EPM 9800

POWER QUALITY METER

High Performance Power Quality Analysis Socket Meter

KEY BENEFITS

- Socket type mounting design with advanced power quality recording and EN50160 Flicker compliance monitoring
- Revenue class .06% Watt/Hr metering with 20 years time of use calendar
- Comprehensive logging & recording capability
- Auto-calibration and temperature change compensation
- Advanced DNP 3.0 implementation
- High speed waveform recording with programmable 16 to 512 samples per cycle resolution
- Extensive harmonics capability provides a real-time harmonic magnitude analysis to the 128th order for every channel. Records THD to the 255th order peak
- Real time phasor analyzer monitors phase angles between the voltage and the currents
- Communication option of 10/100BaseT ethernet with Modbus/TCP
- Expandable output modules

APPLICATIONS

- Advanced power quality monitoring
- Revenue class energy and power billing with .06% accuracy
- Control of external devices using output modules

FEATURES

Monitoring and Metering

- True RMS real-time power and energy parameters reporting
- 4 quadrant, high accuracy revenue metering
- Automatic dial-out for remote data downloads. Dial-In during outage notification
- Comprehensive events and alarms recording using GPS synchronized time stamps.
- Historical logs for energy, power events and alarms.
- Flicker and waveform recording
- Real-time PQ monitoring and analysis

Communications

- RS 485 communication ports
- Optical port
- 10/100 BaseT ethernet with Modbus/TCP
- Built-in dial-in and dial-out telephone modems
- DNP 3.0 level 2 plus, Modbus RTU and Modbus ASCII protocols
- Multiple analog, digital and relay outputs
- 8 KYZ Pulse/Status Inputs Standard
- Programmable LCD display screen

Standard Features

Description

With the socket type mounting design the EPM 9800 meter is perfect for industrial and utility applications where comprehensive power quality monitoring and revenue accuracy are required. The EPM 9800 provides the most accurate analysis of electric power and energy. Using advanced DSP technology the meter measures instant and stored revenue power data.

The meter includes all the attributes required for the highest level of PQ analysis and communication. For today's utility companies and large industrial users, an effective energy management and power-monitoring program is critical for success. The EPM 9800 is an advanced monitoring product, providing the total picture of power usage and power quality for any metered point within a power distribution network. This allows users to make power related decisions quickly and effectively. The EPM 9800 is simple to use and easy to set up.

Precision Power Quality Measurement

16-bit Waveform and Fault Recorder

The EPM 9800 captures up to 512 samples per cycle for an event. Voltage and current are recorded with pre-and-post-event analysis. Hardware and software triggers are available to activate a waveform reading, which can be used for power quality surveys, fault analysis, breaker timing, motor start-up, etc.

Measure and Record Harmonic Magnitudes to the 255th Order

Measures harmonic magnitudes up to the 255th order for each voltage and current channel. Real-time harmonics are resolved to the 128th order. Percent THD and K-factor are also calculated. Harmonic magnitude analysis allows users to conduct power quality analysis at the high end of the harmonic spectrum.

Sub-Cycle Transient Recorder

The unit records sub-cycle transients on voltage and current readings. It monitors switching noise from capacitors, static transfer switches, SCRs and many other "power quality harmful" devices. Transients are often the cause of intermittent and expensive downtime.

Phasor Analysis

The monitor reads a phase angle analysis between the voltage and current channels, allowing for efficiency and system-integrity analysis.

Inter-Harmonics Analysis

The EPM 9800 provides users with the ability to view inter-harmonics, the discrete frequencies that lie between the harmonics of the power frequency voltage and current. Frequencies can now be observed which are not an integer multiple of the fundamental.

Flicker

The EPM 9800 complies with EN50160 Flicker standard requirements. Flicker consists of low frequency (less than 24 Hz) to intermittent line disturbances on the power line. Flicker can affect equipment as well as have negative effects on humans. The Flicker requirements of EN50160 includes:

- Short term readings - PST-10 Min/ Logging & monitoring
- Long Term Reading - PLT-4hour/ Logging and monitoring
- Log viewer - Pst and Plt for Va, Vb, and Vc

Revenue Grade Metering

Full 4-quadrant revenue grade metering capability provides 0.06% accuracy for energy and power usage. The EPM 9800 provides robust Time of Use (TOU) metering with 8 TOU schedules, 4 Seasons, and 20 year calendar with prior month and prior season data for each TOU schedule.

