

Choosing the Right Ground Resistance Tester



Inside this Issue:

- **Featured Products: Choosing the Right Ground Resistance Tester**
- **Understanding Uncertainty Specifications for Electrical Test Equipment**
- **Customer Support Tip: Detecting Phantom “Ghost” Voltages with AEMC[®] Multimeters using the V_{lowZ} setting**
- **AEMC[®] Interview: Mike Van Dunk, Quality Assurance Analyst**
- **Customer Testimonial: AEMC[®] Goes to Sea**
- **New Products: Indoor Air Quality Tester C.A 1510, Digital Multimeters Models 5212, 5215, and 5217**

Featured Products:

Choosing the Right Ground Resistance Tester

There are a wide variety of ground resistance testers available on the market today. These vary in design, features, and complexity, and include small handheld models as well as larger field instruments that are often packaged as part of a complete kit. These products also range in price, from few hundred up to several thousand dollars.



In this article, we discuss several critical questions to consider when selecting a ground resistance tester. Our goal is to help guide you in choosing the instrument best suited to your specific application and requirements.

Q Do you need to regularly test sites for soil resistivity?

The first – and probably most important – question is whether your current or future needs require soil resistivity testing, because it will determine the type of ground resistance tester you will need. For example, if your work involves the design and/or installation of new grounding systems, soil resistivity testing is a necessity. An instrument designed for 4-pole testing (also referred to as 4-point testing) is required for this application. A basic low-cost 4-pole tester provides measurement results in ohms. You can then use this reading to manually calculate soil resistivity, which is usually expressed in ohm/centimeters or ohm/meters.

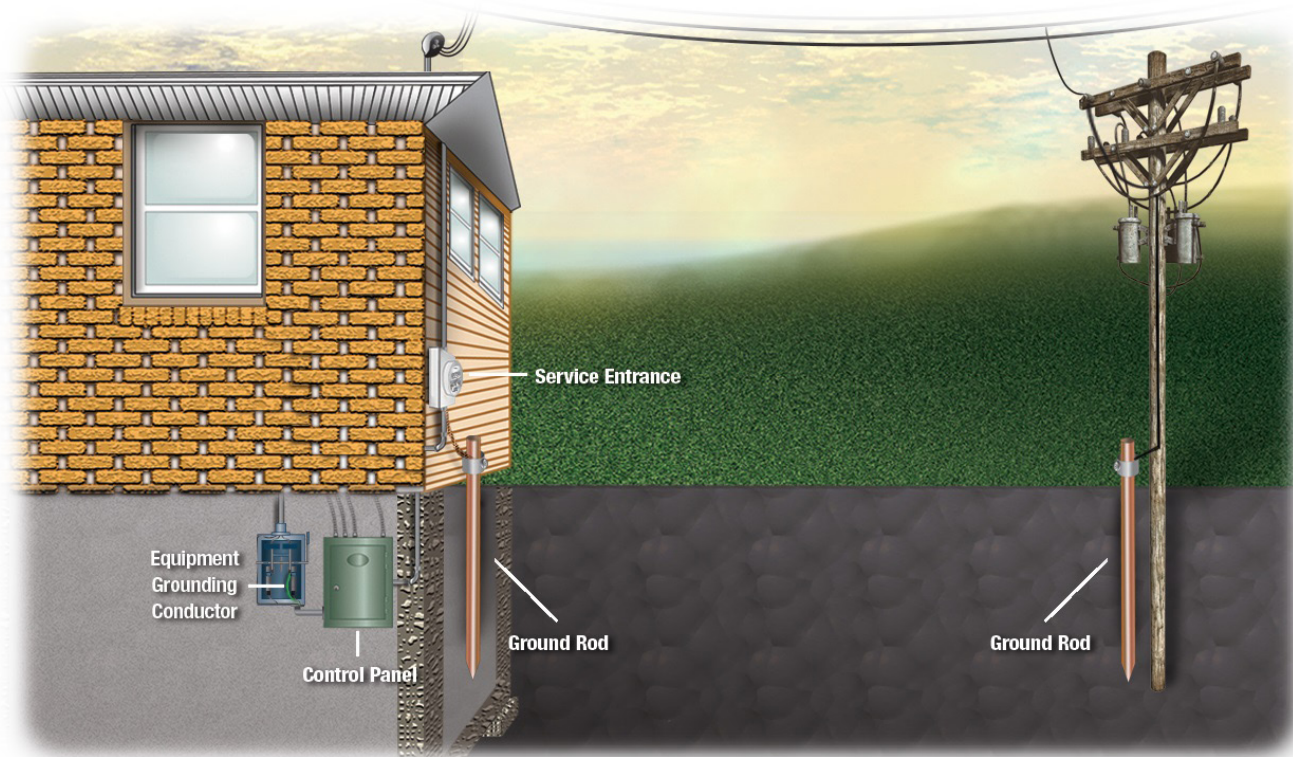
More sophisticated instruments include built-in formulas for calculating soil resistivity using the Wenner or the Schlumberger method.

