

ThruBit HRLA

High-resolution laterolog array tool

APPLICATIONS

- Reservoir characterization workflow in unconventional plays
- Evaluation in slim highly deviated and horizontal wells
- Well placement, completion, and hydraulic fracturing optimization
- Invasion characterization for permeability indication
- Thin-bed detection and evaluation
- Resistivity determination in conductive mud systems
- Water saturation determination
- Identification of fluid contacts

The ThruBit HRLA* slim high-resolution laterolog array tool attacks the difficult task of resolving true formation resistivity R_t by providing five independent, actively focused, depth- and resolution-matched measurements. The physics of measurement, array spacing, and electrical range of the ThruBit HRLA tool are derived from the standard-size HRLA* high-resolution laterolog array tool, but the ThruBit HRLA tool furthers this industry norm by incorporating updated electronics in a reduced-OD package to provide unsurpassed measurement and accessibility capabilities.

The ThruBit HRLA tool operates using six different modes. The shallowest mode, mode 0, is primarily sensitive to the borehole and is used to estimate the mud resistivity R_m . The array of measurements simultaneously obtained with modes 1 through 5 provides information for each mode's depth of investigation. These measurements can be used to compute the invaded zone resistivity R_{xo} , diameter of invasion d_i , and R_t .

The 1D inversion-based interpretations combined with the resistivity profile are readily available at the wellsite.

The ThruBit HRLA tool's measurements in combination with a 2D earth model and inversion scheme can simultaneously account for borehole, shoulder bed, and invasion effects to yield a more accurate, more robust value of R_t , which is critical for identifying and estimating reserves and providing details for completion optimization.

An integrated 2D and dip model—or 2.5D model—provides enhanced 2D modeling that takes the effect of the dipping layers on the measurements into account.

The ThruBit HRLA tool can be run in combination with the other slim multiconveyance formation evaluation tools of ThruBit* through-the-bit logging services to deliver a complete formation evaluation dataset from a single trip in the hole. Because the ThruBit HRLA tool is run bridleless, wellsite efficiency and combinability are further improved. The absence of a surface current return eliminates Gröningen and other voltage reference effects.

The tool is also compatible with ThruBit services conveyance, enabling conveyance through most drillpipe sizes, jars, and collars before passing through the coordinating Portal* pass-through bit.



ThruBit HRLA high-resolution laterolog array tool.

Measurement Specifications

	ThruBit HRLA High-Resolution Laterolog Array Tool
Output	Five array resistivities, true resistivity R_t , diameter of invasion, invaded zone resistivity R_{xo}
Logging speed	Up to 3,600 ft/h [1,097 m/h]
Sampling rate	2.0 in [5.08 cm] at 3,600 ft/h
Range of measurement	0.2 to 100,000 ohm.m: $R_m = 1$ ohm.m 0.2 to 20,000 ohm.m: $R_m = 0.02$ ohm.m
Vertical resolution	12 in [30.48 cm]
Accuracy	1 to 2,000 ohm.m: $\pm 5\%$ 2,000 to 5,000 ohm.m: $\pm 10\%$ 5,000 to 100,000 ohm.m: $\pm 20\%$
Depth of investigation	50 in [12.7 cm] [†]
Mud type or weight limitations	Conductive mud systems only
Logging environment	Open hole
Combinability	Fully combinable with ThruBit services tools
Acquisition mode	Real time (surface readout) Memory

[†] Median response at 10:1 R_t/R_{xo} contrast

Measurement Specifications

	ThruBit HRLA High-Resolution Laterolog Array Tool
Temperature rating	300 degF [150 degC]
Pressure rating	15,000 psi [103 MPa]
Borehole size—min.	3 in [7.62 cm] Through-pipe conveyance: 2.375-in [6.03-cm] min.-drift ID
Borehole size—max.	16 in [40.64 cm]
Outside diameter	2.125 in [5.4 cm]
Length	24.08 ft [7.34 m]
Weight	247 lbm [112 kg]
Tension	13,488 lbf [60,000 N]
Conveyance options	Standard wireline logging Wireline through pipe Memory mode Memory pumpdown Tractor Coiled tubing Slickline

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