

SECTION 11

Portable Power Meters (Single Phase, Poly Phase)

- AEMC
- Fluke
- Fluke - LEM
- Yokogawa (YCA)
- Electro-Industries

PORTABLE
POWER METERS



Power Quality Analyzers

Three-Phase Power Quality Analyzer PowerPad® Model 3945

Captures & records
transients, events
& waveforms
simultaneously!

**FREE full
featured
software
included for
complete
power quality
analysis and
reporting!**



Model 3945



Features

- True RMS single-, two- and three-phase measurements at 256 samples/cycle, plus DC
- Real-time color waveforms
- Easy-to-use on-screen setup
- Automatic current probe recognition and scaling
- True RMS voltage and current measurement
- Measures DC volts, amps and power
- Display and capture voltage, current and power harmonics to 50th order, including direction, in real time
- Capture transients down to 1/256th of a cycle
- Stores comprehensive data base of logged data
- Phasor diagram display
- VA, VAR and W per phase and total
- kVAh, VARh and kWh per phase and total
- Neutral current display for three-phase
- Transformer K-factor display
- Power Factor, displacement PF display
- Captures up to 50 transients
- Short-term flicker display
- Phase unbalance (current and voltage)
- Harmonic Distortion (total and individual) from 1st to 50th
- Alarms, surges and sags
- Screen snapshot function captures waveforms or other information on the display
- Includes DataView® software FREE for data storage, real-time display, analysis and report generation

SPECIFICATIONS

MODEL	3945
ELECTRICAL	
Sampling Frequency	256 samples/cycle
Data Storage	4MB partitioned for waveforms, transients, alarms and trend recording
Voltage (TRMS)	Phase-to-Phase: 960V Phase-to-Neutral: 480V
Current (TRMS)	MN Clamp: 5mA to 100mA/120A or 2 to 240A MR Clamp: 10 to 1000Aac, 10 to 1400Aac SR Clamp: 3 to 1200A AmpFlex®: 10 to 6500A ⁽¹⁾
Frequency (Hz)	40 to 69Hz
Other Measurements	kW, kVAR, PF, DPF, kWh, kVARh, kVAh, K-Factor, Flicker
Harmonics	1 st to 50 th , Direction, Sequence
Power Source	9.6V NiMH rechargeable battery pack AC Supply: 110/230Vac ±20% (50/60Hz)
Battery Life	≥Eight hours with display on; ≥35 hours with display off (record mode)
MECHANICAL	
Communication Port	Optically coupled RS-232
Display	1/4 VGA (320 x 240) color LCD
Dimensions	9.5 x 7 x 2" (240 x 180 x 55mm)
Weight	4.6 lbs (2.1kg)
Safety Rating	EN 61010, 600V Cat. III, Pollution Degree 2

⁽¹⁾Crest factor at 6500 = 1

Choose from a variety of current probe options



Set of three color-coded SR193 (1200A) current probes



Set of three color-coded AmpFlex®193 (6500A) flexible current probes (available in 24" or 36" lengths)



Set of three color-coded MN93 (240A) current probes or MN193 (6A/120A) current probes



All models include three color-coded current probes with 10 ft leads (AmpFlex® example shown), four color-coded 10 ft voltage leads, four color-coded alligator clips, RS-232 DB9F optically coupled serial cable, NiMH battery, US 120V power cord, DataView® software, carrying bag, soft carrying pouch and user manual.

Power Quality Analyzers

Single-Phase Power Quality Analyzer Power-Pad® Jr. Model 8230



Model 8230

NEW!

Features

- Measures up to 660Vrms or V_{bc}
- Measures up to 6500Aac or 1400A_{dc} (probe dependent)
- Displays Min, Max and Average Volts and Amps, Crest Factor, Peak value and K-Factor
- Calculates and displays Watts, VARs and VA, Power Factor and Displacement Power Factor for single-phase and balanced three-phase
- Displays total harmonic distortion (THD-F and THD-R) for voltage and current
- Displays individual harmonic values and % for Volts and Amps through the 50th harmonic
- Captures, displays and stores inrush current waveforms and statistics
- Stores up to eight screen captures
- Stores up to 1MB of trend recorded data
- Configurable from DataView® software or front panel
- Download stored data to DataView® software via optical USB port
- Captures up to 4096 alarm events from up to 10 different thresholds
- Displays and records up to 17 different power quality parameters
- Includes DataView® software FREE for data storage, real-time waveform display, analysis and report generation

