HOW TO SELECT THE RIGHT POWER METER

WHITEPAPER

Energy Management programs have a substantial impact on the operational cost of a building. Well defined objectives of the program determine which components will be necessary. Virtually all energy management programs will require or benefit from the use of a power meter. Understanding the capability of submeters and their application within a project allows the contractor to bid more effectively, and to provide a more effective solution for their customer.

The steps below are a "How-to" guide that will help you select the best submeter for any application.

1. What Type of Load is Going to Be Monitored?

Is the monitored load single-phase, split-phase or three-phase? What voltage/current ranges are to be monitored? Residential and light commercial applications commonly use single or split-phase supply to drive small motors, fans, blowers, pumps, lighting and plug loads. These applications typically use 120 VAC (sometimes ranging up to 240 VAC) and draw less current than three-phase applications. Single or split-phase applications require a corresponding single or split-phase meter. While some of the more advanced meters are compatible with single, spit and three-phase applications, it is essential to check with the meter manufacturer prior to purchase to ensure this compatibility.

Chillers, air-handling units (AHU's) and process equipment are typically require three-phase power. The advantage of three-phase power is that it provides 1.7 times more power than single-phase power at the same current. Most three-phase motors will range up to 480 VAC (600 VAC in Canada) and can handle current ranges of up to 5,000 Amps. If the monitored load is greater than 600 VAC, a potential (step down) transformer is required to scale the voltage within the operating range of the meter. Many sub-meters require selection of the monitored voltage range when ordering; more advanced meters allow the user to configure the voltage in the field using a broadband power supply. This provides the contractor the flexibility to use the same meter model on several circuits with different power loads.

What's Inside

2. How Does the Meter Need to Be Mounted?

With space at a premium in mechanical rooms, finding a location to accommodate a NEMA4 enclosure for a meter can be challenging. Depending on the mounting flexibility of the meter selected, additional material and labor costs can be significant during installation. The need to install conduit between a meter and the mounted circuits can be costly, as well as certain requirements from manufacturers to use fused leads (fuse pack) with their meters. Many of these costs can be avoided by selecting the correct meter, however it is critical to make sure that a meter is mounted in adherence with National Electrical Code (NEC) and local electrical codes.

When connecting to an electrical source it is recommended that the voltage leads are connected through an electrical breaker with properly sized wiring (in order to comply with UL61010-1 and the UL listing). If a wire is damaged, the breaker is the protection for any short that might happen just as it is for any other device connected through a breaker. Per NEC 240.21 (B)(1), code states that a 14AWG wire can be connected to a breaker with a rating up to 150A if the run is 10' or less and either in an enclosure or raceway. This means that a meter with the proper form factor and safety ratings can be mounted directly inside of an electrical panel, without the need for fused leads; these meters provide significant material, labor, and time savings. Not all meters are capable of this installation flexibility, so speak to the manufacturer before purchasing the meter to ensure that mounting the specific meter inside of an electrical enclosure without fused leads is in adherence with NEC feeder tap codes. The Power Patrol is internally fused and is cULus listed to UL61010-1 without the need for fused leads.

3. What Type of Current Transformers Will Be Used With the Meter?

Once the type of meter has been defined, the next step is to select the type of current transformers (CT's) to be used. The two most common types of current transformers used with power meters are split/solid-core CT's and Rogowski coils. Split/solid-core CT's have historically been the industry standard, however over the last decade technology innovations have made Rogowski coils the preferred CT's for contractors. Standard split/solid-core CT's are sized for specific amperage to give the user better accuracy based on the monitored load (e.g. 0-20A, 0-5,000A, etc.) As the amperage requirements increase, so does the size, weight cost and linearity error of the current transformer. Most standard split/solid-core CT's have a 0.333V output, which makes it a "safe CT" because the output has a low potential to harm the installer. However, some manufacturers only offer 5A output CT's which are considerably more dangerous and should be installed with extreme caution in order to avoid injury.

CT installation can be difficult and time consuming, which is why Rogowski coils are extremely popular with installers. Busbars and irregular shaped cable bundles are common in applications with high power requirements. The flexibility of Rogowski coils can save the installer a great deal of time and physical exertion because of how easily they surround a conductor. Rogowski coils have a current range of 5-5,000A depending on the max current rating of the meter. This means any Rogowski coil can be installed in any application, regardless of monitored amperage load. For low amperage loads <5A, split/solid-core CT's remain the better option. However, recent advancements in Rogowski coil technology allow Rogowski coils to equal or exceed the accuracy of split-solid-core CT's, making them a superior option for any installer or contractor in submetering applications.

4. How Will the Meter Communicate?

Power meters can communicate through a variety of methods or protocols; pulse, BACnet (MS/TP or IP), Modbus (Serial and TCP), LON, as well as a host of wireless options. Understanding these options is essential to selecting the right meter. Pulsed output is very common in single-phase applications, where less information is required by the end user. Meters with a pulse output transmit a single parameter such as kW or kWh to track cumulative energy consumption. Meters using advanced protocols such as BACnet, Modbus and LON have the ability to communicate all parameters through a building automation system, providing the end user with a more complete picture to understand the consumption data. Advanced protocols are typically used in commercial and industrial facilities, and are more common in energy management programs that require a more granular level of data illustrating a facility's energy use. Some newer meters offer multiple connectivity options in the same meter, which provides superior flexibility during installation and reduces the risk of buying the wrong part number during the ordering process.

Wireless sub-meters are becoming more prevalent because of the cost savings associated with installation. There a number of different options for wireless metering from mesh to cellular; no single solution is right for all applications. Frequency of data transmission, type of application and required range are all key factors in determining the right wireless system for the job.

5. Field Configuration

The ability to configure a meter in the field is extremely important. Historically, meters were built to order using a long part number which clearly defined the monitored current range, CT type and communication protocol. When installing a pre-configured meter, if the wrong part number is ordered, the meter cannot be installed and must be exchanged for a different meter which meets the specification. Perfect information is not always available to the contractor prior to installation, so when modifications are required on the job site pre-configured meters become a large inconvenience. Advanced meters offer varying levels of field configurability either through a menu interface on the meter or through a PC to meter connection. Some offer the ability to configure CT values, CT types, and communication protocols. Setup profiles of some meters can be cloned and copied to subsequent meters, significantly reducing set-up and installation time.

If mistakes are made and a pre-configured meter arrives on a job site with the wrong settings, time and money are wasted and the contractor has to come back to finish the installation at a time they would prefer to be on another job. A configurable power meter is more forgiving on the job site and eliminates the risk of receiving the wrong part number. Every good contractor knows that "call backs break the bank" and the nominal cost savings of a factory configured meter are insignificant compared to the loss of time, money, and customer goodwill when the 'wrong' meter arrives at the job site.

6. What is Total Installed Cost?

All of the considerations above contribute to a meter's total installed cost, which is perhaps the most important factor to consider when selecting a meter. Total installed cost takes purchase price, labor costs, and project compatibility and effectiveness into account so the contractor can better understand costs prior to bidding a job. More accurate bids will win more jobs. The greatest time loss in meter installation is usually in configuring the meter, installing CT's around busbars or cable bundles, and safely/appropriately mounting the meter.

Not all meters are created equally. Some meters have a lower purchase price, but a higher total installed cost. Before selecting a power meter, understand the application requirements, installation requirements, and the available metering options. These factors will give you the best bid, and the most effective solution for your energy management needs.

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About Setra:
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