SATEC
Powerful Solutions

Model PM174 Advanced Power Quality Monitor

Model PM174 PQ Monitor

The Model PM174 Advanced Power Quality Monitor is SATEC's new generation of power instrumentation that fully complies with the IEEE-1159 power quality category to define phase, magnitude and duration of events. The extensive features of the Model PM174 Series make it ideal for applications such as feeder, switchgear monitoring, revenue billing, PQ monitoring and utility SCADA. It is also ideal for substation automation because of its support for the industry standard DNP3.0 and Modbus RTU protocols. The PQ monitor fits the ANSI C39.1 4-inch round cutout for easy analog meter replacement. Its galvanically isolated voltage, current, and power supply inputs make it extremely durable and reliable even in the harshest substation environment.

STANDARD FEATURES

Measurements

- Class 0.2S revenue accuracy
- 128 samples per cycle true RMS measurements
- Fast, real-time, cycle by cycle measurements, averaging values of 8, 16, or 32 cycles, selectable via the front panel
- Four-Quadrant measurements
- Min/Max values (instantaneous & demands)

Wiring configurations

- Each model accepts all wiring configurations, selectable via the front panel
- Supports Wye and Delta in 2-element, 2½-element, and 3-element wiring configurations

Digital Inputs

- 2 Dry Contact Digital Inputs
- Status or breaker monitoring
- Time stamp operation to 1ms
- Pulse counting and accumulation with user configurable weighting factors

Relay Outputs

- 2 programmable Form A relays
- Energy pulsing output (Wh, VARh, VAh)
- Alarming via programmable setpoint triggers such as phase loss, low volts demands, etc
- Manual control via communication commands
- Fail Safe mode

Integrated / Remote Display Module

- Display module can be integrated with the base unit or mounted remotely
- 3 line high-visibility 7-segment LED display, fully visible under bright sunlight
- Two 4-digit and one 6-digit window
- Simultaneous display of 3 phase parameters for quick phase balance assessment
- 6-digit Energy readings
- Configurable 8-segment LED % Load Bar mimics analog meter needle
- Energy pulse LED
- Communications activity LEDs
- Kilo and Mega LEDs for scaling indicators
- Menu driven selection with password
- Automatic scrolling with adjustable scroll time or fixed display
- User configurable, simple two-button Demand RESET operation
- Adjustable update time from 0.1 to 10 seconds
- Supports a second remote display module over RS485

Setpoints

- 16 user programmable set points with actions
- Independent Operate & Release Limits
- Independent Operate & Release Time Delays
- Logical AND/OR conditions
- Fast 10 ms update
- Choice of actions:
  - Close / Open relay
  - Increment / Clear counters

Demands

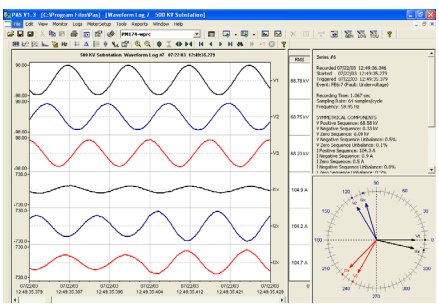
- Configurable demand calculation to match utility settings
  - Demand period from 1 to 60 minutes.
  - Number of demand periods from 1 to 15
- External synchronization for demand interval with Status Input or via communications

Communications

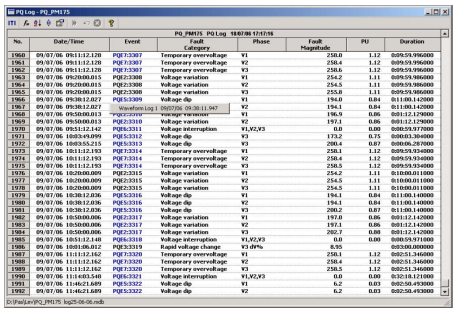
- Two independent communication ports
- **COM1** - optically isolated RS232/422/485 port, selectable via the front panel
  - Optional 10BaseT Ethernet-Modbus/TCP, DNP3/TCP protocols
  - Optional 56K modem
  - Optional Profibus DP
- **COM2** - optically isolated RS422/485 port
- Supports industry standard Modbus RTU & ASCII, DNP3.0,
- Unique "Assignable Register Map" allows users to assign registers from different ranges into a single contiguous Modbus address space or a DNP Class 0, 1, 2, or 3 poll, limiting the amount of data passed over the communications line and therefore making efficient use of the available bandwidth
- Supports up to 2 AX8 Analog Expanders for an additional 16 analog output channels
- Firmware upgrade via communications, eliminating chip replacement

