FLUKE®

Fluke 430 Series II

Three-Phase Power Quality and Energy Analyzers

Technical Data

More detailed power quality analysis capability, and a new Fluke-patented energy monetization function

The new 430 Series II Power Quality and Energy Analyzers offer the best in power quality analysis and introduce, for the first time ever, the ability to monetarily quantify energy losses.

The new Fluke 434, 435 and 437 Series II models help locate, predict, prevent, and trouble-shoot power quality problems in three-phase and single-phase power distribution systems. Additionally, the Fluke-patented energy loss algorithm, Unified Power Measurement, measures and quantifies energy losses due to harmonics and unbalance issues, allowing the user to pinpoint the origin of energy waste within a system.



- **Energy loss calculator:** Classic active and reactive power measurements, unbalance and harmonic power, are quantified to pinpoint true system energy losses in dollars (other local currencies available).
- **Power inverter efficiency:** Simultaneously measure AC output power and DC input power for power electronics systems using optional DC clamp.
- **PowerWave data capture:** 435 and 437 Series II analyzers capture fast RMS data, show half-cycle and waveforms to characterize electrical system dynamics (generator start-ups, UPS switching etc.).
- **Waveform capture:** 435 and 437 Series II models capture 50/60 cycles (50/60Hz) of each event that is detected in all modes, without set-up.
- **Automatic Transient Mode:** 435 and 437 Series II analyzers capture 200 kHz waveform data on all phases simultaneously up to 6 kV.
- **Fully Class-A compliant:** 435 and 437 Series II analyzers conduct tests according to the stringent international IEC 61000-4-30 Class-A standard.
- **Mains signaling:** 435 and 437 Series II analyzers measure interference from ripple control signals at specific frequencies.
- **400 Hz measurement:** 437 Series II analyzer captures power quality measurements for avionic and military power systems.
- **Troubleshoot:** Analyze the trends using the cursors and zoom tools.
- **Highest safety rating in the industry:** 600 V CAT IV/1000 V CAT III rated for use at the service entrance.
- **Measure all three phases and neutral:** With included four flexible current probes with enhanced thin flex designed to fit into the tightest places.
- **Automatic Trending:** Every measurement is always automatically recorded, without any set-up.
- **System-Monitor:** Ten power quality parameters on one screen according to EN50160 power quality standard.
- **Logger function:** Configure for any test condition with memory for up to 600 parameters at user defined intervals.
- **View graphs and generate reports:** With included analysis software.
- **Battery life:** Up to 8 hours operating time per charge on Li-ion battery pack.

437 Series II Three-Phase Power Quality and Energy Analyzer will be available in early 2012

Unified Power Measurement

Fluke's patented Unified Power Measurement system (UPM) provides the most comprehensive view of power available, measuring:

- Parameters of Classical Power (Steinmetz 1897) and IEEE 1459-2000 Power
- Detailed Loss Analysis
- Unbalance Analysis

These UPM calculations are used to quantify the fiscal cost of energy loss caused by power quality issues. The calculations are computed, along with other facility-specific information, by an Energy Loss Calculator that ultimately determines how much money a facility loses due to wasted energy.

Energy savings

Traditionally energy savings are achieved by monitoring and targeting, or in other words, by finding the major loads in a facility and optimizing their operation. The cost of power quality could only be quantified in terms of downtime caused by lost production and damage to electrical equipment. The Unified Power Measurement (UPM) method now goes beyond this to achieve energy savings by discovering the energy waste caused by power quality issues. Using the Unified Power Measurement, Fluke's Energy Loss Calculator (see screen shot below) will determine how much money a facility is losing due to waste energy.

Unbalance

UPM gives a more comprehensive breakdown of the energy consumed in the plant. In addition to measuring reactive power (caused by poor power factor), UPM also measures the energy waste caused by unbalance; the effect of unevenly loading each phase in three-phase systems. Unbalance can often be corrected by reconnecting loads on different phases to ensure the current drawn on each phase is as equal as possible. Unbalance can also be corrected by installing an unbalance reactance device (or filter), that will minimize the effects. Correcting unbalance should be basic good housekeeping in the facility as unbalance problems can cause motor failure or shorten equipment life expectancy. Unbalance also wastes energy. Using UPM can minimize or eliminate that energy waste, thus saving money.