Other advanced billing features includes:

- kWh delivered and received
- kVAh and kVArh in each quadrant
- Bi-directional consumption and demand
- Transformer Loss Compensation

Demand with Reset switch

The EPM 9800 provides a lockable demand reset switch that prevents tempering. It provides multiple demand windows and simultaneous monitoring and calculation of 4 demand types -

- Block or Fixed Demand
- Rolling or Sliding Window Demand
- Predictive Demand
- Thermal Demand

Demands can be programmed in variable intervals ranging from 1 second to several hours, with up to 255 subintervals. Demand data is time stamped using the internal clock. To further enhance time stamp accuracy the meter clock can be synchronized using an IRIG-B signal. The following demand data is time stamped:

- kW Demand Delivered and Received, minimum and maximum
- kVAr Demand Delivered and Received, minimum and maximum
- kVAr coincident with kW Demand
- kVA Demand, minimum and maximum
- Current (Amp) minimum and maximum
- Voltage minimum and maximum

Auto-calibration and temperature compensation

The Digital Sensing Technology (DSP) provides unmatched accuracy through automatic self calibration and making adjustments based on changes in ambient temperature. This ensures the meter data integrity even under harsh environments.

CT & PT Line Compensation

The EPM 9800 units compensates errors in current transformers and potential transformers that include multipoint current compensation and multipoint phase angle compensation. The meters also adjust for both copper and iron losses via a simple user set-up.

Multiple Programmable Memory Logs

The EPM 9800 meters utilize two separate logs of historical information. Furthermore, circuit breaker pressure, transformer temperature or any other analog or digital parameter can be monitored which can help in conducting preventative maintenance on critical equipment.

Primary Historical Trending Log File - Log 1

Log any measured parameter from either the main unit or any of the option modules. Up to 64 values can be logged per programmable interval.

Secondary Historical Trending Log File - Log 2

This log can be set up as an additional historical interval log or as an exclusive energy log. Up to 64 values can be logged per interval.

Out Of Limit Log

The units offer an independent out of limit log. This allows a user to download out of limit information to obtain a sequence of events for any occurrence. Utilizing the 1 millisec clock resolution, the logs can be combined with different metered points through a distribution system to provide an accurate system-wide depiction of a power disturbance.

Event-Triggered Waveform Recording Log

The EPM 9800 records waveforms with a resolution of up to 512 samples per cycle. The amount of waveform recording is based on the amount of memory installed. The unit records the waveform when a value goes out of limit and when the value returns to normal. All information is time stamped to the nearest 1 millisec. The 8 on-board high-speed inputs can be tied to the waveform recording. Record when the breaker tripped as compared to when the relay activated. This is very useful for fault and breaker integrity analysis.

The unit can be programmed to take more than one recording every time an event occurs. Thousands of cycles can be recorded per event.

System Events Log

The EPM 9800 records system events for security and anti-tempering for the following:

- Power Up/down
- Password access/modification
- Change in programmable settings
- Change of run time
- Change of clock time through remote communication (Modbus or DNP)
- Testmode usage
- Meter resets (min/max,logs etc)

Communications

The EPM 9800 offers two built-in, isolated high-speed RS485 communication ports. Either of these ports can communicate using standard protocols that includes Modbus RTU/ASCII and DNP 3.0. Logs and waveform events are available in Modbus format.

Industry Leading DNP 3.0 Level 2 Plus Protocols

The EPM9800 provides the industry's most advanced DNP 3.0 protocol implementations. Meter complies with all DNP Level 1 and Level 2 certification requirements and a host of additional features including:

- Up to 136 measurements (64 binary inputs, 8 binary counters, 64 analog inputs) can be mapped to DNP static points in customizable DNP point maps
- Up to 16 relays and 8 resets can be controlled through DNP
- Report-by-exception processing (DNP Events) dead-bands can be set on a per-point basis
- 250 events of combinations of four events (Binary Input Change, Frozen Counter, Counter Change, Analog Change)
- Freeze Commands: Freeze, Freeze/ No-Ack, Freeze with Time, Freeze with Time/No-Ack
- Freeze with time command enables the EPM 9800 meter to have internal time driven frozen counter and frozen counter event data. When the EPM 9800 meter receives the time and interval the data is created

4 KYZ Pulse Outputs

The EPM 9800 comes equipped with 4 standard internal KYZ pulse outputs for generating energy and power signal that can be sent to external devices such as PLCs.