Advanced Power Quality Functions

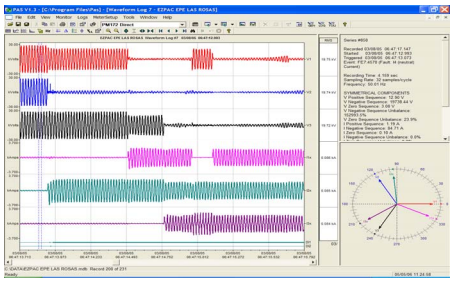
- Transient recording (minimum width: 130us @ 60Hz)
- Sag/Swell detection as per IEEE-1159 PQ categories: detailed description of event, phase, magnitude and duration
- Flicker (IEC 61000)
- ITI curves (CBEMA)
- Statistical Report Writer
- Export to PQDIF & COMTRADE format



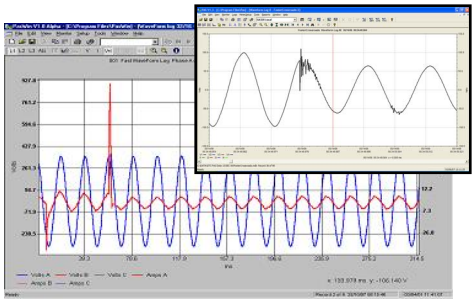
Real-Time "Scope Mode"



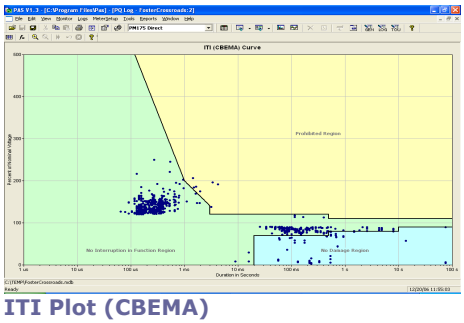
IEEE-1159 Categories - PQ Log



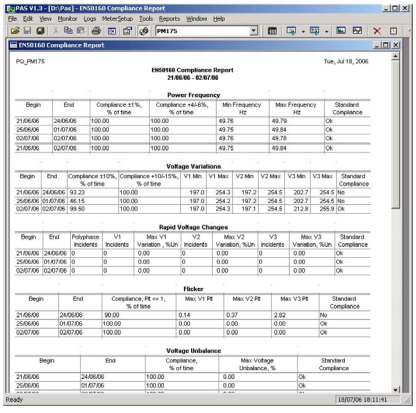
Detailed Waveform Capture



Transient Capture



ITI Plot (CBEMA)



Statistical Compliance Report

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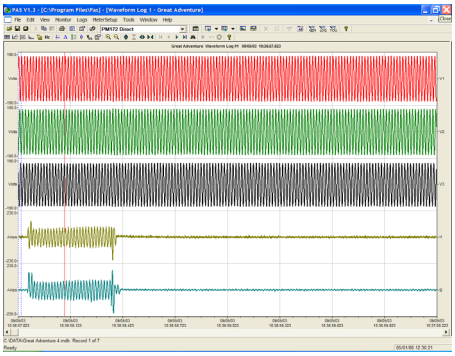
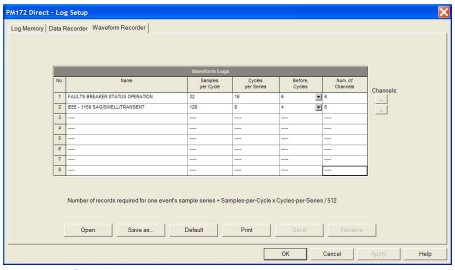
Waveform Logs

