Honeywell’s Smart Digital Magnetometer (HMR) has three independent transducers which are oriented to provide x, y, and z axis outputs. The key features of the HMR are:

- Easy to use
  - Complete unit, plug and play
  - Microcontroller based
- Linear and repeatable for precise measurements
- High sensitivity for detection of small magnetic masses
- Offset and gain calibrated for greater accuracy.

The above qualities make the HMR an ideal and effective device for measuring magnetic fields in a laboratory environment.

The HMR series of magnetometers is based on transducers made of NiFe thin films deposited onto a silicon substrate forming a Wheatstone resistor bridge. In the presence of an external magnetic field (Ha), the magnetoresistive characteristics of the Permalloy cause a change in the bridge resistance. The change in output of the transducer is converted to a 16-bit digital value using an internal A/D converter and microprocessor.

The output of the HMR is a digital serial stream of ASCII format or binary data. The data is organized as three 16-bit values representing the x, y, and z components of the magnetic field (see below). These are actually 15-bit signed numbers ranging from ±30,000 that correspond to a ±2 gauss full scale applied field (Ha). Sample rates can be set from 10–154 readings/second.

\[
|H_a| = \sqrt{H_x^2 + H_y^2 + H_z^2}
\]

**Product Features**

The HMR has many features, making it versatile enough for use in both commercial and laboratory environments.

- Measurement range, +2 Gauss with less than 1% error
- Resolution of 70μG/LSB
- Fast response time
- High sensitivity
- Data output serially using the RS-485 or RS-232 standard for serial input to most personal computers.

The device is easy to use and has a user-selectable range of 9600 or 19200 baud.
How To Access Data

Connect the HMR2300 RS232 version to a serial connection port of a computer. Evaluate data using either a terminal emulator program or the software provided with the unit.

Using Terminal Emulator
   Included with most windows applications
   Found under “accessories”

Set-up for Terminal Emulator
   Under settings—choose communications
   Make the following settings:
   Baud Rate .............. 9600
   Data Bits .............. 1
   Flow Control .......... xon/xoff
   Connector .............. Select one HMR unit to connect

   Also check terminal preferences. Use all the standard defaults except select CR>CR/LF inbound and outbound.

The standard settings are: linewrap, local echo, sound, column—80, cursor, block & blink.

Follow the command inputs found in Table 1, page 3 of the HMR2300 data sheet. For a continuous flow of data, use input ddP. (We use 99P.)

Using HMR-Demo Software supplied with the part
   Load HMR-Demo to your hard disk.
   DOS is the preferred software over Windows
   Data can be evaluated using:
   Plot—see spikes or a 60Hz cycle
   Compass—notice flickers or subtle changes in overall field
   Show—same as terminal mode

Laboratory Applications

The HMR can have a variety of applications in a laboratory environment such as a three-axis gauss meter to simultaneously measure the strength and direction of magnetic fields in the x, y, and z axis.

Uses include:

• Sensing magnetic fields on a small localized area—Magnetic fields acting on a small area can be detected and measured accurately. For example, magnetic fields acting on the center of a silicon wafer-chuck can be measured by this device.

• Measuring low levels of magnetic field noise

• Proximity Detector—The HMR measures field strength and direction. The change in the strength and shape of the magnetic field can be used to approximate the distance from the source of a magnetic field or anomaly.

• Detection of ferromagnetic properties in a substance—The distortion in the three-axis output of the HMR suggests the presence of ferromagnetic material.

Application Idea

Characterize the magnetic field of your laboratory environment over a period of time.

This is done to understand and identify areas of improvement to make the laboratory a magnetically quiet area and to improve the accuracy of magnetic field measurements.

• In software, write a short program (such as HP basic) using polled commands to poll data from the HMR unit (example once/minute).

• Store the data in Excel format.

• Plot versus time.

ORDERING INFORMATION
Customer Service Representative
(612) 954-2888 fax: (612) 954-2582
Email: clr@mn14.ssec.honeywell.com

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