FLUKE®

Power Quality

# Fluke 430 Series three-phase and Fluke 43B single-phase Power Quality Analyzers

## Technical Data

### Analyze your power network quickly

In industry, healthcare, and business – in fact wherever electrical and electronic equipment is depended on – power quality plays a critical role in maintaining productivity and consistency. Non-linear loads, switching, load changes and equipment problems can result in poor power quality. Poor power quality is not only costly in terms of wasted energy and unnecessary downtime, it is also dangerous and increases the risk of equipment failure.

Fluke has an unrivalled range of three-phase and single-phase power quality analyzers to help you maintain power systems. The tools give you the power to analyze every parameter, power-related event or anomaly faster, safer and in more detail than ever before.

The range includes the Fluke 435 and 434 three-phase power quality analyzers and the 43B single-phase power quality analyzer.

### Power Quality Analyzer Selection Table

| | 435 | 434 | 43B |
|---|---|---|---|
| **Application** | Three-phase | | Single-phase |
| **Inputs** | 4 voltage and 4 current (for 3 phases and neutral) | | 1 voltage and 1 current |
| **Measurements** | | | |
| Vrms, Arms, Hz, W, VAR, VA, PF, Cos φ (DPF), Crest Factors | ● | ● | ● |
| Harmonics and THD (V,A,W), k-factor | ● | ● | ● |
| Inter-harmonics | ● | ● | - |
| kWh and kVARh, kVAh, demand interval | ● | ● | - |
| Flicker (Plt, Pst, PF5) | ● | ● | - |
| Unbalance | ● | ● | - |
| Mains signaling | ● | Optional* | - |
| **Recorder/Auto trend** | ●/● | ●/● | ●/- |
| **Logger** | ● | Optional* | - |
| **System monitor** | ● | ● | - |
| **Real time scope/Phasor diagrams** | ● | ●/● | ●/- |
| **Dips and swells/Half cycle based** | ● | ●/● | ●/- |
| **Transient display** | ● | ● | ● |
| **Inrush current** | ● | ● | ● |
| **IEC61000-4-30, -4-7, -4-15 compliance** | Class A | Class B | - |
| **Built-in general purpose Scope and DMM** | - | - | ● |
| **Memory (screens/data)** | 50/10** | 50/10 | 20 for screens and data |
| **Memory size** | 16 MB | 8 MB** | |
| **FlukeView Software and interface cable** | ● | ● | Depending on configuration |
| **Power Log Software** | ● | Optional* | - |
| **EN61010 safety rating** | 600 V CAT IV/1000 V CAT III | | 600 V CAT III |
| **Current clamps included** | 4 X i430 Flex | 4 X i400S | i400S |

** Optional functionality can be added with upgrade kit. For details see ordering information.*
*** Logger uses user-configurable shared memory.*

# Technical Specification Fluke 430 Series Power Quality Analyzers

The specifications of the instrument are verified using the "implementation verification" table 3 as specified in IEC 61000-4-30 a Chapter 6.2
Accuracy is specified in % of reading unless otherwise specified Specifications are valid for models Fluke 435 and Fluke 434 unless orherwise specified

