Dipmeter **User Guide**

Primary Calibration of The Tool

Of most importance to the dipmeter log is the accurate and precise measurement of the four pad micro current circuits and the orientation of these pads in relationship to the hole deviation. The following calibration standards and responses are below:

Primary Calibration	Standard	Response Range
Voltage	0 mv 341 mv	o cps 1,200-1,500 cps
Cur 1-4	0 ua 2,135 ua	0 cps 9,000-20,000 cps
Caliper 1 & 2	15.2 cm (6 in.) 25.4 cm (10 in.)	14,000-16,000 cps 19,000-24,000 cps

Voltage and current calibrations are performed with "Dipmeter Calibration Box" as pictured below. Prior to entering the calibration menu, you must first open the caliper arms.

Other calibration points:

The natural gamma can alternately be calibrated with a small calibration source or run with the default calibrations from the Houston test pits.

Calibration	Standard	Response Range
Natural Gamma	0 api units 200 api units	0 cps 190-210 cps

Deviation:

Borehole deviation and pad 1 azimuth are recorded in real time, via a deviation package contained within the tool, which contains the X-Y inclinometers and the X-Y-Z magnetometers. From these sensors the Compu-Log computes and records slant angle, (angle of the tool), and slant angle bearing (tool direction) as the tool proceeds along the borehole path. Alignment of this device is done to correct for spatial indications with pad 1 azimuth. The deviation calibration is performed by recording two CPS rotating logs, and then using the dipmeter calibration to produce a special deviation calibration file called XXXX.DEV (XXXX being the tool serial number). Refer to the Deviometer Test Stand User Guide for procedures to calibrate the X-Y inclinometers and X-Y-Z magnetometers.

When a Dipmeter is shipped from Century’s Tulsa manufacturing and repair group, a 3.25" floppy disk containing an XXXX.DEV file specifically for the Dipmeter provided will be included. This file must be copied into the /PCL/CAL directory before attempting to log with the tool.

It is recommended that a Century Deviometer Test Stand be used to check the accuracy of slant angle, pad one azimuth and bearing measurements. This test should be done after the XXXX.DEV file is copied to the CAL directory and before beginning a critical logging operation.

Default Calibrations

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

Natural Gamma

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

Other Sensors

Default Calibrations should not be used for the resistivity caliper inclinometer or magnetometer sensors.

Detailed Logging Instructions

1. Change sample interval. The system configuration must be set to 0.006 m (0.02 ft) Sample Interval in the System Configuration Menu.
2. Logging Menu: The tool should automatically ID itself, giving the proper tool serial number and tool name (9410).
3. Check tool response. You should see normal gamma readings, slant angle and bearing, caliper readings showing closed, (approximately 6.6 cm (2.6 in.)), and four current readings.
4. Enter depth of cable head relative to borehole collar.
5. Proceed downhole.
6. Go to depth, and open caliper arms. [OPEN]
7. Start recording.
8. Proceed to surface.
9. Do not exceed maximum logging speed, with optimum speed of 2.7 m/m (9 f/m.)
10. Stop recording.
11. Close caliper arms [CLOSE]
12. Plot log, process deviation data, compute dips, and backup data.

Notes On Logging The Dipmeter Tool

The Dipmeter tool is a high resolution dipmeter, which measures currents on four sides of the borehole. Differences in the logged depths between the four simultaneous recordings of an anomaly are used to calculate the direction of the slope of the plane of the anomaly with respect to the borehole. A borehole deviation device is run simultaneously with the dipmeter. This measurement, combined with the measurement of slope, is used to calculate formation dip.

The tool incorporates a tensioned four-arm electrode assembly. This configuration improves pad contact in boreholes that are deviated or irregular. The distance between opposing pads of each pair of arms is recorded to provide two caliper measurements at right angles to each other. A Natural Gamma section is included on this tool for lithology interpretation and for depth correlation to other logging tool runs.

Field Checkout Prior to Logging

Prior to starting any logging operation, a field check of the tool and system should be performed. Optimal tool performance is necessary to record proper dipmeter logs, which includes proper caliper

calibrations, deviation accuracy, 4 pad response of currents, and proper location of pad 1 azimuth. The following checks are then performed. Location of the pads from pad 1 are clockwise around the tool, looking at the tool from above the cable head.

