

Fluke 430 Series Three-Phase Power Quality Analyzers

Pinpoint power problems
faster, safer and in greater detail

Technical Data

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

- Records all your necessary values in a three phase system.
- Minimal setup required with intuitive menus.
- Highest safety rating in the industry.
- Four voltage and four current channels.
- Captures waveform data on all phases simultaneously.
- System-Monitor: Six power quality parameters on one dashboard
- Automatic Transient display: Never miss an event.
- Auto Trend: Don't waste time setting up recordings.
- Rugged, handheld recorder.
- Seven hours operating time per charge on NiMH battery pack.
- Transfer data files to your PC for reporting and analysis using FlukeView® software.



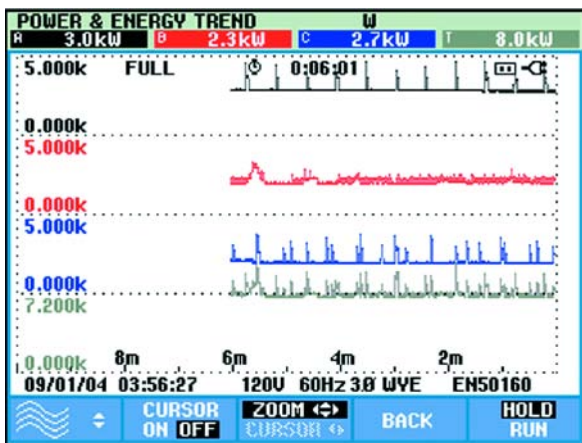
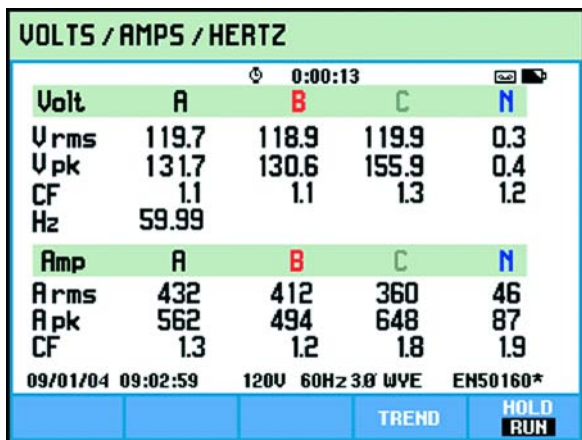
CAT IV 600 V and CAT III 1000 V safety rating

Designed to help protect you and your equipment against electrical shock and fire, the Fluke 430 Series analyzers, accessories and charger are all certified to meet the stringent safety standards for use in CAT IV 600 V and CAT III 1000 V environments. They are the first tools of their kind to carry the CAT IV rating and therefore can be used at virtually all power connections and outlets in a low-voltage power distribution system.



Quickly see the trend

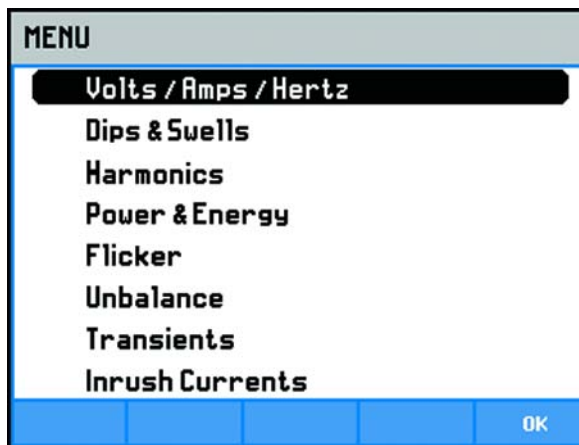
Auto Trend feature allows fast insight into changes over time. Every displayed reading is automatically and continuously recorded without having to set thresholds or intervals and without manually starting the process. Quickly view trends for voltage, current, frequency, power, harmonics or flicker on all phases and neutral. Analyze the trends using the cursors and zoom tools – even while background recording continues.



