

# Power Quality Analyzer Topas 2000

Effecting measurement tasks in medium and low voltage networks faster and with a single tool:

- **Complies with IEC 61000-4-30 class A with synchronization to power frequency and absolute time (GPS)**
- **Analysis of disturbances and their causes**
- **Reserves of transformers/feeders**
- **Transient analysis with 10 Ms/s up to 6 kV**
- **Power quality as per EN 50160**
- **Detection of interferences, power peaks**
- **Measurements in ripple control systems**
- **Day extreme values, load profiles**
- **Report writer**
- **No moving parts**

## General

**Topas 2000** is a Power Quality Analyzer for disturbance investigation and assessing the power quality in compliance with IEC 61000-4-30 class A.

The rugged mechanical construction of **Topas 2000** is highly estimated especially in harsh environments. The large data memory (1 GB flash memory, optional 2 GB) provides effecting long-term recordings. These recordings are the basis for detailed evaluations and analyses to assess disturbances and the mains voltage quality. **Topas 2000** was developed in cooperation with power utilities optimized for field applications and the requirements of operating electrical energy assets.

## Fields of applications

- Disturbance source detection
- Voltage, current and power analysis
- Load and energy measurements
- Transient analysis
- Signalling voltage analysis (ripple control systems)
- Power quality analysis as per EN 50160

## Measurement methods, evaluations

- Assessment of power quality as per EN 50160
- RMS values with adjustable intervals
- Sample values (oscilloscope)
- Amplitude spectrum
- Signalling voltage analysis (ripple control systems)
- Transients



## General specification

<b>Intrinsic error:</b>	refers to reference conditions and is guaranteed for two years
<b>Quality system:</b>	developed, manufactured as per ISO 9001: 2000
<b>Environment conditions:</b>	Operating temp. range: 0° C ... +50° C Working temp. range: -20° C ... +50° C Storage temp. range: -20° C ... +70° C Reference temperature: 23° C ±2 K Climatic class: B3 (IEC 654-1), -20° C ... +50° C Max. operating altitude: 2000 m: 300 V CAT IV, 600 V CAT III, power supply: 300 V CAT III 5000 m: 300 V CAT III, power supply: 300 V CAT II,
<b>Reference conditions:</b>	Environment temp.: 23° C ±2 K Power supply: 230 V ±10 %, Power frequency: 50 Hz / 60 Hz Signal: Nominal voltage $U_{nom}$ Averaging: 10 minute intervals
<b>Housing:</b>	insulated, robust plastics housing
<b>Protection:</b>	IP50 as per EN 60529 with interface cover closed, pollution degree 2
<b>Safety:</b>	<b>Topas 2000</b> is designed and manufactured as per IEC/EN 61010-1
<b>EMC:</b>	Emission: Class A as per IEC/EN 61326-1:1997+A1 Immunity: IEC/EN 61326



## Power supply:

Range	AC: 83 V ... 264 V, 45...65 Hz DC: 100 V ... 375 V
Safety:	IEC/EN 61010-1 300 V CAT III, class I
Power consumption:	max. 30 VA
Battery pack:	NiMH, 7.2 V, 2.7 Ah (NiMH battery can be replaced by user)

In case of a power supply failure an internal accumulator maintains the supply for up to 45 minutes. Afterwards, or in case of discharged accumulators the **Topas 2000** is turned off and continues the measurements with the latest settings as soon as the supply voltage returns. The accumulator can be replaced by the user.

**Display:** **Topas 2000** features LED indicators for the status of the 8 channels, phase sequence, power supply (mains or accumulator), memory usage, time synchronization, and data transfer.

**Power LED:** Permanent light: normal power supply from mains.  
OFF: supply via internal accumulator in case of a power failure.

**Channel LEDs:** 3-colour LEDs per channel for overload condition  
underload condition  
signal level in nominal range

**Data memory:** 1 GB Flash memory,  
2 GB optional

**Memory model:** linear or circular

**Interfaces:** Ethernet (100MB/s, compatible to Windows® 98/ME/NT/2000/XP  
USB (version 2.0)  
RS 232, external modem via RS 232

**Baud rate for RS 232:** 9600 Baud ... 115 kBaud

**Dimensions:** 325 mm x 300 mm x 65 mm (H x W x D)

**Weight:** appr. 4.9 kg (without accessories)

**Warranty:** 2 years

**Calibration interval:** 2 years recommended

## Self-test

**Topas 2000** features comprehensive functions for system diagnosis. The internal data memory, input channels, sensors, interfaces and battery are during power on sequence. The analogue channels are tested by measuring the noise voltage and the offset voltage.

