

BSS-02B

Borehole Magnetic Susceptibility Sonde





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The BSS-02B is a borehole probe for measurement of magnetic susceptibility from 10^{-5} to 10^{-1} cgs. It is calibrated for use in 50mm diameter boreholes at temperatures up to $+90^{\circ}\text{C}$, and it is able to operate at depths of up to 6000 metres over a temperature range of ambient to $+120^{\circ}\text{C}$.

The sonde comprises two sections: an aluminium alloy cylindrical enclosure containing electronic circuitry, and a high strength, non-magnetic enclosure in which the detector is located. The electronics enclosure must be surrounded by a pressure enclosure; this is usually provided by the client, to fit the rest of their system.

The sonde operates from an unregulated $+15\text{V}$ nominal supply. It provides an output in the form of a three-wire CMOS serial interface (for integration into the client's data acquisition system), and a single wire pulse rate output for use with rate meters and counters.

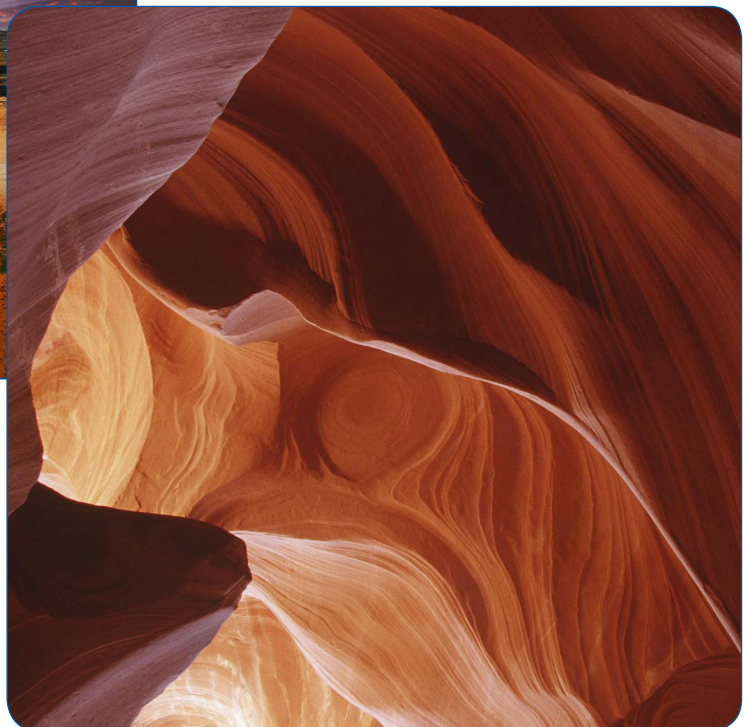


Features

- Wide measuring range: 10^{-5} to 10^{-1} cgs
- Low operating frequency: 1.36kHz
- Stratigraphic resolution of 25mm
- Operates to pressures of 10,000 psi maximum
- Operates to temperatures of 120°C: calibrated to 90°C
- Frequency up to 21 readings per second
- Low temperature induced drift: $<20 \times 10^{-5}$ cgs over the calibrated temperature range ambient to 90°C
- Calibration sample supplied

Typical Applications

- Mineral prospecting, including discrimination of kimberlites, iron ore and uranium ore
- Stratigraphic correlation
- Delineation of alteration fronts
- Delineation of strata of economic interest and evaluation of the ore's grade