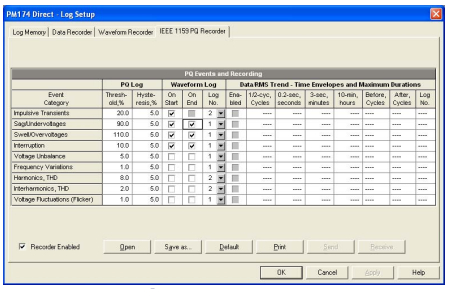
- Two independent, simultaneous waveform recorders, each recording the complete 3-phase voltage and current waveforms
- Recording resolution at 32, 64 and 128 samples/cycle
- Up to 20 pre-fault cycles
- Any number of post-fault cycles, limited only by available memory
- Supports Wrap-Around and Stop-on-Full recording modes



Motor Startup



Waveform Log Setup



PQ Setup Tab

Log Memory

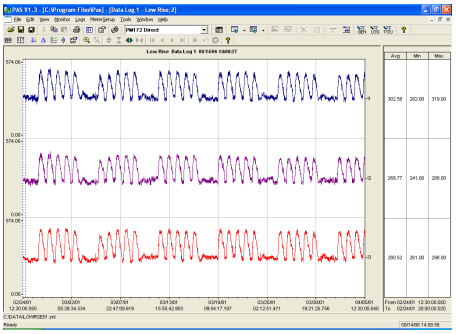
- 1MB of non-volatile log memory with battery backup. Up to 140 days of trending & load profile (16 measurements @ 15 minute interval)
- User-partitionable for Event Log, Data Logs, and Waveform Log Files

Event Log

- 1 Event Log of programmable depth

Data Logs

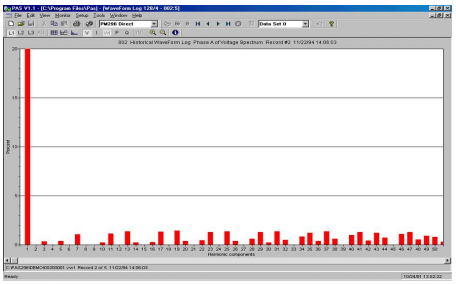
- 16 Data Logs of 16 parameters each
- Configurable depth
- Recording intervals from 1 to 9999 seconds
- Supports wrap-around and Stop-on-Full recording modes



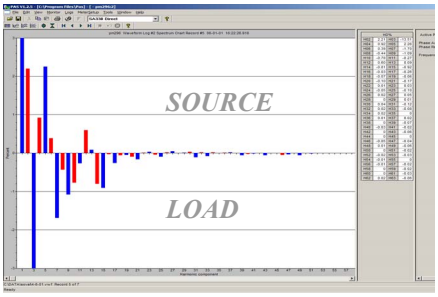
Log Profile / Data Trend

Advanced Harmonic Measurements

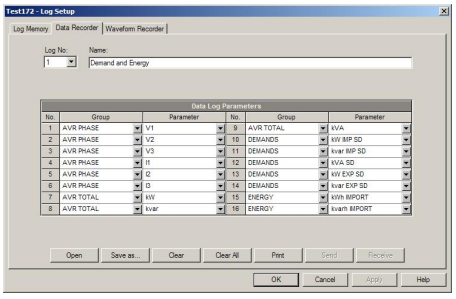
- Individual Harmonics up to 63rd, Amplitude & Phase
- Harmonic Power Direction (Load/Source)
- Total Harmonic Power and Energies



Harmonics Spectrum



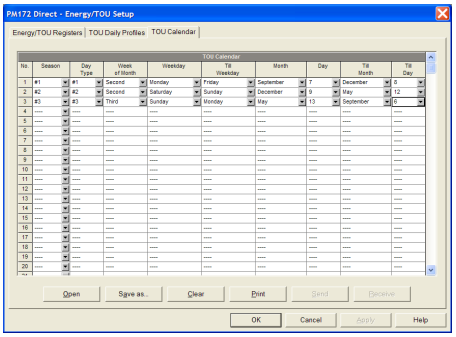
Directional Harmonics



Data Log Setup

Time Of Use (TOU)

