FLUKE®

Fluke 1760

Three-Phase Power Quality Recorder *Topas*

Technical Data

Class-A compliance for the most demanding power quality tests

The Fluke 1760 Three-Phase Power Quality Recorder is the ideal portable instrument for power quality experts. It is fully compliant to IEC 61000-4-30 Class-A, for advanced power quality analysis and consistent compliance testing. Designed for analysis of utility and industrial power distribution systems, in medium- and low-voltage networks, the Fluke 1760 provides the flexibility to customize thresholds, algorithms, and measurement selections. It captures the most comprehensive details on user-selected parameters and allows for later analysis and reporting.

- **Fully Class-A compliant:** Conduct tests according to the stringent international IEC 61000-4-30 Class-A standard
- **GPS time synchronization:** Correlate data with events or datasets from other instruments, with precision
- **Flexible and fully configurable thresholds and scale factors:** Allows user to pinpoint specific issues by defining the detailed criteria for detection and recording of disturbances.
- **Highest safety rating in the industry:** 600 V CAT IV/1000 V CAT III rated for use at the service entrance
- **Uninterrupted power supply (40 minutes):** Never miss important events – even record the beginning and end of interruptions and outages, to help determine the cause
- **10 MHz, 6000 Vpk waveform capture:** Get a detailed picture of even the shortest event
- **2 GB data memory:** Enables detailed, simultaneous recording of numerous power parameters for long periods of time
- **Comprehensive software included:** Provides trend diagrams for root cause analysis, statistical summaries, report writing and real-time data monitoring in the online mode
- **Plug and play:** Allows quick setup with automatic sensor detection; sensors are instrument powered, eliminating the need for batteries
- **Rugged field design:** Insulated housing and a solid state design with no rotating components, enable reliable testing under nearly any conditions

Applications

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

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

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

Simultaneous measurement of independent power systems — Built with Galvanic separation and dc coupling of voltage inputs, the instrument can conduct complete measurements on dissimilar power systems. For example, the Fluke 1760 can troubleshoot UPS systems by simultaneously recording 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.