8 Digital Inputs for Load Aggregation

Using standard 8 kYZ pulse/status inputs, the EPM 9800 can count pulses from external meters and accumulate usage. The pulse inputs can be used to totalize electrical usage and utility values such as water and gas. These pulse inputs can be also used to:

- Accumulate individual registers
- 4 totalized registers that can be added or subtracted
- Totalize with meters kWh readings

Infrared Test Pulse Output

The meter provides an Infra-red test pulse that selects to pulse for the following:

- (+) Watt-hour o (-) Watt-hour
- (+) VAr-hour o (-) VAr-hour
- VA-hour

The pulse uses a time modulated pulse integration allowing the pulse to be accurate during short duration pulse tests using industry accepted reference standards.

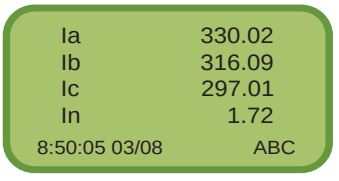
IRIG -B Synchronization Pulse Input

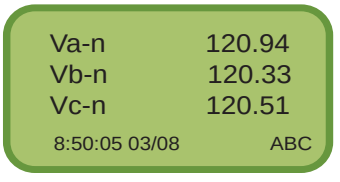
The EPM 9800 has built-in input for IRIG-B time synchronization using universal GPS signal. The meter's clock can be synchronized within 1 millisec time resolution.

User Interface

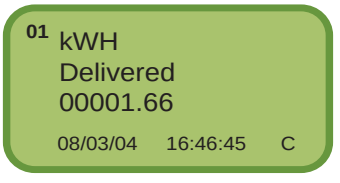
The EPM 9800 comes standard with a built-in user programmable, back-lit graphical display. The meter displays both data and graphical elements, for example, vector diagrams and harmonic plots. The display is comprised of over 400 display screens in three different flexible modes.

- Normal Mode
  - kWh delivered and received
  - kVArh delivered and received
  - kVAh delivered and received
  - Rolling Demands
  - Block Demands

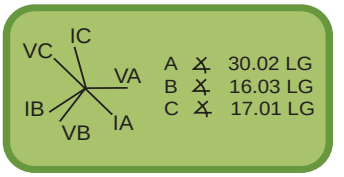




- Time-of-use Mode
  - kWh & kW Demand Delivered & Received for each TOU rate
  - kWh & kW Demand Delivered & Received Total
  - kVArh & kVAr Demand Delivered & Received for each TOU rate
  - kVAh Delivered & Received for each TOU rate
  - kVAh Delivered & Received Total



- Diagnostic Mode
  - Voltages and Currents all phases
  - Phasor Diagram
  - Harmonics to the 63rd order
  - kW, kVA, kVAr, and Power Factor
  - Frequency



Options

Dial-Out Modem

The 9800 has a 56K dial-out modem circuit with a battery that detects voltage loss and dials out to provide outage notification. The meter can also be configured to dial-out for other events and alarms as following:

- Limits and status change
- High speed Input change
- Waveform record capture
- CBEMA power quality event
- Control output change
- Memory full
- Cycling of control power
- Password failure on an in-coming call
- Meter communication failure

Dial-In Server Capability

The dial in server will record all notifications and accept downloads from the meter.

Modem and Ethernet Combination

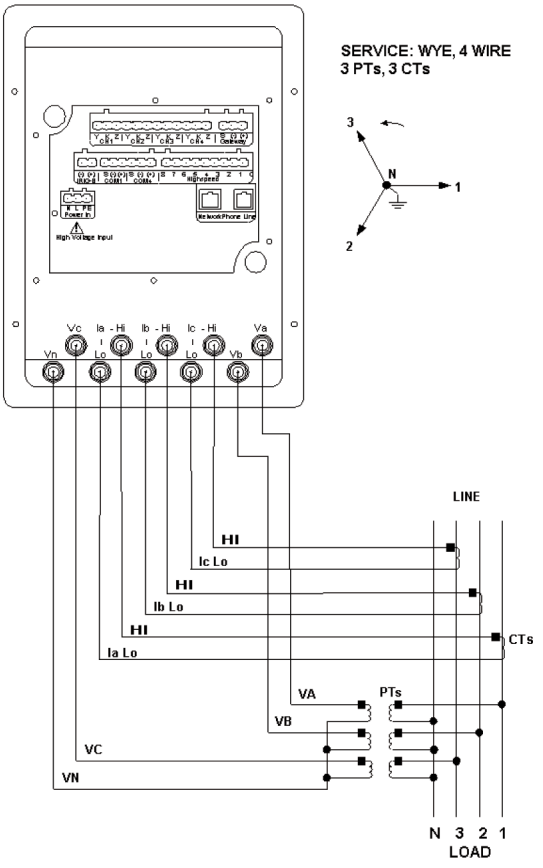
The EPM 9800 offers Ethernet and modem combination for dial-in communication. Meter supports 56k baud Modem and 10/100 Base T Ethernet.