- Configurable to match any utility billing profile
- 8 Energy and Maximum Demand Registers
- 8 tariffs for each energy register



TOU Calendar with Daily Profiles

Optional Inputs/Outputs

Analog Outputs (optional)

- 2 isolated, programmable Analog Outputs
- Fast 1-cycle update time
- Settable to any electrical measurement
- Programmable HI/LO Ranges

Analog Inputs (optional)

- 2 isolated, programmable Analog Inputs
- Fast 1-cycle scan time
- For monitoring substation and transformer temperature, oil level and pressure, etc

Software and Integration

System Integration

- Easy integration with Energy Management or SCADA systems via Modbus RTU, ASCII, DNP3.0 protocols
- Remote display and logging of all measured parameters
- Automatic/Remote Alarm & Control
- Remote configuration

PAS Software

- Included with every SATEC device
- Easy to use remote configuration software
- Supports off-line programming to allow easy downloading of a standard configuration to multiple meters
- Supports scheduled polling, viewing of real-time data, and automatic retrieval of historical and waveform logs
- Provides the ability to export waveform and data logs to COMTRADE and PQDIF formats
- Advanced Power Quality Analysis

Installation & Connections

- Each model accepts all wiring configurations, selectable from the front panel
- Analog meter replacement. Mounting standard to both ANSI C39.1 4-inch round and DIN 96x96 mm² cutouts
- Direct connection up to 400/690V or via PT
- Configurable PT and CT ratios via front panel
- Optional switchboard case for retrofit situations

Contact factory for details

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Accuracy

Voltage: 0.2% reading + 0.01% F.S.
(10% to 120% Nominal)
Range: 0 to 1,150,000V
Starting Voltage: 1.5% F.S.

Current: 0.2% reading + 0.02% F.S.
(1% to 200% Nominal)
Range: 0 to 10,000A
Starting Current: 0.1% F.S.

I Neutral: 0.6% F.S. (2% to 150% Nominal)

Frequency: 0.02% reading (15 to 480 Hz)

PF: 0.2% F.S. (|PF| ≥ 0.5)

THD: 1.5% reading + 0.1% F.S.
THD ≥ 1%
V ≥ 10% F.S.V
I ≥ 10% F.S.I.

TDD: 1.5% F.S.
TDD ≥ 1%
I ≥ 10% F.S.I.

Watts: 0.2% reading + 0.02% F.S.
(|PF| ≥ 0.5)
-10,000,000 to +10,000,000 kW

VARs: 0.3% F.S. (|PF| ≤ 0.9)
-2,000,000 to +2,000,000 kVAR

VAs: 0.2% F.S. (|PF| ≥ 0.5)
0 to +2,000,000 kVA

Wh: Class 0.2S as per IEC 62053-22: 2003
-999,999,999 to +999,999,999 MWh

VARh: Class 0.2S as per IEC 62053-22:2003
-999,999,999 to +999,999,999 MVARh

VAh: Class 0.2S as per IEC 62053-22: 2003
0 to 999,999,999 MVAh

INPUT SPECIFICATIONS

Power Supply:

- 85-265V AC/DC universal power supply
  - 85-265VAC 50/60Hz, 88-290VDC, 10W
  - Isolation:
    - Input to output: 3000VAC
    - Input to ground: 2000VAC
- Options:
  - 12VDC: 10-16VDC
  - 24VDC: 18-36VDC
  - 48VDC: 36-72VDC

Voltage:

Direct Input: Up to 400V-ln/690V-ll
Input impedance: 500 kΩ
PT Ratio: 1.0-6500
Range: 1-999,000V
Burden: <0.4VA for 400VAC
<0.04VA for 120VAC
Overload withstand: 1000VAC continuous
2000VAC for 1 second
Galvanic Isolation: 3500VAC
Wire size: Up to 12AWG (2.5mm²)

