

PR2

LWD Propagation Resistivity

w/ optional Borehole Pressure & 3-axis Shock Measurements

Real-time formation evaluation

The PR2 provides resistivity measurements when formation evaluation is required in real time. Typically 1-2 resistivity measurements are telemetered to the surface with gamma ray data to provide identification of the subsurface strata. Additional resistivity and gamma ray measurements are stored in tool memory and added to the real-time log after drilling to provide a complete, high-resolution profile of formation properties.

Multiple depths of investigation

The PR2 measures formation resistivities at multiple depths of investigation, using two receiver antennas located in the middle of a balanced array of four transmitter antennas operating at two frequencies. The antenna arrangement provides compensation for both borehole irregularities and electronics drift. This technology is capable of measuring formation resistivities up to 3000ohmm using phase-difference measurements.

Combinable with existing MWD systems

The PR2 was designed to add resistivity measurements to existing 3rd-party MWD directional / gamma systems, including both top-mount & bottom-mount mud pulser systems and also systems using electromagnetic or dual telemetry. Typically no additional investment is required to upgrade existing surface decoding, depth tracking or log plotting capabilities. Generic variables (GV's) are used in Tensor-compatible systems to deliver data to the MWD directional module and support is available for proprietary tool bus designs. Hardware adapters are available for rotary and Kintec connector systems. Fully custom solutions can also be created to meet specific interface requirements.

APPLICATIONS

- Formation evaluation while drilling in all well trajectories and drilling mud types
- Geosteering
- Invasion profiling / permeability indication
- Reserve calculations
- Casing point determination
- Managed pressure drilling / equivalent circulating density monitoring
- Shock detection & mitigation

BENEFITS

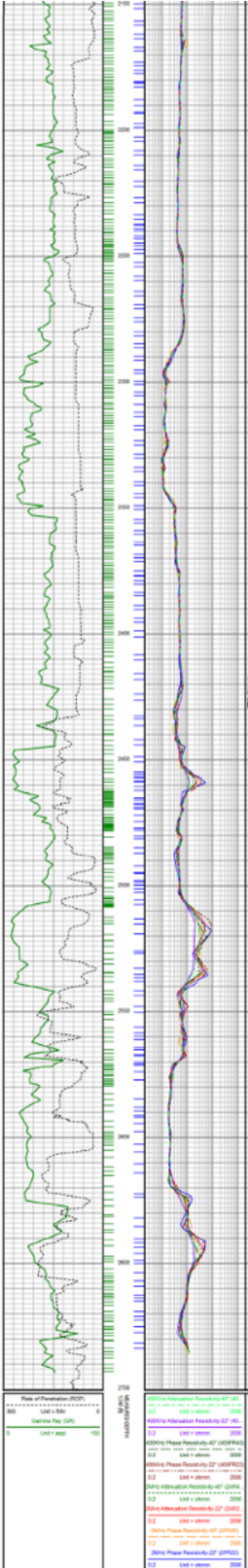
- Maximum pay-zone exposure
- Wireline-quality resistivity measurements in hard-to-reach deviated sections

FEATURES

- 8 compensated multi-depth resistivities
- Optional bore & annular pressure
- Optional 3-axis shock
- 3 collar sizes
- Compatible with all drilling fluids
- Low power for long battery life
- Compatible with 3rd party MWD systems
- Connection for gamma ray & bottom-mount pulser below
- Rated to 175C, 20,000psi



PR2 LWD Propagation Resistivity



Measurement Specifications

Resistivity

Spacing / Frequency	22" / 400KHz	40" / 400KHz	22" / 2MHz	40" / 2MHz
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Measurement Range

Phase Difference	0.1 - 400 ohmm		0.1 - 3000 ohmm	
Attenuation	0.1 - 10 ohmm		0.1 - 50 ohmm	

Accuracy

Phase Difference	Below 10ohmm: +/- 2%		Below 60ohmm: +/- 2%	
	Above 10ohmm: +/- 2mmho/m		Above 60ohmm: +/-0.3mmho/m	
Attenuation	Below 3ohmm:	Below 3ohmm:	Below 15ohmm:	Below 15ohmm:
	+/- 5%	+/- 3%	+/- 5%	+/- 3%
Attenuation	Above 3ohmm:	Above 3ohmm:	Above 15ohmm:	Above 15ohmm:
	+/- 18mmho/m	+/- 10mmho/m	+/- 4mmho/m	+/- 2mmho/m

Bore & Annular Pressure (optional)

Range	0 - 20,000 psi	Resolution	0.1 psi
Accuracy	+/- 0.75% Full Scale standard / +/- 0.1% Full Scale optional		

3-axis Shock (optional)

Range	+/-250g	Resolution	1 g
Measurements	Axial & Lateral, Peak and RMS, 200Hz Sample Rate		

General Specifications

Input Voltage	18 - 36V from Lithium Batteries or Alternator
Input Power	~6W (typical)
Battery Life	8 - DD cells (28V, single pack): 125 hours 10 - DD cells (36V, single pack): 150 hours
Data Memory	64Mbytes (>200 hours)
Temp. Range	0 - 175 deg. C Operating

Mechanical Specifications

Max. pressure	20,000 psi		
Nom. diameter	4.75"	6.75"	8.25"
Max. diameter	5.25"	7.25"	8.75"
Nom. length	176"	176"	174"
Max. flow rate	350 USGPM	750 USGPM	1200 USGPM (std) 1800 USGPM (optional)
Dogleg Severity			
Rotary mode	12.5°/100 ft.	8°/100 ft.	7°/100 ft.
Sliding mode	25°/100 ft.	16°/100 ft.	14°/100 ft.
Connections	NC-38 (3.5" IF)	NC-50 (4.5" IF)	NC-61
Box - Pin			

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