Application Technique

Allen-Bradley

PowerMonitor Products Application Guide

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LISTEN.
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Introduction

As companies see significant savings through energy-efficiency projects, managing energy consumption, reducing demand, and improving power quality have become an essential factors in reducing the overall cost of doing business. By using smart power monitoring devices on a connected enterprise, power and energy data is readily available. This data provides the information for companies to take action to reduce energy use while they consider energy as an ingredient of production and a variable cost.

To manage energy effectively, knowledge of what happens is required. At times, energy is considered a hidden cost because it's often unaccounted for when considering the cost that goes into the manufacturing of products. Labor and materials are just part of the cost equation and when not properly managed, energy can become a significant portion of the cost of doing business. As an energy consumer, it's important to start investigating the following issues:

- Are your processes running as efficiently as possible?
- Do you have high demand?
- How consistent is your load?
- Is it evenly distributed or do you have peaks where your load is excessively high?

Implementing power monitoring solutions provides a window of information on what's happening and the knowledge to do something about it. It’s understanding and answering the questions on where, when, and how much energy is being consumed and having the ability to act. Finding the hidden energy costs can be a source of substantial savings for manufacturers if they know where to look and have the ability to monitor usage in real time.

In addition to effectively managing power and energy, not overlooking the quality of the power that is received is important. Utility providers are only responsible for providing a reliable source of power. Again, further investigation is required:

- How healthy is your energy (power)?
- Are power quality issues affecting production equipment and shortening life spans?
- Can power factor correction reduce utility penalties due to largely inductive motor loads?
- Can harmonic analysis be used to determine problems with high-value production assets?

When events occur that affect the quality of the power, it is your responsibility to have proper monitoring and mitigation solutions in place. Power Quality Management is critical to understanding the impact of power quality on equipment and the associated costs that come with power quality (downtime, equipment damage, risk to personnel, maintenance activities). Data must be collected on power quality events (voltage/current quality, harmonics, and transients) to determine what impact they are having on the facility and a course of action to correct and prevent the issues going forward.

By developing an integrated energy management program based on accurate consumption and spending patterns and demand profiles, companies can calculate power consumption costs between their energy base load and various utility equipment, production lines, or in the manufacturing of a specific product. With a more accurate determination of actual product costs, managers are able to make more intelligent business decisions.

Determine Business Goals

Business today has changed and it added a color - green. Not only must you meet your business and production goals, but global dynamics are forcing you to pursue energy reductions. Many companies can help reduce energy consumption at their manufacturing facilities when a plan is implemented.

Before you implement the required energy management solution, first identify your overall business goals. The determining of these business goals is the first step to understand and develop the scope of your energy and power management strategy to accomplish those goals. Your business goals can include the following:

- Energy cost reduction
- Operating equipment efficiency
- Usage-based cost accounting
- Downtime reduction through power quality monitoring
- Sustainable production initiatives
- Driving energy cost accountability to the energy user
- Identifying and justifying energy cost savings projects

Plant Walk-Through

After determining your business goals, conduct a walk-through of your plant or campus. This walk-through helps you to identify the largest energy consumption uses and events to establish detailed base load energy metrics.

To maximize the efficiency of the walk-through, gather pertinent facility documentation that is available:

- Facility one line diagrams for electricity, gas, water, steam, air, and other fuels
- Production equipment layout
- Electric power-equipment list
- Other energy equipment documentation including boilers, air compressors, HVAC equipment, and process cooling equipment
- Energy meters and monitoring equipment

The plant walk-through steps includes the following:

- Listing the equipment and processes that consume large amounts of energy
- Listing typical time of use or duty cycle
- Listing operational or production dependencies
- Identifying applications using variable speed drives
- Reviewing operation of air compressors, boilers, and chillers

Energy Assessment

The assessment process is a detailed analysis of the data collected during the walk-through. Identifying opportunities for energy savings and developing the return on investment for these projects is critical. Energy assessments should identify not only opportunities, but savings, project costs, and payback calculations. Projects should also be categorized as awareness or behavior changes, minor cost, and capital. This approach helps prioritize the steps in the energy savings plan.

Collect and Analyze Utility Bills and Rate Schedules

An important part of the energy assessment is to collect and analyze your current utility rate schedules and bills. This typically includes electric, natural gas, water, and sewer. Other fuels consumed may include fuel oil, propane, or steam.

Understanding your bill is crucial in executing an appropriate energy management plan to maximize your energy savings investment.

Energy rate schedules from your local utilities can include, but are not limited to, line item charges such as:

- Demand Charges - A variable monthly or yearly charge for the highest amount of energy consumed over a fixed period, typically 15 minutes. This charge can contribute significantly to overall energy costs.
- Energy Charge - A variable monthly charge for the total energy that is consumed. This charge typically includes on-peak and off-peak rates, contracted minimums, alternative charges, ratchet demand penalties, or other special terms.

Business Case for Energy Monitoring

Energy monitoring makes energy usage data visible so that it is included in the planning and execution of a business strategy along with other management information. Because utility bills can be a significant portion of business expense, it is important to understand how energy is used. Implementing a monitoring plan helps your business set goals for energy reduction that translate into cost savings.

Typical energy users evolve through a number of energy awareness phases.

Ignorance is Expensive

In the first phase, energy is not considered a significant expense or important management information. The operations group uses energy and accounts payable pays for it. Management begins to notice the higher costs and sets goals for energy reduction. If operation managers are not aware of the energy cost of their operations, energy savings is not captured.

Metering the Envelope

In the second phase, energy monitoring is installed on the plant main feeds. Electricity, natural gas, water, and other feeds are recorded. The investment is relatively low. The monitoring system generates shadow bills to verify the utility billing. Major users of energy are identified. The relationship between operating schedules and plant demand becomes clearer. A few energy saving opportunities are identified and cost savings generated. However, monitoring only the entire plant has limitations addressed in the next phase.

Submetering the Processes

In this phase, submeters are installed on process lines and utility equipment such as air, compressors, and boilers. This phase requires a higher level of investment but provides a more detailed view of energy usage. Reports run daily or weekly provide a direct line of sight to the impact of operations decisions. Energy use is correlated with key production indicators to identify peak producers and opportunities for improvement. Operations are benchmarked within a plant or across an enterprise. More cost-saving opportunities are identified. Historical data is used to accurately forecast energy use, providing the basis for negotiating more favorable rates from energy providers. The same data is used in justifying capital projects to improve efficiency and further reduce energy usage, cost, and waste. Energy accountability grows.

Controlling Energy Use and Demand

The volume and accuracy of energy use information gathered in the preceding phases is useful in determining the next steps. Perhaps an automated demand control system would be effective in increasing energy efficiency and sustainability. Opportunities for heat recovery and on-site generation may be identified. Potential trouble spots might be avoided that would minimize unnecessary downtime.

Once critical energy consumer's design or target consumption levels are defined, one then needs to be able to measure it. Once the underlying infrastructure is in place to understand where and how energy is being consumed, it is easier to formulate a strategy that lets you transition into the three core steps of energy management: Monitor, Analyze, and Control.

Monitor and Measure

Effectively monitoring energy and power quality includes power monitoring smart devices that can capture and communicate energy consumption information.

Know What to Measure

These devices are used to measure energy parameters associated with a specific system. For electricity, it can be a bus in a facility's electrical distribution system, allowing plant managers to gather detailed information on power consumption in different areas of their plants, on specific machines and even on individual product lines. In addition to usage data, these smart power monitoring devices offer access to power quality information that can improve productivity and lengthen equipment life.

Through the use Rockwell Automation® power monitor units, controllers, and data collection software such as FactoryTalk® EnergyMetrix™, plant floor energy usage is measured and monitored in real time to help you understand usage patterns, optimize processes, and reduce utility costs in your organization. You can use these tools to monitor electrical loads, consumption, power quality, analyze demand, and generate billing and cost allocation reports. The following are some of the monitoring capabilities:

Consumption Reporting

Consumption reporting typically monitors periodic utility usage, production, or other key performance indicators, and assists with the early detection of production/equipment problems such as leaks, inefficiencies, and production problems.

Demand Analysis

Demand analysis monitors the electrical demand of plant areas so that you can make energy saving production scheduling or demand control decisions.

Submetering

Sub-metering is the practice of deploying power meters to monitor individual loads or work cells. A sub-metering strategy lets you measure differences in power consumption from shift-to-shift or line-to-line to provide internal cost allocation. Sub-metering gives companies the ability to reward a specific group or department within a plant that implements successful energy saving initiatives.

Cost Allocation

Cost allocation monitoring lets you allocate energy costs based on actual usage that is based on production area sub-metering rather than other measurements such as square footage allocation. Effective cost allocation helps drive energy accountabilities to the user.

Distribution System Monitoring

Distribution system monitoring provides operators and engineers with a centralized view of the entire facility's power distribution system, including information for trending, alarming, and targeting. By monitoring a facility's power distribution system, engineers can identify equipment approaching failure, reconfigure electrical system topology, and manually limit demand by shedding loads or increasing generator output.

Power Quality Monitoring

The power quality data is used to capture power quality events or conditions that can cause a production shutdown like voltage sags, swells, and brownouts and pinpoint failures of motors and sensitive equipment, negotiate better service from the utility, and identify the need for power factor correction and harmonic filters. Power quality monitoring systems centralize power quality data from distributed power monitors. The system senses voltage excursions, momentary power losses, phase reversals, and harmonics then reveals this information in the form of instantaneous displays, trends, reports, and alarms.