| | | | | |
|---|---|---|---|---|
| **Input characteristics** | | | | |
| **Voltage inputs** | | | | |
| Number of inputs | | 4 (3 phases + neutral) DC coupled | | |
| Maximum input voltage | | 1000 Vrms | | |
| Nominal Voltage range | | 50…500 V internally devided in three ranges 500 V, 250 V and 125 V | | |
| Maximum peak voltage | | 6 kV | | |
| Input impedance | | 4 MΩ // 5 pF | | |
| Bandwidth | | > 10 kHz, up to 100kHz for transient display | | |
| Scaling | | 1:1, 10:1, 100:1, 1000:1 and variable | | |
| **Current inputs** | | | | |
| Number of inputs | | 4 (3 phases + neutral) DC coupled | | |
| Type | | Clamp on current transformer with mV output | | |
| Range | | 1..400 Arms with included clamps (I400S)<br>0.1..3000 Arms with optional clamps | | |
| Input impedance | | 50 kΩ | | |
| Bandwidth | | >10 kHz | | |
| Scaling | | 0.1, 1, 10, 100, 1000 mV/A, variable, i5s and i430-Flex | | |
| **Nominal frequency** | | 40..70 Hz | | |
| **Sampling system** | | | | |
| Resolution | | 16 bit analog to digital converter on 8 channels | | |
| Maximum sampling speed | | 200kS/s on each channel simultaneously | | |
| RMS sampling | | 5000 samples on 10/122 cycles according IEC 61000-4-30 | | |
| PLL synchronization | | 4096 samples on 10/122 cycles according IEC 61000-4-7 | | |
| **Display modes** | | | | |
| Waveform display | | Available in Scope and Transient mode<br>Captures 8 waveforms simultaneously<br>Display update rate 5x per second<br>Up to 10/12 times horizontal zoom<br>Cursors: Single vertical line showing min, max, avg reading at cursor position | | |
| Phasor | | Shows real time phasor diagram<br>Available in Scope and Unbalance mode<br>Display update rate 5x per second | | |
| Meter readings | | Available in Volts/Amps/Hertz, Harmonics, Power & Energy, Flicker, Unbalance and Logger[4] mode. | | |
| AutoTrend graph | | Available in Volts/Amps/Hertz, Dips & Swells, Harmonics, Power & Energy, Flicker, Unbalance, Inrush, Mains Signaling[4]<br>Logger[4] and Monitor mode<br>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 Mains Signaling[4], Logger[4] 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 | | Vrms½, Arms½<br>Captures up to 1000 events with date, time, duration, magnitude and phase identification with programmable thresholds | | |
| Harmonics<br>DC, 1 ... 50 | | Harmonic Volts, THD Volt, Harmonic Amps, THD Amps, K Amps, Harmonic Watts, THD Watts, K Watts, Interharmonic Volts[4], Interharmonic Amps[4]<br>(relative to fundamental or to total rms) | | |
| Power and Energy | | Watts, VA, VAR, Power factor, Cos φ / DPF, Arms, Vrms, kWh, kVAh, KVARh, peak demand interval using trend, KYZ revenue meter verification via optical input. | | |
| Flicker | | Pst(1min), Pst, Plt, PF5, Vrms½, Arms½, Dc, Dmax, TDEX | | |
| Unbalance | | Vneg, Vzero, Aneg, Azero, Vfund, Afund, Hz, V phase angles, A phase angles | | |
| Transients | | Vrms, Arms, Vcursor, Acursor | | |
| Inrush Currents | | Inrush Current, Inrush duration, Arms½, Vrms½ | | |
| Mains Signaling[4] | | Relative signaling voltage and absolute signaling voltage averaged over three seconds for two selectable frequencies | | |
| Logger[4] | | Measures and records up to 100 parameters on all 4 phases simultaneously with selecable averaging time.<br>Captures up to 10000 events with date, time, duration, magnitude and phase identification with programmable thresholds | | |
| System Monitor | | Vrms, Arms, Harmonic Volts, THD Volts, Plt, Vrms½, Arms½, Vneg, Hz, dips and swells, unbalance. All parameters are measured simultaneously in accordance with EN50160.<br>Using Flagging to indicate unreliable readings according IEC61000-4-30. | | |
| **Accuracy, resolution and range** | | | | |
| **Volt/Amps/Hertz** | | **Measurement range** | **Resolution** | **Accuracy** |
| Vrms (AC+DC) | Fluke 435<br><br>Fluke 434 | 1…600 Vrms<br>600…1000 Vrms<br>1…1000 Vrms | 0.01 Vrms<br>0.01 Vrms<br>0.1 Vrms | ± 0.1% of nominal voltage<br>± 0.1%<br>± 0.5% of nominal voltage |
| Vpk | | 1…1400 Vpk | 1 V | 5% of nominal voltage |
| Voltage Crest Factor (CF) | | 1.0 ... > 2.8 | 0.01 | ± 5% |
| Arms (AC+DC) | Fluke 435<br>Fluke 434<br>Fluke 434 with i400s<br>Fluke 435 with I430Flex | 0…20.00 kArms[1]<br>0…20.00 kArms[1]<br>0…40 / 400 Arms<br>30…3000 Arms | 0,001…10 Arms[1]<br>0,001…10 Arms[1]<br>0.1 and 1 Arms<br>1 Arms | ± 0.5% ± 5 counts[3]<br>± 1% ± 5 counts[3]<br>± 1% ± 5 counts[3]<br>± 0.5% ± 20 counts[3] |
| Apk | using 1mV/A scaling | 0 - 5500 Apk | 1A | ± 5% |
| A Crest Factor (CF) | | 1 … 10 | 0.01 | ± 5% |
| Hz[5] | Fluke 435 @ 50Hz nominal<br>Fluke 435 @ 60Hz nominal<br>Fluke 434 @ 50Hz nominal<br>Fluke 434 @ 60Hz nominal | 42.500 ... 57.500 Hz<br>51.000 ... 69.000 Hz<br>42.50 ... 57.50 Hz<br>51.00 ... 69.00 Hz | 0.001 Hz<br>0.001 Hz<br>0.01 Hz<br>0.01 Hz | ± 0.01Hz<br>± 0.01Hz<br>± 0.01Hz<br>± 0.01Hz |
| **Dips and swells** | | | | |
| Vrms½ (AC+DC) | Fluke 435<br>Fluke 434 | 0.0% ….200% of nominal voltage<br>0.0% ….200% of nominal voltage | 0.1Vrms<br>0.1Vrms | ± 0.2% of nominal voltage<br>± 1% of nominal voltage |
| Arms½ (AC+DC) | Fluke 435<br>Fluke 434<br>Fluke 434 with i400s<br>Fluke 435 with i430Flex | 0 … 20,000 Arms[1]<br>0 … 20,000 Arms[1]<br>0 … 400 Arms<br>30 … 3000 Arms | 0,001 Arms…10 Arms<br>0,001 Arms…10 Arms<br>0.1 Arms and 1 Arms<br>1 Arms | ± 1% ± 10 counts[3]<br>± 2% ± 10 counts[3]<br>± 2% ± 10 counts[3]<br>± 1% ± 20 counts[3] |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Threshold levels | | Programmable thresholds in percent of nominal voltage<br>Event detection based upon _cycle rms voltages<br>Captures Dips, Swells Interruptions and Rapid Voltage Changes | | | | | | | | |
| Duration | | hhh,mm,ss,mmm | | Half cycle | | | | One cycle | | |
