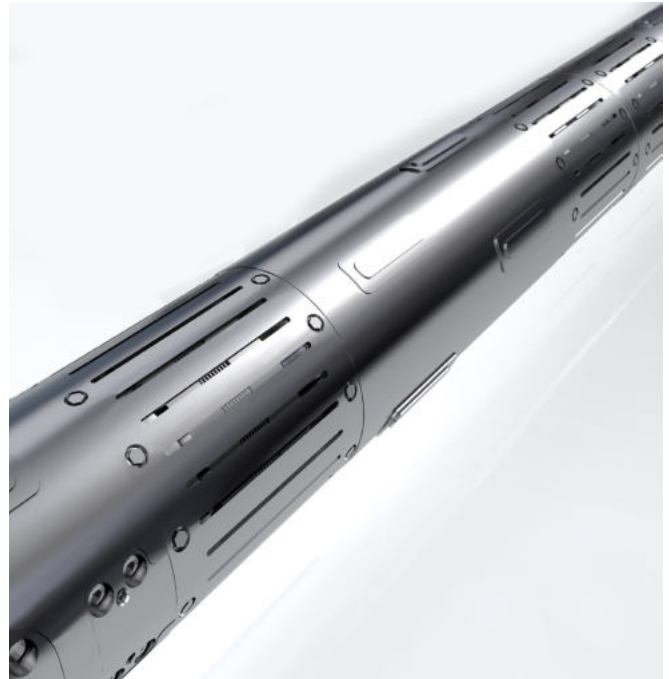
- 8 borehole compensated measurements - 19 & 41 in., 400 kHz & 2 MHz, Phase Difference & Attenuation
- Deep-reading 41 in. 400 kHz measurements ideal for geosteering
- 2 MHz measurements offer excellent vertical resolution for thin bed identification
- Proven performance with 200+ collars deployed globally

Eclipse Touch Surface System

- Market leading decoder automatically applying 100+ filters for near perfect detection
- Continuous algorithm tuning to maintain detection in most challenging conditions
- Fully wireless and remote control ready
- Multi-channel WITS In/ Out

MicroPulse 3 Directional

- High accuracy tri-axial MEMS accelerometers and solid-state magnetometers
- Advanced shock & vibration logging
- Reliable continuous inclination & azimuth
- Low power consumption



Full System

- Low power Pulser allows for >280 operating hours with three batteries
- Retrievable MWD string should BHA become stuck
- Robust Pulser capable of 0.25 - 2.0 second pulse widths
- 2 or 3 standard batteries depending on run duration

System Pre-Assembly - Minimal Rig Time

- System built as a single assembly in workshop and shipped to rigsite
- System configured on deck & power applied
- Lifted to floor and made to BHA - rig time limited to scribing of motor to directional

Centerfire LWD System - Specifications

Mechanical and Environmental Specifications			
Nominal OD	4.75 in.	6.91 in.	8.25 in.
Tool OD (antennas / wear bands)	5.0 in. / 5.25 in.	6.91 in. / 7.16 in.	8.25 in. / 8.5 in.
Centerfire Collar Length	14.5 ft (174 in.)	14.5 ft (174 in.)	15.16 ft (182 in.)
Tool Connections	NC 38	NC 50	6 5/8 in. API REG
Equivalent Collar Stiffness (OD x ID)	5.00 in. x 2.81 in.	6.58 in. x 2.81 in.	8.25 in. x 2.81 in.
Make-up Torque	9,600 lbf-ft	24,000 lbf-ft	46,000 lbf-ft
Flow Rate Range	200 - 350 usgpm	300 - 750 usgpm	450 - 1,200 usgpm
Max. Dogleg Rotation	12°/ 100 ft	8°/ 100 ft	7°/ 100 ft
Max. Dogleg Sliding	25°/ 100 ft	17°/ 100 ft	14°/ 100 ft
Measurement Points from Bottom of Centerfire Collar	Directional	21.16 ft (254 in.)	21.10 ft (253 in.)
	Resistivity	6.08 ft (73 in.)	6.08 ft (73 in.)
	Gamma*	-1.9 ft (-23 in.)	-1.9 ft (-23 in.)
Max. Pressure	20,000 psi	Max. Temperature	329 °F
Max. Sand	1.0% at max. fluid velocity	Max. Mud Weight	18 ppg
Max. Rotation	200 RPM		
Max. LCM Tolerance	40 ppb any type, thoroughly and evenly mixed, with use of surface drill pipe screens		
Memory Capacity	14 MB (~250 hrs @ 10 second update) Centerfire, 24 MB MicroPulse 3		

*4.75 in. & 6.91 in. Collars employ Gamma Modules below the collar. 8.25 in. collars have internal Gamma sensors.

LWD Sensor Specifications					
	Frequency	Spacing	Range	Accuracy	DOI*
Phase Difference	2 MHz	41 in.	0.1 to 2,000 ohm-m	± 2% (0.1 to 20 ohm-m) ± 1 mmho/m (>20 ohm-m)	49 in.
		19 in.	0.1 to 1,000 ohm-m	± 1% (0.1 to 10 ohm-m) ± 1 mmho/m (>10 ohm-m)	32 in.
	400 kHz	41 in.	0.1 to 500 ohm-m	± 2% (0.1 to 10 ohm-m) ± 2.0 mmho/m (>10 ohm-m)	66 in.
		19 in.	0.1 to 250 ohm-m	± 3% (0.1 to 5 ohm-m) ± 6 mmho/m (>5 ohm-m)	42 in.
Attenuation	2 MHz	41 in.	0.1 to 50 ohm-m	± 5% (0.1 to 16 ohm-m) ± 3 mmho/m (>16 ohm-m)	71 in.
		19 in.	0.1 to 50 ohm-m	± 5% (0.1 to 8 ohm-m) ± 6 mmho/m (>8 ohm-m)	47 in.
	400 kHz	41 in.	0.1 to 10 ohm-m	± 3% (0.1 to 3 ohm-m) ± 10 mmho/m (>3 ohm-m)	104 in.
		19 in.	0.1 to 10 ohm-m	± 5% (0.1 to 3 ohm-m) ± 15 mmho/m (>3 ohm-m)	73 in.
Vertical Resolution (Resistivity)			6 in. in conductive beds < 10 ohm-m		
Gamma			0-1023 API	+/- 3%	12 in.

*Diameter of Investigation - Resistivity: Radial diameter, centered on the tool axis, at which the Integrated Geometric Factor is 50%. Data presented relates to a modeled formation with $R_t = 10$ ohm-m and $R_{xo} = 1$ ohm-m

Directional Sensor Specifications					
	Range	Accuracy		Range	Accuracy
Inclination	0 - 180°	+/- 0.10°	Total Gravity Field	-2 - 2 g	+/- 2.5 mg
Azimuth	0 - 360°	+/- 0.25°	Total Magnetic Field	-0.8 - 0.8 Gauss	+/- 300 nT
Gravity Toolface	0 - 360°	+/- 0.75°	Continuous Inclination	0 - 180° (<10 gRMS)	+/- 0.2°
Magnetic Toolface	0 - 360°	+/- 0.75°	Continuous Azimuth	0 - 360° (<10 gRMS)	+/- 0.5°
Dip Angle	-90 - 90°	+/- 0.40°			