

# 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

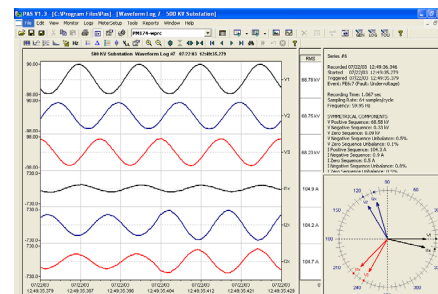
- Configurable demand calculation to match utility settings
  - Demand period from 1 to 60 minutes.
  - Number of demand periods from 1 to 15
- External synchronization for demand interval with Status Input or via communications

## Communications

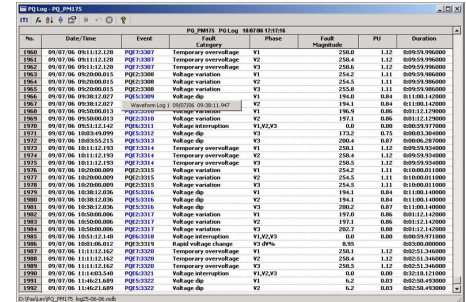
- Two independent communication ports
- **COM1** - optically isolated RS232/422/485 port, selectable via the front panel
  - Optional 10BaseT Ethernet-Modbus/TCP, DNP3/TCP protocols
  - Optional 56K modem
  - Optional Profibus DP
- **COM2** - optically isolated RS422/485 port
- Supports industry standard 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

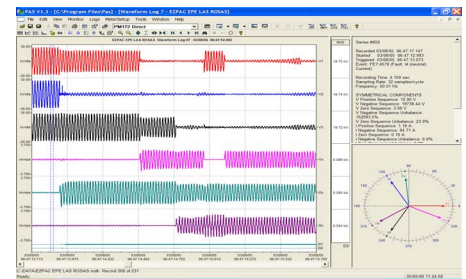
- Transient recording (minimum width: 130us @ 60Hz)
- Sag/Swell detection as per IEEE-1159 PQ categories: detailed description of event, phase, magnitude and duration
- Flicker (IEC 61000)
- ITI curves (CBEMA)
- Statistical Report Writer
- Export to PQDIF & COMTRADE format



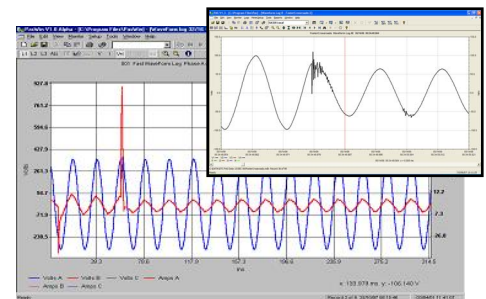
## Real-Time "Scope Mode"