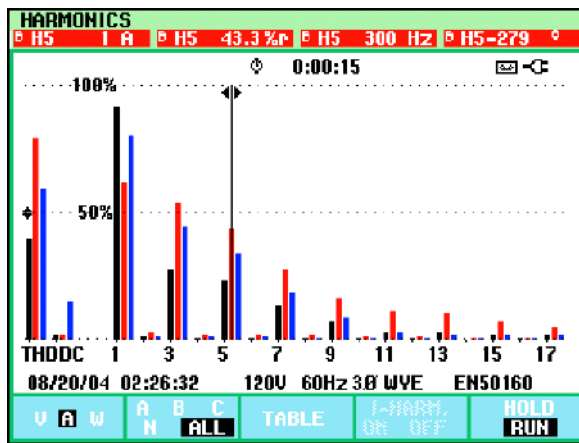
AutoTrend automatically records all displayed parameters in the background. Toggle between data and trend view and use cursors and zoom to analyze measurements without interrupting the recording.

Measures everything

Measure true-rms & peak voltage and current, frequency, dips and swells, transients, interruptions, power and power consumption, peak demand harmonics, inter-harmonics, flicker and unbalance.



Simple menu structure with logical function grouping gives fast access to key measurements.



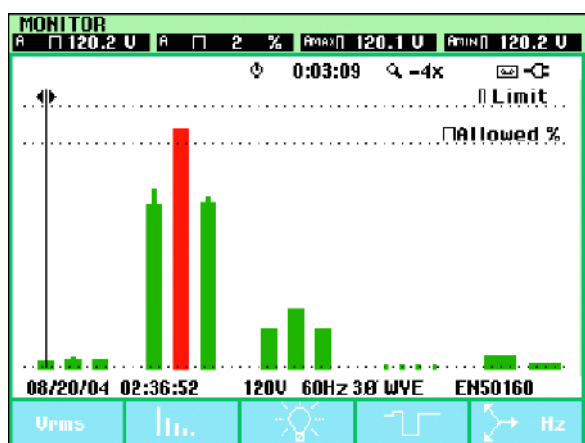
Track harmonics up to the 50th, and measure and record THD in accordance with IEC61000-4-7 requirements.

Automatic transient display

Every time an event or distortion on voltage is detected, the instrument triggers and automatically stores voltage and current waveforms on all three phases and neutral. The analyzer will also trigger when a certain current value level is exceeded. Up to 40 dips, swells, interruptions and transients can be captured this way. You can see voltage transients as high as 6 kV and as fast as 5 microseconds.

System-Monitor: Multi-parameter power quality health check on one display

A single push of the MONITOR button delivers a single dashboard display of rms voltage, harmonics, flicker, interruptions, rapid voltage changes, swells, unbalance and frequency. The dashboard is updated live, showing compliance of each parameter to EN50160 limits or your own limits. Color-coded bars clearly show which parameters are inside (pass) or outside limits (fail). During a Monitor session, you can easily drill down to more detail of any parameter and view and capture its trend for a report.



The System-Monitor overview screen gives instant insight into whether the voltage, harmonics, flicker, frequency and the number of dips and swells fall outside the set limits.

MONITOR EVENTS URMS				
START 09/01/04 07:51:38		EVENT 8 / 8		
DATE	TIME	TYPE	LEVEL	DURATION
09/01/04	08:34:38:098	H21	0.5 %	0:00:10:000
09/01/04	08:36:38:098	H21	0.5 %	0:00:10:000
09/01/04	08:51:38:098	H21	0.5 %	0:00:10:000
09/01/04	08:53:38:098	H21	0.5 %	0:00:10:000
09/01/04	08:55:28:098	H21	0.5 %	0:00:10:000
09/01/04	09:02:58:098	H21	0.5 %	0:00:10:000
09/01/04	09:04:58:098	H21	0.5 %	0:00:10:000
09/01/04	09:08:38:098	H21	0.5 %	0:00:10:000

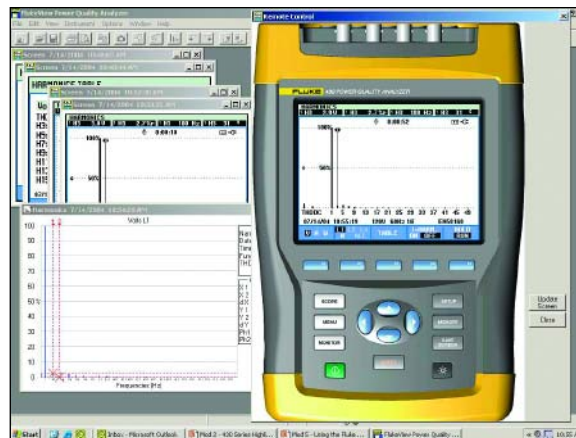
09/01/04 09:12:03 120V 60Hz 3Ø WYE EN50160				
SELECTED	NORMAL	TREND	BACK	
ALL	DETAIL			

A detailed list is given of all events falling outside the set limits. By scrolling through the event list and selecting an event, the event can be analyzed in detail.

