



Wolverine
Oilfield Technologies

NEUTRINO™

ULTRA-HIGH-SPEED MODULAR MWD PLATFORM

NEUTRINO™ ULTRA-HIGH-SPEED MODULAR MWD

NEUTRINO™ High-Speed Pulsar

- Interchangeable Sleeve Assemblies (4 ¾ – 8" sizes available)
- Poppet Orifice Configurations Interchangeable in Slips for Pulse Size Adjustment
- Pulsar Tool Kit
- Pulsar Running Gear

NEUTRINO™ Directional Module

- Proprietary Master/ Triple Power Supply

NEUTRINO™ Surface System

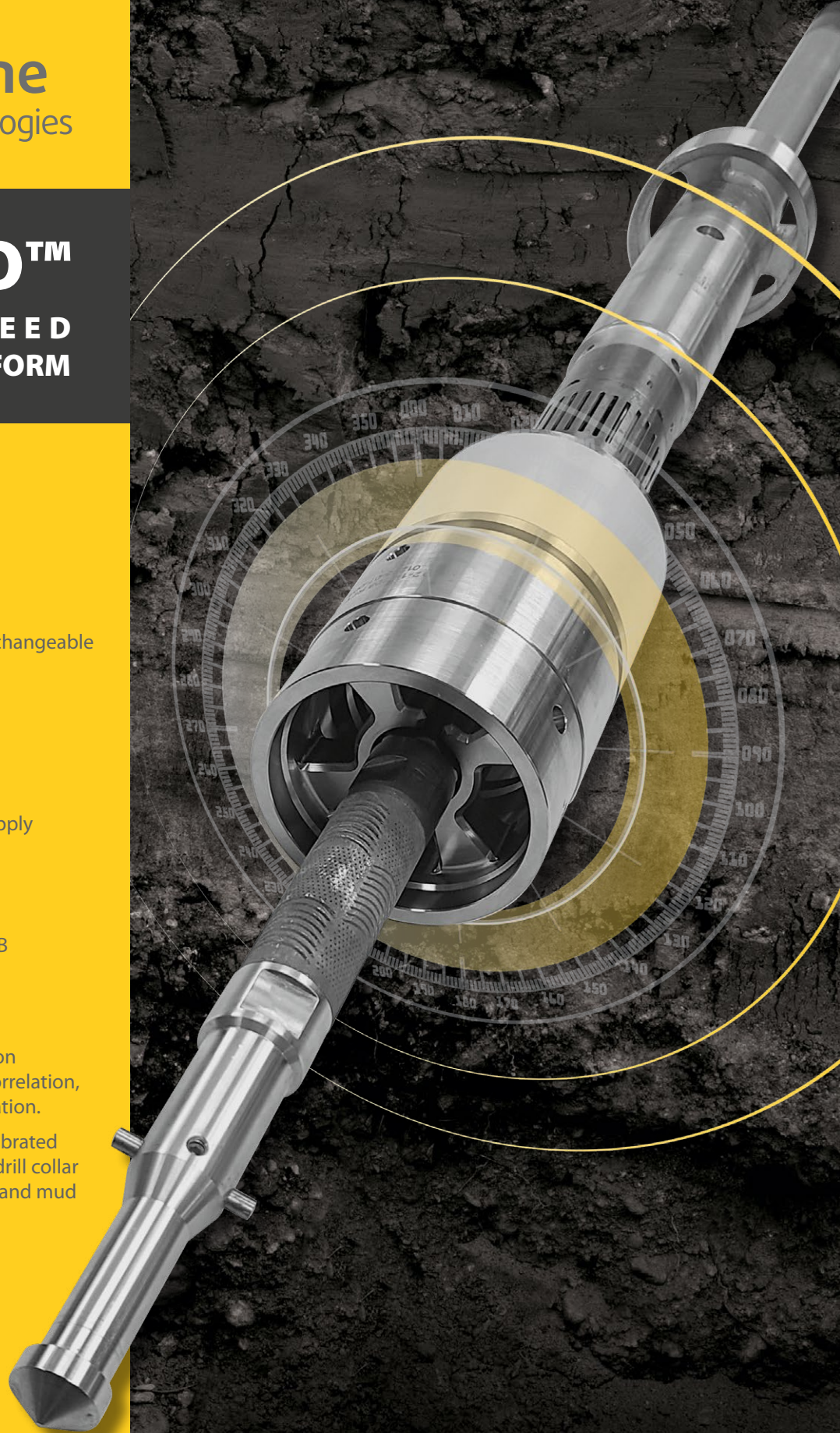
- Proprietary Encoding System
- Compatible WITS out to QuantumDB Logging Suite

