

1773/1775/1777

3 Phase Power Quality Analyzer

Product Specifications



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General Specifications

Dimensions	28.0 cm x 19.0 cm x 6.2 cm (11.0 in x 7.5 in x 2.4 in)
Weight	2.1 kg (4.6 lb)
Display.....	7-in TFT, 1024 x 600 pixels with capacitive touch that supports operation with PPE gloves for up to 1000 V ARC 4 rating
Anti-Theft Protection	Slot to support Kensington lock
Warranty	
Logger	2 years (battery not included)
Accessories	1 year (battery included)
Calibration Cycle	2 years

Environmental Specifications

Logger

Temperature

Operating	-10 °C to 50 °C
Storage	-20 °C to 60 °C 15 °C to 30 °C (recommended)

Operating Humidity	IEC60721-3-3: 3K5, modified: -10 °C to 30 °C: ≤95%, no condensation or ice 35 °C: 70 % 40 °C: 55 % 50 °C: 35 %
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Altitude

Operating	2000 m
Storage	12 000 m

BP1770 Battery.....	Li-ion 3.65 V, 14.6 Wh
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Ingress Protection

with protection caps attached	IEC 60529: IP50 (Category 2 Enclosure)
with protection caps removed.....	IEC 60529: IP20

A Category 2 enclosure is where no pressure difference relative to the surrounding air is present.

Vibration	IEC 60721-3-3 / 3M2
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Safety

General	IEC 61010-1: Pollution Degree 2
Power Supply	Overvoltage Category IV 600 V
Mains Adapter MA-C8.....	Overvoltage Category II 300 V
Measurement	IEC 61010-2-030: CAT IV 600 V, CAT III 1000 V
Altitudes between 2000 m and 4000 m, derate to:	
Power Supply	Overvoltage Category IV 300 V
Mains Adapter MA-C8.....	Overvoltage Category II 150 V
Measurement.....	IEC 61010-2-030: Overvoltage CAT IV 300 V, CAT III 600 V

Electromagnetic Compatibility (EMC)

International	IEC 61326-1: Industrial CISPR 11: Group 1, Class A <i>Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for the internal function of the equipment itself.</i> <i>Class A: Equipment is suitable for use in all establishments other than domestic and those directly connected to a low-voltage power supply network that supplies buildings used for domestic purposes. There may be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted and radiated disturbances.</i> <i>Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.</i> <i>Emissions that exceed the levels required by CISPR 11 can occur when the equipment is connected to a test object.</i>
Korea (KCC).....	Class A Equipment (Industrial Broadcasting & Communication Equipment) <i>Class A: Equipment meets requirements for industrial electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and not to be used in homes.</i>
USA (FCC).....	47 CFR 15 subpart C.

Wireless Radio with WiFi/BLE Module (depends on region)

2.4 GHz band	
Frequency Range	2400 MHz to 2483.5 MHz
Output Power.....	<100 mW
5 GHz band 1	
Frequency Range	5150 MHz to 5725 MHz
Output Power.....	<200 mW
5 GHz band 2	
Frequency Range	5725 MHz to 5875 MHz
Output Power.....	<25 mW

Electrical Specifications

Power Supply

Voltage Range	
using safety plug input with power from the measurement circuit	100 V to 600 V -10 % / +10 % (90 V to 660 V)
using MA-C8 with standard power cord (IEC 60320 C7).....	100 V to 240 V
Power consumption.....	Maximum 40 VA
Maximum no-load consumption.....	<0.6 W