| **Harmonics** | | | | | | | | | | |
| Harmonic order (n) | | DC, 1..50 Grouping: Harmonic groups according to IEC 61000–4–7 | | | | | | | | |
| Inter–Harmonic order | | Off, 1..49 Grouping: Harmonic and Interharmonic subgroups according to IEC 61000–4–7 | | | | | | | | |
| Vrms | Relative (%f): | 0.0 … 100.0% | | 0.1% | | | | ± 0.1% ± n x 0.1%<br>(± 0.4% for %r) | | |
| | Fluke 435 Absolute: | 0.0 … 1000 Vrms | | 0.1 Vrms | | | | ± 0.05% of nominal voltage if < 1% of nominal voltage ± 5% if ≥ 1% of nominal voltage | | |
| | Fluke 434 Absolute: | 0.0 … 1000 Vrms | | 0.1 Vrms | | | | ± 5% ± 2 counts | | |
| Arms | Relative (%f): | 0.0 … 100.0% | | 0.1% | | | | ± 0.1% ± n x 0.1%<br>(± 0.4% for %r) | | |
| | Absolute: | 0.0 … 4000 mV x clamp scaling | | 1 mVrms x clamp scaling | | | | ± 5% ± 5 counts | | |
| Watts | Relative: | 0.0 … 100.0% | | 0.1% | | | | ± n x 2% | | |
| (Harmonics only) | Absolute: | depends on clamp and voltage scaling | | | | | | ± 5% ± n x 2% ± 10 counts | | |
| DC | Relative: | 0.0 … 100.0% | | 0.1% | | | | ± 0.1% V and A (± 2% Watt) | | |
| | Fluke 435 Absolute V: | 0.0 … 1000V | | 0.1V | | | | ± 0.2% of nominal voltage | | |
| | Fluke 434 Absolute V: | 0.0 … 1000V | | 0.1V | | | | ± 5% ± 10 counts | | |
| | Absolute A: | 0.0 … 4000 mV x clamp scaling | | 1 mVrms x clamp scaling 0.1V | | | | ± 5% ± 10 counts | | |
| | Absolute W: | depends on clamp and voltage scaling | | depends on scaling | | | | ± 5% ± 10 counts | | |
| $THD_{(n=40)}$ | (relative %f or %r) | 0.0 … 100.0 % | | 0.1% | | | | ± 2.5% V and A (± 5% Watt) | | |
| Hz | | 0 … 3500 Hz | | 1 Hz | | | | ± 1Hz | | |
| Phase angle | Fluke 435 | –360° ... +0° | | 1° | | | | ± n 1.5[8] | | |
| | Fluke 434 | –360° ... +0° | | 1° | | | | ± n 1°[8] | | |
| **Power and Energy** | | | | | | | | | | |
| Watt (VA, VAR) | Fluke 435 | 1.0 … 20.00MW[1] | | 0.1 … 1 kW[1] | | | | ± 1% ± 10 counts[3] | | |
| | Fluke 434 | 1.0 … 20.00MW[1] | | 0.1 … 1 kW[1] | | | | ± 1.5% ± 10 counts[3] | | |
| kWh[6] (kVA[6], kVAR[6]) | | 00.00 kWhr…200.0 GWhr[1] | | 00.00 kWhr…200.0 GWhr[1] | | | | 0.01 Xhr….100 Whr[1] | | |
| | | 0.01 Whr….100 Whr[1] | | ± 1% ± 10 counts[3] | | | | ± 1.5% ± 10 counts[3] | | |
| Power Factor | | 0…1 | | 0.01 | | | | ± 0.033 | | |
| Cos φ / DPF | | 0…1 | | 0.01 | | | | ± 0.033 | | |
| **Flicker** | | | | | | | | | | |
| Pst (1min), Pst, Plt, PF5 instantenous Flicker | | 0.00 … 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 … ± 100.0% for Dc% and Dmax% and 0.000 ... 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 | Fluke 435(neg. and zero seq.) | 0.0 … 5.0% | | 0.1% | | | | ± 0.15% | | |
| | Fluke 434(neg. and zero seq.) | 0.0 … 5.0% | | 0.1% | | | | ± 0.5% | | |
| Current | (neg. and zero seq.) | 0.0 … 20% | | 0.1% | | | | ± 1% | | |
| **Transient capture** | | | | | | | | | | |
| Volts | cursor reading | ± 6000 Vpk | | 1 V | | | | ± 15% of cursor reading | | |
| | rms reading | 10 … 1000 Vrms | | 1 V | | | | ± 2.5% of Vnominal | | |
| Minimum detect duration | | 5 µs | | | | | | | | |
| Sampling rate | | 200kS/s | | | | | | | | |
| **Inrush mode** | | | | | | | | | | |
| Arms (AC+DC) | | 0.000 … 20.00 kArms[1] | | 0.001.. 10 Arms[1] | | | | ± 1% of meas ± 5 counts | | |
| Inrush Duration | | mm:ss:mmm between 7.5s … 30minutes selectable | | 10ms | | | | ± 20 ms (Fnominal = 50 Hz) | | |
| **Mains Signaling[4]** | | | | | | | | | | |
| Threshold levels | | Thresholds, limits and signaling duration is programable for two independent signalling frequencies. | | | | | | | | |
| Signaling frequency | | 60 … 3000 Hz | | 0.1 Hz | | | | | | |
| Relative V% | | 0% … 100% of | | 0.1% | | | | ± 0.4% | | |
| Absolute V3s (3 second average) | | 0.0 … 1000 V | | 0.1 V | | | | ± 5% of nominal voltage | | |
| **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 & Energy, Flicker, Unbalance and Mains Signaling[4] mode** | | | | | | | | | | |
| Sampling | | 5 readings/sec continuous sampling per channel | | | | | | | | |
| Recording time | | From 30 min with 1 second display resolution up to 450 days with 6 hour display resolution. | | | | | | | | |
| Zoom | | Up to 6x horizontal zoom | | | | | | | | |
| Memory | | 1800 min, max and avg points for each reading | | | | | | | | |
| | Duration | 30 min. | 2.5 h | 7.5 h | 15 h | 30 h | 150 hr | 450 hr | 900 hr | 75 days |
| | Resolution | 1 s | 5 s | 15 s | 30 s | 60 s | 5 min. | 15 min. | 30 min. | 1 hr |
| **Dips & Swells mode** | | | | | | | | | | |
| Sampling | | 100/120[2] readings/sec continuous sampling per channel | | | | | | | | |
| Recording time | | From 90 sec with 25msec display resolution up to 450 days with 3 hr display resolution. | | | | | | | | |
| Zoom | | Up to 12x horizontal zoom | | | | | | | | |
| Memory | | 3600 min, max and avg points for each reading | | | | | | | | |
| | Duration | 90 s | 180 s | 6 min. | 12 min. | 30 min. | 1 hr | 2.5 hr | 7.5 hr | 15 hr | 30 hr |
| | Resolution | 25 ms | 50 ms | 100 ms | 200 ms | 500 ms | 1s | 2.5 s | 7.5 s | 15 s | 30 s |
| **Inrush Currents and Flicker PF5 mode** | | | | | | | | | | |
| Sampling | | 100/120[2] readings/sec continuous sampling per channel | | | | | | | | |
| Recording time | | From 7.5 sec with 25msec display resolution up to 30 min with 500msec display resolution for Inrush measurements and up to 2hr with 2.5 sec display resolution for PF5 recordings. Recording time | | | | | | | | |
| Zoom | | Up to 12x horizontal zoom | | | | | | | | |
| Memory | | 3600 min, max and avg points for each reading | | | | | | | | |
| | Duration | 7.5 s | 15 s | 30 s | 90 s | 180 s | 6 min. | 12 min. | 30 min. | 1 hr | 2hr |
| | Resolution | 25 ms | 25 ms | 25 ms | 25 ms | 50 ms | 100 ms | 200 ms | 500 ms | 1 s | 2s |