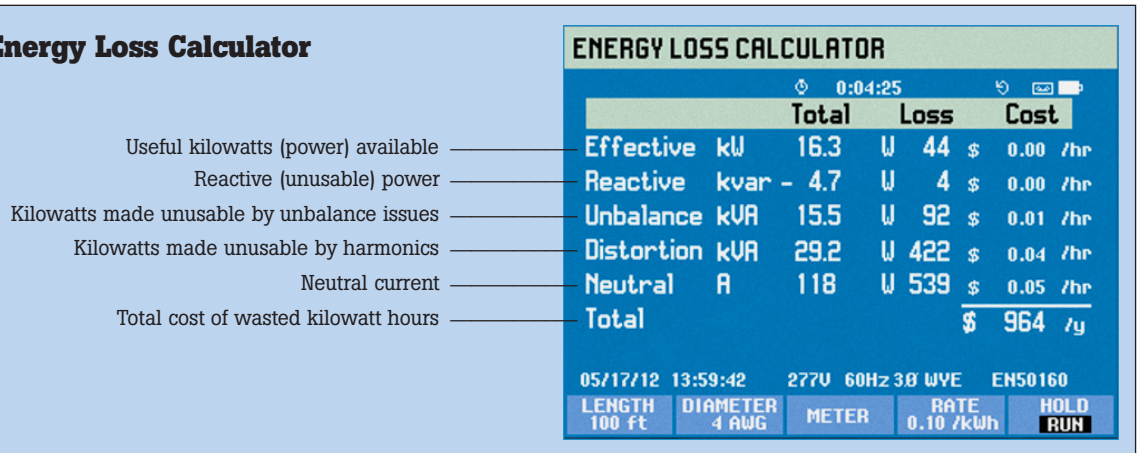
Harmonics

UPM also provides details of the energy wasted in your facility due to the presence of harmonics. Harmonics may be present in your facility due to the loads you operate or may be caused by loads in adjacent facilities. The presence of harmonics in your facility can lead to:

- overheating transformers and conductors
- nuisance tripping of circuit breakers
- early failures of electrical equipment

Quantifying the cost of wasted energy due to the presence of harmonics simplifies the return-on-investment calculation needed to justify purchasing harmonic filters. By installing a harmonic filter the ill effects of harmonics can be reduced and energy waste eliminated, resulting in lower operational costs and more reliable operation.

Energy Loss Calculator



430 Series II Power Quality and Energy Analyzer selection table

Model	Fluke 434-II	Fluke 435-II	Fluke 437-II
Standard compliance	IEC 61000-4-30 Class S	IEC 61000-4-30 Class A	IEC 61000-4-30 Class A
Volt Amp Hz	•	•	•
Dips and swells	•	•	•
Harmonics	•	•	•
Power and energy	•	•	•
Energy loss calculator	•	•	•
Unbalance	•	•	•
Monitor	•	•	•
Inrush	•	•	•
Event waveform capture		•	•
Flicker		•	•
Transients		•	•
Mains signaling		•	•
Power wave		•	•
Power inverter efficiency	•	•	•
400Hz			•
C1740 Soft Case	•	•	
C437-II Hard Case with rollers			•
SD card (Max 32 GB)	8 GB	8 GB	8 GB

All models include the following accessories TL430 test lead set, 4 x i430 thin flexi current probes, BP290 battery, BC430 power adapter with international power adapter set, USB cable A-B mini and PowerLog CD.

Technical specifications

Specifications are valid for models Fluke 434-II, Fluke 435-II, Fluke 437-II unless otherwise specified. Specificatons for Amp and Watt readings are based upon i430-Flexi-TF unless otherwise specified.