BSS-02B Specifications

| Performance | | | |
|--|--|--|--|
| Max operating pressure | | 10,000 psi | |
| Maximum stratigraphic (spatial resolution) Note: below 20mm a small double response will be recorded. | | 25mm F.W.H.M. (Full-Width-Half-Maximum) | |
| Calibration | | Calibrated to read directly in $\times 10^{-5}$ cgs units in a 50mm borehole | |
| Diameter effect (relative to 25mm layer normalised to a 50mm diameter borehole) | Borehole \varnothing (mm) 70 80 100 | Response centralised 0.75 0.275 0.09 | Response decentralised 0.725 0.5 0.45 |
| Temperature induced drift Baseline Scaling | | <20 $\times 10^{-5}$ cgs from 20°C to 90°C <1.0% full scale | |
| Max operating temperature | | 120°C | |
| Pressure induced baseline drift | | Typ. -5.5×10^{-5} cgs | |
| Sensing coil type Overall length Separation Diameter Distance from nose to centre of detection | | Focused dual coil 97mm 27mm 35mm 190mm | |
| Principle of operation discrimination | | AC induction by frequency | |
| Operating frequency | | 1.36 kHz | |
| Power supply rejection ratio | | Not measurable | |

| Mechanical | |
|---|--|
| Construction ¹ - Non-magnetic enclosure - Pressure barrel | PEEK enclosure Supplied by user |
| Dimensions (mm) | $\varnothing 43 \times 720$ (733 BSS-02B-1) |
| Weight in air (g) | 815 |
| Seals - Pressure barrel to mid-adaptor - Mid-adaptor to PEEK barrel - PEEK barrel to nose | 2 Viton "O" rings BS 216 1 Viton "O" ring BS 126 "O" ring BS 126 |
| Mating threads - BSS02B-1 ² - BSS02B-2 - BSS02B-3 | 1.375" – 18 WHIT FORM 1.375" – 12UNF-3A 1.375" – 16UN |
| Pressure compensation | Piston |
| Volume of silicone oil | 155ml |

1. The sensor coil is housed in a pressure compensated, thin walled cylinder to achieve optimum magnetic coupling to the borehole wall. This cylinder is sufficiently robust for downhole operation but can be damaged if it is subjected to excessive shock through dropping or strain through bending.
2. BSS-02B-1 is chamfered to provide a smooth step down to a $\varnothing 38$ mm outer pipe.

| Electrical | |
|---------------------|---|
| Power requirements | +14 to +18V DC at 32mA |
| Input connection | 300mm of 6-core PTFE coated leads |
| Connector type | Flying leads |
| Interface | Three-wire 5V CMOS serial interface and single wire pulse rate output, all ESD protected |
| Pulse rate output | A pulse of approximately 50µs width is output at a rate which is proportional to the current measurement. Refresh time is 47.5ms but will extend by 0.2ms for every 1000 units of measurement. Maximum output is 16000cps. |
| Digital data output | The Ready signal goes low for a period of 10ms when the conversion has been completed and bit 24 (MSB) is present on the SDO Line. The minimum repetition period of Ready is 47.5ms in air but will extend by 0.2ms for every 1000 units of measurement. Each low to high transition of Clock In will cause the next bit to be placed on the SDO line. Data can be conveniently clocked into the external interface on high to low transitions of Clock In. Minimum clock pulse width is 0.5µs. Data are presented as 24 bits with the MSB first. |

Calibration

The system is scaled to a change of one least significant bit = 1×10^{-5} cgs units. A residual value of circa 1000 accommodates negative values and ageing effects. Departure from linear response will be:

| Range $\times 10^{-5}$ cgs | Error % |
|----------------------------|--------------|
| 1-1000 | 0 to -0.9 |
| 1000-10,000 | -0.9 to -9.0 |
| 10,000-100,000 | -9.0 to -50 |

To calculate true value of K (volume susceptibility):

$K \times 10^{-5}$ cgs = $(R + R^2 / 10^5) \times 10^{-5}$ cgs where R is the measured value.

| Calibration block | |
|-------------------------|--|
| Dimensions of cylinder | Overall diameter 110mm Length 100mm |
| Bore | 44mm |
| Weight | 1.13kg |
| Calibration value | (as marked) |
| Temperature coefficient | +0.05% / °C |

Note: To simulate groundwater effects the calibrator should be grounded via hand contact. This will depress the measured value by approximately -15×10^{-5} cgs.

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The specifications of the products described in this brochure are subject to change without prior notice.