# Technical Specifications Fluke 430 Series three-phase Power Quality Analyzers

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Logger mode** | | | | | | | | | |
| Sampling | Combination of 5 readings/sec and 100/1202 readings/sec continuous sampling per channel depending on the parameter measured | | | | | | | | |
| Recording time | Depends on selected readings and averaging time | | | | | | | | |
| Zoom | Two zoom positions, display all or 1x | | | | | | | | |
| Memory | User configurable shared memory, up to 15 MB on Fluke 435, up to 7 MB on Fluke 434[4] | | | | | | | | |
| Nr of readings on 3 phases + N | 1 | | | 10 | | | 100 | | |
| Averaging time | 0.5 s | 10 min | 2 hr | 0.5 s | 10 min | 2 hr | 0.5 s | 10 min | 2 hr |
| Max[7] duration using 15MB | 66 hr | 9 year | 100 year | 6 hr | 333 days | 10 year | 18 min | 31 days | 1 year |
| **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 resoluton | | | | | | | | |
| Memory | 1008 min, max and avg points for each reading, 10 minute resolution | | | | | | | | |
| Limits | According 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 40µs 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<br>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<br>Calculates apparent power using Vrms x Arms value over 10/12 cycle period<br>Total Apparent Power is root mean square of real and apparent power | | | | | | | | |
| VAR | Selectable Total of Fundamental reactive power display<br>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.<br>Includes 230V 50Hz lamp and 120V 60Hz lamp models | | | | | | | | |
| Transient capture | Captures waveform triggered on signal envelope.<br>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.<br>Each half-cycle interval is contiguous and non-overlapping as recommended by IEC 61000-4-30.<br>Markers indicate inrush duration. Cursors allow measurement of peak Arms half cycle. | | | | | | | | |
| Mains Signaling | Measurement are based on: either the corresponding 10/12-cycle r.m.s. value interharmonic bin or the rms of the four nearest 10/12-cycle rms value interharmonic bins per IEC 61000-4-30<br>Limit setup for Monitor mode follows EN50160 "Meistercurve" | | | | | | | | |
| Time Synchronisation | Optional GPS430 timesync module provides time uncertainty ≤ 20 ms or ≤ 16.7 ms2 for time tagging of events and time aggregated measurements. When synchoronisation becomes unavailable, time tolerance is ≤ 1-s/24 h | | | | | | | | |
| **Wiring Combinations** | | | | | | | | | |
| 3Ø WYE | Three phase four wire system WYE | | | | | | | | |
| 3Ø DELTA | Three phase three wire system Delta | | | | | | | | |
| 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 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) | | | | | | | | |
| 2_-ELEMENT | Three phase four wire system without voltage sensor on phase L2 / B | | | | | | | | |
| **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 30g, Vibration: 3g Sinusoid, Random 0.03g2/Hz according to MIL-PRF-28800F Class 2 | | | | | | | | |
| **Display** | Bright Full-Color LCD with CCFL backlight, 80cd/m2 | | | | | | | | |
| Size | 115.2 x 86.4 mm | | | | | | | | |
| Resolution | 320 x 240 pixels | | | | | | | | |
| Contrast and brightness | User adjustable, temperature compensated | | | | | | | | |
| **Memory** | | | | | | | | | |
| Screens | 50 screen memories | | | | | | | | |
| Data | 10 data memories for storing data including recordings | | | | | | | | |
| Logger | User configurable shared memory, up to 15 MB on Fluke 435, up to 7 MB on Fluke 434 | | | | | | | | |
| 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 | | | | | | | | |
| Weight | 2kg | | | | | | | | |