## Signal conditioning

### Sampling rate

The sampling rate is synchronized to mains frequency.  
Range for 50 Hz systems:  
50 Hz  $\pm 15\%$  (42.5 Hz ... 57.5 Hz)  
60 Hz systems:  
60 Hz  $\pm 15\%$  (51 Hz ... 69 Hz)

Resolution: 16 ppm  
Sampling frequency for  
50/60 Hz power frequency: 10.24 kHz  
Error for frequency  
measurements: <20 ppm  
Error of internal clock: <1s / day

### Measurement intervals

Aggregation of the interval values as per IEC 61000-4-30 class A  
Min-, Max-values: 10 ms rms values  
Transients: Sample rate 100 kHz ... 10 MHz per channel  
as per IEC 61000-4-7:2002: 200 ms  
Harmonics: as per EN 61000-4-15:2003:  
Flicker: 10 min (Pst), 2 h (PIt)

## Measurement inputs

**Topas 2000** features 8 galvanically isolated inputs for voltage and current measurements.

**Safety:** 300 V CAT III  
the category is determined by the  
connected sensor,  
see specification of accessories

**Nominal voltage (rms):** 100 mV

**Range (peak value):** 280 mV

**Overload capacity (rms):** 1000 V, continuously

**Voltage rise rate:** max. 15 kV /  $\mu$ s

**Input resistance:** 1 M $\Omega$

**Input capacitance:** 5 pF

**Intrinsic error:** <0.1 %

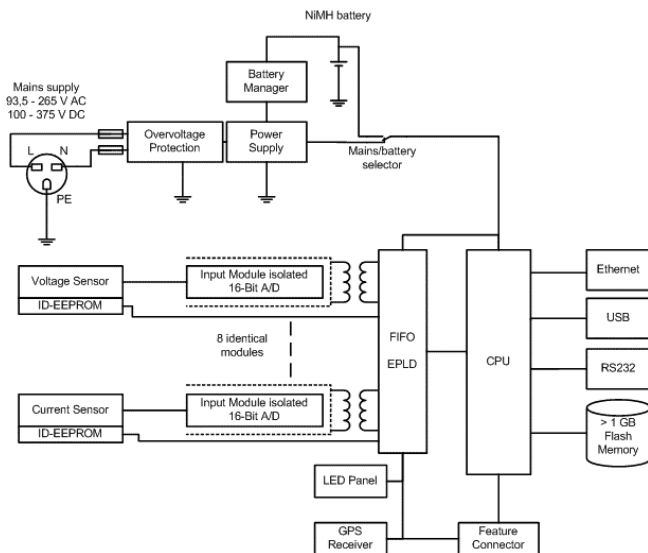
**Intrinsic error for harmonics:** class I as per EN 61000-4-7:2002

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.

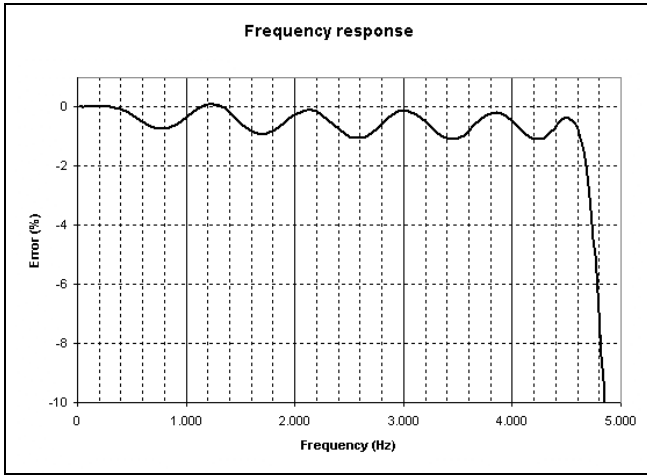
**Topas 2000** effects measurements with precisely defined frequency response. Between the 3 dB limit frequency at 0.45-fold sampling frequency and the 1.2 higher frequency the magnitude falls 80 dB below the A/D converter's resolution. Particular attention is paid to identical phase responses of the analogue inputs in order to avoid errors during power measurement.

## Block diagram

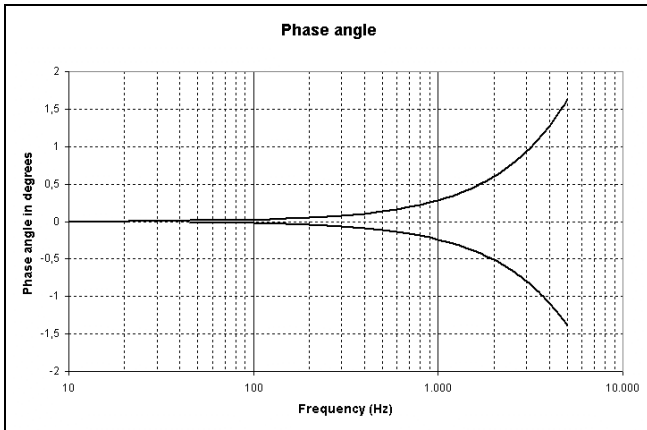


**Frequency response**

Signal level: 100%, sampling rate  $f_s = 10.24$  kHz:

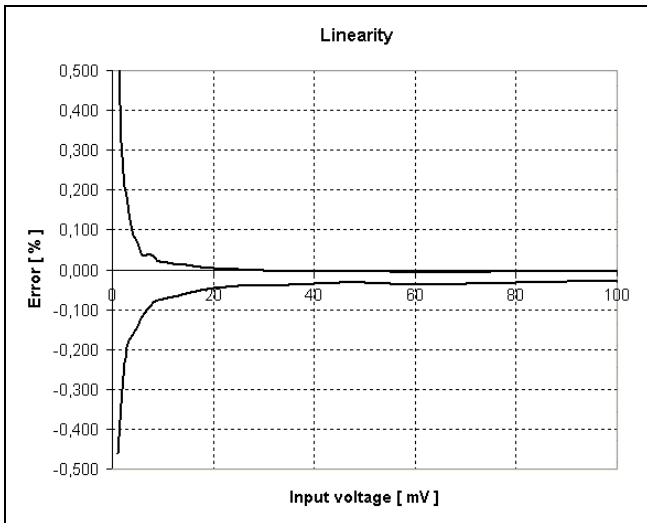


**Phase angle of analogue channels**



**Linearity**

Signal frequency: 50Hz, sampling rate  $f_s = 10.24$  kHz:



**Errors**

The total measuring error of the measurement system **Topas 2000** including voltage or current sensor is below class 0.5 and the error for harmonics complies with class I of standard EN 61000-4-7:2002.

**Topas 2000** is suited for current, voltage and power measurements on frequency converters. Current measurements on the converter with shunts are possible. Taking into account the maximum voltage rise rate the same error indications apply.

The total error results from the error of the **Topas 2000** measurement channel and the error of the connected sensor. The error values apply to reference conditions (e.g. environment temperature of  $23^\circ\text{C} \pm 2\text{K}$ ), warmed up instrument without sensors up to the maximum voltage rise rate.

Frequency	Signal level	Error in % of m. v.
50 Hz	100 %	<0.1 %
50 Hz	>1 %	<0.5 %
<4.600 Hz	100 %	<1 %
<4.600 Hz	>1 %	<1.2 %

The accuracy of **Topas 2000** including the sensors is in compliance with IEC 61000-4-30 class A.

**Common mode rejection**

Common mode rejection between 0 Hz and 100 kHz: -130 dB of measuring range.

**Temperature drift**

Change of amplification through temperature: < 150 ppm/K.

**Ageing**

Change of amplification due to ageing: < 0.05 % / year.

**Noise**

Noise voltage, input short-circuited: < 20  $\mu\text{V}$ .  
Spectral noise voltage density: 0.4  $\mu\text{V} / \sqrt{\text{Hz}}$ .

**Measurement functions**

**Topas 2000** records measurement data for long periods of time and transfers them online for analyzing to a computer (typically a notebook). Measuring data can be retrieved during data logger operation without interrupting the measurements via one of the existing interfaces. An online display is also available.

**Topas 2000** measures 4 currents and 4 voltages or 8 voltages alternatively.

**Data Logger mode**

Assessment of the power quality as per EN 50160, rms values, extreme values (min-, max-values), Flicker intensity, voltage dips, voltage swells, voltage interruptions (long and short), voltage unbalance, harmonics, THD, inter-harmonics, signalling voltages, power harmonics (amplitude and phase angle), transients are recorded with various averaging intervals.

**Online mode**

Sample values (waveforms, oscilloscope) of current and voltage, amplitude spectrum of active power, reactive power and transients, rms values, active power, power factor, phasor diagrams of voltage, current, and apparent power are available in the online mode.

Overview of measurement functions		
EN50160	Power quality all parameters as per EN50160	
Day	1 day average values	
Long Interval	Free interval (1 min – 1 day)	
10 Min	10 minute average values: voltage, current, frequency, Flicker, power values, symmetrical components	
Events	Events, triggers Dips, swells, interruptions	
3 s	3 sec average values: Harmonics, THD	
RMS	Rms values Averaging time adjustable between 10 ms – 1 day	
Oscilloscope	Sample rate: 10,24 kHz / channel	
Ripple contr. sig	Ripple control signals on phases and N-conductor Voltage, current	
Transients	Transients: sample rate 100 kHz – 10 MHz per channel	
	Online mode	Oscilloscope Transients Events

## Measurement methods

### Assessment of the power quality as per EN 50160

Harmonics, Interharmonics  
THD U  
Flicker  
Voltage events (dips, swells, interruptions)  
Unbalance  
Frequency