External Output Modules

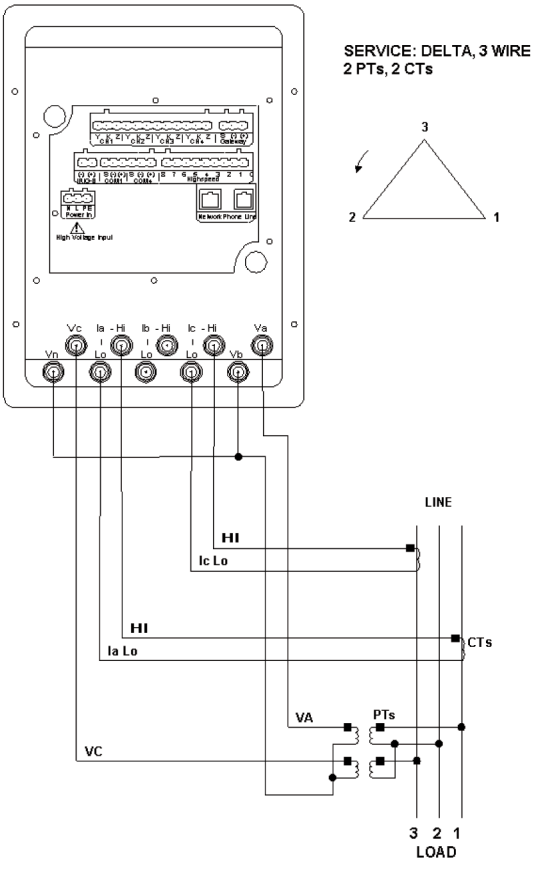
Multiple analog and digital output modules for external connection to the meter are being offered. EPM 9800 can be programmed using Boolean logic to activate outputs on desired events and conditions.

