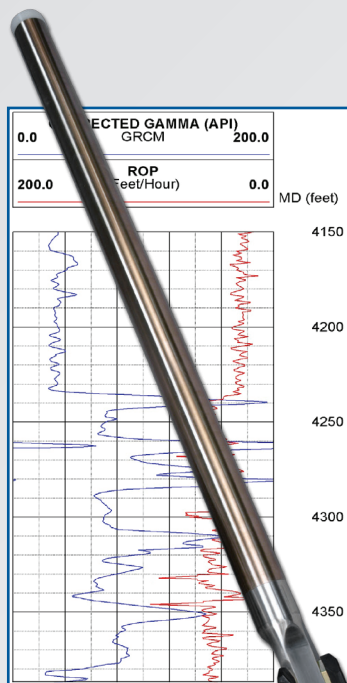


# SureShot™ MWD Gamma Sensor with Environmental Monitoring

## SureShot-Gamma



APS's next-generation SureShot natural gamma sensor employs a rugged scintillation counter and photomultiplier mounted in a specially designed package which provides protection against the high levels of shock and vibration encountered in the drilling environment. In addition, this extensively qualified new design offers environmental monitoring capability and lower power consumption, while maintaining back-compatibility with APS's earlier sensor designs.

APS's gamma sensor is an add-on to our SureShot Measurement-While-Drilling (MWD) system. The APS gamma sensor is calibrated to API-standard units, and a wellsite check source is available to verify tool performance in the field or maintenance repair shop. The easy-to-use SureShot surface system scales natural gamma ray data to API units; corrects for borehole size, mud weight and drill collar effects; assigns each point a depth from the depth tracking system; and plots both real-time displays and configurable hard copy logs. Data can be exported in standard industry formats (WITS and LAS).

The SureShot MWD downhole system can be programmed to send a combination of gamma ray and tool face data transmissions to allow logging while steering and sliding. A rotation sensor in the directional package enables the tool to optionally transmit only gamma ray data while rotating. The SureShot MWD can store up to 32 MB of gamma data for retrieval during trips.

## Product Specifications

Physical Parameters		
Length	46 in.	117 cm
Outside Diameter	1.875 in.	48 mm
Measurement		
Sensor	Nal scintillation detector with PMT	
Measurement Range Accuracy (Apparent API Units)	API-calibrated 0 - 800 API ±3 API @ 100 API (based on typical API scale factor of 1.35 API counts/sec)	
Vertical Resolution	6 in.	152 mm
Max. Data Sampling	Every 5 sec	
Update Resolution (real time)	2.5 to 3.5 points/ft at 50 ft/hr; 0.8 to 1.2 points/ft at 150 ft/hr	
Environmental		
Operating Temperature	0° to 347°F	0° to 175°C
Maximum Pressure	20,000 psi; 25,000 psi option	137.9 MPa; 172.4 MPa option

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## Gamma Controller Environmental Data Files and Event Log

Gamma Lifetime Data						
File Number	Reason	Format	Record Period	FileSizeInBlocks	NumberOfRecords	File Time
0	POR	MinMaxTempAndAccel	5	1	4	Thu Aug 16 13:54:00 2012
1	TimeChange	MinMaxTempAndAccel	5	1	6	Thu Aug 16 14:13:52 2012
2	POR	MinMaxTempAndAccel	5	14	224	Thu Aug 16 14:47:54 2012
3	POR	MinMaxTempAndAccel	5	6	93	Fri Aug 17 09:33:29 2012
4	POR	MinMaxTempAndAccel	5	1	1	<unknown>
5	POR	MinMaxTempAndAccel	5	1	3	<unknown>
6	POR	MinMaxTempAndAccel	5	1	2	<unknown>
7	POR	MinMaxTempAndAccel	5	1	3	<unknown>
8	POR	MinMaxTempAndAccel	5	7	109	Tue Aug 21 08:04:10 2012
9	POR	MinMaxTempAndAccel	5	15	240	Thu Aug 23 11:50:43 2012
10	POR	MinMaxTempAndAccel	5	12	188	Wed Aug 29 16:38:35 2012
11	POR	MinMaxTempAndAccel	5	2	31	<unknown>
12	POR	MinMaxTempAndAccel	5	1	13	<unknown>
13	POR	MinMaxTempAndAccel	5	1	7	Thu Aug 30 13:16:21 2012
14	POR	MinMaxTempAndAccel	5	2	19	Thu Aug 30 13:56:46 2012
15	POR	MinMaxTempAndAccel	5	15	230	Thu Aug 30 15:33:29 2012

TimeStamp	MinTemperature	MaxTemperature	LateralAccel	AxialAccel
Thu Aug 23 11:50:43 2012	123	124	2	2
Thu Aug 23 11:55:43 2012	124	124	1	2
Thu Aug 23 12:00:43 2012	124	124	1	1
Thu Aug 23 12:05:43 2012	124	124	1	1
Thu Aug 23 12:10:43 2012	124	124	2	2
Thu Aug 23 12:15:43 2012	124	125	1	2
Thu Aug 23 12:20:43 2012	125	125	42	50
Thu Aug 23 12:25:43 2012	125	125	1	2
Thu Aug 23 12:30:43 2012	125	125	1	1
Thu Aug 23 12:35:43 2012	125	125	1	3
Thu Aug 23 12:40:43 2012	126	126	1	1
Thu Aug 23 12:45:43 2012	124	124	2	3
Thu Aug 23 12:50:43 2012	126	126	1	1
Thu Aug 23 12:55:43 2012	126	126	1	3
Thu Aug 23 13:00:43 2012	126	126	1	1
Thu Aug 23 13:05:43 2012	126	126	2	3

## Environmental Monitoring

The gamma sensor's built-in accelerometers measure axial and lateral vibration. Peak axial shock, lateral shock, and temperature data are stored in on-board memory every 5 minutes, up to 5,000 hours. Information on the service history of the tool is also stored in on-board memory.

This lifetime log provides valuable information to evaluate the health of the tool, and to develop preventative maintenance cycles base on the actual operating environment over time rather than total downhole hours alone. Vibration measurements can also be used to justify claims for repairs that are a result of out-of-spec drilling conditions.

Gamma module environmental data can be downloaded using APS's MWD Master Interface PC application. Future APS software releases will run the downloaded data through an "Accumulated Damage Model" to enable Condition-Based Maintenance scheduling based on the gamma module's operating history.

**Headquarters ♦ Wallingford ♦ USA**  
7 Laser Lane, Wallingford, CT 06492 USA  
Phone: 860.613.4450 ♦ Fax: 203.284.7428  
contact@aps-tech.com

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