Engineer's Notebook

Understanding Power & Power Quality Measurements

Power and Power Quality Measurements

The threatened limitations of conventional electrical power sources have focused a great deal of attention on power, its application, monitoring and correction. Power economics now play a critical role in industry as never before. With the high cost of power generation, transmission, and distribution, it is of paramount concern to effectively monitor and control the use of energy.

For economic reasons, electric power is generated by utility companies at relatively high voltages (4160, 6900, 13,800V are typical). These high voltages are then reduced at the consumption site by step-down transformers to lower values, which may be safely, and more easily used in commercial, industrial and residential applications.

Personnel and property safety are the most important factors in the operation of electrical system operation. Reliability is the first consideration in providing safety. The reliability of any electrical system depends upon knowledge, preventive maintenance and subsequently the test equipment used to monitor that system.

TYPICAL VOLTAGE CONFIGURATIONS

Single-Phase Systems

Single-phase residential loads are almost universally supplied through 120/240V, 3-wire, single-phase services. Large appliances such as ranges, water heaters, and clothes dryers are supplied at 240V. Lighting, small appliances, and outlet receptacles are supplied at 120V. In this system the two "hot" or current carrying conductors are 180 degrees out-of-phase with respect to the neutral.

Three-Phase, 3-Wire Systems

In this type of system, commonly known as the "DELTA" configuration, the voltage between each pair of line wires is the actual transformer voltage. This system is frequently used for power loads in commercial and industrial buildings. In such cases, service to the premises is made at 208V, three-phase. Feeders carry the power to panel boards supplying branch circuits for motor loads. Lighting loads are usually handled by a separate single-phase service. The 480V distribution is often used in industrial buildings with substantial motor loads.

Three-Phase, 4-Wire Systems

Known as the "WYE" type connection, this is the system most commonly used in commercial and industrial buildings. In office or other commercial buildings, the 480V three-phase, 4-wire feeders are carried to each floor, where 480V three-phase is tapped to a power panel or motors. General area fluorescent lighting that uses 277V ballasts is connected between each leg and neutral; 208Y/120 three-phase, 4-wire circuits are derived from step-down transformers for local lighting and receptacle outlets.

Typical voltage:
phase-to-phase = 208/480V
phase-to-neutral = 120/277V

Balanced vs. Unbalanced Loads

A balanced load is an AC power system using more than two wires, where the current flow is equal in each of the current-carrying conductors. Many systems today represent an unbalanced condition due to uneven loading on a particular phase. This often occurs when electrical expansion is affected with little regard to even distribution of loads between phases or several nonlinear loads on the same system.

RMS vs. Average Sensing

The term RMS (root-mean-square) is used in relation to alternating current waveforms and simply means "equivalent" or "effective," referring to the amount of work done by the equivalent value of direct current (DC). The term RMS is necessary to describe the value of alternating current, which is constantly changing in amplitude and polarity at regular intervals. RMS measurements provide a more accurate representation of actual current or voltage values. This is very important for nonlinear (distorted) waveforms.

Until recently, most loads were "linear"; that is, the load impedance remained essentially constant regardless of the applied voltage. With expanding markets of computers, uninterruptable power supplies, and variable speed motor drives, resulting nonlinear waveforms are drastically different.

Measuring nonsinusoidal voltage and current waveforms requires a True RMS meter. Conventional meters usually measure the average value of the amplitudes of a waveform. Some meters are calibrated to read the equivalent RMS value (.707 x peak); this type calibration is a true representation only when the waveform is a pure sine wave (i.e., no distortion). When distortion occurs, the relationship between average readings and True RMS values changes drastically.

Only a meter which measures True RMS values gives accurate readings for a nonsinusoidal waveform. RMS measuring circuits sample the input signal at a high rate of speed. The meter's internal circuitry digitizes and squares each sample, adds it to the previous samples squared, and takes the square root of the total. This is the True RMS value.

DEMAND

The amount of electrical energy consumed over time is known as demand. Demand is the average load placed on the utility to provide power (kilowatts) to a customer over a utility-specified time interval (typically 15 or 30 minutes). If demand requirements are irregular, the utility must have more capability available than would be required if the customer load

requirements remained constant. To provide for this time-varying demand, the utility must invest in the proper size equipment to provide for these power peaks. Brief high peaks such as those present when large equipment initially comes on line are not critical in the overall equation because the duration is short with respect to the demand averaging interval.

CONSUMPTION

Watts and vars are instantaneous measurements representing what is happening in a circuit at any given moment. Since these parameters vary so greatly within any period, it is necessary to integrate (sum) electrical usage over time. The fundamental unit for measuring usage is the watthour (Wh), or more typically the kilowatthour (kWh). This value represents usage of 1000W for one hour. Typical costs in the United States for one kilowatthour range from 8 to 15 cents.

POWER FACTOR

Power factor is the ratio of ACTUAL POWER used in a circuit to the APPARENT POWER delivered by a utility. Actual power is expressed in watts (W) or kilowatts (kW); apparent power in voltamperes (VA) or kilovoltamperes (kVA). Apparent power is calculated simply by multiplying the current by the voltage.

$$\text{Power Factor} = \frac{\text{Actual Power}}{\text{Apparent Power}} = \frac{\text{kW}}{\text{kVA}}$$

Certain loads (e.g., inductive type motors) create a phase shift or delay between the current and voltage waveforms. An inductive type load causes the current to lag the voltage by some angle, known as the phase angle.

On purely resistive loads, there is no phase difference between the two waveforms; therefore the power factor on such a load will be 0 degrees, or unity.

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Engineer's Notebook

Power and Power Quality Measurements

ELECTRICAL HARMONICS

Until fairly recently, power quality referred to the ability of the electric utilities to supply electric power without interruption. Today, the phrase encompasses any deviation from a perfect sinusoidal waveform. Power quality now relates to short-term transients as well as continuous state distortions. Power system harmonics are a continuous state problem with dangerous results. harmonics can be present in current, voltage, or both. It is estimated that as many as 60% of all electrical devices operate with non-linear current draw.

Utility companies invest millions of dollars each year to ensure that voltage supplied to their customers is as close as possible to a sinusoidal waveform. If the power user c onnects loads to the system which are resistive, such as incandescent light bulb, the resulting current waveform will also be sinusoidal. However, if the loads are nonlinear, which is typically the case, the current is drawn in short pulses and the current waveform will be distorted. Total current that is then drawn by the nonlinear load would be the fundamental as well as all the harmonics.

Harmonic distortion can cause serious problems for the users of electric power, from inadvertent tripping of circuit breakers to dangerous overheating of transformers and neutral conductors, as well as heating in motors and capacitor failure. Harmonics can cause problems that are easy to recognize but tough to diagnose.

Loads which produce harmonic currents include:

- Electronic lighting ballasts
- Adjustable speed drives
- Electric arc furnaces
- Personal computers
- Electric welding equipment
- Solid state rectifiers
- Industrial process controls
- UPS systems
- Saturated transformers
- Solid state elevator controls
- Medical equipment

Harmonics can cause a variety of problems to any user of electric power. For large users, the problems can be intense. For electronic equipment that relies on the zero crossing of the sinusoidal waveform, such as clock timing devices, heavy harmonic content can cause a zero crossing point offset.

Odd number harmonics (third, fifth and seventh) cause the greatest concern in the electrical distribution system. Because the harmonic waveform usually swings equally in both the positive and negative direction, the even number harmonics are mitigated.

False tripping of circuit breakers is also a problem encountered with the higher frequencies that harmonics produce. peak sensing circuit breakers often will trip even though the amperage value has not been exceeded. Harmonic current peak values can be many times higher than sinusoidal waveforms.

Most harmonic problems result when the resonant frequency is close to the fifth or seventh harmonic. These happen to be the largest harmonic amplitude numbers that adjustable speed drives create. When this situation arises, capacitor banks should be resized to shift the resonant point to another frequency.

Detection and Measurement

In harmonic analysis, field measurements are performed to identify frequency and magnitude of harmonic currents generated by susceptible equipment (e.g., electronic equipment, variable speed motors, etc.). Remember that most distribution systems are designed specifically to carry 60Hz.

Most nonlinear harmonic problems can be detected at the electrical panel. Excessive current flow on the neutral can be detected with a True RMS current meter, but may be indicated by a resonant buzzing sound or by discolored connections on the neutral buss.

Beginning at the service entrance panel, measure and record the True RMS current in each phase, as well as the neutral of the distribution transformer secondary. Compare this measured neutral current to the anticipated current due to phase imbalance. If the phase currents are equal, the vector sum of the neutral currents will add to zero. If there are excessive amounts of triplen harmonics in the neutral, neutral current may exceed phase current. Consult the NEC® for the maximum ampacity for each of the tested conductors.

Effects on the System

To compound the problems that harmonic currents present to the system, nonlinear harmonic load also have an Ohm's law relationship with the source impedance of the system to produce voltage harmonics. Consider a heavily loaded transformer that is affected by one branch circuit feeding a non-linear load. The creation of voltage harmonics can then be passed down to all the remaining circuits being fed by that transformer.

Voltage harmonics may cause havoc within the electrical system. Motors are typically considered to be linear loads; however, when the source voltage supply is rich in harmonics, the motor will draw harmonic current. The typical result is a higher than normal operating temperature and shortened service life.

Different frequency harmonic currents can cause additional rotating fields in the motor. Depending on the frequency, the motor will rotate in the opposite direction (counter-torque). The fifth harmonic, which is very prevalent, is a negative sequence harmonic causing the motor to have a backward rotation, shortening the service life.

Transformer Derating

Most generators and transformers base their operating characteristics on undisturbed 60Hz waveforms. When the waveforms are rich in harmonics, shortened service or complete failure often follows.

The derating K factor can be applied specifically to transformers to ensure that dangerous heating will not result due to the transformer supplying load currents rich in harmonic content.

The K factor is basically an index of the transformer's ability to handle nonlinear load current without abnormal heating. Some distribution transformers are now being designed with magnetic cores and windings to accommodate harmonic content. A K-rated transformer is specifically designed to handle nonlinear loads. The higher the K factor value, the better the transformer's ability to handle nonlinear loads.

Meter Readings

Harmonic problems can be analyzed more easily when the proper test equipment is used.

The term "True RMS", or Root-Mean-Square, relates to the equivalent DC heating value of the current or voltage waveform. If a pure sine wave and a distorted sine wave were both applied to a resistive load, the point where they both create the same heating value is the point where they both have the same RMS value.

True RMS capability is required to accurately measure systems where harmonic current is present. Average responding instruments will yield erroneous measurement results from 25 to 40% below the actual value when harmonic distortion is present.