Load Profiling

Load profiling is a method where electrical loads are monitored or profiled. Load profiling can help to identify peak demands so that you can reschedule loads accordingly to reduce energy costs.

Shadow Billing

Shadow billing generates a replication of a monthly bill from your energy provider for comparative billing analysis and potential energy cost recovery.

Hardware Overview

These sections are an overview of each power monitor and accessories in the Rockwell Automation Power and Energy Management portfolio.

PowerMonitor 500 Unit

The PowerMonitor™ 500 unit is an AC power monitor with a built-in advanced configuration system and LCD data display. The display makes this unit ideal for point of use metering. Operators can easily view power and energy data at the machine and make at-process decisions by using real time data. The unit is designed for measurement of electrical parameters in various three-phase and single-phase circuits. The unit is enclosed in a modular housing for panel mounting, with IP65 degree of protection in front of the panel. The power monitor is provided with analog or digital outputs. These outputs are selected to output a pulse proportional to the real and reactive energy that is measured, or to annunciate alarms. The instrument is also equipped with a serial RS-485/RS-232 port, an EtherNet/IP™ port, and analog outputs. The power monitor is fully integrated into the FactoryTalk EnergyMetrix software.

The following are key features of the PowerMonitor 500 unit:

- Measure voltage, current, power, energy, demand, and power factor
- Multiple communication types including Modbus RTU or EtherNet/IP
- Two optional analog outputs for variable speed process control
- Two optional digital relay outputs
- Four configurable alarms that notify you of specified conditions

PowerMonitor 1000 Unit

The PowerMonitor 1000 unit is a compact, cost-effective, electric power and energy metering device intended for use in industrial control applications, such as distribution centers, industrial control panels, and motor control centers. The power monitor measures voltage and current in an electrical circuit, meeting revenue accuracy standards. The power monitor communicates power and energy parameters to applications, such as FactoryTalk EnergyMetrix, over Ethernet or serial networks.

The PowerMonitor 1000 unit can serve as a utility feed meter, but is also ideal for systems where sub-metering is required. The PowerMonitor 1000 unit is available in three models. The basic model (BC3) features entry level data collection like consumption and power. The mid-range model (TS3) collects voltage and current as well as the basic model data set. The advanced model (EM3) gathers all data for consumption, demand, and power factor reporting.

The following are key features of the PowerMonitor 1000 unit:

- EtherNet/IP, Serial DF1, Modbus RTU, Modbus TCP communication options
- Compact size with integrated LCD display
- UL, c-UL, CE certifications
- Wiring diagnostics
- Time of Use (On-peak, Off-peak)
- Logs - Energy, Min/Max, Status, and Load
- Revenue Meter Accuracy
- Two Status Inputs
- Configurable KYZ Output
- Power Factor
- Alarms

PowerMonitor 5000 Unit

The PowerMonitor 5000 unit is the premier power quality meter from Rockwell Automation. Building on core power and energy metering capabilities, the PowerMonitor 5000 unit takes energy monitoring to the next level with additional features including the following:

- Virtual wiring correction capability
- Sag/swell detection alert
- Up to 20 setpoints with conditional, logical, and relational programming
- Single cycle metering

This power meter is a scalable solution which you can fully integrate into a plant-wide network. When connected with other PowerMonitor 5000 meters, the system event snapshot tool feature offers a system-wide event picture, which lets you view the process upstream and downstream to gain a better understanding of your energy structure and potential impact to your equipment.

This cutting edge meter provides detailed power quality data that, when used with FactoryTalk EnergyMetrix software, can offer you a powerful set of data analytics to understand and take action on power quality issues and energy management activities. The PowerMonitor 5000 unit is ideal for utility feed metering.

- Scalable Power Quality platform product monitors four voltage and four current channels for each electrical cycle
- Provides 1024 samples across eight channels every cycle
- Measures up to the 127th harmonic
- Internal webpage for the meter simplifies configuration and lets you view real-time data
- Virtual wiring correction capability can correct miswiring during commissioning, which reduces the need to power down for correction

- Configurable alarms for up to 20 events can help prevent issues or equipment damage
- Four inputs for WAGES (water, air, gas, electricity, steam) data collection
- Four outputs for connection to SCADA or control systems
- Native EtherNet/IP communication port included (optional DeviceNet and ControlNet cards)

Current Transformers

Instrument grade current transformers are required for all PowerMonitor unit installations. When you select the correct Bulletin 1411 line of current transformers for your application, consider several factors:

- Type of installation- Current transformers fall into two categories, solid core and split core. Solid core transformers are typically used for new installations and split core transformers can be separated for easy installation on existing or retrofit applications.
- Current Ratio- Current transformers are also designated by their current ratio. The primary represents the highest current that the transformer can measure. Select the CT primary value to match the current rating of the circuit protective device to measure accurately overcurrent and nominal currents so that current inputs are not clipped. The CT secondary to the PowerMonitor unit is always 5 A.
- Current Transformer Window Size - Knowing the size of your power conductors is also crucial. CTs are also differentiated by their window size. This inside dimension helps you determine which CT can fit around your conductors.

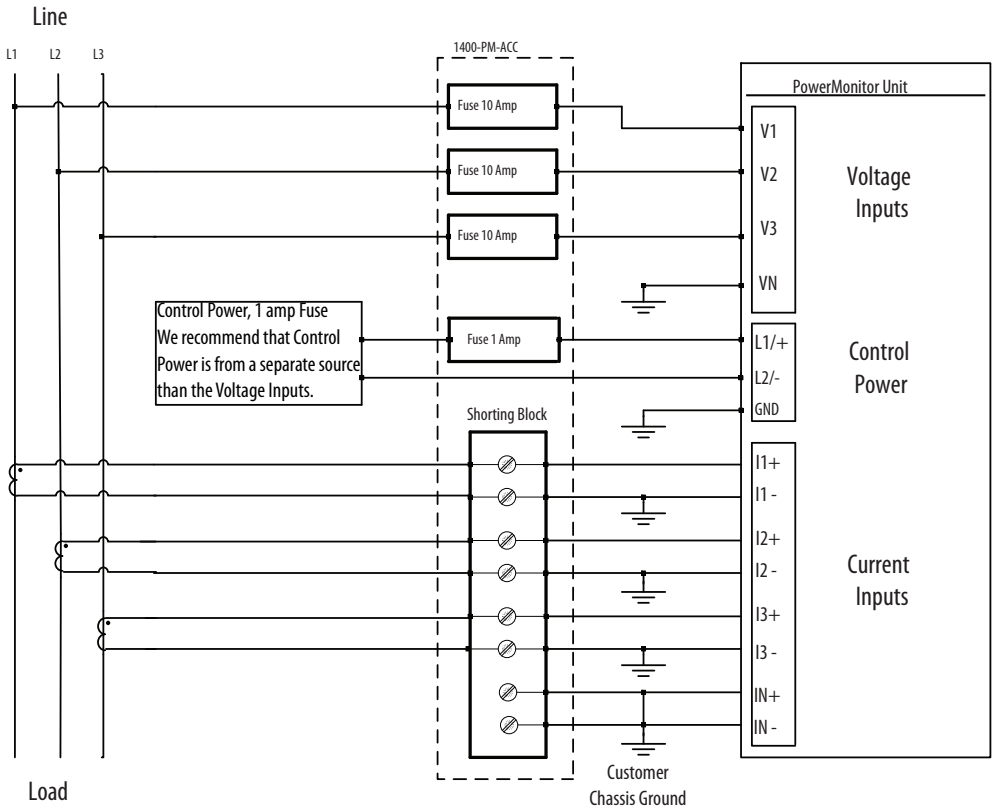
For more details on the current transformers, see Bulletin 1411 Current Transformers Technical Data, publication 1411-TD001.

Potential Transformers

Potential transformers are required for applications with a line voltage that exceeds 600...690V. This value is dependent on the power monitor selected. Rockwell Automation does not offer potential transformers. For a selection of potential transformers, visit our list of Encompass™ partners found under the Sales and Partners tab at RockwellAutomation.com.

Accessory Kit

Wire all PowerMonitor units with a 1400-PM-ACC accessory kit. The accessory kit includes proper fusing for both control and power wiring. A current transformer shorting block is also included. The shorting block is for protection against high voltages that can be present at the current transformer secondary when the wires are removed from the PowerMonitor unit current sensing terminals. The accessory kit must be included in all PowerMonitor unit installations.

