QL40-DEV-2G

Borehole Deviation Probe

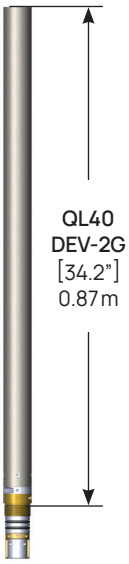
22.05.2023

The QL40 DEV-2G is the new generation of deviation probe. The new tool consists of a completely redesigned mechanical assembly and electronics. It implements the latest telemetry design to improve telemetry performance on long and multi-conductor wirelines when used in conjunction with Opal and Scout acquisition systems.

The QL40 DEV-2G measures the direction relative to magnetic north, inclination and trajectory of the borehole. Measurements are based on an orientation sensor containing both a 3-axis fluxgate magnetometer and 3 accelerometers. Deviation parameters are calculated in real time and displayed as continuous logs during the measurement.

Deviation data can be processed further using the WellCAD software and Deviation module. The WellCAD Deviation module includes various 2D and 3D display options for deviation from classical Bull's eye, projection and closure 2D views to 3D cubic and cylindrical displays.

The QL40 DEV-2G is a middle sub. It can be operated as a stand-alone probe or in combination with other subs of the QL product line.



Application

- Borehole True Vertical Depth, Northing, Easting
- Borehole trajectory based on direction, inclination/tilt and drift measurement
- True bed thickness
- Calculation of DLS (Dog Leg Severity), closure angle and closure distance
- Only applicable in non magnetic environment

Tool

Diameter : 40mm (1.6")
Length : 0.87m (34.2")
Measurement point : 0.43m (16.9")
from bottom QL joint
Weight : 3.4 kg (7.5 Lbs)
Max. Temp : 70°C (158°F)
Max.Pressure : 200bar (2900psi)

Orientation sensor

Orientation : 3 axis magnetometer,
3 accelerometers

Location : Middle point of sensor located at 57.0cm (22.45") from tool bottom QL joint

Inclination : Range : 0-180 degree
Accuracy : +/- 0.5 degree

Azimuth : Range : 0-360 degree
Accuracy : +/-1.2 degree

Operating conditions

Cable type : Mono, multi-conductor, coax

Compatibility : Scout Pro / Opal (Scout / Bbox / Matrix)

Digital data transmission telemetry :
Variable baudrate telemetry according to cable length/type & surface system

Logging speed : 3-5m/min recommended

Centralisation : Non magnetic centralizer required

Boreholes conditions : Dry and fluid-filled boreholes
Open or plastic cased borehole

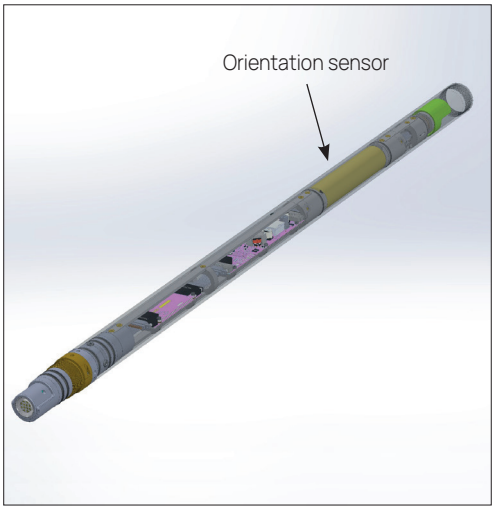


Fig 1 : Tool general architecture

Principle of measurement

The orientation sensor implemented in the QL40-DEV-2G contains both a 3-axis fluxgate magnetometer and 3 accelerometers. The combination of these two sensor systems enables the inclination, roll and azimuth angles of the sensor reference frame to be determined. Inclination and roll angles are determined from the accelerometer sub-system, which measures the pull of gravity. After inclination and roll are known, the magnetometer sub-system is used to determine the azimuth angle. Knowledge of the inclination and roll angles enables determination of the horizontal components of the earth's local magnetic field; this information defines the azimuth angle.