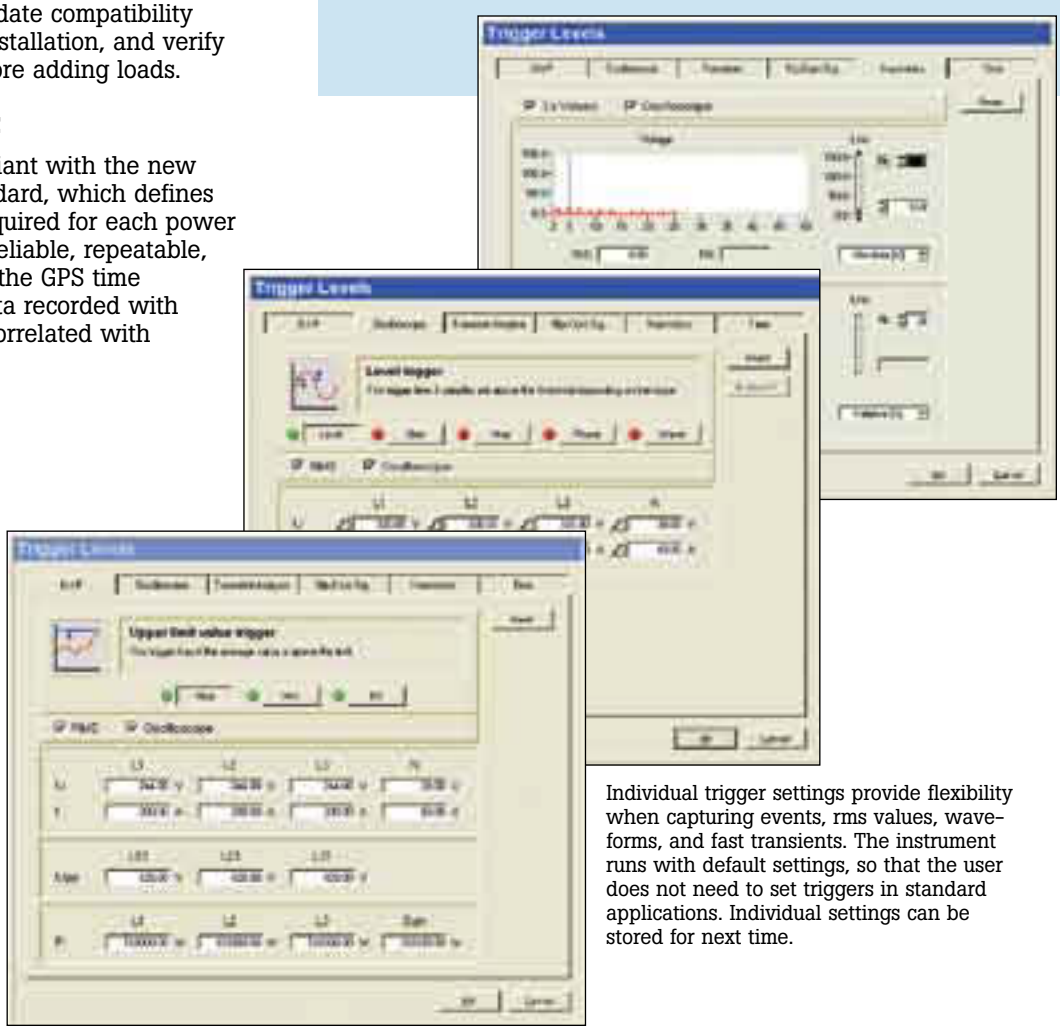
Fully Class-A compliant

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 under-stand 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.



Individual trigger settings provide flexibility when capturing events, rms values, waveforms, and fast transients. The instrument runs with default settings, so that the user does not need to set triggers in standard applications. Individual settings can be stored for next time.

User-configurable operation

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

Rugged and reliable

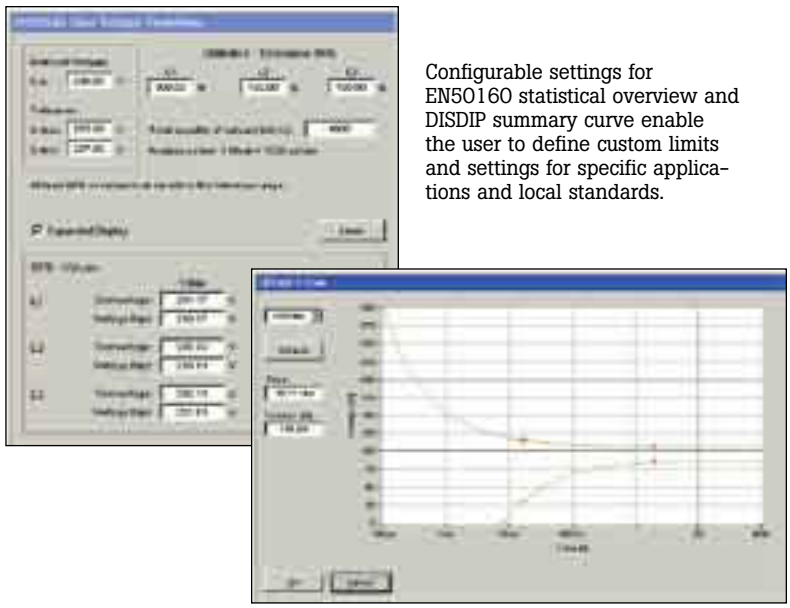
The instrument, accessories, and power supply help you safely conduct tests with a 600 V CAT IV rating per EN 61010-1 conformity requirements. The Fluke 1760 features a double insulated enclosure, which helps protect the user, equipment, and surroundings from electrical shock. With a 2 GB compact flash 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, the EN50160 statistical analysis presents a summary of the quality of voltage against internationally defined limits. When a threshold is exceeded, the Fluke 1760 automatically captures voltage and current waveform data on all phases simultaneously. Nearly every power quality and power parameter is 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.

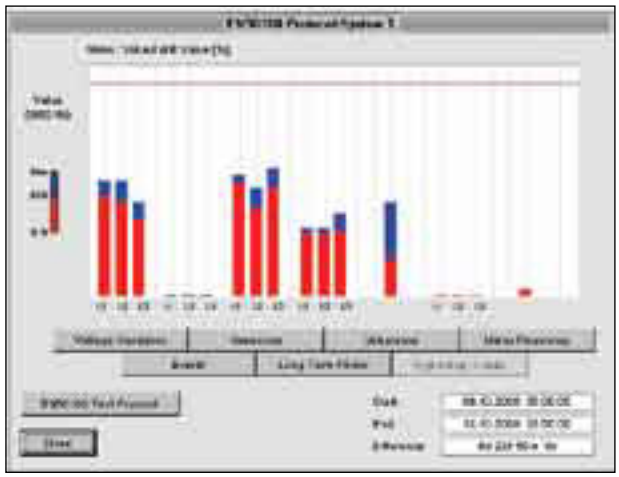
Plug and play

The Fluke 1760 Power Quality Recorder features easy plug and play setup for immediate use. The current and voltage probes are plugged in separately to 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.