Extensive data analysis possibilities

The Fluke 430 Series provides three ways to analyze measurements. Cursors and zoom tools can be used 'live' while taking measurements or

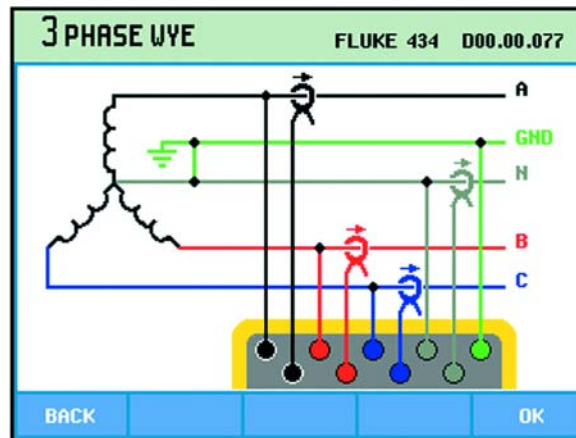
'off line' on stored measurement data. The stored measurements can also be transferred to a PC with FlukeView® software. The software's 'view' mode allows cursors and zoom tools to be used on stored measurements. Perform custom analysis and create reports, measurement data can also be exported to common spreadsheet programs. Store up to 10 measurement datasets, each dataset can contain up to 32 parameters and up to 50 screens for use in reports.



Perform custom analysis and create reports with FlukeView® Power Quality software. Measurement data can also be exported to common spreadsheet programs.

Easy-to-use

Thanks to thoughtful features like user-friendly menus in local languages and setups with minimal steps. The high-resolution color screen updates every 200 mS and displays waveforms and wiring diagrams color coded to industry standards. Handy on-screen wiring diagrams for all commonly used three phase and single phase configurations guide you through connections.



The full color display uses region specific industry-standard color-coding (user selectable) to correlate measurements with actual wiring.

Specifications

Input characteristics	
Voltage inputs	
Number of inputs	4 (3 phases + neutral)
Maximum input voltage	1000 Vrms
Maximum peak voltage	6 kV
Input impedance	4 MΩ / 5 pF
Bandwidth	9 kHz, up to 100 kHz for transient display
Scaling	1:1, 10:1, 100:1, 1000:1 and variable
Current inputs	
Number of inputs	4 (3 phases + neutral)
Type	Clamp on current transformer with mV output
Range	1 to 400 Arms with included clamps (I400S) 0.1 to 3000 Arms with optional clamps
Input impedance	50 kΩ
Bandwidth	9 kHz
Scaling	0.1, 1, 10, 100, 1000 mV/A and variable
Nominal frequency	40 to 70 Hz
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 ² cycles according IEC 61000-4-30
PLL synchronization	4096 samples on 10/12 ² cycles according IEC 61000-4-7
Display modes	
Waveform display	Available in Scope and Transient mode Captures 8 waveforms simultaneously Display update rate 5 x per second Up to 10/12 times horizontal zoom ² Cursors: Single vertical line showing min, max, avg reading at cursor position
Phasor	Shows real time phasor diagram Available in Scope and Unbalance mode Display update rate 5 x per second
Matrix readings	Available in Volts/Amps/Hertz, Harmonics, Power & Energy, Flicker and Unbalance mode
AutoTrend graph	Available in Volts/Amps/Hertz, Dips & Swells, Harmonics, Power & Energy, Flicker, Unbalance, Inrush and Monitor mode Cursors: single vertical line showing with min, max, avg reading at cursor position
Bargraph	Available in Harmonics and Monitor mode
Eventlist	Available in Dips & Swells and Monitor mode
Measurement modes	
Scope	Vrms, Arms, Vcursor, Acursor, Vfund, Afund, Hz, V phase angles, A phase angles
Volts/Amps/Hertz	Vrms, Vpk, V Crest Factor, Arms, Apk, A Crest Factor, Hz
Dips and Swells	Vrms ^{1/2} , Arms ^{1/2} Captures up to 1000 events with date, time, duration, magnitude and phase identification with programmable thresholds
Harmonics DC, 1 to 50	Harmonic Volts, THD Volt, Harmonic Arms, THD Arms, K Arms, Harmonic Watts, THD Watts, K Watts, Interharmonic Volts ⁴ , Interharmonic Arms ⁴ (relative to fundamental or to total rms)
Power and Energy ⁴	Watts, VA, VAR, Power factor, Cos φ / DPF, Arms, Vrms, kWh, kVAh, KVARh, peak demand interval using trend, KYZ revenue meter verification via optional input
Flicker	Pst _(1min) , Pst, Plt, PF5, Vrms ^{1/2} , Arms ^{1/2} , Dc, Dmax, TDEX
Unbalance	Vneg, Vzero, Aneg, Azero, Vfund, Afund, Hz, V phase angles, A phase angles
Transients ⁴	Vrms, Arms, Vcursor, Acursor
Inrush Currents ⁴	Inrush Current, Inrush duration, Arms ^{1/2} , Vrms ^{1/2}
System Monitor	Vrms, Arms, Harmonic Volts, THD Volts, Plt, Vrms ^{1/2} , Arms ^{1/2} , Vneg, Hz, dips and swells, unbalance. All parameters are measured simultaneously in accordance with EN50160. Using Flagging to indicate unreliable readings according IEC61000-4-30.