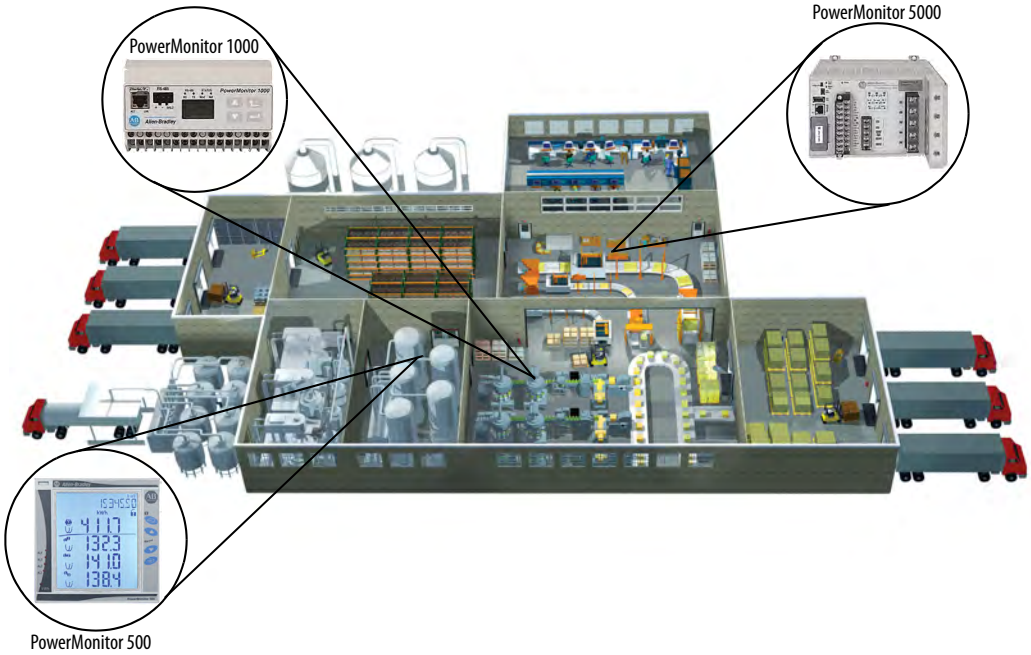


Display Module

The 1426-DM PowerMonitor Display Module can be used with the PowerMonitor 1000 and the PowerMonitor 5000 units. The display module is preloaded with applications that support up to 3 power monitor devices. The display module provides real-time voltage, current, power, and energy data. By having access to this information, you can make quick decisions around energy management on the plant floor.

Select the Right Hardware

The selection of the right power monitoring hardware is critical to achieving your energy management goals. At the core, each PowerMonitor unit functions on the same basic principle: Voltage and current signals are wired to the PowerMonitor unit and the PowerMonitor unit uses those values to calculate power, energy, and power factor.

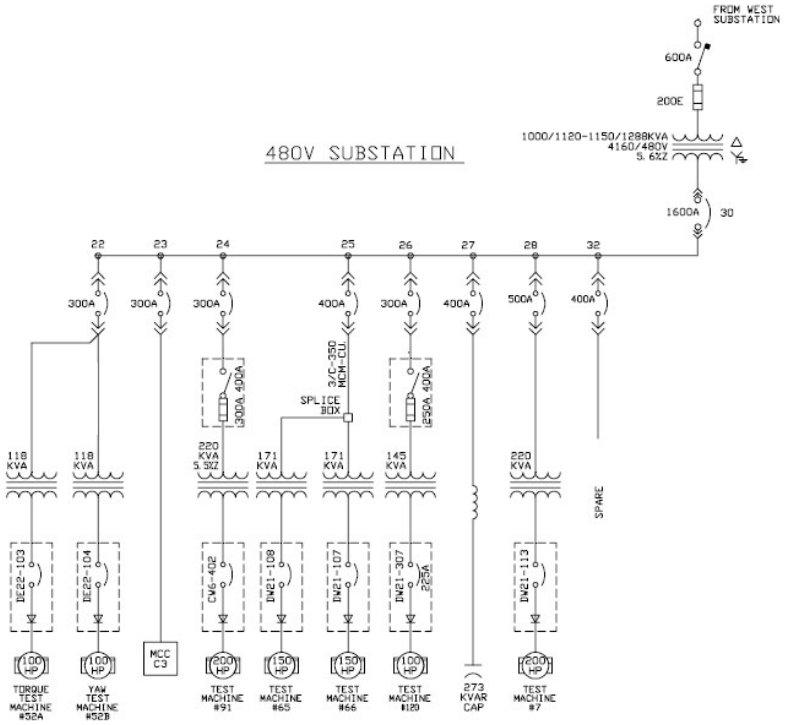


The differences between the PowerMonitor units come in the features that each one offers. When selecting the right power monitor based on the type of application and the desired business goal, consider several factors:

- Measurement Capacity
  - Consumption/Demand
  - Power Factor
  - Power Quality: Sag/Swell Detection, Harmonics, Transients
  - Waveform Capture
- Accuracy
  - Accuracy as a percentage: 'Revenue Grade Accuracy'
- Networking/Communication
  - EtherNet/IP, Serial
- Internal Data Logging Capacity
  - Record activity without external data logging software
- Embedded Inputs/Outputs
  - Status Inputs: Log data from external meters via pulse inputs
  - Relay Outputs: Direct control over connected devices
  - KYZ Outputs: Standardized pulse output for electrical metering
- Setpoint Control
  - Activate outputs based on internal metering setpoints
  - Example: Turn off Relay 1 if power consumption exceeds 3 kW
- CIP Energy Support
  - CIP Energy: Common Industrial Protocol for Energy Data

Step 1: Understand Your System

PowerMonitor products can monitor various three-phase, single-phase, and split-phase circuits. Gather any power one-line drawings available to help you identify the distribution types for your system. This step is critical for selecting the appropriate meter for your application.



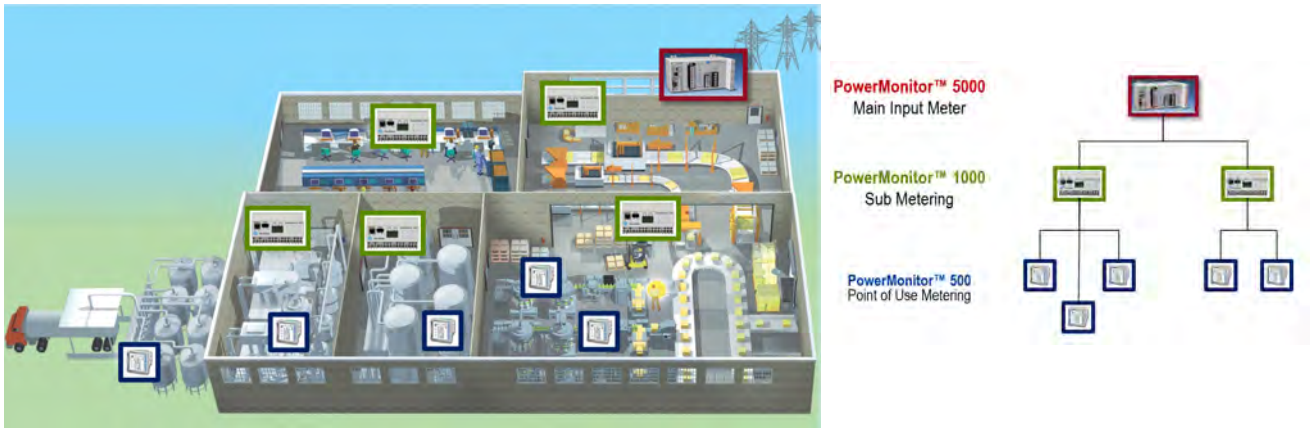
The voltage sensing, current sensing, and metering mode must be properly selected to match the configuration of the circuit being monitored. It is important to gather information on the distribution type during the plant walk-through. The power monitor cannot provide accurate measurements if the inputs are inaccurate. In addition to the feature sets of each power monitor, consider the ability to monitor your distribution type. Information on the distribution type is typically found in plant layout or power one-line drawings. This table lists the type of wiring connection available for each power monitor.

Distribution Types	PowerMonitor 500	PowerMonitor 1000	PowerMonitor 5000
3-phase, 4-wire Wye	X	X	X
3-phase, 3-wire Grounded Wye	X	X	X
3-phase, 4-wire Impedance Grounded Wye			X
3-phase, 3-wire Delta or Ungrounded Wye			X
Split-phase	X	X	X
3-phase, 3-wire Delta, Grounded B Phase(1)		X	X
3-phase, 4-wire Highleg (1) (wildcat)			X
Single-phase	X	X	X

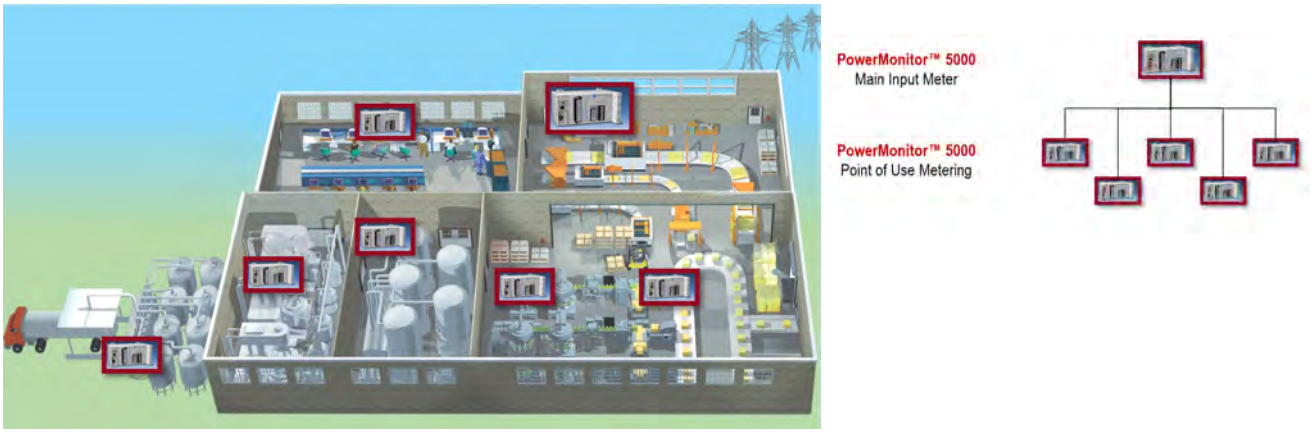
Step 2: Determine your Architecture

By using your power one-line diagrams, develop a plan to deploy your power monitors. Identify energy distribution points to be monitored. In most architectures, a PowerMonitor 5000 unit is installed at the utility feed. This device is capable of monitoring most distribution types and can detect power quality issues that are present where the power is sourced. The PowerMonitor 1000 unit can also be deployed at the feeder circuit, but is commonly used for Submetering where energy intelligence is needed at the cell or site level. The PowerMonitor 500 unit is ideal for energy measurement at the machine or device level. For applications where devices such as an across the line starter is controlling a motor load and no intelligence data is available, the PowerMonitor 500 can provide that information.

