JH-8 manual

SUSCEPTIBILITY

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Magnetic susceptibility describes the magnetic ability of a substance. It can be defined by the vector equation:

$$\vec{B} = \vec{H}\mu_o(1 + K)$$

where $\vec{B}$ stands for the magnetic flux density within the substance,

$\vec{H}$ is the external magnetic field due to magnetization,

μ_o = permeability in vacuum, and

K = susceptibility

For an isotropic substance, susceptibility is a quantity that depends on the substance itself and on the magnetizing field. The susceptibility of an anisotropic substance is a symmetric tensor.

The JH-8 is designed to measure the magnetic susceptibility of rock samples. Rocks are mixtures of different minerals, and hence, their magnetic properties depend on those of the component minerals.

The mineral that largely governs the magnetic behaviour of a rock, and which accounts for most of the susceptibility observed, is magnetite. The susceptibility of magnetite depends on several factors, such as the intensity of the magnetizing field, the chemical composition

of the magnetite and its grain size. Susceptibility can, however, be applied to determine the magnetic abudance, provided that local dependence between susceptibility and magnetic abudance is known.

In the JH-8 the sample to be measured is placed in a weak source field that does not saturate the sample. The so-called initial susceptibility obtained is independent on the magnetizing field.

As indicated by the above formula, susceptibility is a dimensionless quantity. The different systems of units are related to each other as follows:

$$K\,[\mathrm{SI}] = 4\pi K\,[\mathrm{c.g.s.}]$$

PRINCIPLE OF OPERATION

The function of JH-8 is based on electromagnetic induction. There are two coils placed orthogonally to each other in the detector head, which is mounted in the bottom of the instrument case. In non-magnetic environment the voltage induced from transmitter coil to receiver coil is zero. When a sample is brought near the coils, a voltage which is proportional to magnetic susceptibility of the sample is induced to the receiver coil. This signal is detected by a phase-locked amplifier and after rectification it is used to drive an analog panel meter, which is thermally compensated and directly calibrated for susceptibility.

OPERATION INSTRUCTIONS

To make a susceptibility measurement by JH-8 proceed as follows:

1. Switch the instrument on by turning the rotary switch on the right hand side clockwise. Battery voltage can be checked in "B" position where the needle of the panel meter should rise above the red mark on the scale. Choose the most suitable of the four measuring ranges.

2. Check zero setting while the instrument is kept away from metal objects. Sufficient distance is 30-50 cm. Adjust the panel meter to zero by turning the potentiometer on the left hand side. Zero adjustment is usually needed only when range 1 or 2 has been selected.

   Note: Care should be taken to avoid errors caused by metal objects in user's clothes e.g. buttons, belt, etc., especially when range 1 is used.

3. Press the bottom of JH-8 against the material to be measured and the susceptibility value can be read from the scale of the panel meter. The location of the most sensitive point of the detector head is marked by a red dot.

Note: The low signal frequency (1000 Hz) and phase sensitive receiver circuit usually eliminates the influence of electric conductivity in the sample.
However, very good conductors can give erroneus values (negative readings).

CALIBRATION

Calibration is done for a half-space, which is convenient when measurements are done on outcrops.
When other samples are measured, readings should be multiplied by the following approximate correction factors:

sample	multiplier
ø 42 mm drill core	2.0
ø 37 mm drill core	2.1
ø 32 mm drill core	2.3
ø 22 mm drill core	3.0
rock sample, fist sized	2

The length of drill cores should be 10 cm or more.

APPLICATION HINTS

- Because of the continuous display of susceptibility, JH-8 can be moved on the surface of an outcrop or along drill-cores in a box to detect magnetized zones or to choose measuring points representing typical susceptibility values.
- The red dot area can be used to observe susceptibility differences between mineral grains in coarse grained rocks.
- Qualitative conductivity comparisons between very conductive rock samples can be made by setting the zero to the right end of the meter scale and observing the negative meter deflection.
- Because of the high sensitivity of the instrument, magnetite-hematite alteration zones can be followed even in weakly magnetized rocks.

TECHNICAL SPECIFICATION

Control knobs

1. 10-turns, long life potentiometer for zero adjustment on the left side of the instrument case.
2. 6-position range switch

Position

0	off	
B	battery test	
1	measuring range 0-100	x 10^{-5} SI
2	measurnig range 0-1000	x 10^{-5} SI
3	measuring range 0-10000	x 10^{-5} SI
4	measuring range 0-100000	x 10^{-5} SI

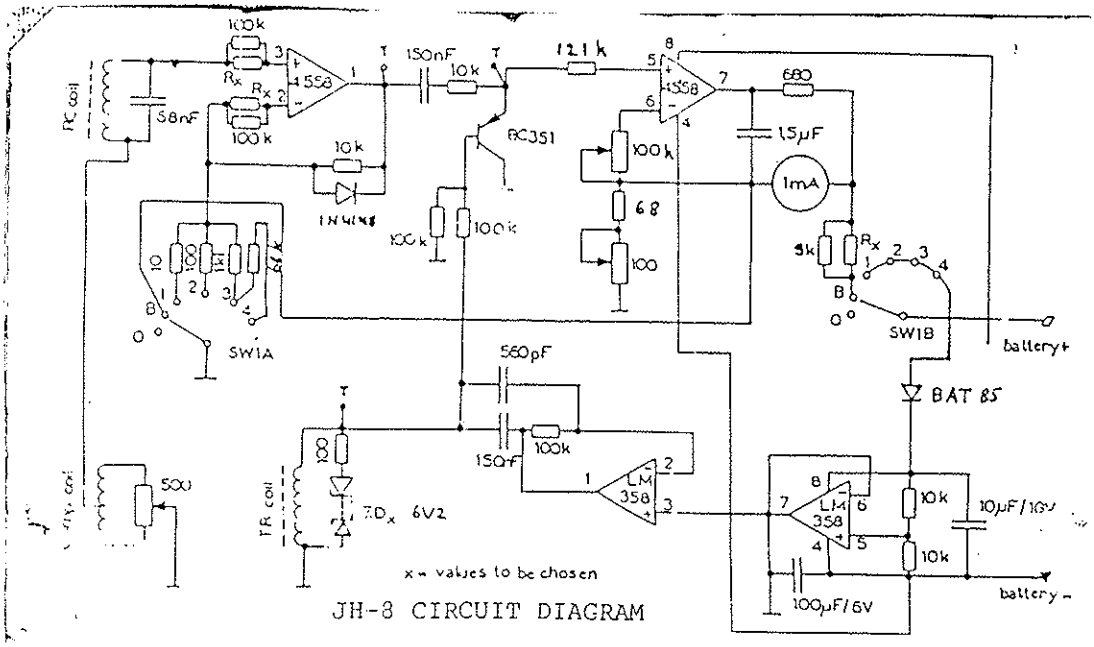
Resolution — The scale of the panel meter is divided in 20 parts, which gives 5 x 10^{-5} SI resotlution on the most sensitive measuring range.

Current consumption — 8 mA

Battery — One disposable 9V calculator battery which is located behind plastic cover containing range information. To replace the battery the cover has to be removed.

Dimensions — 190 x 80 30 mm

Weight — 0,5 kg



JH-8 CIRCUIT DIAGRAM