Specifications continued

Accuracy, resolution and range			
Volt/Amps/Hertz	Measurement range	Resolution	Accuracy
Vrms (AC+DC)	1 to 1000 Vrms	0.1 Vrms	± 0.5 % of nominal voltage
Vpk	1 to 1400 Vpk	1 V	5 % of nominal voltage
CFV	1.0 to > 2.8	0.1	± 5 %
Arms (AC+DC) with included clamps	0 to 20,000 Arms ¹ 0 to 400 Arms	0,001 to 10 Arms ¹ 0.1 and 1 Arms	± 1 % of reading ± 5 counts ³
Apk using 1mV/A scaling	0 - 5500 Apk	10 A	± 5 %
CFA using 1mV/A scaling	1 to 10	0.1	± 5 %
50 Hz nominal	42.50 to 57.50 Hz	0.01 Hz	± 0.1 % of nominal frequency
60 Hz nominal	51.00 to 69.00 Hz	0.01 Hz	± 0.1 % of nominal frequency
Dips and swells			
Vrms ^{1/2} (AC+DC)	0.0 to 100 % of nominal voltage	0.1 Vrms	± 1 % of nominal voltage
Arms ^{1/2} (AC+DC) with included clamps	0 to 20,000 Arms ¹ 0 to 400 Arms	0,001 Arms to 10 Arms 0.1 Arms and 1 Arms	± 1 % of reading ± 5 counts ³
Threshold levels	Programmable in percent of nominal voltage		
Duration	hhh,mm,ss,mmm with half-cycle cycle time resolution		
Harmonics			
Harmonic selection (n)	DC, 1 to 50		
Inter-Harmonic selection	Off, 1 to 49		
Vrms Relative (%f):	0.0 to 100.0 %	0.1 %	± 0.1 % ± n x 0.1 % (± 0.4 % for %r)
Absolute:	0.0 to 1000 Vrms	0.1 Vrms	± 5 % of reading ± 2 counts
Arms Relative (%f):	0.0 to 100.0 %	0.1 %	± 0.1 % ± n x 0.1 % (± 0.4 % for %r)
Absolute:	0.0 to 4000 mV x selected clamp scaling	1 mVrms x selected clamp scaling	± 5 % of reading ± 5 counts
Watts Relative:	0.0 to 100.0 %	0.1 %	± n x 2 %
Absolute:	depends on selected clamp and voltage scaling		± 5 % of reading ± n x 2 % of reading, ± 10 counts
DC voltage Relative:	0.0 to 100.0 %	0.1 %	± 1 %
Absolute:	0.0 to 1000 V	0.1 V	± 5 % of reading ± 10 counts
THD	0.0 to 100.0 %	0.1 %	± 2.5 %
Hz	0 to 3500 Hz	1 Hz	± 1Hz
Phase angle	-360 ° to +360 °	1 °	± n x 1.5 °
Power and Energy			
Watt	1.0 W to 20.00 MW ¹	0.1 W to 1 kW ¹	± 1.5 % of reading ± 10 counts ³
VA	1.0 VA to 20.00 MVA ¹	0.1 VA to 1 kVA ¹	± 1.5 % of reading ± 10 counts ³
VAR	1.0 VAR to 20.00 MVAR ¹	0.1 VAR to 1 kVAR ¹	± 1.5 % of reading ± 10 counts ³
kWh	00.00 kWhr to 200.0 GWhr ¹	0.01 Whr to 100 Whr ¹	± 1.5 % of reading ± 10 counts ³
kVA	00.00 kVAhr to 200.0 GVAhr ¹	0.01 VAhr to 100 VAhr ¹	± 1.5 % of reading ± 10 counts ³
kVAR	00.00 kVARhr to 200.0 GVARhr ¹	0.01 VARhr to 100 VARhr ¹	± 1.5 % of reading ± 10 counts ³
Power Factor	0 to 1	0.01	± 0.03 ³
Cos φ / DPF	0 to 1	0.01	± 0.03 ³
Flicker			
Pst (1min), Pst, Plt, PF5 instantaneous Flicker	0.00 to 20.00	0.01	Within ± 5 % of tabulated values according IEC61000-4-15
Dc %, Dmax % and Time d(t) exceeds limits. As described per IEC 61000-3-3	0.0 to ± 100.0 % for Dc % and Dmax % and 0.000 to 9.999s for Time	0.1 % for Dc % and Dmax % and 10 ms for Time	± 1% for Dc % and Dmax % and 20 ms for Time
Unbalance			
Volts	0.0 to 5.0 %	0.1 %	± 0.5 %
Current	0.0 to 20 %	0.1 %	± 1 %
Transient capture			
Volts	± 6000 Vpk	1 V	± 15 % of cursor reading ± 2.5 % of Vrms
Minimum detect duration	5 μs	Sampling rate	200 kS/s
Inrush mode			
Arms (AC+DC)	0.000 to 20.00 kArms ¹	0.001 to 10 Arms ¹	± 1 % of meas ± 5 counts ³
Inrush Duration	mm:ss:mmm between 7.5 s to 30 m selectable	10 ms	± 20 ms (Fnominal = 50 Hz)