Crest Factor

Crest factor is the ratio of the Peak value of a sinusoidal waveform to its RMS value.

$$\text{Crest Factor (CF)} = \frac{\text{Peak Value}}{\text{RMS Value}}$$

Crest factor indicates the level of peaking which an instrument can handle without measurement errors. For a perfect sine wave the crest factor would be 1.414. This relates to the Peak amplitude that an instrument can measure accurately. Typical crest factor ratings are from 2.0 to 6.0. The higher the factor, the more capable the instrument of measuring a complex waveform correctly. When harmonics are present crest factors may be less than (CF of a square wave = 1) or greater than 1.414.

Limiting the Effects of Harmonics

Derating certain types of electrical equipment is the easiest way to limit the effects that increased heating has on the equipment. A 25% derating for transformers and generators is commonly employed in industry.

Filtering is currently the most common method used to limit the effects that harmonics present to the rest of the system. Filters typically consist of tuned series L – C circuits. Filter impedance is negligible with respect to the rest of the system, limiting its interaction effects for harmonic control. Filters are sized to withstand the RMS current as well as the value of current for the harmonics.

Information for this article contributed by AEMC® Instruments.

NEW AEMC Three-Phase Power Quality Analyzer

- 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
- Phasor Diagram Display
- VA, VAR and W per Phase and Total
- kVAh, VARh and kWh Per Phase and Total
- Neutral Current Display
- 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® Professional Software to Configure Instrument, Run Tests and Generate Reports

PowerPad 3945

Specifications

Sampling Frequency	256 samples/cycle
Voltage (TRMS)	Phase-to-Phase: 830V Phase-to-Neutral: 480V
Current (TRMS)	MN Clamp: 0 to 6A/120A or 0 to 240A MR Clamp: 0 to 1200Aac, 0 to 1400Adc SR Clamp: 0 to 1200A AmpFlex™: 0 to 6500A
Frequency (Hz)	40 to 69Hz
Other Measurements	kW, kVAR, PF, DPF, kWh, kVARh, kVAh, K-Factor, Flicker
Harmonics	1st to 50th, Direction, Sequence
Communication Port	Optically coupled RS-232
Power Source	9.6V NiMH rechargeable battery pack AC Supply: 110/230Vac ±20% (50/60Hz)
Battery Life	6 hrs with display on; ≤96 hrs with display off (record mode)
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

All models include: three color-coded current probes (MN93 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® Professional software, carrying bag, soft carrying pouch and user manual

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

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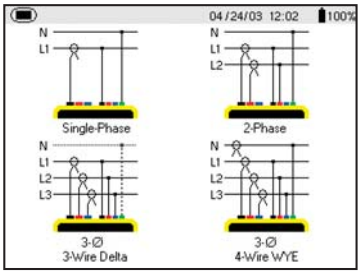
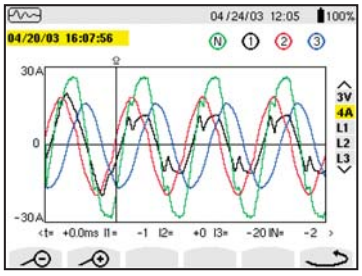
Large Color Display!

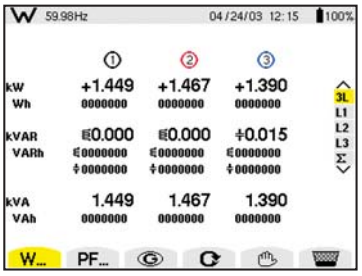
Configuration



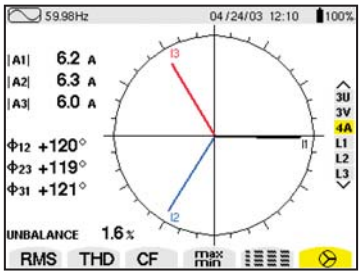
Transient Mode



Power & Energy Mode



Phasor Diagram



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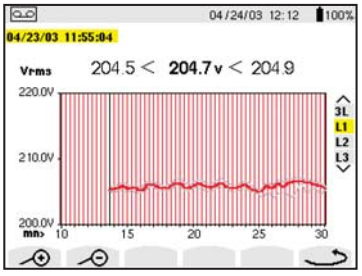
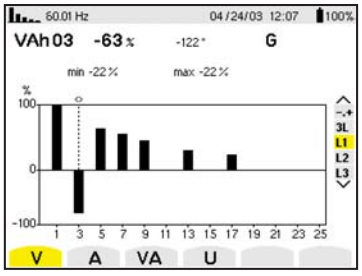


Harmonics Mode



The screens above are a sample of the many available on PowerPad™

DataView®

Data Analysis and Reporting Software

DataView® is included with the PowerPad™ Model 3945

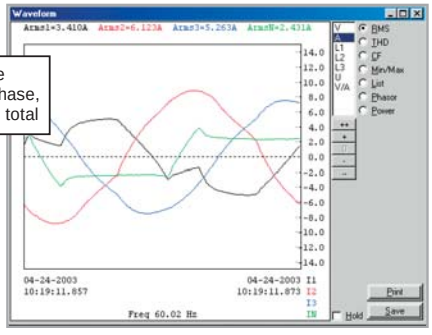
Configure all functions of the PowerPad™

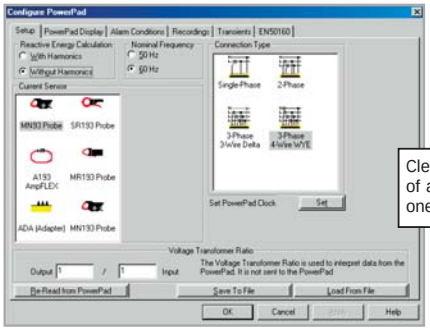
- Display and analyze real time data on your PC
- Configure all PowerPad™ functions and parameters from your PC
- Customize views, templates and reports to your exact needs
- Create and store a complete library of configurations that can be uploaded to the PowerPad™ as needed
- Zoom in and out and pan through sections of the graph to analyze the data
- Display waveforms, trend graphs, harmonic spectrums, text summaries, transients, event logs and stored alarms
- Print reports using standard or custom templates you design

Minimum System Requirements:

- Windows®95/98/2000/ME/XP or Windows®NT 4.0
- 32MB of RAM (128MB recommended)
- 35MB of Hard Disk Space (200MB recommended)
- CD ROM drive

Display real-time waveforms by phase, by parameter or total





AUTOMATIC REPORT GENERATION

Clear and easy setup of all functions from one tabbed dialog box

Ordering Information

Order #	Mfg #	Description	Price
MP2130.75	2130.75	PowerPad™ Model 3945 w/MN93 (240A)	
MP2130.76	2130.76	PowerPad™ Model 3945 w/SR193 (1200A)	
MP2130.77	2130.77	PowerPad™ Model 3945 w/24" 6500A AmpFlex™193-24	
MP2130.78	2130.78	PowerPad™ Model 3945 w/36" 6500A AmpFlex™193-36	
Accessories (Optional)			
MP2140.09	2140.09	Set of three MN93 probes (240A)	
MP2140.10	2140.10	Set of three SR193 probes (1200A)	
MP2140.11	2140.11	Set of three 24" AmpFlex™193-24 probes (6500A)	
MP2140.12	2140.12	Set of three 36" AmpFlex™193-36 probes (6500A)	
MP2140.13	2140.13	Set of three MR193 probes (1000Aac/1400Adc)	
MP2140.14	2140.14	Set of three MN193 probes (5A/120A)	
MP2140.17	2140.17	5A Adaptor Box	

Hioki Power Quality Analyzer/Logger

- Measures Power Factor, Sags, Swells, Flicker and Transients
- Harmonic to the 50th Order
- High Frequency Transients
- Detection and Waveform Display
- Single Phase and Three Phase
- Four Current and Voltage Channels
- TFT Color LCD Display

This unit measures the most common power measurements including: Transient overvoltage, voltage swell, dip, interruption, frequency, voltage, current, voltage/current peak, active/reactive/apparent power, power factor, voltage or current imbalance ratio, harmonic voltage/current/power, inter harmonic voltage/current, harmonic voltage/current phase angle, total harmonic/inter harmonic distortion and UIE flicker.

▲ 3196

▲ 3196-01

Each Unit Includes:
3196 Analyzer, Voltage Cables (9438-02), AC Adapter (9458), Battery Pack (9459), Shoulder Strap, Quick Reference Guide, Operating Manual, LAN Connector Cover, Marking Label

Each Kit Unit Includes:
3196 Analyzer, Voltage Cables (9438-02), (4)500 Amp Current Clamp (9661), AC Adapter (9458), Battery Pack (9459), Soft Carrying Case (9339), PC Software (3196PCSFT), Shoulder Strap, Quick Reference Guide, Operating Manual, LAN Connector Cover, Marking Label

Specifications

Measurements	Single-Phase 2 and 3 wire Three-Phase, 3 and 4 wire	
Voltage Range	Ch1, Ch2, Ch3: 150/300/600 VAC Ch4: 60/150/300/600 VAC	
Current Range	Up to 1,500 AAC	
Measurement Method	Transient Overvoltage: Qrithmetic Operation:	2MHz/s 256 Points/cycle
Harmonic:		2048 points/10 Cycles (50Hz) 2048 points/12 Cycles (60Hz)
Internal Memory	13MB	
Interface	PC Card Slot: RS-232 LAN	PCMCIA/JEIDA (not included) sub 9 Pin Connector Ethernet, TCP/IP (10BaseT, RJ-45)
Power Supply	110 VAC ± 10%, 50/60 Hz	
Dimensions	11.73W x 8.46H x 2.64D Inches (298 x 215 x 67 mm)	
Weight	4.5 lbs (2.0 Kg.)	

Ordering Information

Order #	Mfg #	Description	Price
MP3196-01/500HK	3196-01/500	Power Analyzer/Logger Kit	
MP3196HK	3196	Power Analyzer/Logger	
Recommended Options			
MP9660HK	9660	Current Clamp On (0-100 AAC), 1 mV/mA	
MP9661HK	9661	Current Clamp On (0-500 AAC), 1 mV/mA*	
MP9290HK	9290	Current Clamp On Adapter (1,500 AAC)	
MP32PC-CARDHK	32PC-CARD	32Mb Compact Flash Card	
MP64PC-CARDHK	64PC-CARD	64Mb Compact Flash Card	
MP9339HK	9339	Portable Soft Case*	
MP9642HK	9642	LAN Cable (5m)	
MP9670HK	9670	Printer	
MP9671HK	9671	AC Adapter for 9670 Printer*	
MP9223HK	9223	Recording Paper (80mm x 30m, 5 rolls)	
MP9438-02HK	9438-02	Voltage Cables*	
MP9458HK	9458	3196 AC Adapter*	
MP9459HK	9459	3196 Battery Pack*	
MP9638HK	9638	Serial Printer Cable	
MP9237HK	9237	Box 4 rolls/box	
MP9340HK	9340	Hard Carrying Case	
MP9264-01HK	9264-01	3P3W Wire Adapter	
MP9264-02HK	9264-02	3P4W Wier Adapter	
MP3196PCSFTHK		PC Application Software (Include in Kit)	
* Included with kit			

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NEW Hioki Power Quality Analyzer/Logger

- Simultaneous Recording of Demand Values and Harmonics
- Measure Up to 3-phase, 3-wire system (displays voltage and current for three lines)
- Measure Up to Four Single-phase, 2-wire Systems
- 0.5A to 5000A Range
- Simultaneously Measure Voltage, Current, Power (active, reactive, and apparent), Integrated Power, Power Factor, and Frequency
- Supports High-speed Data Storage from Individual Waveforms
- PC Card Compatible Plus 1 Mb Internal Memory for Extra Memory
- High-speed Data Storage from Individual Waveforms
- Detect Incorrect Connection using Vector Diagrams
- Polarity Display and Measurement Using the Reactive Power Measurement Method

The 3169 is a Clamp On Power HiTESTER that allows measurement of single-phase to three-phase 4-wire circuits with a single unit. In addition to measuring standard parameters such as voltage, current, power, power factor, and integrated values, these clamp-on power meters can simultaneously perform demand measurements required for carrying out power management and energy-saving measures, as well as harmonic measurements. This new power meter also features PC card data storage, and comes equipped with an RS-232C interface for PC communications. Further, with greater data processing speeds, it is possible to measure the power of just a few cycles, enabling more detailed and effective energy-saving measures for equipment. The 3169 is ideal for users who want to achieve close control over energy-saving management activities and measures.

