FLUKE®

Fluke 1760 Three-Phase Power Quality Recorder *Topas*

Technical Data

Class-A compliance for the most demanding power quality tests

Designed for troubleshooting in utility and industrial power distribution systems in medium- and low-voltage networks, the three-phase Fluke 1760 Power Quality Recorder provides the flexibility to customize thresholds, algorithms, and measurement selections. It has 8 channels (4 currents /4 voltages or 8 voltages) and captures the most comprehensive details on user-selected parameters and allows for later analysis and reporting. There are four models to choose from:

Fluke 1760

	1760 Basic	1760TR Basic	1760	1760TR
Power quality statistics according to EN50160	•	•	•	•
Voltage event list (dips, swells and interruptions)	•	•	•	•
Continuous recording of:				
Voltage	•	•	•	•
Current	•	•	•	•
Power P, Q, S	•	•	•	•
Power factor	•	•	•	•
kWh	•	•	•	•
Flicker	•	•	•	•
Unbalance	•	•	•	•
Frequency	•	•	•	•
Voltage and current harmonics to the 50th/ Interharmonics	•	•	•	•
THD	•	•	•	•
Mains signaling	•	•	•	•
Triggered recordings	•	•	•	•
Online mode (Oscilloscope, transients and events)	•	•	•	•
Fast transient analysis up to 10 MHz		•		•
4 600V voltage probes			•	•
4 dual-range flexible current probes (1000 A / 200 A ac)			•	•
GPS time sync receiver			•	•
Memory	2 GB Flash memory			

Applications

Detailed disturbance analysis – Perform high-speed transient analysis and uncover root cause of equipment malfunction for later mitigation and predictive maintenance. The fast transient option, with its 6000 V measurement range, allows capture of lightning strikes.

Class-A quality-of-service compliance – Validate incoming power quality at the service entrance. Thanks to Class A compliance, the Fluke 1760 allows undisputable verification.

Event correlation at multiple locations – Thanks to GPS time synchronization, users can quickly detect where a fault occurred first, either inside or outside the facility.

Galvanic separation and DC coupling: Allows complete measurements for example on UPS systems including the battery voltage and power output.

Power quality and power load studies – Assess baseline power quality to validate compatibility with critical systems before installation and verify electrical system capacity before adding loads.

User-configurable operation

The versatile measurement algorithms and trigger settings allow the expert user to optimize the 1760 for each application to capture exactly the data required. Data can be transferred to a computer directly or via an Ethernet network, and retrieved during logging without interrupting the measurements.

Rugged and reliable

The instrument, accessories, and power supply help you safely conduct tests with 600 V CAT III rating and EN 61010-1 conformance. The Fluke 1760 features a fully insulated housing, which helps protect the user, equipment, and surroundings from electrical shock. With a 2 GB compact flash memory instead of a hard disk, there are no rotating parts inside the instrument, increasing its reliability and durability for everyday use.

Broad measurement range

Developed in cooperation with power utilities providers, the Fluke 1760 provides statistical analysis of power quality according to EN 50160. It automatically captures voltage and current waveform data on all phases simultaneously. A variety of power quality and power parameters are measured, including RMS values, flicker, voltage dips, voltage swells, voltage unbalance, current and voltage harmonics to the 50th, interharmonics, THD, mains signaling, reactive power, transients, and power factor.

Plug and play

The Fluke 1760 power quality recorder features easy plug and play setup for immediate use. The current and voltage probes are plugged in separately into the instrument, which automatically detects, configures, and provides power to the probes. All accessories are individually calibrated and can be shared with multiple Fluke 1760 recorders.

Fully Class-A Compliant

The Fluke 1760 is fully compliant with the new IEC 61000-4-30 Class-A standard, which defines the measurement methods required for each power parameter in order to obtain reliable, repeatable, and comparable results. With the GPS time synchronization accessory, data recorded with multiple instruments can be correlated with Class-A precision.

