Geomagnetometer Instructions For Model IDR-321

General Information

Please read before operating meter

Congratulation! You have purchased a very accurate and sensitive instrument for measuring the DC magnetic field intensity (magnetic flux density B) of Earth, air shipment inspection, motors, generator, etc. We are proud to say that this meter
"Measures what it is calibrated for", and it has a rare and unique quality around the World.
The geomagnetometer is sold with a shielded probe. Care with placement of the probe will allow it to be used almost anywhere even under water. Please note that we can assume the probe is an axial hall probe. Therefore, when the probe is placed in a magnetic field, it measures the magnetic field in that direction, the maximum reading will occur when the axis of the probe is parallel to the DC magnetic fields. The Hall generator (sensor) is located at the middle of the probe, right in front of the arrow. (See fig.1)

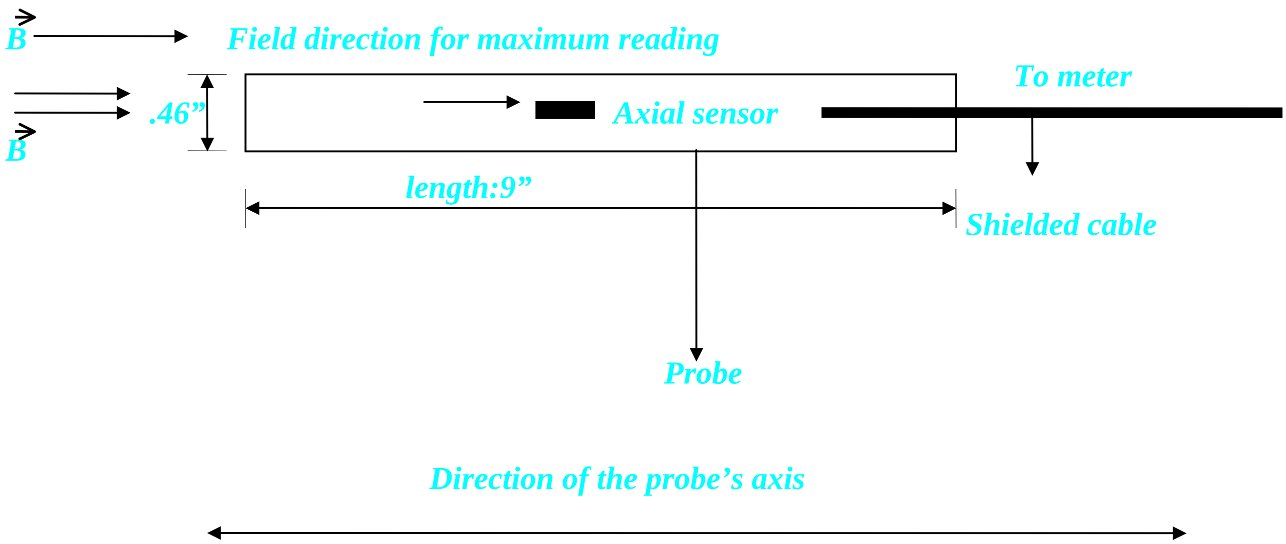


Fig.1

We think you will appreciate the Coarse and Fine knobs available for zero adjustment. If the meter appears to be slightly off from zero, adjust the coarse knob first, and then adjust the fine knob. Note that the Coarse and Fine knobs are attached to twenty-turn potentiometer, which will continue to turn at each "end" of its range. Therefore, if the Coarse and Fine adjustment knobs appear not to work, try turning
Them in the opposite direction. During this zeroing adjustment, make sure the probe (Hall Generator) is away from any magnetic material; therefore we recommend the probe should be inside a Zero Gauss Chamber (IDR-800).