Input characteristics

Voltage inputs	
Number of inputs	4 (3 phase + neutral) dc-coupled
Maximum input voltage	1000 Vrms
Nominal voltage range	Selectable 1 V to 1000 V
Max. peak measurement voltage	6 kV (transient mode only)
Input impedance	4 MΩ//5 pF
Bandwidth	> 10 kHz, up to 100 kHz for transient mode
Scaling	1:1, 10:1, 100:1, 1,000:1 10,000:1 and variable
Current inputs	
Number of inputs	4 (3 phase + neutral) dc- or ac-coupled
Type	Clamp or current transformer with mV output or i430flex-TF
Range	0.5 Arms to 600 Arms with included i430flex-TF (with sensitivity 10x) 5 Arms to 6000 Arms with included i430flex-TF (with sensitivity 1x) 0.1 mV/A to 1 V/A and custom for use with optional ac or dc clamps
Input impedance	1 MΩ
Bandwidth	> 10 kHz
Scaling	1:1, 10:1, 100:1, 1,000:1 10,000:1 and variable

Input characteristics cont.

Sampling system	
Resolution	16 bit analog to digital converter on 8 channels
Maximum sampling speed	200 kS/s on each channel simultaneously
RMS sampling	5000 samples on 10/12 cycles according to IEC61000-4-30
PLL synchronization	4096 samples on 10/12 cycles according to IEC61000-4-7
Nominal frequency	434-II and 435-II: 50 Hz and 60 Hz 437-II: 50 Hz, 60 Hz and 400 Hz

Display modes

Waveform display	Available in all modes via SCOPE key 435-II and 437-II: Default display mode for Transients function Update rate 5x per second Displays 4 cycles of waveform data on screen, up to 4 waveforms simultaneously
Phasor diagram	Available in all modes via Scope waveform display Default view for Unbalance mode
Meter readings	Available in all modes except Monitor and Transients, provides tabulated view of all available readings Fully customizable up to 150 readings for Logger mode
Trend graph	Available in all modes except Transients Single vertical cursor with min max and avg reading at cursor position
Bar graph	Available in Monitor and Harmonics mode
Event list	Available in all modes Provides waveforms on 435II & 437II only.

Measurement modes

Scope	4 voltage waveforms, 4 current waveforms, Vrms, Vfund. Arms, A fund, V @ cursor, A @ cursor, phase angles
Volts/amps/hertz	Vrms phase to phase, Vrms phase to neutral, Vpeak, V Crest Factor, Arms Apeak, A Crest Factor, Hz
Dips and swells	Vrms½, Arms½, Pinst with programmable threshold levels for event detection
Harmonics dc, 1 to 50, up to 9th harmonic for 400 Hz	Harmonics Volts, THD, Harmonic Amps, K factor Amps, Harmonic Watts, THd Watts, K factor Watts, Interharmonic Volts, Interharmonic Amps, Vrms, Arms (relative to fundamental or to total rms)
Power and energy	Vrms, Arms, Wfull, Wfund., VAfull, VAfund., VAharmonics, VAunbalance, var, PF, DPF, CosQ, Efficiency factor, Wforward, Wreverse
Energy loss calculator	Wfund, VAharmonics, VAunbalance, var, A, Loss Active, Loss Reactive, Loss Harmonics, Loss Unbalance, Loss Neutral, Loss Cost (based upon user defined cost / kWh)
Inverter efficiency (requires optional dc current clamp)	Wfull, Wfund, Wdc, Efficiency, Vdc, Adc, Vrms, Arms, Hz
Unbalance	Vneg%, Vzero%, Aneg%, Azero%, Vfund, Afund, V phase angles, A phase angles
Inrush	Inrush current, Inrush duration, Arms½, Vrms½
Monitor	Vrms, Arms, harmonic Volts, THD Volts, PLT, Vrms½, Arms½, Hz, dips, swells, interruptions, rapid voltage changes, unbalance and mains signalling. All parameters are measured simultaneously in accordance with EN50160 Flagging is applied according to IEC61000-4-30 to indicate unreliable readings due to dips or swells
Flicker (435-II and 437-II only)	Pst(1min), Pst, Plt, Pinst, Vrms ½, Arms ½, Hz
Transients (435-II and 437-II only)	Transient waveforms 4x Voltage 4x Amps, triggers: Vrms ½, Arms ½, Pinst
Mains Signaling (435-II and 437-II only)	Relative signaling voltage and absolute signaling voltage averaged over three seconds for up to two selectable signaling frequencies
Power Wave (435-II and 437-II only)	Vrms½, Arms½ W, Hz and scope waveforms for voltage amps and watts
Logger	Custom selection of up to 150 PQ parameters measured simultaneously on 4 phases