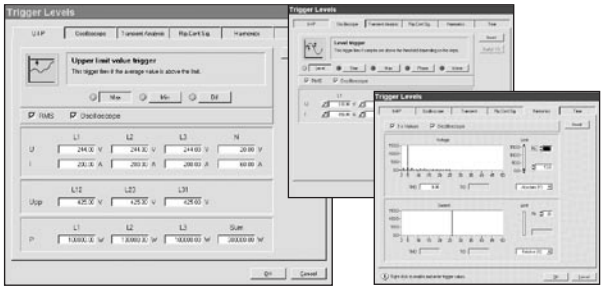
What is Class-A conformity?

Power quality measurement is a relatively new, and quickly evolving field. There are hundreds of manufacturers around the world with unique measurement methodologies. Whereas basic single- and three-phase electrical measurements like rms voltage and current were defined long ago, many power quality parameters were not previously defined, forcing manufacturers to develop their own algorithms. With so much variation between instruments, electricians tend to waste too much time trying to understand an instrument's capabilities and measurement algorithms instead of understanding the quality of the power itself!

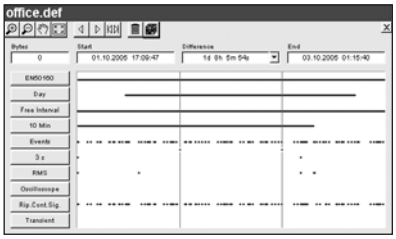
The new IEC 61000-4-30 Class-A standard takes the guesswork out of selecting a power quality instrument. The standard IEC 61000-4-30 defines the measurement methods for each parameter to obtain reliable, repeatable and comparable results. In addition, the accuracy, bandwidth and minimum set of parameters are all clearly defined.

PQ Analyze software

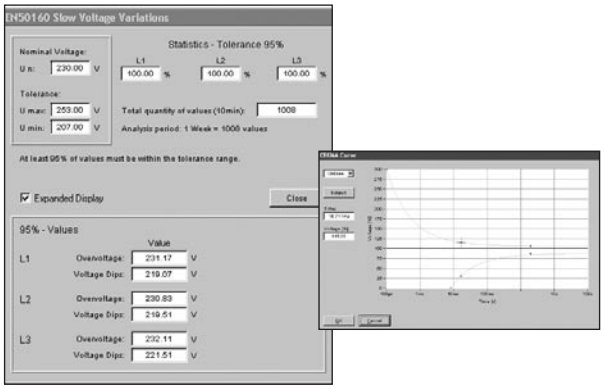
The Fluke 1760 includes comprehensive software for detailed power quality analysis on PCs with Windows® based operating systems. In the online function, the software enables remote instrument setup, job processing, real–time verification of actual measurement values, and data download in the online function. Data can be viewed in trend diagrams for root cause analysis or in statistical summaries in a variety of formats. You can also generate professional reports with the Report Writer function.



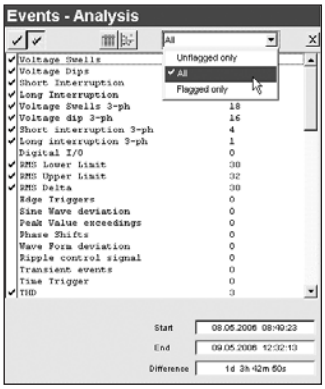
Individual trigger settings to capture events, RMS values, waveforms, and fast transients. The 1760 comes with default settings, so that the user does not need to set triggers in standard applications. Individual settings can be stored for next time.



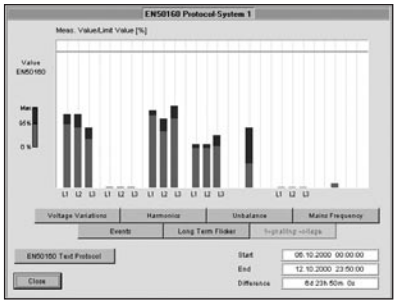
Overview of data for each measurement function. The user can select which data is to be downloaded to the PC.



