POWER MONITORING:

Successful Studies Follow a PROCESS

By Michael Daish

Introduction

Newsflash! Not all power studies are successful! Why? Usually because of errors in operation or connection. How can we ensure successful studies, first time, every time and eliminate the possibility of mistakes? Let's begin by asserting that a power study is a process. Consider that whether you are balancing a panel, data logging at a load, performing an energy audit, or conducting a power quality investigation, it's a process. There's a beginning, a middle, and an end involving several activities. This paper discusses the "process" and how PowerSight® meters take into account the entire process to ensure a successful outcome.

The Role of the Test Meter

The meter plays the central role for data collection. But how will it enable the steps in the process? And will it deliver a good user experience? Most meters do collect the essential data, but as will be seen, to achieve success there are other considerations besides just data collection and measurement.

Why Studies Go Wrong

The major reasons why power studies are unsuccessful are due to:

1) Bad planning
2) Incorrect voltage and current connections
3) Incorrect set-up in the meter
4) Corrupted data
5) Difficulty presenting the results

As we describe the process we will show how these problems can be avoided.

The Steps in the Process

The power study process can be broken down into these steps:

- Prepare for connecting safely – put on NFPA 70E safety attire
- Connect meter with voltage and current probes to conductors
- Setting-up and programming of the meter
- Measurement and recording of data with meter
- Return to collect the meter data – suit up again in safety gear
- Download or transfer the data to PC
- Analysis of data in PC
- Generation of final report - documenting results, making recommendations

Planning

Good planning is vital. A good plan begins by declaring what you want to accomplish by defining the problem that you want to solve. Some examples:

"I need to add more load(s) – will my panels / circuits support the new additions?"

"We need to reduce energy consumption – I need to perform an energy audit."
"How are the energy savings measures we have implemented performing?"

"This transformer is very hot – is it overloaded, or are high harmonics the cause?"

"My (machine/process) is operating erratically – is power quality the cause?"

"When the HVAC (or motor or other equipment) turns on the breaker trips, why?"

"I'm commissioning a UPS and need to verify it's performance."

You can probably come up with other examples of your own. The point here is to understand and declare the objectives of the intended power study. What will the "big result" look like when the study is complete? Many studies fail because the user isn't sure of what should be accomplished. Articulate the "end-game" and you have a direction to aim in – so describe the goal.

Summit Technology has identified over 70 possible errors and has developed a technology called SureStartTM to eliminate connection problems. It is software in the meter that checks the connections and advises of errors before you begin monitoring. SureStart makes these determinations regardless of the power system type, in the presence of multiple connection or wiring errors, and presents the results in clear English statements.

Continued on page 16

Connecting Correctly

A common problem is discovering at the end of the study that the data is useless due to connection errors. Here are just a few examples:

Voltages misidentified	One, two, or three currents not connected to source
Currents misidentified	One, two, or three currents not connected to measuring system
Two voltage connections switched	One, two, or three voltages not connected
Two current sensors switched	Two or three connections to the same voltage
All voltages rotated one position left	Two or three connections to the same current
All voltages rotated one position right	One, two, or three current sensors backwards
One phase not present	Non-standard frequency due to power system problem
Two phases not present	Non-standard voltage due to power system problem
All currents rotated one position left	Neutral not connected to ground
All currents rotated one position right	Non-standard voltage due to improper loading
Three phases not present	Two phases shorted to neutral or ground
One phase offered as two or three phases	Non-standard phase shift between phases due to power system problem
One phase shorted to neutral or ground	Combinations of the above listed errors

Connect and Monitor with Safety

Summit Technology recently introduced three PowerSight models: the PS2500 Data Logger, PS3500 Energy Analyzer, and PS4500 Power Quality Analyzer with a stringent CAT-IV safety rating for hand-held meters. They can withstand an 8,000 V surge at a 600 V service so you can feel safe using the meters at 600V circuits or below. With Bluetooth wireless communications you can observe waveforms and real-time meters, check connections, view phasors, all on a PC or PDA. You can do this remotely and safely from up to 20 feet away from dangerous high voltages without the need to wear cumbersome and restrictive PPE (Personal Protective Equipment) safety gear. Under NFPA 70E it's mandatory to wear PPE to install the meter's voltage and current probes on energized circuits. Unfortunately, PPE involves wearing visors that impair visibility of the meter display. Thick gloves also make operation of tiny meter buttons a challenge. Such restrictions can introduce operator errors. With Bluetooth the operator can move to a safe zone a few feet away to remove gloves and visors and operate remotely.

