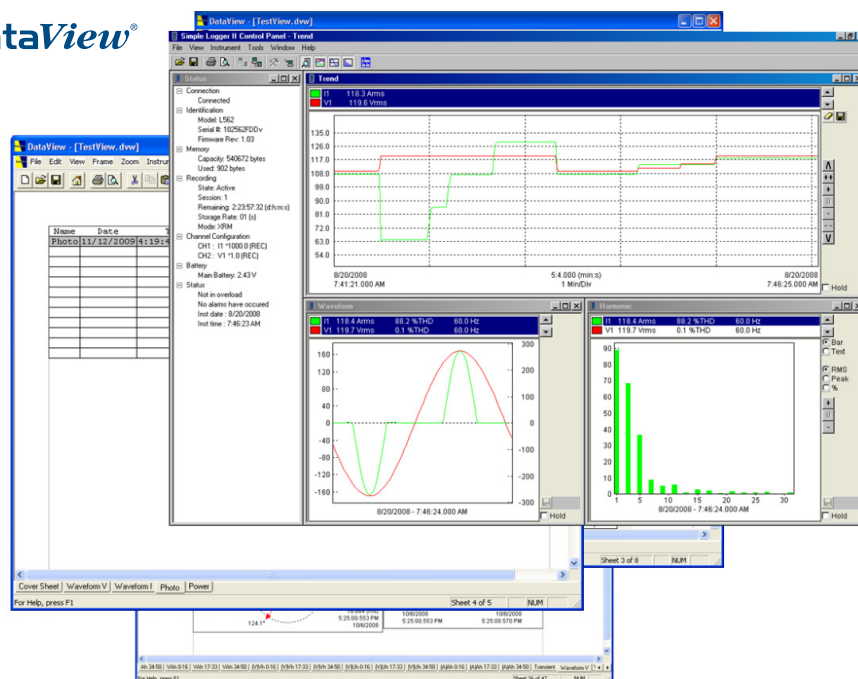


## DataView<sup>®</sup>



## AEMC Instruments' Bulletin

This is the maiden issue of a new AEMC<sup>®</sup> Instruments quarterly publication, the **“Watts Current” Bulletin**. The purpose of the bulletin is to provide an additional way for our customers (and potential customers) to learn about AEMC<sup>®</sup> products and their many capabilities. Each issue will feature at least one:

- Technical article on a subject of interest to the electronics industry
- Technical article about one or more DataView<sup>®</sup> products
- Interview with key AEMC<sup>®</sup> Instruments personnel
- Customer support tip
- Summary of recently released AEMC<sup>®</sup> product

A critical goal of the bulletin is to ensure the content we provide is relevant to the needs and interests of our readers. If you have any suggestions for future articles, please let us know by sending us a note at [techsupport@aemc.com](mailto:techsupport@aemc.com).

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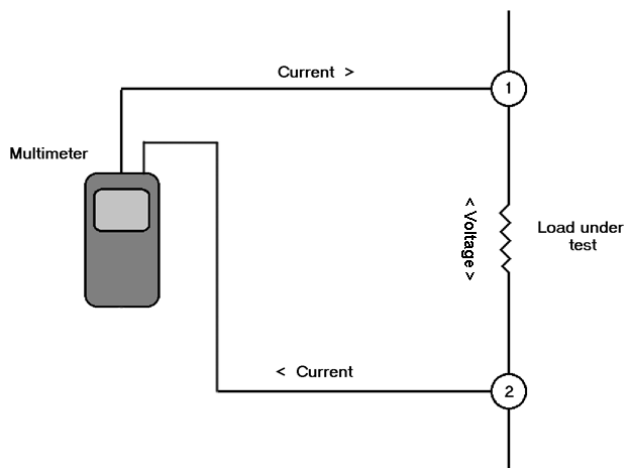
**AEMC - 6292 Micro-  
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# Measuring Resistance/Impedance with the Four-Wire Kelvin Method

By JP Martin

To measure the resistance or impedance of a load, multimeters often use a technique known as "constant current." In this method, a source current of constant and known amperage flows across the load under test. The multimeter simultaneously measures the voltage across the load and employs Ohm's Law to calculate the resistance, which in this case results in the formula  $R = V/I$ .