For root cause analysis, different measurements such as flicker, voltage and THD can be shown in the same time plot, to help you quickly identify the cause of a disturbance.

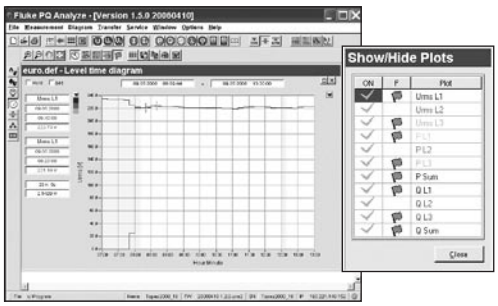


The Event List summarizes how often an event occurred during the selected time period.

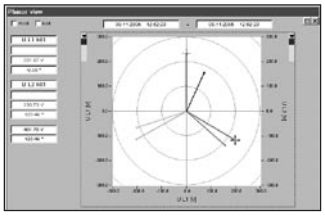


Quick power quality assessment – Summary overview of seven power quality parameters on one dashboard according to EN 50160.

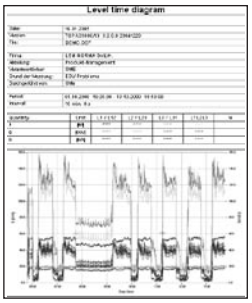
By double–clicking on an event, the software displays any trends related to this event.



The 1760 provides flagging of data according to IEC 61000–4–30 Class–A. The flagging feature alerts the user that either a dip, swell or interruption occurred during a specific time interval. Values out of nominal ranges are marked by either a colored background or with a flag symbol.



Using an Ethernet connection, the power can be monitored in real–time to view phasor diagrams, trends, waveforms, meter screens and more.



The report–generator function allows the user to create custom professional reports quickly and easily.

Overview of measurement functions	
Statistical Evaluation	Power quality statistics according to EN 50160 and DISDIP tables like ITIC, CEBEMA, ANSI
Event List	Dips, swells and interruptions are detected and stored in the event list. Also any trigger which fires generates an event added to this list. The Event list shows the exact time when the event occurred as well as the duration and magnitude. Sorting by several attributes of these events is possible to select one for further root cause analysis. RMS values, transients and fast transients can be stored if a trigger fires.
Continuous Recording	Fluke 1760 records RMS values together with corresponding minimum and maximum values for: • Voltage • Current • Power P, Q, S • Power Factor • kWh • Flicker • Unbalance • Frequency • Harmonics/Interharmonics continuously with the following time aggregations: Day 10min Free Interval, e.g.: 15 min, 2h
Triggered Recordings	RMS: Aggregation time is adjustable between 10 ms (1/2 cycle), 20ms (1 cycle), 200ms (10/12 cycles) or 3 sec (150/180 cycles). Calculating RMS values, Harmonics and Interharmonics is performed synchronous to the power frequency. Basic aggregation for harmonics and interharmonics is 200ms Oscilloscope: Sample rate is 10,24 kHz for all 8 channels Fast Transients: Sample rate is selectable from 100 kHz to 10 MHz for channel 1–4 FFT of Fast Transients
Mains Signalling	Phases and N–conductor, Voltage and current
Online Mode	Variable refresh rate. This feature allows verification of instrument set up and delivers a quick overview of oscilloscope, transients and events.