If you regularly need to perform 4-pole testing, consider purchasing an instrument that automatically calculates soil resistivity. This will save time and eliminate potential math errors.

Q What type(s) of ground systems will you test?

The obvious follow-up question involves the types of grounding systems you will test. Will this include small systems such as residential, or larger and more complex systems such as commercial, industrial, telecommunication, or electric utilities?

To illustrate the importance of this question, let's consider a typical small site with a grounding system consisting of a copper rod or two, driven into the ground and connected to the service entrance.



In the above illustration, if the house has not yet been connected to the power line, a basic 3-pole ground resistance tester (or a 4-pole instrument configured for 3-pole testing) will suffice for measuring the resistance of the house ground rod. If the house has been connected to the power line, a clamp-on ground resistance tester can measure the house ground rod resistance.

If you choose a 3- or 4-pole instrument for this, one point to bear in mind is the distances required for auxiliary rod placement. For example, performing a Fall-of-Potential test on a single electrode rod driven 8 feet deep requires at least 80 to 100 foot test leads. If more ground rods are used, the distance requirement increases.

Ground resistance test kits are available that include the measurement instrument, the auxiliary electrodes, and leads. Typical lead lengths provided in these kits are 150, 300, and 500 feet. We suggest selecting a ground resistance test kit with leads at least one size longer than your immediate need. So if 150 feet is required, a kit that includes 300 foot leads will provide a good margin of error. For larger sites with multiple rods or ground grids, consider kits that provide 500 foot leads.

Q Does the test site have high soil resistivity and/or requires long test leads?

Another question is whether the soil resistivity is high in the area that you will be testing, or whether the distance required for the auxiliary rods to perform Fall-of-Potential testing is unusually long. If the answer to either or both of these questions is yes, and you intend to perform Fall-of-Potential and/or soil resistivity tests, you must consider the instrument's injection current and test voltage. Typical injection currents range from a few milliamps up to several hundred mA. High soil resistivity usually produces high contact resistance for the auxiliary electrodes. This can be of concern when using lower-cost instruments that typically provide 10mA test current; so in this circumstance we recommend an instrument capable of delivering higher test current.

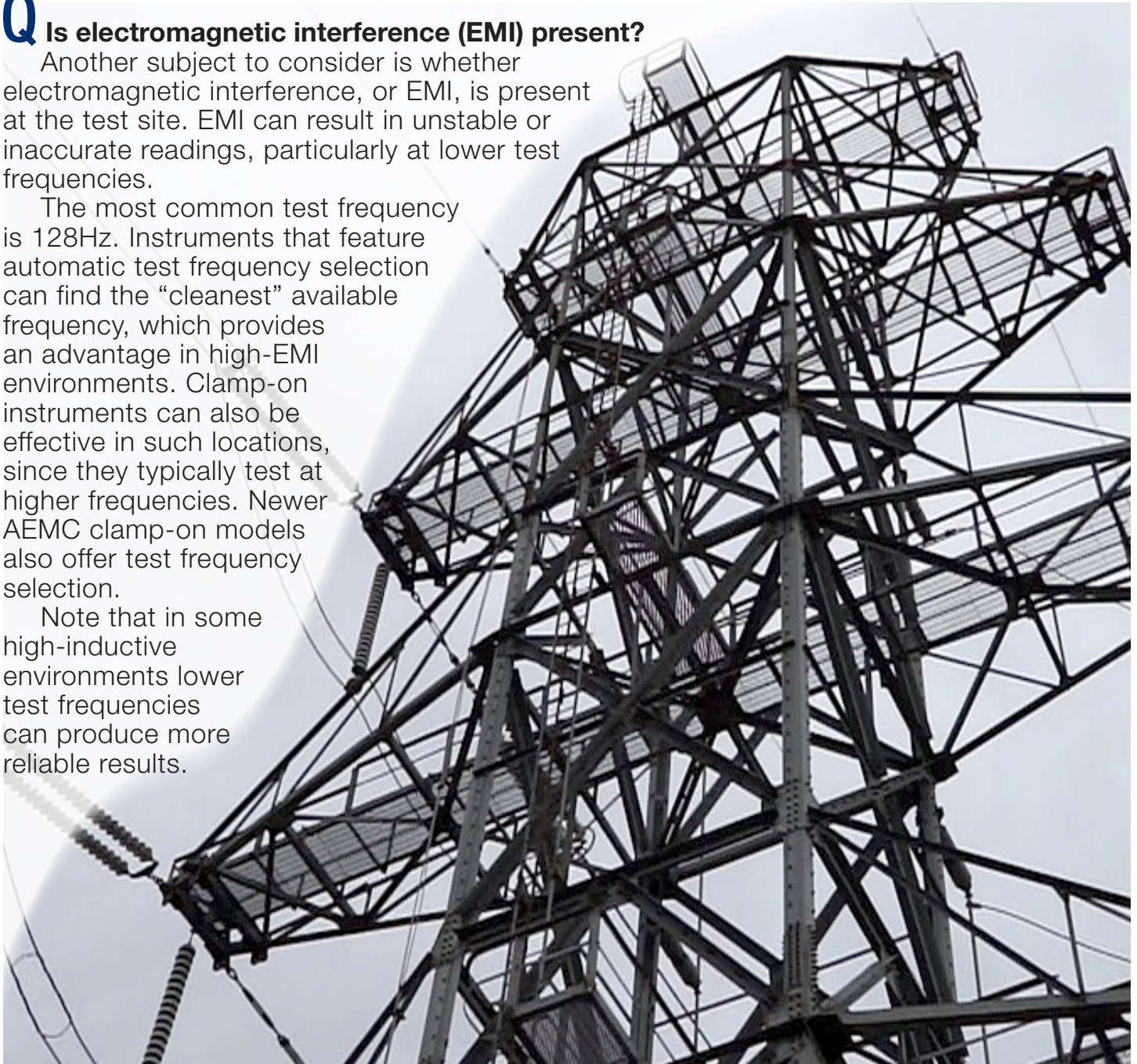
Before we leave the topic of auxiliary electrodes, note that clamp-on instruments do not require any auxiliary rods or leads. Another advantage is that you do not need to take the grounding system out of service to perform the test.

