

Instructions for Use: DSP-523
True-RMS 3 Axis DSP Gaussmeter
Magnii Technologies
www.magnii.com

FEATURES

3 Axis AC Gaussmeter: Accurately measure AC magnetic fields regardless of meter orientation.

Advanced DSP Filtering: A powerful Digital Signal Processor allows you to isolate or ignore power line frequencies at 50 (Europe) or 60 Hz (North America). Also, accurately measure non-power line related fields without ANY distortion from power line fields (including harmonics), or accurately measure power line fields without any distortion from other field sources.

Measurement Range: Auto-ranging 0.01 to 250.0 mG. The highest resolution setting possible will automatically be picked based on the waveform and amplitude.

Bandwidth: Typical $\pm 1/2$ dB 30 to 300 Hz, covering entire SLF (Super Low Frequency) spectrum.
Typical -3dB frequencies of 15 Hz and 330 Hz

True-RMS Measurements: Other meters use pseudo-RMS circuitry to estimate the field strength. This is ONLY accurate for pure sine waves, which are rarely found in non-laboratory conditions. The DSP-523 uses an advanced microprocessor to calculate the True RMS (root-mean-square) magnetic field values detected by three orthogonal inductive sensors. This ensures accurate measurements of any waveform – square, triangle, sine, or even “dirty” sine waves from power lines.

Adjustable Backlight: Blue LED backlight has 9 different brightness settings.

Bargraph Display: Displays a graph of the current field strength

Max Hold: Display the max value of the field strength measured.

Peak Axis Detection: See which axis has the strongest field strength, making it easy to find the source of the field.

Selectable Units: Select between milliGauss and microTesla.

AC Adapter Option: All units come standard with a power supply jack that will accept an AC Adapter (9v DC). This allows you to power the unit through a 120 VAC wall outlet, saving on batteries. An AC Adapter may be purchased through www.magnii.com.

Screen Update Rate: 1.6 times per second

Battery Life: Approximately 20 hours with 9v alkaline battery (included)

Intro: Power Line Noise

Power line electromagnetic noise is an invisible force all around us, emitted by anything that is powered by the AC power grid. This power grid provides energy to your home or office with current alternating at a rate of 60 cycles per second in North America, or 50 cycles per second in Europe. This manual will use 60 cycles per second (or 60 Hertz, “Hz”) for examples, but all examples can be applied to 50Hz fields as well. This alternating current creates a strong magnetic field at 60 Hz, but small power glitches caused by changing power needs creates magnetic fields at harmonics of 60 Hz. These harmonics exist at 120 Hz, 180 Hz, 240 Hz, and every integer multiple of 60 Hz to infinity. Other types of waveforms, for example square or triangle waves, also contain many harmonics. What if you wanted to measure a field that isn’t caused by power line noise? Say you want to measure a 90 Hz field, or a 40 Hz field? How do you distinguish between power line fields and the fields you want to measure? The DSP-523 allows you to do all this and more.

DSP Filtering

The core of the DSP-523’s technology is its patent-pending digital signal processing (DSP) algorithms that allow not only the ability to filter 60Hz power line noise, but also harmonics of 60Hz. The DSP-523 works by zeroing out (notching) or bandpassing fields at 60 Hz and every harmonic of 60 Hz.

DSP-523 Quick Start Guide

Switch the meter to the “Menu” position, and then press the → arrow button to switch to the “DSP Filters” menu. Use the ↑ arrow to select “60Hz+Harmonics” (or 50Hz+Harmonics for Europe). “60Hz+Harmonics” means the meter will ignore (filter out) or bandpass 60Hz fields and all harmonics of 60Hz.

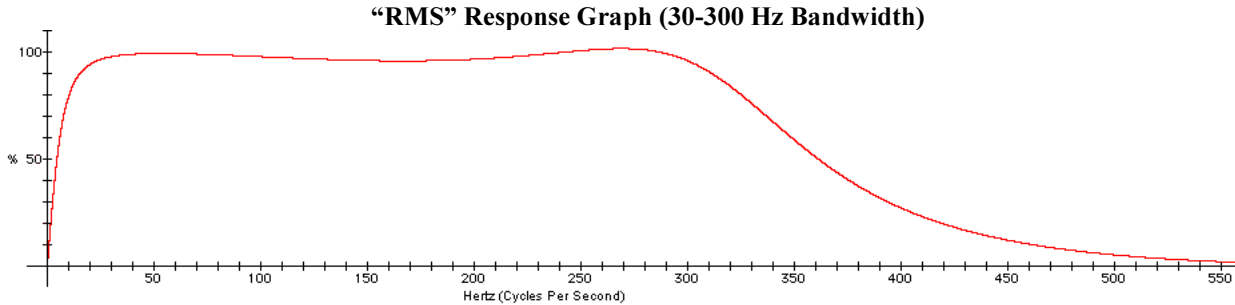
Switch the meter to the “DUAL” position. This shows you the unfiltered field strength on the top line (“RMS”), and the field strength with power line noise removed (“-PWR”). Take some time to measure different areas of your home or office to get a feel for how strong power line noise is. Try measuring the field from an alarm clock or AC adapter; you can see that the RMS field strength is much greater than the “-PWR” field strength, so you know that these fields are from power line noise and not another frequency. For the most accurate filtering and measurements, hold the meter as still as possible, as movement can create other frequencies (called “sidebands”) that can alter your measurements.