Product specifications

	Model	Measurement range	Resolution	Accuracy
Volt				
Vrms (ac+dc)	434-II	1 V to 1000 V phase to neutral	0.1 V	± 0.5% of nominal voltage****
	435-II and 437-II	1 V to 1000 V phase to neutral	0.01 V	± 0.1% of nominal voltage****
Vpk		1 Vpk to 1400 Vpk	1 V	5% of nominal voltage
Voltage Crest Factor (CF)		1.0 > 2.8	0.01	± 5%
Vrms½	434-II	1 V to 1000 V phase to neutral	0.1 V	± 1% of nominal voltage
	434-II and 435-II		0.1 V	± 0.2% of nominal voltage
Vfund	434-II	1 V to 1000 V phase to neutral	0.1 V	± 0.5% of nominal voltage
	435-II and 437-II		0.1 V	± 0.1% of nominal voltage
Amps (accuracy excluding clamp accuracy)				
Amps (ac +dc)	i430-Flex 1x	5 A to 6000 A	1 A	± 0.5% ± 5 counts
	i430-Flex 10x	0.5 A to 600 A	0.1 A	± 0.5% ± 5 counts
	1mV/A 1x	5 A to 2000 A	1A	± 0.5% ± 5 counts
	1mV/A 10x	0.5 A A to 200 A (ac only)	0.1 A	± 0.5% ± 5 counts
Apk	i430-Flex	8400 Apk	1 Arms	± 5%
	1mV/A	5500 Apk	1 Arms	± 5%
A Crest Factor (CF)		1 to 10	0.01	± 5%
Amps½	i430-Flex 1x	5 A to 6000 A	1 A	± 1% ± 10 counts
	i430-Flex 10x	0.5 A to 600 A	0.1 A	± 1% ± 10 counts
	1mV/A 1x	5 A to 2000 A	1A	± 1% ± 10 counts
	1mV/A 10x	0.5 A A to 200 A (ac only)	0.1 A	± 1% ± 10 counts
Afund	i430-Flex 1x	5 A to 6000 A	1 A	± 0.5% ± 5 counts
	i430-Flex 10x	0.5 A to 600 A	0.1 A	± 0.5% ± 5 counts
	1mV/A 1x	5 A to 2000 A	1A	± 0.5% ± 5 counts
	1mV/A 10x	0.5 A A to 200 A (ac only)	0.1 A	± 0.5% ± 5 counts
Hz				
Hz	Fluke 434 @ 50 Hz nominal	42.50 Hz to 57.50 Hz	0.01 Hz	± 0.01 Hz
	Fluke 434 @ 60 Hz nominal	51.00 Hz to 69.00 Hz	0.01 Hz	± 0.01 Hz
	Fluke 435/7 @ 50 Hz nominal	42.500 Hz to 57.500 Hz	0.001 Hz	± 0.01 Hz
	Fluke 435/7 @ 60 Hz nominal	51.000 Hz to 69.000 Hz	0.001 Hz	± 0.01 Hz
	Fluke 437 @ 400 Hz nominal	340.0 Hz to 460.0 Hz	0.1 Hz	± 0.1 Hz
Power				
Watts (VA, var)	i430-Flex	max 6000 MW	0.1 W to 1 MW	± 1% ± 10 counts
	1 mV/A	max 2000 MW	0.1 W to 1 MW	± 1% ± 10 counts
Power factor (Cos j/DPF)		0 to 1	0.001	± 0.1% @ nominal load conditions
Energy				
kWh (kVAh, kvarh)	i430-Flex 10x	Depends on clamp scaling and V nominal		± 1% ± 10 counts
Energy loss	i430-Flex 10x	Depends on clamp scaling and V nominal		± 1% ± 10 counts Excluding line resistance accuracy
Harmonics				
Harmonic order (n)		DC, 1 to 50 Grouping: Harmonic groups according to IEC 61000-4-7		
Inter-harmonic order (n)		OFF, 1 to 50 Grouping: Harmonic and Interharmonic subgroups according to IEC 61000-4-7		
Volts	%f	0.0% to 100%	0.1%	± 0.1% ± n x 0.1%
	%r	0.0 % to 100%	0.1%	± 0.1% ± n x 0.4%
	Absolute	0.0 to 1000 V	0.1 V	± 5% *
	THD	0.0% to 100%	0.1%	± 2.5%
Amps	%f	0.0% to 100%	0.1%	± 0.1% ± n x 0.1%
	%r	0.0% to 100%	0.1%	± 0.1% ± n x 0.4%
	Absolute	0.0 to 600 A	0.1 A	± 5% ± 5 counts
	THD	0.0% to 100%	0.1 %	± 2.5%
Watts	%f or %r	0.0% to 100%	0.1 %	± n x 2%
	Absolute	Depends on clamp scaling and V nominal	–	± 5% ± n x 2 % ± 10 counts
	THD	0.0% to 100%	0.1%	± 5%
Phase Angle		-360° to +0°	1°	± n x 1°