Q Is electromagnetic interference (EMI) present?

Another subject to consider is whether electromagnetic interference, or EMI, is present at the test site. EMI can result in unstable or inaccurate readings, particularly at lower test frequencies.

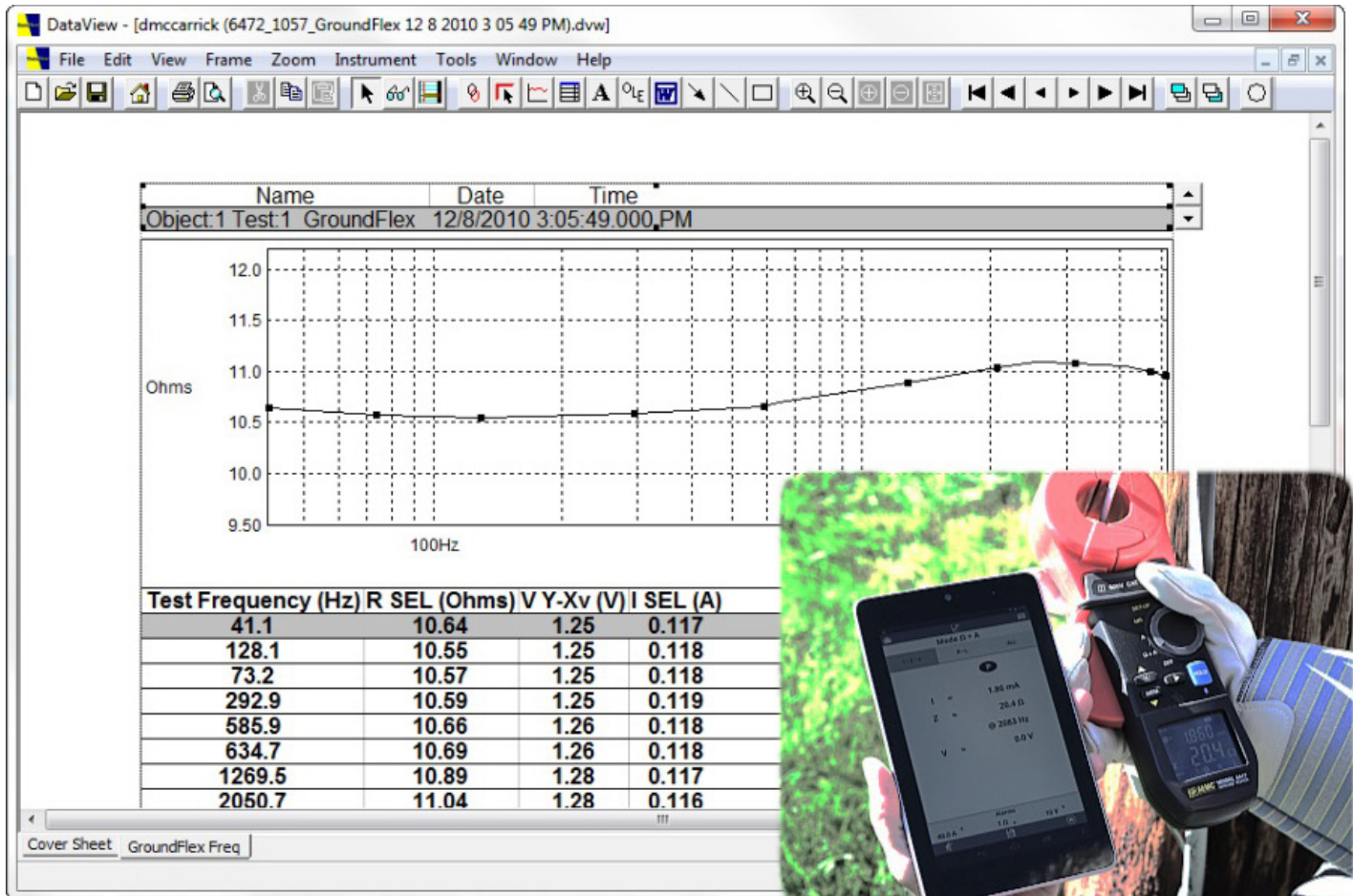
The most common test frequency is 128Hz. Instruments that feature automatic test frequency selection can find the "cleanest" available frequency, which provides an advantage in high-EMI environments. Clamp-on instruments can also be effective in such locations, since they typically test at higher frequencies. Newer AEMC clamp-on models also offer test frequency selection.

