

## Principles of Operation

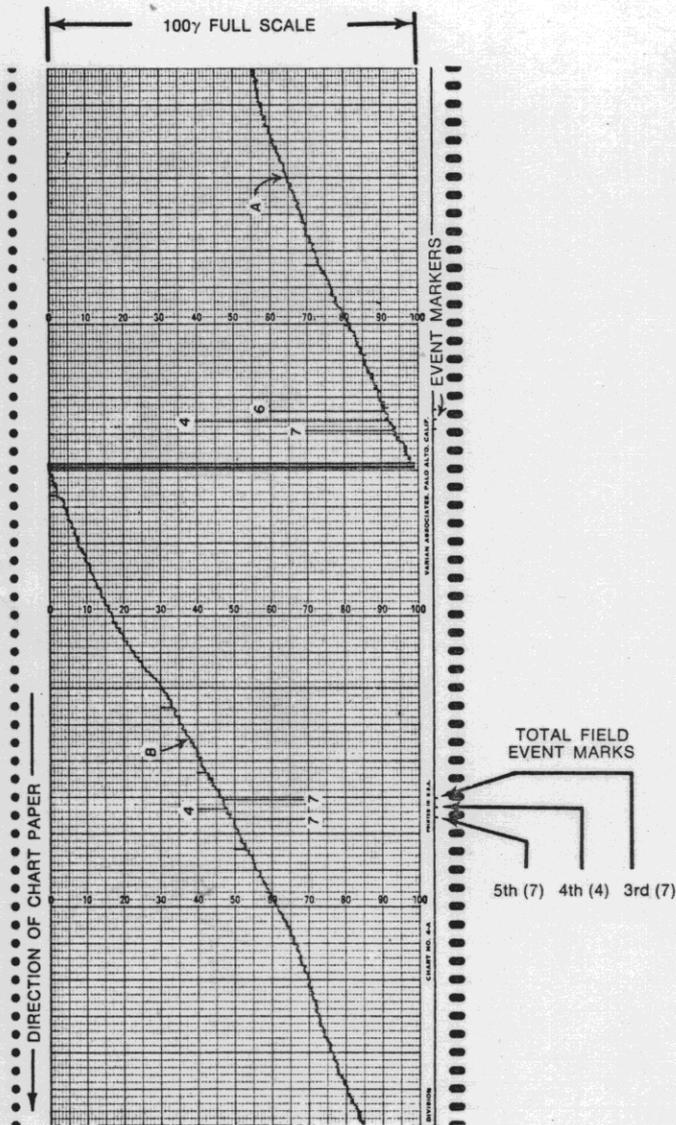


Figure 10: Analog Program Record. The Total Field Programmer option provides an automatic means for making the total field on the analog strip record. Every 30 minutes the programmer controlled digital-analog converter will sample the fifth, fourth and third place digits at 30-second intervals respectively. The single digits are analoged on the recorder and identified by event marks on the edge of the chart papers. In the example above, the total field at point A reads 74665 gammas and at point B the field changes to 74738 gammas. The need for a mechanical printer has thus been eliminated.

### Total Field Programmer Option:

#### Varian Part No. 980413

The use of the analog total field programmer will provide a permanent record of the complete field value. The three most significant digits displayed on the counter will be recorded on the strip chart once each 30 minutes as a reference for the minor magnetic variations otherwise present on the chart. Figure 10 gives an example of this display. This feature eliminates the necessity for hand recording the first three digits of the total field or employing a mechanical printer.

### Digital Data Recording Systems

Varian will furnish a number of different types of digital recording equipment to record the magnetometer data, time, location, and other parameters on either paper punch or an incremental magnetic tape recorder to suit individual customer requirements. A digital clock can be integrated into the data acquisition system that is capable of automatically recording hours, minutes, and seconds. Means for manually selecting calendar data (day, month, year) are also provided. The recorded data can be supplied in any one of several computer formats including IBM 8-level code. A coupler in the digital recording system accepts digital information in parallel form from the magnetometer electronic counter and registers the values in serial form on paper tape or magnetic tape.

A digital printer can be utilized when only a permanent digital record on a strip of paper is desired and computer entry is not necessary.

For further details, write stating your particular data acquisition requirements, i.e., total number parameters to be recorded, sampling sequence, paper punch code or magnetic tape code, voltage levels and polarity.

### PRINCIPLES OF OPERATION

All elementary particles of the atom spin about their axis. The proton being no exception spins continuously with a precise angular momentum. Due to its positive charge the spinning proton also possesses a magnetic moment; it can be thought of as a tiny spinning magnet. If these "nuclear" magnets are subjected to an external magnetic field of sufficient strength their axis will try to align themselves with the applied field. Instead of jumping directly into alignment, however, the proton axis will precess (rotate) about the external field vector. The frequency at which the protons precess is directly proportional to the strength of the external field and is given by the relationship:

$$H \text{ gammas} = 23.4875 f_p \text{ Hz}$$

where  $f_p$  = precession frequency

The proton constant (23.4875) is an immutable constant of physics and has been measured by the National Bureau of Standards to an accuracy of 8 parts per million. The immutability of the proton constant along with the fact that frequency