Measurement features

Azimuth : Azimuth from Magnetic North - deg

Tilt : Inclination from verticality - deg

MRoll : Tool relative bearing calculated from magnetometers - deg

Roll : Tool relative bearing calculated from accelerometers - deg

MagField : Total Magnetic field strength at measurement point - µT

Grav : Absolute value of the earth gravity - g

Voltage : Deviation sensor voltage - V

MX : Magnetometer X-component - µT

MY : Magnetometer Y-component - µT

MZ : Magnetometer Z-component - µT

AX : Accelerometer X-component - g

AY : Accelerometer Y-component - g

AZ : Accelerometer Z-component - g

TCPU : Temperature at CPU board - °C

TDEV : Temperature at deviation sensor - °C

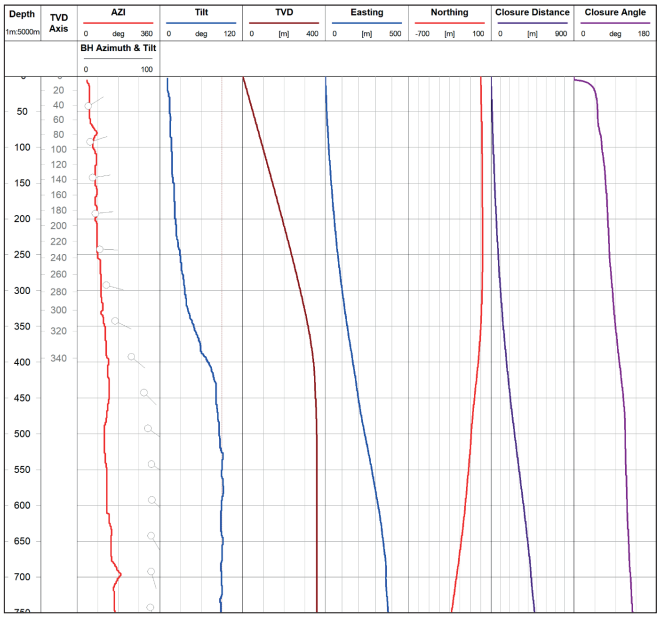


Fig 2 : WellCAD deviation plot
(TVD, Easting, Northing, Closure distance, Closure angle)

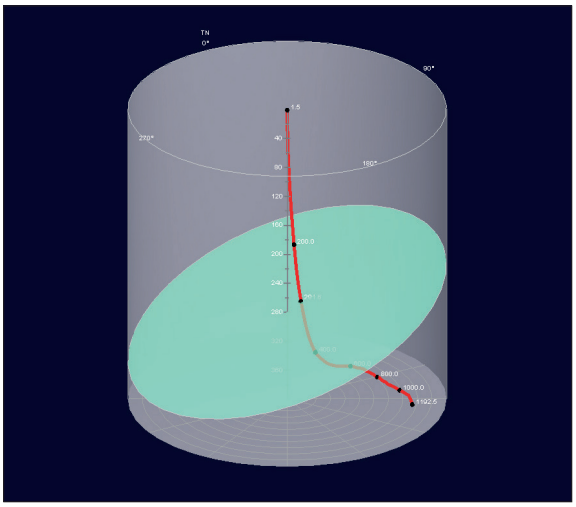


Fig 3 : WellCAD deviation module
3D cylinder display

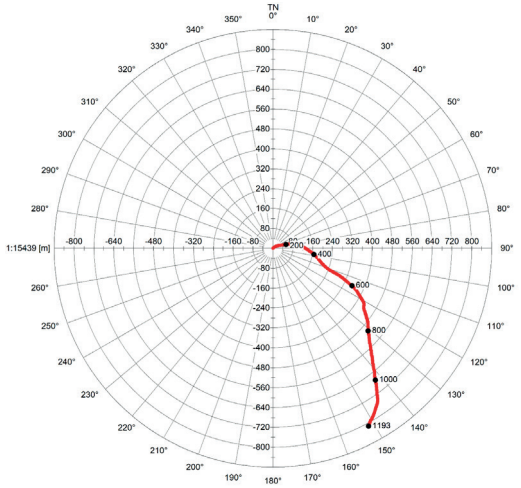


Fig 4 : WellCAD deviation module
Bull's eye view