Note that in some high-inductive environments lower test frequencies can produce more reliable results.



Q How will you use the measurement data?

The choice of instrument can also depend on how you intend to use the data you obtain. For example, if you plan to save, analyze, and distribute your test results, data storage and report generation become important considerations. Newer and more advanced instruments, both 3- and 4-pole testers and clamp-on models, can store test results in internal memory. This data can then be downloaded and analyzed using software running on a computer, or via mobile apps for smartphones and tablets.



DataView® Ground Tester Resistance vs Frequency report (above, left) and Model 6417 Android™ app (above, right)

This can be a very powerful tool for contractors conducting tests for clients. An added advantage for a mobile app is the ability to immediately send test results as an e-mail or text message.

Q Do you need to test the bonding of grounding system components?

Finally, if you’re planning to test complex grounding system consisting of many components including a ground mat or grid, you will need to test the continuity of bonding between the various elements. This test is most often conducted using DC voltage and current. Several ground resistance testers provide this capability, with test currents up to a few hundred milliamps. In addition, a more complete test can be performed with a micro-ohmmeter. The advantage in using this instrument is its ability to test at high test currents up to 200A. This can expose problem areas not always revealed when testing with milliamp-range currents.

AEMC® Ground Testing Solutions

Whatever your ground resistance testing needs, AEMC has an instrument that meets your requirements:



AEMC Model 3620

Basic ground resistance testing, soil resistivity testing not required:

The AEMC Ground Resistance Tester Models 3620 (above) and 3640 measure the resistance of grounding systems via 2- and 3-point tests. Both instruments feature simple "one-button" operation. The Model 3640 also provides auto-ranging. Each instrument can be purchased standalone or as part of a kit that includes leads, auxiliary electrodes, and other accessories.

In addition, the hand-held Clamp-On Ground Resistance Tester Models 6416 and 6417 (right) measure ground rod and grid resistance and impedance without requiring auxiliary rods.



AEMC Model 6417

Basic ground resistance testing, soil resistivity testing required:

In addition to providing basic 3-point ground resistance testing, the Models 4620 and 4630 (right) also perform 4-point soil resistivity testing. Each instrument is rugged, easy to use, and can be purchased standalone or as part of a complete ground testing kit.

Advanced ground resistance testing, high soil resistivity present:

High soil resistivity requires instruments that can produce test currents greater than the 10mA current typically provided by lower-cost instruments. The Models 6470-B, 6471, and 6472 (below) provide test currents up to 250mA. These instruments also offer a number of other advanced ground resistance capabilities.



AEMC Models 4620 and 4630

Bonding testing:

Testing the bonding between components in complex grounding systems requires checking continuity at higher test currents. In addition to the Ground Resistance Testers Models 6470-B, 6471, and 6472 (left), AEMC offers micro-ohmmeters (for example, the Model 6240, bottom right) that can be used in this application.



AEMC Model 6472

Ground resistance testing in high EMI environments:

The best way to minimize the effects of high EMI is to use instruments that automatically select the “cleanest”

test frequency for the environment. The Models 6470-

B, 6471, and 6472 provide this capability, as do the Models 6416 and 6417 Clamp-On Ground Testers. Note that the latter two instruments are the only clamp-on hand-held ground resistance testing products in the industry that offer test frequency selection.



AEMC Micro-Ohmmeter Model 6240

High-end ground resistance testing, including pylon testing:



AEMC® GroundFlex® Field Kit in action

Pylon (tower) testing usually requires disconnecting the overhead ground conductor – a time consuming, expensive, and potentially hazardous operation. AEMC's GroundFlex® Field Kit offers the unique capability of testing pylon resistance without disconnecting the overhead ground conductor. The kit includes the Model 6472 as well as the GroundFlex® Adapter Model 6474, and comes with all the sensors, leads, and other accessories needed to perform pylon testing and other ground resistance testing applications.