Product specifications cont.

Flicker				
Plt, Pst, Pst(1min) Pinst		0.00 to 20.00	0.01	± 5%
Unbalance				
Volts	%	0.0% to 20.0%	0.1%	± 0.1%
Amps	%	0.0% to 20.0%	0.1%	± 1%
Mains signaling				
Threshold levels		Threshold, limits and signaling duration is programable for two signaling frequencies	—	—
Signaling frequency		60 Hz to 3000 Hz	0.1 Hz	
Relative V%		0% to 100%	0.10%	± 0.4%
Absolute V3s (3 second avg.)		0.0 V to 1000 V	0.1 V	± 5% of nominal voltage

Trend recording

Method	Automatically records min, max and average values over time for all readings being displayed for the three phases and neutral simultaneously
Sampling	5 readings/s continuous sampling per channel, 100/120** reading/s for 1/2 cycle values and Pinst
Recording time	1 hr up to 1 year, user selectable (default setting 7 days)
Averaging time	Minimum of 1 second
Memory	Data is stored on SDcard (8GB included 32GB max)
Events	434-II: Tabulated in event list 435-II & 437-II: Tabulated in event list, including 50/60** waveform cycles and 7.5s 1/2 cycle rms Voltage and Amps trend

Measurement method

Vrms, Arms	10/12 cycle contiguous non-overlapping intervals using $500/416^2$ samples per cycle in accordance with IEC 61000-4-30
Vpeak, Apeak	Absolute highest sample value within 10/12 cycle interval with 40 µs sample resolution
V Crest Factor	Measures ratio between the Vpeak and Vrms
A Crest Factor	Measures ratio between the Apeak and Arms
Hz	Measured every 10 sec in accordance with IEC61000-4-30. Vrms½, Arms½ Value is measured over 1 cycle, commencing at a fundamental zero crossing, and refreshed each half-cycle. This technique is independent for each channel in accordance with IEC 61000-4-30.
Harmonics	Calculated from 10/12-cycle gapless harmonic group measurements on Voltage and Amps according to IEC 61000-4-7
Watt	Full and fundamental real power display. Calculates average value of instantaneous power over 10/12 cycle period for each phase. Total Active Power PT = P1 + P2 + P3.
VA	Full and fundamental apparent power display. Calculates apparent power using Vrms x Arms value over 10/12 cycle period.
var	Fundamental reactive power display. Calculates reactive power on fundamental positive sequence components. Capacitive and inductive load is indicated with capacitor and inductor icons.
VA Harmonics	Total disturbance power due to harmonics. Calculated for each phase and for total system based upon total apparent power and fundamental real power.
VA Unbalance	Unbalance power for total sytem. Calculated using symmetrical components method for fundamental apparent power and total apparent power.
Power factor	Calculated total watt/VA
Cos φ	Cosine of angle between fundamental voltage and current
DPF	Calculated fundamental Watt/VA
Energy/energy cost	Power values are accumulated over time for kWh values. Energy cost is calculated from user defined /kWh cost variable
Unbalance	The supply voltage unbalance is evaluated using the method of symmetrical components according to IEC61000-4-30
Flicker	According to IEC 61000-4-15 flickermeter—functional and design specification. Includes 230 V 50 Hz lamp and 120 V 60 Hz lamp models.
Transient capture	Captures waveform triggered on signal envelope. Additionally triggers on dips, swells, interruptions and Amps level
