AEMC® INSTRUMENTS
CHAUVIN ARNOUX GROUP

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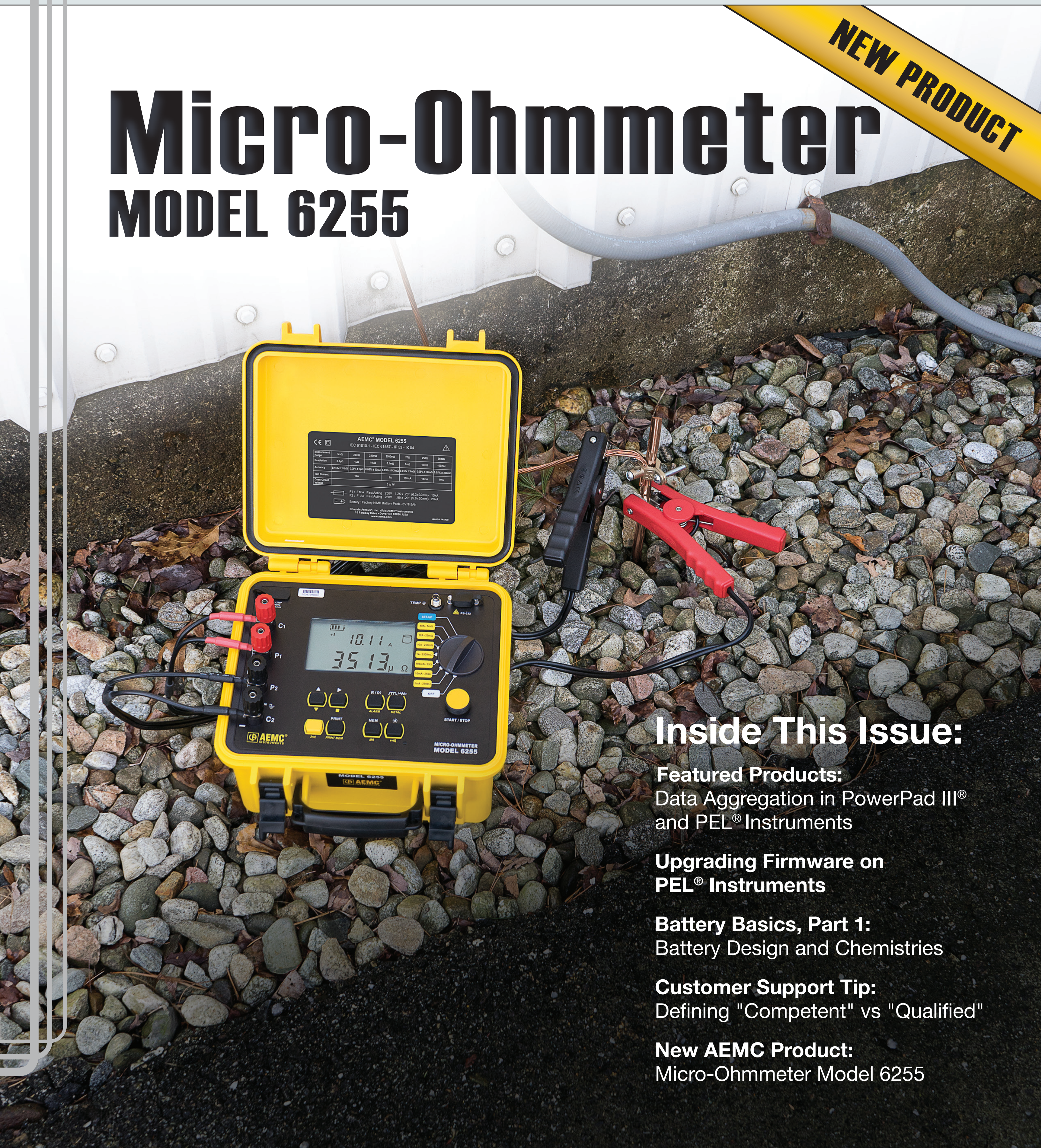
NEW PRODUCT

Micro-Ohmmeter
MODEL 6255



Inside This Issue:

Featured Products:

Data Aggregation in PowerPad III® and PEL® Instruments

AEMC's Power and Energy Loggers Model PEL instruments provide all the necessary functions and features for power and energy data logging for most 50Hz, 60Hz, 400Hz, and DC distribution systems worldwide. Primary users include contractors performing power system evaluation and monitoring. These instruments measure phase-to-phase, phase-to-neutral, and neutral-to-earth voltage, measuring up to 1000 volts. They also measure phase and neutral current, using a variety of external current sensors. Measurement data is then used to calculate numerous values, including active, reactive, and apparent power and energy; crest factor, harmonics and total harmonic distortion; and others.