Report generation:

AEMC's DataView software enables you to download test results from the instrument to a computer. You can then generate reports from this data, using templates provided with the software or custom templates you create to suit your specific requirements. These reports can be analyzed, shared, and stored for future review. DataView supports the Models 6470-B, 6471, and 6472. It also supports the Clamp-on Ground Tester Model 6417. An Android™ app is also available for interacting with the Model 6417.

Conclusion

Let's take a moment to review:

- When deciding which ground resistance tester is right for you, consider whether or not you need an instrument that can measure soil resistivity.
- If so, think about what types of ground systems you are likely to test.
- Take into consideration the environmental factors at your potential test sites, such as high soil resistivity or EMI.
- Bear in mind how you plan to use the measurement data.
- If you need to measure complex grounding systems, consider an instrument that can perform continuity checking on the bonding between components.

These are just a few points to consider when choosing a ground resistance tester. For more information on ground resistance testers provided by AEMC, see our [Product Page](#).

Check our [YouTube Channel](#) for instructional videos on various topics in electronics, including the many products offered by AEMC.

Understanding Uncertainty Specifications for Electrical Test Equipment

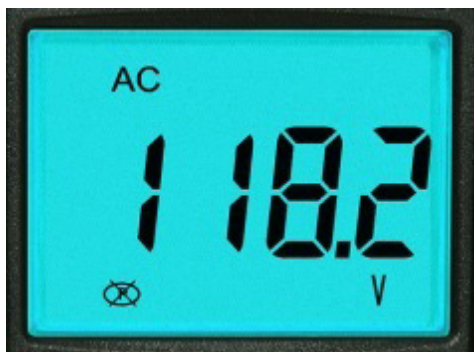
A critical characteristic of any measurement instrument is its accuracy – in other words, how closely the instrument's reading reflects the true value being measured with a minimum of uncertainty. Unfortunately, the relevant specifications for electronic measurement equipment are often expressed in terms unfamiliar to less experienced users. The specs for a digital multimeter may list its uncertainty for measuring DC voltage as " $\pm(0.2\% + 2 \text{ counts})$ " with no further explanation about what this formula means and how it applies to the displayed measurement. This can make it difficult to compare the accuracy of different products, or even know whether or not a particular instrument is suited to your requirements.

This article describes how to determine accuracy for electrical measurement instruments. We define terms such as digits, counts, resolution, uncertainty, and error. We also explain the importance of selecting the right measurement range when taking a reading.

In this article we use a digital multimeter (DMM) as our demonstration instrument. However, most of what we'll cover also applies to other types of instruments.

Digits and Counts

Two terms critical to understanding accuracy are digits and counts. It's important to note that neither term defines accuracy; instead they define an instrument's resolution (more on this point later). Resolution is a key factor in calculating accuracy and uncertainty, so we need to clearly understand these concepts.



Digits defines the number of digits an instrument can display. For example, a 4-digit DMM can display four 0 through 9 digits (10.00, -0.024, 9999, and so on).

This fairly simple concept becomes more complex when the left-most digit (called the *most significant digit*) cannot display the full range of numbers. For example, a so-called "3½-digit" DMM can display either a 1 or 0 as its most significant digit.

Thus the highest reading this instrument can display within a single measurement range is 1999. Readings greater than this must be displayed in a higher range, if available. For instance a reading of 20 volts could be displayed as 020.0V, with the decimal point shifted one digit to the right. This is further complicated when the most significant digit can be numbers other than 0 or 1. There is no uniformly adopted standard for expressing this as a fraction. For example, a 3¾-digit DMM typically refers to an instrument whose most significant digit can be 0, 1, or 2. But this fraction is also used on occasion for instruments that can display 3, 4, or 5 as the most significant digit.

To minimize this confusion, many manufacturers now describe their products in terms of *counts* rather than digits. Basically, this defines the number of different readings the instrument can display within a measurement range. For example, the 3½ -digit DMM described above is a 2000-count instrument, since it is capable of displaying readings from 0 to ± 1999 .

The value of each count is determined by the reading's right-most number, called the *least significant digit*. In the preceding example, for a reading of 19.99V each count equals 0.01V; for a reading of 020.0V each count equals 0.1V. Therefore an instrument's measurement range can significantly impact accuracy, as we'll discover later in this article.

Accuracy vs Resolution

Users often refer to resolution and accuracy interchangeably; but it's important to understand the distinction between these terms. Generally speaking, **resolution** defines the smallest possible measurement change the instrument can detect. Thus at their lowest ranges, a 1000 count DMM can display a change of .001 unit, while a 10,000 count instrument can detect .0001 – in other words, 10 times the resolution of the 1000 count DMM. And since resolution depends on the size of each unit (the smaller the better), the lowest possible measurement range should be selected when making high-resolution readings.