Specifications

General specifications	
Intrinsic uncertainty	refers to reference conditions and is guaranteed for two years
Quality system	developed, manufactured as per ISO 9001: 2000
Environment conditions Operating temp. range Working temp. range Storage temp. range Reference temperature Climatic class Max. operating altitude	 0 °C ... +50 °C; 32 °F ... +122°F –20 °C … +50 °C; –4°F ... +122°F –20 °C ... +60 °C; –4°F ... 140°F 23 °C ± 2 K; 74°F ± 2 K B2 (IEC 654–1), –20 °C … +50 °C; –4°F ... +122° 2000 m: max. 600 V CAT IV*), power supply: 300 V CAT III 5000 m: max 600 V CAT III*), power supply: 300 V CAT II *) depending on sensor
Reference conditions	Environment temp.: 23 °C ± 2 K ; 74°F ± 2 K Power supply: 230 V ± 10 %, Power frequency: 50 Hz / 60 Hz Signal: declared input voltage U_{din} Averaging: 10 minute intervals
Housing	insulated, robust plastics housing
EMC Emission Immunity	 Class–A as per IEC/EN 61326–1 IEC/EN 61326–1
Power supply Range Safety Power consumption Battery pack	 AC: 83 V … 264 V, 45...65 Hz DC: 100 V ... 375 V IEC/EN 61010–1 2nd edition 300 V CAT III max. 54VA NIMH, 7.2 V, 2.7 Ah In case of a power supply failure an internal battery maintains the supply for up to 40 minutes. Afterwards, or in case of discharged accumulators the Fluke 1760 is turned off and continues the measurements with the latest settings as soon as the supply voltage returns. The battery can be replaced by the user.
Display Power LED Channel LEDs	Fluke 1760 features LED indicators for the status of the 8 channels, phase sequence, power supply (mains or accumulator), memory usage, time synchronization, and data transfer. • Permanent light: normal power supply from mains. • OFF: supply via internal accumulator in case of a power failure. 3–color LEDs per channel for: • overload condition • under load condition signal level in nominal rang
Data memory	2 GB Flash memory depending on model
Memory model	Linea
Interfaces	Ethernet (100MB/s), compatible to Windows® 98/ME/NT/2000/XP RS 232, external modem via RS 232
Baud rate for RS 232	9600 Baud … 115 kBaud
Dimensions (H x W x D)	325 mm x 300 m x 65 mm; 2.8 x 11.8 x 2.6 in.
Weight (without accessories)	appr. 4.9 kg; 10.8 lbs.
Warranty	2 year
Calibration interval	1 year recommended for Class–A, otherwise 2 years

Specifications

Signal conditioning	
Range for 50 Hz systems	50 Hz ± 15 % (42.5 Hz … 57.5 Hz)
Range for 60 Hz systems	60 Hz ± 15 % (51 Hz … 69 Hz)
Resolution	16 ppm
Sampling frequency for 50 Hz power frequency	10.24 kHz, The sampling rate is synchronized to mains frequency.
Uncertainty for frequency measurements	< 20 ppm
Uncertainty of internal clock	< 1s / day
Measurement intervals Min-, Max-values Transients	Aggregation of the interval values as per IEC 61000-4-30 Class-A Half cycle, e.g.: 10 ms RMS values at 50Hz Sample rate 100 kHz …10 MHz per channel
Harmonics	as per IEC 61000-4-7:2002: 200 ms
Flicker	as per EN 61000-4-15:2003: 10 min (Pst), 2 h (Plt)

Measurement inputs	
Number of inputs	8 galvanically isolated inputs for voltage and current measurements.
Sensor safety	up to 600 V CAT IV depending on sensor
Basic safety	300 V CAT III
Nominal voltage (rms)	100 mV
Range (peak value)	280 mV
Overload capacity (rms)	1000 V, continuously
Voltage rise rate	max. 15 kV / µs
Input resistance	1 MΩ
Input capacitance	5 pF
Input filter	Each channel is equipped with a passive low-pass filter, an anti-aliasing filter and a 16-bit A/D converter. All channels are sampled synchronously with a common quartz-controlled clock pulse. The filters protect against voltage transients and limit the signal rise rate, reduce high frequency components and especially the noise voltage above half the sampling rate of the A/D converter by 80 dB, thus achieving very small measuring errors in an exceptionally large amplitude range. This is also valid under extreme operating conditions like transient voltages at the output of converters.