| Power | |
|---|---|
| Line power | Switchable 115V, 230V adapter with country specific plug |
| Power Adapter input voltage | 15...23 Vdc; use only Power Adapter BC430 |
| Battery power | Rechargeable NiMH BP190 (installed) |
| Battery operating time | > 7 hours |
| Battery charging time | 4 hours, 8 hours for /006 version (Instrument off) |
| Power saving | Adjustable time for dimmed backlight with on screen power indicator |
| **Standards** | |
| Measurement methods used | IEC61000-4-30 class A |
| Measurement performance | Fluke 435 IEC61000-4-30 Class A, Fluke 434 IEC61000-4-30 Class B |
| Power Quality | EN50160 |
| Flicker | IEC 61000-4-15 |
| Harmonics | IEC 61000-4-7 |
| **Cross talk** | |
| Between V inputs | -60 dB @ Fnominal |
| Voltage to current input | -95 dB @ Fnominal |
| **Safety** | |
| Compliance | IEC/EN61010-1 (2nd edition) pollution degree 2;<br>CAN/CSA C22.2 No 101.1<br>ANSI/ISA S82.01 |
| Max voltage on banana input | 1000 V CAT III / 600 V CAT IV |
| Max voltage on current BNC input | 42 Vpeak |
| **Environmental** | |
| Operating temperature | 0°C to +50°C battery only, 0°C to +40°C with adapter, within spec +15°C to +35°C |
| Storage temperature | -20 °C to +60 °C |
| Humidity | 10 .. 30 °C: 95% RH non condensing<br>30 .. 40 °C: 75% RH non condensing<br>40 .. 50 °C: 45% RH non condensing battery only |
| Maximum operating altitude | 3000m. Derate to 1000 V CAT II / 600 V CAT III / 300 V CAT IV above 2000m |
| Maximum storage altitude | 12km |
| Warranty | 3 years on mainframe, 1 year on included accessories |
| **Printers and Interface** | |
| Type | Serial, optically isolated. Compatible with PM9080 (RS-232) or OC4USB (USB) |
| Baud rate | 1200, 2400, 9600 … 57k6 |
| Print out facility (B&W only) | Via optional adapter PM9080 or PAC 91 |
| Print protocol | Epson FX LQ, Deskjet, LaserJet , DPU-414 or PostScript |

# Accessories Fluke 430 Series

| Accessories | | |
|---|---|---|
| **Included** | **435** | **434** |
| | Water-tight hard case with rollers C435 | Hard carrying case with clamp holders C430 |
| | 4 current clamps, i430-Flexipack | 4 current clamps, i400s |
| | 5 Test leads, 4black, 1 green | 5 Test leads, 4black, 1 green |
| | 5 Alligator clips, 4black, 1 green | 5 Alligator clips, 4black, 1 green |
| | Battery Charger Eliminator, BC430 | Battery Charger Eliminator, BC430 |
| | FlukeView Software, SW43W | FlukeView Software, SW43W |
| | Power Log Software | |
| | Optical Cable for USB , OC4USB | Optical Cable for USB, OC4USB |
| | Color localization set, WC100 | Color localization set, WC100 |
| | Getting Started printed | Getting Started printed |
| | User Manual (CD-ROM) | User Manual (CD-ROM) |

**Ordering Information**

| | |
|---|---|
| Fluke 435 | Power Quality Analyzer (three-phase) with Logger Function |
| Fluke 434 | Power Quality Analyzer (three-phase) |
| Fluke 434Kit | Logger Upgrade Kit: Adds the Logger Function of the 435 to the 434 |
| OC4USB | Serial Interface Adapter/Cable (USB) |
| PM9080 | Serial Interface Adapter/Cable (RS232) |
| SW43W | FlukeView Software |

1 depending clamp scaling, volt scaling 1:1
2 50Hz/60Hz nominal frequency according to IEC 61000-4-30
3 Add clamp accuracy
4 The logger and Mains Signaling function are optional for the Fluke 434 and standard available on the Fluke 435
5 Measured on reference voltage input A/L1
6 Maximum time 9999 hours
7 Estimated duration
8 Add +/- (n-1) x 2.5° for Amp. when using i430-flex-4pk

# Technical Specifications Fluke 43B single-phase Power Quality Analyzer

The Fluke 43B Power Quality Analyzer is optimized for industrial measurements on the 50 Hz fundamental frequency. Since its usable fundamental frequency range extends from 10 Hz to 400 Hz, the 43B is ideal for industrial, aviation, marine and railway applications.

