

SONAR TOOL

TYPE BSF2 70mm



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AREAS OF APPLICATION

The BSF2 is a sonar and logging tool used in cavern surveying to measure the geometry of underground cavities. In caverns being leached the tool is used to document the development of the shape and volume. For measurements of storage caverns the focus is on the change in volume (convergence) and any possible associated changes in shape.

The BSF2 probe has a modular design so that it can be customised to the respective measuring task.

MEASURING PRINCIPLE

Sonar surveying of caverns is based on travel time measurements. In this arrangement a sonar tool measures the time a sonic signal takes to travel from the survey tool to the target (cavern wall) and back again. The distance to the cavern wall is calculated from the measured travel time and the speed of sound in the medium. As the speed of sound depends on a complex relationship between the physical parameters, it is measured in-situ using the special tool module SGM.

SURVEY PROCEDURE

Initially a log is run to determine the physical conditions prevailing in the cavern. This logging measures various parameters along the survey axis such as speed of sound, M-CCL (Multiple Casing Collar Locator), pressure, temperature, natural gamma and dew point (in gas). Once these parameters have been determined the actual sonar survey of the cavern geometry is carried out by measuring numerous horizontal sections over the entire depth range of the cavern. The bottom, roof and possibly any hidden pockets of a cavern are measured with the measuring head in a tilted position. The vertical intervals between the individual horizontal sections as well as the angular intervals between the measurements made with the tilted head are optimised in relation to the cavern geometry.

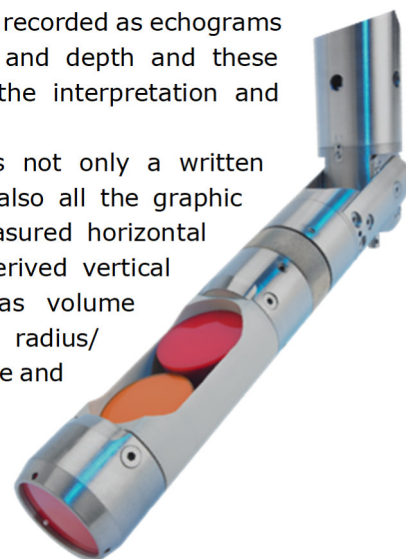
During the recording of a section, the measuring head with its sonic transducers is moved into the required direction with the required tilt by means of servo motors. It remains in this position as long as it takes to determine with certainty a point on the cavern wall

and to carry out all the necessary plausibility checks and correlations. In order to be able to apply this technique in a reasonable and useful way the SOCON sonar tools are fitted with a gyro stabilisation that prevents the tool from rotational oscillations during a survey. A fibre-optic gyro supplies the orientation of the measurements when surveying through casing. The tools of the latest generation are equipped in addition not only with three magnetic field sensors, but also with an integrated natural gamma sensor and an optimised stabilization unit.

RESULTS

The echo signals are recorded as echograms for every direction and depth and these form the basis of the interpretation and reporting.

The report contains not only a written survey report, but also all the graphic displays of the measured horizontal sections and the derived vertical sections, as well as volume presentations and radius/diameter, perspective and 3D representations.