Specifications

Measurement lines	Single-phase/two-wires, Single-phase/three-wires, Three-phase/three-wires, Three-phase/four-wires	
Measurement items	Voltage, Current, Active power, Apparent power, Reactive power, Power factor, Frequency, Power integral, Harmonics	
Measurement ranges	Voltage:	150 V to 600 V, 3 ranges
	Current:	5 A to 5 kA, 8 ranges (use clamp sensor)
	Power:	750 W to 9 MW, 16 combination patterns
Basic accuracy	Voltage:	±0.2 % rdg. ±0.1 % f.s.
	Current:	±0.2 % rdg. ±0.1 % f.s. + Clamp accuracy (active power, at 45 to 66 Hz)
Clamp sensor accuracy	9660 (100 A AC): ±0.5 % rdg. ±0.3 % f.s.	
	9661 (500 A AC): ±0.5 % rdg. ±0.11 % f.s.	
	9669 (1000 A AC): ±1.2 % rdg. ±0.11 % f.s.	
	9667 (5000 A AC, flexible): ±2.2 % rdg. ±0.4 % f.s.	
Frequency characteristics	Fundamental waveforms up to 40th harmonic ±3 % f.s. + measurement accuracy (of a 45 to 66 Hz fundamental waveform)	
Data storage	Internal memory: 1 MB	
	Flash Card: Up to 528 MB	
Other functions	RS-232C, External I/O (Option; D/A output)	
Display update rate	Approx. 0.5 time/second	
Power supply	100 to 240 V AC, 50/60 Hz	
Dimensions, mass	210 mm(8.27 in)W _ 160 mm(6.30 in)H _ 60 mm(2.36 in)D, 1.2 kg (42.3 oz)	
Accessories	9438-03 Voltage cord set, Input cord label, Operation manual, Power cord	

Each Kit includes: 4 current clamps, Voltage Leads, Carrying Case, software, 32 MB Flash Card and Operating Manual.

Ordering Information

Order #	Mfg #	Description	Price
MP3169-20-01/500	3169	Power Quality Analyzer Kit, 500 AAC	
MP3169-20-01/1000	3169	Power Quality Analyzer Kit, 1000 AAC	
MP3169-20-01/5000	3169	Power Quality Analyzer Kit, 5000 AAC	

Electro Industries Power Disturbance Analyzer

- Datalogger, Harmonic Analyzer, Disturbance Waveform Recorder
- On-Board Mass Memory plus Software for Downloading and Analysis
- True RMS Sensing

Use the 23607E to obtain comprehensive power-quality data around your entire facility. This three-in-one instrument lets you conduct profiling for even your most complex or demanding applications. Its mass-storage capacity eliminates the need to carry along a laptop, and its Windows™-based Futura+ Communicator software enables downloading to a PC. Complete charting and graphing capability is built-in, and stored data exports directly to most spreadsheets or databases.

Complete Power Analysis
All vital power parameters are measured and recorded: three-phase true RMS voltage, current, watts, VARs, VA, PF, frequency, THD, and more. Instantaneous and averaged readings are stored with date/time stamps, and the 23607E indicates when setpoints were exceeded and when values returned to normal. You can log up to three months of trend data with this unit. And, for calculating on-peak/off-peak demand and automated utility-bill generation, order the 23607E-1 option.

Powerful Harmonics Capabilities
The instrument detects and displays harmonics, both odd and even, to the 31st order for each voltage and current channel. You can view captured waveforms and display a spectrum analysis for each channel, so you can locate the source of otherwise unexplained power-quality problems.

Pre- and Post-Event Disturbance Recording
When a disturbance—i.e., voltage surge/sag or current fault lasting more than 1¼ of a cycle—occurs, the analyzer records all six channels of voltage and current, plus 10 cycles prior to the event and up to 50 cycles after it. This gives you a complete look at the power-quality disturbances affecting system integrity and can help head off expensive equipment failures.

Each Unit Includes: Futura+ Communicator Windows™-based software, and instruction manual.

NOTE: Voltage leads and current clamps need to be ordered separately.

Don't forget to order the current probes and voltage leads.

PDA-1000– Shown with optional probes and leads

Specifications

Parameter	Range	Resolution	Accuracy*
Volts:	0 to 2000	0.1%	0.3%
Amps:	0 to 2000	0.1%	0.3%
Watts:	0 to 2000	0.1%	0.5% (ea. phase and total power)
VA:	0 to 2000	0.1%	0.5% (ea. phase and total power)
VAR:	0 to 2000	0.1%	0.5% (ea. phase and total power)
PF:	1.0 to ±0.5	0.2%	0.5% (ea. phase and total power)
Watt-Hour (±):	0 to 199,999	1 kW hour	0.2%
VAR-Hour (±):	0 to 199,999	1 kVAR hour	0.2%
VA-Hour:	0 to 199,999	1 kVA hour	0.2%
Frequency:	47 to 75 Hz	0.01 Hz	0.02 Hz
Harmonics:	To 31st order	0.2%	0.5%

* Unless otherwise specified, accuracy is in percent of FS ±0.05% of range ±1 digit

Input Voltage Range:	300V phase to neutral
I/O Isolation:	Min. 2500 VAC, 60 Hz, between any input to output of analog retransmitting module, digital communication module, or relay output terminals
Input Limits:	Voltage and Current: 200% of rated, continuous; 10 times rated for 3 seconds, surge
Burden (per element):	0.3 VA max, voltage; 0.2 VA max, current
RMS Calculation:	128 samples per cycle
Waveform Recording:	16 samples per cycle
Storage Capability:	1 MB mass memory total; 110,000 snapshots, configurable to any profile; 100 events, six channels
Operating Temperature:	-20 to +70°C
Power Supply:	115 VAC ±20%, 12 VA

Ordering Information

Order #	Mfg #	Description	Price
MP23607E	PDA-1000	Portable Disturbance Analyzer	
MP23607E-1		Time-of-Use Calculator Software	
MP23608E	EV400	Voltage Leads	
MP23712E-8	2115.75	100:1 Clamp-on CT, 0.5 to 240A*	
MP23707E-5	2113.44	1000:1 Clamp-on CT, 0.1 to 1000A*	
MP4493E-1	2110.83	3000:1 Clamp-on CT, 1000 to 3000A	

Transcat Calibration with Data	CALL
Transcat Calibration without Data	CALL

Contact your Transcat authorized representative today!

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Ideal 800 Series Power Analyzer

Small power quality instrument. Huge Capabilities.

Four programs measure and analyze power quality on both single- and three-phase electrical systems. Instantaneous readouts including tables, bar graphs and even individual waveforms make job site data interpretation easy. With a real-time clock and 1 MB of memory, the Power Analyzer stores data that can be downloaded to a personal computer for in-depth analysis using PowerVision™ Software.

The Energy and Harmonics Program comes standard with the IDEAL Power Analyzer. Disturbances, Check-Meter and Fast-Check Programs are available separately.

▲ **Power Analyzer**

- Single- or Three-Phase Measurements
- True RMS
- Data Logging (1MB Memory)
- Energy and Harmonics Program
- PowerVision Software
- Optional programs:
  - Disturbances
  - Check-Meter
  - Fast-Check
- Lightweight, Portable Design
- Easy-to-use Push-Button Operation
- Password Protected On-Screen Setup
- 160 x 160 Pixel LCD
- RS-232 Interface
- Customized Data Collection
- Real-Time Clock
- Programmable Trigger-points and Start/Stop Time
- Auto Display Shutoff
- Rechargeable Ni-Cad Battery
- Intelligent Battery Charging System

Power Measurements

- Kilowatts (kW)
- Voltamperes (VA)
- Inductive Reactive Power (kvarL)
- Capacitive Reactive Power (kvarC)
- Power Factor (PF)
- Frequency (Hz)
- Kilowatt Hours (kWh)
- Reactive Power Per Hour (kvarhL, kvarhC)

Harmonics Measurements

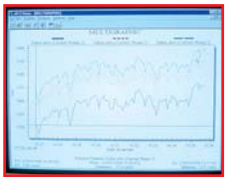
- Total Harmonic Distortion (%THD)
- Harmonic Factorization to 51st Harmonic

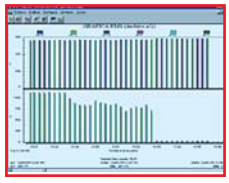
61-805 (as purchased)
Kit measures 21L x 17.5W x 7.5D
Meter measures 8.75L x 4.75W x 2.75D
Operating temperature 0°C - 50°C

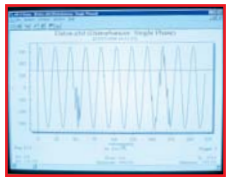
Each Unit Includes: (1) Power Analyzer, (4) Color Coded test leads with Alligator Clips, (3) 1000 AAC Current Clamps, (1) RS-232 Interface / Power Supply, (1) Hard Carrying Case, Energy and Harmonics Programming module, and PowerVision Analysis Software.
61-805 Includes: Power Quality Analyzer - standard model
61-806 Includes: Power Quality Analyzer - neutral current measurement capability auto detect clamps, optional FIFO memory & backlight.
61-807 Includes: Same features as 61-806 plus 100 AAC clamp adapter

PowerVision™ Analysis Software (included)

For in-depth troubleshooting, data can be downloaded to a computer and evaluated through a variety of graphs, charts and detailed readouts.