SPECIFICATIONS	
MODEL	8230
ELECTRICAL	
Voltage (TRMS)	Phase-to-Phase: 660V Phase-to-Neutral: 600V
Current (TRMS)	MN Clamp: 5mA to 100mA/120A or 2 to 240A MR Clamp: 10 to 1000A _{ac} , 10 to 1400A _{dc} SR Clamp: 3 to 1200A AmpFlex®: 10 to 6500A ⁽¹⁾
Frequency (Hz)	40 to 70Hz
Other Measurements	kW, kVAR, PF, DPF, kWh, kVARh, kVAh, K-Factor, Flicker, Harmonic Phase Shift, Phase Rotation
Harmonics	THD-R, THD-F, V, A, VA 1 st to 50 th , Direction, Sequence
Sampling Frequency	256 samples/cycle
Data Storage	1.5MB partitioned for waveforms, alarms and trend recording
Power Source	Six NiMH AA rechargeable battery pack AC Supply: 120/230V _{ac} (50/60Hz)
Battery Life	≥8 hrs with display on ≥40 hrs with display off (recording mode)
MECHANICAL	
Communication Port	Optically isolated USB
Display	1/4 VGA (320 x 240) color LCD
Dimensions	8.3 x 4.3 x 2.4" (211 x 108 x 60mm)
Weight	1.9 lbs (0.88kg)
Safety Rating	EN 61010, 600V Cat. III, Pollution Degree 2

⁽¹⁾ Crest factor at 6500 = 1



All models include current probe with 10 ft lead and black connector (MN93 example shown), black and red 10 ft voltage leads and alligator clips, optical USB cable, NiMH battery, US 120V power cord, DataView® software, carrying bag, soft carrying pouch and user manual.

Power Quality Meters

Power Quality Meter Model 8220



Model 8220

NEW!

Features

- Measures up to 660Vrms or Vdc
- Measures up to 6500Aac or 1400Adc (probe dependent)
- Displays Min, Max and Average Volts and Amps, Crest Factor, Peak value and K-Factor
- Calculates and displays Watts, VARs and VA, Power Factor and Displacement Power Factor for single-phase and balanced three-phase
- Displays total harmonic distortion (THD-F and THD-R) for voltage and current
- Displays individual harmonic values and % for Volts and Amps through the 50th harmonic
- Captures and displays inrush current
- Calculates and displays phase rotation and RPM
- Displays temperature in both °F and °C
- Displays resistance up to 200Ω
- Conducts continuity and diode tests
- Stores up to nine complete sets of readings for all volt, amp, power and harmonic measurements
- Configurable from DataView® software or front panel
- Download stored data to DataView® software via optical USB port
- Operates off batteries or recharger
- Includes DataView® software FREE for data storage, real-time waveform display, analysis and report generation



All models include current probe with 10 ft lead and black connector (MN93 example shown), black and red 10 ft voltage leads and alligator clips, optical USB cable, six 1.5V batteries, two safety test probes, DataView® software, carrying bag, soft carrying pouch and user manual.
See page 15 for optional accessories available for Model 8220.

SPECIFICATIONS

MODEL	8220
ELECTRICAL	
Voltage (TRMS)	Phase-to-Phase: 660V Phase-to-Neutral: 600V
Current (TRMS)	MN Clamp: 5mA to 100mA/120A or 2 to 240A MR Clamp: 10 to 1000Aac, 10 to 1400Aac SR Clamp: 3 to 1200A AmpFlex®: 10 to 6500A ¹
Frequency (Hz)	40 to 70Hz
Other Measurements	kW, kVAR, PF, DPF, VA, Phase Rotation Temperature, RPM, Resistance, Continuity, Diode Test
Harmonics	1 st to 50 th
Sampling Frequency	256 samples/cycle
Data Storage	Stores nine sets of readings for volts, amps, power and harmonics
Power Source	Six NiMH AA rechargeable battery pack or six 1.5V AA Alkaline batteries AC Supply: 120/230VAC (50/60Hz)
Battery Life	≥8 hrs with display on ≥40 hrs with display off (recording mode)
MECHANICAL	
Communication Port	Optically isolated USB
Display	Three-line backlit digital display with custom icons
Dimensions	8.3 x 4.3 x 2.4" (211 x 108 x 60mm)
Weight	1.9 lbs (8.8kg)
Safety Rating	EN 61010, 600V Cat. III, IP 54, Pollution Degree 2