### Averaging intervals for 20 ms ... 24 h

rms values of voltage, current  
Active power  
Reactive power  
Apparent power  
Power factor  
Energy  
Day extreme values

### Oscilloscope presentation of

Voltage  
Current

## Transients (optional)

Recording of 4 voltage channels  
100 kHz up to 10 MHz sampling rate per channel  
65.536 samples per record  
Triggering at voltage levels of high-frequency signal components  
6 kV input voltage range

## Spectrum of

Voltage, current  
Active power, reactive power

## Ripple control signals

Ripple control signals (voltage, current)  
Level-time diagrams

## Symmetrical components

Zero-, positive, and negative sequence

## Configuration

Before starting data logging **Topas 2000** must be configured with a computer and the **Topas** software. Configuration files can be created, stored, and loaded with menu-guidance. The configuration menu provides for the following settings:

## Descriptive text

A descriptive text can be entered into a text box with information about the measurement.

## Nominal values and limit values

All the limit values regarding EN 50160 can be set.

## Interharmonics

The rms value of all interharmonics (TID) is measured as per IEC 61000-4-7:2002. If a preset threshold is exceeded recordings are triggered.

## Measuring time

Start time and stop time for a measurement campaign can be defined. A universal time trigger records pre-selected parameters periodically at defined times.

## Memory management

The amount of memory for various measurement parameters can be reserved. This will avoid the memory being filled unintentionally e.g. with oscilloscope values. The memory management can be circular or linear. Linear: no more data is stored on reaching the memory limit. Circular: the oldest data records are overwritten.

## Trigger conditions

**Topas 2000** can determine the trigger thresholds automatically. This operating mode requires no settings. The trigger thresholds can also be set manually by the user. If the trigger thresholds are exceeded harmonics, rms values and powers, oscilloscope views of current and voltage, transients and signalling voltages can be recorded.

It is also possible to trigger on exceeding of one or more harmonics (1 – 50). For all channels it is possible to trigger on upper or lower violation of oscilloscope and/or rms threshold values.

## Hardware settings

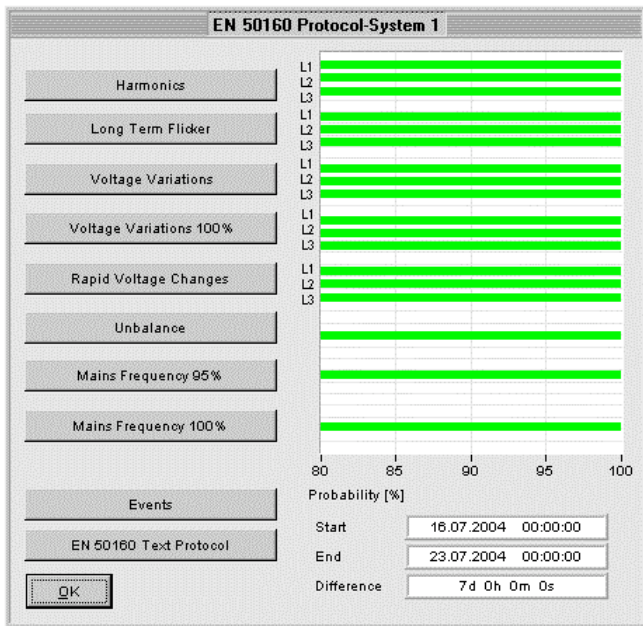
Current and voltage sensors can be connected to the input channels. The setting of the measuring range is effected during configuration. Certain measuring ranges or sensors can be selected. Wrong sensors or overflow conditions are indicated with the channel LEDs. An additional scaling factor can be entered for each channel: the transformer ratio of current or voltage transformers can thus be taken into account.

## Measuring Data Analysis

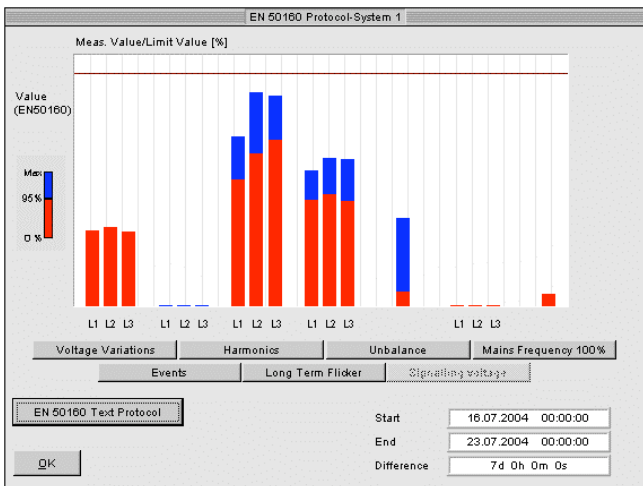
The measuring results are presented graphically as level time diagrams, or cumulative frequency functions, or bar diagrams. Different data can be superimposed in one diagram. Each data point can be selected by cursor and its data displayed in numerical fields. Data out of diagrams can be exported as a text table. "Copy and Paste" via the Windows® clipboard is possible. ASCII-tables can be imported into spreadsheet applications. Day extreme value presentations compress data out of long-term recordings to comprehensive evaluations. A configurable report writer provides repetitive protocol generation.