However, these numbers say nothing about an instrument's accuracy. The 1000 count DMM may have a measurement uncertainty much smaller than the 10,000 count model, and therefore produces more accurate readings. Although resolution is a critical factor in calculating uncertainty, it is not the sole factor.

Percent of Reading vs Percent of Range

A second factor in calculating uncertainty is expressed as a percentage. Recall our previous example specification of " $\pm(0.2\% + 2 \text{ counts})$." This indicates that the total uncertainty is 2 counts plus a percentage of a value. This can be a percentage of the reading, or a percentage of the instrument's range.

Uncertainty can be significantly affected by which of these values – reading or range – is used in the calculation, since the reading is generally much smaller than the range. For example, consider a 1000 count digital multimeter displaying a reading of 100V, with the range set to ± 999 . One percent of the reading would be 1V, while one percent of the range would be 10V. So be sure to check whether the percentage applies to the reading or the range when comparing specifications of different digital multimeter models.

Note that uncertainty specifications for all AEMC instruments are always expressed as a percentage of the reading.



Deciphering Uncertainty Specifications

Now let's apply what we've learned. Suppose we hook up a 6000 count multimeter to a battery. This instrument features an uncertainty specification of $\pm(0.2\% (\text{reading}) + 2 \text{ counts})$ when measuring DC voltage. With the range at the lowest setting, we get a reading of 5.000V.

Since the percentage is based on the reading, we start by deriving 0.2% of 5.000V, or approximately 0.010V. We then add 2 counts. Taking the least significant digit, we define each count as 0.001V. Thus the sum of two counts equals 0.002V.

Adding the percentage and counts together, we calculate an uncertainty of around $\pm 0.012\text{V}$. Thus for the reading shown above, the actual value falls within the range of 4.988V ($5.000 - 0.012\text{V}$) to 5.012V ($5.000 + 0.012\text{V}$). Or stated in terms of accuracy, this reading reflects an accuracy of 99.76%, with an uncertainty of 0.24% (0.012 divided by 5.000).

This calculation highlights the importance of selecting the optimal measurement range. To demonstrate this point, consider what happens as we change the range from ± 5.999 to ± 59.99 , ± 599.9 , and finally ± 5999 :



Range: $\pm 5.999\text{V}$
1 count = 0.001V , uncertainty = $\pm 0.012\text{V}$



Range: $\pm 59.99\text{V}$
1 count = 0.01V , uncertainty = $\pm 0.030\text{V}$



Range: $\pm 599.9\text{V}$
1 count = 0.1V , uncertainty = $\pm 0.210\text{V}$



Range: $\pm 5999\text{V}$
1 count = 1V , uncertainty = $\pm 2.010\text{V}$

As the preceding illustration shows, the decimal point moves to the right with each change of range. This indicates an order of magnitude increase in our least significant digit, and as a result, a commensurate increase in the value of one count. At the highest range, the reading is 0005V , with one count equal to 1V . Applying the formula, the uncertainty in this case would be approximately $\pm 2\text{V}$, producing a measurement range of around 3 to 7V , orders of magnitude greater than our original uncertainty of 0.012V . Such a reading would of course have no practical value. This highlights the importance of selecting the correct range for a measurement.

Note that AEMC digital multimeters feature auto-ranging for automatically selecting the most appropriate range for the measurement.

This also illustrates the advantage of higher count instruments. For example, a 6000 count multimeter can display 1000 more readings than a 5000 count model without changing to the next higher range. Since these 1000 additional readings will have a lower per-count unit value, they will result in a lower uncertainty.

Uncertainty vs. Error

Before leaving this topic, we should point out the difference between uncertainty and error. Although the terms are sometimes used interchangeably, uncertainty represents the range within which the true measurement falls, while error defines the absolute amount the reading differs from the true value. Although it may seem initially counter-intuitive, it would be easier to accommodate error than uncertainty: all we would need to do is offset the measurement by the amount of the error to obtain 100% accurate results!

Conclusion

Let's review a few of the key points we've covered:

- It's important to understand uncertainty specifications to properly judge an instrument's accuracy.
- Digits and counts define an instrument's resolution, but not its accuracy.
- When comparing performance, bear in mind whether an instrument's uncertainty is based on percentage of measurement or percentage of range.
- Be sure to select the optimal range (generally the lowest possible) when making a measurement.
- Higher count instruments can produce more readings without changing ranges than lower count instruments.

We hope this will help you better understand and interpret uncertainty specifications and how they define an instrument's accuracy. This in turn will enable you to make more informed decisions when choosing the instrument best suited to your requirements.

