



### Solar Storm Detection

Solar storms generate magnetic field fluctuations that can be detected and measured given a high quality magnetic sensor. A magnetometer used for this application must be sensitive and stable enough to measure the variation of the magnetic fields as well as having a wide range so that spikes in the data won't saturate the sensor.



Watson Industries manufactures a fluxgate magnetometer that is well suited for this application. The FGM-301 provides all three axes of magnetic field data as analog voltages. These signals can be input to a data acquisition system to provide digital magnetic readings.

#### Technical Challenges:

During a period of increased solar activity in mid December 2006, Watson Industries set up one of its magnetometers to monitor the earth's magnetic field. The goal of this experiment was to determine whether a Watson magnetometer FGM-301 was sensitive and stable enough to detect a solar flare and if so, to see if useful data could be collected as well. The test was successful in all respects.

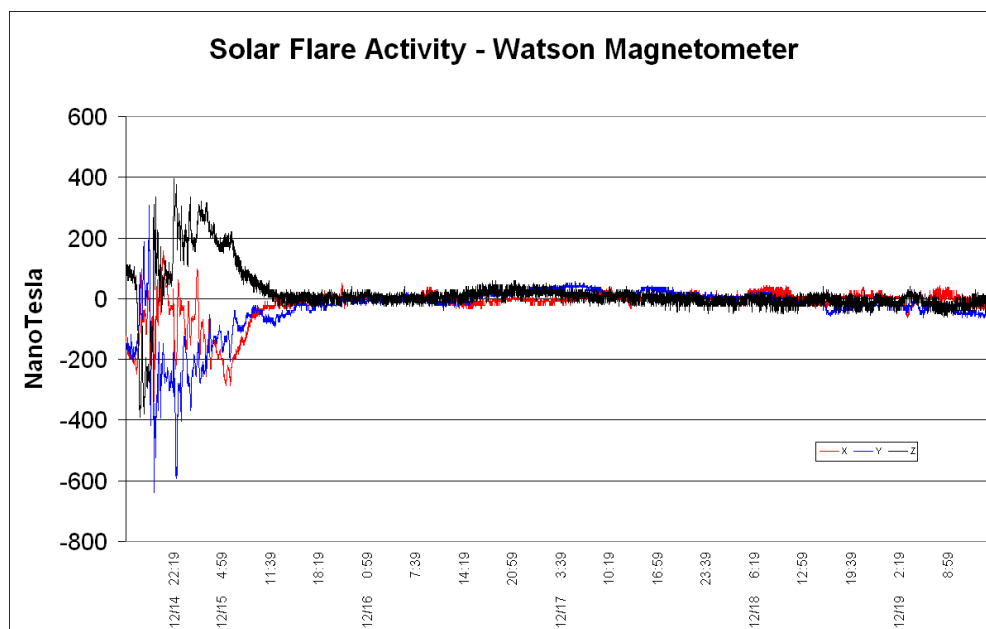


Figure 1. Magnetic Field Observations December 2006 – Watson FGM-301



#### Watson Industries, Inc.

3035 Melby Street Eau Claire, Wisconsin 54703 U.S.A  
Phone: +1 (715) 839-0628 Fax: +1 (715) 839-8248  
e-mail: support@watson-gyro.com Website: www.watson-gyro.com

The data shown on the previous page was collected with our Watson magnetometer FGM-301. Note that the data for all magnetometer axes (X, Y, and Z) has been normalized about zero NanoTesla.

As can be observed, there were very pronounced peaks in the Watson magnetometer readings early during our test. Once the test was completed and the data was interpolated and graphed, we set about to determine whether the magnetometer has indeed observed a solar flare. For confirmation, we went to the NOAA's website and viewed magnetometer data from their GOES satellites during the time frame of our study. As can be seen below, the data from the GOES magnetometer shows a spike in magnetic field readings during the same interval.

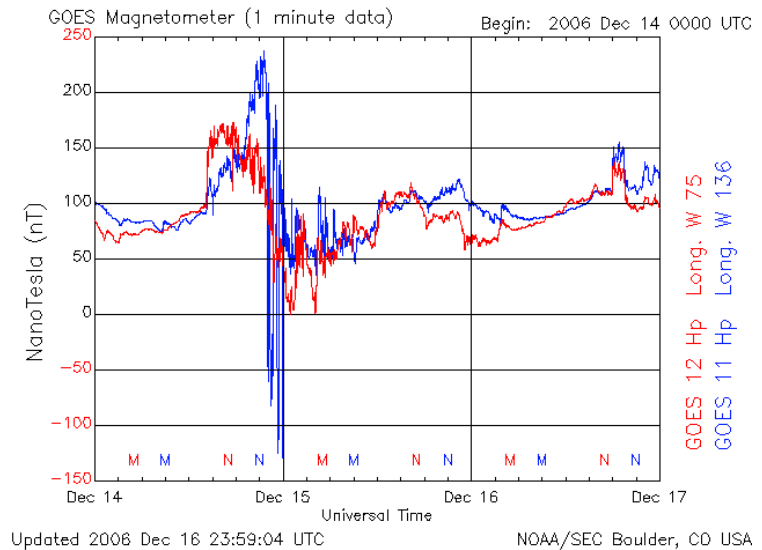


Figure 2. Magnetic Field Data 12/14/2006  
GOES Magnetometer

Note that the data from the GOES magnetometer is only 1 axis of data, Hp, from two satellites. This indicates the field strength in the direction perpendicular to the orbital plane of the satellites.

### Watson Experience:

Watson Industries has been manufacturing fluxgate magnetometers since 1985.

### Requirements:

- Magnetic Field:  $\pm 70,000$  nTesla
- Accuracy:  $>2\%$

### Applicable Products:

- FGM-301
- GCM-360

### Typical Options:

We are able to accommodate your custom needs. Shown below is a listing of our most common custom modifications.

- Custom specifications – For certain applications, customers require specifications that are different from our standard units. Watson Industries engineering is willing and able to accommodate these needs.
- Input Voltage – Many different input voltages can be accommodated.
- Output Analog Scale – We can customize our output scale to meet your requirements.
- Bandwidth – Sensor bandwidth can be modified to your specifications.
- Sensor Ranges – The ranges for most of our sensors can be expanded or reduced to meet your requirements.

Graph acquired from: Space Environment Center, Boulder, CO.  
National Oceanic and Atmospheric Administration  
U.S. Dept. of Commerce (<http://www.sec.noaa.gov>)

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