The AEMC PowerPad family of instruments combine data logging with sophisticated power quality analysis. These instruments are portable three-phase network analyzers designed to:

- Measure RMS values, powers, and fluctuations of electric hookups
- Deliver a snapshot of the principal characteristics of a three-phase network
- And track variations of specified parameters over time.

These instruments enable utility company technicians and engineers to measure single and three-phase networks, and perform diagnostics and power quality analysis. Trend data can be recorded for days, weeks or even months. Inrush current can also be captured and stored.

When recording data, AEMC PowerPad and PEL instruments perform data aggregation. This involves determining the average value for a measured parameter over a user-specified time interval. Aggregation saves storage space by reducing the number of measurements recorded over the duration of the recording. It also ensures more accurate and complete data by including all individual measurements in the aggregation, rather than periodically taking single measurements.

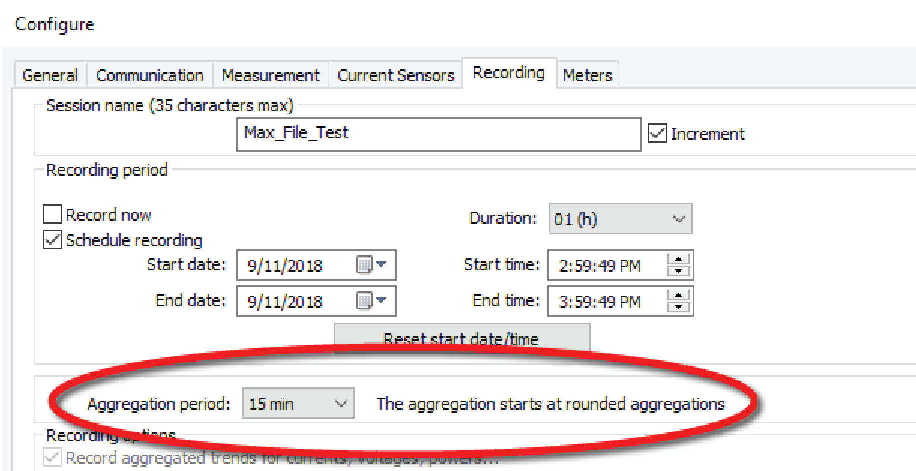
The interval over which aggregation is performed can be selected by the user. Some AEMC models allow you to do this through the instrument interface, while others require configuration via AEMC's DataView software.

Some instruments allow aggregation periods as short as one second, while others let you set the period up to one hour. Shorter periods are recommended for short recordings containing minute-by-minute detailed measurements, while longer periods are ideal for monitoring long-term trends for several weeks or months. The typical aggregation period used by utility companies in the U.S. is 15 minutes, while in Europe the period is typically 10 minutes.

Note that aggregation does not affect how often an instrument takes each measurement. Instead, during the recording session the instrument take measurements at a constant rate, such as 128 samples per cycle for the PEL. At the end of each aggregation period, the instrument automatically applies a mathematical formula to determine the average of all the measurements taken. Depending on the instrument and measured parameter, the average is determined by calculating the root mean square, arithmetic mean, or other calculation. This average is then recorded in the instrument memory.

The recorded time of the aggregated measurement depends on the instrument model. On PowerPad instruments, the time stamp of the aggregated measurement for most parameters is the beginning of the aggregation period, while on PEL instruments the time stamp is the end of the period.