A relatively simple setup for constant current resistance measurement is the two-wire method, also called the two-probe method. This entails connecting two probes to the load under measurement, running a known current through the load and measuring the resulting voltage, and then calculating the resistance. A simplified representation of this setup is shown below:

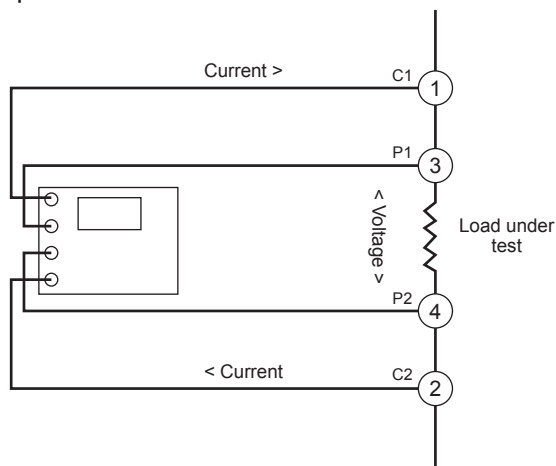


Two-wire setup for measuring resistance/impedance

In the preceding diagram, the probes numbered 1 and 2 provide constant current to the load under test, and also measure the voltage across the load in order to determine the resistance.

The two-wire method works well for moderate-to-high load resistance or impedance. However, for very low load resistances, the resistance inherent in the probe wiring and contacts can contribute a significant percentage to the overall results, making the measurement of the test load resistance inaccurate.

To accommodate this issue, more advanced instruments employ a setup known as the four-wire or Kelvin method. As the name implies, this involves using four probes in an arrangement similar to the example shown below:



Four-wire (Kelvin) setup for measuring resistance/impedance

In the preceding illustration, two separate pairs of probes are used. Pair 1 and 2 (sometimes referred to as the "source" probes) provides a known quantity of constant current, as in the two-wire setup. In addition, the Kelvin technique employs a second pair of probes (labeled 3 and 4 above) to sense voltage. This second pair is often called the "sense" probes. The placement of these probes ensures that only the voltage across the load is measured, independent of any resistance contributed by the current (source) probes. Virtually no current passes through the sense probes; the current instead passes through the source probes. This allows for a high level of measurement sensitivity and accuracy when the load under test is of low resistance. The ability to accurately measure low resistances can be critical in applications that involve high current, since even a small change in resistance (for example, due to fluctuating temperature) can have a significant effect on voltage levels.

## AEMC Micro-Ohmmeter Model 6292

AEMC® Instruments offers a family of micro-ohmmeters capable of performing four-wire measurements for load resistance and impedance. This includes the recently announced 200A Micro-Ohmmeter **Model 6292**. This instrument is designed for testing EHV circuit-breaker contact resistances, bushing contact joints, welding joints, or any low-resistance measuring application. The Model 6292 can provide high current up to 200A, and is designed to meet the IEEE C57.09-1999 (5.15) requirement for testing circuit breaker contact resistance.

This instrument can precisely measure resistance values from  $1\mu\Omega$  to  $1\Omega$ , with a resolution of  $0.1\mu\Omega$  with current up to 200A DC and down to 5A at  $1\Omega$ .



Four-wire Kelvin connection. In this example, an AEMC® 200A Micro-Ohmmeter Model 6292 is measuring the resistance of a test shunt.

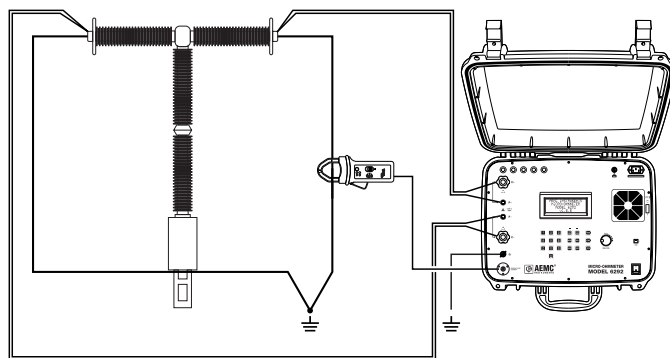
Other AEMC® micro-ohmmeter instruments that provide 4-wire testing include:

- **Model 6240:** This is compact and economical 10A micro-ohmmeter designed for applications such as aerospace, telecommunications, automotive, research laboratories, and maintenance departments. This instrument is lightweight (5kg) and can be easily carried into the field or other remote locations.
- **Model 6250:** This 200A micro-ohmmeter is also easily portable, with a very high accuracy and temperature compensation, and can be used in a variety of locations. It offers a wide measurement range ( $0.1\mu\Omega$  to  $2500\Omega$ ) and provides three measurement modes optimized

to suit the application: inductive (small transformers, engines, motors, and so on), non-inductive (contacts, metallization, and others), and automatic non-inductive.

