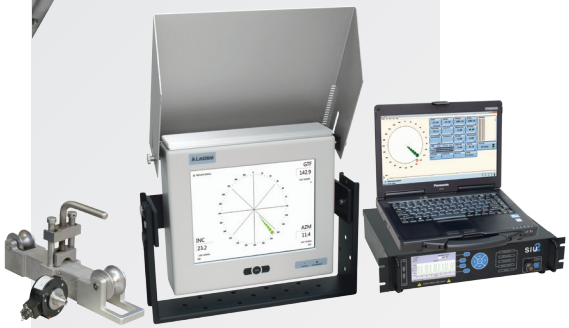
SureShot™ MWD System

SureShot-MP

Fixed-mount Pulser



Standard APS Surface System

Printrex Plotter

APS's SureShot family of directional and directional plus gamma systems provides reliable and flexible measurement-while-drilling performance in combination with our second-generation Rotary Pulser. The system can be powered by our battery modules, our turbine alternator, or a combination of the two. This MWD system provides highly accurate azimuth and inclination data for all applications from straight-hole through horizontal drilling. Rapid and accurate toolface transmission enables the most complex well paths to be drilled with confidence.

SureShot's downhole portion includes a rugged directional sensor package with NIST-traceable magnetometer calibration; a reliable, field-proven, Rotary Pulser*; and battery and/or turbine alternator for power. SureShot's modular design allows the addition of other functions like high-quality gamma and/or vibration logging. Each package is protected by a state-of-the-art vibration isolation system and is mounted in beryllium copper or high-strength steel pressure barrels. A small, robust surface decoder interfaces with a computer running APS's SureShot Control Center software. The SureShot MWD can store up to 32 MB of MWD/LWD and diagnostic data for retrieval during trips.

SureShot's patented second-generation Rotary Pulser* is the toughest, most advanced, most LCM-tolerant mud pulse transmitter in the industry. Our pulser's ultra-reliable, high-efficiency DC brushless motor and controller, single open-flow path, positive pulse output and anti-jamming control virtually eliminates jamming or blockage, and the on-board memory allows post-run analysis of pulser performance. The Rotary Pulser is easily converted between fixed-mount and retrievable configurations.

The SureShot system is easy to learn, assemble and operate. In fact, APS's customers frequently train their personnel themselves to operate our system.

- The highly reliable APS second-generation Rotary Pulser converts easily from fixed-mount to retrievable, providing fixed-mount reliability or retrievable lost-in-hole security.
- Additional sensors including gamma, vibration monitoring and resistivity can be quickly incorporated into our "LWD-Ready" system.
- The surface system presents data in a simple, user-friendly control and display module. The data is transferred to a central control PC from which it can be directed back to a dedicated wireless rig-floor display and/or rig monitoring system.
- Multiple encoding schemes and advanced decoding enable rapid customization of the data stream for maximum speed or maximum data integrity.
- The unique APS power management module enables the system to be powered through dual battery packs or a combination of battery power and APS turbine alternator †.