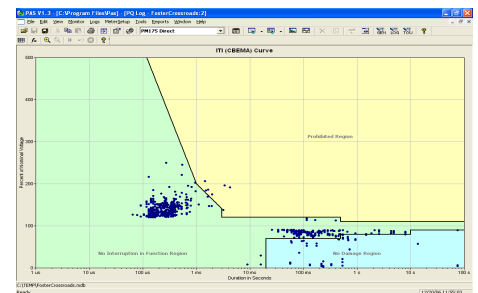
## IEEE-1159 Categories - PQ Log



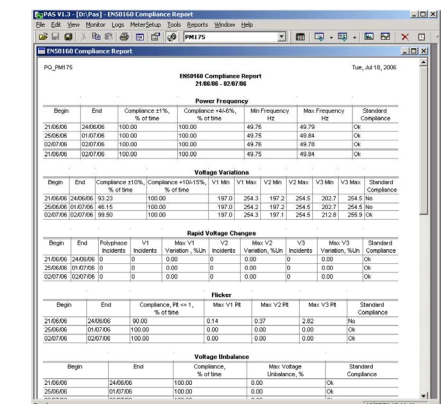
## Detailed Waveform Capture



## Transient Capture



## ITI Plot (CBEMA)

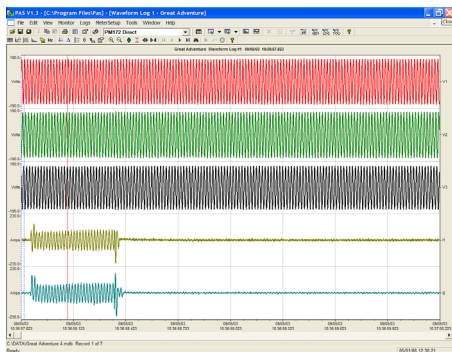


## Statistical Compliance Report

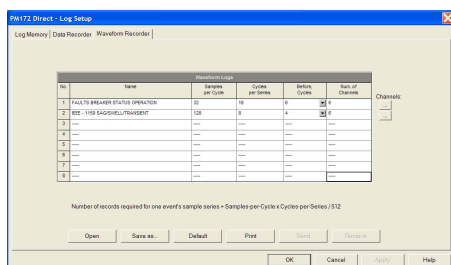
# Model PM174 Advanced Power Quality Monitor

## Waveform Logs

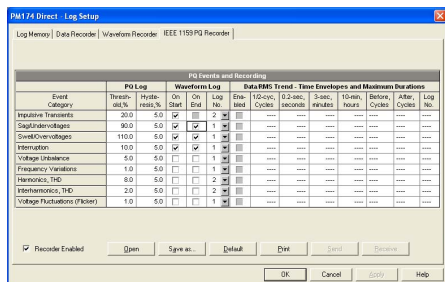
- Two independent, simultaneous waveform recorders, each recording the complete 3-phase voltage and current waveforms
- Recording resolution at 32, 64 and 128 samples/cycle
- Up to 20 pre-fault cycles
- Any number of post-fault cycles, limited only by available memory
- Supports Wrap-Around and Stop-on-Full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



## Motor Startup



## Waveform Log Setup



### PQ Setup Tab

## Log Memory

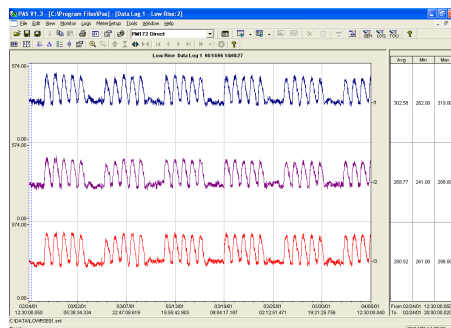
- 1MB of non-volatile log memory with battery backup. Up to 140 days of trending & load profile (16 measurements @ 15 minute interval)
- User-partitionable for Event Log, Data Logs, and Waveform Log Files

## Event Log

- 1 Event Log of programmable depth

## Data Logs

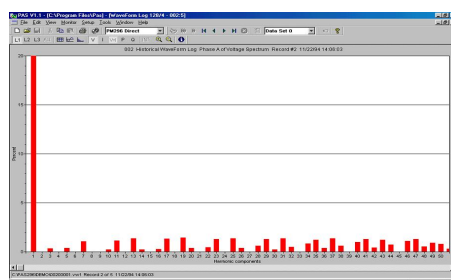
- 16 Data Logs of 16 parameters each
- Configurable depth
- Recording intervals from 1 to 9999 seconds
- Supports wrap-around and Stop-on-Full recording modes



