



# Automated Remote Mudlogger

## RoboLogger Specifications and Applications

### Summary

The Automated Remote Mudlogger – ARM or RoboLogger – is the industry’s only fully automated sample collection device. It is designed to collect and store up to 350, 10 to 20-gram samples at a maximum rate of 2 minutes per sample. The RoboLogger depth-stamps each sample with a barcode and can take white-light or ultra-violet images prior to wrapping or storing. Each sample can be viewed remotely.



### Application

RoboLogger increases the data density of cuttings and cuttings related data during the rapid drilling common in unconventional drilling. It collects, cleans and stores faster than can be achieved manually and reduces the human footprint at the wellsite and HSE risks. The RoboLogger works in any weather.

Easy to deploy, realtime operation can be controlled remotely and samples can be viewed immediately, directly on the customer’s computer. Human interaction is required to replace the storage reel which can then be analyzed in a wellsite geochem cabin, or in an offsite DWL laboratory.

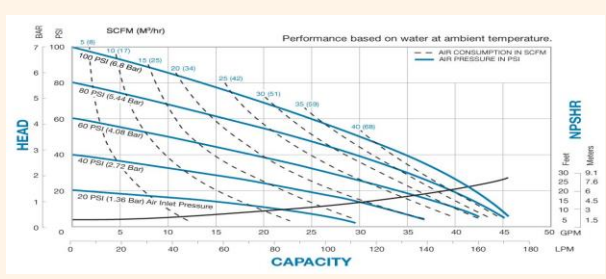
With a greater amount of samples and our XRF analysis we achieve far higher data resolution which leads to better stratigraphic correlation, improved understanding of geomechanical properties and optimized completions. Wells in a pad or field can be correlated effectively without the need for high-cost and high-risk downhole logging tools or coring runs.

- The RoboLogger with XRF will
- ✓ Allow high resolution sampling
  - ✓ Lower HSE risk
  - ✓ Give consistent sampling
  - ✓ Provide automated sample images
  - ✓ Optimize completion designs
  - ✓ Model depositional environment
  - ✓ Replace many high-cost, high-risk services

### Technical Specifications

Size	40" x 40" x 80"
Weight	300 lbs.
Power Supply	110/240 vac.
Operating Temperature	-10 to 35 Degrees C
Air Supply Requirement	120 psi
Air Used While Operating	80 – 85 psi
Sample Weight/Volume	10 to 20 grams
Sample Storage	300 to 350
Fastest Collection Time	1 sample per 2 minutes

### Base Fluid Dilution Rate 2.75 gal per sample





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## Case History

### Installation

RoboLogger was installed in a couple of hours with minimal rig Intervention. The involves the connection of a hydraulic collection device which is submerged in the possum belly or flow line. The samples are drawn into the machine via specialized pumps and valves and deposited in the machine’s collection chamber.

### Collection

Solids and liquids are separated by 635-micron mesh which is pre-stamped with serial bar codes which are correlated to lag depth via a Wellsite Information Transfer Standard (WITS) connected to the Electronic Drilling Recorder or other data acquisition system of record. Samples are collected onto a rotating drum and held in place by a proprietary sealing system. Up to 350 - 20gm samples, can be collected on each reel. The reels weigh less than 20lbs when full and take approximately 5 minutes to change.

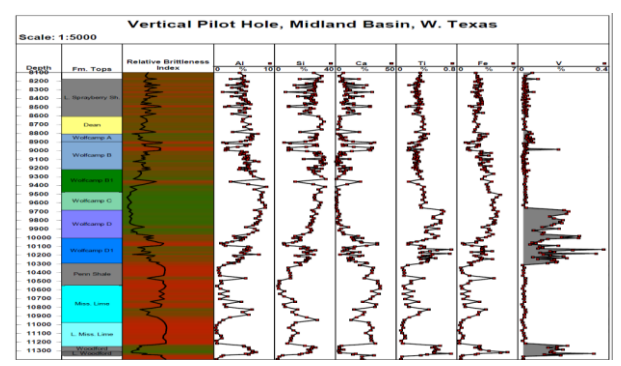
### Operation

The RoboLogger was deployed on a core drilling program in West Texas. It was active throughout the well catching 10’ and 20’ samples at the client’s request. The total interval collected was 4718’ including 1150’ during the cored sections. 508 samples with 479 samples 15gms or greater. The system consistently collected at 10’ intervals vs. 30’ from mudloggers. Average ROP of 100’/hr. gave the ARM 10 collections per hour, vs. 3 collections per hour from mudloggers. 5’ intervals were attempted on several occasions, but insufficient cuttings load was observed after a few successful collections.

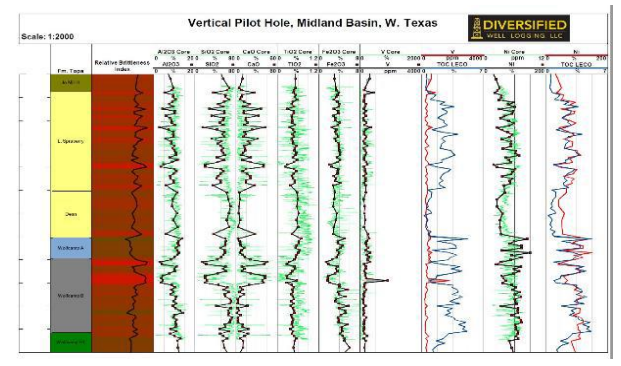
### Evaluation

XRF analysis was carried out on the samples providing important insights into the nature of the elemental and mineralogical composition of the rock (and the cost-effective utility of the RoboLogger). Several observations can be drawn from the data. The Redox element vanadium commonly a proxy for TOC (Total Organic Carbon) can be seen at its highest levels in the Woodford, Wolfcamp D and Wolfcamp

D1. The most ductile rock can be seen from the green shading on the relative brittleness index in Wolfcamp C & D. Silica and Calcium trend in opposite directions as sequences change from predominantly siliciclastic to carbonates. See figure below.



The RoboLogger data was compared with core data analyzed at a millimetric scale. On the plot below, there is very strong agreement between the core (green) and the RoboLogger samples (black).



All deployments of the RoboLogger have allowed sample collection that has been of better definition than traditional mud-logging, has provided greater geological insight and above all, has cost-effectively improved reservoir characterization and optimized completions.