Typical Architecture for Submetering Application



Typical Architecture for Power Quality Application



Step 3: Select Your Hardware

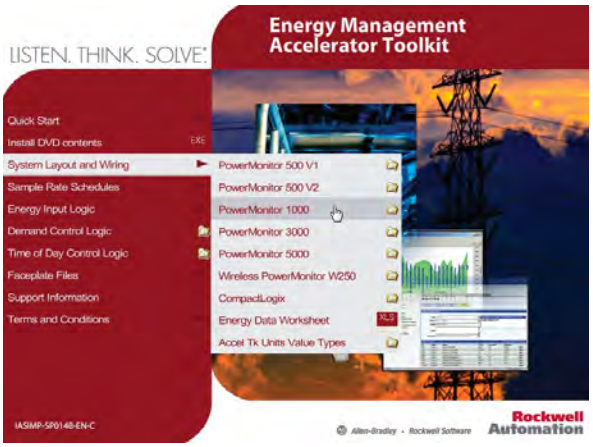
This chart provides a quick comparison to guide you in selecting the right PowerMonitor unit for your application based on the application.

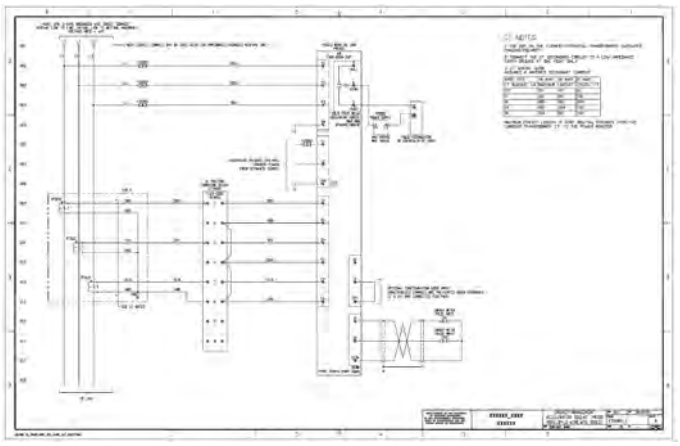
Feature	PowerMonitor 500	PowerMonitor 1000	PowerMonitor 5000	Consideration[1]
Consumption	X	X	X	Is your primary concern to reduce your consumption and peak demand to lower your utility bill?
Demand	X	X	X	
Power Factor	X	X	X	
Power Quality			X	Are power quality issues resulting in unplanned downtime and lost product? Are equipment failures occurring more frequently?
Sag/Swell Detection			X	
Harmonics			M6 and M8	
Waveform Capture			M6 and M8	
CIP Energy / Logix AOP	(EDS AOP)	(EDS AOP)	X	Does data need to be available for operators to make manual adjustments? Is PLC control used to automate energy control actions?
Onboard Display	X	(limited)	(optional)	
Internal Logging		X	X	
Status Inputs		X	X	Is I/O needed for external devices?
Relay Outputs	(optional)		X	
Setpoint Control			X	
Communications	Ethernet, Modbus RTU	Ethernet Serial	EtherNet/IP DeviceNet ControlNet	Is there a communication network in place that data is transmitted on?

(1) For a more comprehensive comparison of power monitor features, see the Power Quality and Energy Management Selection Guide, publication 1400-SG001.

Step 4: Wire Your PowerMonitor Units

Wiring plays a critical part in achieving accurate measurements. Follow the wiring diagrams and guidelines that are found in each PowerMonitor unit user manual. Additional wiring resources are found in the Energy Management Accelerator Toolkit. The drawing files are available in .pdf and .dwg format and you can easily add the drawings into a panel wiring schematic.





The Energy Management Accelerator Toolkit is available to help in the design and installation of your energy management system. Application files and other information is provided on the Energy Management Accelerator Toolkit CD, publication IASIMP-SP014, or can be downloaded by visiting Product Selection and Configuration from the Support tab on RockwellAutomation.com. The toolkit provides an energy data worksheet, layout and wiring drawings, data collection and control logic, and more. With these tools and the built-in best-practices design, you can focus on the design of your system and not on the design of overhead tasks.

Step 5: Configure Your PowerMonitor Units

Through onboard displays, embedded webpages, and data management software, there are several ways to configure the PowerMonitor units during commissioning. The following diagram outlines the basic steps for configuring the PowerMonitor units.

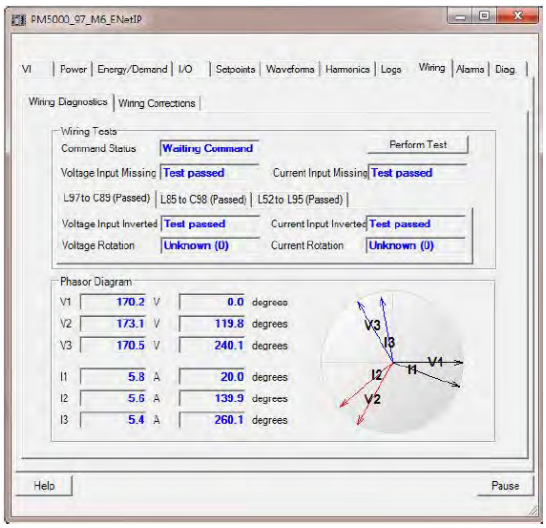
- PowerMonitor 500 Unit
  - Onboard Display
  - Configuration Software
  - FactoryTalk EnergyMetrix
- PowerMonitor 1000 Unit
  - Onboard Display
  - Embedded Webpage
  - FactoryTalk EnergyMetrix
- PowerMonitor 5000 Unit
  - Embedded Webpage
  - Optional Display
  - Studio 5000® Add-on Profile
  - FactoryTalk EnergyMetrix

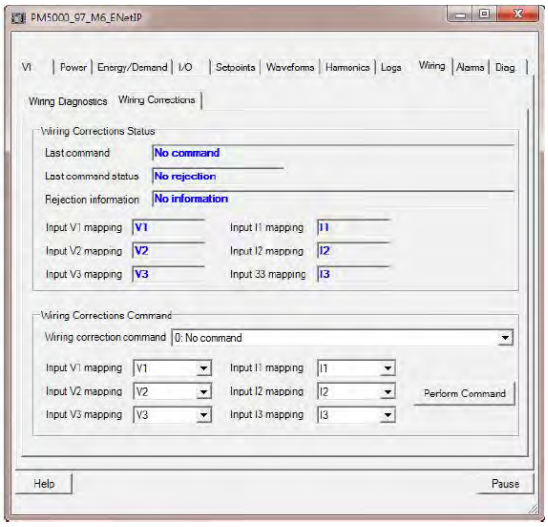
Wiring Diagnostics

The PowerMonitor 1000 and PowerMonitor 5000 units provide advanced wiring diagnostic features that provide a means for you to verify proper PowerMonitor unit connections and diagnose wiring errors. To meter power and energy correctly, voltage and current inputs must be connected to the power circuit with the correct phase rotation and polarity. Indications of wiring errors include the following:

- Indication of negative real power (kW) on a load, or indication of positive power on a generator
- Power factor outside the appropriate leading and lagging range

In addition to the wiring diagnostics, the PowerMonitor 5000 unit also offers a wiring correction feature. This feature affords you the ability to correct any wiring virtually. You can perform wiring diagnostics and correction through the embedded webpage and the device configuration window in FactoryTalk EnergyMetrix software.





Analyze the Data

The first layer in the foundation for accurate collecting and reporting of energy data is to monitor the energy data. When you analyze this information, you can make better decisions around controlling costs and reducing power quality issues. For this energy data information to make a difference in operations, it must seamlessly integrate into a connected enterprise. To maximize the benefits of an energy management program, you have to coordinate the combination of power monitoring, control devices, communication networks, and visualization technologies into a unified system that relates energy consumption to plant activities.

