



Production Logging Tools

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PL TOOL DESCRIPTION

The Production Logging stack consists of a single string of tools made up from a number of individual tools, each containing one or more sensors. These tools are designed to provide a full set of measurements in any combination of oil, gas and water in producing wells. Along with standard measurements of Pressure, Temperature, Density, Capacitance and Flow,

the PL stack provides accurate depth correlation with Gamma and Collar Locator tools. All sensors have been verified in a Flow-loop over a wide range of three-phase flow rates and borehole inclinations.

All tools are digital and modular, so they can be stacked in any order below the CPT-B, Combo tool which is the master controller. The CPT interrogates up to 11 compatible sensors stacked below it at a rate of 16 times per second.

CPT-B COMBO TOOL

The COMBO tool is used to make high-resolution pressure and temperature measurements in producing wells, and also provides digital wireline telemetry/power supply functions. It consists of a sensor section that samples the temperature of fluids flowing past the tool and a unique silicon-on-sapphire strain-gauge pressure sensor, together with an electronics section that digitizes the sensor outputs and transmits the data on high-speed digital telemetry up the monocable wireline. The tool also interrogates up to 11 other compatible tools stacked below the Combo at a rate of 16 times per second.



ICL-A INDUCTION COLLAR LOCATOR

Our patented (U.S. Pat. No. 6,084,403) Induction Collar Locator tool is used to make depth corrections to logs by identifying the location of casing collars and other mechanical features of the casing such as thickness variations or perforations. It uses a low-frequency induction method with two receiver coils arranged to provide an absolute phase measurement that senses the average thickness of metal around the tool, along with a two-inch differential measurement to sense smaller details. The ICL's response is independent of logging speed, unlike conventional collar locators, and most importantly, it sees flush-joint collars just as well as any other kind. Also, since it does not contain any magnets, there is no problem of sensitivity degradation with temperature or time and there are no special handling or safety problems. The tool works best when centralized, unlike most other collar locators, but operates very well not centered when conditions require. It will operate in all casing/tubing sizes although the response is greatest in casing sizes from 4-1/2 to 9-5/8 inch diameter and weights up to 35 lb./ft. Tubing joints are also recorded, as are casing collars through tubing. The ICL-A is available with either the CBG Digital Telemetry or as a modulating current output.



NGT-B GAMMA TOOL

The NGT-B Gamma-ray tool is used to make depth corrections to logs by identifying the location of naturally radioactive rock formations behind casing that can be correlated with open-hole logs. It uses a super-sensitive hermetically-sealed scintillator crystal and photomultiplier for maximum log quality. Mechanical design techniques derived from MWD tools ensure a rugged and reliable tool. The Titanium housing not only provides maximum protection in sour-gas environments, but minimizes attenuation of gamma-rays due to the low density. The electronics are fully temperature compensated to maintain constant count-rates at all rated temperatures. The NGT-B is available with the CBG Digital Telemetry, or as a Pulse output tool.



FIT-A FLUID ID TOOL

The Fluid ID tool is used to make logs of the fluid mixture Density and Capacitance. It uses an internal 1 mCi Ba-133 radioactive source (50 times less strong than competing tools) and super-sensitive shielded scintillator crystal with a photomultiplier for maximum log quality. The electronics are temperature compensated to maintain accurate count-rates at all rated temperatures. High count-rates (typically 30,000 cps) ensure statistical errors are less than 0.01 gm/cc. (with averaging over 1 second intervals) and minimize the influence of NORM radiation. The center-sample measurement includes a simultaneous 250 KHz capacitance measurement that senses water content from 0 - 100%. The tool replaces the conventional fluid density and capacitance tools with greatly improved accuracy and range due to the new sensors and the simultaneous sampling. Correlation of the two sensor readings may be made at approximately 16 times per second to compensate for separation of the fluid phases in slug or turbulent flow.



FLM-B CONTINUOUS FLOWMETER

The Flowmeter tool is used to make fluid flow-rate measurements in producing wells. It contains a unique 24 pulse/revolution sensor section that operates with the SPN-B rotating magnet impeller unit, together with an electronics section that digitizes the sensor count-rate and produces a binary word including a direction bit. The high number of pulses per revolution together with the low threshold of the SPN-B and the fast 16 times/sec sampling allow unprecedented resolution of complex flow regimes.