¹Crest factor at 6500 = 1

CATALOG NO.	DESCRIPTION
2130.91	Power Quality Meter Model 8220 w/MN93-BK (240A)
2130.92	Power Quality Meter Model 8220 w/SR193-BK (1200A)
2130.93	Power Quality Meter Model 8220 w/24" AmpFlex® 193-24-BK (6500A)
2130.94	Power Quality Meter Model 8220 w/36" AmpFlex® 193-36-BK (6500A)
2130.95	Power Quality Meter Model 8220 w/MR193-BK (1000Aac/1400Adc)
2130.96	Power Quality Meter Model 8220 w/MN193-BK (1000Aac/1400Adc)

FLUKE®

Power Quality Analyzers

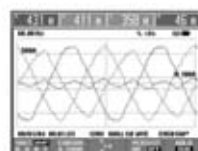
Fluke 434 Power Quality Analyzer

Pinpoint power quality problems faster, safer and in greater detail



The Fluke 434 and 433 Three-Phase Power Quality Analyzers help you locate, predict, prevent and troubleshoot problems in power distribution systems. These easy-to-use handhelds are a "must have" for any person who maintains or troubleshoots three phase distribution. The new IEC standards for flicker and power quality are built right in to take the guess work out of monitoring.

- Troubleshoot real-time: Analyze the trends using the cursors and zoom tools—even while background recording continues
- Autotrend: every measurement you see is always automatically recorded, without any setup
- Automatic transient mode captures 200 kHz waveform data on all phases simultaneously—transfer data files to your PC for reporting and analysis using FlukeView software
- Four voltage and four current channels actually measures neutral
- Inrush mode for troubleshooting nuisance circuit breaker tripping



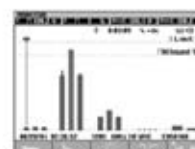
Application note, literature code 2435490:

Six simple ways to reduce costs with a Fluke 434 Power Quality Analyzer

There are hundreds of power quality measurements you can take on electrical systems and equipment. These instructions focus on four predictive maintenance (PdM) measurements and two power consumption measurements that can help you uncover hidden costs, protect equipment from damaging conditions, reduce unscheduled downtime and improve system performance.



- Rugged, handheld troubleshooter with Fluke three-year warranty
- Seven hours operating time per charge on NiMH battery pack
- System-Monitor: Six power quality parameters on one dashboard



Features - 433 and 434 PQ Analyzers

Function	Fluke 433*	Fluke 434
Volts/Amps/Hz		
Volts rms	0.5 % of nominal voltage	0.5 % of nominal voltage
Amps rms**	1 % ± 5 counts	1 % ± 5 counts
Frequency (Hz)	0.1 % of nominal frequency	0.1 % of nominal frequency
Peak (Voltage and Current)	5 %	5 %
Crest Factor (CF)	5 %	5 %
Dips and swells (half cycle based)	1 % of nominal voltage	1 % of nominal voltage
Power and Energy		
W, VAR, VA	1.5 % ± 10 counts	1.5 % ± 10 counts
PF, Cos φ (DPP)	•	•
KWh, KVARh, KVAh, Demand Interval	Optional*	Standard
Harmonics and THD		
Harmonics	0.1 % ± n x 0.1 %	0.1 % ± n x 0.1 %
THD	2.5 %	2.5 %
Inter-harmonics	Optional*	Standard
Flicker		
Flt. Pst, PFS	5 %	5 %
Unbalance		
Voltage	0.5 %	0.5 %
Current	1 %	1 %
Transient display		
Minimum transient detection	Optional*	5 μs
Inrush current	Optional*	1 %
Additional Capabilities		
AutoTrend	•	•
System-Monitor	•	•
Real time scope/phasor diagrams	•	•
Memory (screens/data)	25/3, Optional 50/30	50/30
FlukeView software and interface cable	Optional	Standard
Safety rating	CAT IV 600 V/CAT III 1000 V	
Battery life	Up to 7 hours/charge	

*Optional functionality can be added with upgrade kit. For details, see ordering information.

**Accuracy does not include current probe accuracy.

Included accessories

The 433 and 434 come with four dual-range (40 A and 400 A) current clamps, five voltage test leads and clips, line adapter/battery charger, color localization input decals, color wire clips for test leads, FlukeView software, USB cable, carrying case, manual and quick start guide.

Ordering information

Fluke-433 Power Quality Analyzer
 Fluke-434 Power Quality Analyzer
 Fluke-433UGK Upgrade Kit for Fluke 433

Recommended accessories

i2000 PQ4 4 pack of 2000A Flexible Current Probes
 i5spq3 3 pack of 5 A Precision Current Clamps

Power Quality Analyzers

LEM Analyst 3P Three-Phase Power Logger

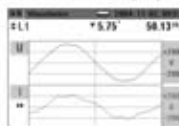
The new standard for NEC mandated 30-day load studies



The Analyst 3P is the ideal electrician's tool for conducting load studies and logging power and energy. The instrument sets up in seconds with the four included flexible current probes and easy-to-read display. The Analyst 3P can log all the basic power parameters as well as harmonics and also captures voltage events.