Uncertainties	
Uncertainty at reference conditions With Sensor 1000 V With Sensor 600 V	Uncertainty including the voltage sensors is in compliance with IEC 61000-4-30 Class-A. All voltage sensors are suitable for DC ...5 kHz 0,1% at Udin = 480 V and 600 V P-N 0,1% at Udin = 230 V P-N
Intrinsic uncertainty for harmonics	Class I as per EN 61000-4-7:2002
Reference conditions	23 °C ± 2 K < 60 % rH; 74 °F ± 2 K < 60 % rH Warmed up instrument > 3h Power supply: 100 V ... 250 V ac
Temperature drift:	100 ppm / K
Aging:	< 0.05 % / year
Common mode rejection	> 100 dB at 50 Hz
Temperature drift	Change of amplification through temperature: < 0.005 %/K.
Aging	Change of amplification due to ageing: < 0.04 %/year
Noise	Noise voltage, input short-circuited: < 40 µV.
DC	± (0.2% rdg + 0.1% sensor)

Optional probe accessories

Voltage probes

Model no.	Type	Range rms	Vnom	Vmax. Contin.	Fast Transient Range $V_{p<1ms}$	Intrinsic error	Operating voltage
TPS VOLTPROBE 10 V	VOLTAGE PROBE 10 V	0.1 V to 17 V	10 V	100 V	-	0.15%	150 V CAT **IV**
TPS VOLTPROBE 100 V	VOLTAGE PROBES 100 V	1 V to 170 V	100 V	1000 V	6000	0.15%	600 V **CAT IV**
TPS VOLTPROBE 400 V	VOLTAGE PROBES 400 V	4 V to 680 V	400 V	1000 V	6000	0.15%	600 V **CAT IV**
TPS VOLTPROBE 750 V	VOLTAGE PROBE 400 V/750 V PEAK	4 V to 680 V	400 V	1000 V	5 to 750 detects voltage harmonics > 50st with fast transient	0.2%	600 V **CAT IV**
TPS VOLTPROBE 600 V	VOLTAGE PROBE 600 V	10 V to 1000 V	600 V	1000 V	6000	> 0.1%	600 V **CAT IV**
TPS VOLTPROBE 1 KV	VOLTAGE PROBE 1000 V	10 V to 1700 V	1000 V	2000 V	6000	> 0.1%	600 V **CAT IV**

Current probes and Shunts for AC and DC currents

Model No.	Type	Measuring Range selectable per software	Peak current for sinusoidal currents	Intrinsic error	Frequency Range	Operating voltage	Phase error	Jaw opening
TPS FLEX 18	Flexible Current Probe	1 A to 100 A 5 A to 500 A	240 A 1350 A	1 %	45 Hz to 3.0 kHz	300 V CAT IV	0.5 °	45 cm length 2 M cable
TPS FLEX 24	Flexible Current Probe	2 A to 200 A 10 A to 1000 A	480 A 2700 A	1 %	45 Hz to 3.0 **kHz**	600 V CAT **IV**	0.5 °	61 cm length 2 M cable
TPS FLEX 36	Flexible Current Probe	30 A to 3000 A 60 A to 6000 A	10 kA 19 kA	1 %	45 Hz to 3.0 **kHz**	300 V CAT **IV**	0.5 °	91 cm length 4 M cable
TPS CLAMP 10 A / 1 A	CLIP-ON CURRENT TRANS-FORMER	0.01 A to 1 A 0.1 A to 10 A	3.7 A 37 A	0.5 %	40 Hz to 10 **kHz**	300 V CAT **IV**	0.5 °	< 15 mm diameter or 15 X 17 mm bush bars
TPS CLAMP 50 A / 5 A	CLIP-ON CURRENT TRANS-FORMER	0.05 A to 5 A 0.5 A to 50 A	18 A 180 A	0.5 %	40 Hz to 10 **kHz**	300 V CAT **IV**	0.5 °	< 15 mm diameter or 15 X 17 mm bush bars
TPS CLAMP 200 A / 20 A	CLIP-ON CURRENT TRANS-FORMER	0.2 A to 20 A 2 A to 200 A	74 A 300 A	0.5 %	40 Hz to 10 **kHz**	300 V CAT **IV**	0.5 °	< 15 mm diameter or 15 X 17 mm bush bars
TPS SHUNT 20MA	SHUNT 20 mA ac/dc	0 to 55 mA	77.8 mA I_{max}=1.5A	0.2 %	DC to 3.0 **kHz**	300 V CAT II	0.1 °	-
TPS SHUNT 5A	SHUNT 5A ac/dc	0 to 10 A	21.9 A I_{max}=10 A	0.2 %	DC to 3.0 **kHz**	300 V CAT II	0.1 °	-