Configurable settings for EN50160 statistical overview and DISDIP summary curve enable the user to define custom limits and settings for specific applications and local standards.

Overview of data for each measurement function. The user can save data transfer time by selecting which data is to be downloaded to the PC.



Quick power quality assessment – Summary overview of seven power quality parameters on one dashboard according to EN50160 international power quality standard.

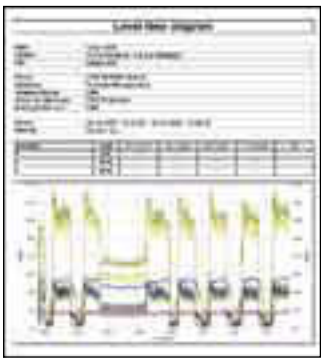
The event list summarizes how often an event occurred during the selected time period.

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

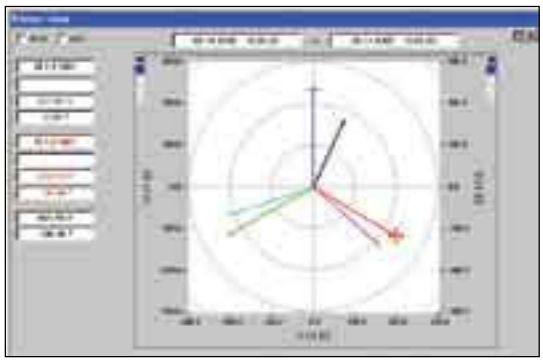
PQ Analyze Software

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

The 1760 provides flagging of data according to IEC 61000-4-30 Class-A. The flagging feature alerts the user that 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.



The report-generator function allows the user to create custom professional reports quickly and easily. The PQ Analyze Software features templates for standard reports.



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

Overview of measurement functions

Statistical evaluation	Power quality statistics according to EN50160 and DISDIP tables like ITIC, CEBEMA, ANSI	EN 50160
Event list	Dips, swells, and interruptions are detected and stored in the event list. Also any trigger which fires generates an event, which is added to this list. Together with the event, rms values, transients, and fast transients can be stored. The event list shows the exact time of occurrence, as well as duration and magnitude. Several parameters of the events can be sorted. The user can thereafter select an event for further root cause analysis.	Event List DISDIP
Continuous recording	The Fluke 1760 logs rms values, together with corresponding minimum and maximum values, continuously – with the following time aggregations: 1 Day 10 min Free interval, e.g. 15 min, 2 h	Voltage Current Power P, Q, S Power Factor kWh Flicker Unbalance Frequency Harmonics/Interharmonics
Triggered recordings	RMS with adjustable aggregation time between 10 ms (1/2 cycle), 20ms (1 cycle), 200 ms (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 200 ms 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	Oscilloscope Fast Transients FFT of Fast Transients
Mains signaling	Voltage and current on all phases and neutral	
Online mode	Variable refresh rate. This feature allows verification of set up of the instrument and delivers a quick overview.	Oscilloscope Transients Events

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Specifications

General

Warranty	2 years
Quality system	Developed and manufactured as per ISO 9001: 2000
Reference conditions	Environment temp.: 23 °C ± 2 °C (74 °F ± 2 °F)
	Power supply: 230 V ± 10 %
	Power frequency: 50 Hz/60 Hz
	Signal: declared input voltage U_{din}
	Averaging: 10 minute intervals
Intrinsic uncertainty	All specified intrinsic uncertainties are valid under these reference conditions
Display	The Fluke 1760 features LED indicators for the status of the 8 channels, phase sequence, power supply (mains or battery), memory usage, time synchronization, and data transfer.
Power LED	Permanent light: normal power supply from mains
	OFF: supply via internal battery in case of a power failure
Channel LEDs	3-color LEDs per channel for: • overload condition • under load condition signal level in nominal range
Data memory	2 GB flash memory depending on model
Memory model	Linear
Interfaces	Ethernet (100 MB/s), RS 232, external modem via RS 232
Baud rate for RS 232	9600 Baud to 115 kBaud
Dimensions (H x W x D)	325 mm x 300 mm x 65 mm (13 in x 11.8 in x 2.6 in)
Weight (without accessories)	appr. 4.9 kg (10.8 lb)
Calibration interval	1 year recommended for Class-A, otherwise 2 years

