

Branch Circuit Monitoring: Power Monitoring and Measurement in Production Facilities

Moving Away From a Break-Fix Model for Power

This application brief will address many of the power infrastructure challenges that are common in factories, production facilities, and large distribution centers. Provided will be real life, on-site experiences as well as an outline of steps required to overcome these costly challenges. In many cases, the implementation of affordable and easy-to-install modular technology has helped address these issues. One vital component to combat these costly encounters is the development of a strategy to troubleshoot them when they occur. This will help minimize downtime, keep cost down and production up.

Why Branch Circuit Monitoring?

With the increase of machine and industrial automation, power consumption is on the rise. The ever-changing conditions in today's production facilities and data centers can result in costly damages if circuit breakers become overloaded. As a result, monitoring power consumption has become an important issue in the functionality and reliability of the data center.

Earlier approaches to power monitoring in both data centers and industrial facilities did not take into account branch circuits feeding multiple power strips, or could not measure the power consumption of components not being fed from a power strip. Branch circuit monitoring was originally developed for the data center as a means of addressing these issues by measuring power use at the branch circuit level.

The primary concern of facilities/production monitoring was to ensure that circuit breakers were not overloaded. More recently, metering has evolved into measuring the power capacity and usage of each production unit for the purposes of balancing loads and provisioning power. Operation managers are becoming increasingly concerned about power from a cost and future expansion point of view. They are beginning to work with facilities engineers to request BCM as a way to obtain refined data on power use.

Branch circuit monitoring systems can be integrated into new main power panels (Power Distribution Units) and remote power panels (RPPs), as well as retrofitted into existing PDUs and RPPs without causing disruptions or downtime to the facility.

Split core current transformers (CTs) are placed on each breaker of a PDU or RPP panelboard in order to gather the real-time current readings required to monitor the load of each circuit. The readings are then communicated to a central management system where the system can be monitored.

Typical systems have current monitoring for the three-phase main, neutrals, and up to 96 branch circuits on a given panel. Advanced systems are capable of collecting further readings for voltage, kVA, and kWh on each circuit, which is useful in heavily managed facilities leveraging a 3rd party facilities manager, that charges based on power consumption.

After widespread adoption in the data center market over the past 4 years, BCM is gaining acceptance within manufacturing facilities as a tool that can offer significant cost-saving capabilities. With rising electricity costs, industrial owners and operators are motivated to find ways of decreasing energy consumption.

BCM at Work in Your Production Facility

Why should processing facilities care about detailed insight into their power infrastructure? Intensive production and industrial facilities rely heavily on all the data they get out of BCM solutions in order to make efficient power management decisions. This ensures higher uptime, impacting run rates and overall profitability.



Split Core CTs, 60 Amps to 400 Amps

Implementing real-time branch circuit monitoring will enable you to identify power and energy needs by ensuring maximum production availability. Production line energy demand fluctuates and surges depending on the load and production speed. Performing random manual check-ups on distribution panels will not suffice in many cases. Closely monitoring the load on relevant breakers and/or lines, by real-time web based monitoring enables you to quickly act on potential issues. Having a single pane of glass, providing insight into all electrical and environmental values throughout your facilities will guarantee easy and less cumbersome management. When issues occur, alerting can be used to send notifications including email or SMS, informing assigned personnel, who can act accordingly to minimize product loss.

There are dozens of distribution panels in the production facility, scalability of the solution is crucial. As Raritan's BCM solution takes the modular approach, it enables you to easily add additional meters or upgrade the rating of the current transformers (CT). The available CTs are scalable from loads up to 60 Amperes or even way above 400 Amperes.

Split core CTs can be installed on live circuits without interrupting power to the critical equipment, instantly monitoring the load on circuits. Traditional CTs are sensitive to the direction of the circuit and must be installed only in a single direction leading the installers to revisit an installation and rotate the CTs in order to enable accurate metering. "Auto Correcting" CTs takes away this risk by minimizing the need for installers having to revisit an installation.

Power distribution panels generally receive very little inspection or maintenance except when suspected of causing a problem. Placing environmental sensors on these panels allows you to closely monitor their condition. Placing a door-panel sensor will generate alerts for the maintenance crew, notifying them that a potentially unauthorized individual is opening a panel. Placing temperature sensors will alert you of overheating panels, which can be inspected quickly ensuring fire or other disasters can be avoided.

Getting a grip on energy spending and trying to comply with local energy initiatives requires active metering. Leveraging the BCM's billing-grade metering technology will enable you to comply with initiatives like those of the Environmental and Energy Study Institute (EESI). Visibility into energy consumption permits you to do cost allocation to production lines and/or department. Creating the awareness of consumption cost has frequently shown to lead to noticeable energy savings. Potential investment in more efficient equipment will also be easier to defend in budget discussions.