For example, if you schedule a recording on the PEL to begin at 12:00 and end at 1:00, and select a 15 minute aggregation period, the recording will consist of 4 measurements (12:15, 12:30, and so on until the final measurement at 1:00). On a PowerPad with the same configuration, most aggregated measurements will be recorded at 12:00, 12:15, and so on, with the final measurement at 12:45. The one exception are energy measurements, which in PowerPad recordings are time stamped at the end of the aggregation period, similar to PEL instruments.



Note that aggregation will only begin or end at clock times evenly divisible by the aggregation period. For instance, if a one-hour recording on the PEL begins at 12:06 with a 15 minute aggregation period, the first aggregation begins at 12:15 and ends at 12:30. Aggregation is then performed every 15 minutes, with the final aggregation ending at 1:00. Although the recording continues until 1:06, no aggregation will be performed for the final 6 minutes. Therefore for this recording, only 3 aggregated measurements will be made.

For more information about AEMC PowerPad and PEL instruments, please visit our web site. And be sure to visit our YouTube channel for instructional videos on a wide variety of topics in electronics.

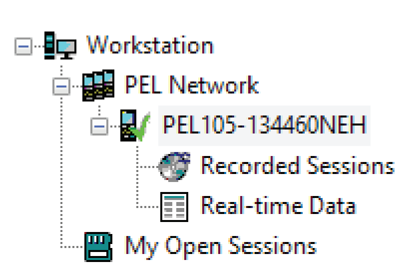
Updating Firmware on PEL® Instruments

The firmware for the PEL series of power and energy loggers (PEL 102, 103, and 105) controls the features and functionality of each instrument model. AEMC provides firmware updates free of charge to download through our DataView PEL Control Panel software. The procedure for updating PEL firmware has been significantly upgraded, to provide a more streamlined user experience. The process of opening the AEMC Download web page, navigating to the PEL firmware downloads, checking the firmware revision number and comparing it to the version running on your instrument, and other tasks has been fully automated.

This short article explains the PEL firmware upgrade process. Before you begin, note that updating the firmware could reset the configuration and cause loss of stored data. As a best practice, we suggest you save the data to a computer before updating. Also ensure that an active recording is not running on the instrument.

To update the firmware, your computer must be running DataView with the PEL Control Panel (V2.2.9665 or later). In addition, the Control Panel option "Check automatically for new firmware for connected instruments upon start of program" must be selected, as it is by default. Then proceed as follows:

1. Power ON the instrument using external power, to ensure the instrument remains ON throughout the update procedure. Also ensure that the battery is at least 50% (and ideally fully) charged. **Do not perform an update with the instrument running on battery power, or with low battery charge. If the instrument turns OFF while firmware updating is in progress, it could become inoperative and require you to send it back to AEMC for repair. External power with a sufficiently charged battery for backup helps minimize the risk of power interruptions during updating.**
2. Connect the PEL instrument to the computer:
   - PEL 102/103: Connect via the provided USB cable
   - PEL 105: Connect via any supported connection type other than Bluetooth or IRD
3. Launch the DataView PEL Control Panel.
4. Ensure the instrument is listed in the PEL Network navigation tree. If it is, skip this step and go to step 5 below. If not, click **Instrument** in the menu bar and select **Add an Instrument**, then connect the instrument using the Add an Instrument Wizard. (Press F1 if you need assistance.)



5. Ensure the instrument is listed with a green check next to its name, indicating it is connected. If not, select the instrument and click **Instrument > Reconnect Instrument**.

6. By default, the PEL Control Panel automatically checks the connected instrument's firmware. If it is out of date, the Firmware Update dialog box appears, listing the instrument and any others running out-of-date firmware.