Specifications continued

Trend recording	
Method	AutoTrend automatically records min, max and average values over time for all readings being displayed for the 3 phases and neutral simultaneously
Volts/amps/hertz, harmonics, power and energy, flicker and unbalance mode	
Sampling	5 readings/sec continuous sampling per channel
Memory	1800 min, max and avg points for each reading
Recording time	From 30 min with 1 second display resolution up to 450 days with 6 hour display resolution
Zoom	Up to 6 x horizontal zoom
Dips and swells mode	
Sampling	100/120 ² readings/sec continuous sampling per channel
Memory	3600 min, max and avg points for each reading
Recording time	From 90 sec with 25 msec display resolution up to 450 days with 3 hour display resolution
Zoom	Up to 12 x horizontal zoom
Inrush currents and flicker PF5 mode	
Sampling	100/120 ² readings/sec continuous sampling per channel
Memory	3600 min, max and avg points for each reading
Recording time	From 7.5 sec with 25 msec display resolution up to 30 min with 500 msec display resolution for Inrush measurements and up to 2.5 hour with 2.5 sec display resolution for PF5 recordings
Zoom	Up to 12 x horizontal zoom
Monitor mode	
Sampling	Combination of 5 readings/sec and 100/120 ² readings/sec continuous sampling per channel depending on the parameter measured
Recording time	Up to 1 week with 10 min resolution
Memory	1008 min, max and avg points for each reading
Limits	According to EN50160 or customer definable
Measurement method	
Vrms, Arms	10/12 ² 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 ² 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
Vrms ^{1/2} , Arms ^{1/2}	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	Selectable Total or Fundamental real power display Calculates average value of instantaneous power over 10/12 cycle period for each phase Total Active Power $P_T = P_1 + P_2 + P_3$
VA	Selectable Total or Fundamental apparent power display Calculates apparent power using Vrms x Arms value over 10/12 cycle period Total Apparent Power is root mean square of real and apparent power
VAR	Selectable Total of Fundamental reactive power display Calculates reactive power as root of VA squared minus Watt squared over 10/12 cycle period Capacitive and inductive load is indicated with capacitor and inductor icons
Power Factor	Calculated Watt / VA
Cos φ / DPF	Cos of angle between fundamental voltage and current
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 as specified by IEC61000-4-30
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.