Correct Set-Up

Programming errors can render the survey useless before we have even begun! PowerSight meters allow you to create and save set-up files for different three-phase and single-phase scenarios. Thus you can create a library of set-up files for recall to minimize errors and save time.

Download of Data to a PC

At the end of the study period the user retrieves the meter, wearing the appropriate PPE safety clothing of course, to download data to a PC. Download of data with the PowerSight meters is either via Bluetooth or by a memory card. New models of PowerSight meters have SD memory card slots to accept cards up to 2GB.

Data Analysis and Reports

After downloading, the data is analyzed. Then you generate a report. Summit Technology's PSM software for the PC has excellent analysis tools for viewing logs and events, zooming and expanding areas of the graphs, and printing of log graphs with annotation. Export of data to an Excel spreadsheet just takes a mouse click!

Documenting the results and creating a final report involves reporting on as many as 140 different parameters. Imagine having to manually cut and paste to tabulate each parameter individually, going back and forth between Excel and Word for each value in multiple Continued on page 18

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operations. That would be tedious and time-consuming. The PSM software Report Writer "wizard" makes the task easier. It automatically creates a complete report in just a couple of mouse clicks. You can filter the results to make your report as broad or as focused as you need. You can also edit the text to add your conclusions. It takes about a minute. And here's the good news – the power study process is now complete!

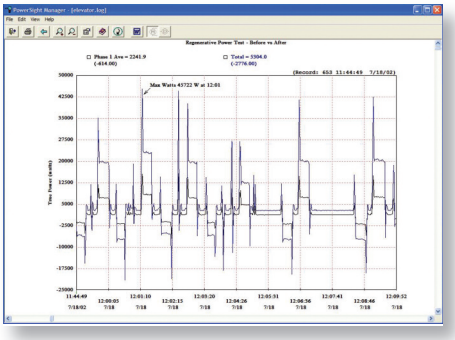
Conclusion: Successful Studies and A Better User Experience.

When the user experience and the monitoring "process" are considered there are significant distinctions for PowerSight meters. They are the most portable monitors on the market; they fit in your hand and weigh only 1lb. They are easily transported and their small size enables them to be installed in switchgear and equipment in voids "out of sight" and are thus less prone to tampering – a common source of data corruption and wasted surveys.

Commercial power monitors all use similar measurement techniques so there is no distinction between them in terms of what they measure. PowerSight meters measure and record (log) volts, amps, watts, va, var, power factor, total harmonic distortion (THD), frequency, and energy (kWh) for single-phase and three-phase power types. The PS4500 Power Quality Analyzer also measures sags, swells, and transients. The PS4500 also has options for motor diagnostics and measuring high-frequency noise.

When choosing a meter consider the "process". There are other considerations to be taken into account besides the data capture. At Summit Technology we assert that the meter should provide:

- Appropriate safety rating (CAT-IV) for NFPA 70E rules
- Remote communications for up to 20 feet away via Bluetooth so workers can safely and comfortably perform measurements without the encumbrance of PPE safety clothing
- Warn of connection errors
- Minimize set-up errors with pre-configured set-ups



- Provide extensive PC data analysis tools, and export of data to Excel
- Versatile Report Writer software wizard to automate documenting results
- Small size and weight
- Good documentation

At Summit Technology we have developed technology to give a more satisfactory user experience by designing meters that address the entire process as described above. Use a tool that is designed to fit the process and you too will enjoy successful power studies. ❑

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