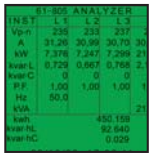

Power Factor


Harmonics


Disturbances

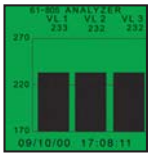
Power Analyzer Display Screens


Program Setup

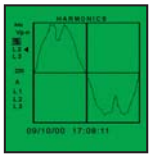


Table

Exploded View


Bar Graph


Oscilloscope


WaveForm

Specifications

Measurements	Energy and Harmonics	Disturbances	Check-Meter	Fast-Check
ACV	•	•	•	•
ACA	•		•	•
kW	•		•	•
kVAR	•		•	•
kVA	•		•	•
PF	•		•	•
Hz	•	•	•	•
kWh	•		•	•
kVARh	•		•	•
%TDH	•			
to 51st Harmonic	•			
No. of Disturbances		•		•
Energy Meter Error			•	

Ordering Information

Order #	Mfg #	Description	Price
MP61-805	61-805	800 Series Power Analyzer Kit	
MP61-806	61-806	800 Series Power Analyzer Kit w/ Neutral	
MP61-807	61-807	800 Series Power Analyzer Kit w/ 100A Clamps	
Recommended Accessories			
MP61-474	61-474	Disturbances Program Module	
MP61-475	61-475	Check-Meter Program Module	
MP61-476	61-476	Fast-Check Program Module	
MP61-453	61-453	2000/200 AAC Current Clamp Adapter (Set of 3)	
MP61-455	61-455	500 AAC Clamp Current Adapter (Set of 3)	

Contact your Transcat authorized representative today!

NEW Yokogawa Clamp-on Power Meters

- CW120 CoversThree-phase 3-wire and Three-phase 4-wire
- CW120 Covers Single-phase 2-wire to Three-phase 3-wire
- CW121 Covers Single-phase 2-wire to Three-phase 4-wire
- Measurable Voltages on Systems up to 400V
- 50A, 200A, 500A, 700A, and 1000–3000A Current clamps
- Settings Software (Toolbox) is Included

The CW-140 Clamp-on Power Meter is lightweight and easy to use. It offers the latest technology in power monitoring and quality analysis. A large LCD Screen (5.9 inches, 320 x 240 pixels) and displays values corresponding to displayed parameters. The display of the parameters on screen can be enlarged for easier visibility. There is also four different modes that allow the meter to have various applications for better viewing (instant mode, electric energy mode, demand mode and harmonics mode.

Measuring a wide variety of different parameters including Power Factor and Phase Angle is ideal for detecting systems problems. The CW-140 measures voltage (VRMS), current (ARMS), active power (W),reactive power (VAR), and frequency (Hz). There is an internal 1MB memory and can log and store measurement in one minute intervals for up to 1000 hours. The 1st through the 13th order of harmonic parameters can be displayed in an easy to understand bar graph values, or can also be displayed as numeric values.

The CW120 Series has an instantaneous value filing function (enabling multiple data records to be saved in a single file when multiple measurements are taken) which is useful for determining equipment operating conditions.

The CW120 Series is compact in size (117x161x51mm (WxHxD)), making it ideal for installation in cubicles and inside distribution panels. Installation is even easier with the magnetic case.

The software allows you to set CW120 Series measurement conditions through a PC and save measurement data on a PC when the unit is connected to the PC through RS-232 or RS-485 port. The data file stored can be transfered to a PC. Microsoft Excel can read the transfered data file.

Specifications

Model	CW-120	CW-121	CW-140
Unit	Power Monitor and Recorder	Power Monitor and Recorder	Power Monitor, Recorder, and Power Analyzer
Operating Temp. / RH	0-40C / 5-85% RH		5-40C / 5-85% RH
Power	AC Power Supply from input		AC Power/AA Alkaline batteries
Parameters	Single phase 2 wire to three phase 3 wire	Single phase 2 wire to three phase 4 wire	Single phase 2 wire to three phase 4 wire
Demand	N/A		Demand Mode Measurement
Harmonics	N/A		Harmonics Mode Measurement (1st thru the 13th)
Events	N/A		Event Inputs (0-5V)
Trigger	N/A		External Trigger (0-5V)
Communications	RS-232 and RS-485		RS-232
Memory	ATA Flash Memory Card		One Meg of on-board internal memory
Wiring Alert	Wiring Check Error Function		
Floppy Disk	N/A		External Floppy Disk
Languages	English Language		English, French, German, Italian, Spanish, Japanese

Ordering Information

Order #	Mfg #	Description	Price
MPCW120D/2/C2/PM1	CW120D/2/C2/PM1	CW120 Power Meter, RS 485, (3) 200 A Current Clamp and Case	
MPCW120D/2/C4/PM1	CW120D/2/C4/PM1	CW120 Power Meter, RS 485, (3) 500 A Current Clamp and Case	
MPCW121/2/C2/C2/PM1	CW121/2/C2/C2/PM1	CW121 Power Meter, RS 485, (4) 200 A Current Clamp and Case	
MPCW121D/2/C2/C2/PM1	CW121D/2/C2/C2/PM1	CW121 Power Meter, RS 485, (4)500 A Current Clamp and Case	
MPCW140D/C2/PMI	CW140D/C2/PMI	CW140 Power Meter, (4) 200 A Current Clamp, NIMH Battery Pack and Case	
MPCW140D/C4/PM1	CW140D/C4/PM1	CW140 Power Meter, (4) 500 A Current Clamp, NIMH Battery Pack and Case	

Yokogawa CW-Series Clamp-on Power Meter Recommended Accessories

Order #	Mfg #	Description	Price
MP96030	96030	Clamp-on (20/200ACA)	
MP96031	96031	Clamp-on (50/500ACA)	
MP97020	97020	Floppy Disk Drive*	
MP94004	94004	NiMH Battery Pack*	
MP97010	97010	Printer	
MP94006	94006	AC Adapter for printer (Europe)	
MP94007	94007	AC Adapter for printer (USA)	
MP97080	97080	Thermal Paper (10 Rolls)	
MP91007	91007	Voltage Probe	
MP366969	366969	AC Convertor with Power Cord	
MPB9017VD	B9017VD	RS 232 Cable to PC*	
MPAP140E	AP140E	Data Analyzing Program	

Note * Indicates for CW-140 Only

NEW LEM/Dranetz-BMI Analyst 3Q

- 3 Phase Power Quality Meter, Oscilloscope and Data Logger
- 10.2 KHz Sample Rate for Sub Cycle Event Detection
- Numerical Display of RMS Values of Current and Voltage, Plus Frequency, Power, Energy, Flicker and Related Parameters
- High Resolution Backlit Display (320 x 240) for Waveform, Harmonics, Chart and Multi Parameter Display
- Unique Graphical Overview Mode for All Key Power Quality Parameters
- Assessment of Voltage Quality Parameters According to EN50160 in Single or Three Phase Systems, Star or Delta Configuration
- Internal Trend Recording with Real Time Clock
- Automatic Recording of Min-, Max-, Average Values (1/2 cycle values) and Simple Detection and Measurement of Dips, Surges and Interruptions
- Unique Vector Diagram for Analysis of Imbalance of the Three Phase Voltages and Currents
- Built-in 1.5 MB Memory for Data Logging, Saving Screens and Capturing of up to 100 Events
- On Screen Analysis or Data Download via RS232 for Reporting and Archiving of Results
- Four Channel (incl. neutral) Current Measurement up to 3000A
- NiMH Rechargeable Battery Giving 24 hours Operation or Mains Powered for Continuous Use
- Safety: IEC61010-1, 600V CATIII, Pollution Degree 2

3 Phase 7 Channel Hand Held Graphical Power Quality Measurement

The Analyst 3Q combines the functionality of power quality meter, disturbance analyser, and data logger in a single hand held instrument which has been designed for safety and ease of use. The Analyst 3Q is the ideal troubleshooting tool to identify and quantify power quality problems that effect the performance and efficiency of electrical plant and equipment.

Specifications

Voltage Ranges	
Nominal Voltage Star:	115/230/480V
Delta:	200/400/830V
Intrinsic Error	115V - 830V – 0.2%
Resolution 0.1V	115V - 830V – 0.2%
Current Ranges	30/300/3000A
Intrinsic Error	0.5% (excludes probe)
Resolution	0.01A
Power	
Intrinsic Error	0.01
Resolution	1W
Frequency Range	45-65Hz
Intrinsic Error	0.02%
Resolution	0.01Hz
Harmonics	1st-40th Vrms, Irms, THD V, THD I
Imbalance	
Intrinsic Error	0.5% resolution 1deg
Events	
Intrinsic Error	0.01
Flicker	FL, Pst, Plt, IEC 1000-4-15
Intrinsic Error	3%

Ordering Information

Order #	Mfg #	Description	Price
MPAN3Q-200	AN3Q-200	Analyst 3Q with 200A Mini Current Clamps	
MPAN3Q-3000	AN3Q-3000	Analyst 3Q with 3000A LEMflex Current Clamps	
MPAN3Q-3000LDM	AN3Q-3000LDM	Analyst 3Q with 3000A LEMflex Current Clamps and Dran-View Pqdif Software	

Each Unit Includes: four (4) Current transformer as supplied per part number, Three (3) voltage Leads, re-charger, basic LEM software(AN3Q-200 and AN3Q-3000), Dran-View Pqdif Software (AN3Q-3000LDM) and hard shell case

Engineer's Notebook

Power Harmonics

They're being discussed and searched for in commercial and industrial facilities everywhere. But what are they, why are they important, and how do you tell if they're causing trouble in your power systems?

What Are Power Harmonics, and Where Do They Come From?

Harmonics are, very simply put, high-frequency current and voltage distortions within your power system. Their frequencies are integer multiples of the fundamental system frequency; e.g., if the fundamental frequency (the first harmonic) is 60 Hz, the second harmonic is 120 Hz; the third, 180 Hz; the fourth, 240 Hz; and so on.

Power harmonics have become much more prevalent with the development of high-efficiency electronic equipment. Personal computers, medical test equipment, solid-state motor drives, uninterruptible power supplies (UPS), etc., are designed to draw current only in pulses, during the peak of the incoming voltage wave. This results in a non-linear load, which, in turn, creates the distorted (non-sinusoidal) wave-forms that cause harmonics to flow back into the power system. Harmonics can be present in both single- and three-phase non-linear loads.

Ramifications and Symptoms of Power Harmonics

Left "untreated," harmonics can cause a multitude of problems, from compromised performance to overheating and component or system failure. Circuit breakers may trip at low current or fail to trip when they should. Of particular concern are harmonics called "triplens:" the third, ninth, fifteenth, etc. Triplens cause a buildup of current in the neutral conductor. In fact, in four-wire systems with numerous single-phase, non-linear loads, neutral current can exceed phase current, leading to dangerous overheating since there is no breaker on the neutral conductor. Excessive current in the neutral conductor can cause higher than normal voltage drops between neutral and ground at the 120V outlet and can also lead to bus bar overload.