Current:

5A secondary:
Operating Range: Continuous 10A RMS
Burden: < 0.1VA
Overload: 15A continuous
300A RMS for 1 second

1A secondary:
Operating Range: Continuous 2A RMS
Burden: < 0.02VA
Overload: 6A continuous
80A RMS for 1 second

CT Ratio: 1-50,000A
Range: 0-60,000A
Galvanic Isolation: 3500VAC
Wire size: Up to 12AWG (2.5mm²)

Digital Inputs:

- 2 dry contact digital inputs
- Internal supply: 15V
- Scan time: 1ms
- Isolation: 2000V RMS
- Wire size: Up to 14AWG (1.5mm²)

Analog Inputs (optional):

- 2 optically isolated analog inputs
  - 0-1mA (100% overload)
  - ±1mA (100% overload)
  - 0-20mA
  - 4-20mA
- Accuracy: 0.5% F.S.
- Scan time: 1 cycle
- Isolation: 2000V RMS
- Wire size: Up to 14AWG (1.5mm²)

OUTPUT SPECIFICATIONS

Relay Outputs:

- 2 Form A relays for alarming and control
- 3A @ 250VAC/30VDC
- Galvanic Isolation:
  - 2000VAC/1min. between contacts and coil
  - 1000VAC between open contacts
- Operate time: 10 ms max.
- Release time: 5 ms max.
- Update time: 1 cycle

Analog Outputs (optional):

- 2 optically isolated analog outputs
  - ±1mA, max. load 5kΩ (100% overload)
  - 0-20mA, max. load 510Ω
  - 4-20mA, max. load 510Ω
  - 0-1mA, max. load 5kΩ (100% overload)
- Accuracy 0.5% F.S.
- Update time: 1 cycle
- Isolation: 2000V RMS
- Wire size: Up to 14 AWG (1.5mm²)

COMMUNICATION:

2 independent and simultaneous connections

COM1

- Standard
  - Optically isolated RS-232/422/485 port
  - Isolation: 2000V RMS
  - Selectable baud rate to 115,200 maximum
  - 7/8 bit even parity or 8 bit no parity
  - Protocols supported: Modbus RTU & ASCII, and DNPV3.0
- Optional Ethernet
  - Transformer-isolated 10/100BaseT
  - Connector: RJ45
  - Protocols supported: Modbus TCP, DNP3/TCP
  - 2 simultaneous connections
- Optional Dial-up Modem
  - Transformer-isolated 56KB modem
  - Connector: RJ11
  - Protocols supported: Modbus RTU, Satec ASCII, and DNPV3.0
- Optional Profibus DP (IEC 61158)
  - RS-485 optically isolated Profibus interface
  - Connector: DB9
  - Baud rate: 9600 - 12Mbps auto detection
  - 32 bytes input, 32 bytes output
  - Protocol supported: Profibus DP

COM2

- Optically isolated RS-422/RS-485 port
- Isolation: 2000V RMS
- Connector: 5-pin removable connector
- Selectable baud rate to 115,200 maximum
- 7/8 bit even parity or 8 bit no parity
- Protocols supported: Modbus RTU & ASCII, and DNPV3.0
- Wire size: up to 14 AWG (1.5mm²)

Real-time clock:

- Accuracy: 15 seconds per month @ 25°C (25ppm)

Standards of Compliance:

UL E129258
UL61010B-1

CE EMC: 89/336/EEC as amended by 92/31/EEC and 93/68/EEC
LVD: 73/23/EEC as amended by 93/68/EEC and 93/465/EEC

Harmonized standards to which conformity is declared:

EN EN55011: 1991; EN 50082-1: 1992;
EN61010-1: 1993; A2/1995
EN50081-2: 1994 Generic Emission Standard – Industrial Environment
EN50082-2: 1995 Generic Immunity Standard – Industrial Environment
EN55011:1994 Class A
EN61000-4-2: 1995 Electrostatic Discharge
EN61000-4-4: 1995 Electrical Fast Transient
EN61000-4-8: 1993 Radio Frequency Electromagnetic Field, Amplitude Modulated.
ENV50140: 1995 (200Hz) Radio Frequency Electromagnetic Field, Pulse Modulated
ENV50204: 1995 (900MHz)
ENV50141: 1993 Radio Frequency Common Mode, Amplitude Modulated