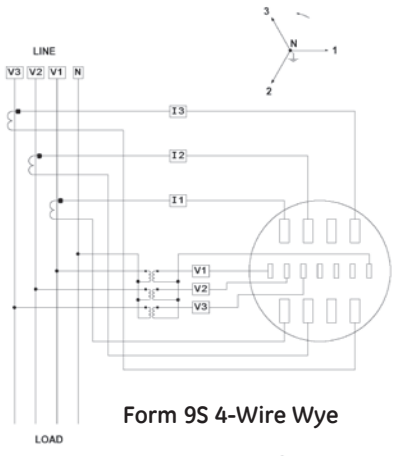
Typical Wiring

Switchboard Mount

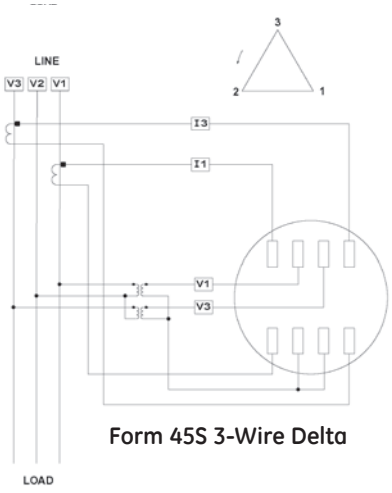


Switchboard Mount





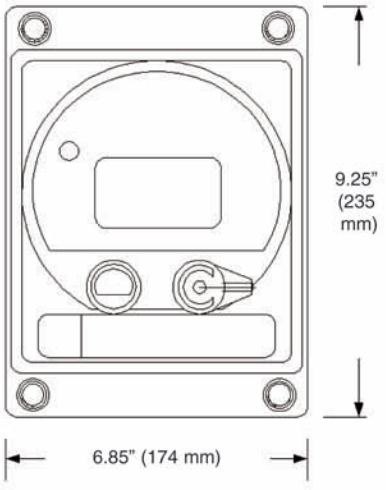
Form 9S 4-Wire Wye



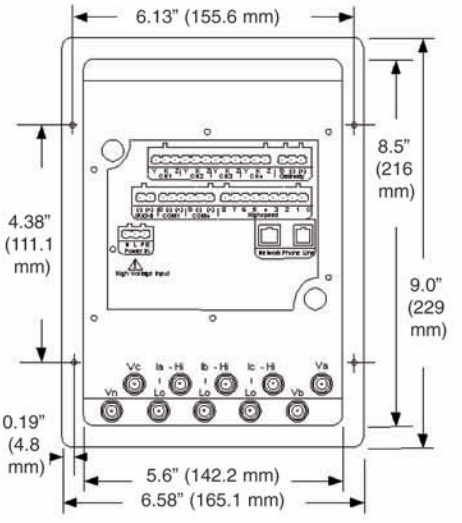
Form 45S 3-Wire Delta

Typical Wiring

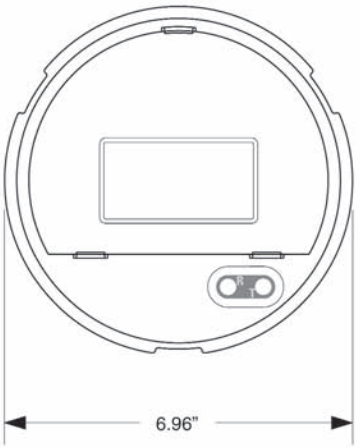
Switchboard Case Front View



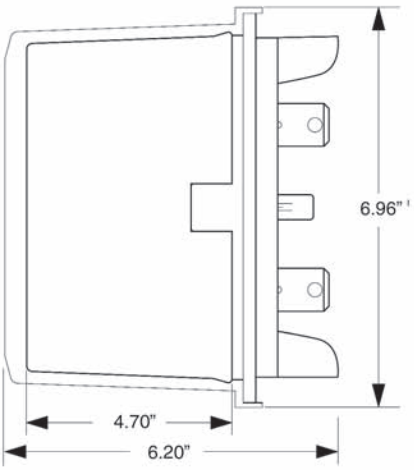
Switchboard Case Back View



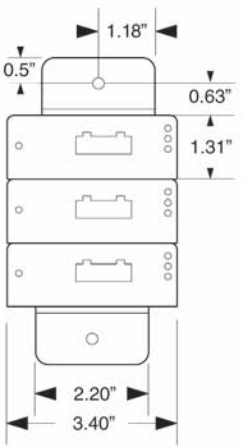
Front View



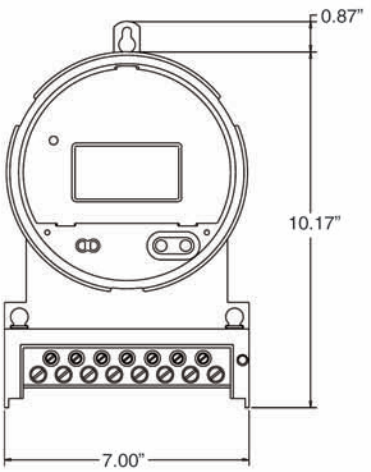
Side View



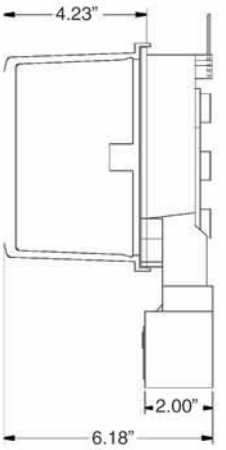
I/O Modules
Front View



A Base Front View



Side View



Technical Specifications

INPUT CURRENT
- 3 or 4 Current Inputs Depending on Form (IA, IB, IC, and IN)
- CT Rated 0-20 Amps Class 20
- CT Rated 0-2 Amps Class 2
- Transformer Rated
- Continuous 120% of Meter Class
- Overload 500% for 1 Second, Non Recurring

INPUT VOLTAGE
- 0 - 360V Line to Neutral
- 0 - 660V Line to Line

BURDEN *(SENSE INPUTS)*
- Voltage Inputs: 0.33VA@576V
- Current Inputs: 0.0125VA@25V

ISOLATION
- All Inputs and Outputs Isolated to 2500 Volts
- Com Ports Isolated From Each Other to 1000 Volts