Symptoms reflecting the presence of power harmonics are fairly straightforward. An early indicator is noise in your phone lines. Since telecommunications lines are generally run next to the power cables, inductive interference caused by triplens can be heard on a phone or can cause problems in your fax lines.

Other common symptoms are vibrating and buzzing electrical panels; premature transformer and motor failures; blown capacitors; circuit breakers tripping under normal loads; and hot-to-the-touch power system components. Personal computers are extremely sensitive to voltage harmonics, and may reset due to undetected, momentary power loss.

Not Always the Culprit

As troublesome as power harmonics can be, it's important to remember that they may not be the true problem. It's become fashionable to blame "PH" for system malfunctions, when simple explanations—such as defective equipment—are in order. So, it's often as vital to prove that harmonics don't exist in your power system as it is to discover that they do.

Troubleshooting Power Harmonics

Once you suspect the presence of harmonics, you can take steps to pinpoint specific trouble spots. A visual survey of your facility's in-use equipment, as well as a check of transformers for excessive heating, will give you a good idea of where to start. The next step is to choose the proper measuring and testing tools. These fall generally into three categories.

The basic tools are those used for checking current load and frequency, e.g., true RMS digital multimeters and clamp-ons. These typically feature peak (or crest), min and max modes, along with fast response time to detect transients and surges. Some have an LCD bargraph with the digital display so that frequency and current can be observed simultaneously.

The next level of instrumentation, harmonic analyzers, provides extended capabilities. These analyzers measure a wider array of parameters and feature a graphical display, which provides a scope-like "snapshot" of waveforms. In addition, such units can measure and display individual harmonic components out to the 31st; as well as total harmonic distortion (THD).

For the most sophisticated analysis work, select a power harmonics datalogger. As the analyzer reading is a "snap-shot" of harmonics, the logger is a "video." This has advanced measurement functions—such as power factor; phase angle; VARs; THD; odd, even, triplen harmonics; etc.—and full data logging and output capabilities. It allows you to record measurements with respect to time, which is extremely valuable in isolating factors causing harmonic distortion. The data logger's powerful software enables comparisons, analysis, reporting, and storage on your PC.

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Fluke Power Quality Analyzer

Advanced power system analysis in a hand-held tool

- Combines Capabilities of a Power Quality Analyzer, Multimeter and Scope
- Calculates 3-Phase Power on Balanced Loads
- Measures Power Harmonics, and Captures Voltage Sags, Transients and Inrush Current
- Records Two Selectable Parameters for up to 16 Days
- 20 Measurement Memories
- FlukeView® Software can Log Harmonics Over Time
- FlukeView® Software Provides a Complete Harmonics Profile
- Measures Resistance, Diode Voltage Drop, Continuity, and Capacitance
- Users / Applications Manual and Power Quality Video
- Complete Package with Voltage Probes, Current Clamp, Software and Optically Isolated Interface Cable
- 3 Year Warranty

Fluke 43B performance and construction, backed by a three-year warranty

Transcat and Fluke bring you the Model 43B, which combines the key functions of a power quality analyzer, multimeter, and scope. Maintain power systems, troubleshoot problems, and diagnose equipment failures with this "can't-be-without" tool. Perform fast spot checks, and use the monitoring functions to track intermittent problems and overall power system performance. With advanced recording, the 43B catches voltage sags as short in duration as a single line cycle and multiple transients down to 200 ns. And it includes FlukeView® Power Quality Software to help you document system history and define parameters.

Measures and Displays Multiple Parameters

The instrument has all the power measurements you typically need: volts, amps, Hz, watts, VA, VAR, PF, DPF. It displays harmonics characteristics to the 51st, and its built-in scope lets you view waveforms up to 20 MHz. Even the most complex power waveform signal is stable. The unique inrush function catches starting current and provides cursors for waveform analysis.

In spite of its advanced performance, the 43B is simple and intuitive, with menus that use familiar electrical terms. And because it also has built-in resistance, diode, continuity, and capacitance measurements, it's the only tool you need to carry on power system calls.

Each Unit Includes: Test leads (TL24), Hard Case (C120) industrial test clips (AC20), large-jaw alligator clips (AC85), flat-tipped Slim-Reach™ test probes (TP1), 4 mm round Slim-Reach™ test probes (TP4), 500A AC current clamp 80i-500s), optically isolated RS 232 interface adapter (PM9080/001), rechargeable NiCd battery pack (installed, BP120), line adapter/battery charger (PM 8907), shielded banana-to-BNC adapter, FlukeView® Power Quality Software for Windows™, with user's manual, user's manual and application guide, and power quality video.

Approvals: IEC1010-1, CAT III 600V

Specifications

Ranges / Accuracy	
True RMS Voltage:	5.000 to 1250V/±(1% + 10 counts)
True RMS Current:	50.00A to 50.00 kA/±(1% + 10 counts)
Watts, VA, VAR:	250W to 2.50 MW/±(4% + 4 counts)
PF, DPF:	0.25 to 1.00/±0.04
Harmonics Display / Accuracy	
Voltage, Current, Power:	1st to 51st harmonic (±2% + 2 counts) to ±(6% + 10 counts)
Phase:	2nd to 51st harmonic/±2° to 15°
Sags and Swells Recording:	4 minutes to 16 days recording time, selectable
Ranges:	Same as Full-Scale true RMS voltage and current
Transient Capture:	40 transients max; 40 ns, min pulse width
Voltage Thresholds:	20%, 50%, 100%, 200% above or below line voltage
Inrush Current:	1 to 1000A range; 1 sec to 5 minutes, inrush times
Input Impedance:	1 MΩ, 20 pF
Voltage Rating:	IEC1010-1 CAT III, 600V RMS
Scope Display	
Time Ranges:	20 ns/div to 60 s/div
Bandwidth:	Voltage channel (1), 20 MHz at inputs; current channels (2), 15 kHz at inputs
Vertical Sensitivity:	5 mV/div to 500V/div
Measurements:	DC, AC, peak, frequency, duty cycle, phase, pulse width
Screen Memories:	20 screens with data
Ohms, Diode, Continuity:	500.0Ω to 30.00 MΩ
Capacitance:	50.00 nF to 500.0 µF
Power:	NiCd battery, operating time 4 hours
Size/Weight:	9.1 x 4.5 x 2" (HWD)/2.5 lbs.

Ordering Information

Order #	Mfg #	Description	Price
MP43E	43B	Power Quality Analyzer	
MPC789	C789	Soft Carrying Case	
MPI1000S	I1000S	AC Current Probe, 1000A AC	
MPi-2000	I-2000FLEX	AC Flexible Current Probe, 2000A	

Transcat Accredited Calibration with Data	CALL
Transcat Accredited Calibration without Data	CALL

AEMC Clamp-On Harmonics Meters/Power Analyzers

Operate like simple clamp-on meters, perform like advanced power-quality analyzers

- True RMS AC Voltage and Current
- Read Frequency Through Voltage or Current Measurements
- Directly Read (%THD), (%DF), (CF), Peak Value of Distorted Currents, and Complex Voltages
- Record Min, Max, Avg, Max, Peak
- Peak Function Captures Instantaneous Peak Values, Smooth Function Stabilizes Fluctuating Readings
- Detect Low-Signal Levels—300 mA, 50 mV—for Power Quality on Low-Power or Idling Equipment
- Simultaneously Monitor Power Quality and Load
- Analog Output Enables Display of Current Waveform on Scope, Datalogger, or Recorder (5764E only)
- Feature Auto and Manual Ranging, Digital and Analog Displays

2111.39 ▲

1208.52 ▲

Specifications and Ordering Information

Mfg#	1208.52 (721)	2111.39 (725)
AC Current (TRMS):	0.05 to 700.0A (±999.9A pk)	0.30 to 1000.0A (±1500.0A pk)
Basic Accuracy:	2% Rdg, 100 to 400A	2% Rdg ±2 counts, 60 to 1500A pk
Frequency Range:	15 Hz to 10 kHz	0.5 Hz to 5 kHz
AC Voltage (TRMS):	0.05 to 600V (±1200V pk)	0.05 to 600V (±1500V pk)
Basic Accuracy:	1.5% Rdg	1% Rdg
Frequency Range:	15 Hz to 10 kHz	0.5 Hz to 5 kHz
DC Current:	N/A	0.30 to 1500.0A
Basic Accuracy:	N/A	2% Rdg ±20 counts
DC Voltage:	N/A	±0.05 to ±600V (±1500V pk)
Basic Accuracy:	N/A	1% Rdg ±2 counts, 60 to 1500V pk
Total Harmonic Distortion:	0.5% to 600.0%	0.2% to 1000%
Accuracy:	10% Rdg ±5 counts, to 100%	5% Rdg ±2 counts
Frequency Range:	Fundamental 45 to 65 Hz	Fundamental 40 Hz to 70 Hz
Distortion Factor:	0.5% to 100%	0.2% to 100%
Accuracy:	10% Rdg ±5 counts, to 100%	5% Rdg ±2 counts
Frequency Range:	Fundamental 45 to 65 Hz	Fundamental 40 Hz to 70 Hz
Crest Factor:	1.00 to 10.00	1.00 to 10.00
Accuracy:	10% ± 3 counts (at 40–450 Hz)	5% ±2 counts, 3.51 to 5.99 CF (at 40–70 Hz)
Frequency Measuring Range:	0.5 to 9999 Hz	0.5 to 20,000 Hz
Accuracy:	0.2% Rdg ±1 count, 1000 to 9999 Hz	0.2% Rdg ±2 counts, 1000 to 9999 Hz
Individual Harmonics:	N/A	0.2% to 300% (% THD or %DF)
Rank:	N/A	Hdc (DC component), H01 to H25
Accuracy:	N/A	From 5% Rdg ±2 counts to 15% Rdg ±2 counts, depending on amount of distortion and harmonic rank
Frequency Range:	N/A	Fundamental 40 Hz to 70 Hz
Analog Output:	1 mV/A, 0.05 to 700A RMS or 10 mV/A, 0.05 to 60A RMS	N/A
Display:	Quadriplexed LCD, $3^{3}/_{4}$-digits, 9999 counts, plus analog bargraph	Quadriplexed dual LCD, 4-digits, 10,000 counts, plus 31-segment analog bargraph
Safety Approvals:	UL, CSA, GS, VDE pending	UL, CSA, GS, VDE pending
Power Supply:	9V alkaline battery,	Four 1.5V AA batteries, approx. 50-hr. use approx. 40-hr. use
Dimensions:	10 x 3.8 x 1.7" HWD (254 x 97 x 44 mm)	10.8 x 4 x 2" HWD (275 x 103 x 52 mm)
Weight:	1.3 lbs (600g)	1.5 lbs (670g)
Order #	**MP5764E**	**MP5764E-1**
Price		

The 5764E is an AC only instrument with overall harmonic and distortion measurements. Choose 5764E-1 for more thorough evaluations. Measures DC voltage and current, reads AC + DC values, and percent AC ripple in the DC signal. Displays parameters for individual harmonic orders through the 25th odd and even or just odd harmonics, amplitude or frequency of individual harmonics, and more. In addition to crest-factor measurement, it has advanced transformer-evaluation functions: harmonic-derating factor (THDF) calculates transformer derating for phase-to-neutral loads. K factor determines a transformer's ability to handle nonlinear load current without overheating.