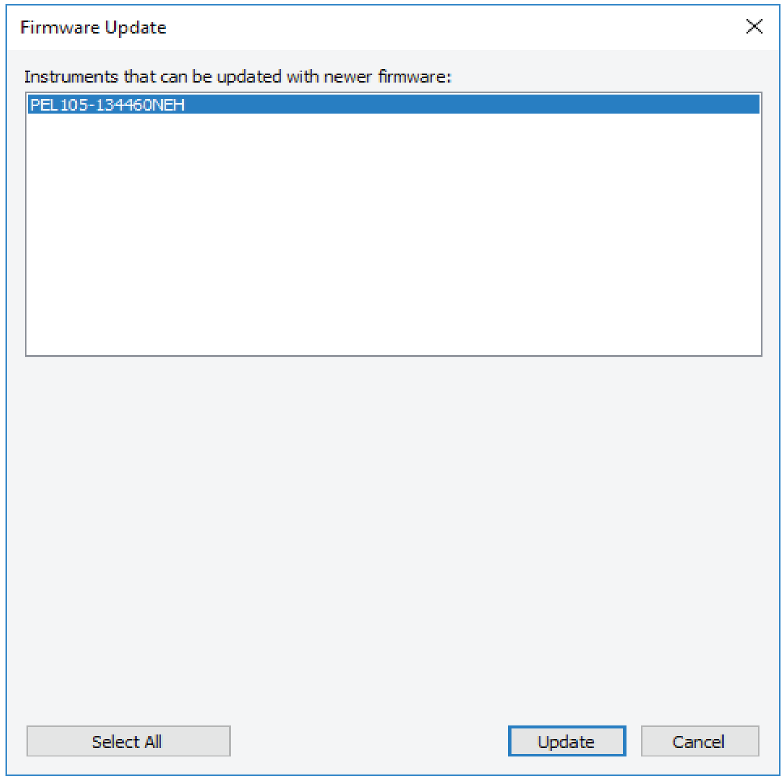
   Click **Update** (or **Select All** to update multiple instruments). This displays the Firmware Upgrade dialog box listing the latest firmware revisions for the PEL DSP and microprocessor; proceed as instructed in Step 7 below.

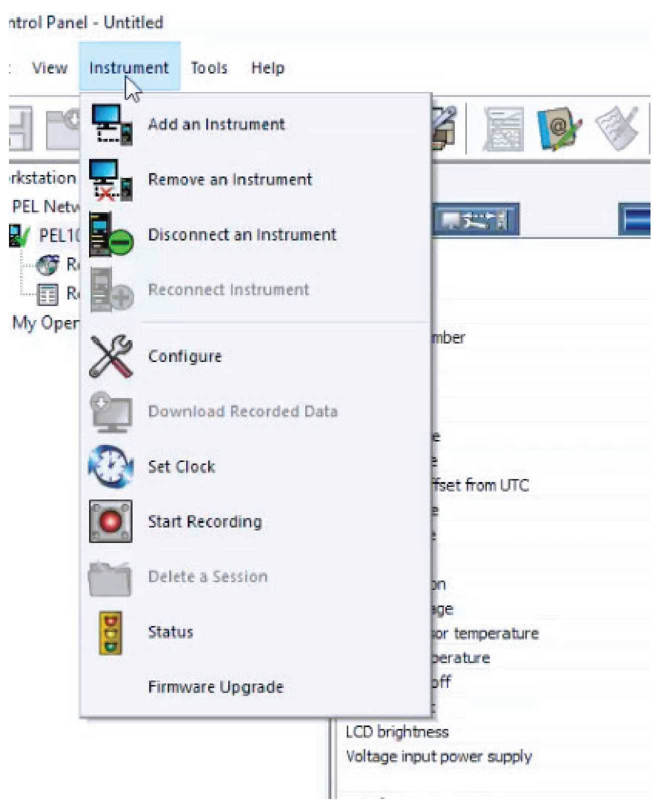
   If the PEL Control Panel option "Check automatically for new firmware for connected instruments upon start of program" has been previously de-selected, the automatic firmware check does not occur. In this case, click Instrument in the menu bar. This includes the option **Firmware Upgrade**.

   If the selected instrument is running the latest firmware, this option is grayed out and inactive. If the instrument is not running the latest firmware, click Firmware Upgrade to display the Firmware Upgrade dialog box.

7. Click the **Start** button to begin the update. During this process, status bars display the progress of the DSP and microprocessor firmware updates. (Note that if only one of these requires updating, only its status bar appears.)