Most production facilities generally have technical staff on site and maintenance crew making it difficult to settle on which communication protocols to use. Raritan understands this and has implemented the most frequently used IT communication protocol, SNMP, as well as the most commonly used facility protocol, MODBUS. By supporting both protocol types, Raritan ensures easy integration in both IT and facility monitoring solutions.

When a maintenance crew has no access to a computer system, they can quickly review all readings and alerts on the full featured color display of the BCM2. For ease of access, we also have apps for Android and IOS, enabling visibility of all parameters on a phone or tablet.

Advantages of Retrofitting BCM

Retrofitting a facility with BCM is a viable way to optimize power usage and infrastructure capacity and save money without the expense of a complete product overhaul. The level of detailed monitoring that BCM offers allows diverse sets of operators to charge back energy usage to different groups and production functions.

One significant drawback facing branch circuit monitoring solutions with solid core CTs is the substantial costs for the equipment and installation, as the user needs to rewire the entire panel, adding as much as 60% of the cost of a panelboard to the equation. Leveraging split core CTs operators have to install BCM as a simple add-on, and with Raritan auto correct, the CTs can be plugged in on live circuits without worrying about the orientation.

It has been proven many times that retrofitting BCM solutions, allows the user to reduce downtime significantly by deploying a clear capacity planning strategy, and leverage instant cost benefits from operational efficiency into their operation.

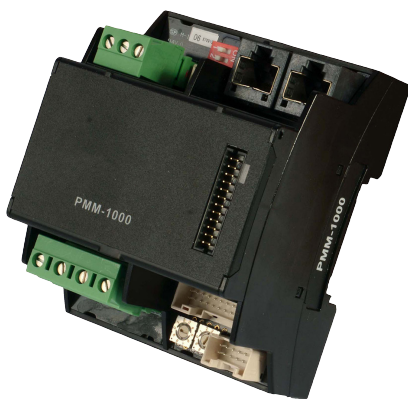
BCM is definitely an ROI-type solution that will unfold its benefits over time, from a defined power management policy impacting behavioral change across the organization, to a more accurate and clear power chain visibility.

Metering Accuracy

Most BCM products strive for "utility-grade" (also referred to as "billing-grade") accuracy, which means the information is accurate enough to legally use to bill customers or internal business units. These meters have the same degree of accuracy as the meters of a utility company which are +/-1% accurate.

One nuance to consider when referring to the accuracy of BCM: distinguishing the accuracy of the meter from that of the entire system, i.e. with the CTs added. When claiming +/-1% accuracy, many suppliers are referring to the accuracy of just the meter itself. Once the CTs are added, accuracy can drop by multiple points.

The combination of the meter itself and the CT accuracy is what determines the accuracy of the overall system. Raritan offers a BCM solution with +/-1% accuracy on the overall system, CTs included.



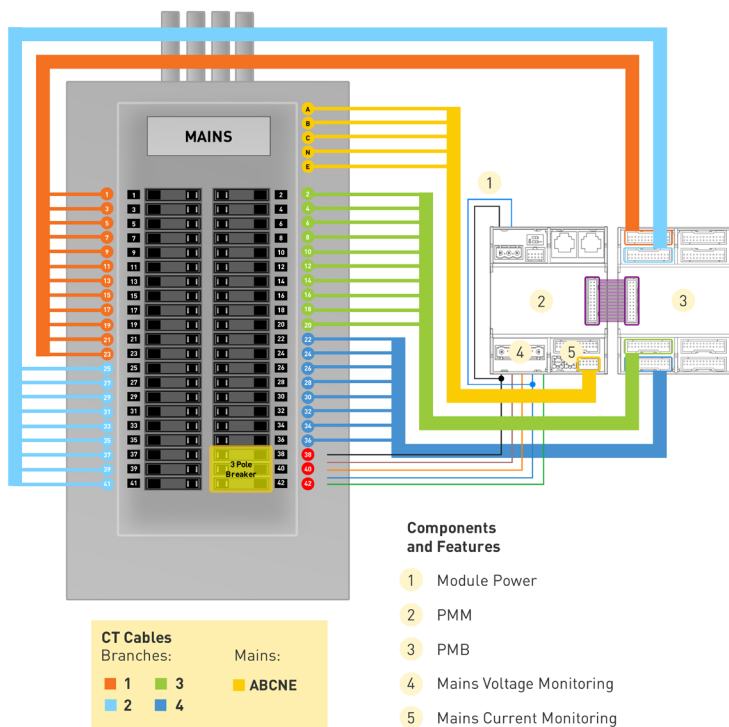
Power Meter Main (PMM) DIN Rail Main Metering Module

Getting Started with BCM

Raritan's intelligent branch circuit monitoring system allows you to fully utilize your power infrastructure and manage capacity as your data center grows and changes. Whether you are retrofitting an existing facility or planning for growth or new construction, Raritan's BCM system can help you reduce energy costs, track power usage, and prevent downtime.