Note that the four-wire method is not suitable for all applications. For example, when the load resistance is high, the resistance in the probes is relatively negligible as a percentage of the overall resistance and therefore does not introduce an unacceptable margin of error. Further, measuring high resistance loads requires that the constant current be kept at very low levels. As a result, ground leakage resistance can become a significant contributor to the overall resistance measurement, in the process rendering the measurement inaccurate.

Note that the Model 6292 mitigates the problem of ground leakage by offering a mode called "Both Sides Grounded" (BSG). Utilities require transformers to employ safety grounds on both sides for safety and expediency testing. In BSG mode, the Model 6292 uses an external DC current probe to measure and eliminate ground leakage current from the total test current, as illustrated in the following diagram:



Model 6292 setup for Both Sides Grounded (BSG) testing



About the Author:

JP Martin is the Director of Manufacturing for AEMC® Instruments, Dover NH.



# DataView® File Types

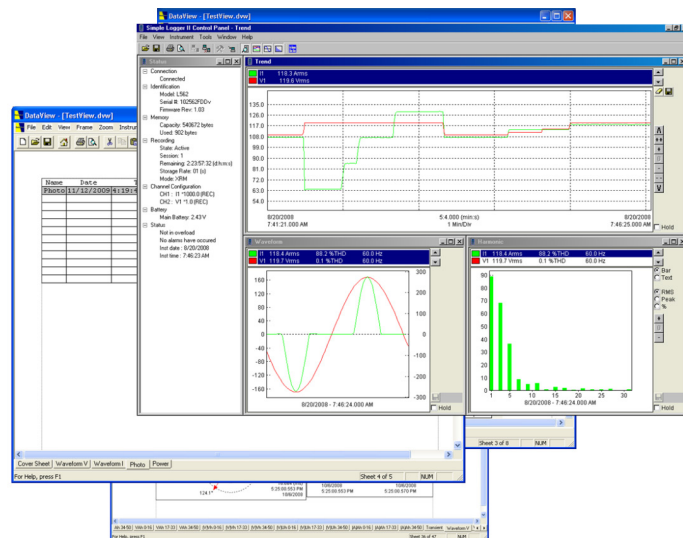
AEMC's DataView® data analysis software is very versatile. It accepts raw data recorded by a number of AEMC® instrument families, and displays that data on your PC in a wide variety of ways. This includes reports formatted with templates that ship with the product; or with templates created and customized by users to suit the specific needs of their facilities.

To accommodate the downloading, storage, manipulation, and display of measurement information, DataView® uses a number of different file types and formats. These files, usually identified by extensions specific to DataView®, can sometimes cause some confusion among new DataView® users.

In this article, we review the various file types used by DataView®. We define each type, and explain its role within DataView's features and functionality.

## The DataView® Report Generation Process

As explained in several videos available on AEMC's YouTube channel, the primary purpose of DataView® is contained in the product name. The program takes measurement data recorded on your AEMC® instrument, and presents it for viewing on a PC.



DataView® reports

There are four main DataView® file types involved in this process: .icp, .dvb, .dvt, and .dvw. By default, these files are stored in the computer's Documents folder, in the DataView® sub-folder (Documents/DataView/).