8. When the firmware update is complete, click the **Close** button to exit.





Battery Basics, Part 1:

Battery Design and Chemistries

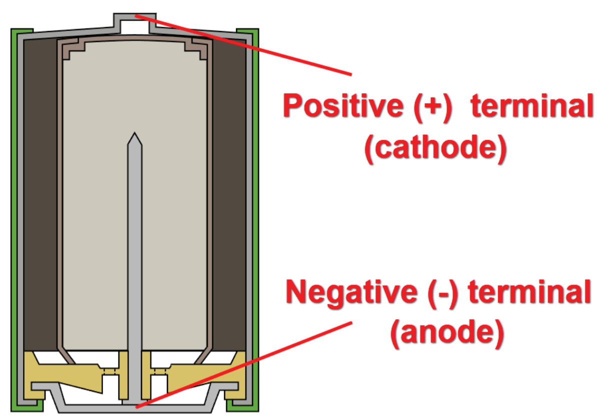
It's no exaggeration to say that the modern world depends on batteries. Whether you're home, at work, or on the road, chances are you're using one or more batteries at any given moment. Batteries come in a wide – and often bewildering – range of types and sizes. Selecting the right one for an application can be a challenge, but it's critical to ensure your electrical devices operate properly when you need them.

This article is the first of a three-part series that provides a quick review of a few key battery concepts. In Part 1, we begin with a brief explanation of how a battery works. We then explain the difference between disposable and rechargeable batteries, and the various designs used for each. In future installments, we will discuss battery specifications, and how to interpret them to judge characteristics such as battery capacity, performance, and life. We will conclude with a review of battery recharging, storage, cleaning, and disposal.

By the end of this series, you should have a good basic understanding of how to select the ideal battery that meets your requirements.

Basic Design

Most people probably know a battery converts chemical energy into electricity. To do this, a battery incorporates one or more voltaic cells consisting of electrolyte material enclosed in a container with two external terminals. The combination of materials is referred to as the battery's chemistry. Electrochemical reactions within the cell produce electrons that accumulate at the negative terminal, called the anode. When connected to a conducting circuit, electrons flow from the anode through the circuit and back into the positive terminal, known as the cathode. This provides direct current for a vast array of electronic devices.



This basic design comes in many variations, encompassing a spectrum of chemistries, shapes, capacities, and other variables.

Each battery has a limit to how much electricity it can produce over its lifetime. Most are discarded when their original charge falls below a useful level, while others are designed to be re-charged and used repeatedly. This difference – disposable versus rechargeable – forms one of the basic divisions between battery types.


Disposable

Rechargeable

Disposable vs Rechargeable

Disposable batteries, also known as primary or single-use batteries, are based on reactions that irreversibly change their chemistry and therefore cannot be re-energized. Rechargeable batteries, on the other hand, employ chemistries that can be discharged and recharged multiple times using an applied electric current; the original composition of the electrodes can be restored by reverse current. Some rechargeable battery types are available in the same sizes and approximately the same voltages as disposables, and can be used interchangeably with them.

The majority of batteries used today are disposable. They have a lower purchase price compared to rechargeable, and also provide several performance advantages. For example, disposables are significantly better at retaining their charge when not in use. Rechargeable batteries are susceptible to self-discharge – in other words, they lose power even when on the shelf. This makes disposables the superior choice for devices where full power needs to be available after long intervals of inactivity, such as emergency equipment. They are also ideal for smoke alarms and other instruments that draw small amounts of power continuously over extended periods.

An obvious drawback of disposal batteries is long-term expense. Rechargeable batteries can be re-energized up to 1000 times, spreading their higher initial price over a much longer period and resulting in a lower per-use cost. Products such as wireless devices and cordless tools have high energy requirements, which cannot be economically met by disposable batteries. As these high-end products proliferate, rechargeable batteries are steadily becoming more common.

Another concern is environmental. Billions of batteries end up in landfills annually. Most contain toxic heavy metals, strong acids, and other hazardous pollutants. Many municipalities have enacted legislation to control the disposal of batteries. Therefore batteries that can be re-used are generally considered the more environmentally conscious choice.

Chemistries

One of the more complicated and confusing aspects about batteries is the variety of materials and chemical reactions they employ to generate electricity. Each of these chemistries has advantages and disadvantages, involving variables such as energy output, capacity, size and weight, safety, and cost. Selecting the right chemistry for your specific application can be one of the more difficult choices in electronics.

