

# VELOCITY EDGE ADVANCED AZIMUTHAL SONIC & ULTRASONIC IMAGER

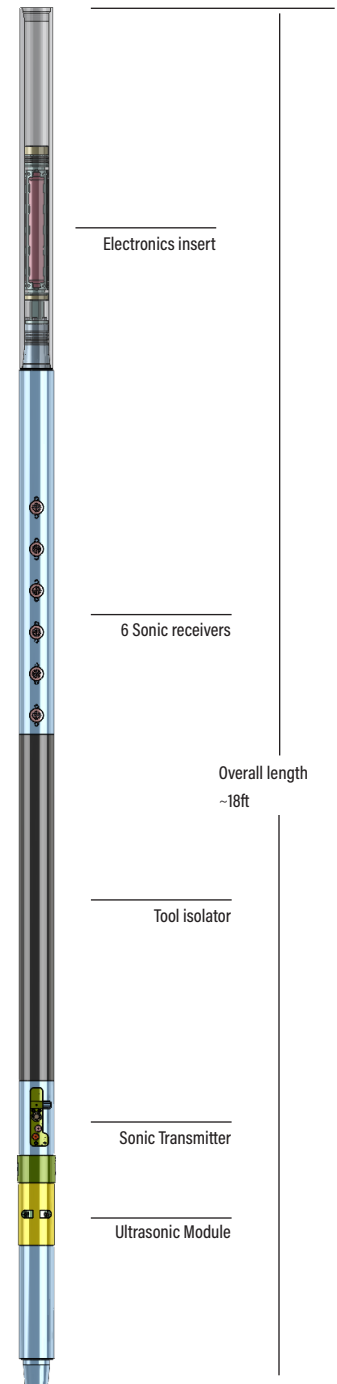
Innovative Downhole Solutions provide state-of-the-art formation evaluation tools to the Oil and Gas services industry. The Advanced Azimuthal Sonic and Ultrasonic Imager Tool is a fit-for-purpose single collar design housing the sensors and electronics necessary to provide azimuthal sonic, ultrasonic 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:

- Compressional and refracted shear measurements
- Azimuthal compressional and refracted shear measurements
- Ultrasonic travel time
- Average borehole caliper
- Azimuthal ultrasonic travel time
- Azimuthal borehole image
- Azimuthal ultrasonic amplitude for formation imaging
- 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	1s
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

Sonic Measurements	
One directional transmitter	six directional receivers
Distance between transmitter and first receiver	6 ft
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	13.5 ppg OBM and WBM
Maximum mud slowness	275 us/ft
Standoff measurement range	0.5-2.5"
Measurement total error	+/- 0.075" at 1" standoff
Azimuthal data while rotating	128 sectors recorded, 16 sectors compressed real-time
Measurement point from 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	
Azimuthal amplitude image	

<b>Toolface Measurements for Azimuthal Data</b>	
Using 2-axis MEMS magnetometer and (2) 2-axis MEMS accelerometer	
Inclination is determined from a single axis MEMS accelerometer	
Referenced to magnetic or gravity toolface depending 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)
<b>Customer Deliverables</b>	
Stick/slip indicator	
<b>Vibration, Temperature, and RPM Measurements</b>	
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	+/- 1 C
Measurement point from bottom of tool	14 ft (estimated)
<b>Customer Deliverables</b>	
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	