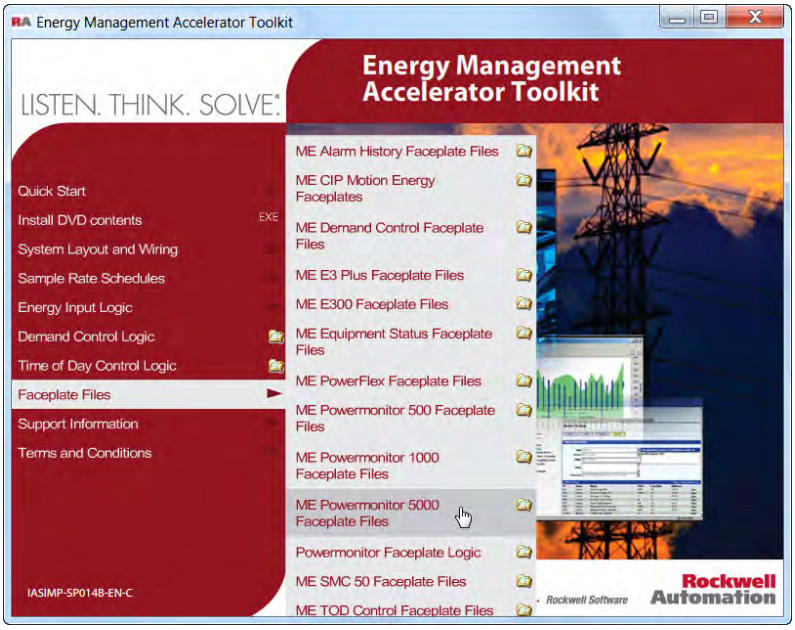
Embedded Webpages

Both the PowerMonitor 1000 and PowerMonitor 5000 units have built-in webpages that allow for quick and easy access of energy and power quality data over an Ethernet network. A connection to the embedded webpage is made by entering the IP address of the PowerMonitor unit into an internet browser window. With a click, all data parameters are available. The embedded webpage also provides another means for configuring the PowerMonitor unit, which is useful when commissioning an energy management solution. During the commissioning process, you can open the webpage to view wiring diagnostic data to verify that the unit is wired correctly. Parameters such as line voltage, current, and power factor can be monitored to confirm that the PowerMonitor unit is metering accurately. Data logs can also be exported from the webpage and analyzed for demand management or power quality control.

PLC-Based/ Studio 5000 Environment

All Rockwell Automation PowerMonitor solutions are designed to fit into an integrated architecture where data is seamlessly shared with a high-performance programmable automation controller for providing the analysis and control. For analysis of energy data, Add-on Profiles can be integrated into a controller program through Studio 5000 Logix Designer® application to view real-time data. The controllers also provide a common means of bringing discrete inputs from circuit breakers, switches, and protective relays in the power management system to provide system control that is based on measured data. Preconfigured graphical interface files ('faceplates') can easily be integrating into an operator interface application for access to this real-time data in the control room or on a panel-mounted HMI display.

Faceplate files and PLC sample programs are found in the Energy Management Accelerator Toolkit.

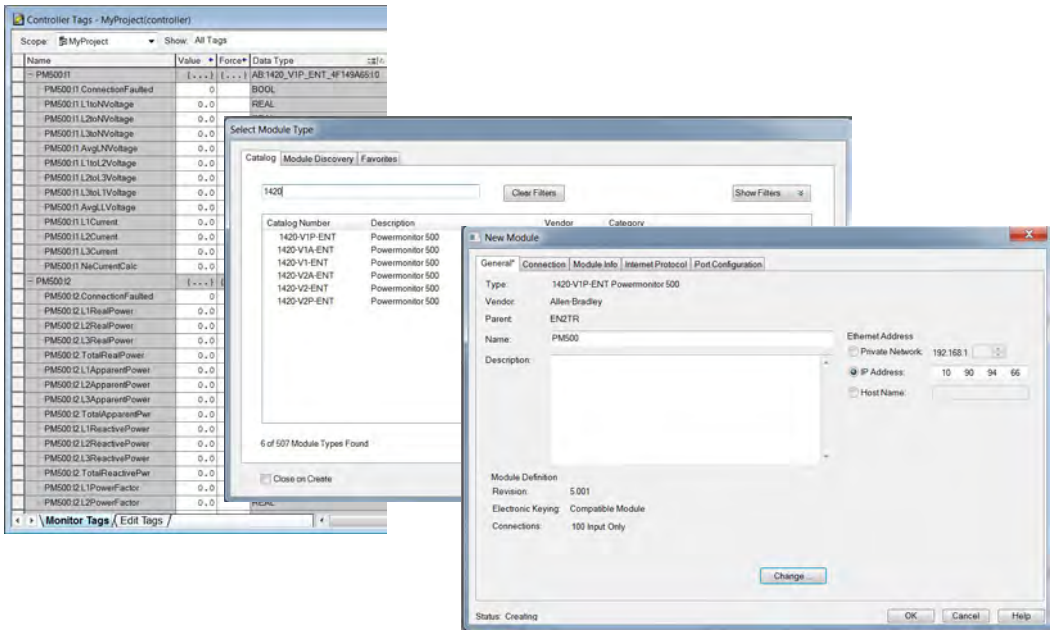


PowerMonitor 500 Unit AOP

The PowerMonitor 500 unit has an electronic data sheet-based Add-on Profile. You can add the PowerMonitor 500 unit to the Logix Designer application version 21 or later with an electronic data sheet (EDS) based AOP (Add-on Profile). Register the PowerMontior 500 EDS file by using the EDS Hardware Installation Tool on the computer on which you develop the software project.

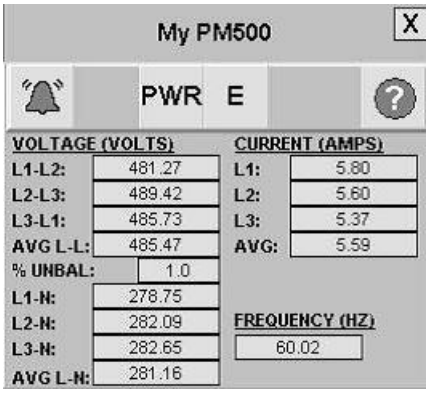
IMPORTANT The EDS AOP is available for PowerMonitor 500 units with Ethernet firmware revision 5.001 and later.

When adding a module in the Studio 5000 application, the PowerMonitor 500 module is displayed under the catalog number 1420 after the EDS file has been installed.

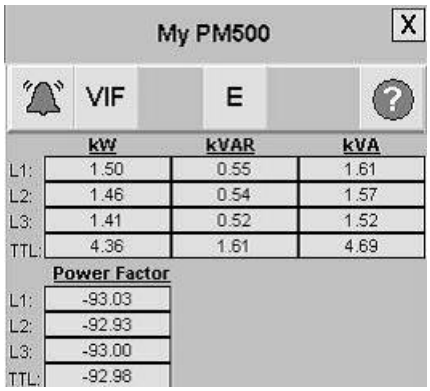


PowerMonitor 500 Unit Faceplates

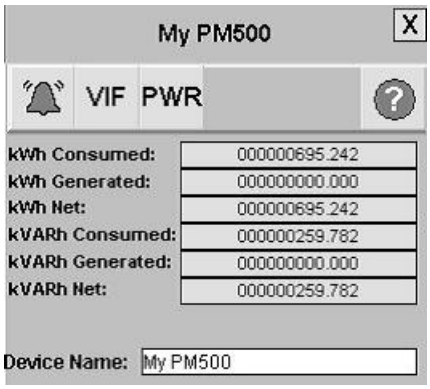
VIF Display - Shows voltage, current, and frequency status.



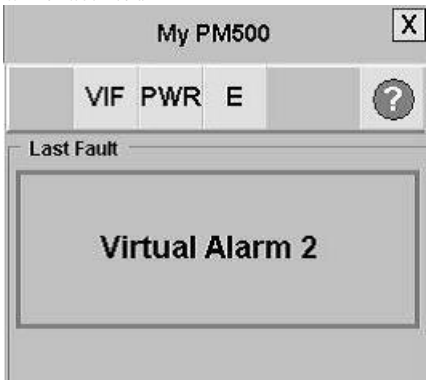
PWR Display - Shows the power status.



Energy Display - Shows real, reactive, and apparent energy odometers. Also lets the operator configure the device name for display at the top of the faceplate.