Alkaline

To kick off this topic, let's consider alkaline, the most common type of battery chemistry. This is based on the electrochemical reaction between zinc and manganese dioxide. These batteries account for 80% of units manufactured in the US, with over 10 billion produced worldwide, and are used in many household and consumer items. Alkaline batteries are typically disposable, although there has been some recent research dedicated to developing rechargeable products based on this chemistry.

The nominal voltage of a new alkaline cell is 1.5 volts, although this is typically somewhat lower when the battery is under load and higher when it is not. Higher voltages can be achieved by connecting multiple cells in series. For instance, a common 9 volt alkaline battery incorporates 6 separate cells, each equivalent to an AAAA single-cell battery. Note that battery voltage declines steadily during use, therefore the battery's total usable capacity depends on the cut-off voltage of the application.

In general, an alkaline battery's capacity is roughly proportional to its physical size. Larger cells, such as C and D cells, can usually deliver more current than AAA or AA cells.

Lithium

Another chemistry used for disposable batteries is lithium. This is not to be confused with lithium-ion, a different chemistry used for rechargeable batteries we'll discuss shortly. Lithium is used in the majority of so-called button or coin batteries (see illustration to the right), and can be designed to provide energy for extended periods of up to 10 years.

These batteries are therefore the choice for long-life, critical electronics, such as pacemakers and other implantable electronic medical devices. Silver oxide is also used for some button batteries.

Lithium-ion

Other chemistries are used for rechargeable batteries, including lead-acid, nickel-metal hydride, and lithium ion.

One of the most popular batteries for portable electronics is lithium-ion, in which lithium ions move from the anode to the cathode during use and back when re-charging. Lithium-ion batteries provide high energy density and low self-discharge.

A variation of this is the lithium polymer battery, often abbreviated as LiPo. This chemistry uses high conductivity gel polymers to provide higher specific energy than other lithium battery types. This makes them suitable for applications where weight is a critical feature, such as mobile devices and radio-controlled aircraft. LiPo batteries nominally produce around 3.6 volts per cell.

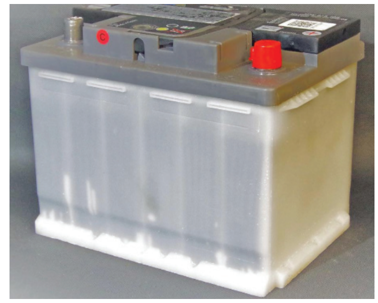
A downside of lithium-ion batteries is high cost. They also present several potential safety risks not associated with other battery types. Lithium ion cells are susceptible to catastrophic failure, including fire and explosion, when exposed to overcharge, over-discharge, or high heat. They are also subject to delamination, resulting in internal damage and reduced reliability in the cell. This is especially noticeable in LiPo batteries, which can visibly inflate. And when punctured, LiPo batteries react with air, generating heat and smoke.

Nickel-metal hydride

Another popular rechargeable chemistry is nickel metal hydride battery, abbreviated NiMH. In some respects, this can be considered a successor to nickel–cadmium cells, commonly called NiCd, which were formerly a popular choice for portable devices. Both use nickel oxide hydroxide. The difference is that nickel-metal hydride uses a hydrogen-absorbing alloy for the cathode instead of cadmium. This provides two to three times the capacity of an equivalent size NiCd, with an energy density approaching lithium-ion at a significantly lower price. As a result, nickel-metal hydride batteries require less frequent recharging than equivalent NiCd batteries when used in the same application. Nickel-metal hydride is also less susceptible to the memory effect, which causes nickel-cadmium batteries to gradually lose their maximum energy capacity if they are repeatedly recharged after being only partially discharged.

Nickel-metal hydride units are suitable for high-current-drain applications, such as digital cameras, due to their lower internal resistance. They are commonly available in AA size. NiMH batteries nominally operate at 1.2 volts per cell, which is lower than alkaline. However, they can still power many devices designed for 1.5 volts, and exhibit a lower voltage drop-off during use compared to alkaline.

Lead-acid



The oldest type of rechargeable battery chemistry is lead-acid. Compared to more modern types, lead-acid batteries have low energy-to-weight and energy-to-volume ratios. However, their ability to provide high surge currents makes them attractive in applications where portability is not a strict requirement. They are also more durable compared to other battery types, and are less affected by extremes in temperature.