Each Unit Includes: Test leads and probes, two grip probes, batteries: one 9V for 5764E, four 1.5V AA for 5764E-1, and hard carrying case.

Approvals: EN 61010, CAT III, 600V

Accessories

Order #	Mfg #	Description	Price
MP2111.29	2111.29	Safety Test Leads, 1000V	
MP2111.30	2111.30	Two Safety Test Probes	
MP2111.31	2111.31	Two Safety Grip Probes	

Transcat Accredited Calibration with Data	CALL
Transcat Accredited Calibration without Data	CALL

Contact your Transcat authorized representative today!

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NEW AEMC Clamp-On Harmonic Power Meters

- True RMS
- Intensity: 1000A and 1500A peak
- Voltage: 600V and 1500V peak
- Power: 600kW, VA or VAR
- Power Factors and Power Shift
- Measurement of Total Harmonic Distortion
- Large Display with Three Reading Levels (3 x 10,000 cts)
- RS-232 Optical Output for Processing Results on a PC or Printer (Model F27)
- EN 61010-2-032, 600V, Cat. III

▲ 1208.56 ▲ 1208.57

Specifications and Ordering Information

Mfg#	1208.56 (F23)	1208.57 (F27)
Current (True RMS)	300 mA to 1000 AAC (1500A peak)	
Voltage (True RMS)	50 mV to 600 VAC (1500V peak)	
Peak Value (PEAK)	PEAK ± 2 ms	
Crest Factor (CF)	1 to 10	
Frequency	0.5 to 20kHz	
Power		
Active 10W	600 kWac	600 kWac/dc
Reactive 10VAR	600k VARac	600 kVARac/dc
Apparent 10VA	600 kAac	600 kAac/dc
Power Factor (PF)	0 to 1	
Displacement Power Factor (DPF)	-1 to +1	
Total Harmonic Distortion (THD)	0.2 to 600%	Absolute value (A or V) or relative value (%) of THD and DF
Distortion Factor (DF)	0.2 to 100%	
Jaw Opening	1.7" (43mm)	
Conductor Size	Cable: 1.97" (50mm); 2 Busbars: 1.97 x 0.20" (50 x 5mm)1 Busbar: 3.15 x 0.20" (80 x 5mm)	
Order #	**MP1208.56**	**MP1208.57**
Price		

NEW LEM/Dranetz-BMI Analyst Q70

Single Phase Power Quality Analyzer

- Photo Quality Backlit Color Display for Oscilloscope Mode, Spectrum Mode and Multi Parameter Display
- 10.2 KHz Sample Rate, Sub Cycle Event Detection
- AC Voltage and Current (via flexible CT up to 3000A)
- Additional Current Probes Available for Low Current Measurement
- mV/A Input for Installed Current Transformers
- W, VA, VAR, kWHr and Power Factor Measurement, Even for Distorted Waveforms
- Built in 3 Phase Power Capability for Balanced Loads
- TRMS, Peak, Crest Factor, THD, DF and Frequency for Current and Voltage
- Harmonics to the 50th with Magnitude and Phase Information
- Measurement of Dips, Sags, Swells, Flicker
- Inrush Current Measurement
- Record Function for MIN, MAX and Average
- Internal Datalogging and Full Power Quality Surveying with Time and Date Stamped Values
- Reporting to EN50160 Power Quality Standard with Customized Parameters

ANQ70-DV

Specifications

Voltage Ranges	
Nominal Voltage Star:	115/230/480V
Delta:	200/400/830V
Intrinsic Error	115V - 830V - 0.2%
Resolution	0.1V
Current Ranges	30/300/3000A
Intrinsic Error	0.5% (excludes probe)
Resolution	0.01A
Power	
Intrinsic Error	1%
Resolution	1W
Frequency Range	45-65 Hz
Intrinsic Error	0.2%
Resolution	0.01Hz
Harmonics	1st-40th VRMS, IRMS, THD V, THD I
Events	
Intrinsic Error	1%
Flicker	FL, Pst, Plt, IEC 1000-4-15;
Intrinsic Error	3%

Each Unit Includes ANQ70-DV : (1) 30/300/3000A LEMflex flexible CT, Voltage Leads, Dran-View" software, carrying case ANQ70 (1) 30/300/3000A LEMflex flexible CT, Voltage Leads, basic LEM software for file transfer, carrying case

Dran-View", leading software for the Power Quality industry.
Allows the viewer to scroll through event, timeline and waveform data simultaneously, zero in on captured disturbance waveforms, scan historical trends, evaluate static's and perform harmonic and interharmonic analysis-all with the click of a mouse. With it's intuitive two-pane browser, complete report writing capabilities, Windows" interface and simple-to-use visualization and analytical capabilities, Dran-View" turns every user into a power quality expert.

Ordering Information

Order #	Mfg #	Description	Price
MPANQ70-DV	Analyst Q70	Graphical Power Quality Analyzer with Dran-View Software	
MPANQ70	Analyst Q70	Graphical Power Quality Analyzer with LEM Software	

Fluke Power Harmonic Meter or Analyzer

- Powerful® System Maintenance Tool
- 41B Includes FlukeView Forms Software for Reporting and Datalogging
- Single or Balanaced 3-Phase Measurement
- Waveform, Bargraph, and Numeric Views All Measurements
- Displays Individual Harmonics Up to the 31st
- One-Button Measurement of True RMS Voltage and Current

The 5945E Zoom Mode feature lets you see small amounts of harmonics. It also adds data storage and a built-in optically isolated serial port. Data can be sent to a printer for quick hard copy readout or to a computer for later analysis.

Each Unit Includes: 500A AC current probe (80i-500S), test clips (AC20), test leads (TL24), test probes (TP20), four alkaline C-cell batteries, and harmonics video.

5945E Also Includes: Isolated RS-232-C cable (PM9080/001) and FlukeView® software.

41B

REGISTERED ISO 9000 MANUFACTURER

Specifications

Voltage Input Range:	0.0–600.0V TRMS AC + DC
Basic Accuracy:	RMS: ±0.5% + 2 digits; peak, DC: ±2% + 3 digits
Current Input Range:	1.00 mV (A) to 100 mV (A) RMS (A), AC + DC
Basic Accuracy:	RMS: ±0.5% + 3 digits + probe specs
Power Input Range:	0–600 kW (kVA) average; 0–2000 kW (kVA) peak
Basic Accuracy:	Active Power: ±1% + 4 digits + probe specs
Harmonics Accuracy	
Volts:	Fundamental to 13th: ±2% + 2 digits; at 31st ±8% + 2 digits
Amps Watts:	Fundamental to 13th: ± 3% + 3 digits + probe specs
Phase:	Fundamental ±2° + probe specs
Frequency Range:	5.00 Hz–99.9 Hz
Size/Weight:	9.2 x 3.9 x 2.5" HWD/2 lbs; 234 x 100 x 64 mm HWD/1 kg

Ordering Information

Order #	Mfg #	Description	Price
MP5945E	41B	Power Harmonics Analyzer	
MPi1000S	I1000S	AC Current Probe, 1000A AC	
MPC789	C789	Soft Carrying Case	

Transcat Accredited Calibration with Data	CALL
Transcat Accredited Calibration without Data	CALL

LEM Instruments AC/DC AC+DC Clamp-On Power Meter

- Current Clamp, Power Quality Meter, Oscilloscope and Data Logger in One Instrument
- Rotary Switch Function Selection
- Display up to 5 Parameters including Peak, Average, Crest Factor, Fundamental Frequency and THD for Volts and Amps
- Integrated 3 Phase Power Capability for Balanced Loads
- Conformance to IEC1010-1 750V Cat IV Safety Standards
- A Single Key Press Gives Access to Current and Voltage Waveforms (Analyst 2060E)

2050E Analyst AC/DC AC+DC Clamp-on Power Meter: Multi-parameter digital display, waveform display, measure watts, W3Ø, VA, VAR, Whr, power factor, Hz, true RMS, peak, crest factor and total harmonic distortion, 40/400/2000 amps AC+DC, AC/DC true RMS, 4/40/400/600 AC+DC, AC/DC, integrated three-phase capability, min, max, average and 5 parameter internal logging, 2000 readings stored internally, digital output for external data logging downlaod (requires PCL2), 600mm Ø jaw.

2060E Analyst AC/DC AC+DC Clamp-on Power Meter: Same features as the 2050E Analyst with the addition of distortion factor, harmonics display, ripple and internal storage for 5000 readings, digital output for data logging, waveform and harmonics (requires PCL2), 60mm Ø jaw.

PCL2E: WinLOG PC logging and analysis software for the power clampds, includes interface cable.

2050

Ordering Information

Order #	Mfg #	Description	Price
MP2050E	2050	Analyst AC/DC AC+DC Clamp-on Power Meter	
MP2060E	2060	Analyst AC/DC AC+DC Clamp-on Power Meter	
MPPCL2E	PCL2E	WinLog Cable and Software	

Megger Power Clampmeter

Power meter, scope, harmonics analyzer, datalogger in one

- AC/DC Current to 2000A
- 4-Digit Resolution
- W, VA, VAR, kWH, and PF Even on Distorted Waveforms
- 3 Phase Power Capability
- Internal Logging of Five Parameters with 5000 Readings
- True RMS Measurement, Hall-Effect Technology
- Backlit LCD Displays Up to Five Parameters at a Time Plus Waveforms, Harmonics, and Chart Trends

Exceptionally versatile meter performs the work of several bench-type instruments in a package not much larger than a standard clamp-on volt/amp meter. The DCM2000P measures and logs power parameters, displays waveforms and harmonic content "live," logs data internally or directly to a PC-satisfies most power applications, from basic to advanced.

Each Unit Includes:
Test leads (EV6220-685), carrying case (EV 6420-127), and instruction manual.