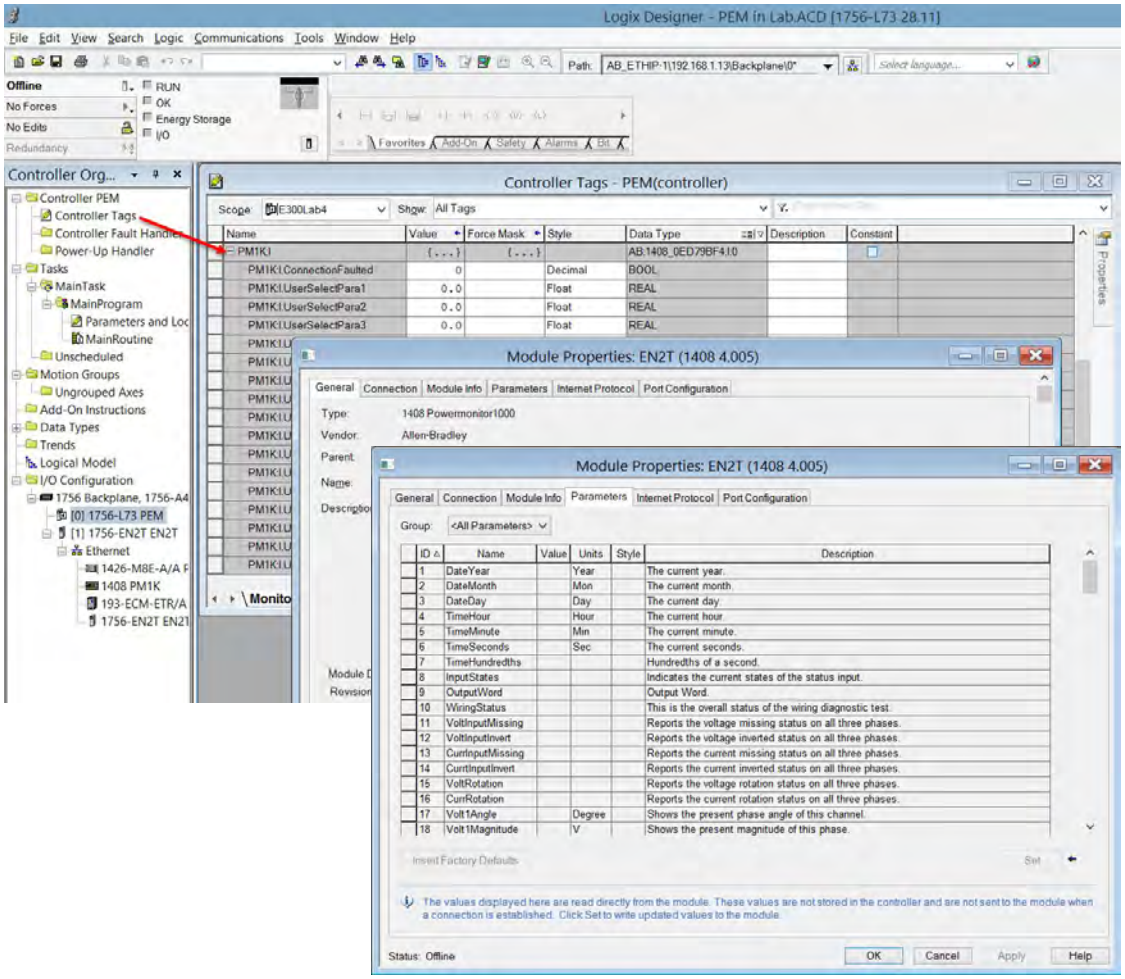


Alarm Display - The PowerMonitor 500 unit provides two user configurable alarms (Virtual Alarm 1 and 2). The alarm display indicates when either of these alarms is active or if there is a communication fault.



PowerMonitor 1000 Unit AOP

The PowerMonitor 1000 unit has an electronic data sheet-based Add-on Profile. The module properties window of the Add-on Profile provides access of real-time parameter data. There are 16 User Selected Parameters available as controller tags. These parameters serve as datalinks between the PowerMonitor 1000 unit and Studio 5000 environment. Your selected parameters are configured by entering the desired parameter numbers into the user configurable data table. These parameters can then be used in a controller program for analysis, alarming, and control.

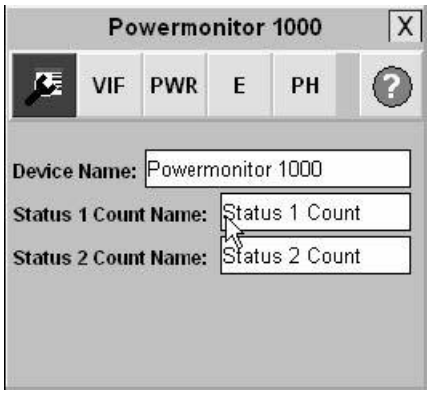


PowerMonitor 1000 Unit Faceplates

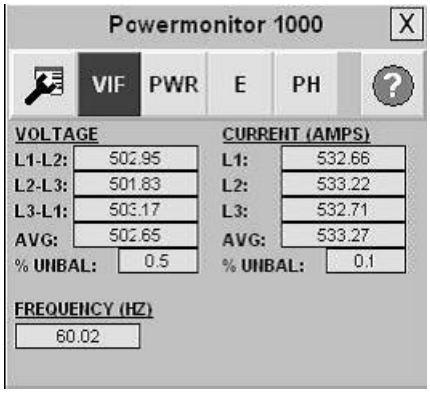
Faceplate files for the PowerMonitor 1000 unit are available in the Energy Management Accelerator toolkit.

The faceplate files are implemented in a FactoryTalk® View Studio application for immediate access to power and energy parameter data.

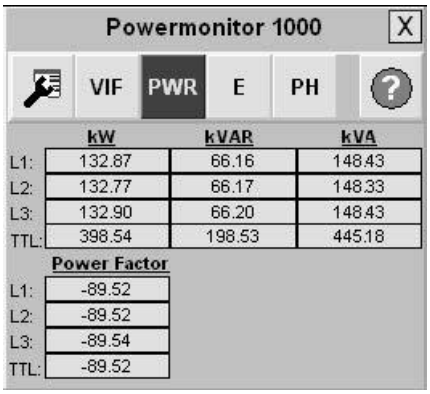
Configuration Display - Renames the Device, and the Status 1 and Status 2 counters.



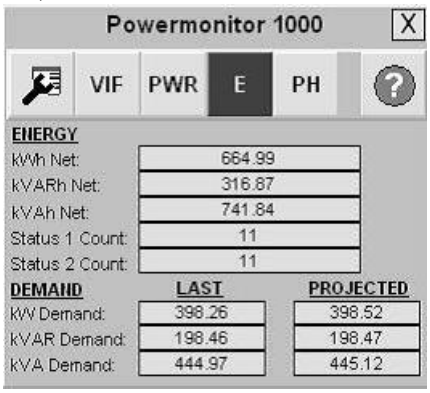
VIF Display - Shows voltage, current, and frequency information for three phases.



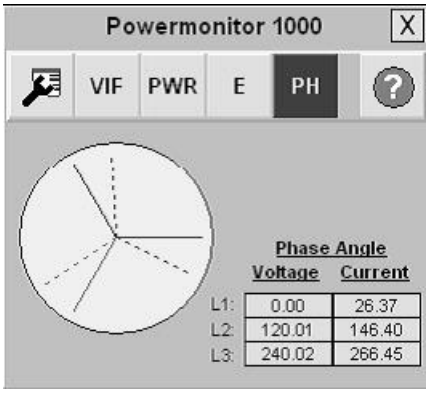
PWR Display - Shows real, reactive, and apparent power, and power factor data.



E Display - Shows real, reactive, and apparent energy, status count, and demand data.



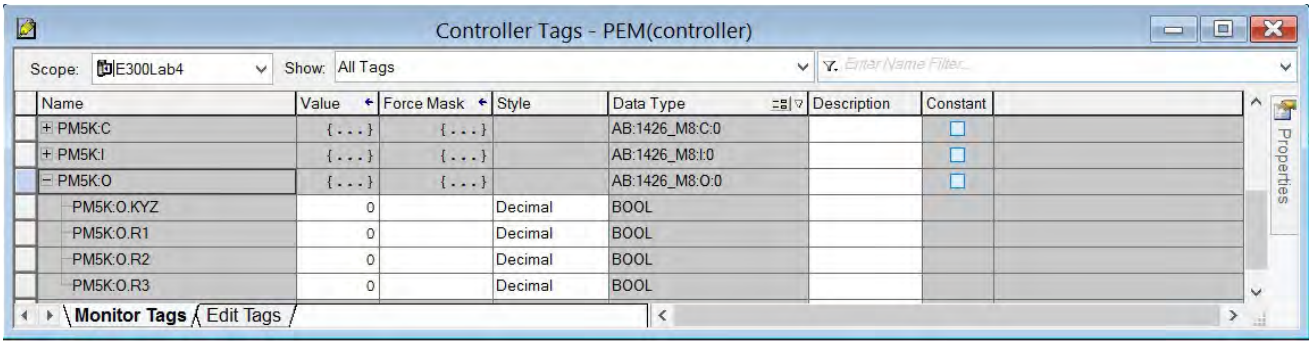
PH Display - Shows real, reactive, and apparent energy, status count, and demand data.