SENSING
- Accu-Measure®Technology

MEMORY
- All Meter Setup Parameters, Measurements & Logs Contained in Nonvolatile RAM

INTERNAL 8CH DIGITAL INPUTS
- Type: Self Excited, for Dry Contacts Only
- Internal Wetting Voltage: 12V DC Typical

INTERNAL 4CH SOLIDSTATE OUTPUTS *(KYZ)*
- Type: Form A or C
- On Resistance: 23-35Ω
- Peak Voltage: 350V DC
- Continuous Load Current: 120mA
- Peak Load Current: 350mA *(10ms)*
- Off State Leakage Current @350V DC: 1: µA
- Opto Isolation: 3750V rms *(60Hz, 1 min.)*

CLOCK TIMING
- Internal Clock Crystal - Accuracy Better than 1 Minute per Month
- IRIG-B Input for Synchronizing to External GPS Clock Signal - Accuracy Better than 1 msec per Month
- Line Sync -Accuracy Better than 1 Second per Month

OUTPUT MODULES

ANALOG TRANSDUCER SIGNAL OUTPUT
4 Analog Outputs, 0–1mA, self-powered, scalable, bi-directional
8 Analog Outputs, 0–1mA, self-powered, scalable, bi-directional
4 Analog Outputs, 4–20mA, self-powered, scalable
8 Analog Outputs, 4–20mA, self-powered, scalable

Wiring: Common Mode
Accuracy: 0.1% of Full Scale
Calibration: Self-Calibrating
Scaling: Programmable
Ordering Specifics: Up to 4 Analog Output modules can be used with each unit

Wiring: Common Mode
Accuracy: 0.25% of Full Scale
Scaling: Programmable
Ordering Specifics: Up to 4 modules can be used

DIGITAL DRY CONTACT RELAY OUTPUTS
4 Relay Outputs, 5 amps, 125, AC/DC, Form C

Ordering Specifics: Multiple modules can be used

DIGITAL SOLID STATE PULSE OUTPUTS
4 Solid State Pulse, Outputs, Form A or C KYZ Pulses

Maximum Pulse Speed: 20 pulses per second
Ordering Specifics: Up to 4 modules can be used

USER INTERFACE

STANDARD
- LCD Display
- IR Port
- Two RS-485 Serial Ports
- Modbus RTU, Modbus ASCII, DNP 3.0
- Data Speeds of up to 115k bps
- Eight High-Speed Input Channels

OPTIONAL
- 56K Modem with Dial-Out Capabilities
- Internal 10/100Base T
- Modem/Ethernet Combo Card
- Modbus TCP and DNP LAN/WAN

AUX POWER SUPPLY OPTION
- Standard **(OPTION S)**
  102 to 550 Volts AC Auto-Ranging 3 Phase.
  12VA Worst Case Total Burden. Meter Power Provided by any of the 3 Phase Voltage Sources Being Monitored. Blade Powered.
- Standard External **(OPTION E)**
  102 to 275 Volts AC/DC Max Power Consumption: 16 VA@276VAC. Separate Power Cord.
- Low Voltage **(OPTION L)**
  69V AC 20%± – Low Voltage Supply for 69 Volt L-N Applications
- Low Voltage External **(OPTION D)**
  18 to 60 Volts DC – External Low Voltage Supply for DC Powered Applications

NOTE: Switchboard Meter is always separately powered.

SECURITY
- Hardware Lock Secures Meter Settings
- Two 10-Character Passwords
- One Password Controls Access to Read Meter Digitally
- Separate Password Controls Access to Program Meter

ENVIRONMENTAL
- Operating Temperature: (-40 to +85)°C
- Display Temperature: (-20 to +60)°C
- Raintight Lexan Cover *(Socket)*

SHIPPING
Weight:
Socket: 8 Lbs Switchboard: 14 Lbs
Dimensions:
Socket: 10" x 11" x13" Switchboard: 16" x14" x 11"

COMPLIANCE
Compliance Standards:
ANSIC12.20 ANSI-Certified
IEC 60687 — Certified
Approvals:
- Europe: IIEC 60687 — KEMA Certified
- ANSI/IEEE C37.90.1 Surge Withstand
- ANSI C62.41 Surge Immunity
- IEC 1000-4-2 ESD
- IEC 1000-4-3 Radiated Immunity
- IEC 1000-4-4 Fast Transient
- IEC 1000-4-5 Surge Immunity
- IEC 1000-4-6 Conducted Immunity
- IEC 60068-2-6 Vibration *(Sinusodial)*
- IEC 60068-2-27 Shock Test
- IEC 695-2-1 Resistance to Heat & Fire
- IEC 529 Dust & Water
- IEC 68-2-1 Cold Test
- IEC 68-2-2 Dry Heat
- IEC 68-2-30 Damp Heat