### EN 50160 Analysis

This analysis provides a rapid overview. By red and green bars we can see whether the power quality is compliant or if further investigations are necessary.



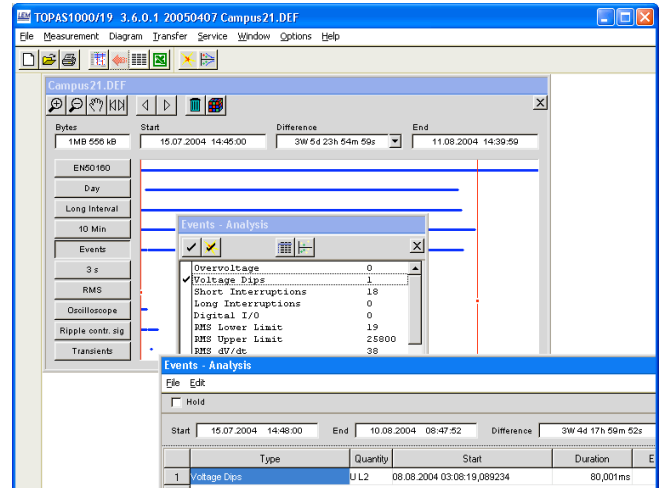
Power quality overview as per EN 50160 in CODAM format:



A compliance report (text protocol) can be created and exported immediately.

## Events list

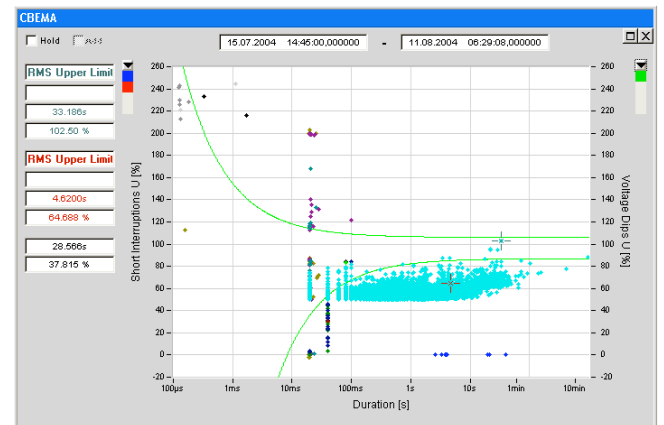
A compact overview of all events which occurred. This list can be transferred easily even via modem connections.



With the sorting functions it is possible to select and analyze the most important events. Clicking on the items in the list opens immediately detailed presentations (level-time diagrams) for further analysis.

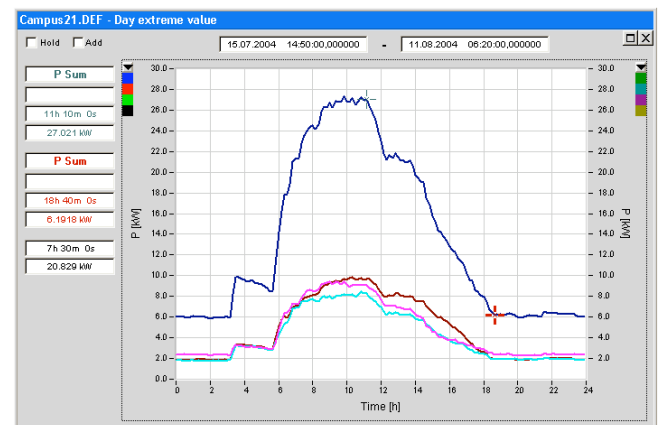
### CBEMA presentation

The events can also be displayed in the CBEMA (ANSI) diagram – events are classified according to amplitude and duration.



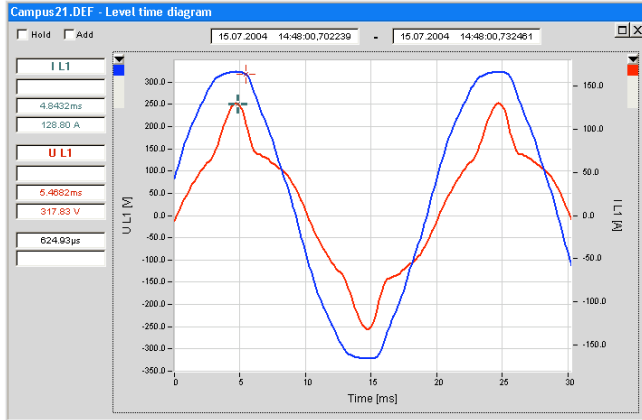
### Day extreme values

In this presentation the measurement data of a long period are presented as a day profile.