Total Gamma

- Neutrino MWD includes a scintillation gamma ray detector for real-time correlation, geosteering, and reservoir identification.
- The gamma ray measurement is calibrated to API standards, and corrected for drill collar attenuation, hole size, mud weight, and mud potassium content.

Batteries

- Standard 8 Cell Lithium Batteries
- 150-Watt Turbine as Battery Replacement



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CONTINUOUS INNOVATION

IN TOUCH WITH TOMORROW

At 2 bits/sec we deliver 4 times the speed of other telemetry systems

NEUTRINO™ uses an encoding method that is 40% more efficient than other encoding methods

INSTRUMENT ACCURACY SPECIFICATIONS

Inclination	
Absolute	± 0.1°
Spread	± 0.1°
Azimuth (Magnetic Dip Angle at <70°)	
At 5° inclination	
Absolute	± 1.2°
Spread	± 1.0°
At 10° inclination	
Absolute	± 1.0°
Spread	± 0.75°
At 90° inclination	
Absolute	± 0.5°
Spread	± 0.5°
Toolface Accuracy, Axial Rotation, 10 through 90 inc	± 1.0°
Total G Field Accuracy, Absolute	± 3.0 mg
Total H Field Accuracy, Absolute	+/- 4.0 mGauss
RPM Measurement, 10 to 255 RPM	± 0.5 of value

MECHANICAL & ENVIRONMENTAL SPECIFICATIONS

Outside Diameter	1.875 in. [47.6 mm]
Length (W/End Caps)	56.73 in. [1.44 m]
Operating Temperature	32° to 347°F [0 to 175°C]
Survival Temperature	-40° to 365°F [-40° to 185°C]
Vibration (Random)	20 g RMS, 10 to 200 Hz
Shock	1000 g, 0.5 mSec, half-sine

GAMMA RAY SPECIFICATIONS

Static Vertical Resolution	~6 inches (152 mm)
Accuracy	+/- 5%
Calibration Standard	API gamma units
Borehole Corrections	Hole size, mud weight, & mud potassium content

Imperial UOM [Metric UOM]

ENVIRONMENTAL CAPABILITIES

Standard Measurements	6-axis static surveys, continuous inclination and azimuth*, gamma, shock and vibration, RPM, and temperature		
Inclination	Absolute	± 0.1°	
	Spread	± 0.1°	
Azimuth (Magnetic Dip Angle at <70°)	At 10° inclination	Absolute	± 1.0°
		Spread	± 0.75°
	At 90° inclination	Absolute	± 0.5°
		Spread	± 0.5°
Continuous Inclination (cInc) Accuracy		up to 150 RPM	
cInc (Inc <10°)		- 1.0 / +3.0°	
cInc (Inc >10°)		+ / - 0.5°	
Continuous Azimuth (cAzM) Accuracy		up to 150 RPM	
cAzM (Inc <45°)		+ / - 15°	
cAzM (Inc >45°)		+ / - 5°	
Toolface Accuracy, Axial Rotation, 10 through 90 inc		± 1.0°	
Total G Field Accuracy, Absolute		± 3.0 mg	
Total H Field Accuracy, Absolute		+/- 4.0 mGauss	
RPM Measurement, 10 to 255 RPM		± 0.5 of value	
Gamma Accuracy		+ / - 0.5 cps	