Errors in % of measuring range at 23 °C ± 2 K; 74 °F ± 2 K, for 48 to 65 Hz
Phase angle error at nominal current
I_{max} maximum current without time limit (for ac and dc shunts)

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Ordering Information

Fluke 1760 Basic Power Quality Recorder Topas
Fluke 1760TR Basic Power Quality Recorder Topas
Fluke 1760 Power Quality Recorder Topas
Fluke 1760TR Power Quality Recorder Topas

Includes:

- 2 GB internal Flash-memory
- PC software on CD-ROM
- 1 Ethernet cable for network connection
- 1 crosslink Ethernet cable for direct PC connection
- 1 mains cable
- Hardware and software manual
- 1 carrying bag

Recommended probe accessories

• TPS VOLTPROBE 10 V	10 V Voltage Probe (Range: 0.1 V to 17 V)
• TPS VOLTPROBE 100 V	100 V Voltage Probe (Range: 1 V to 170 V)
• TPS VOLTPROBE 400 V	400 V Voltage Probes (Range: 4 V to 680 V)
• TPS VOLTPROBE 750 V	400 V / 750 V Peak Voltage Probe (Range: 4 V to 680 V)
• TPS VOLTPROBE 600 V	600 V Voltage Probes (Range: 10 V to 1000 V)
• TPS VOLTPROBE 1 KV	1000 V Voltage Probe (Range: 10 V to 1700 V)
• TPS FLEX 18	Flexible Current Probe (Range: 1 A to 100 A / 5 A to 500 A)
• TPS FLEX 24	Flexible Current Probe (Range: 2 A to 200 A / 10 A to 1000 A)
• TPS FLEX 36	Flexible Current Probe (Range: 30 A to 3000 A / 60 A to 6000 A)
• TPS CLAMP 10 A / 1 A	Clip-on Current Transformer (Range: 0.01 A to 1 A / 0.1 A to 10 A)
• TPS CLAMP 50 A / 5A	Clip-on Current Transformer (Range: 0.05 A to 5 A / 0.5 A to 50 A)
• TPS CLAMP 200 A / 20 A	Clip-on Current Transformer (Range: 0.2 A to 20 A / 2 A to 200 A)
• TPS SHUNT 20 MA	20 mA ac/dc Shunt (Range: 0 to 55 mA)
• TPS SHUNT 5 A	5 A ac/dc Shunt (Range: 0 to 10 A)

Fluke. *Keeping your world up and running.*™

Fluke Corporation
P.O. Box 9090
Everett, WA USA 98206

Fluke Europe B.V.
P.O. 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 2 675 200
or Fax +31 (0)40 2 675 222
In Canada (905) 890-7600
or Fax (905) 890-6866
From other countries +1 (425) 446 -5500
or Fax +1 (425) 446 –5116

Visit us on the worldwide web at:
www.fluke.com

Fluke (UK) Ltd.
52 Hurricane Way
Norwich
Norfolk
NR6 6JB
United Kingdom
Tel.: (020) 7942 0700
Fax: (020) 7942 0701
E-mail: industrial@uk.fluke.nl

Visit us on the worldwide web at:
www.fluke.co.uk

Printed in the Netherlands 06/06
Data subject to alteration without notice.

Pub_ID: 11138-eng

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

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Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:
moschip.ru
moschip.ru_4
moschip.ru_6
moschip.ru_9