Customer Support Tip:

Detecting Phantom "Ghost" Voltages with AEMC[®] Multimeters using the V_{lowZ} setting.

By Guy Belliveau

Due to the high impedance of digital multimeters and many other voltage measuring instruments, a voltage may be detected on de-energized/open conductors when there is no connection to a voltage source. Conductors that are in close proximity to each other can be capacitively coupled and possibly cause an AC voltage reading. This is what is referred to as Phantom or Ghost Voltage. Since this Ghost Voltage is a product of very small capacitance values, it cannot energize a load or present a safety concern to personnel. It is therefore considered a weak voltage.

The high impedance voltage input of a standard multimeter, in the VAC setting, places very little burden on the circuit under test and therefore reads this weak voltage. The resultant value is likely false, and could lead the operator to wrong conclusions about the circuit under test (and whether or not it is truly energized).

To verify that these readings are not false, we recommend using the low impedance "V_{lowZ}" setting on the multimeter. This is an additional test selection on the mode selector dial or buttons. This input has much lower impedance than the standard voltage input, and therefore places a burden on the circuit under test. If the voltage measured is truly a ghost voltage, then the V_{lowZ} setting will load the circuit and collapse the weak ghost voltage. The meter will correctly read at or near 0V. The operator will then know that the circuit is truly de-energized.

V_{lowZ} is an important feature of our multimeter offerings (other than the Model MX57Ex). Verifying de-energized circuits using the V_{lowZ} function should be an integral part of your test procedures when de-energized/open circuits are displaying unexpected voltages.

Please visit our website to explore our wide variety of Digital Multimeter offerings, including the new Models 5212, 5215, and 5217 described later in this Technical Bulletin.

We welcome your feedback and can be reached at techsupport@aemc.com or by calling 1-800-343-1291 x351 for our Technical Support Help line.



About the Author:

Guy Belliveau is Technical Support Specialist for AEMC[®] Instruments, Dover, NH.

AEMC® Interview:

**Mike Van Dunk,
Quality Assurance Analyst**



All AEMC products are rigorously tested before being released for sale to the public. Deeply involved in this effort is Quality Assurance Analyst Mike Van Dunk. In this interview Mike explains some of the processes involved in ensuring AEMC software products meet the highest standards of precision and reliability.

Q. What are your main responsibilities at AEMC?

Primarily I am a Quality Assurance analyst for software development and software maintenance. This includes QA testing for both released and in-development software applications to accompany our instruments, firmware, and hardware. I also perform document reviews on help files and user manuals.

Q. Is there a standard Quality Assurance procedure or template for testing AEMC products?

There is a very basic level approach that I use with everything; but after that the process is pretty flexible. Every piece of software and every instrument has some unique features that the others do not. If I generalized my testing to "blanket" everything, I really wouldn't be doing it right. Some areas require more attention than others, especially for in-development items; so I constantly have to adapt as new problems are found and new features are added.

Q. When a new product is being developed, what components need to be tested – hardware, software, firmware, documentation, others?

All of the above, and there is a domino effect that goes along with that. A new instrument means new hardware, but also new firmware, software and a new manual. New software means new features -- which also mean a new help file or other accompanying documentation.

When a product is in development, new features are constantly being added and things are being changed. Each time that happens there is a trickle-down effect for documentation. So, a small change in a user interface can result in three or four pieces of documentation being updated. It's my job to make sure those modifications are correct and represent the current state of the product.

Q. Does QA ever impact product design?

It absolutely can. Being in a position of wearing many hats so to speak, I tend to get a feel for potential problem areas in development with software, firmware, and so on. I can then take that knowledge to the developers. And as we design new user interfaces or add features, I can sometimes identify where we are likely to see issues before they happen. This allows the developers to really fine-tune areas where we've experienced issues in the past.

Q. How do you ensure you have typical customer usage scenarios covered when testing a product?

It's a multi-level testing approach, if you will. As funny as this may sound, my first responsibility is to simply try to break things. So I approach the software initially with a very aggressive mentality: "If I click here, then here, then push this button, what will happen?" It often involves doing things with the programs that your average customer probably wouldn't think to do.

Then I put myself in the shoes of a typical customer who may be completely unfamiliar with our products, and I adopt the mentality of "Can I use this efficiently?" This involves determining whether or not the interface is user friendly, whether the help file is detailed yet understandable, and whether the data being displayed within the program is easily understandable. You have to come at it from a couple of different angles.

Q. Does the QA process continue beyond the initial release of the product?

Most definitely. There is a maintenance factor to QA. You can't just forget about a product once you've released it to the public; and that goes for all areas including documentation. There are always new issues, new features, new suggestions and improvements that can be made. The software applications, firmware, and the instruments themselves are pretty much always evolving; so you have to keep testing and keep checking to make sure that the evolution is stable. Otherwise you may be introducing more bugs.