For considerations of accuracy and economy, use the AC adaptor for long-term use of Geomagnetometer, especially inside the lab. Just connect the adaptor to a 110 or 220-volt outlet and turn the ON/OFF switch to the adaptor mode. If BAT appears on the display, accuracy will diminish and it is the time to change the battery. Lastly, the meter is calibrated at the factory with a Hemholtz coil producing a uniform magnetic field. If you think the meter is out of calibration, it can be recalibrated at our facility for a cost of $95 prepaid, which includes shipping. Or, you may choose to take the calibration "into your own hands' by using a very small screwdriver. Our factory calibration is guaranteed to a +/-3% error. The geomagnetometer (IDR-321) is designed to measure very low level DC magnetic fields (-/+ 2000 Milligausses) or
(-/+ 200Microtesla). For strong level DC magnetic field, we recommend to use other kinds of gaussmeters like (IDR-309, or IDR-329). If you have any questions, do not
Hesitate to call integrity Design & Research Corp. at (802) 872-7116 or fax to (802) 872-7115 or send us an email at http://www.Integritydesign.com.

***Operating Instructions*:**

- ***Step 1***:

Connect the 5 pins black plug to the jack labeled" Hall Probe" on the meter by pushing down to tighten.

- ***Step 2*:**

Turn the meter ON by pushing the black switch in. The display should now read out numbers. If it doesn't, check to make sure the battery or the adaptor is connected.
It is recommended to use the 9 V DC adaptor to save the battery life. Once you connect the DC adatptor to the meter, the meter will be powered automatically from it.

- ***Step 3:***

Take your reference point by turning the coarse adjustment knob. Turn the knob clockwise to adjust higher, and counter clockwise to adjust lower. Adjust until you are near the reference point, and then use the same procedure with the Fine adjustment knob to get the precise reference point. We prefer the zero reading as reference point to avoid an arithmetic subtraction. Also, We strongly suggest using the Zero Gauss Chamber (IDR-800) during this process, especially during the measurement of the Earth's magnetic field.

- ***Step 4:***

Now you are ready to take the magnetic field measurements. These could be done by many ways. It depends what kind of applications the Geomagnetometer is used for. We will study only the two most important applications:
1-*Earth's field vector measurement*: During this procedure and by using the Zero Gauss Chamber, two different measurements can be done.
-The first testing: it is common and easy to be accomplished .Try to find the maximum magnitude field B resultant ($\vec{Br}$) of the Earth. Br is located somewhere between $\vec{B}$ vertical ($\vec{Bv}$) and B horizontal ($\vec{Bh}$) of the Earth. To measure Br, first slide the probe inside the Zero Gauss Chamber for zeroing the meter (step 3), then take out the Zero Gauss Chamber by keeping the probe at the same position and direction. A new reading will register at the meter. This new reading is the magnitude field of the Earth in the

direction of the probe. Try many times for different positions of the probe, until you hit the maximum reading, which is the actual magnetic field ($\overrightarrow{Br}$) of the ambient at this specific location of the Earth.
-<u>The second testing</u>: From the realms of algebra and geometry, we find a simple and reliable method for determining the maximum field intensity of the Earth $|Br|$. Since

Any vector $\overrightarrow{Br}$ can be broken into its Bx, By, Bz, components; we can also build the vector by measuring its three components. It's as simple as Square Root

$|Br| = \sqrt{Bx^2 + By^2 + Bz^2}$. (See fig.2)

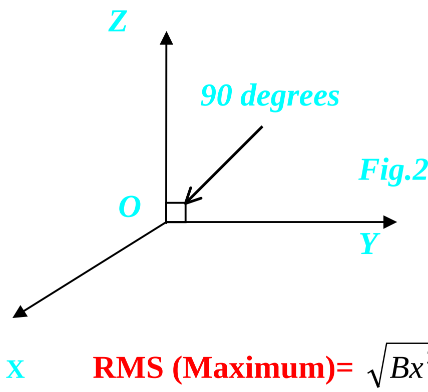


Fig.2

RMS (Maximum)= $\sqrt{Bx^2 + By^2 + Bz^2}$

2-*<u>Maping and Recording field perturbation</u>*: This procedure consists to measure the relative change of the magnetic field between two or many locations on the Earth. These measurements could be done by taking the difference of readings on the meter between two different points or locations. During this operation, using the Zero Gauss Chamber (IDR-800) isn't necessary; also, make sure to hold the probe in the same direction and angle for better accuracy on the measurement.
Finally, using the Geomagnetometer can do other applications. For further technical information about a special measurement you are looking for, please call us <u>Note</u>: In case your reference in Step 3 wasn't a Zero, The actual reading of the magnetic field will be =Absolute Value [Step4 - Step3]. If the display is blank except for One (1.) in left most end, then the field is too high to read in this scale. To change scales, simply turn the big knob labeled "Milligauss" clockwise to be able to take a higher reading.