Specifications

	Range	Accuracy
Current (3 Ranges):	0–2000A	0±1.5% rdg ±5 digits
Voltage (4 Ranges):	0–750V	±1% rdg ±5 digits
kW/kVA (4 Ranges):	0–1200 kW/kVA	±2.5% rdg ±5 digits
kVAR (4 Ranges):	0–850 kVAR	±2.5% rdg ±5 digits
kWH (5 Ranges):	0–40,000 kWH	±0.5% rdg (40–70 Hz)
Frequency:	10 Hz to 1 kHz	±3% rdg ± 5 digits
Crest Factor:	1 to 5	±3% rdg ±5 digits (CF 1-3), ±5% rdg ±5 digits (CF 3-5)
THD:	1 to 600%	±3% rdg ±5 digits (1-99), 5% rdg ±5 digits (100–600)
Distortion Factor:	1 to 100%	±3% rdg ±5 digits
Safety and Installation Standards:	IEC 1010-1-1992, EN 61010-1 1992-09, 600V CAT IV (750V CAT III)	
Jaw Capacity:	2.36" (60 mm)	
Power Supply:	Six 1.5V alkaline batteries, MN1500 or IEC LR6, or equivalent	
Size/Weight:	12 x 3.75 x 2" HWD (300 x 98 x 52 mm)/1.8 lb (820g)	

Ordering Information

Order #	Mfg #	Description	Price
MPDCM2000P	DCM2000P	Power Clampmeter	
MP24355E-SW	EV6220-633	PowerLog Windows™ Software and Serial Cable	

Transcat Accredited Calibration with Data	CALL
Transcat Accredited Calibration without Data	CALL

▲ **DCM2000P**

Megger Digital Power Clampmeter

- Performs 7 Power Measurements
- True RMS AC, DC, and AC + DC
- Direct Measurement of Balanced Three-Phase Power
- Data Hold, Min/Max/Avg Recording
- 3½-Digit, 4000-Count Display Plus 25-Segment Bargraph
- Optional Logging and Analysis Software

Read power, apparent power, reactive power, and power factor. True RMS functioning gives you accurate results even with distorted waveforms.

Key Applications
Unlike many other meters, the unit is reliable even when you're measuring waveforms with a high content of high-order harmonic current, such as on electronic drives and frequency converters. You can balance loading on three-phase supplies (star or delta), check actual consumption against plate ratings, and check feeder lines from a main supply.

Optional Logging and Trend Analysis
For longer-term monitoring and data analysis, order PowerLog Windows™ software. It will give a multi-parameter display, or mimic a Y-t chart recorder or datalogger. You can export the data to your PC for detailed analysis with Microsoft Excel® or other packages.

Each Unit Includes: Test leads with probes (EV6220-562), 9V alkaline battery, carrying case (EV6172-310), and instructions.

Specifications

	Range	Accuracy
Current:	400, 1000A DC or peak AC	±1.5% ±5 digits @ >20A
Voltage:	400V, 600 VDC coupled, true RMS	±1% ±5 digits @ >40V
Power (1ø, 3ø):	40 kW, 400 kW, 600 kW (to 425 kW AC)	±2.5% ±5 digits, except: 0.08 kW @ <2 kW, 1ø; 0.25 kW @ <4 kW, 3ø
VA (1ø, 3ø):	40 kVA, 400 kVA, 600 kVA (to 425 kVA AC)	±2.5% ±5 digits @ >2 kVA; ±0.08 kVA @ ≤2 kVA
VAR:	40 kVAR, 400 kVAR 600 kVAR	±2.5% ±5 digits @ >4 kVAR; ±0.25 kVAR @ ≤4 kVAR
Power Factor:	-0.3 (capacitive), 1.0, +0.3 (inductive); 72.5°, 0°, +72.5°	±3°
Frequency:	DC, 20 Hz to 1 kHz, typical	
Jaw Opening:	2" max. (50 mm); accepts one 50 mm cable or two 30 mm cables	
Size/Weight:	9.9 x 3.9 x 2.1" HWD (251 x 98 x 52 mm)/1.1 lb (500g)	

Ordering Information

Order #	Mfg #	Description	Price
MP24355E	DCM1000P	Digital Power Clampmeter	
MP24355E-SW	EV6220-633	PowerLog Windows™ Software	

Transcat Accredited Calibration with Data	CALL
Transcat Accredited Calibration without Data	CALL

DCM1000P ▲

Contact your Transcat authorized representative today!

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Ideal 800 Series Power Clamps

- 2000A AC/DC Current Capability
- True RMS
- Kilowatts
- Data Hold
- Auto Ranging
- DC Current Zero Function
- Overload Protection
- Analog Output, Relative Mode and Audible Continuity (61-800 only)
- Dual Display, Memory Recall, 3ø3W and 3ø4W Readings (61-802 only)

800 Series Power Clamps from IDEAL.
True RMS clamps designed to handle power quality measurements for commercial and industrial jobs. Loaded with user-friendly features designed to save time and effort. Determines true power, apparent power, reactive power and power factor in a single clamp, bypassing the need for manual calculations.

Specifications and Ordering Information

Mfg#	61-800	61-802
AC Voltage		
Range & Resolution	4.000/40.00/400.0/600V	200.0/500/600V
Basic Accuracy	1.5%	1.5%
DC Voltage		
Range & Resolution	400.0m/4.000/40.00/400.0/600V	200.0/500/800V
Basic Accuracy	1.5%	1.5%
AC Current		
Range & Resolution	400.0/1000/2100A	200.0/500/2000A
Basic Accuracy	1.5%	1.5%
DC Current		
Range & Resolution	400.0/2000/2500A	200.0/500/2000A
Basic Accuracy	1.5%	1.5%
Kilowatt (True Power)		
Range & Resolution	40.00/400.0/1200kW	100.0/1000/1200kW
Basic Accuracy	2.5%	2.0%
kVAR (Reactive Power)		
Range & Resolution	—	100.0/1000/1200kVAR
Basic Accuracy	—	2.0%
kVA (Apparent Power)		
Range & Resolution	—	100.0/1000/1200kVA
Basic Accuracy	—	2.0%
Resistance		
Range & Resolution	40.00/400.0Ω	—
Basic Accuracy	1.0%	—
Frequency		
Range & Resolution	—	50.0/60.0/400.0Hz
Basic Accuracy	—	0.5%
Temperature		
Range & Resolution	-50.0 to 1000°F	—
Basic Accuracy	1.0%	—
Size / Weight	10.7L x 4.4W x 1.8D, 2.3 Lbs. (BOTH UNITS)	
Operating Temp.	4°C - 50°C (Both Units)	
Order #	**MP61-800**	**MP61-802**
Price		

Transcat Accredited Calibration with Data	CALL
Transcat Accredited Calibration without Data	CALL

Extech Clamp-On Power Meter/Datalogger

- 1000A Clamp Measures 1 or 3 Phase Power to 600 kW
- Display True Power, Apparent Power, Power Factor, True RMS Voltage and Current, Resistance and Frequency
- Dual Display of kW+PF, kVA+PF, V+A, A+Hz or V+Hz
- Clamp Jaws Open to 1.8" (46mm)
- Built-in Recorder Datalogs Up To 4000 readings or Download to a PC
- 25 Point Data Memory Viewable on the LCD Display
- Full Function Display on Large 4-digit LCD with Fast 40 Segment Bar Graph, Peak Hold and Min/Max
- Optional RS-232C Module with PC Software

382065

Specifications

Display Mode	Range	Accuracy	Resolution
True Power:	600 kW	±(2% rdg + 5d)	10W
Apparent Power:	600 kVA	±(2% rdg + 5d)	10 VA
Power Factor:	0.3–1	±(2% rdg + 5d)	0.01
Peak Current:	1000A	±(6% rdg + 10d)	0.1A
Peak Voltage:	600V	±(6% rdg + 10d)	0.1V
AC Current (45–500 Hz):	1000A	±(1.5% rdg + 10d)	0.1A
DC Current:	1000A	±(1.5% rdg + 5d)	0.1A
AC Voltage (45–500 Hz):	600V	±(0.5% rdg + 10d)	100 mV
DC Voltage:	600V	±(0.5% rdg + 2d)	100 mV
Crest Factor:	<3	<3	<3
Frequency:	500 kHz	±(0.5% rdg + 5d)	0.1 Hz
Resistance:	10 kΩ	±(1% rdg + 5d)	1Ω
Continuity:	Beeper <50Ω		
Dimensions:	10.2 x 3.7 x 1.8" (260 x 93 x 45 mm)		
Weight:	1lb (454g)		

Each Unit Includes: 9V alkaline battery, test leads (380965), carrying case, alligator clips, and instructions.

Ordering Information

Order #	Mfg #	Description	Price
MP22627E	382065	Clamp-On Power Datalogger	
MP22627E-2	382062	Plug-In RS-232-C Interface Module	
MP22579E	480172	AC Line Separator	

Transcat Accredited Calibration with Data	CALL
Transcat Accredited Calibration without Data	CALL

Extech 3-Phase Clamp-On Power Analyzer

- 3¾ Digit (3999 count) Dual Display LCD with Data-Hold
- 3-Phase on 3- or 4-Wire Balanced and Unbalanced Loads
- Measures True Power (AC, DC, AC + DC)
- Measures Reactive (kVAR), and Apparent (kVA) Power
- Display Lead/Lag Current/Voltage Phase Shift in Degrees
- Store and Recall Last Five Measurements
- Dual Dislays: kW and PF, kVA and kVAR, Phase-Angle and Hz, Volts and Hz, Amps and Hz
- Clamp Jaws Open to 2.2" (55 mm) for 1000 MCM Conductors
- Built-In DCA Auto-Zero
- Advanced Relative and MIN/MAX Functions
- Meets IEC-1010 (Cat III—600V)

Each Unit Includes: Test leads, carrying case, and 9V battery.

Applications:
- Great for all typical AC/DC measurements
- 3-phase electrical analysis of motors
- Category III rating for industrial measurements

CE

382075

Specifications

	Range	Resolution	Accuracy (% rdg + digits)
True Power (W):	1200 kW	0.01/0.1 kW	±2% + 5d
Reactive (kVAR) Power:	1200 kVAR	0.01/0.1 kVAR	±2% + 5d
Apparent (kVA) Power:	1200 kVA	0.01/0.1 kVA	±2% + 5d
Power Factor (PF):	0–1	0.01	PF = W/(V x A)
Phase Angle (Ø):	-90 to +90°	0.1°	±0.5°
AC/DC Current:	2000A	0.1/1A	±2% + 5d
AC/DC Voltage:	600V	0.1/1V	±2% + 5d
Frequency:	40–400 Hz	0.1 Hz	±1% + 2d
Dimensions/Weight:	10.7 x 4.8 x 1.8" (271 x 122 x 46 mm)/24.7 oz (700g)		

Ordering Information

Order #	Mfg #	Description	Price
MP23745E	382075	3-Phase Clamp-On Power Analyzer	

Transcat Accredited Calibration with Data	CALL
Transcat Accredited Calibration without Data	CALL

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Extech Power Analyzer/Appliance Tester

Simultaneous monitoring of Watts, PF, Volts, Hz, and Amps

- Direct AC or DC Monitoring
- Complete Line Isolation of Analyzer Batteries or AC Adapter
- Simultaneous Readout of Watts, PF or VA, Volts or Hz, Amps
- Crest Factor <5 Handles Distorted Waveforms Accurately
- Max Hold, Present Data Hold, All Functions Overload Protected
- Fast 400 ms Sampling Rate
- Applications: Power Consumption, Single-Phase AC and DC Loads—Lighting, Uninterruptible Power Supplies, CATV Distribution Amplifiers, EPA, Energy Compliance

RS-232-C PC Includes: Interface that connects to PC COM port, software, serial cable, eight AA batteries, and case.
Model 380803 Includes: Built-In datalogger (1012 readings).