Motor vehicle batteries are typically lead-acid. Other applications include providing backup power for cell phone towers, hospitals, and stand-alone power systems. They are also relatively safe and inexpensive.

Rechargeable Chemistry Comparison

To summarize our review of rechargeable battery chemistries, here's a quick comparison of the advantages and disadvantages of each:

- **Lithium-ion** batteries, including lithium polymer, offer superior energy density and small size. This makes them ideal for applications where size and weight is critical. The primary disadvantages of these batteries are expense and safety. Overcharging, over-discharging, temperature extremes, and other conditions can cause them to fail suddenly, resulting in explosion and fire.
- **Nickel-metal hydride** batteries are safe, have high weight-to-power ratios, and are relatively inexpensive compared to lithium-ion. Their main disadvantage is their lower energy density. These batteries are a popular and economical choice for mobile devices.
- **Lead acid** batteries are durable, safe, cheap, and can handle large surge currents. Their disadvantages include their size and weight per power output. Uses include automobiles, power storage, and other applications where space is not critical.

Note that in addition to the common chemistries we discuss in this article, there are several other types, both disposable and re-chargeable, used in various devices and applications around the world. Be sure to check the manufacturer's specifications when considering a battery that uses a chemistry with which you may not be familiar.

This concludes Part 1 of our series on battery basics. In Part 2, we take a look at how to interpret battery specifications (such as capacity, performance, and life) and how to match them to your specific application to help ensure you select the most appropriate battery for your requirements.

Customer Support Tip:

Defining "Competent" vs "Qualified"

Those of us familiar with safety specifications have almost certainly come across the terms "competent" and "qualified." At first glance these words may appear more or less interchangeable, based on their classic dictionary definitions. But within the world of OSHA regulations, "competent" and "qualified" are two distinct concepts. And understanding the difference is critical to ensure your facility is safe and in compliance with all safety rules and regulations.

According to the OSHA definition, a **competent** person

> "…is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them."

Basically, a competent person can recognize a hazard, knows what to do about it, and has the authority to implement these measures.

Compare this to OSHA's definition of a **qualified** person as someone who

> "…by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project."

Typically, a qualified person has received some type of official recognition of a particular expertise.

Obviously, the two terms are not necessarily mutually exclusive. But nor are they equivalent. For example, a competent person has the hands-on experience required to address and rectify a hazardous situation before it endangers equipment and personnel, but may lack the formal training to be recognized as qualified. And although a qualified person may hold a degree or certification in a particular area, there is no guarantee that person also possesses the on-the-job experience required to recognize and understand an emerging problem quickly enough to prevent a significant disruption.

To help understand how these roles differ, consider a manufacturing process that incorporates hazardous materials and high electrical power. A competent person should be on site whenever the process is in operation, as someone who can notice potential danger and shut things down before it places operators and equipment at risk. A qualified person could then be called in to help modify the design of the process to ensure the dangerous situation does not happen again.

In addition, understanding these terms can help reduce potential legal risk. Having a competent person on hand at all times minimizes your exposure to lawsuits and similar court actions. And ensuring that individuals with the appropriate official qualifications have designed, reviewed, and approved your processes and systems can avoid accidents and claims of negligence.

New Product:

Micro-Ohmmeter Model 6255

The 10A Micro-Ohmmeter Model 6255 is a rugged, low resistance tester designed for plant maintenance, quality control, and field use. Utilizing the four-lead Kelvin method of testing, the Model 6255 (which replaces the Model 6250) is one of the most accurate micro-ohmmeters available, with 0.05% accuracy.

Resistance measurements are automatically calculated and displayed, taking into account the measurement value, ambient temperature, reference temperature, and metal temperature co-efficient. Sample temperature can be manually entered by the operator or directly measured by the Model 6255 with an external RTD temperature probe.

The Model 6255 is uniquely designed to conduct tests on both resistive and inductive material, with operator selection directly from the front panel. Three test modes are available; resistive (instantaneous test), inductive (continuous test), and auto (repetitive tests). A key feature is the ability to test at 10A for over 40 minutes.

Includes FREE DataView® software for data storage, real-time display, analysis, and report generation.

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