- **.icp files**, also called Instrument Control Panel files, contain the raw data downloaded from the instrument. These files are created when you open the DataView® Control Panel and save downloaded measurement data to the PC. Note that each DataView® Control Panel has its own .icp file format. DataView® assigns names to these files as they are created, based on data such as the name of the recording session as it is stored on the instrument, the name of the Control Panel creating the file, and other factors. By default, .icp files are stored in the DataFiles sub-folder in the DataView folder (Documents/DataView/DataFiles).
- **.dvb files**, also called DataView® database files, contain data that has been specially formatted for report generation within DataView®. These files are created automatically when you use the DataView® interface to create a report from an .icp file. The name of the .dvb file is based on the name of the .icp file. As with .icp files, .dvb files by default are stored in the DataFiles sub-folder (Documents/DataView/DataFiles).
- **.dvt files** are DataView® report templates. These templates determine how the data contained in the .dvb files is organized and displayed. DataView® includes a number of standard templates that come with the product. You can also create templates to your own requirements and specifications. Standard templates come with pre-defined names; while custom templates are assigned names by the user who creates them. By default, .dvt files are stored in the Templates sub-folder in the DataView folder (Documents/DataView/Templates).
- **.dvw files** contain DataView® reports. Whenever you save a DataView® report, the program creates a .dvw file to store it on the PC. The name of the .dvw file is assigned

by the user when the report is saved. By default, these files are stored in the Reports sub-folder (Documents/DataView/Reports).

The basic process flow is as follows:

- (1) When you open DataView® and use the Control Panel to download and save measurement data from your instrument to the PC, the Control Panel creates an .icp file to store this data.
- (2) If you then choose to view this data as a report, DataView® creates a .dvb file as the database in which to store the data derived from the .icp file.
- (3) DataView® then prompts you to choose a .dvt file as the template to use to select, organize, and display the data in the .dvb file. (4) If you then save the report, DataView® creates a .dvw file in which to store it.

## Spreadsheets

Downloaded measurement data can also be organized and displayed as a Microsoft Excel-compatible spreadsheet, via the "export to a spreadsheet" option in the Control Panel.

When you do this, the data is stored as either an .xls (Microsoft Excel) or .csv (comma-separated values) file, depending on the Control Panel used. Either file type can be viewed as an Excel-compatible spreadsheet. Although these file types are not unique to DataView®, they can play an important role in viewing and distributing data recorded by AEMC® instruments.

## Other DataView® File Types

In addition to the ones mentioned above, there are two other file types associated with DataView®. The first is .dvc, or DataView® configuration file. This contains the instrument configuration settings specified by the user through the Control Panel. Some Control Panels allow you to save these settings to a file on your PC, and then use this file for future configuration sessions. This can be useful in situations when you want to configure multiple instruments in exactly the same way.

Also, some long-time users of DataView® may have encountered the file type .dvl, or layout file. This file contains layout settings that define how the Control Panel displays data on the PC screen. Layout files are no longer used by more recently developed and

released versions of DataView® Control Panels, so in most situations it's probably unlikely you'll ever have a need to work with .dvl files.

## Summary

The following table lists all the DataView® file types described in this article:

File type	Definition	Contains
.icp	Instrument Control Panel file	Measurement data downloaded from the instrument to the PC
.dvb	DataView database	.icp data formatted for DataView report generation
.dvt	DataView template	Template for organizing and displaying .dvb data
.dvw	DataView report	.dvb data formatted by the selected .dvt template
.xls*	Microsoft Excel-compatible spreadsheet	.icp data formatted as an Excel-compatible spreadsheet
.csv*	Comma-separated values file	.icp data formatted as a "comma separated values" file (viewable as a spreadsheet)
.dvc	DataView configuration file	Instrument configuration settings entered through the Control Panel
.dvl	DataView layout file	Layout instructions for the Control Panel interface (not used by recently released Control Panels)

*\*Not unique to DataView*

# AEMC® Instruments' YouTube Channel



## Dataview Tutorials



AEMC Instruments -  
DataView Introduction



AEMC Instruments -  
DataView Installation Pr...



AEMC Instruments -  
DataView User Interface



AEMC - DataView -  
Connecting Instruments ...



AEMC Instruments -  
Configuring PEL Throug...

## Ground Resistance



AEMC - 6472 Ground  
Tester - Tower Testing wi...

AEMC's YouTube channel provides another medium to learn how to use our instruments effectively. Each video addresses an individual topic, such as recording a measurement on a specific instrument, and presents it in a visual, easy to understand manner. Videos are generally short, usually running no more than a few minutes each, and can be viewed at the customer's convenience. They are designed to complement each other, so that material learned in one video will be useful when watching a more advanced video.