Press and hold the VIEW button until the second line changes to “@PWR”. This measurement is the field strength of the main power lines only (bandpass at 60Hz and harmonics). Take another measurement of an alarm clock or AC adapter and notice that the @PWR measurement is almost the same as the RMS measurement. This, again, tells you that these fields are from power line noise.

Now switch back to the Menu setting and change the DSP Filters to “60 Hz Only” (or “50 Hz Only” for Europe). “60Hz Only” means the meter will ignore (filter out) or just measure 60 Hz fields, without filtering harmonics. Switch back to the “DUAL” position and repeat your measurements of the alarm clock or AC adapter. You’ll probably notice that the “-60Hz” reading is higher than it was before, but still much less than the “RMS” reading. This means that there is some energy in the harmonics of 60Hz. Press the VIEW button until the second line changes to “@60Hz”. This value is the strength of 60Hz fields only; you will notice that if harmonics are strong, this value will be less than the RMS value.

“RMS” Measurements

The DSP-523 can take general EMF measurements, without any DSP filtering. To do a basic survey, look at the “RMS” reading on the DUAL or RMS switch setting. This is the field strength with no filtering, covering a bandwidth of 30 to 300 Hz.



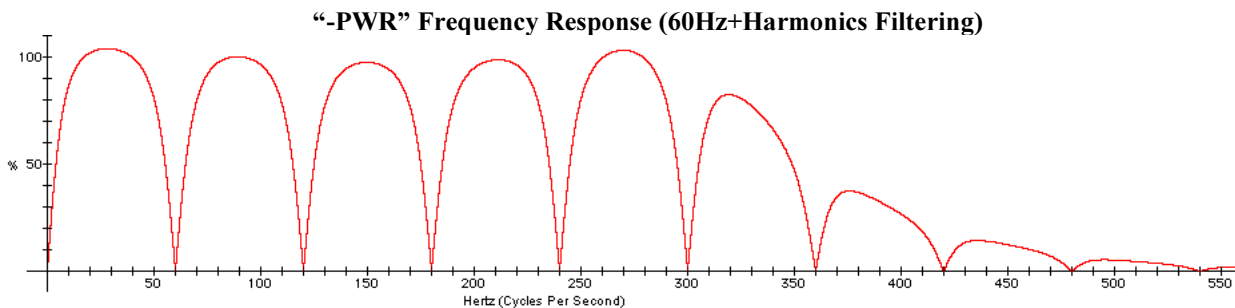
“-PWR” Measurements

Tracking Down the Source of a Field

If you are doing on-site surveys and are trying to track the source of a field, or trying to determine if a field is man-made, set the DSP-523 to “60Hz+Harmonics” filtering, and compare the readings on the DUAL setting. If a frequency other than one associated with power lines is present, it will show up in the “-PWR” reading. If the “-PWR” reading is significantly lower than the “RMS” reading, you know the field is from man-made power lines. If the “-PWR” reading is close to the “RMS” reading, you know that the field is NOT related to 60 Hz power line noise, but other frequencies.

