

NOTE 3
COMBINED E AND B SENSOR

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SENSOR AND SIMULATION NOTES III

Combined E and B Sensor

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The device described in this note represents an attempt to combine simultaneous independent E and B measurements in a single sensor for those applications where many sensors must be packed close together.

We start with a half loop above ground as sketched in Fig. 1. The output is not loaded, or is only loaded lightly, and is fed to a differential amplifier. The differential amplifier rejects the common mode signal which will arise from the E field sensitivity of the loop considered as a vertical probe. The output of the differential amplifier is, of course, proportional to B.

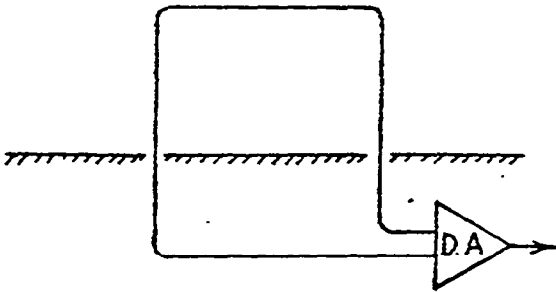


Fig. 1

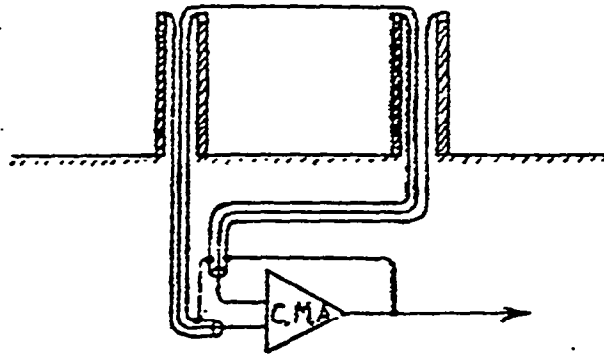


Fig. 2

The two loop leads are also connected to a unity-gain common-mode amplifier as in Fig. 2. The output of the common-mode amplifier is equal to half the sum of the two inputs. (In its simplest form this could simply be a unity-gain single-input amplifier driven from the junction of two equal resistors connected to the loop leads.) The amplifier output drives two voltage-distributing columns of the type described in SSN II.

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We now connect both amplifiers and change the upper edge of the loop to a plate, as in Fig. 3. The output of the common-mode amplifier is proportional to E and the B output is unchanged. An alternative arrangement is shown in Fig. 4.

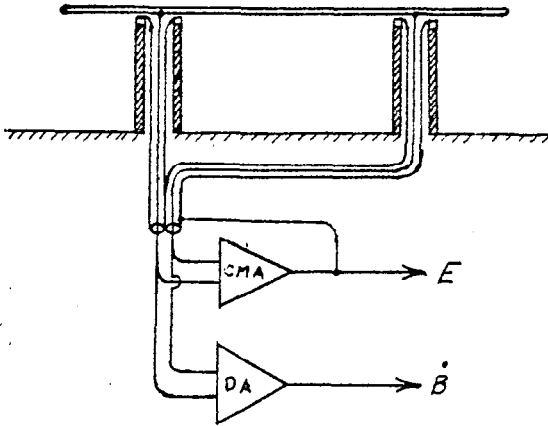


Fig. 3

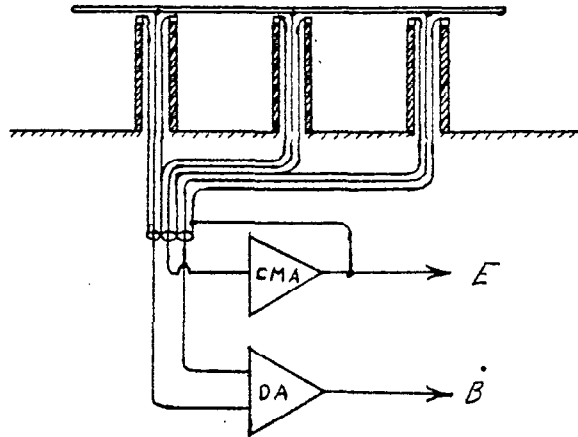


Fig. 4

The common-mode amplifier must be located close to the point of measurement, but the differential amplifier may be some distance away, since it incorporates no external feedback.

Note that this sensor is also "invisible" to E fields, although it will perturb the B field slightly.