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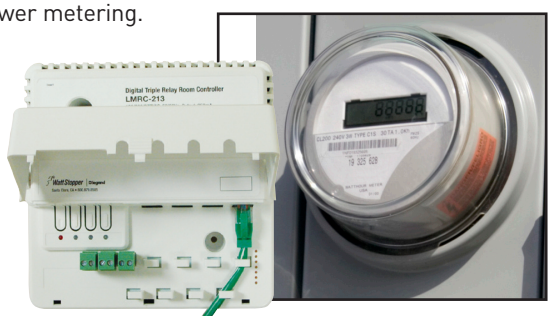
DLM Power Monitoring Provides Unique Snapshots of Power Use

Topic: Power Monitoring vs. Metering **Issue:** # TB178 **Date:** April 10, 2011

Digital Lighting Management (DLM) enhanced room controllers allow users to monitor the electrical current (amperage) passing through the device at any moment in time. This bulletin explains the benefits and limitations of this DLM power monitoring capability, and the differences between DLM power monitoring and various forms of power metering.



Characteristics of power metering

In most cases electricity is metered for the purpose of billing customers for their total power usage (kWh). In today's world of high-performance buildings, metering is also being used to provide a benchmark comparison of energy use scenarios within a building.

Like homes, commercial buildings are generally metered by the utility at the service entrance. The utility meters used are sophisticated instruments that provide current monitoring, voltage monitoring, time of day capabilities, peak power monitoring (kW) and data storage, and they are highly accurate. Some may be the newly-introduced "smart meters," which add communication capabilities for remote reading and disconnect capabilities for the service provider.

Electrical meters may also be used within buildings to track the power usage of specific systems or areas for energy management, including LEED certification, or tenant billing. This practice is referred to as sub-metering, and while accuracy is not as critical as it is for primary utility meters, the meters must be accurate enough to provide the information required for a comprehensive understanding of where and when the electricity is being used. For commercial applications, devices typically include a timer and totalizing feature that show consumption over time, allowing users to analyze both instantaneous demand (kW) and aggregate consumption (kWh). Unlike utility meters, sub-meters are typically owned by the property owner and installed downstream of the primary utility meter.

Regardless of whether it is a utility meter or a sub-meter installed to monitor building systems, to be classified as a power "meter," a device must include these key capabilities:

- Current measurement
- Voltage measurement
- Power factor determination*
- Time reference

Characteristics of DLM power monitoring

Digital Lighting Management LMRC-2xx and -3xx Series and LMPL-201 room controllers have the ability to measure current and calculate instantaneous power use (kW). They do not have the ability to measure cumulative power use over time (kWh). However, when used in conjunction with a building automation system with data storage capability, DLM's monitoring functionality can be harnessed to provide information about energy consumption over time.

Regardless of the number of relays, room controllers are powered from a single input. As the hot input lead

* Power factor is a complex relationship between the offset of voltage and current as they relate to the phase angle. Meters have electrical connections to the circuit to determine this relationship, which is expressed as a decimal value above or below the ideal value of 1.0.

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enters the room controller housing, it passes through a current transformer (CT) that measures the total current for the room controller in real time. This measurement is expressed in amps (A). The room controller does not measure voltage, and it does not have a time reference.

Since the room controller does not measure voltage, the user must input a nominal value, typically near 120 or 277 volts. Power (W) is then calculated by multiplying the selected voltage, times the measured amperage, times a power factor (PF) constant (W = V x A x PF). The default value for the power factor constant is 1.0. This calculation is performed automatically by the room controller allowing it to report the total instantaneous power, or wattage, that is being supplied through the room controller.

The CT and circuitry in the room controller measure amperage quite accurately, and the voltage, as entered, will be close to actual for most readings. Additionally, the power factor constant will be close to actual for most modern electronic ballast loads, but the resulting calculation is an estimate because only one variable is actually measured. Therefore, DLM will report instantaneous power with a margin of error of 2 to 5%.

Based on this level of accuracy, and the fact that DLM by itself does not report power over time (kWh), the DLM literature characterizes this capability as "power monitoring" rather than "metering."

Monitoring can provide actionable information that metering does not, and can be a valuable tool for an energy or facility manager. For example, distributed DLM room controllers let users focus on individual rooms, providing a close up view of power use unavailable from even the most accurate sub-meter that measures loads up to 150 kilowatts. When viewing the demand on one room controller or plug load controller with a typical connected load of less than 1500 watts, small variances will be easy to detect. This granularity can help managers spot anomalies that might indicate malfunctioning fixtures or burned out lamps, or unauthorized plug loads such as space heaters or other personal equipment.

For energy management, more monitoring stations, even with less accuracy, should provide better information that fewer, higher-accuracy sub-meters. For revenue recovery purposes, only highly accurate "revenue grade" meters are suggested.

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SUMMARY: KEY CHARACTERISTICS

	DLM Power Monitoring	Sub-metering	Revenue-grade Metering
Instantaneous demand (W, kW)	yes, W	yes, kW	yes, kW
Current (A)	measured	measured	measured
Aggregate consumption (kWh)	no (requires BAS)	yes	yes
Voltage (V)	user entry	measured	measured
Power Factor (PF)	1.0 or user entry	measured	measured
Typical range	200-1920 W	50-150 kW	50-150 kW
Data storage	no (requires BAS)	sometimes	yes
Communication capability	yes	smart meters	smart meters
Accuracy	95-98%	99.5% nominal	99.8% Class Revenue Certifiable

For energy management, distributed monitoring stations provide more actionable information than even the most highly-accurate sub-meters. A building automation system can read DLM monitoring data to create very detailed reporting.

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