ANSI C37.90.1: 1989 Surge Withstand Capability

ANSI C62.41: 1991 Standard Surge

MISCELLANEOUS

Warranty:

3 Year limited warranty

Environmental Conditions

Operating Temp.: -4 to 140°F (-20 to +60°C)
Storage Temp.: -13 to 176°F (-25 to +80°C)
Humidity: 0 to 95% non-condensing

Construction

Case enclosure: Plastic PC/ABS blend
Display body: Plastic PC/ABS blend
Front panel: Plastic PC
PCB: FR4 (UL94-V0)
Terminals: PBT (UL94-V0)
Plug-in connectors: Polyamide PA6.6 (UL94-V0)
Dimensions: 5x5x5.8"
(127x127x147mm)
Mounting: ANSI 4" round
DIN 92x92mm cutout
Weight: 1.23kg (2.7 lb.)

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RDM172E – LED Remote Display

RDM312 – Multi-Window Remote Display

Optional Remote Display Modules

ADVANCED POWER QUALITY MONITOR
Model PM174 as per IEEE-1159 Categories

PM174 – ☐ ☐ ☐ ☐ ☐

Options:

CALIBRATION
50HZ 50Hz
60HZ 60Hz

CURRENT INPUTS
5 5 Amps
1 1 Amps

POWER SUPPLY
AC/DC 85-265VAC/85-290VDC
1DC 10-18 VDC
2DC 18-36 VDC
3DC 38-72 VDC

ANALOG OUTPUT OR INPUT
00 No Analog Output or input

Analog Outputs
AO1 ±1mA
AO2 0-20mA
AO3 0-1mA
AO4 4-20mA

Analog Inputs
AI1 ±1mA
AI2 0-20mA
AI3 0-1mA
AI4 4-20mA

COM1
00 RS232/422/485
MOD Dial up modem 56K
ETH Ethernet
PRO Profibus

EXAMPLES:
PM174-60HZ-5-ACDC-AO4-ETH
PM174-50HZ-1-3DC-AO4-MOD

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Your Local Representative

Measurements	
Measurements	**PM174**
Voltage L-L per phase	▪
Voltage L-N per phase	▪
Current per phase	▪
Neutral current	▪
Frequency	▪
Phase Rotation	▪
Relay Status	▪
Counters	▪
TxD, RxD Comm Status	▪
Alarm Trigger Code	▪
PF per phase and total	▪
kW per phase and total	▪
KVAR per phase and total	▪
KVA per phase and total	▪
Voltage Unbalance	▪
Current Unbalance	▪
%THD Volts per phase	▪
%THD Amps per phase	▪
%TDD Amps per phase	▪
K-Factor per phase	▪
Fundamental Volts, Amps per phase	▪
Fundamental kW, kVAR, kVA per phase & total	▪
Displacement PF per phase and total	▪
Voltage & Current Phasors	▪
Volts Demands	▪
Amps Demands	▪
kW, kVAR, kVA Demands	▪
V, I THD Demands	▪
kWh Imp/Exp, per phase & total	▪
kVARh Imp/Exp, per phase & total	▪
kVAh per phase and total	▪
TOU parameters	▪
16 Data Logs	▪
1 Event Log	▪
2 Waveform Logs	▪
Individual I Harmonics to 63rd	▪
Individual V Harmonics to 63rd	▪
Total harmonic kW and kVA	▪
Total harmonic kWh Import, Export	▪
Total harmonic kVAh Total	▪
Waveform Capability 32/64/128 samples/cycle	▪
Up to 20 pre-cycles	▪
PQ event Categories (IEEE-1159)	▪
Flicker (61000)	▪
Compliance Report via PAS	▪