

SYMMETRIC PROPAGATION RESISTIVITY

FORMATION EVALUATION GRADE RESISTIVITY MEASUREMENT WHILE DRILLING



TRANSMITTERS

RECEIVERS

TRANSMITTERS

C&J Directional Services, through its in-house Research & Technology facility, offers real-time LWD resistivity combined with advanced, high-bandwidth MWD tools. The Symmetric Propagation Resistivity (SPR) tool creates high-quality resistivity logs with both phase and attenuation measurements in real time. Measurements with multiple depths of investigation and vertical resolutions help with the drilling process. With a total of eight curves recorded into memory, the SPR tool has extremely high resolution memory data with fast data dump capability. This feature enables our field operators to create high resolution logs after the run is complete with no impact on drilling time.

The SPR was designed and engineered around the concept of borehole compensation with a symmetric configuration of transmitters and receivers. This reduces the artifacts on the log due to borehole rugosity while minimizing errors caused by drifts in electronic circuits. The bed boundaries are better delineated with the symmetric design. These attributes and the continuing engineering support from C&J's Research and Technology Center allows the SPR to produce the operational excellence demanded in today's drilling environment.

- High quality, real-time data for better well placement
- Multiple depths of investigation
- Symmetric design for enhanced data quality
- Borehole compensated data
- Low maintenance
- High reliability

MECHANICAL AND OPERATIONAL SPECIFICATIONS

	SPR475	SPR675
General		
Maximum operating pressure	20,000 psi	20,000 psi
Maximum operating temperature	300°F (150°C)	300°F (150°C)
Maximum flow rate	400 galUS/min	750 galUS/min
Maximum sand content	3% by volume	3% by volume
Drill collar nominal OD	4.75-in.	6.75-in.
Diameter at wear bands	5.25-in.	7.25-in.
Makeup length	14.7 ft	13.7 ft
Total tool weight	800 lbm	1,700 lbm
Top thread connection	NC 38 box	NC 50 box
Bottom thread connection	NC 38 pin	NC 50 pin
Maximum rotation speed	300 rpm	300 rpm
Torque		
Maximum operating rotary torque	8,000 ft-lbf	15,000 ft-lbf
Connection makeup torque	9,000 ft-lbf	30,000 ft-lbf
Bending		
Maximum tool curvature	Rotating 15°/100 ft Sliding 30°/100 ft	Rotating 8°/100 ft Sliding 16°/100 ft
Axial		
Maximum jarring load	200,000 lbf	330,000 lbf
Maximum tensile load	30,000 lbf	40,000 lbf
Electrical Power (average)		
	6W	6W
Memory		
	64 MB	64 MB
Maximum data recording time at 10 s sampling	728 hours	728 hours

MEASUREMENT SPECIFICATIONS FOR SPR475 AND SPR675

Resistivity Range and Accuracy

Measurement	Frequency	Range ($\Omega.m$)	Accuracy	Range ($\Omega.m$)	Accuracy
Attenuation	400 KHz	0.1-5	$\pm 2\%$	5-35	± 8 mS/m
Attenuation	2 MHz	0.1-25	$\pm 2\%$	25-60	± 1 mS/m
Phase shift	400 KHz	0.1-25	$\pm 1\%$	25-2000	± 1 mS/m
Phase shift	2 MHz	0.1-125	$\pm 1\%$	125-3000	± 0.2 mS/m

Depth of Investigation (ft)

Radial depth in a plane transverse to the tool axis at which the integrated geometrical factor reaches 50%.

Measurement	Frequency	Resistivity = 1 $\Omega.m$		Resistivity = 10 $\Omega.m$	
		TX-RX Spacing		TX-RX Spacing	
		<u>22 in.</u>	<u>40 in.</u>	<u>22 in.</u>	<u>40 in.</u>
Attenuation	400 KHz	2.6	3.4	5.0	6.2
Attenuation	2 MHz	1.8	2.4	3.0	3.9
Phase shift	400 KHz	1.5	2.1	2.2	3.2
Phase shift	2 MHz	1.1	1.5	1.7	2.3

Vertical Resolution (ft)

Width along the tool axis at which the normalized response function is 50% of its maximum.

Measurement	Frequency	Resistivity = 1 $\Omega.m$		Resistivity = 10 $\Omega.m$	
		TX-RX Spacing		TX-RX Spacing	
		<u>22 in.</u>	<u>40 in.</u>	<u>22 in.</u>	<u>40 in.</u>
Attenuation	400 KHz	4.1	4.2	5.8	8.8
Attenuation	2 MHz	2.2	2.2	4.6	5.2
Phase shift	400 KHz	1.3	1.3	1.7	2.0
Phase shift	2 MHz	1.0	1.0	1.4	1.5