TECHNICAL SPECIFICATIONS

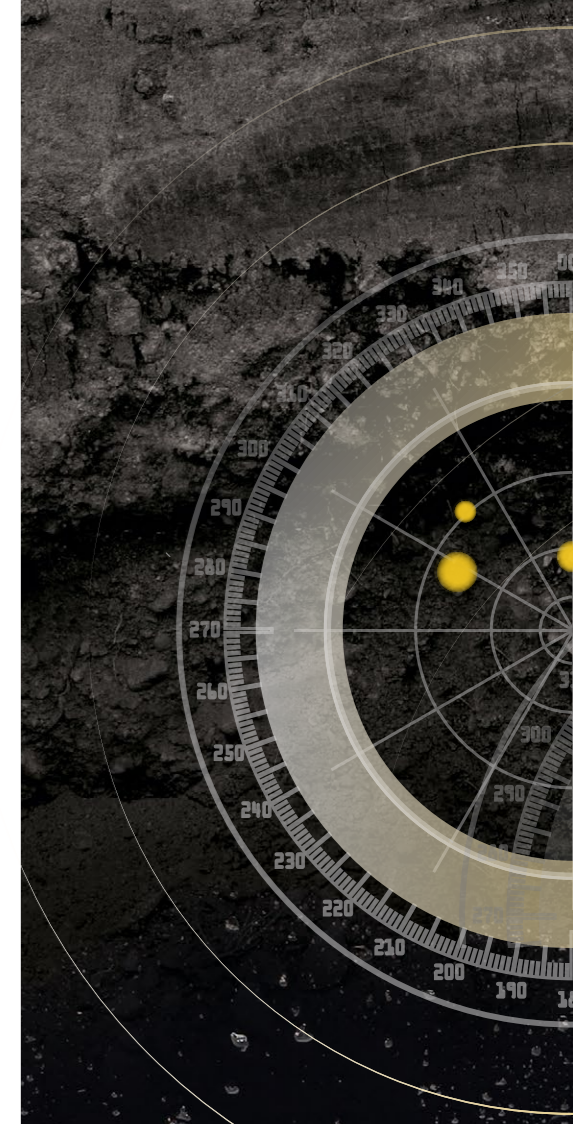
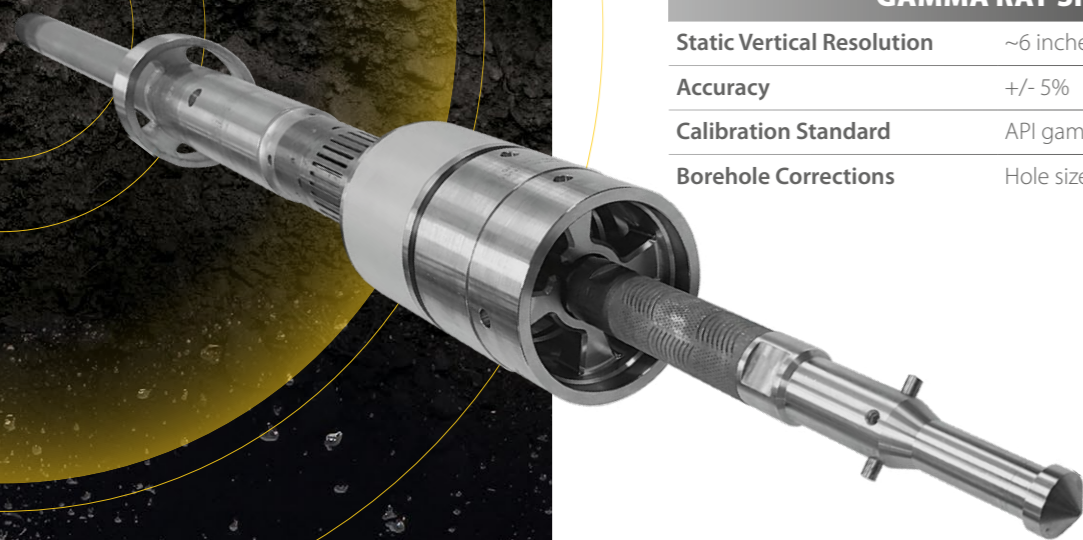
Tool Size (OD)	4 3/4"	6 1/2"	6 3/4"	8"
Transmission Speed	2-10 Bit/Sec (Neutrino™ MWD)			
Compatibility	Neutrino™ MWD / Tolteq MWD / GE MWD			
Connection Uphole	3 1/2" IF (NC38)	4 1/2" XH (NC50)	4 1/2" IF (NC50)	6 5/8" Reg
	Box	Box	Box	Box
Connection Downhole	3 1/2" IF (NC38)	4 1/2" XH (NC50)	4 1/2" IF (NC50)	6 5/8" Reg
	Pin	Pin	Pin	Pin
Orifice/Collar Size	Orifice/Collar Size Configurable on Rigsite			
Flow Range (GPM)	200-500		300-800	400-1000
	486hrs @ 2bits/sec 552hrs @ 0.5bits/sec (2 bat config)			
Battery Life	486hrs @ 2bits/sec 552hrs @ 0.5bits/sec (2 bat config)			
Pulse Width (configurable)	0.32s/pulse		(Reliable 0.064s/pulse)	
LCM Tolerance	60 ppb			