Caliper Calibrations

An accurate measurement of the borehole diameter is vital to produce accurate dip calibrations. Once calibrated, record a time drive log of the calipers by placing the two circular pipes or rings over the caliper assembly. The readings should be within 0.5 cm (0.2 in.) of the standard.

Wiring Check

The wiring check used provides three checks, of the following:

1. Pad 1 signal is recording on current 1 response. Pad 2 signal is recording on current 2 response. Pad signal 3 is on current 3, and pad 4 signal is on current 4.
2. Pad 1 azimuth gives true orientation of pad #1 with respect to the high side of the borehole.
3. The slant angle bearing is aligned with pad #1.

Procedure

1. Place the tool in an attitude of a few degrees from vertical (5-10). The tool should then be sighted or inclined to a south direction.
2. Turn instrument so that pad 1 is on the high side of the instrument or facing south.
3. Perform a time drive at 3 m/m (10 f/m) and sample interval 0.1 (or the metric equivalent).
4. Pad check: Place calibration device (or use a resistor to short to cable armor) on pad 1. Record for 6.096 meters (20 feet) and then rotate to pad 2, record another 6.096 meters, then to pad 3, and finally to pad 4. Each change of the calibration device or short should be indicated on the proper pad. Slant angle should read tool angle, slant angle bearing should read 180 pointing to south, and pad 1 azimuth should read also 180.
5. Rotate the tool 90 degrees clockwise, so that pad 4 is now instrument high side, and pad 1 azimuth is 270 degrees. Record another 6.096 meters of time drive.
6. Rotate the tool 90 degrees clockwise, so that pad 3 in now instrument high side, and pad 1 azimuth is 360 degrees. Record another 6.096 meters of time drive.
7. Rotate the tool 90 degrees clockwise, so that pad 2 is now instrument high side, and pad 1 azimuth is 90 degrees. Record another 6.096 meters of time drive.
8. Rotate the tool 90 degrees clockwise, so that pad 1 in now instrument high side, and pad 1 azimuth is 180 degrees. Record another 6.096 meters of time drive.

Note: If using a deviation test stand, proper leveling and orientation of the stand must be done before placement of the tool and optional motor for rotation. The stand must also be placed in an environment free from magnetic materials, approximately 15.24 m (50 feet) from buildings, etc. Expected wobble of the slant angle should be less than 0.5 degrees, and slant angle bearing within +/- 1.5 degrees of the expected value.

If in a field location where no stand is available, the values above cannot be expected because the tool is not in a leveled and oriented position. You should be able to verify the proper orientation of the pads, pad 1 azimuth, slant angle, and slant angle bearing. But there will be more variation of the above directional components.

Dipmeter Logging Using Compu-Log System

Install new software with 9410 tool module on it. If you have software version 8.2X or greater, it should already be installed in your tool module directory. The 9410 is a high-telemetry tool; therefore, the MPTC tool card is required.

Special consideration must be given to the downhole power requirement of this tool. 110 volts must be available at the cable head to successfully operate this tool. Century's standard remote DHPS put out a maximum voltage of 185 volts. Depending on cable length, the voltage at the cable head may not be sufficient to maintain the 250 milliampe required for the 9410 to operate properly. If your cable is greater than 2000 meters (6000 feet), you should check the downhole voltage.

Special Dipmeter Logging Items

Caliper Operation

With the Dipmeter logging tool attached, the logging menu may contain one special menu option for dipmeter logging, depending on system configuration. When using the Remote Down Hole Power Supply (RDHPS) which does not contain a manual switch for tool current reverse (caliper), the system configuration must show "DOWNHOLE CURRENT REVERSE" [COMPUTER-CONTROLLED]. Using this configuration one menu option (Item 9, for opening and closing the caliper arms) will display.

(9) CALIPER [CLOSED] or [OPEN] (COMPUTER-CONTROLLED) only

This option is used for tool current reverse when using the RDHPS which does not contain a manual switch for tool current reverse. The caliper should open in about 30 seconds.

Electrical Insulation

The 9410 caliper section is painted with a light green electrical insulating paint. In time a significant amount of the paint will wear off, exposing bare metal. The current resolution will be reduced once a significant amount (20%) of the painted surface becomes exposed. Once this occurs, the tool must be returned to Century and repainted.

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