Ignoring Power Line Fields

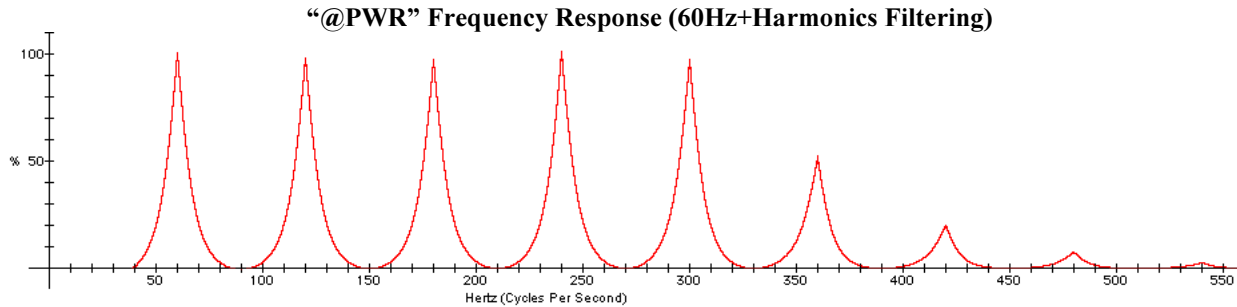
What if you want to measure a magnetic field that is not associated with power line frequencies, for example, the 80Hz refresh rate of an LCD monitor? Set the meter to “60Hz+Harmonics” DSP filtering, and then look at the “-PWR” measurement on either the DUAL or NOTCH setting. This value is the magnetic field strength WITHOUT any interference from power line magnetic fields. This type of measurement is very powerful, as it allows you to completely ignore power line fields while still accurately measuring other fields.



“@PWR” Measurements

Measuring Power Frequency Magnetic Fields

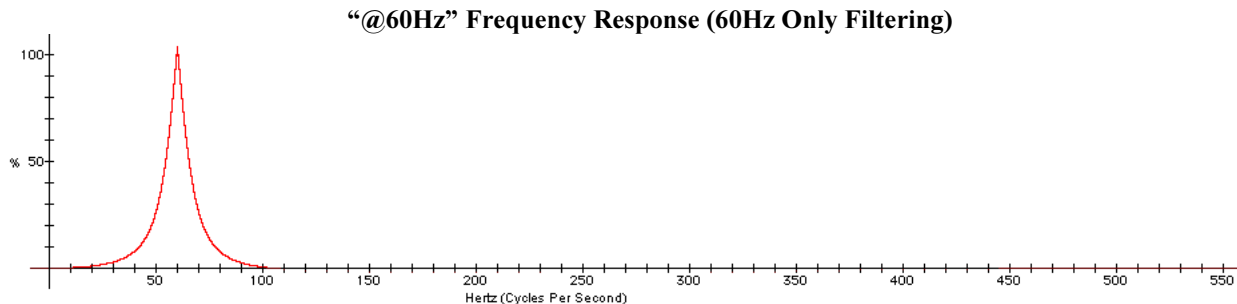
If you’re interested in seeing exactly how much radiation is due to power line frequencies, set the meter to “60Hz+Harmonics” DSP filtering, and then look at the “@PWR” measurement on either the DUAL or BANDPASS setting. This value is the magnetic field strength caused by power lines (60Hz and harmonics of 60Hz).



“@60Hz” Measurements

Measuring Power Line Magnetic Fields without Harmonics

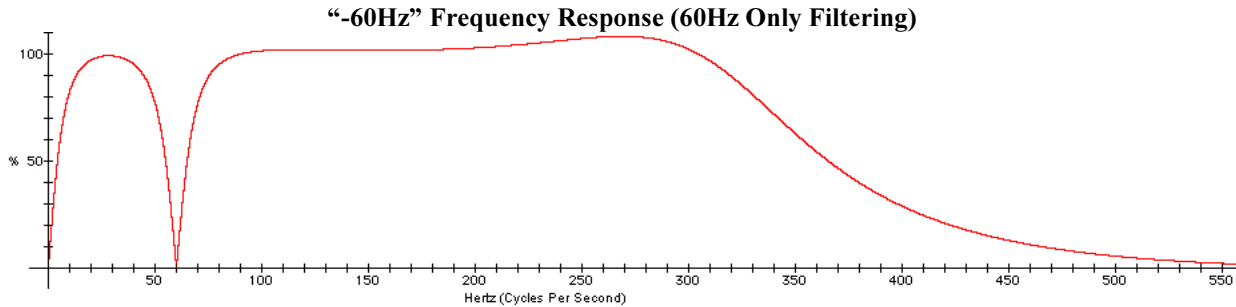
Sometimes you want to see how “clean” the 60Hz sine wave from an AC powered device is. When a sine wave is pure or “clean”, it will only contain the fundamental frequency (60Hz Only), but when a sine wave is “dirty” from power glitches or other faults, it will contain harmonics of the fundamental frequency (120Hz, 180Hz, etc). Set the meter to “60Hz Only” DSP filtering, and then compare the “RMS” and “@60Hz” measurements on the DUAL setting. The “@60Hz” value is the field strength with a very narrow bandpass filter at 60 Hz. For a magnetic field consisting of just 60Hz and no harmonics, both the “RMS” and “@60Hz” values will be almost the same.



