



RUGGED, HIGH SPEED, HIGHER TEMPERATURE, RETRIEVABLE DUAL TELEMETRY MWD SYSTEM.

WHAT MAKES IT RUGGED?

Robust design & construction: Threaded barrel sections connected with robust latch connectors and a direct drive actuator main pulser shaft that does not require downhole screens and performs in harsh and high LCM environments.

Battery, gamma & directional shock suspension: Each component section has internal torsional and axial shock suspension systems that improve vibration dampening over other designs. The risk of Gamma, Accelerometer, and even catastrophic battery failure is reduced.

WHAT MAKES IT HIGH SPEED?

Higher amplitude (bigger) pulses: The tool's hydro assist creates higher amplitude pulses. This allows for data transmission with shorter widths while still maintaining excellent detection.

Narrow pulse width transmission: Allows more data to be transmitted in a given period of time.

WHAT MAKES IT HIGH TEMP?

Latest sensors, soldering techniques, and select components: Conventional designs utilize readily available electrical components that do not function at temperatures that are encountered in hot hole applications. RapidFire designs are based on select components that are capable of surviving elevated temperatures. Specialized soldering materials and techniques are utilized to maintain electrical integrity at temperatures well above the quoted operating limits.

WHAT MAKES IT RETRIEVABLE?

The RapidFire system can be configured as a wireline retrievable tool, lowering the risk of lost-in-hole exposure.

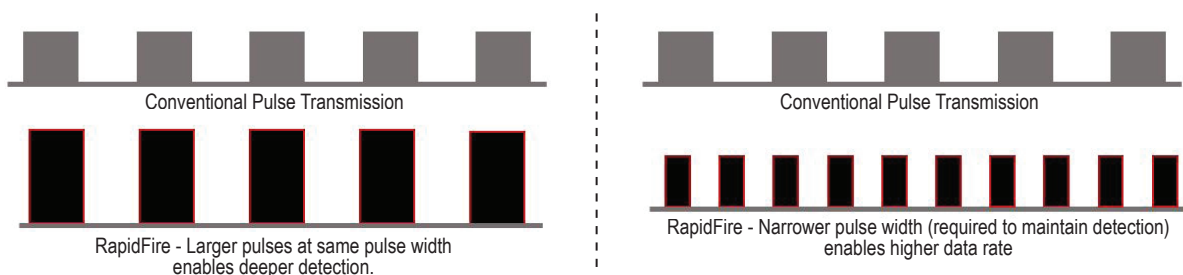
WHAT ELSE MAKES IT UNIQUE?

Well-suited for high density drilling: RapidFire's ability to send data at high speeds, allows vector surveys to be transmitted in a relatively short period of time for wells requiring survey management. Well-suited for monitoring formation trends in lateral sections: Accurate surveys while rotating supports monitoring of formation trends and trajectories while drilling lateral sections.

Well-suited for programs utilizing agitators: With RapidFire's ability to generate bigger pulses, detection can be maintained for longer than conventional pulse systems that are routinely nullified by agitators.

Well-suited for high LCM programs: With its large diameter, direct-actuated shaft and larger orifice, RapidFire does not have the screens, small orifices, or susceptibility to wash that challenges conventional poppet and helix systems. Drilling fluid does not flow through the internals of the RapidFire pulser. These factors make RapidFire very tolerant of high LCM environments. RapidFire can be configured without the hydro assist for extreme LCM environments.

» THE HYDRO ASSIST ENABLES FASTER DATA TRANSMISSION FROM GREATER DEPTHS

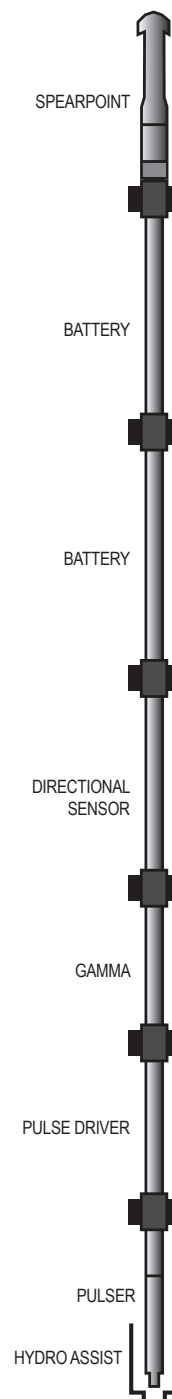


Survey Transmission Time				
Pulse Width (Sec)	Data Rate (bps)	Survey Transmission Time		Avg. Update Frequency
		Calculated	Vector	Tool Face & Gamma
0.25	2.0	0:30	0:54	0:05
0.5	1.0	1:00	1:49	0:10
0.75	0.67	1:30	2:44	0:14
1.0	0.5	2:00	3:38	0:19
1.5	0.33	3:00	5:27	0:29
2.0	0.25	4:00	7:16	0:38

*Survey times do not include delay for pumps-up (estimated at 30 seconds)

Tool Specifications	
Max. Operating Temp	350°F (175°C)
Max. Operating Pressure	20,000 psi (137 MPa)
Downlink Method	Toggle pumps to switch between pre-programmed data speeds and sequences
Wireline Retrievalability	Yes (minimum bore diameter of 2.25"/57mm)
OD-Housing	1.875" (4.76cm)
Total Length	157" (398.8cm)
Total Weight (w/o collar)	220lbs (100kg)
Flow Ranges (Dependant on collar bore diameters)	
4.75"	175 - 300gpm (0.8-1.4m³/min)
6.5"	285 - 660gpm (1.3-3.0m³/min)
8.0"	600-1200gpm (2.7-5.4m³/min)
Pressure Drop	
@ 250 gpm (0.9m³/min)	80 psi (550 kPa)
@ 500 gpm (1.9m³/min)	110 psi (750 kPa)
@ 750 gpm (2.8m³/min)	200 psi (1,360 kPa)

Sensor Specifications		
Sensor Parameter	Range	Absolute Accuracy
Inclination - Static	0-180 Deg	+/- 0.1 Deg
Inclination - Rotating	0-180 Deg	+/- 0.2 Deg
Azimuth	0-360 Deg	+/- 1.0 Deg
Azimuth - Rotating	0-360 Deg	+/- 1.0 Deg
Azimuth at Toolface	0-360 Deg	+/- 1.0 Deg
Magnetic Toolface	0-360 Deg	+/- 1.0 Deg
Gravity Toolface	0-360 Deg	+/- 0.5 Deg
Gamma	0-511 cps	+/- 1 AAPL
Environmental Specifications		
Sand Content	<1% by volume recommended	
LCM Size	All types	
LCM Weight	100lbs/bbl (285 Kg/m³)	



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RapidFire Pulse