SPN-B CONTINUOUS FLOWMETER SPINNER

The SPN-B Spinner is sensitive to fluid flow in both axial directions, with a rotation rate linearly proportional to flow speed. A new shrouded design eliminates sensitivity to transverse flow or Coriolis effect, which can lead to serious errors in inclined or horizontal wells, or where the flow from perforations may enter the casing at significant rates. The assembly is very rugged, using a shroud with the same dimensions as a pressure housing, so that the spinner is capable of supporting the entire weight of a tool-string without damage. As with all CBG tools, all surfaces exposed to the borehole are 100% Titanium or compatible materials.



ATS-A ACCELEROMETER/TEMPERATURE TOOL

The accelerometer/temperature tool is used to make environmental corrections to logs made by other sensors. Acceleration data is passed through special processing software to compute the instantaneous deviation in depth from the indicated value provided by the measure-wheel, caused by stick-slip or yo-yo motion of a tool string. Temperature

(internal) is used to correct for thermal expansion of a long tool-string that introduces errors into the depth offsets. These corrections must be combined with accurate calibrated values of the measure-points for each tool in the string, for maximum accuracy.

CBG CABLE SIMULATOR BOX

This low-cost easy-to-use piece of equipment tests CBG tool data transmission, without requiring a full length of logging cable. Three different monocable choices are included, selectable via rear-panel BNC connectors. Standard examples are 7/32", 1/4", H2S, conductor slickline, and versions simulating high-temperature environments. Custom cable designs can be incorporated. A front panel switch selects cable length in five increments. The test box is useful for testing, repair, and calibrating tools.

CBG TELEMETRY TEST BOX

This low-cost easy-to-use piece of equipment tests CBG tool data transmission, without requiring a truck computer system. It can test tools separately or in a string, and gives a GO/NO-GO indication of functional data output. The COMBO tool is not required. An RS-232 serial port connector allows data to be collected on any PC for analysis, while internal circuits analyze the data stream for time-out, correct parity, frame, and bit-7 errors, along with pulse width and amplitude. The test box will be useful for testing, repair, and calibrating tools.

TRAINING

Training in the planning and interpretation of Production Logging is available through a course offered by Robert E. Maute, PhD, of RSE Inc. Dr. Maute teaches his program entitled Practical Interpretation of Production Logs worldwide, and is very familiar with the CBG tools.

LOGGING SYSTEM

The CBG Production Logging Tools are compatible with the Scientific Data Systems, Inc., Warrior Well Logging System and Software. The CBG tools are one of the selectable systems that can be chosen during setup.

CBG PRODUCTION LOGGING TOOL SPECIFICATIONS

	CPT-B COMBO	ICL-A	FIT-A	FLM-B	SPN-B	NGT-B	ATS-A
Measurement	Pressure / Temperature	CCL / Casing Inspection	Capacitance / Density	Flowmeter	Spinner	Gamma	Accelerometer / Temperature
Mechanical							
Diameter (OD)	1 11/16"	1 11/16"	1 11/16"	1 3/8"	1 11/16"	1 11/16"	1 3/8" or 1 11/16"
Length (make up)	28"	24"	28"	11.4"	5.1"	22.25"	12.0"
Weight	6.5 lb.	6.5 lb.	6.5 lb.	2.0 lb.		6.0 lb.	
End Connectors	GO Single Pin	GO Single Pin	GO Single Pin	GO Single Pin	GO Single Pin	GO Single Pin	GO Single Pin
Material	Ti-6Al-4V Titanium	Ti-6Al-4V Titanium	Ti-6Al-4V Titanium	Ti-6Al-4V Titanium	Ti-6Al-4V Titanium	Ti-6Al-4V Titanium	Ti-6Al-4V Titanium
Performance							
Sensitivity					0.038 rev/sec per ft/min	1.7 Counts per API	
Accuracy	10 PSI / 1°F		3% / +/- 0.025 gm/cc		Threshold: <5ft/min in liquid; <15ft/min in gas	+/- 5% to 300° F. +/- 10% to 350° F	
Resolution)	0.01 PSI / 0.001°F		0.1% / 0.01 gm/cc			8.8"	
Environmental							
Operating Temp	350°F	350°F	350°F	350°F	350°F	350°F	350°F
Pressure	15,000 PSI	15,000 PSI	15,000 PSI	15,000 PSI	20,000 PSI	18,000 PSI	15,000 PSI
Power							
Input Voltage	200V	32V – 50V	32V – 50V	32V – 50V		46-48 Volts	32V – 50V
Input Current	40 mA	30mA	38mA	8mA		20-23 mA	20mA
Output Signal	Digital Telemetry	Digital Telemetry/ Modulated Current	Digital Telemetry	Digital Telemetry		Digital Telemetry/ Pulse	Digital Telemetry

For more information, call us today at 512-491-7541

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