Inrush current	The inrush current begins when the Arms half cycle rises above the inrush threshold, and ends when the Arms half cycle rms is equal to or below the inrush threshold minus a user-selected hysteresis value. The measurement is the square root of the mean of the squared Arms half cycle values measured during the inrush duration. Each half-cycle interval is contiguous and non-overlapping as recommended by IEC 61000-4-30. Markers indicate inrush duration. Cursors allow measurement of peak Arms half cycle.
Mains signaling	Measurements are based on: either the corresponding 10/12-cycle rms value interharmonic bin or the rms of the four nearest 10/12-cycle rms value interharmonic bins per IEC 61000-4-30. Limit setup for Monitor mode follows EN50160 standard limits.
Time synchronization	Optional GPS430-II timesync module provides time uncertainty ≤ 20 ms or ≤ 16.7 ms for time tagging of events and time aggregated measurements. When synchronization is not available, time tolerance is ≤ 1-s/24h

Wiring configurations

1Ø + NEUTRAL	Single phase with neutral
1Ø SPLIT PHASE	Split phase
1Ø IT NO NEUTRAL	Single phase system with two phase voltages without neutral
3Ø WYE	Three phase four wire system WYE
3Ø DELTA	Three phase three wire system Delta
3Ø IT	Three phase system without neutral WYE
3Ø HIGH LEG	Four wire three phase Delta system with center tapped high leg
3Ø OPEN LEG	Open delta three wire system with 2 transformer windings
2-ELEMENT	Three phase three wire system without current sensor on phase L2/B (2 watt meter method)
2½-ELEMENT	Three phase four wire system without voltage sensor on phase L2/B
INVERTER EFFICIENCY	dc voltage and current input with ac output power (automatically displayed and selected in Inverter Efficiency mode)

General specifications

Case	Design Rugged, shock proof with integrated protective holster Drip and dust proof IP51 according to IEC60529 when used in tilt stand position Shock and vibration Shock 30 g, vibration: 3 g sinusoid, random 0.03 g^2/Hz according to MIL-PRF-28800F Class 2
Display	Brightness: 200 cd/m^2 typ. using power adapter, 90 cd/m^2 typical using battery power Size: 127 mm x 88 mm (153 mm/6.0 in diagonal) LCD Resolution: 320 x 240 pixels Contrast and brightness: user-adjustable, temperature compensated
Memory	8GB SD card (SDHC compliant, FAT32 formatted) standard, upto 32GB optionally Screen save and multiple data memories for storing data including recordings (dependent on memory size)
Real-time clock	Time and date stamp for Trend mode, Transient display, System Monitor and event capture

Environmental

Operating temperature	0 °C ~ +40 °C; +40 °C ~ +50 °C excl. battery
Storage temperature	-20 °C ~ +60 °C
Humidity	+10 °C ~ +30 °C: 95% RH non-condensing
	+30 °C ~ +40 °C: 75% RH non-condensing
	+40 °C ~ +50 °C: 45% RH non-condensing
Maximum operating altitude	Up to 2,000 m (6666 ft) for CAT IV 600 V, CAT III 1000 V
	Up to 3,000 m (10,000 ft) for CAT III 600 V, CAT II 1000 V
	Maximum storage altitude 12 km (40,000 ft)
Electro-Magnetic-Compatibility (EMC)	EN 61326 (2005-12) for emission and immunity
Interfaces	mini-USB-B, Isolated USB port for PC connectivity SD card slot accessible behind instrument battery
Warranty	Three years (parts and labor) on main instrument, one year on accessories