Specifications continued

General	
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	
Type	Bright Full-Color LCD with CCFL backlight, 80cd/m ²
Size	115.2 x 86.4 mm (4.5 x 3.4 in)
Resolution	320 x 240 pixels
Contrast and brightness	User adjustable, temperature compensated
Memory	
Screens	50 screen memories on Fluke 434 25 screen memories on Fluke 433
Data	10 data memories for storing data including recordings on Fluke 434 5 data memories for storing data including recordings on Fluke 433
Limit templates	2 preprogrammed, 2 administrator (programmable via FlukeView, 2 user locations)
Real-time clock	Time and date stamp for AutoTrend, Transient display and SystemMonitor
Mechanical	
Size	256 x 169 x 64 mm (10 x 6.6 x 2.5 in.)
Weight	2 kg (4.4 lb.)
Power	
Line power	Switchable 115 V, 230 V adapter with country specific plug
Battery power	Rechargeable NiMH (installed)
Battery operating time	> 7 hours
Battery charging time	4 hours
Power saving	Adjustable time for dimmed backlight with on screen power indicator
Standards	
Measurement methods used	IEC61000-4-30 class A
Power Quality	EN50160
Flicker	IEC 61000-4-15
Harmonics	IEC 61000-4-7
Safety	
Compliance	IEC/EN61010-1 (2nd edition) pollution degree 2; CAN/CSA C22.2 No 101.1; ANSI/ISA S82.01
Max voltage on banana input	CAT III 1000 V / CAT IV 600 V
Max voltage on current BNC input	42 V _{peak}
Environmental	
Operating temperature	0 °C to +50 °C (32 °F to 122 °F)
Storage temperature	-20 °C to +60 °C (-4 °F to 140 °F)
Humidity	10 to 30 °C: 95 % RH non condensing (50 to 86 °F: 95 % RH non condensing) 30 to 40 °C: 75 % RH non condensing (86 to 104 °F: 75 % RH non condensing) 40 to 50 °C: 45 % RH non condensing (104 to 122 °F: 45 % RH non condensing)
Maximum operating altitude	3000 m (9842 ft) Derate to CAT II 1000 V / CAT III 600 V / CAT IV 300 V above 2000 m (6561 ft)
Maximum storage altitude	12 km (39,372 ft)
Warranty	3 years on mainframe, 1 year on included accessories
Accessories	
Included	Hard carrying case with clamp holders BC430 4 current clamps, i400s 5 Test leads, 4 black, 1 green 5 Alligator clips, 4 black, 1 green Battery Charger Eliminator, BC430 FlukeView Software, SW43W (Fluke 434 only) Optical Cable for USB , OC4USB (Fluke 434 only) Color localization set, WC100 Getting Started (printed) User Manual (CD-ROM)

¹ depending clamp scaling

² 50 Hz/60 Hz nominal frequency according to IEC 61000-4-30

³ Add clamp accuracy

⁴ The advanced functions: interharmonics, energy, transients and inrush are optional for the Fluke 433 and standard available on the Fluke 434



Optional 430 Series Accessories

- **i400s AC Current Clamp** – Replacement current clamp for the Fluke 430 Series: It is compatible with any oscilloscope, ScopeMeter® Test Tool or Power Quality Analyzer that accepts BNC connectors and is capable of millivolt measurements.
- **TLS430 Test Lead Set** – Test lead replacement set for the 430 Series Power Quality Analyzer. Set includes five test leads and five alligator clips.
- **WC100 Multi-Color Wire Clips** – 32 wire clips in 8 colors easily snap onto test leads and current clamp cables to organize multiple leads and cables in a work area.
- **CCS430** Color coding set for Fluke 430 Series.
- **C430** Hard carrying case.
- **OC4USB** Optical cable for USB.
- **BC430** Battery charger 230 V/110 V.
- **Fluke-433/UGK** Upgrade kit for Fluke 433, includes FlukeView software, USB cable and advanced feature upgrade.



Fluke offers a full suite of power quality test tools to locate, predict, prevent and troubleshoot power problems.

- Handheld troubleshooters for instant analysis
- Ready-to-use event loggers
- Full Disclosure power analyzers
- Power calibrators and standards backed by Fluke metrology expertise

The Fluke power quality set of products offers the highest level of performance and maintains the Fluke promise of rugged and reliable test tools.

Ordering information

Model

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

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**35 Vantage Point Drive
Rochester, NY 14624
1.800.800.5001**

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