REAL-TIME DATA

- Shock
- Vibe
- RPM
- Stick/Slip
- Inclination / Azimuth (with R-Nav)

INTEGRATED PUMP RECOGNITION

AGITATOR NOISE FILTRATION

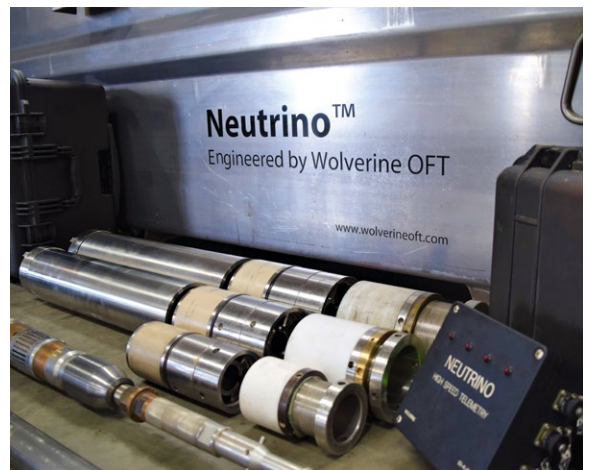


NEUTRINO™ KIT ASSEMBLY

FEATURES & BENEFITS

- Operational time and environmental history recorded in internal memory*
- On-board rotation detection
- Shock, vibration and RPM pulsed to surface in real time
- Addition of new rotation sequence
- Advanced internal logging*
- Internal current usage logged to memory*
- Start power management – efficient battery switching and logging of voltage and current
- Fluxgate magnetometers
- Quartz-flexure accelerometers
- Legacy compatible
- Enhanced circuit protections
- Calibration coefficients included directly into module memory

* Available with iDM NXT and NXT pulsers



Wolverine Oilfield Technologies is a subsidiary of NewTech Services Holding Limited, an international oilfield services company founded in 2009.

NewTech Services Holding Limited develops technology and expertise within 4 Business Divisions: Drilling Services, Completion Systems, Integrated Project Management, and Capital Equipment.

NewTech Services Holding Limited supplies technology products and services to the oil and gas exploration and production industry in Russia and CIS, Europe, Middle East, North and South America.

Wolverine Oilfield Technologies is a subsidiary of NewTech Services Holding Limited specializing in drilling technology products such as MWD/LWD/RSS.



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