Included accessories

Power options	BC430 Power Adapter International plug adapter set BP290 (Single capacity Li-ion battery) 28Wh (Up to 8 hours)
Leads	TL430 Test lead and Alligator clip set
Color coding	WC100 color coding clips and regional decals
Flexible current probes	i430flex-TF, 24 inch (61cm) length, 4 clamps
Memory, Software and PC connection	8 GB SD card PowerLog on CD (includes operator manuals in PDF format) USB cable A-Bmini
Carrying case	C1740 Soft Case for 434-II and 435-II C437 Hard Case with rollers for 437-II

* ± 5 % if ≥ 1 % of nominal voltage ± 0.05 % of nominal voltage if < 1% of nominal voltage
** 50Hz/60Hz nominal frequency according to IEC 61000-4-30
*** 400Hz measurements are not supported for Flicker, Mains Signaling and Monitor Mode.
****for nominal voltage 50 V to 500 V

Flexible Current Probe i430 Flexi-TF specification

General specifications	
Probe and cable material	Alcryn 2070NC, reinforced insulation, UL94 V0, Color: RED
Couplings material	Lati Latamid 6H-V0 Nylon
Probe cable length	610 mm (24 in)
Probe cable diameter	12.4 mm (0.49 in)
Probe cable bend radius	38.1 mm (1.5 in)
Output cable length	2.5 meters RG58
Output connector	Safety BNC connector
Operating range	-20 °C to +90 °C
Storage temperature	-40 °C to +105°C
Operating humidity	15% to 85% (non condensing)
Degree of protection (Probe)	IP41
Specifications	
Current range	6000 A AC RMS
Voltage output (@1000 ARMS, 50 Hz)	86.6 mV
Accuracy	± 1% of reading (@ 25 °C, 50 Hz)
Linearity (10% to 100% of range)	± 0.2% of reading
Noise (10 Hz – 7 kHz)	1.0 mV ACRMS
Output impedance	82 Ω min
Load impedance	50 MΩ
Internal Resistance per 100 mm probe length	10.5Ω ± 5%
Bandwidth (-3dB)	10 Hz to 7 kHz
Phase error (45 Hz – 65 Hz)	± 1°
Position sensitivity	± 2% of reading max.
Temperature coefficient	± 0.08% max of reading per °C
Working voltage (see safety standards section)	1000 V AC RMS or DC (head) 30 V max. (output)

Ordering information

Fluke-434-II	Three-Phase Energy Analyzer
Fluke-435-II	Three-Phase Power Quality and Energy Analyzer
Fluke-437-II	400 Hz Three-Phase Power Quality and Energy Analyzer

Optional/replacement accessories

I430-FLEXI-TF-4PK	6000 A Fluke 430 Thin Flexi 61 cm (24 in) 4 pack
C437-II	Hard Case 430 Series II with roller
C1740	Softcase for 174X and 43X-II PQ Analyzer
i5sPQ3	i5sPQ3, 5 A ac Current Clamps, 3-pack
i400s	i400s AC Current Clamp
WC100	WC100 Color Localization Set
GPS430-II	GPS430 Time Synchronization Module
BP291	Double capacity Li-ion battery (up to 16 hr)
HH290	Hanging hook for use on cabinet doors

Fluke. *The Most Trusted Tools in the World.*

Fluke Corporation
PO Box 9090, Everett, WA 98206 U.S.A.

Fluke Europe B.V.
PO Box 1186, 5602 BD
Eindhoven, The Netherlands

For more information call:
In the U.S.A. (800) 443-5853 or
Fax (425) 446-5116
In Europe/M-East/Africa +31 (0) 40 2675 200 or
Fax +31 (0) 40 2675 222
In Canada (800)-36-FLUKE or
Fax (905) 890-6866
From other countries +1 (425) 446-5500 or
Fax +1 (425) 446-5116
Web access: http://www.fluke.com

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Printed in U.S.A. 6/2012 2643006E D-EN
Pub ID 11858-eng