380801

Windows™ software included to monitor readings on PC, display kWH, kWH$/mo, Phase Angle, print reports, and calculate power factor correction

Specifications

Function	Range	Resolution	Accuracy	Input Signal Range
Watt (AC/DC):	200.0W/2000W	0.1W/1W	±(0.9% rdg + 4d)	300V, 20A, 0–400 Hz
Power Factor (PF = Watt/VA):	0–1.00	0.01	±4 digits	250V, 20A, 50/60 Hz Overload Protection
Voltage (Autoranging):	200.0V/750V	0.1V/1V	±(0.9% rdg + 3d)	1000 VDC, 750 VAC
Current:	2/20A via terminals 2/15A via sockets	1 mA/10 mA 1 mA/10 mA	 ±(0.9% rdg + 3d)	Fuse Protection 20.00A fused DCA/ACA
Frequency (min sensitivity 5V):	2k, 20 MHz	1 Hz to 10 kHz	±(0.5% + 2d)	
Dimensions/Weight:	13.9 x 11.8 x 3.9" (352 x 300 x 100 mm)/3.6 lbs (1.6 kg)			

Ordering Information

Order #	Mfg #	Description	Price
MP380801	380801	True RMS Single-Phase Power Analyzer	
MP380803	380803	Power Analyzer Kit with Datalogging	
MP380817	380817	110 VAC Adapter	

Extech 400A DC/AC Power DMM

- True RMS AC Voltage and Current
- DC and AC True Power to 240 kW
- High Resolution to 10W or 100 mA
- 0.9" (23 mm) Jaw Opening
- Large 4000 Count LCD Display with 40 Segment Analog Bargraph
- Auto Zero Function for DC Current
- Data-Hold, Max/Min Recall Display
- Frequency to 1MHz

Each unit includes: Test leads, two AA batteries, and carrying case.

380940

Specifications

	Range	Resolution	Accuracy ±(%rdg + digits)	Input Signal Range
AC Power:	40 kW 240 kW	10W 100W	±(1.5% + 3d) ±(1.5% + 3d)	0–250V, 0–400A, PF 0–1 0–600V, 0–400A, PF 0–1
DC Power:	40 kW 240 kW	10W 100W	±(1.5% + 3d) ±(1.5% + 3d)	0–250V, 0–400A 0–600V, 0–400A
AC Current (40 Hz–1 kHz):	400A	100 mA	±(1.5% + 3d) @ 50/60 Hz	Overload protection: 600 AAC
DC Current:	400A	100 mA	±(1.5% + 3d)	Overload protection: 600 ADC
AC Voltage (40 Hz–1 kHz):	600V	1V	±(1.5% + 2d) @ 50/60 Hz	Overload protection: 800 VAC
DC Voltage:	600V	1V	±(1.0% + 2d)	Overload protection: 800 VDC
Frequency:	1 MHz	0.01–100 Hz	±(0.5% + 2d)	Overload protection: 600 VAC
Dimensions/Weight:	7.2 x 2.5 x 1.4" (183 x 64 x 36 mm)/6.7oz (190g including batteries)			

Ordering Information

Order #	Mfg #	Description	Price
MP380940	380940	Mini Clamp Power DMM	

Transcat Accredited Calibration with Data	CALL
Transcat Accredited Calibration without Data	CALL

For a complete selection of Current Probes and Meters

see pages B43.

Hioki AC/DC Power Meter

The definitive high-performance unit for single-phase power measurements

- Measures Positive and Negative DC Voltage/Current, Active Power, Apparent Power, Reactive Power, Power Factor, Phase Angle, Frequency, Current Integral, Power Integral. Automatic or Manual Ranging
- Voltage and Current Terminals Isolated for Optimum Sensitivity and Accuracy
- Simultaneous Voltage, Current, Effective Power Analog Outputs Plus Simultaneous Voltage and Current Monitor Outputs
- Plus, Minus, Total Integration Functions for Current and Power, with Separate Integration for Each Polarity
- Optional GPIB Interface Enables Simultaneous Output of All Data to Printer with Listen-Only Interface, Makes for Easy Upgrading to More Automated Systems

▲ 3187

The 3187 is specially designed to measure power consumption in single-phase, two-wire equipment. Covers a wide frequency range of DC and 10 Hz to 20 kHz, has high basic accuracy of ±0.35%, measures and computes multiple power parameters.

Each Unit Includes: Power cord, fuse, and instructions.

Specifications

Measurement Ranges	
Voltage:	15.00 to 600.0V, 6 ranges
Current:	500.0 mA to 20.00A, 6 ranges (direct input)
Shunt Input:	50 mV, 100 mV
Power:	7.5000W to 12.00 kW, 36 ranges
Frequency:	500 Hz, 50 kHz
Integration Range:	0 to ±999999 mWh/mAh (max. integration time 1000 hours)
Basic Accuracy:	±0.2% f.s., DC; ±0.25% rdg. ± 0.1% FS, AC (45 to 66 Hz)
Sampling Rate:	5 times/second
Signal Outputs	
Analog Level:	2 VDC full scale, three channels (voltage, current, active power)
Waveform Monitor:	2V full scale, two channels (voltage, current)
Other Functions:	Display scaling, display averaging, PT or CT scaling
Power Supply:	100 to 240V AC, 50/60 Hz
Size/Weight:	3.15 x 8.46 x 11.02" HWD (80 x 215 x 280 mm)/7.28 lb (3.3 kg)

Ordering Information

Order #	Mfg #	Description	Price
MP3187HK	3187	AC/DC Power Meter	
MP9588HK	9588	GPIB Interface	
MP9151-02HK	9151-02	GPIB Connector Cable, 2m	
MP9151-04HK	9151-04	GPIB Connector Cable, 4m	

Valhalla Power Meter

- True RMS Voltage and Current Measurements
- Autoranging True Watts

The 7401E has 150V, 300V, and 600V AC/DC ranges and measures true power from 30 to 12,000W in nine ranges. 7402E has AC/DC ranges of 30V, 150V and 300V and measures true power from 6 to 6000W in seven ranges. Both meters have 0.2A, 2.0A, and 20.0A AC/DC current ranges.

▲ 2101

Specifications

TRMS AC/DC Voltage	
7401E:	150.00V, 300.0V, 600.0V
7402E:	30.000V, 150.00V, 300.0V
TRMS AC/DC Current:	0.2A, 2A, 20A
True Power	
7401E:	30, 60, 120, 300, 600, 1200, 3000, 6000, 12000W
7402E:	6, 30, 60, 300, 600, 3000, 6000W
Power	
7401E:	0.01W, 0.1W, 1W
7402E:	0.001W, 0.01W, 0.1W, 1W
True Power Accuracy	
DC & 40 Hz to 5 kHz:	±0.25% of reading ±6 digits
5 kHz to 10 kHz:	±0.5% of reading ±0.5% of range
10 kHz to 20 kHz:	±1.0% of reading ±1.0% of range (2A only)
Display:	Dual 4½-digit LED indicators
Power Supply:	115/230 VAC ±10%, 50/60 Hz, 5 Watts
Size/Weight:	2.5 x 9.25 x 8.5" HWD/5 lb

Ordering Information

Order #	Mfg #	Description	Price
MP7401E	2100	Digital V-A-W Meter, 150/300/600V	
MP7402E	2101	Digital V-A-W Meter, 30/150/300V	
MP7736E	I-150	Current Clamp-On (150A) Probe	
MP7737E	I-1000	Current Clamp-On (1000A) Probe	
MP4778E	X21	Load Power Adapter Cord	

Transcat Accredited Calibration with Data	CALL
Transcat Accredited Calibration without Data	CALL

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Hioki Power HiTester

Built for comprehensive, highly accurate device assessment

- Accommodates Up to Six Input Units and Six Single-Phase Systems at Once, Simultaneously Measures Input and Output of Three-Phase Inverters
- Measures Voltage; Current; Peak Voltage/Current; Effective, Reactive, Apparent Power; Power Factor; Phase; Frequency; Current/Power Integration; Load Rate; Efficiency; Torque; RPM; Motor Output; Waveforms (Depending on Input Unit). Supports Harmonics Analysis and Flicker Measurement for Thorough Overall Device Assessments (with 9605 Unit)
- Built-In TFT Color LCD Display, GPIB and RS-232 Interfaces

▲ 3193

Wide-spectrum, multi-function power meter, Model 3193, makes measurements on circuit types from single-phase/two-wire to three-phase/four-wire. Not a stand-alone instrument, must be used with one or more available input units (see ordering information).

Each Unit Includes: Power cord, connector, and instructions.

Specifications

Measured Parameters	
With 9600, 9601, 9602 Input Units:	Voltage; current; peak voltage/current; effective, reactive, apparent power; power factor; phase; frequency; current/power integration; load rate; efficiency
With 9603 Input Unit:	Voltage, torque, RPM, motor output
With 9605 Input Unit:	Harmonics, waveforms, voltage fluctuation/flicker
Measured Ranges:	6.0000V to 1.0000 kV, 200.00 mA to 500.00A (dependent on input unit), power range dependent on voltage/current ranges
Integration Range:	0 to ±999999 TAh/TWh (integration time up to 10,000 hours)
Basic Accuracy:	±0.1% rdg ± 0.1% FS (voltage, current, power at 45 to 66 Hz) when used with 9600, 9601, 9602 input units
Frequency Response:	DC and 0.5 Hz to 1 MHz with 9600, 5 Hz to 100 kHz with 9601, DC and 0.5 Hz to 200 kHz with 9602:
Signal Output	
Analog Level:	5V DC full scale (voltage, current, active power)
Waveform Monitor:	1V RMS full scale (voltage, current)
D/A Output:	±5V DC full scale (for 8 arbitrarily selected items)
Other Functions:	RMS/MEAN rectification, FDD, scaling, averaging
Power Supply:	100/120/200/230V AC, automatically switched; 50/60 Hz
Size/Weight:	5.9 x 16.9 x 14.6" HWD (150 x 430 x 370 mm)/ 33.1 lb (15 kg) with all options

Ordering Information

Order #	Mfg #	Description	Price
MP3193HK	3193	Power HiTester	
MP9600HK	9600	AC/DC Direct-Input Unit	
MP9601HK	9601	AC Direct-Input Unit	
MP9602HK*	9602	AC/DC Clamp-Input Unit	
MP9603HK	9603	External Signal-Input Unit	
MP9270HK*	9270	Clamp-On Sensor for 9602	
MP9290HK*	9290	Clamp-On Adapter for 9602	
MP9604HK	9604	Printer Unit	
MP9605HK	9605	Harmonics/Flicker Measurement Unit	

NOTE: 3193 must use one or more input units. * Non-CE mark product.

For current probes
see pages B34-B40