“-60Hz” Measurements

Ignoring 60Hz Fields

If you want to measure the field strength of the power line harmonics, or accurately measure a field that is close to a harmonic of 60Hz (190Hz for example). Set the meter to “60Hz Only” DSP filtering, and then look at the “-60Hz” measurement the DUAL or NOTCH setting. This measurement is without 60Hz magnetic fields, but includes harmonics of 60Hz.



SWITCH POSITIONS REFERENCE

DUAL:

The DUAL setting lets you compare two measurements at once. The first line always shows the RMS field strength (unfiltered). The second line shows either the notched or bandpassed field strength (hold the VIEW button to switch between the two).

RMS, NOTCH & BANDPASS:

These switch positions allow you to graph the field strength of the selected value. On the “RMS” position, the unfiltered field strength is shown on the top line, and the second line is a horizontal bargraph showing the relative field strength. As the field strength increases, the length of the bar will grow, giving a visual indicator of field strength. The bargraph will auto-scale depending on the strength of the signal. The “NOTCH” and “BANDPASS” settings operate the same way, but show you the field strengths after filtering. “NOTCH” being the “-PWR” or “-60Hz” field strength and “BANDPASS” being the “@PWR” or “@60Hz” field strength, depending on the DSP Filtering option chosen.

MAX HOLD:

You may also display the max value measured on any of the three RMS, NOTCH or BANDPASS switch positions. To switch between the graph and max views, press and hold the VIEW button until the second line switches to show the MAX value.

MENU:

The MENU switch position allows you to configure your meter to your needs. All settings in the Menu are saved even after power down, so the next time you power the meter up it will still have your desired settings.

BACKLIGHT: Press the ↑ arrow button to change the backlight brightness, you may select the brightness level from 1-9, or turn the backlight off. Press the → arrow button to advance to the next menu screen.

DSP Filters: Selects what frequencies will be filtered. Options are:

- 60Hz Only (North America, no harmonic filtering)
- 60Hz+Harmonics (North America, filters all power line noise)
- 50Hz Only (Europe, no harmonic filtering)
- 50Hz+Harmonics (Europe, filters all power line noise)
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Display Units: Press the ↑ arrow button switch between display units of milliGauss (mG) or microTesla (μT). 1 μT is equal to 10 mG. Press the → arrow button to advance to the next menu screen.

MagniiTech: Informational screen shows www.magnii.com, where instructions, application notes and other measurement equipment can be found. Press the → arrow button loop back to the beginning of the menu system.

OTHER FEATURES

AXIS SELECTION:

On any of the measurement screens you can select which axis to measure. Press and hold the AXIS button to switch between 3D, X, Y and Z. 3D displays the 3-Axis True RMS measurement, which is equal to $\sqrt{X^2 + Y^2 + Z^2}$. This setting allows you to see the magnetic field strength, regardless of meter orientation. Magnetic fields are vectors, which not only have strength, but also a direction. Selecting X, Y, or Z only displays that axis's field strength, so meter orientation is important on these settings. For general surveys, it is recommended to use the 3D setting, so meter orientation does not affect the measurement. The sensors are located in the top right corner of the meter.

UNIT OF MEASUREMENT:

The current unit of measurement, either milliGauss (mG) or microTesla (μT), is displayed in the upper right corner of the screen. This is changeable in the Menu system.

BATTERY LEVEL:

A general indicator of battery strength is shown in the upper right corner on powerup. If the battery begins to die, -BATT- will be periodically displayed on the screen, indicating that it's time to change the battery.

MEASUREMENT RANGE & RESOLUTION

Measurement range on any axis is 0.01 to 250.0 mG (autoranging). Because this is a 3 axis meter, the maximum possible reading of a 3D field is therefore $\sqrt{250^2 + 250^2 + 250^2} = 433$ mG, but for most areas the energy is only found on one axis, limiting the 3D measurement range to approximately 250 mG. If the field strength is over 250 mG on one axis, the meter will show "OVFLOW" (overflow) or "N/A" (not applicable). The highest resolution setting possible will automatically be picked based on the waveform and amplitude of the field. For sinusoidal fields, resolution of 0.01 mG is typical up to 20 mG, and 0.1 mG above this.

WARRANTY

This product is covered by a manufacturer's warranty for a period of 2 years. If the product fails because of a manufacturer's defect within the warranty period, Magnii Technologies will repair or replace the unit at no cost to you, less shipping. Additional extended warranty options may be available at www.magnii.com. Assembled in the U.S.A.