One recent example is a series of short videos related to AEMC's DataView® data analysis software. This video series thus far covers the following topics:

## Megohmmeters



AEMC - 6555  
Megohmmeter - 15kv M...

- Introduction to DataView®
- Installing the DataView® software
- Quick tour of the DataView® user interface
- Connecting an instrument to DataView®
- Configuring an AEMC® Power & Energy Logger (PEL) through the DataView® PEL Control Panel
- Viewing PEL real-time data in DataView®

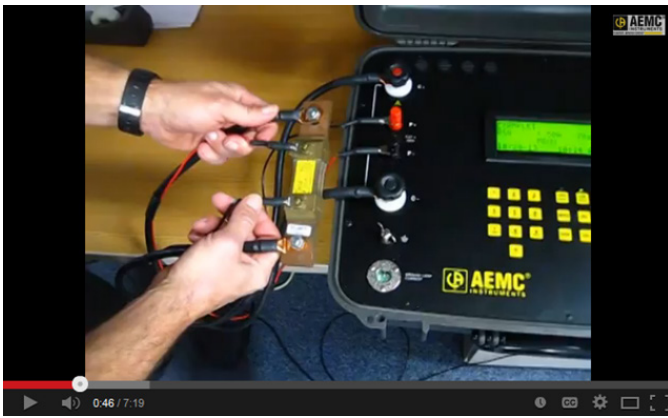
## Micro-Ohmmeters



AEMC - 6292 Micro-  
Ohmmeter - Part 1 - How...

More DataView® videos are planned for release over the upcoming weeks and months. These will cover topics such as working with various instrument Control Panels, creating and analyzing DataView® reports, setting up recording sessions, and others. The ultimate goal of this series is to offer a comprehensive video library covering all the major aspects of how to use DataView® to collect and analyze data provided by AEMC® instruments, augmenting other forms of technical content such as instrument user manuals and online Help. These videos as a group will serve as an informal online "course" on DataView®, introducing novice users to basic DataView® concepts and eventually moving on to more advanced topics. Similar video series are also planned.

Other videos cover performing tasks with AEMC® hardware, including micro-ohmmeters, megohmmeters, ground testers, power analyzers, data loggers, and other products.



*A scene from a video explaining how to record a measurement on the AEMC® Micro-Ohmmeter Model 6292.*

Some AEMC® videos answer a specific customer question or problem. For example, one recent video explains how to connect an AEMC® Simple Logger® to a PC using Windows 7. This video was developed in direct response to a number of Customer Support calls from users looking for additional information about this subject. AEMC® is carefully monitoring Customer Support calls for consistent themes and frequently asked questions, as a guide for planning future videos.

Other AEMC® videos are targeted towards viewers who may not yet own AEMC® products but are interested in learning more about one or more instruments. These videos offer a quick demonstration of the capabilities of the subject instrument, to help potential customers understand how the instrument is used and whether or not it is suitable for the viewer's requirements.

To stay current with the AEMC® YouTube channel, you can subscribe to it to receive an email notification whenever a new video is produced. And if you have any ideas for topics for future AEMC® videos that you would find helpful, please email your suggestions to:  
[techsupport@aemc.com](mailto:techsupport@aemc.com) or [techinfo@aemc.com](mailto:techinfo@aemc.com).



# AEMC® Interview:

*Guy Belliveau,  
Technical Support*



*Some of you may already know Guy Belliveau as one of the patient, helpful voices of AEMC® Technical Support. Based in Dover, NH, Guy joined AEMC® in mid-2013.*

*In this interview, he shares some of his thoughts and experiences providing answers to customer questions from around the world.*

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**Q. How do you prepare for customer calls? Do you have to know "something about everything," or are there certain areas upon which you focus?**

**A.** There are a lot of variables to each caller's problem. The more knowledge I have of the product lineup, the quicker I can help a customer. After joining AEMC®, I focused on learning as much as possible about our ground testers, power products, and megohmmeters. These three product lines typically account for the largest portion of the support calls.

You can also be surprised by a caller having issues with a long-discontinued product that's been their "go to" instrument for the past 20 years! I've been proud to guide them through their issues or help them select the best replacement out of our current catalog offerings.

