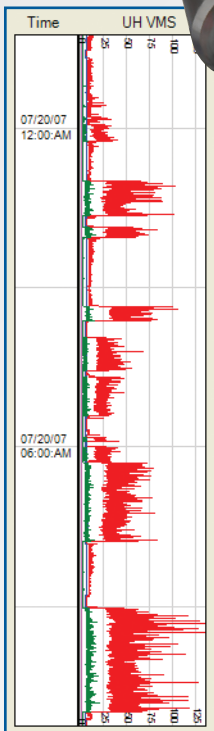


SureDrill-VMS



*Axial/
Lateral
Vibration
vs. Time*



Vibration Memory Sub (VMS™)

The SureDrill™ Vibration Memory Sub (VMS) is a standalone downhole tool that measures, calculates and records axial, lateral and angular down-hole vibrations for retrieval and analysis at the surface. The VMS allows operators to assess the severity of downhole drilling shock and vibration, including stick-slip and whirl, and correlate the data to drilling events and equipment performance or failures. Measurements are stamped by date and time for correlation with other data. The VMS can be used to characterize downhole conditions for future BHA planning, post-well analysis of equipment failures or to provide evidence for use in warranty claim resolution.

The tool provides data in the form of ASCII text files which can analyzed by APS's Vibration Data Viewer software or your own analysis software.

The tool's 32 MB memory is capable of recording up to ~250 hours of continuous data.

This sonde-based tool is available in 6.75 in. and 4.75 in. drill collar sizes, with standard box and pin connections. The sonde-based design allows this tool to be scaled up or down easily for use with other drill collar sizes. Please inquire with your APS sales representative if you require a different collar size.

Operation

Preparing the tool for recording vibration data is straightforward:

- > Ensure that a battery is installed with sufficient life for recording the desired bit run.
- > Set desired user programmable recording parameters through VMM/VMS interface software installed on a standard Windows-based (2000 or XP) PC.
- > Clear memory or ensure that there is sufficient memory remaining.
- > Install all covers.

Battery replacement is easily performed in a shop environment using basic hand tools.

Data Collection

Vibration measurements are made using $\pm 120 g$ (lateral) and $\pm 60 g$ (axial) accelerometers, plus one fluxgate magnetometer rotation sensor. Vibration and RPM data are collected and stored every 20 seconds. Raw data "snap shots" can be collected and stored in 20-second data sets at the maximum processor speed, up to 1000 samples per second. Storage parameters are user configurable.

Calculated Data

Every 20 seconds, the microprocessor calculates and stores:

- > Maximum lateral acceleration – vector sum of x- and y-accelerometer measurements
- > RMS lateral acceleration
- > Maximum half-second RMS lateral acceleration
- > Maximum axial vibration – from z-accelerometer
- > RMS axial acceleration
- > Maximum half-second RMS axial acceleration
- > Maximum and minimum angular speed (RPM)
- > Stick-slip ratio and other rotational parameters
- > Absolute date and time

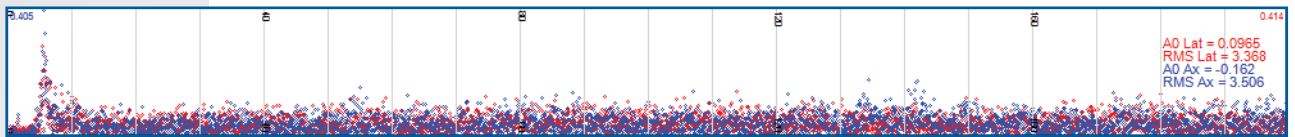
Vibration Memory Sub (VMS™)

Raw Data Snapshots

In addition to the maximum and average data, the tool stores “snapshots” of the raw accelerometer and magnetometer readings. 20-second sets of raw readings are recorded. Raw data can be collected for several user-selectable time intervals.

Retrieving Data

Data is easily retrieved by accessing the data dump port on the sub and connecting it through an Interface Box to PC-based software that converts the stored data to a text file with acceleration levels as a function of real time. The data is typically erased when retrieved.



Axial/Lateral Spectral Density of High-vibration Event

Product Specifications

Mechanical			
Tool Size	4.75 in. (121 mm) OD 2.687 in. (68 mm) ID	6.75 in. (172 mm) OD 3.25 in. (85 mm) ID	8.00 in. (203 mm) OD 3.50 in. (89 mm) ID
API Connection	NC 38 Box/Pin	NC 50 Box/Pin	6 5/8 Reg
Sub Material	Non-magnetic steel		
Length	66 in. (167.6 cm)		
Weight (approx.)	270 lb (122.5 kg)	470 lb (213.2 kg)	825 lb (374.2 kg)
Environmental			
Pressure	20,000 psi (137.9 MPa)		
Operating Temperature	-40° to 302°F (-40° to 150°C)		
Bending Limit	Connection-limited		
Data Collection & Handling			
Memory	32 MB		
Duration	Limited by battery life; ~ 250 hrs		
Accelerometers	± 120 g (X & Y axes), ± 60 g (Z axis); surface mount		
Magnetometer	Two-axis fluxgate		
Acceleration Data Range	± 120 g (X & Y axes), ± 60 g (Z axis)		
Rotation Rate Data Range	± 1,500 RPM (± 157 rad/s)		

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Specifications subject to change without notice.

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