TECHNICAL SPECIFICATIONS

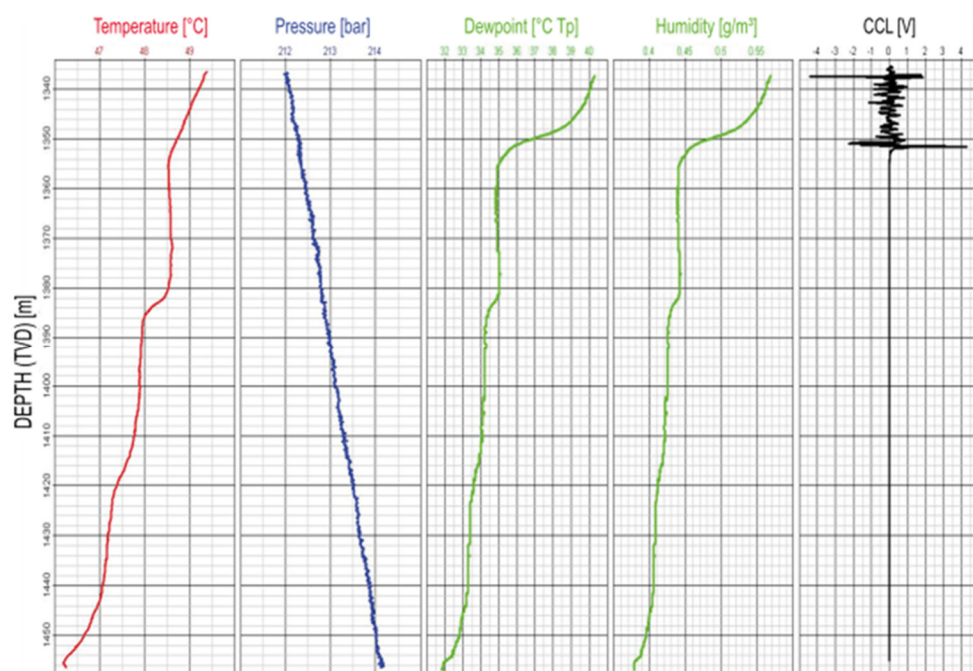
Diameter:	70 mm
	80 mm (incl. fibre optic gyro)
Length:	5.02 m (incl. SGM)
Weight:	75 kg
Temperature:	90° C maximum resolution: 0.01 K accuracy: +/- 0.2 K
Pressure:	400 bar max resolution: 0.1 bar accuracy: +/- 0.5 bar
Tilt angle:	resolution: 0.05° accuracy: +/- 0.2°
Further values:	M-CCL/CCL, Natural-Gamma, etc.
Liquid media:	brine/water (max. two tubings), Hydrocarbons (max. one tubing string)
Gaseous media (no tubing):	hydrocarbons, Air, H ₂ , N ₂ , He

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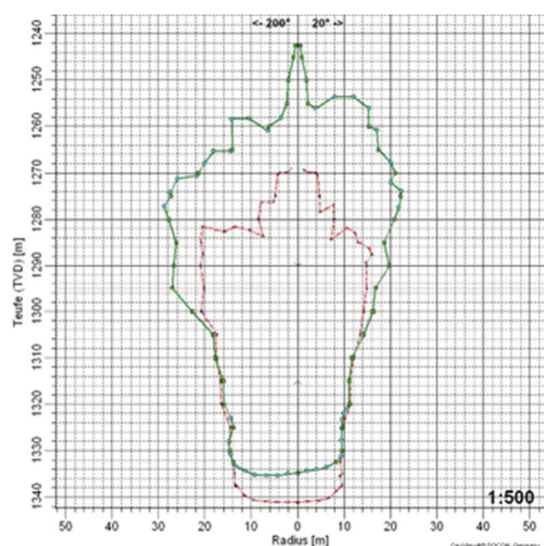
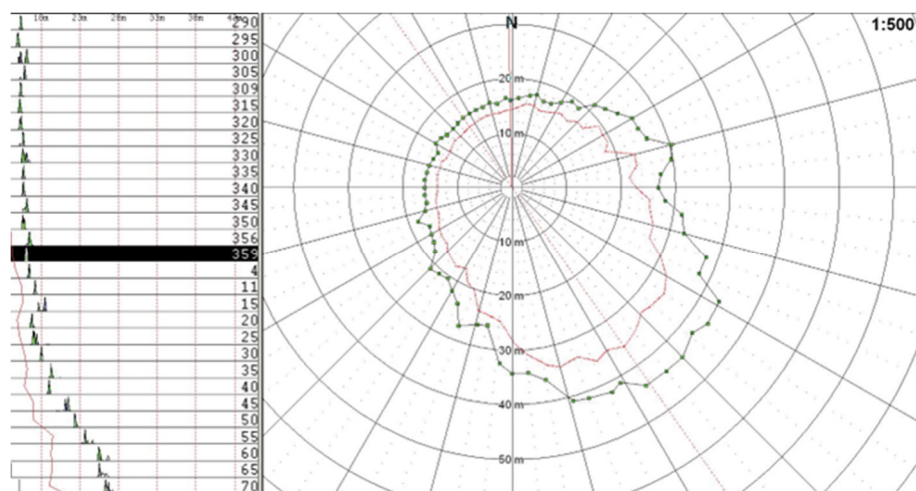
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EXAMPLES OF LOGGING AND CAVERN SURVEYING



Log results measured with the sonar tool BSF2



Top: Illustration of a measured horizontal section with the BSF2 sonar tool.

Left: Illustration of an interpreted vertical section

Right: Schematic representation of the BSF2 with standard modules