** U.S. Patents #6,714,138 and #7,327,634* *† U.S. Patent #7,201,239*

APS TECHNOLOGY

SureShot™ MWD System

Retrievable Pulser with Stinger

Low-temperature Rig Floor Display

SureShot Ruggedized System with Integrated Server and Terminal

Operating Specifications		
Inclination Range	0˚ - 180˚	
Inclination Accuracy	± 0.1˚	
Azimuth Range	0˚ - 360˚	
Azimuth Accuracy	± 1.0˚ (Inc > 10˚, Dip < 70˚)	
Tool Face (Gravity)	± 1.0˚ (Inc > 10˚)	
Tool Face (Magnetic)	± 2.25˚ (Dip < 70˚)	
Gamma (Optional)	API-calibrated 0 - 800 API ±5% to 300˚F (150˚C) ±10% to 350˚F (175˚C) (based on typical API scale factor of 1.35 API counts/sec)	
Sensors		
Directional	Tri-axial fluxgate magnetometer with NIST-traceable calibration; quartz accelerometer	
Gamma (Optional)	Scintillator/PMT unit	
Product Specifications		
Signal Transmission	Positive mud pulse	
Pulse Height	Adjustable	
Retrievable/Reseatable	Available	
Fixed-mount	Available	
Activation	Electromechanical	
Operating Voltage	28 - 40 VDC	
Pulser sub O.D.	9.5§, 8, 6.25 to 6.75, 4.75, 3.5 & 3.125 in.**	241§, 203, 159 to 171,121, 89 & 79 mm**
Flow Ranges	9.5 in. or larger – 650 to 1200 gpm 8 in. – 300 to 1100 gpm 6.25 to 6.75 in. – 150 to 750 gpm 4.75 in. – 125 to 350 gpm 3.125 & 3.5 in. – 70 to 250 gpm	241 mm or larger – 41 to 76 L/sec 203 mm – 19 to 69 L/sec 159 to 171 mm – 9 to 47 L/sec 121 mm – 7.9 to 22 L/sec 79 & 89 mm – 4 to 16 L/sec
Sand Content	< 1% by volume recommended, 3% by volume max	
LCM Tolerance	50 lb/bbl medium nut plug	143 kg/m³ medium nut plug
Operating Temperature	-13˚ to 302˚F; 347˚F option	-25˚ to 150˚C; 175˚C option
Maximum Pressure	20,000 psi; 25,000 psi option	137.9 MPa; 172.4 MPa option
Differential Pressure	No requirement	
Dogleg Capability	API connection limited	
Surface System		
SIU 2 & Plotter General Specifications		
Electrical Requirements	100 - 240 VAC, 47 - 63 Hz, 13 W	
Operating Temperatures	32˚ to 158˚F	0˚ to 70˚C
Storage Temperatures	14˚ to 185˚F	-10˚ to 85˚C
"Ruggedized" System		
Directional	Case – 19 in. EIA Standard 17 in. (h) x 27 in. (w) x 34.25 in. (d) Weight – 119 lb	Case – 483 mm EIA Standard 431mm (h) x 686 mm (w) x 870 mm (d) Weight – 54.0 kg
Directional & Depth Tracking	Case – 19 in. EIA Standard 17 in. (h) x 27 in. (w) x 34.25 in. (d) Weight – 119 lb	Case – 483 mm EIA Standard 431 mm (h) x 686 mm (w) x 870 mm (d) Weight – 54.0 kg
"Lite" System		
Directional	5.5 in. (h) x 22 in. (w) x 20 in. (d) Weight – 12 lb plus laptop	140 mm (h) x 559 mm (w) x 508 mm (d) Weight – 5.4 kg plus laptop
Directional & Depth Tracking	5.5 in. (h) x 22 in. (w) x 20 in. (d) Weight – 12 lb plus laptop	140 mm (h) x 559 mm (w) x 508 mm (d) Weight –5.4 kg plus laptop
Printrex Plotter		
	7.25 in. (h) x 22 in. (w) x 20 in. (d) Weight – 37 lb	184 mm (h) x 559 mm (w) x 508 mm (d) Weight – 16.8 kg
Rig Floor Displays		
Standard	Certified Zone 1 Division 2; 9 in.; wireless -4˚ to 140˚F (-20˚ to 60˚C) operating; -40˚ to 167˚F (-40˚ to 75˚C) storage	
Low-temperature	Certified Zone 1 Division 2; 15 in.; wired/wireless -40˚ to 122˚F (-40˚ to 50˚C) operating; -40˚ to 167˚F (-40˚ to 75˚C) storage	
Surface Sensors		
Pressure Transducer	4 - 20 mA current loop; certified intrinsically safe Class 1 Division 1, Class 1 Zone 0 -40˚ to 250˚F (-40˚ to 121˚C) operating; -67˚ to 302˚F (-55˚ to 150˚C) storage	
Hook Load Sensor	4 - 20 mA current loop; certified intrinsically safe Class 1 Division 1, Class 1 Zone 0 -40˚ to 180˚F (-40˚ to 80˚C) operating; -40˚ to 257˚F (-40˚ to 125˚C) storage	
Depth Encoder	Standard NAMUR Type; certified intrinsically safe Class 1 Zone 0 -40˚ to 180˚F (-40˚ to 80˚C) operating; -40˚ to 257˚F (-40˚ to 125˚C) storage	

§ Larger O.D. subs can be accommodated using the pulser for 9.5 in. (241 mm) O.D.

*** Pulsers for 3.125 in. (79 mm) & 3.5 in. (89 mm) BHAs are available in fixed-mount only.*

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