

Borehole logging

maximising your water-well potential

Borehole logging is a simple cost-effective method of characterising the construction and performance of water wells. Logging has a vital role not only in initial drilling but also in regular performance monitoring to identify developing well problems before they lead to costly failures.

RG's Micrologger2 digital logging and television equipment is small, easy-to-use and highly reliable. After 5 years and 250 units sold worldwide, the unit has a proven track record for reliability and technology. In addition to well known logging service companies, users include water-well drillers, hydrogeologists, environmental consultants, aid agencies, the military and universities.

- ◆ Locate water table and perched water bodies
- ◆ Characterise aquifers and aquitards
- ◆ Estimate potential reservoir yield
- ◆ Measure hydraulic conductivity
- ◆ Identify regions of contamination
- ◆ Check position of casing, grout and screens
- ◆ Measure borehole size, depth and verticality
- ◆ Create permanent record for monitoring programmes



SURFACE SYSTEM AND WINCHES

Micrologger 2:

The smallest and lightest member of the RG equipment range, the RG Micrologger2 digital surface system packs a powerful punch. It requires only a standard notebook pc, a basic winch and one or more probes from the extensive RG water-well range to be ready for use. 12VDC operated, the Micrologger2 is powered from a vehicle battery or a small generator.

Despite its small size, the Micrologger2 is equally at home as a portable system or with 2000m of cable in a large truck. Its many advanced features including fully digital technology ensures longterm reliability and freedom from drift or errors. The unit is self-contained and no external interface is needed for any RG probe or television camera. The high-speed USB connection to the external pc remains unique to RG while our competitors only offer slow serial links that are no longer supported by current notebook models. The Micrologger is fully video compatible and directly supports RG and third-party borehole television cameras to give a digital image on CD or tape.

Winches:

RG produces a range of winch designs for all requirements. From the battery-powered 150m Miniwinch to the heavy-duty 3000m electro-hydraulic unit, each is precision engineered for reliable operation under arduous field conditions. RG winches are feature-laden and include auto-levelwind, tension measurement, integral depth encoder and remote control from a pc, depending on the model. All RG winches are compatible with the Micrologger2.

RECOMMENDED PROBES

Electric Log (ELOG)

This classic water-well logging probe gives information on the depth, quantity and quality of water contained in the rock pore space. This relies on measurements of the electrical resistivity of the rock at standard radial distances from the borehole. A further separate measurement of the electrical potential of a single electrode (SP or self potential) on the probe gives information on porosity and is a permeability indicator in water-bearing shale-sand or shale-carbonate sequences.

Calliper probe

The calliper probe measures the diameter of the borehole as a continuous record against depth. It is used as a check of borehole condition before casing operations or before running more expensive logging probes. It also provides a borehole volume for grout quantity estimates. The calliper relies on remotely controlled, linked motor-driven arms that are maintained in contact with the borehole walls by springs. 3 and 4-arm variants of the probe provide single or dual 'XY' orthogonal calliper logs, respectively.

Temperature/ conductivity probe

This probe provides continuous high-resolution temperature and electrical-conductivity measurements in the borehole fluid against depth. These provide information on the water salinity and total dissolved solids (TDS). The probe is very useful for identifying points of water entry or leaks which often show as small temperature or conductivity anomalies. The probe has an optional natural-gamma sensor to locate naturally radioactive beds (eg shales) and to aid depth correlation with other log types.

Borehole Television

The "downhole eye" provided by a borehole TV survey allows a quick assessment of well condition to be made. This is invaluable as a quality check on the construction of new wells including placing of screens, gravel packs and casings. It is useful also during well rehabilitation to identify problems such as casing leaks, corrosion and biofouling. RG cameras come in 42mm or 65mm diameter packages and include remote lighting and focus controls and a pan/tilt capability on the larger model. Data can be viewed in real time on a notebook PC or monitor and recorded on CD or to VHS tape. The CD recording is in a standard MPEG format so files can be viewed immediately after the survey using any PC. The Micrologger2 has an optional video interface to control many borehole cameras directly.

Flowmeters

Spinner flowmeter probes are commonly used to measure water flow patterns within a producing water well. The flow log reveals zones of water entry and exit and allows flow contributions from individual zones to be measured. Spinner flowmeter logs are used during well pump tests to measure hydraulic conductivity. With very low flowrates, the spinner flowmeter may be insufficiently sensitive and the heat-pulse flowmeter may be used instead. This probe is used in a stationary mode at selected depths to detect linear flows down to 1mm per second.

Flowmeter



Pan/tilt borehole television



Cement-bond log

This probe uses an acoustic method to show the presence, position and quality of grout behind a steel casing. It is invaluable as a quality control, particularly in environmentally-sensitive situations such as in water-wells to help to avoid cross contamination of clean water-bearing formations by contaminated zones elsewhere in the borehole. The probe is suitable only for use in water-filled holes.

Water-quality probe (Nitrate tool)

This probe contains specialised sensors to measure water quality and the presence of nitrate contaminant throughout the borehole. It also includes the full range of standard water-quality sensors: temperature, electrical conductivity, redox, pH and dissolved oxygen. The probe often allows contamination zones to be identified by a single logging run without the need to take samples and wait for laboratory analyses.

Ultra-violet (UV) hydrocarbon probe

This latest addition to the RG probe range detects low levels of hydrocarbon contamination in borehole water or vapour. A typical cause of such contamination is a leaking underground storage tank. The UV probe allows precise location of the entry point of the contaminant in the well prior to planning clean-up or well remediation programmes. Further uses for the probe currently under study include detection of thief-zones in coal-bed methane (CBM) producing boreholes and ground-water flow studies using fluorescent tracer dyes.

Verticality:

The verticality of a water-well is often a key part of the design specification and may need to be verified as part of the client's hand-over requirements. Provided the well does not contain steel casing, a standard verticality survey, based on a probe containing magnetometer and accelerometer sensors provides a continuous record of well inclination and drift. An alternative, the gyroscopic verticality probe provides the same information in the presence of steel casing.

Water/gas sampler:

Available in capacities from 0.5 to 2li, these remotely controlled devices take a water sample at a specific depth. The sample is returned to the surface in a sealed chamber and transferred in a transport container for laboratory analysis.

Induction probe

A useful alternative to the Electric Log (ELOG) in plastic or grp casing or in air-filled boreholes, the induction probe uses electromagnetics to measure the electrical conductivity of the rock formation. The probe provides similar information to the ELOG including aquifer depth, water content and quality. It is best suited to moderately saline or saline waters and gives only a qualitative reading in low-conductivity fresh-water wells.

Other probes:

Further probes of use in water studies include:

Sidewall density probe (formation bulk density/ lithology)

Dual neutron probe (porosity and shale indicator)

Sonic probe (lithology and porosity)

High-resolution acoustic televiewer (fracture imaging and casing corrosion)

Optical televiewer (this high-specification alternative to TV gives a continuous, oriented, unwrapped 360° image of the borehole walls or casing).

Please refer to our website

www.geologging.com for further details



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Borehole Logging in water-well drilling

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