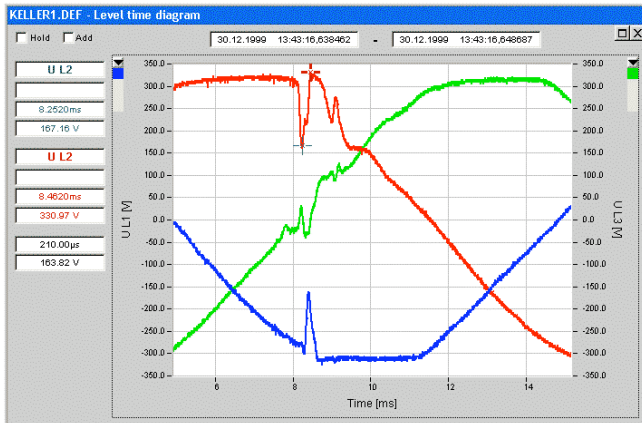
## Oscilloscope

The oscilloscope function is used to evaluate current and voltage waveforms. Highly distorted currents cause thermal overloads of neutral wires and transformers.



## Transients

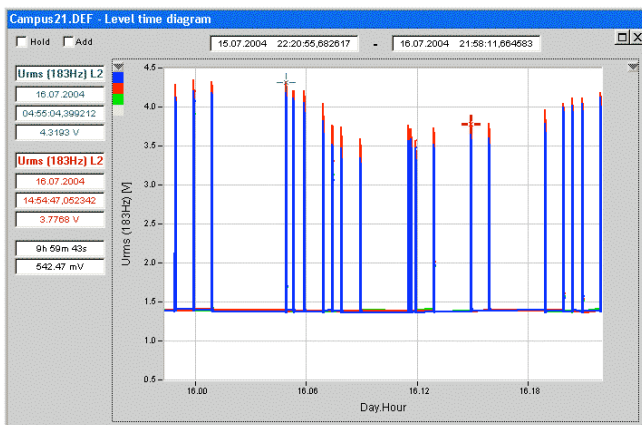
Transient short voltage swells caused by switching in the network or lightning strikes can destroy electronic devices. Only by means of transients analysis such influences can be examined.



Non linear electronic devices can also be the reason for such interferences which can be located only with fast-sampling transient analysis. Amplitude spectrum of voltages and currents is provided.

## Ripple control signal analysis

Some equipment like street lighting and heating devices are remote controlled by means of signalling voltages. Multi-tariff meters can also be switched with these signals. Interferences may result in comprehensive, time-consuming analysis and economic losses.



This function provides a very useful tool to detect the source of interferences (signal level too low, pulse rise rate too low,...)

## Test probes

Voltage probes for various ranges between 100 mV and 1000 V are available for **Topas 2000**.

Current probes for direct current measurement (shunts) are available between 20 mA and 5 A.

Passive current clamps (AC only) are available in ranges with 1 A up to 1000 A, 2 ranges can be selected in the **Topas** software. Flexible current sensors (LEM-flex) are available for ranges between 100 A and 6000 A AC, 2 ranges can be selected in the **Topas** software.

All probes contain a memory for calibration factors, sensor identity and serial number which is read automatically by the **Topas 2000**. Ranges can be selected in the **Topas** software.

Other measuring transducers can be used in front of these standard sensors.

## Voltage probes

Temperature drift: 100 ppm / K

Aging: <0.05 % / year

All voltage sensors are suitable for DC ...5 kHz.

Order number	Trans. Range $V_{p<1ms}$	$U_{nom}$	Range rms	$U_{max}$ contin.
2540613	-	0.1 V	0.01...0.2 V	100 V
2540651	-	1 V	0.01...1.7 V	100 V
2540685	-	5 V	0.05...8.5 V	100 V
2540636	-	10 V	0.1...17 V	100 V
2540624	6000	100 V	1...170 V	1000 V
2540660	6000	400 V	4...680 V	1000 V
2540703	5... 750	400 V	4...680 V	1000 V
2540672	6000	480 V	4.8...820 V	1000 V
2540697	6000	600 V	10...1000 V	1000 V
2540649	6000	1000 V	10...1700 V	2000 V