Q. When a product is enhanced, how do you ensure new features work with (and/or don't break) existing features?

Anything that you change can potentially break something else. When new features are implemented, my job is to test them thoroughly to make sure that particular feature is working as intended. That's step one. Step two is to then back away and look at the application as a whole. Essentially, I go over all of it again to make sure that the code that was added to implement something new didn't inadvertently break something that previously was stable. That has to be done every time something is changed; otherwise you might miss something that directly affects the user.

Q. Are there special changes involved in testing products that will be sold in different countries/languages?

We release in two languages besides English, which means in addition to making sure everything works the way it should, I also have to make sure everything is translated. It's another layer to an already multi-layered process.

Often I find issues that are present in a Control Panel in one language but are not present in the other two, so only checking the English isn't really an option. As I said, any change you make can potentially break something else; and translation is a change in its own right.

Customer Testimonial:

AEMC® Goes to Sea

Boston Harbor Cruises (BHC) offers whale watches, ferry rides to ports along the Massachusetts shore and beyond, and harbor tours to tourists and local residents. BHC also performs a number of offshore industrial and research services ([Click for Website](#))



Keeping BHC's fleet of over 40 vessels in optimal working order can be a very difficult task. To help meet this challenge, BHC Port Engineer Ed Cunnie relies on an AEMC Model 5233 as a critical tool when performing his daily fleet maintenance. For example, Ed recently used the Model 5233 to track down an issue in a circuit breaker panel that caused the failure of critical 28 VDC power circuit.



The Model 5233 is a TRMS (True RMS) digital multimeter designed for:

- Ohmmeter
- Continuity test with buzzer
- Diode test
- Ammeter
- Capacitance meter
- Frequency and duty cycle measurements
- Non-contact detection of presence of network voltage
- AC/DC voltmeter with high input impedance (voltage measurements for electronics)
- AC voltmeter with low input impedance (voltage measurements for electricity and electrical engineering)
- Thermometer in °C or °F by measurement and linearization of the voltage across the terminals of a K-type thermocouple

For more information on the Model 5233 and all other AEMC products, [Click Here](#).

New Products:

Indoor Air Quality Tester C.A 1510

Indoor air quality has become a significant public health concern in recent years. Numerous studies have shown that environmental factors in the office, classroom, and home can have a significant impact on physical comfort and mental performance.

The AEMC Instruments indoor air quality meter C.A 1510 helps address this issue by monitoring temperature, humidity, and carbon dioxide (CO₂) in the local environment. This compact, easy-to-use instrument provides quick and accurate readings, and can store up to a million separate measurements.

Features include:

- Multiple display modes for easy data viewing.
- Adjustable alarm settings for indicating when measurements fall outside a specified range.
- The display blinks with red backlighting when any of the measured parameters exceeds the user selected thresholds.
- Multiple mounting options.
- USB and Bluetooth communication capabilities for downloading recorded data to a computer.
- Software for viewing real-time data, configuring and running recording sessions, and creating reports. These reports can then be saved and reviewed for identifying and analyzing long-term trends.
- On-site calibration features.

You can also work with the C.A 1510 from an Android™ mobile device by downloading a free app from the [Google Play Store](#).

For more information, consult the C.A 1510 datasheet on the [Website](#).



New Products:

Digital Multimeters Models 5212, 5215 & 5217

The Digital Multimeter Models 5212, 5215, and 5217 are True RMS instruments that measure electrical and physical quantities, including:

- AC and DC voltage
- AC and DC current
- Resistance and continuity
- Capacitance
- Temperature (Model 5217)

These instruments can also perform continuity checks, voltage detection, and diode testing (including forward bias voltage). Measurement features include Auto Range mode, which enables the instrument to select the best range for the input detected, and a Data HOLD function.

Features include:

- True RMS (TRMS)
- Backlight and flashlight
- Non-Contact Voltage (NCV) detection
- Sleep Mode for extending battery life
- HOLD function for "freezing" the measurement on the LCD
- Low input impedance voltage measurement (V_{LowZ}) to help prevent "ghost" voltage from affecting the measurement
- Automatic selection of the most appropriate range for the measurement (manual range selection also available)
- MAX/MIN function for displaying the maximum and minimum readings detected during a measurement session (Models 5215 and 5217)
- Comparison of measurement with a user-selected "relative" measurement (Models 5215 and 5217)
- 4000 count (Model 5212) or 6000 count (Models 5215 and 5217) LCD display
- Multiple mounting options (stand, slot, magnet)



For more information, consult the [AEMC Web Site](#).



Chauvin Arnoux[®], Inc. d.b.a. AEMC[®] Instruments
15 Faraday Drive • Dover, NH 03820 USA
Tel: (800) 343-1391 • (603) 749-6434 • Fax: (603) 742-2346
www.aemc.com • techsupport@aemc.com