| Mode | Usable bandwidth | Harmonics on 400 Hz fundamental | Typical accuracy for 400 Hz fundamental |
|---|---|---|---|
| Volt Amp Hz | 10 Hz … 3.5 kHz | 9th harmonic | 5% |
| Power | 20Hz … 2 kHz | 5th harmonic | 10% |
| Harmonics | 10 Hz … 3.5 kHz | 9th harmonic | 10% Channel 1<br>50% Channel 2 |

Note: Current harmonics measurements can be done via channel 1 with improved accuracy

# Technical Specifications Fluke 43B single-phase Power Quality Analyzer

Accuracies are stated as ± (percentage of reading + counts) without probes unless otherwise noted.
Specifications are valid for signals with a fundamental between 40 and 70 Hz.

| Input Characteristics | Ranges | Accuracy |
|---|---|---|
| Input impedance | 1 MΩ, 20 pF | |
| Voltage rating | 600 Vrms, CAT III | |
| **Volt / Amps / Hertz** | | |
| True-rms voltage (AC+DC) | 5.000 V, 50.00 V, 500.0 V, 1250 V* | ± (1 % + 10 counts) |
| True-rms current (AC+DC) | 50.00 A, 500.0 A, 5.000 kA, 50.00 kA, 1250 kA | ± (1 % + 10 counts) |
| Frequency | 10.0 Hz to 15.0 kHz | ± (0.5 % +2 counts) |
| CF Crest Factor | 1.0 to 10.0 | ± (5% + 1 count) |
| **Power** | | |
| W, VA, VAR Reactive Power 1-phase and 3-phase,3 conductor balanced loads | 250 W 2.50 kW, 25.0 kW, 250 kW, 2.50 MW, 25 MW, 250 MW, 625 MW, 1.56 GW | ± (2 % + 6 counts) Total Power<br>± (4 % + 4 counts) Fundamental Power |
| PF Power Factor | 0.00 to 1.00 | ± 0.04 |
| DPF Displacement Power Factor | 0.00 to 0.25<br>0.25 to 0.90<br>0.90 to 1.00 | not specified<br>± 0.04<br>± 0.03 |
| Hz Frequency Fundamental | 40.0 to 70.0 Hz | ± (0.5 % + 2 counts) |
| **Harmonics** | | |
| Volts, Amps, Watts | Fundamental | V,A ± (3 % + 2 counts),<br>W ± (5 % + 2 counts) |
| | 2 to 31st Harmonic | V,A ± (5 % + 3 counts),<br>W ± (10 % + 10 counts) |
| | 32 to 51st Harmonic | V,A ± (15 % + 5 counts),<br>W ± (30 % + 5 counts) |
| Frequency of fundamental | 40 Hz to 70 Hz | ± 0.25 Hz |
| Phase | Volt & Amps (between Fund. & Harmonic) | 2nd (± 3°) … 51st (±15°) |
| | Watts (between Volt Fund. & Amps Harmonic) | Fund (± 5°) … 51st (±15°) |
| K-Factor (Amps & Watts) | 1.0 to 30.0 | ±10 % |
| THD | 0.00 to 99.99 | ± (3% + 8 counts) |
| **Sags & Swells** | | |
| Recording times (selectable) | 4 min to 16 days | |
| Vrms Actual, Vrms max, min (AC + DC) | 5.000 V, 50.00 V 500.0 V, 1250 V* | Readings ± (2% +10 counts)<br>Cursor readings ± (2% + 12 counts)<br>Cursor Readings Average ± (2% +10 counts) |
| Arms Actual, Arms max, min (AC + DC) | 50.00 A, 500.0 A, 5.000 kA, 50,00 kA | |

| Recording | Ranges | Accuracy |
|---|---|---|
| Recording times (selectable) | 4 min to 16 days | |
| Parameters | Choose one or two parameters from one of the groups below | |
| V/A/Hz | Line Voltage, Current, Frequency | |
| Power | Watts, VA, VAR, PF, DPF, Frequency | |
| Harmonics | THD, Volt(Fund. & Harmonic), Amps(F&H) Watts(F&H) Freq.(H), %(H) of total, Phase(H), KF | |
| Ohms | Ohms, Diode, Continuity, Capacitance | |
| Temperature | °C or °F | |
| Scope | DC Voltage, DC Current, AC Voltage, AC Current, Frequency, Pulse Width + or -,Phase, Duty cycle + or -, Peak max, Peak min, Peak min-max, Crest Factor | |
| **Transients** | | |
| Minimum pulse width | 40 ns | |
| Useful bandwidth input 1 | DC to 1 MHz (with test leads TL24) | |
| Number of transients | 40 | |
| Voltage threshold settings | 20%, 50%, 100%, 200% above or below reference signal | |
| Reference signal | After START, the Vrms and frequency of the signal are measured. From these data a pure sinewave is calculated as reference for threshold setting. | |
| Vpeak min, Vpeak max at cursor | 10 V, 25 V, 50 V, 125 V, 250 V, 500 V, 1250 V | ± 5% of full scale |