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**Q. Are there subjects which customers frequently ask about?**

**A.** Many customers have a need for an instrument but don't know the exact one. With the rapidly changing technology, it can be hard for a user to keep up with all of the latest capabilities and new features. I enjoy helping customers select the correct instrument for their application.

In addition, ground testing questions concerning instrument specs, methods and jobsite analysis are frequently asked. Our ground testers can be used in a wide variety of applications and scenarios which some callers need help navigating and understanding.

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**Q. Which questions can be answered relatively quickly, and which usually require additional research before getting back to the customer?**

**A.** Customers looking for specifications and general instrument information are relatively easy to answer. Some of the information is freely available on our website but some callers don't have the time to search and would rather speak to someone and get an answer immediately.

The tough questions are the ones requiring research. Customers who try to use our instruments in situations we've never encountered before can create the need for extensive research before we can provide an answer.

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**Q. Do your calls generally come from the U.S., or do people also call in from other countries?**

**A.** Approximately 9 out of 10 callers are within the continental US. We get a lot of Canadian callers, as well. In my short time here, I've received calls from Guam, Hawaii, Alaska, Philippines and South America.

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**Q. What are some of the resources you have available to you to help answer questions?**

**A.** My resources are a mix of information. The AEMC® website, accessible to



customers, contains a lot of good technical documentation, application notes, datasheets, brochures, user manuals and product videos. Oftentimes most answers can be found in one or more of these places.

I also have access to information that customers do not. I can access a wide range of service and calibration manuals as well as direct interaction with our Product Engineers, Calibration and Repair departments. Eventually, no matter how many people I have to ask, I will find an answer!

**Q. Other than calling on the phone, what other support resources would you recommend to AEMC® customers?**

- A.** As mentioned previously, our website has a lot of technical information regarding our products and I encourage customers to explore and garner as much information as they can from it. In addition, we also are constantly adding videos to our AEMC® Instruments YouTube Channel ([www.youtube.com/user/AEMC\\_instruments](http://www.youtube.com/user/AEMC_instruments)). Our videos show new products, features, software usage, connectivity and instrument usage. We've received a lot of positive feedback and intend to continue to expand our YouTube offerings in the future.

**Q. What have you learned about customers since joining AEMC®? Is there anything that has surprised you?**

- A.** I've learned that our customers are very knowledgeable about their chosen fields and they are not afraid to ask for help when they need it.

I've been surprised by the number of callers that are actually in the field, on the job site, with an instrument in their hand, who have had no training on it and don't know how to use it. Generally this increases the urgency of the call and I'm more than willing to help them in any way I can. It's a good feeling to know that I can help them out and get the information they need to do their job.

**Q. What general piece of advice would you offer to all AEMC® customers?**

- A.** The customers should know that no matter how big or small the issue or problem may seem, we're here to help you through it. Just pick up the phone and dial **1-800-343-1391 x351** or email [techsupport@aemc.com](mailto:techsupport@aemc.com) or [techinfo@aemc.com](mailto:techinfo@aemc.com) to get the help you need.

In addition, I would also like to tell customers that no job is so important and no service is so urgent that you cannot take time to perform your work safely! *Thank you.*



## Customer Support Tip

### Legacy DataView® Version for Discontinued Instruments

Many customers call AEMC® looking for software support for the discontinued products such as Sentinel and Power Quality Logger (PQL) instruments. The most recent version of DataView® no longer supports these products.



Now available on our website is the legacy version (v3.09.008) of DataView® that supports these instruments. This version is available in English, French, and Spanish. To access these files, [click here](#) or follow these steps:

1. Visit us at [www.aemc.com](http://www.aemc.com).
2. Click the link labeled Software and Firmware Updates.
3. Click the link labeled DataView® Software.
4. Find the notice that reads "DATAVIEW NO LONGER SUPPORTS THE PQL & SENTINEL LOGGERS." Below this notice is a link labeled CLICK HERE; click this link.
5. Click the link desired language (English, French, or Spanish) and follow the download instructions.

**NOTE:** AEMC® does not support this legacy version of DataView® and there will not be any further feature or bug updates to this version.

# New AEMC® Instruments' Products

The following are brief descriptions for a few recently released products from AEMC® Instruments. For more information about these and all other AEMC® products, see [www.aemc.com](http://www.aemc.com).