Trends and recorded data can be easily analyzed with the included PQLogView software. Quality reports can be generated with the report generator and screen snapshot functions. The instrument sets up in seconds with the four included flexible current probes and color display.

- Graphic representation of waveforms for voltage and current as well as a numerical representation of the ϕ angle.
- Quality assessment of the line voltage and the load currents



Volts/amps/Hz	
Volts rms	$\pm 0.5\% + 30$ counts
Amps rms	$\pm 1\% + 30$ counts
Dips, swells, interruptions	$< 2\%$ of VI
Frequency	$\pm 0.5\% + 30$ counts
Harmonics and THD	
Voltage	$< 0.15\%$ of VI
Current	$< 0.5\%$ IN
Power	
Power and energy	*
Additional capabilities	
Dust/water resistance	IP 65
Safety rating	CAT III 600 V

Application note, literature code 2584800:

Determining power system loading with the Analyst 3P

When a building owner wants you to add new loads to an existing set of feeders or an existing service, you must first determine whether the existing equipment will support the new loads.

For example, if you have a 600 amp service installed in a facility, can you add another 100 amps of load? To answer this question you have to ask another one: what is the highest load the system carries now? Often, local electrical authorities will need to know these answers before they can issue building permits.



Norma 4000 and 5000 High Precision Power Analyzers

The Norma High Precision Power Analyzers deliver precise measurements of single or three-phase current and voltage as well as calculation of power and other derived values. They provides class-leading accuracy for any waveform, frequency or phase shift. Its 144 mm (5.7 in) color display makes it easy to use both in the field and as a table unit in labs and on test benches.



Basic functions	
FFT	Measured values: U, I, P per phase. Order: 1 to 40; harmonics, max. half sample frequency
DSO	Simultaneous display of up to 3 measured values on sample level
Recorder	Display of 3 average values over time for trend determination
Vector	Display of H01 up to 6 signals
Memory	4 MB RAM are available for the storage of measured values. The memory can be expanded up to 128 MB.
Interface	
RS-232 interface for upload of firmware and data exchange with the PC. A printer can be connected over an external converter.	
Options	IEEE 488.2/I MBz/s Ethernet/10 MBz/s or 100 MBz/s USB 2.0
Frequency and synchronization	
Range	0.2 Hz sample rate
Accuracy	$\pm 0.01\%$ of measured value (reading)
Channels which can be selected	All U/I or external input. One of three low pass filter with different frequencies can be switched into the signal.

In June 2005
Fluke Corporation
acquired LEM Instruments.



FLUKE

Analyst 3P included accessories

Four phase flexible current probes (15A/150A/3000A), NiMH battery package, carrying belt, RS-232 interface cable, carrying case, voltage leads, four dolphin clips, PQLogView software and manual.

Norma 4000 and 5000 included accessories

Test certificate with calibration values, user manual, power supply cable and are completely customizable with a variety of accessories.

Ordering information

Analyst 3P	Three-Phase Power Analyzer
Norma 4000 BU43	High Precision Power Analyzer
Norma 5000 BU56	High Precision Power Analyzer

Power Meters

CLAMP-ON POWER METERS

CW240 Portable Power Monitor

Model CW240-D/DA/SP1 (3P4W) Features:

- Parameters: Volts, Amps, Watts, Vars, VA, PF, PA and Hertz
- Wiring: 1P 2W ~ 3P 4W 4i (Neutral Line Current)
- Waveform Measurement: Voltage and Current
- Record Times: 1 Cycle ~ 0.5 sec, 1 sec ~ 30 sec, 1 min ~ 60 min
- 1 MB Internal Memory & Optional Flash Card (up to 512 MB)
- Demand Measurement: Maximum power and the time it occurs
- Two System Load Measurement: (1P2 W X2) (1P 3W X2) (3P 3W X2)
- Voltage/Current Ranges: 150/300/600/1000 AC, 200.0 mA ~ 3000A
- Voltage Fluctuation Measurement: Dips, Swells & Instantaneous Power Failure
- Harmonic Measurement: Displays 1 ~ 50 order
- Leakage current Measurement: Optional 2 Amp clamp-on CT's
- Four channel analog outputs & two channel analog inputs
- RS232 & CD-ROM with "Tool Box Software" included



Standard Accessories:

- AP240E: Parameter setting tool & run time software
- 97031: 32MB Memory Card & Holder
- M1106RR-A: Card Reader
- 788011-M: UL/CSA Power Cord
- 91007: Four (4) Voltage Probes
- Two (2) Analog In & Four (4) Analog Out
- 94004: NiMH Battery Pack & (6) AA Alkaline Batteries
- 93020: Carrying Case
- B9017VD: 9 Pin RS232 cable & "Tool Box Software"
- Users Manual, Quick Manual & Communication Manual –hard copy & CD

Clamp-On Probe Options: Please Select Your Requirements:

	20/200A	500A	700A	50A	2A	3000A	3000A(F)
2 pcs	/C1	/C3	/C5	/C7	/C9	/C11	/C13
4 pcs	/C2	/C4	/C6	/C8	/C10	/C12	/C14

*** 4-pc clamp sets required to two system load measurement ***

Power Meters

CLAMP-ON POWER METERS

Model CW121-D-1/SP1 Features:

- Portable 3-Phase 4-Wire Power Monitor
- Measurement Parameters: V, A, W, VAR, PF, Hz & WH
- Record Times: Settable from 1~30 s, 1~30 min & 1 hr
- Flash Memory: Compatible with 128MB flash memory card
- Compact Design: Size = 4.6" x 6.3" x 2" & Weight: = 1.3lbs
- External I/O: One of three options for start/stop (WH) measurement
- Data Accumulation: Stores up to 24 hours of data in one second intervals
- Wiring Error Check Function: To ensure measurement operations don't fail
- Display: Large Backlit LCD
- Communications: RS-232 Standard or optional RS-485 available
- UL: Approved



Standard Accessories:

- 91007: Four Voltage probes
- A1022UP: AC Power adapter
- 98030: Power supply cable (supplies instrument power from the measurement circuit)
- 93022: Carrying case for instrument and accessories
- 93023: Main Unit Case (magnetic backing)
- AP140E Software: Parameter setting & run time software for PC
- 97031: 32MB Flash Memory Card, Card Adapter & Reader (M1106RR-A)
- 91011: RS232 Communications Cable (9 Pin)

Options: Please Select Your Requirements:

- /C2: Clamp On Probe 20/200A (3 pc set)
- /C4: Clamp On Probe 500A (3 pc set)
- /C6: Clamp On Probe 700A (3 pc set)
- /C8: Clamp On Probe 50A (3 pc set)
- 96035: Clamp On Probe 3000A (Flex. Type -1 pc)
- 91009: RS232 Communication Cable (25 Pin)
- -2: RS485 Communications

Portable Power Analyzer

PDA 1252

Watertight Portable Power Quality Analyzer

- Comprehensive Power Quality Analysis
- Load Flow and Historical Trending Capability
- Watertight Outdoor Enclosure
- Advanced Software Analysis Tools Included
- Optional Artificial Intelligence Reporting Package
- Touch-Screen Graphical Display

The PDA 1252 is a portable power quality analyzer, designed for use with outdoor ready connections. This unit is ideal for load survey, monitoring transformer banks, indoor and outdoor electrical monitoring, and power quality analysis. The PDA 1252 is mounted in its own watertight carrying case and uses watertight connectors to connect voltage and current leads.



Specifications

Accuracy

Voltage and Current:	0.15% of Reading
Watts and Energy:	0.2% of Reading
Freq:	+/- .01 Hz
%THD:	+/- 1% of Full Scale

Voltage Inputs

0 to 300 Volts L-N; 0 to 600 Volts L-L} Plug powered
100 to 300 Volts AC L-N} Line powered
200 to 600 Volts AC L-L} Line powered
3 or Single Phase Power Systems

Power Supply:

120/220 Volts AC (Plug powered)
200 to 600 Volts L-L (Line powered: must be powered using two phases of voltage.)

Current Inputs

1252-5A – 5 amp Secondary Direct Wiring: Max Energy and RMS Calculation Range (10 Amp Secondary); Max Waveform Recorder Range (40 Amp Secondary)
1252-1A – 1 Amp Secondary Direct Wiring: Max Energy and RMS Calculation Range (2 Amp Secondary); Max Waveform Recorder Range (8 Amp Secondary)



Diagnose Problems Quickly with a Detailed Report

Ordering Information

OPTION #	OPTION NAME
Model	
[PDA1252]	PDA 1252
Current Input	
[1A]	1 Amp
[5A]	5 Amp
Memory	
[S]	Standard Memory
[A]	Advanced Memory
Frequency	
[50]	50 Hz System
[60]	60 Hz System