*Rated 600V CAT III

| Inrush Current | Ranges | Accuracy |
|---|---|---|
| Current ranges (selectable) | 1 A, 5 A, 10 A, 50 A, 100 A, 500 A, 1000 A | |
| Inrush times (selectable) | l s, 5 s, 10 s, 50 s, 100 s, 5 min | |
| Cursor readings | A peak max at cursor 1 and cursor 2 | ± 5% of full scale |
| Time between cursors** | 4 to 235 pixels | ± (0.2% + 2 pixels) |
| **Scope, dual channel scope with measurement reading** | | |
| Input Impedance | | |
| Input 1 | 1 MΩ//12 pF; with BB120: 20 pF | ± 2 pF; with BB120 ±3 pF |
| Input 2 | 1 MΩ//10 pF; with BB120: 18 pF | ± 2 pF; with BB120 ±3 pF |
| **Vertical** | | |
| Voltage ranges | 50 mV/div to 500V/div | ± (1% + 2 pixels) |
| Vertical sensitivity, resolution | 5 mV/div to 500V/div, 8 bit (256 levels) | |
| Bandwidth channel [1] (voltage) | DC to 20 MHz at inputs, or with BB120 and VPS40 (standard with Fluke 43B); 1 MHz with TL24 Leads | |
| Bandwidth channel [2] (current) | DC to 15 kHz at inputs<br>10 kHz with supplied current clamps | |
| Coupling | DC, AC (10 Hz -3 dB) | |
| **Horizontal** | | |
| TimeBase modes | Normal, roll, single | |
| TimeBase ranges | 60 s/div to 20 ns/div | ± (0.4% + 1 pixel) |
| Sampling rate | 25 MS/s | |
| Record length (min / max samples) | 512 per channel | |

| | | |
|---|---|---|
| Trigger source | Input 1 or Input 2 or Automatic selection | |
| Trigger Mode | Automatic Connect-and-View™, Free Run, Single Shot. | |
| Connect-and-View™ | Advanced automatic triggering that recognizes signal patterns and automatically adjusts triggering, timebase and amplitude. Automatically displays stable pictures of complex and dynamic signals like motor drive and control signals. | |
| Pre-trigger | Up to 10 divisions | |
| Measurement readings, per channel selectable | Volts & Amps (DC, AC, AC + DCrms, Peak max, Peak min, Peak min / max ), Frequency, Duty cycle + or - , Phase, Pulse Width + or -, Crest factor | |
| **Ohms, Diode, Continuity, Capacitance** | | |
| Ohms | 500.0 Ω 5.000 kΩ, 50.00 kΩ, 500.0 kΩ, 5.000 MΩ, 30.00 MΩ | ± (0.6% +5 counts) |
| Diode voltage | 0 to 3.000 V | ± (2% +5 counts) |
| Continuity, shorts > 1 ms | Beeper on at < 30Ω ± 5Ω, | |
| Capacitance | 50.00 nF, 500.0 nF, 5.000 µF, 50.00 µF, 500.0 µF | ±(2% +10 counts) |
| Temperature*** | -100.0 °C to 400.0 °C, -200.0 °F to 800.0 °F | ±(0.5% +5 counts) |
| Max current, max open circuit volt. | 0.5 mA, < 4 V (all functions above) | |
| **Memory** | | |
| Number of screens | 20 | |
| **General specifications** | | |
| **Optical Isolated RS-232 Interface** | | |
| To printer | Supports HP LaserJet, DeskJet, Epson FX/LQ and Postscript printers with optional PAC91 Printer Adapter Cable | |
| To PC | FlukeView® Power Quality Analyzer software with PM9080 Interface Adapter included with 43B and 43Kit | |
| **FlukeView® Power Quality Software** | | |
| Hardware requirements | PC or 100% compatible with Windows 95, 98, Me, 2000, NT4.0. | |
| **Power** | | |
| Line voltage adapter/battery charger included | | |
| Installed battery | Rechargeable NiCd pack (4 to 6 Vdc) | |
| Operating time | 4 hours | |
| Charging time | 4 hours (unit OFF) 12 hours (unit ON) | |
| Refresh Cycle | 8 to 14 hours (to keep NiCd battery capacity optimal) | |
| **Environmental** | | |
| Operating Temperature | 0°C to 50°C (32°F to 122°F) | |
| Shock & Vibration | MIL 28800E, Type 3, Class III, Style B | |
| Case | IP51 (dust, drip water proof) | |
| **Mechanical Data** | | |
| Size (H x W x D) | 232 x 115 x 50 mm | |
| Weight | 1.1 kg | |
| **Safety** | | |
| For measurements on 600 Vrms Category III installations, Pollution Degree 2 in accordance with EN61010-1 (1993) (IEC1010-1) ANSI/ISA S82.01-1994 CAN/CSA-C22.2 No. 1010.1-92 UL3111-1 | | |
| Surge protection | 6 kV on input 1 and 2 | |
| Floating measurements | 600 Vrms from any terminal to ground | |
| **Warranty** | 3 years parts and labor on Fluke 43B, 1 year on accessories | |

** 1 pixel = inrush time/250

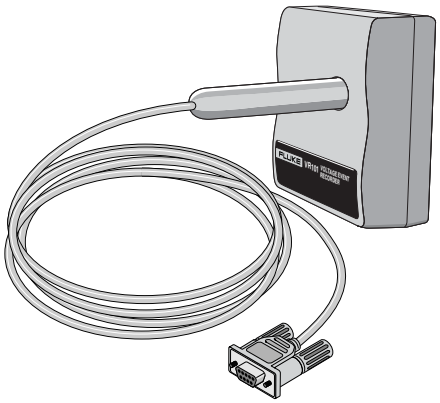
*** Requires optional temperature accessory