- ***<u>Step 5:</u>***

Once you are done taking the measurement, be sure to turn the meter OFF.

Note: If the meter is out of scale at the highest scale (2000mG), the reading on the display will be **+1** **.** Try to turn the coarse counterclockwise, or if the reading is **-1** **.** Try to turn the coarse clockwise.
The positive reading on the display indicates the North Pole & the negative reading is the South Pole.

General Information about the magnetism of the Earth

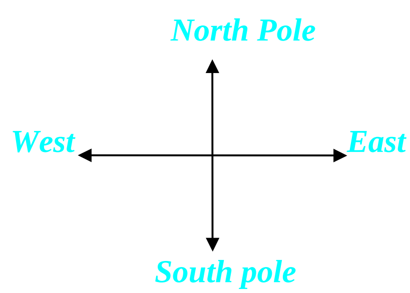
The magnet with which we are most familiar is that on which we live, the Earth. Figure 1 is an idealized sketch of the lines of $\vec{B}$ associated with the Earth's magnetic field, both at and above its surface. To a first approximation we can represent this field by imaging a strong bar magnet located at the center of the Earth. Note that the Earth 's magnetic axis (MM) and its rotational axis (RR) do not coincide, being separated by about 15 degrees. Therefore, the Earth's magnetic field $\vec{B}$ is not necessarily aligned parallel with the North and South geographical meridians. The magnetic pole in the northern hemisphere is in arctic Canada. Note that it is a south magnetic pole because lines of $\vec{B}$ converge toward it. There is a north magnetic pole in the southern hemisphere, in Antarctica; lines of $\vec{B}$ emerge from it. There is, of course, no bar magnet buried at the center of the Earth. The Earth's magnetism must be related to the facts that the central core of the Earth, whose radius, is (a) liquid, (b) highly conducting, and (c) partakes of the Earth's radius.

The Earth's magnetic field is neither as regular nor as static as the idealized field in fig-1 suggests. Also, there are observable phenomena, going far beyond deflections of the compass needle that would not occur if the Earth had no magnetic field. Consider the following:

1**-Local variations**.

2**-Changes with time**.

3**-Interactions with the solar wind.



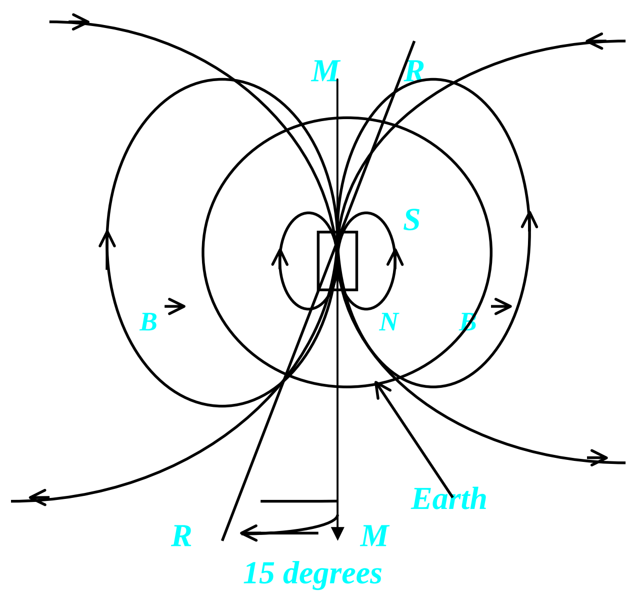


Fig-1