SUPPORTED METER FORMS

Form	Rated Voltage	Hookup
9S	0 to 277V L-N	3E, 4W, Wye
36S	0 to 277V L-N	2.5E, 4W, Wye with Neutral
45S	0 to 480V L-L	2E, 3W, Delta
SWB2	0 to 277V	Programmable (Universal Forms)
9A	0 to 277V L-N	A Base Form

LOGGING

Model	Memory	Historical Log 1 [1]	Historical Log 2 [1]	SBEMA/ ITIC [2]	Out of LimitLog [2]	Waveform Log	Flicker Log	Output Log	Input Log	System Events [2]
9800	Standard	85 days	133 days	512	1024	63	1536	256	1024	1024
9800	Advanced	555 days	133 days	512	1024	95	5120	256	1024	1024

[1] Assumes logs store 4 scaled energy readings every 15 minutes
[2] Number of events recorded (assumes 14 parameters monitored)
[3] Number of waveform records. Each record may be from 8-64 cycles in duration depending upon meter setup

Ordering

EPM 9800	*	*	*	*	*	*	Description
PL9800							LCD Graphical Display 2 RS 485 Serial Communication Ports (Modbus & DNP) 8 Internal Digital Inputs, 4 KYZ Pulse Outputs IR Port, IRIG-B Synchronization Port Flicker and Waveform Detection and Logging
Frequency	6						60 Hz
	5						50 Hz
Power Supply		S					Blade Powered - 102 to 550 VAC Auto Ranging
		E					External - 102 - 270 VAC/DC Auto Ranging
		D					External - 18 - 60 VDC Auto Ranging
		L					Blade Powered - 69 VAC
Form			9S				Rated Voltage 0-277 V L-N - 3E, 4W Wye Hook-up
			36S				Rated Voltage 0-277 V L-N - 2.5E, 4W Wye w/ Neutral
			45S				Rated Voltage 0-480 V L-L - 2E, 3W, Delta
			9A				Rated Voltage 0-277 V L-N - A Base Form
			SB				Switchboard - *Available with "Power Supply" E and D Only*
Logging Options				S			Standard -218 days of data logging, 63 Waveform Record, 1536 Flicker Log, 1024 System Events
				A			Advanced -688 days of data logging, 95 Waveform Record, 5120 Flicker Log, 1024 System Events
Communications					R		Standard 2 RS485 serial communications ports (Modbus & DNP)
					W		10/100 BaseT Ethernet
					M		Modem - Standard with Internal 56k Dial Out Modem
					C		Combination - Standard Modem and 10/100 BaseT Ethernet
CT Secondary						20	5 Amp Phase CT Secondaries - Class 20
						2	1 Amp Phase CT Secondaries - Class 2

Accessories:

Note: Accessories must be ordered separately from base meters.

Analog Output Modules

PL9000	*	*	*	*	*	*	*	0	0	Description
	1	M	A	O	N	4	O			4 Channel 0-1 mA Analog Outputs
	1	M	A	O	N	8	O			8 Channel 0-1 mA Analog Outputs
	2	O	M	A	O	N	4			4 Channel 4-20 mA Analog Outputs
	2	O	M	A	O	N	8			8 Channel 4-20 mA Analog Outputs

Digital Output Modules

PL9000	*	*	*	*	0	0		0	0	0	Description
	4	R	O	1							4 Channel Control Relay Outputs
	4	P	O	1							4 Channel kyz Solid State Pulse Outputs

Auxiliary Output Mounting

PL9000	M	B	I	O	0	0		0	0	0	Description
											Output Mounting Bracket (One set per module group)

Auxiliary I/O Power Supply

PL9000	P	S	I	O	0	0		0	0	0	Description
											Output Auxiliary Power Supply (For more than 4 modules)

9000 Series Meter Software

PL9000	*	*	*	*	0	0		0	0	0	Description
	N	C	M	1							Communicator Software, Single User License
	N	C	M	5							Communicator Software, Five User License
	N	C	M	S							Communicator Software, Multiple User, Single Site License