## Ordering Information

**Fluke 43Basic** Power Quality Analyzer (Single-phase)
**Fluke 43B** Power Quality Analyzer (Single-phase)
**Fluke 43Kit** Power Quality Analyzer (Single-phase)

| **Standard available in all models** | **43Basic** | **43B** | **43Kit** |
|---|---|---|---|
| Fluke 43B Power Quality Analyzer | ● | ● | ● |
| BP120 NiCd Battery Pack (installed) | ● | ● | ● |
| PM 8907 Battery Charger/Line Voltage Adapter | ● | ● | ● |
| TL24 Test Leads | ● | ● | ● |
| AC20 Industrial Test Clips | ● | ● | ● |
| TP4 Slim Reach Test Probe Set (4 mm) | ● | ● | ● |
| BB120 Banana-to-BNC Adapter Plug | ● | ● | ● |
| **Model difference** | | | |
| i400s AC Current Clamp (200 A) | ● | | |
| 80i-500s AC Current Clamp (500 A) | | ● | ● |
| SW43W FlukeView® Software for Windows | | ● | ● |
| PM 9080 Serial Interface/Adapter Cable | | ● | ● |
| C120 Hard Case | | ● | ● |
| TP1 Slim Reach Test Probe Set (flat blade) | | ● | ● |
| AC85 Large Jaw Alligator Clips | | ● | ● |
| Power Quality Video | | ● | ● |
| Users Manual / Application Guide | | ● | |
| Manual CD 43B | ● | | ● |
| **Promotional Model Numbers** | | | |
| VPS40 Voltage Probe | | ● | |
| Fluke 61 IR Thermometer | | ● | |
| Fluke VR101S Voltage Event Recorder System | | | ● |

# Technical Specifications Fluke VR101S Voltage Event Recorder System



**Ordering Information**
(Note: At least one VR101S is required for proper operation)
VR101S Voltage Event Recorder System
VR101 Voltage Event Recorder

**Computer Hardware Requirements for EventView software**
IBM PC or 100% compatible,
with Windows® 3.1 or Windows 95/98/NT/XP or 2000 installed and operating
At least one free RS-232 serial port
A pointing device (recommended)
2 MB hard drive space
4 MB RAM (8 MB for Windows 95/98 or higher)

**Included Accessories VR101S**
VR101 Voltage Event Recorder,
Optical interface cable, 9-to-25 pin adapter,
EventView Software on two 31/2 inch floppies, Users Manual

**Included Accessories VR101**
VR101 Voltage Event Recorder,
Instruction Sheet

| **Electrical** | | | |
|---|---|---|---|
| (voltage versions, plug style, and manual languages are determined by country) | | | |
| **Voltage Version** | **Operating range** | **Nominal frequencies** | **Power consumption** |
| 120 V | 70 V to 140 V | 50 Hz or 60 Hz | 2 W |
| 230 V | 140 V to 270 V | 50 Hz or 60 Hz | 3 W |
| **Sags, Swells and Outage Measurements** | | | |
| **Voltage Version** | **Range** | **Accuracy** | **Resolution** |
| 120 V Hot-to-neutral | 0 to 200 V rms | ±2 V rms | 1 V rms |
| Neutral-to-ground | 3 to 200 V rms | ±2 V rms | 1 V rms |
| 230 V Hot-to-neutral | 0 to 400 V rms | ±4 V rms | 2 V rms |
| Neutral-to-ground | 3 to 120 V rms | ±2 V rms | 1 V rms |
| **Transient Measurements** | | | |
| | **Range** | **Accuracy** | **Resolution** |
| Hot-to-neutral | 100 to 2500 V peak | ±(10% reading +10 V) | 10 V |
| Neutral-to-ground | 50 to 2500 V peak | ±(10% reading +10 V) | 10 V |
| Phase angle | 20° to 180° | ±1° | 1° |
| | 200° to 360° | | |
| Minimum pulse width: 1 µs | | | |
| **Frequency Measurements** | | | |
| | **Range** | **Accuracy** | **Resolution** |
| | 45 to 65 Hz | ±0.1 Hz (3 cycles min) | 0.1 Hz |
| **Time Measurements: Events < 1 second** | | | |
| | **Accuracy** | **Resolution** | |
| Hot-to-neutral | ±0.5 cycles | 0.5 cycles | |
| Neutral-to-ground | ±1 cycle | 1 cycle | |
| **Events ≥1 second (time stamp)** | | | |
| | **Accuracy** | **Resolution** | |
| | ±(2 sec/day + 8 sec) | 8 sec | |

| **General Specifications** | |
|---|---|
| Memory size | 4000 events |
| **Power** | |
| Battery type | 3.5V lithium (non-replaceable) |
| Battery life | 7 years |
| **Mechanical** | |
| Physical size | 85 mm x 68 mm x 35 mm |
| Weight | 120g |
| **Environmental** | |
| Operating temperature | -40 to 70°C |
| Relative Humidity | 0 to 95% (non-condensing) |
| **Safety** | |
| | CSA Certification pending, CSA-NRTL (to UL 3111) certification pending, Complies with requirements of EN61010-1:1993 |
| **Warranty** | 1 year |

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