Order number	Input resistance <sup>1)</sup>	Intrinsic error	Operating voltage
2540613	1 MOhm	-	300 V CAT II
2540651	16 kOhm	0.15 %	300 V CAT II
2540685	16 kOhm	0.15 %	300 V CAT II
2540636	16 kOhm	0.15 %	300 V CAT II
2540624	2 MOhm	0.15 %	600 V CAT III
2540660	2 MOhm	0.15 %	600 V CAT III
2540660 <sup>2)</sup>	2 MOhm	5 %	600 V CAT III
2540660 <sup>3)</sup>	2 MOhm	5 %	600 V CAT III
2540703	4 MOhm	0.2 %	600 V CAT III
2540703 <sup>2)</sup>	2 MOhm	5 %	600 V CAT III
2540672	2 MOhm	0.15 %	600 V CAT III
2540697	2 MOhm	0.15 %	600 V CAT III
2540649	4 MOhm	0.15 %	600 V CAT IV

1) input resistance between red and black connector

2) for transient range

## Current probes

Nominal range Order reference	Measuring ranges	Peak current <sup>3)</sup>	Intrinsic error	Frequency range	Phase error	operating voltage
Clip-on current transformers for AC current						
1 A / 10 A 2540445	0.01 A...1 A 0.1 A...10 A	3.7 A 37 A	0.5 %	40 Hz... 10 kHz	0.5°	600 V CAT III
5 A / 50 A 2540461	0.05 A...5 A 0.5 A...50 A	18 A 180 A	0.5 %	40 Hz... 10 kHz	0.5°	600 V CAT III
20 A / 200 A 2540450	0.2 A...20 A 2 A...200 A	74 A 300 A	0.5 %	40 Hz... 10 kHz	0.5°	600 V CAT III
100 A / 1000 A 2540438	1 A...100 A 10 A...1200 A	370 A 1700 A	0.5 %	40 Hz... 10 kHz	0.5°	600 V CAT III
LEM-flex for AC current						
100 A / 500 A 2540477	1 A...100 A 5 A...500 A	240 A 1350 A	1 %	45 Hz... 3.0 kHz	0.5°	600 V CAT III
200 A / 1000 A 2540489	2 A...200 A 10 A...1000 A	480 A 2700 A	1 %	45 Hz... 3.0 kHz	0.5°	600 V CAT III
3000 A / 6000 A 2540492	30 A...3000 A 60 A...6000 A	10 kA 19 kA	1 %	45 Hz... 3.0 kHz	0.5°	600 V CAT III
Shunts for AC and DC currents <sup>4)</sup>						
20 mA 2540553	0...55 mA	77.8 mA $I_{max}=1,5A$	0.2 %	DC... 3.0 kHz	0.1°	300 V CAT II
1 A 2540548	0...2.8 A	4.0 A $I_{max}=6.5 A$	0.2 %	DC... 3.0 kHz	0.1°	300 V CAT II
5 A 2540566	0...10 A	21.9 A $I_{max}=10 A$	0.2 %	DC... 3.0 kHz	0.1°	300 V CAT II

Errors in % of measuring range at 23° C ±2 K, for 48...65 Hz  
Phase angle error at nominal current

<sup>3)</sup> for sinusoidal currents

<sup>4)</sup>  $I_{max}$  maximum current without time limit



Fig.: Current clamp 100 A / 1000 A AC

## Scope of Delivery, Accessories, Service

### Power Quality Analyzer

Part	Fluke Model Number	Fluke Item Number
Topas 2000 Power Quality Analyzer as per IEC 61000-4-30 class A with 8 input-channels (4 currents / 4 voltages or 8 voltages), Ethernet interface, 1 GB Flash- memory, insulated, robust housing (IP50), incl. 1 RS232 cable, 1 Ethernet cable for network connection, 1 crosslink Ethernet cable for direct PC-connection, 1 mains cable, Topas application software on CD- ROM, 2 manuals	Topas 2000 BASIC	2540384

Part	Fluke Model Number	Fluke Item Number
Topas 2000 comprehensive set Power Quality Analyzer as per IEC 61000-4-30 class A with 8 input-channels (4 currents / 4 voltages or 8 voltages), Ethernet interface, 2 GB Flash- memory, insulated, robust housing (IP50), incl. options trigger functions, EN50160+ripple control signal analysis, transient analysis 10 MHz, 4 voltage probes 400 V, 4 flexible current probes 1000 A / 200 A AC, 1 RS232 cable, 1 Ethernet cable for network connection, 1 crosslink Ethernet cable for direct PC-connection, 1 mains cable, Topas application software on CD- ROM, 2 manuals 1 carrying case	Topas 2000 SET	2540391