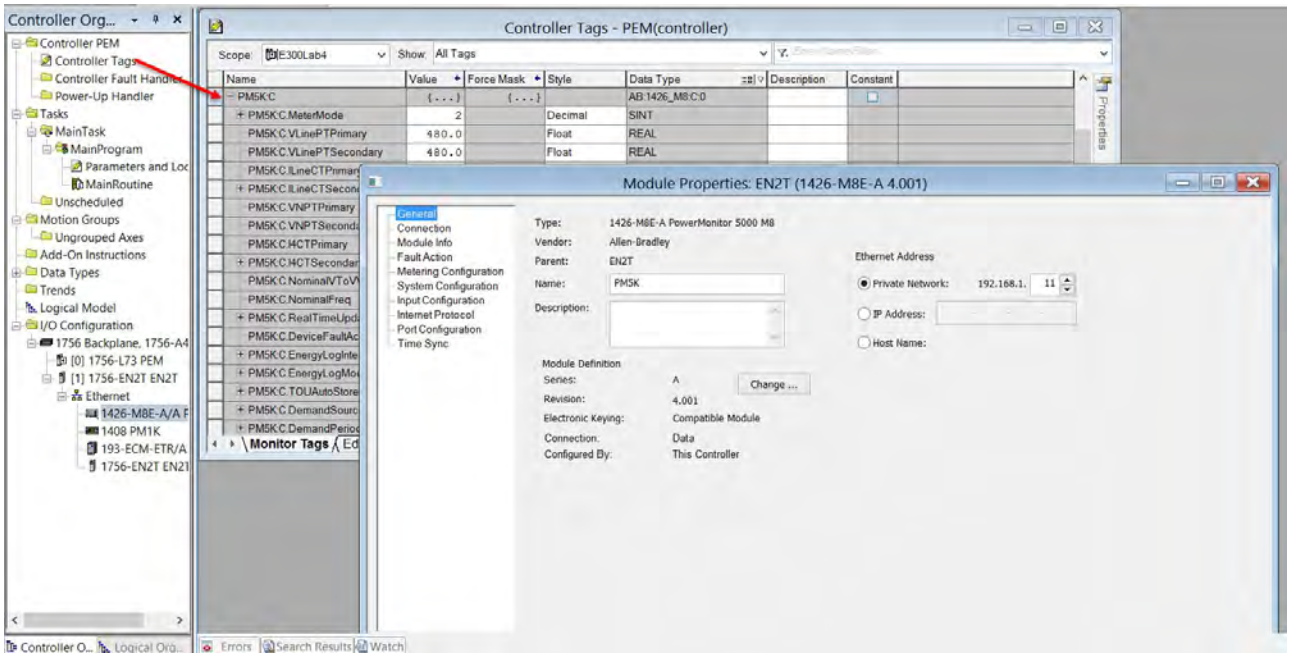


PowerMonitor 5000 Unit AOP

The PowerMonitor 5000 unit provides premier integration to a Logix platform. You have full functionality of configuration and I/O control and monitoring through the controller tags generated by the Add-on Profile.

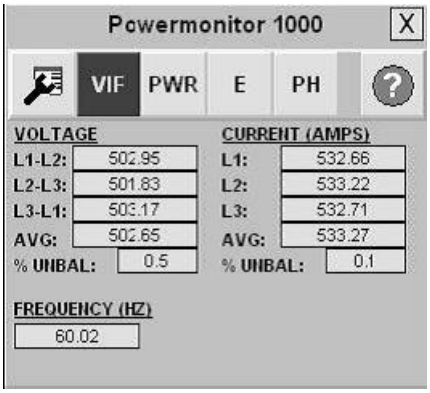
Similar to the PowerMonitor 1000 unit AOP, these tags can be monitored in a controller program and analyzed for control alarm and indication devices, circuit breakers, motor controllers, and other devices to help control the energy consumption or demand of a system.



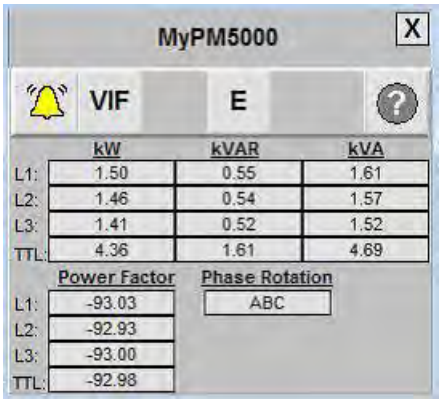


PowerMonitor 5000 Faceplates

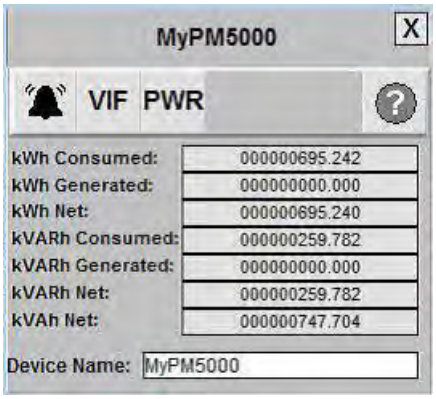
VIF Display - Shows voltage, current, and frequency status.



PWR Display - Shows the power status.

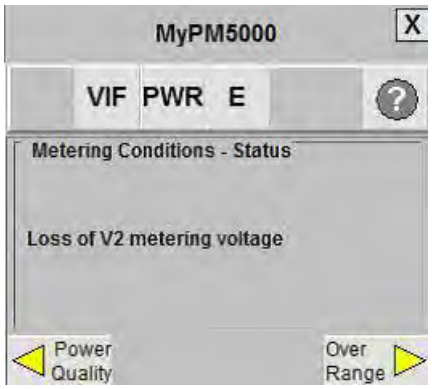


Energy Display - Shows real, reactive, and apparent energy odometers. Also lets the operator configure the device name for display at the top of the faceplate.



Alarm Display - Only the most critical alarms are displayed on the PowerMonitor 5000 faceplate.

- Metering Conditions - Loss of Metering Voltage
- Over Range - Voltage/Ampere Over Range
- Power Quality - Sag/Swell Detected.



FactoryTalk EnergyMetrix Software

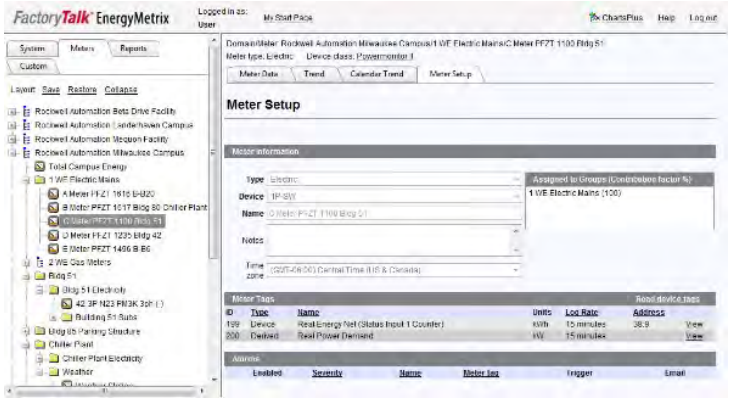
FactoryTalk EnergyMetrix software serves as a centralized database for all energy parameters that can be accessed within a facility or across all facilities in various locations by using a standard web browser. The ability to 'see' a problem often lends additional meaning to the information derived from the raw data, and in turn, leads to the proper corrective actions. The software also lets companies model their energy profiles by doing the following:

- Measuring peak demands and power quality parameters
- Determining demand patterns
- Correlating energy consumption to weather patterns
- Aggregating loads
- Calculating energy costs by business group, department, or site

This modeling approach saves a significant amount of money since solutions can be verified before committing capital expenditures to install new systems or equipment.

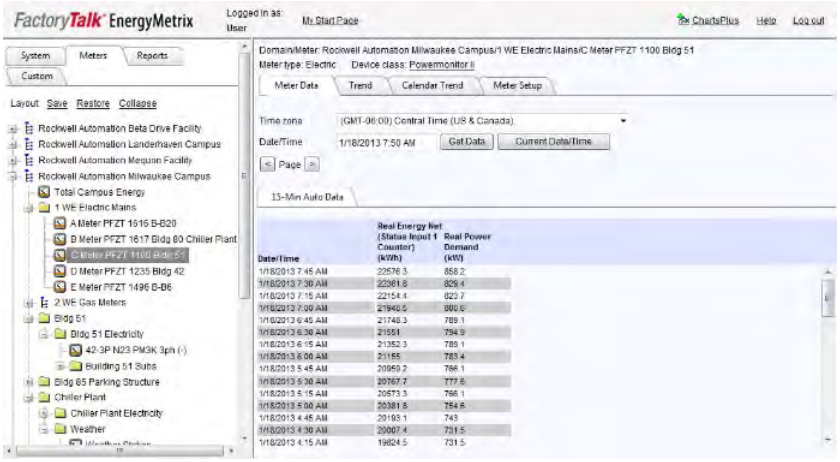
Configure Meters

- Connect to PowerMonitor units and configure meters and meter tags



Collect Meter data

- Collect and store meter data from PowerMonitor units and third-party meters in Database
- Trend meter data



Trending Energy

- Trending Power and Consumption data over time

Calendar Trend

- Powerful tool to compare Power and Demand day-to-day, week-to-week…

Billing Report

- Provides billing information for the selected meters/groups for the specified time range
- Provides line items and a total charge amount

Cost Allocation Report

- Shows cost per specified area that is based on actual usage

FactoryTalk EnergyMetrix

Rockwell Automation
Milwaukee HQ Energy Monitoring System

Rockwell Automation Milwaukee WE Billing 9/1/2012 12:00 AM to 10/1/2012 12:00 AM

Time Zone: (GMT-06:00) Central Time (US & Canada)
Rate Schedule: W CP1 WI Primary TOU fixed 85 PF After 01012011
Total Charge: $240,920.14

Demand Charges

Description	Quantity	Rate	Charge
Customer Demand Charge, > 12,470 and < 138,000	6,364.8 kW	1.007	$6,409.35
On-peak Demand Charge, > 12,470 and < 138,000	6,007.7 kW	10.882	$65,375.57
		Subtotal:	$71,784.92

Fixed Charges

Description	Quantity	Rate	Charge
Facilities Charge	30.0	17.26027	$517.81
		Subtotal:	$517.81

Energy Charges

Description	Quantity	Rate	Charge
On-peak Energy Charge, > 12,470 and < 138,000	1,023,265.8 kWh	0.06985	$71,475.12
Off-peak Energy Charge, > 12,470 and < 138,000	1,810,026.6 kWh	0.04974	$90,030.72
		Subtotal:	$161,505.84

Consumption Report

- Shows consumption values (kWH, kVARh) for selected meters/groups for the specified time range

