Primary Calibration of The Tool

As most of the tool measures electrical properties, (i.e., resistivity) the calibration of the tool is carried out with the use of resistors and the resistance to the current flow. Resistance or resistivity can be described as the "impedance of electrical flow through a material" with the mathematical equation of r = R L/A, where r is the resistance, R is the resistivity of the sample, L is the length, and A is the cross sectional area.

Therefore, a known resistance circuit can be used to simulate a tool response which then becomes the standard. The resistors used to calibrate the tool are all military spec., 1% resistors.

Primary Calibration	Standard	Response Range
Natural Gamma	0 api units 200 api units	0 cps 180-215 cps
Spontaneous Potential	0 mv 400 mv	55,000-65,000 cps 110,000-120,000 cps
Single Point Resistance	0 ohms 3000 ohms	950-1,050 cps 100,000-105,000 cps
40.64 cm (16 In.) Normal	0 ohm/m 000 ohm/m	3,700-3,900 cps 100,000-105,000 cps
162.6 cm (64 In.) Normal	0 ohm/m 2000 ohm/m	3,700-3,900 cps 100,000-105,000 cps
Temperature	23 C (50 F) 37 C (80 F)	TBA TBA
Fluid Resistivity	0 ohm/m 47.5 ohm/m	1,000 cps 48,500 cps

Default Calibrations

The following parameters are sensors and responses are set-up to electronic bench testing specifications. Therefore, these "default" calibration numbers are normally used to log the tool. The sensors are the following:

- Natural Gamma
- Temperature
- Fluid Resistivity

Optionally, the 40.64 cm (16 in.) and 162.6 cm (64 in.) normals and single point resistance will log with default calibrations but it is best if they are calibrated.

In the calibration file if the default values of 0 cps equals 0 engineering units is not changed, the tool will then automatically use the default values in the tool module for that tool.

Notes On Logging The E-Log, Neutron, Deviation Tool

The E-Log, Neutron, Deviation tool can be logged in the down or up direction. For the best results, the temperature log is in the down direction. Downward direction logs are usually made in boreholes that have been allowed to stabilize (i.e.. no drilling or pumping fluids) for a matter of days prior to logging. By doing this, the logs record the natural fluid temperatures. The other electric logs will also function in the down direction but, depending on water level in the borehole, the curve may be cut off if the electric log threshold is set too low.

Electric logs must be run in non-cased, fluid-filled boreholes Correcting for borehole fluid, borehole size and bed thickness must be done to calculate such things as true resistivity, invasion profiles, and water quality.

Standard charts and correction procedures are available in most log interpretation manuals.

The depth of investigation for normal devices is based on the spacing of the current and measure electrodes. Approximately 50% of the signal measured by the measure electrode comes from a volume whose radius is twice the electrode spacing. Therefore, the 40.64 cm (16 in.) normal has 50% of its signal coming from a 81.28 (32 in.) radius around the tool, and the 162.6 cm (64 in.) normal has a 325.2 cm (128 in.) radius. Because of the large volume of investigation, the resolution of the normal devices are proportional to the electrode spacing.

Borehole conditions that affect the resistivity measurements:

- Borehole Size
- Open Hole (Fluid Filled Only)
- Mud Resistivity
- Wash-Outs
- Water column height above tool

Calibration Procedures

Neutron

1. Connect 9055/9057 probe to drawworks; install Am241Be source into tool. Suspend probe in water tank with source completely submerged and approximately 12 to 18 inches from bottom of tank. Tank should be a minimum of 48 inches in diameter. The probe should be suspended in the center of the tank.
2. Start the Log program.
3. Turn tool power on.
4. Click on the LOG button to open the Control Menu.
5. Configure tool. Do not create a log header or set tool position.
6. Click on the CAL button then click on the TOOL button.
7. The calibration window will automatically open for the tool, which is connected and ID to the system.
8. Select Neutron API-N from the list of curves to calibrate.
9. Double click on the curve name or click once on the curve name and click on the word calibrate.
10. This is a two- (2) point calibration. Enter or accept 0 API-N and 0 CPS as the default values
11. Point 2 value enter 271 in the first slot, NEUTRON (API-N) then enter the tool response from the data display in the next slot, NEUTRON (CPS). To get the average neutron CPS, use the integration function. Click on the Integration ON button to begin the integration. The computer will then begin averaging the counts and the average will gradually stabilize (the numbers will not

vary by more than a few CPS). Enter the average CPS (probably around 150 cps) reading you obtained during the integration. Click on the Integration ON button to stop the integration.

12. For porosity measurements, the above neutron response (150 cps) is entered in the POROSITY calibration point which serves as a normalizing response.
13. Click on OK and save your calibration changes.
14. Turn tool power off.
15. Exit calibration menu.
16. Exit log.

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