## Log Profile / Data Trend

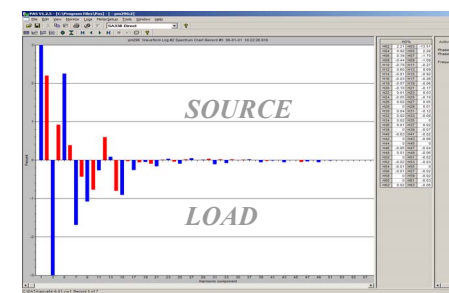
## Advanced Harmonic Measurements

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

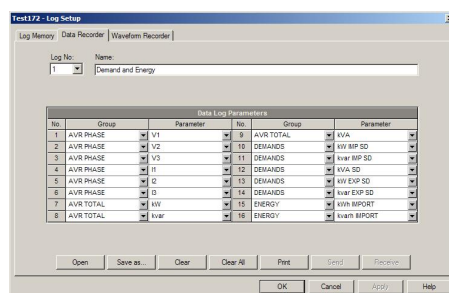


## Harmonics

**Spectrum**



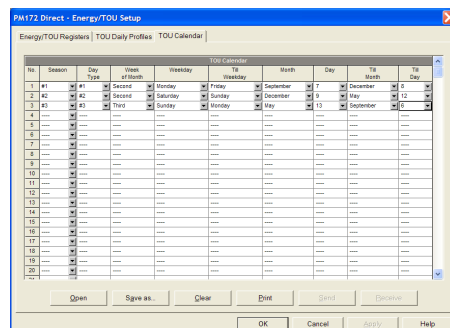
## Directional Harmonics



## 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 mm<sup>2</sup> 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**

# Model PM174 Advanced Power Quality Monitor

## 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-In/690V-II  
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 (2.5mm<sup>2</sup>)

### 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 (2.5mm<sup>2</sup>)

## Digital Inputs:

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

## 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 (1.5mm<sup>2</sup>)

## 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 (1.5mm<sup>2</sup>)

## 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 DNP3.0
- 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 DNP3.0
- 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 DNP3.0
- Wire size: up to 14 AWG (1.5mm<sup>2</sup>)

## 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:

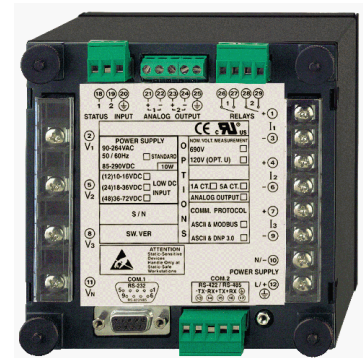
3 Year limited warranty

## 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.)





# Model PM174 Advanced Power Quality Monitor



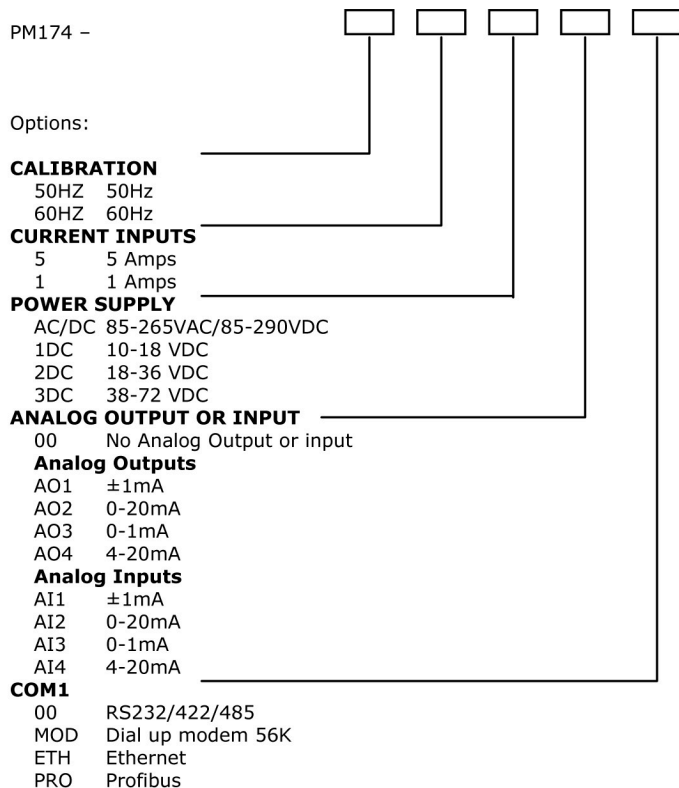
**RDM172E - LED  
Remote Display**



**RDM312 - Multi-Window  
Remote Display**

## Optional Remote Display Modules

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



#### EXAMPLES:

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

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 63 <sup>rd</sup>	■
Individual V Harmonics to 63 <sup>rd</sup>	■
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	■



**誥鑫企業有限公司**  
**ARITH COMPANY LTD.**

地址：台北市105復興北路427巷30號  
電話：(02) 2717-5038 (代表號)  
傳真：(02) 2717-5039  
郵件：taipei@arith.com.tw  
網址：www.arith.com.tw