Demand Analysis Report

- Shows Demand values (kW) for selected meters/groups for the specified time range
- Shows Peak Demand Usage

FactoryTalk EnergyMetrix

Rockwell Automation
Milwaukee HQ Energy Monitoring System

Demand analysis 9/1/2012 12:00 AM to 10/1/2012 12:00 AM

Time Zone: (GMT-06:00) Central Time (US & Canada)

kW

Peak Demand Summary

A Meter PFZT 1616 B-B20	746.8 kW	12.5%	9/4/2012 11:15:00 AM
E Meter PFZT 1496 B-B6	625.9 kW	10.4%	9/4/2012 11:15:00 AM
D Meter PFZT 1235 Bldg 42	1,756.8 kW	29.2%	9/4/2012 11:15:00 AM
C Meter PFZT 1100 Bldg 51	1,071.4 kW	17.8%	9/4/2012 11:15:00 AM
B Meter PFZT 1617 Bldg 80 Chiller Plant	1,804.8 kW	30.0%	9/4/2012 11:15:00 AM
Total	6,007.7 kW	100.0%	

Worst Case Peak Demand Analysis

A Meter PFZT 1616 B-B20	783.4 kW	11.9%	9/7/2012 11:00:00 AM
E Meter PFZT 1496 B-B6	645.1 kW	9.8%	9/6/2012 11:30:00 AM
D Meter PFZT 1235 Bldg 42	1,756.8 kW	26.6%	9/4/2012 11:15:00 AM
C Meter PFZT 1100 Bldg 51	1,255.7 kW	19.0%	9/27/2012 2:45:00 PM
B Meter PFZT 1617 Bldg 80 Chiller Plant	2,154.2 kW	32.7%	9/3/2012 5:45:00 AM
Total	6,595.2 kW	100.0%	

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FactoryTalk EnergyMetrix

Rockwell Automation
Milwaukee HQ Energy Monitoring System

Consumption 9/1/2012 12:00 AM to 10/1/2012 12:00 AM

Time Zone: (GMT-06:00) Central Time (US & Canada)

Steam

Steam

	Steam Usage (mlb)
WE Steam Meter	3,464
Total(s):	3,464

Parking Structure Electricity

Electric

	Real Energy Net (kWh)
Building 85	9,277
Total(s):	9,277

Data Center

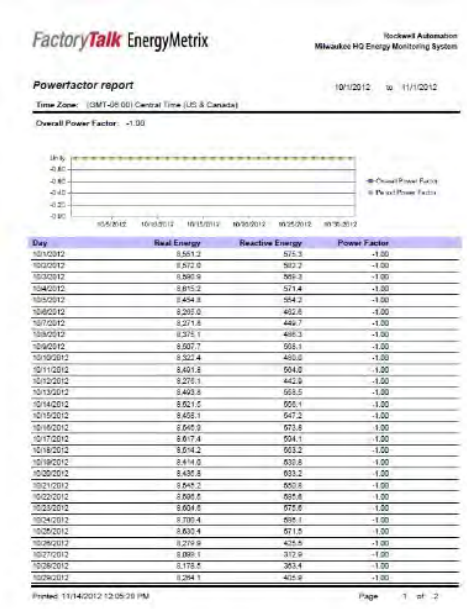
Electric

	Real Energy Net (kWh)	Reactive Energy Net (kVARh)
4N24-SE PM3K	29	1
5N24-SE PM3K	259,473	17,351
6N23-E New	281,927	92,491
8N24-SW New	14,984	11,917
Total(s):	556,412	121,750

Printed 10/18/2012 9:25:40 AM Page 1 of 1

Power Quality Report

- Shows sag/swell information that is detected by PowerMonitor products
- Display waveforms and harmonics in graphical or log formats



FactoryTalk EnergyMetrix

Rockwell Automation
Milwaukee HQ Energy Monitoring System

Powerfactor report 10/1/2012 to 11/1/2012

Time Zone: (GMT-06:00) Central Time (US & Canada)

Overall Power Factor: -1.00

Day	Real Energy	Reactive Energy	Power Factor
10/1/2012	8,561.2	575.3	-1.00
10/2/2012	8,572.0	582.2	-1.00
10/3/2012	8,586.9	569.3	-1.00
10/4/2012	8,615.2	571.4	-1.00
10/5/2012	8,454.8	554.2	-1.00
10/6/2012	8,295.0	462.8	-1.00
10/7/2012	8,271.8	449.7	-1.00
10/8/2012	8,375.1	488.3	-1.00
10/9/2012	8,502.7	508.1	-1.00
10/10/2012	8,527.4	480.0	-1.00
10/11/2012	8,491.8	504.0	-1.00
10/12/2012	8,276.1	442.9	-1.00
10/13/2012	8,493.6	558.5	-1.00
10/14/2012	8,621.0	555.1	-1.00
10/15/2012	8,458.1	547.2	-1.00
10/16/2012	8,546.0	573.8	-1.00
10/17/2012	8,617.4	594.1	-1.00
10/18/2012	8,614.2	603.2	-1.00
10/19/2012	8,414.0	530.8	-1.00
10/20/2012	8,435.8	533.2	-1.00
10/21/2012	8,548.2	560.6	-1.00
10/22/2012	8,596.5	585.8	-1.00
10/23/2012	8,604.5	575.6	-1.00
10/24/2012	8,700.4	595.1	-1.00
10/25/2012	8,630.4	571.5	-1.00
10/26/2012	8,279.9	425.5	-1.00
10/27/2012	8,089.1	372.9	-1.00
10/28/2012	8,175.5	353.4	-1.00
10/29/2012	8,284.1	405.9	-1.00

Printed: 11/14/2012 12:05:28 PM Page 1 of 2

Control

After analyzing the real-time and historical data from PowerMonitor units, an energy management action plan can be devised to start driving new activities to achieve the desired business goals.

Energy Cost Reduction

Demand management systems, for example, automatically project future demand to confirm the peak limit is not exceeded. Load management systems can monitor the electrical consumption of selected equipment and turn them on and off in an operator-selected sequence to minimize peak demand. Loads are prioritized to let you configure the order in which loads are shed and restored. Load shifting maintains a more consistent level of energy use over time, which eases demands on utilities and avoids subsequent charges.

Power Factor Correction can also help minimizecostly penalties from utility providers. Most plants have several highly inductive loads, such as lightly loaded motors and illumination transformers and ballasts. These inductive loads can severely effect power factor. Power factor correction capacitors are one means to combating this issue.

Operating Equipment Efficiency

Proper Utilization of equipment such as HVAC systems or air compressors can be a leading cause of wasted energy. Many companies who have installed power monitors and analyzed their energy data have noticed that their HVAC systems and lighting systems are running through the weekend or at night when no one is working. By simply installing an automated system to control these systems and educating employees to turn off equipment that is not in use, can reduce energy consumption.

Downtime Reduction through Power Quality Monitoring

Power quality events, generally referring to deviations from an ideal sinusoidal voltage waveform, can lead to significant cost in the form of plant downtime and equipment replacement cost. Utility providers are only responsible for power reliability. It is up to the consumer to manage the quality of their power. Voltage sags are one of the most common power quality problems facing many industrial customers. Voltage sags are a reduction in AC voltage that can last from 0.5 cycles to 1 minute. System faults or heavy startup current due to switching on loads cause voltage sags and can result in damaged equipment, data corruption, errors in industrial processing, and system halts. Monitoring these power quality-related events and using the PowerMonitor 5000 power quality logs lets you pinpoint the occurrence of power quality events and mitigate them by installing the necessary equipment.

For more information on power quality detection and mitigation methods, download the Power Quality Issues, Impacts, and Mitigation for Industrial Customers white paper, POWER-WP002, or view the Power Quality and Energy Management Virtual Brochure.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
PowerMonitor 500 Unit User Manual, publication 1420-UM001	Provides information on installing, wiring, and configuring communication with the PowerMonitor 500 unit.
PowerMonitor 1000 Unit User Manual, publication 1408-UM002	Provides information on configuring communication with the PowerMonitor 1000 unit by using other applications and controllers.
PowerMonitor 5000 Unit User Manual, publication 1426-UM001	Provides information on installing, wiring, and configuring communication with the PowerMonitor 5000 unit.
FactoryTalk EnergyMetrix User Manual, publication FTEM-UM003	Provides information on how to use FactoryTalk EnergyMetrix, a modular, scalable, web-enabled, client/ server energy information and management application.
Power and Energy Management Solutions Selection Guide, publication 1400-SG001	Provides information on selecting energy management services and solutions, including hardware and power management software.
Logix Common Procedures Programming Manual, publication 1756-PM001	Provides information on programming Logix 5000™ controllers, including managing project files, organizing tags, programming and testing routines, and handling faults
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website rok.auto/certifications	Provides declarations of conformity, certificates, and other certification details.
Product selection and configuration website, https://www.rockwellautomation.com/global/support/product-selection-configuration/overview.page	Provides information on Integrated Architecture® tools and resources including accelerator toolkits.

You can view or download publications at http://www.rockwellautomation.com/global/literature-library/overview.page. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Notes:

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	www.rockwellautomation.com/knowledgebase
Local Technical Support Phone Numbers	Locate the phone number for your country.	www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	www.rockwellautomation.com/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	www.rockwellautomation.com/global/support/pcdc.page

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at http://literature.rockwellautomation.com/idc/groups/literature/

Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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