## PowerPad® III Model 8435

The PowerPad® III Model 8435 is a waterproof, three-phase power quality analyzer that is easy-to-use, compact and shock resistant. It enables technicians and engineers to measure and carry out diagnostics and power quality work on one-, two- or three- phase networks. Four voltage and four current inputs are provided. It is IP67 waterproof rated when recording with cover closed.



PowerPad® III Model 8435

The Model 8435 has 2GB of memory available for storing trend data. Additional internal memory lets you store alarms, transients, inrush and snapshot data synchronized or independent of each other. The user can store up to 50 screen snapshots, up to 210 captured transients that contain four cycles for each active input, and 10,000 alarm events from up to 40 different parameters. Trend data can also be recorded for days, weeks or even months. Inrush current can also be captured and stored.

## PowerPad® III Model 8333

The PowerPad® III Model 8333 is a portable three-phase network analyzer designed to measure RMS (root mean square) values, powers, and perturbations of electric distribution networks; deliver a snapshot of the principal characteristics of a three-phase network; and track variations of specified parameters over time. This instrument enables technicians and engineers to measure three-phase networks, and perform diagnostics and power quality work.



PowerPad® III Model 8333

The Model 8333 has three current and four voltage input terminals and includes 2GB of memory for storing a variety of measurement data. Data is viewed on the instrument's color LCD display in up to six different modes:

- Waveforms displays volts, amps, THD, and Crest Factor by phase or for all phases.
- Harmonics displays harmonics out to the 50th for volts, amps, and VA.

- Trend records and displays trend data at user selectable sample rates and user programmable recording periods.
- Alarm Events provides a list of the alarms recorded according to the thresholds programmed during configuration. Up to 40 different alarms can be programmed.
- Power/Energy records and displays power levels and associated parameters (power factor, displacement, and tangent)

The 8333's accuracy is better than 1% (excluding accuracy of the current sensors). A choice of sensors allows measurements ranging from a few milliamperes (MN93A) to several kiloamperes (AmpFlex®).

Specs	8333	8435
Input Terminals	4 Voltage / 3 Current	5 Voltage / 4 Current
AC Volts – Phase-Neutral	1000Vrms	1200Vrms
AC Volts – Phase-Phase	2000Vrms	2400Vrms
DC Volts	1200Vdc	1697Vdc
AC Current – Max	10k AAC (Probe Dependent)	6500 AAC (Probe Dependent)
DC Current – Max	5000 Adc (Probe Dependent)	1200 Adc (Probe Dependent)
Flex Sensors Selectable Ranges?	Yes 100A/6500A/10kA	No – MiniFlex = 1000A AmpFlex = 3000A
Transient Mode	7 detections stored 51 Transients recorded	7 detections stored 210 Transients recorded
Alarm Mode	10 types of Alarms 4662 events recorded	40 types of Alarms 16,362 events recorded
Inrush Mode	No	Yes – up to 10 minutes
Flicker	PST (Short Term)	PST & PLT (Short & Long Term)
Photograph Mode	Yes 12 Screenshots	Yes 50 Screenshots
DC Power Mode	No	Yes
Power/Energy Units IEEE 1459	Yes	No
Energy Units	Ph, Q1h, Dh, Nh, Sh	Wh/Joule/Nuclear toe/ Non-nuclear toe/BTU, varh, VADh, VAh
Protection – IP Rating	IP53	IP67

## 200A Micro-ohmmeter Model 6292

The 200A Micro-ohmmeter Model 6292 is a portable, microprocessor-controlled instrument. It incorporates optimized filters and protection for measurements in electrical substations. The Model 6292 can be used to accurately measure very low contact resistances on high voltage circuit-breakers and switches, busbars, etc., with variable test currents up to 200A. It employs the 4 terminal-method Kelvin principle to eliminate errors caused by test leads and their contact resistances.



Micro-ohmmeter Model 6292

Measurement accuracy is assured through a state-of-the-art signal amplification system, offset-free with high long-term stability. Resistance readings are shown in the alphanumeric display with up to 4½ digit resolution. It allows measurement of resistances up to 1Ω with resolution as low as 0.1μΩ. Test currents may be adjusted by the operator and are displayed on the digital display.



**Chauvin Arnoux<sup>®</sup>, Inc. d.b.a. AEMC<sup>®</sup> Instruments**

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