Ambient conditions

Working temperature range	-20 °C to 50 °C (-4 °F to 122 °F)
Storage temperature range	-20 °C to 60 °C (-4 °F to 140 °F)
Reference temperature	23 °C ± 2 °C (74 °F ± 2 °F)
Climatic class	B2 (IEC 654-1), -20 °C to 50 °C (-4 °F to +122 °F)
Max. operating altitude	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
Housing	insulated, robust plastics housing

EMC

Emission	Class-A as per IEC/EN 61326-1
Immunity	IEC/EN 61326-1

Power supply

Range	AC: 83 V to 264 V, 45 to 65 Hz
Safety	DC: 100 V to 375 V IEC/EN 61010-1 2nd edition 300 V CAT III
Power consumption	max. 54 VA
Battery pack	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 battery 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.

Signal conditioning

Range for 50 Hz systems	50 Hz ± 15 % (42.5 Hz to 57.5 Hz)
Range for 60 Hz systems	60 Hz ± 15 % (51 Hz to 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	Aggregation of the interval values as per IEC 61000-4-30 Class-A
Min-, Max-values	Half cycle, e.g.: 10 ms rms values at 50 Hz
Transients	Sample rate 100 kHz to 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

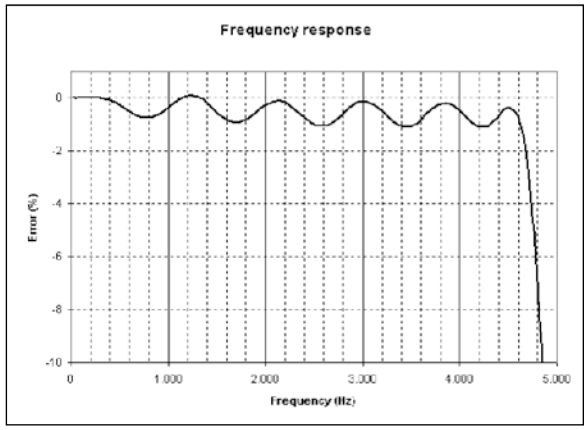
Number of inputs	8 galvanically isolated inputs for voltage and current measurements
Sensor category rating	up to 600 V CAT IV depending on sensor
Basic category rating	300 V CAT III
Nominal voltage (rms)	100 mV
Range (peak value)	280 mV
Overload capacity (rms)	1000 V, continuously
Voltage rise rate	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 achieve extremely high accuracy throughout a wide frequency range. 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. This is also valid under extreme operating conditions such as transient voltages at the output of converters.

Uncertainties: Instrument with 600 V/1000 V sensor

Intrinsic uncertainty	Uncertainty, including the voltage sensors, is in compliance with IEC 61000-4-30 Class-A. All voltage sensors are suitable for dc up to 5 kHz
With sensor 1000 V	0.1 % at U_{din} = 480 V and 600 V P-N
With sensor 600 V	0.1 % at U_{din} = 230 V P-N
Intrinsic uncertainty for harmonics	Class I as per EN 61000-4-7:2002
Temperature drift	< 65 ppm/K
Aging	< 0.04 %/year
Common mode rejection	Instrument > 100 dB at 50 Hz (e.g. shunt). With voltage sensor > 70 dB at 50 Hz
Noise	Noise voltage, input short-circuited: < 40µV rms $0.8\mu V/\sqrt{Hz}$ Sensor 1000 V: < 0.8V rms Sensor 600 V: < 0.5V rms
DC	± (0.2 % rdg + 0.1 % sensor range)

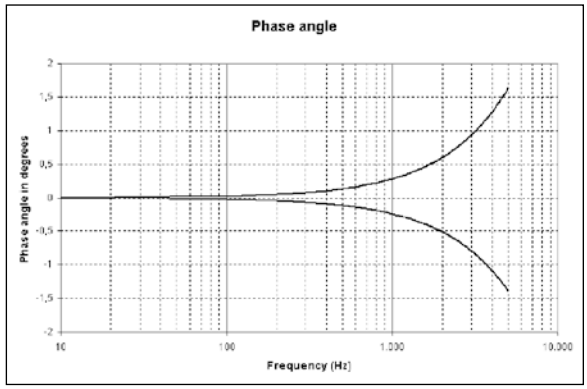
Frequency response

Signal level: 100 %, sampling rate fs = 10.24 kHz:

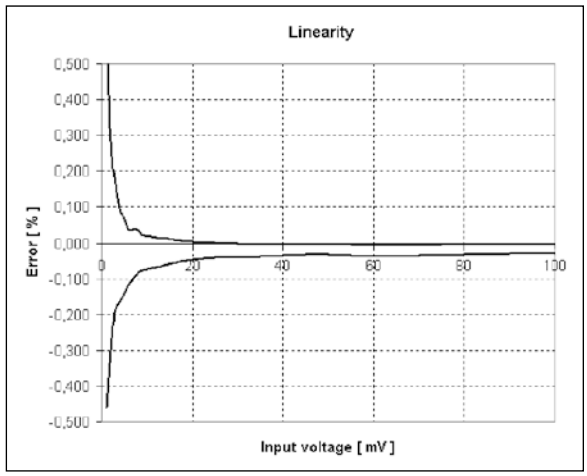


The Fluke 1760 features excellent performance for any frequency up to the 50th harmonic.

Phase angle of analog channels



Linearity



Signal frequency: 50 Hz, sampling rate fs = 10.24 kHz.

Optional accessories

FLUKE-1750/CASE – Water tight transit case with rollers for Fluke 1760 and accessories
GPS-TIME SYNC - GPS time synchronization module provides high accuracy time stamp from GPS clock

Voltage probes

Model No.	Type	Range rms	Vnom	Vmax. contin.	Fast Transient Range Vp < 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 %	–
TPS VOLTPROBE 100 V	Voltage probe 100 V	1 V to 170 V	100 V	1000 V	6000	0.15 %	600 V CAT IV
TPS VOLTPROBE 400 V	Voltage probe 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 > 50th 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 (18 inch) 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 (24 inch) 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 (36 inch) length 4 m cable
TPS CLAMP 10 A/1 A	Clip-on current transformer	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 (0.6 in) diameter or 15 mm x 17 mm (0.6 in x 0.7 in) bush bars
TPS CLAMP 50 A/5 A	Clip-on current transformer	0.05 A to 5 A 0.5 A to 50 A	18 A 180 A	0.5 %	40 Hz to 0 kHz	300 V CAT IV	0.5 °	< 15 mm (0.6 in) diameter or 15 mm x 17 mm (0.6 in x 0.7 in) bush bars
TPS CLAMP 200 A/20 A	Clip-on current transformer	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 (0.6 in) diameter or 15 mm x 17 mm (0.6 in x 0.7 in) 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 5 A 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 °C (74 °F ± 2 °F) for 48 to 65 Hz
Phase angle error at nominal current
I_{max} maximum current without time limit (for ac and dc shunts)

Product Feature	Fluke-1760TR	Fluke-1760	Fluke-1760TR BASIC	Fluke-1760 BASIC
Power Quality Recorder with 8 input-channels (4 currents / 4 voltages or 8 voltages)	•	•	•	•
Internal Flash-memory 2GB	•	•	•	•
PC software on CD-ROM	•	•	•	•
Ethernet cable for network connection (1)	•	•	•	•
Crosslink Ethernet cable and USB cable for direct PC connection (1 of each)	•	•	•	•
Mains cable (1)	•	•	•	•
Operational Manuals	•	•	•	•
Carrying bag	•	•	•	•
Fast transient analysis up to 10 MHz	•		•	
Voltage probes, qty 4 • 600 V for INTL set • 1000 V for US set	•	•		
Current probes, qty 4 • Dual-range flexible current probes 1000 A / 200 A ac	•	•		
GPS time sync receiver	•	•		

Fluke 1760

Ordering information

FLUKE-1760 Basic Fluke 1760 Basic without fast transient without voltage and current sensors

FLUKE-1760TR Basic Fluke 1760TR Basic with fast transient without voltage and current sensors

Fluke 1760 full set without fast transient

FLUKE-1760 INTL INTL with 600 V sensor

FLUKE-1760 US US with 1000 V sensor

Fluke 1760 full set with fast transient

FLUKE-1760TR INTL INTL with 600 V sensor

FLUKE-1760TR US US with 1000 V sensor