This easy-to-deploy, modular system enables real-time views of electrical capacity and power usage on branch circuits and mains in an electrical service entrance or a remote power panel. It sends threshold alerts for power and environmental conditions, thereby helping to prevent downtime.

The data can also support energy efficiency and customer charge-back initiatives and can be integrated with Power IQ® DCIM Monitoring Software, and other building management systems (BMS).



Typical Branch Circuit Monitoring deployment in a power panel

Key Elements That Make Raritan BCM Solution Unique:

- Simplified wiring using multi conductor cable instead of multiple pairs of CT wires.
- Ability to choose different enclosure types as needed.
- Auto correct metering adjusts for CT orientation on wires, prevents mistakes.
- Keyed locking connectors for error proof and reliable connection.
- Real-time configurator displays current and phase allowing you to confirm correct installation.
- Quick configuration via USB stick preloaded with panel schedule.
- Seamless data collection and software integration.

Lower Your Total Cost of Ownership

- Control up to 70 power meters with a single controller.
- Protocols include TCP/IP, Modbus, and SNMP.
- Built-in redundancy; all modules function as long as one meter remains powered.
- Accessible using Wi-Fi networking access.
- Highest density branch circuit metering — 96 branch circuits.
- Easy to install, configure, and scale.
- Prevents downtime and improves efficiency of power infrastructure.
- **Energy Usage Analysis:**
 - Understand usage patterns to detect abnormal consumption that may be caused by faulty equipment
 - Save money following recommendations regarding subscription, peak demand, period rate, and penalties
 - Optimize the use of existing capacity and avoid over-design thanks to load studies and circuit optimization
 - Identify maintenance requirements thanks to detection of power quality issues like voltage sags
 - Maintain equipment efficiency: Base your maintenance schedule on actual operating history
- **Energy Cost Allocation:**
 - Benchmark internal or external best practices
 - Build a list of the required actions to undertake with priority level, consequences, and pay-back period for each action
 - Avoid penalties with automated load shedding, scheduling or peak shaving
- **Energy Sub Billing:**
 - Encourage change behavior towards efficient energy usage by allocating energy usage and costs according to cost center, production unit, shift, etc.

BCM Empowered by Xerus™

Most BCM solutions on the market are standalone components bolted on a third party metering board to provide basic power data. Raritan chose to leverage the Xerus™ technology platform, the most advanced firmware for power management, already used in the full range of Raritan PX™ intelligent PDUs of Raritan.

Xerus technology platform is composed of Raritan proprietary hardware design, matched with a full software stack owned and maintained directly in house, and delivering an open architecture for flexible and future proof application development.

Leveraging a hardened Linux base (Cent OS), Raritan holds full control over Xerus source code and device drivers, allowing better and faster maintenance, and the development of new innovative applications. Xerus firmware is battle tested with millions of hours of uptime across thousands of data centers diverse industrial applications. This guarantees the highest level of hardware/software compatibility.

Out of the box, Xerus delivers the most advanced user interface to date, leveraging a full HTML responsive structure. You can easily access all your BCM modules data through any mobile device or desktop, and plug in any tablet via USB to access a specific controller's data. Field technicians and maintenance teams now have a handy tool to gain key information about specific machine power information.

Future Proof Hardware

With its exclusive hardware architecture, Raritan's BCM leverages the latest controller technology the new iX7™ controller on both BCM2 in-house enclosures and modular controllers.



Raritan Enclosure Kit, Including Main and Branch Metering Modules with the controller



Raritan Enclosure Kit, Including Main and Branch Metering Modules with the controller

Raritan's BCM Controller features a host of control ports with dual USB, color screen, dual networking and standard Gigabit Ethernet. The controller itself is hot swappable in the unlikely event of a failure. Each power meter controller can handle up to 8 main and branch circuit metering modules, or cascade up to 70 main metering modules, with standard Cat5 cable.

If modern product facilities are still operating by a break fix model of power it's time to upgrade your facility to a branch circuit monitoring system. BCM provides a solution that will be able to support your current deployment with the highest flexibility and handle future growth in the metering needs for your operation.

**Ready to find out more? Contact Raritan today.
Call 1.800.724.8090 or visit www.raritan.com**