### Options

Part	Fluke Model Number	Fluke Item Number
TRIGGER FUNCTIONS Trigger-levels can be adjusted manually, analysis of 4 current- and 4 voltage- channels or 8 voltage- channels, harmonics, THD	TPS TRIGGER FUNC	2540608
TRANSIENT ANALYSIS - 500 kHz analysis of 4 voltage- channels, sampling frequency 100 kHz - 500 kHz voltage-range: 6 kV	TPS TRANS 500KHZ	2540582
TRANSIENT ANALYSIS 10 MHz analysis of 4 voltage- channels, sampling frequency 100 kHz - 10 MHz voltage-range: 6 kV	TPS TRANS 10MHZ	2540575
TRANSIENT ANALYSIS UPGRADE upgrade of an existing 500 kHz transient option to a 10 MHz option (software license, no hardware modification required)	TPS TRANS UPGRADE	2540594
EN50160+RIPPLE CONTROL SIGNAL ANALYSIS	TPS OPTION EN50160	2540527
2 GB Flash-memory instead of 1 GB	TPS CF-CARD	2540423
GPS time synchronization	GPS-TIME SYNC	2539223

## Accessories

Part	Fluke Model Number	Fluke Item Number
LEM-flex 500 A / 100 A Measuring ranges: 500 A / 100 A, selectable per software, measuring head length: 45 cm (18 inch), 2 m cable	TPS FLEX 18	2540477
LEM-flex 1000 A / 200 A Measuring ranges: 1000 A / 200 A, selectable per software, measuring head length: 61 cm (24 inch), 2 m cable	TPS FLEX 24	2540489
LEM-flex 6000 A / 3000 A Measuring ranges: 6000 A / 3000 A, selectable per software, measuring head length: 91 cm (36 inch), 4 m cable	TPS FLEX 36	2540492
CLIP-ON CURRENT TRANSFORMER 10 A / 1 A Measuring ranges: 10 A / 1 A, selectable per software	TPS CLAMP 10 A / 1 A	2540445
CLIP-ON CURRENT TRANSFORMER 50 A / 5 A Measuring ranges: 50 A / 5 A, selectable per software	TPS CLAMP 50 A / 5 A	2540461
CLIP-ON CURRENT TRANSFORMER 200 A / 20 A Measuring ranges: 200 A / 20 A, selectable per software	TPS CLAMP 200 / 20	2540450
CLIP-ON CURRENT TRANSFORMER 1000 A / 100 A Measuring ranges: 1000 A / 100 A, selectable per software	TPS CLAMP 1000 / 100	2540438
VOLTAGE PROBE 0.1 V Measuring range: 0.01 ... 0.2 V	TPS VOLTPROBE 0.1 V	2540613
VOLTAGE PROBE 1 V Measuring range: 0.01 ... 1.7 V	TPS VOLTPROBE 1 V	2540651
VOLTAGE PROBE 5 V Measuring range: 0.05 ... 8.5 V	TPS VOLTPROBE 5 V	2540685
VOLTAGE PROBE 10 V Measuring range: 0.1 ... 17 V	TPS VOLTPROBE 10 V	2540636
VOLTAGE PROBE 100 V Measuring range: 1 ... 170 V Measuring range transients: 6000 V	TPS VOLTPROBE 100 V	2540624

Part	Fluke Model Number	Fluke Item Number
VOLTAGE PROBE 400 V Measuring range: 4 ... 680 V Measuring range transients: 6000 V	TPS VOLTPROBE 400 V	2540660
VOLTAGE PROBE 400 V Measuring range: 4 ... 680 V Measuring range transients: 5 ... 750 V	TPS VOLTPROBE 750 V	2540703
VOLTAGE PROBE 480 V Measuring range: 5 ... 820 V Measuring range transients: 6000 V	TPS VOLTPROBE 480 V	2540672
VOLTAGE PROBE 600 V Measuring range: 10 ... 1000 V max. 600 V to ground, 600 V CAT III Measuring range transients: 6000 V	TPS VOLTPROBE 600 V	2540697
VOLTAGE PROBE 1000 V Measuring range: 10 ... 1700 V max. 1000 V to ground, 1000 V CAT III, 600 V CAT IV Measuring range transients: 6000 V	TPS VOLTPROBE 1K V	2540649
SHUNT 1 A	TPS SHUNT 1 A	2540548
SHUNT 5 A	TPS SHUNT 5 A	2540566
SHUNT 20 mA	TPS SHUNT 20 MA	2540553
FH-Probe Set Unique Free-hand voltage probe set consisting of 4 probes (red: L1, L2, L3, blue: N)	TPS/MBX CLIPS	2540715
SAFETY ADAPTER with fuse with 100kA breaking capacity	TPS SAFETY ADAPTER	2540530
FUSE FOR SAFETY CLAW-GRIP 2 A breaking capacity 100 kA	TPS FUSE, 2AMP	2540509
Replacement battery pack	TPS BATTERY PACK	2540406
CARRYING CASE FOR Topas 1000/2000	TPS CASE	2540414
DOLPHIN CLIP blue	TPS/MBX DOLPH BLUE	2540732
DOLPHIN CLIP red	TPS/MBX DOLPH RED	2540744
DOLPHIN CLIP black	TPS/MBX DOLPH BLK	2540726
GPS time synchronization	GPS-TIME SYNC	2539223

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