

## **VELOCITY EDGE** ADVANCED AZIMUTHAL SONIC & ULTRASONIC IMAGER

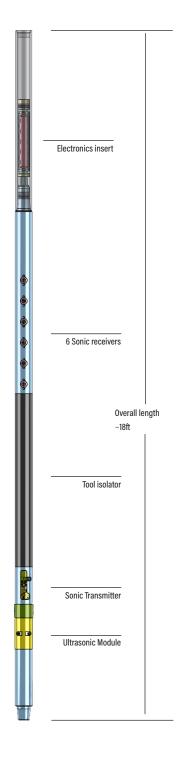
Innovative Downhole Solutions provide state-of-the-art formation evaluation tools to the Oil and Gas services industry. The Advanced Azimuthal Sonic and Ultrasonic Imager Tool is a fit-for-purpose single collar design housing the sensors and electronics necessary to provide azimuthal sonic, ultrasonic imaging along with caliper measurements. The sonic tool provides improved signal to noise ratio within the drilling environment and a focused transmitter and receiver for azimuthal sonic measurements. Ultrasonic measurements are acquired every 1 ms for high resolution image quality.

This LWD tool provides:

- O Compressional and refracted shear measurements
- Azimuthal compressional and refracted shear measurements
- Ultrasonic travel time
- Average borehole caliper
- O Azimuthal ultrasonic travel time
- O Azimuthal borehole image
- O Azimuthal ultrasonic amplitude for formation imaging
- O Borehole fluid travel time and slowness

## **GENERAL SPECIFICATIONS**

Operating Parameters		
Maximum operating temperature	175 C	
Maximum operating pressure	20,000 psi	
Maximum logging speed	360 ft/hr	
Tool length	<18 ft without power and interconnects	
Cutbacks	(8) 0.25 - total of 2" top and 2" bottom	
Ultrasonic imager stabilizer diameter	0.25" under-gauge	
Recorded sampling rate	5, 10, 20s except for ultrasonic measurements	
Ultrasonic measurements sampling rate	15	
Estimated total power consumption	4 watts @ 25 C, 10 watts @ 175C	
Battery voltage	16-48 V	
Maximum memory storage	7 days @ 5s sampling (6" samples @ 360 ft/hr ROP)	
	14 days @ 10s sampling (6" samples @ 180 ft/hr ROP)	
Power requirements and operating time	Configurable, standalone power or powered by MWD	
	~6 amp-h per day, 8.5 days using (2) 26 amp-h batteries	
Memory download time for:	total storage of 1GB < 30 minutes	
	customer deliverables only < 10 minutes	
Real-time communications	adapt to MWD provider specifications	



Mechanical Specifications	4.75" Tool	6.75" Tool
Maximum tool OD	5.25"	7.25"
Tool top/bottom connections	TBD	TBD
Hole sizes	5.875"-6.75" using specific stabilizers	8.5"-9.875" using specific stabilizers
Maximum flow rate	400 gpm	800 gpm
Maximum weight on bit	35,000 lbf	55,000 lbf
Maximum drilling torque	9, 500 ft-lbf	25,000 ft-lbf
Dogleg severity (rotating)	15 degrees/100 ft	8 degrees/100 ft
Dogleg severity (sliding)	30 degrees/100 ft	16 degrees/100 ft

Distance between transmitter and first receiver  Receiver spacing  6 in  Compressional slowness range  70-mud slowness minus 10 us/ft  Shear slowness range  70-mud slowness minus 10 us/ft  Foliamuthal sonic data  16 sectors recorded, 16 sectors compressed real time  Measurement point from bottom of the tool  11 ft (estimated)  Customer Deliverables  Compressional and refracted shear velocities  Compressional and refracted shear roherences  Poisson's Ratio and mechanical moduli when possible  Ultrasonic Measurements  Maximum for transducers  2; one facing the formation for standoff measurement and one in a mud cell for mud velocity measurement  4; one facing the formation for standoff measurement  135 ppg OBM and WBM  Maximum mud slowness  275 us/ft  Measurement total error  4/- 0.075' at 1" standoff  Azimuthal data while rotating  Measurement toma bottom of tool  4 ft (estimated)  Customer Deliverables  Mud slowness derived from mud-cell transducer  Average travel time  Average Standoff  Average borehole diameter  Azimuthal travel time  Azimuthal standoff and borehole caliper	Sonic Measurements		
Receiver spacing 6 in Compressional slowness range 30-270 us/ft Shear slowness range 70-mud slowness minus 10 us/ft Slowness accuracy +/- 0.625 us/ft Azimuthal sonic data 16 sectors recorded, 16 sectors compressed real time Measurement point from bottom of the tool 11 ft (estimated)  Customer Deliverables Compressional and refracted shear velocities Compressional and refracted shear arrival times Compressional and refracted shear coherences Poisson's Ratio and mechanical moduli when possible  Ultrasonic Measurements  Number of transducers 2; one facing the formation for standoff measurement and one in a mud cell for mud velocity measurement  Maximum mud weight 135 ppg OBM and WBM  Maximum mud slowness 275 us/ft Standoff measurement trange 0.5-2.5*  Measurement total error 4/- 0.075* at 1* standoff  Measurement point from bottom of tool 4 ft (estimated)  Customer Deliverables  Mud slowness derived from mud-cell transducer  Average Standoff  Average Standoff  Average Derehole diameter  Azimuthal standoff and borehole caliper	One directional transmitter	six directional receivers	
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Azimuthal standoff and borehole caliper	Average travel time		
Azimuthal travel time Azimuthal standoff and borehole caliper	Average Standoff		
Azimuthal standoff and borehole caliper	Average borehole diameter		
·	Azimuthal travel time		
Azimuthal amplitude image	Azimuthal standoff and borehole caliper		
	Azimuthal amplitude image		

Toolface Measurements for Azimuthal Data		
Using 2-axis MEMS magnetometer and (2) 2-a.	xis MEMS accelerometer	
Inclination is determined from a single axis ME	MS accelerometer	
Referenced to magnetic or gravity toolface de	pending on inclination and user-defined cross-over angle	
Toolface range	0-360 degrees	
Toolface accuracy	+/-2 degrees	
RPM range	-500 - +500	
RPM accuracy	+/-5 %	
Measurement point from bottom of tool	14 ft (estimated)	
Customer Deliverables		
Stick/slip indicator		
Vibration, Temperature, and RPM Measureme	ents	
Vibration	Using 3-axis MEMS accelerometer (X,Y, and Z)	
Measurement range	+/- 200 G	
Measurement accuracy	+/- 5%	
RPM	Using 2-axis MEMS magnetometer (X and Y)	
Measurement range	+/- 500 RPM	
Measurement accuracy	+/- 2%	
Temperature	Using board-mounted temperature sensor	
Measurement range	-20 - 175 C	
Measurement accuracy	+/-1C	
Measurement point from bottom of tool	14 ft (estimated)	
Customer Deliverables		
X, Y, lateral and Z (axial) RMS vibration		
X, Y, and Z shock rate		
X, Y, and Z peak rate		
Fast (1 ms) vibration data during high-vibration	events	
RPM		
Stick/slip index		

Temperature