Efficiency	≥78 % (depends on input voltage)
Mains Frequency	50/60 Hz (42.5 Hz to 69 Hz)
UPS	Li-ion battery BP1770 with extended temperature range, customer-replaceable
On-Battery Runtime	up to 1.25 hr
Charging Time	8 hr, 3 hr when power is turned off
Voltage Inputs	
Number of Inputs	4, 3 phases and neutral referenced to PE (5 connectors)
Measurement Category	1000 V CAT III / 600 V CAT IV
Maximum Input Voltage	1000 V _{rms} / 1000 V dc (1700 Vpk)
Nominal Voltage Range	
Wye and single phase	Variable (50 V – 1000 V)
Delta	Variable (100 V – 1000 V) IEC 61000-4-30 Class A compliance for the nominal voltages (U _{din}) 100 V – 690 V
Input Impedance	10 MΩ between P-P and P-N, 5 MΩ between P-PE and N-PE
Bandwidth	DC to 30 kHz for PQ measurements, excluding transients
Sampling Frequency	80 kS/s at 50/60 Hz
Scaling	1:1, variable for use of potential transformers
Voltage Transients	
Measurement Range	±8 kV
Sampling Rate	
1775	1 MS/s
1777	1 MS/s, 20 MS/s
Bandwidth	DC to 1 MHz
Trigger	Adjustable trigger level. Triggers on high-frequency components >1.5 kHz
Resolution	14-bit synchronous sampling
Current Inputs	
Number of Inputs	4 inputs 3 phases and Neutral, range selected automatically to attached sensor
Input Voltage	
Clamp	50 mV / 500 mV _{rms} ; CF 3
Rogowski Coil	15 mV / 150 mV _{rms} at 50 Hz 18 mV / 180 mV _{rms} at 60 Hz; CF 3; all at nominal probe range
Input Impedance	11 kΩ

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Product Specifications

Range

AC

i17XX-flex1500 12.....	1 A to 1500 A
i17XX-flex1500 24.....	1 A to 1500 A
i17XX-flex3000 24.....	3 A to 3000 A
i17XX-flex6000 36.....	6 A to 6000 A
i40s-EL clamp	40 mA to 40 A
i400s-EL clamp.....	4 A to 400 A

DC

80i-2010-EL	20 A to 2000 A
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Bandwidth	DC to 30 kHz
Resolution	24-bit synchronous sampling
Sampling frequency.....	80 kS/s at 50/60 Hz
Scaling.....	1:1, variable

Auxiliary Inputs

Wired connection with 17xx-AUX adapter

Number of Inputs.....	2
Input Range	Direct: 0 V dc to ± 10 V dc or 0 V dc to ± 1000 V dc
Input Impedance	Direct: 2.92 M Ω
Scale Factor	Format: mx + b (gain and offset) user configurable
Displayed Units	User configurable (up to 8 characters, for example °C, psi, or m/s)

Wireless Bluetooth connection (check for availability)

Number of Inputs.....	2
Supported Modules.....	Fluke Connect™ 3000 series
Acquisition	1 reading/s

Data Acquisition Voltage and Current

Input Mains Frequency	DC, 50/60 Hz ± 15 % (42.5 Hz to 57.5 Hz, 51 Hz to 69 Hz)
Topologies	1- Φ , 1- Φ IT, Split phase, 3- Φ delta, 3- Φ wye IT, 3- Φ Aron/Blondel (2-element delta), 3- Φ delta open leg, 3- Φ high leg delta

Data Storage

1773/1775.....	8 GB Internal (expandable with microSD card)
1777	32 GB microSD card (installed)
Memory Size.....	Typical 10 logging sessions of 8 weeks with 1-minute intervals and 100 events. The number of possible logging sessions and logging period depends on user requirements.

Real-Time Accuracy

Internal.....	3 ppm (0.26 s/day, 8 s/month)
NTP (Internet time).....	Depending on Internet latency, typical <0.1 s absolute to UTC
GPS	<1 ms absolute to UTC

Trend Interval

Measured Parameter	see <i>Users Manual</i>
Interval	User selectable: 1 sec, 3 sec, 5 sec, 10 sec, 30 sec, 1 min, 5 min, 10 min, 15 min, 30 min

Averaging Interval Min/Max Values

Voltage, Current	Half-cycle RMS (one-cycle RMS refreshed each half-cycle)
AUX, Power	200 ms

Power Quality Measurements

Measured Parameter	see <i>Users Manual</i>
Harmonics	h0 to h50 % fund and RMS for voltage, current and power Phase angles for voltage and current up to h11
Interharmonics.....	ih0 to ih50 % fund and RMS for voltage and current
Supraharmonics	2–9 kHz with 200 Hz bins 9–30 kHz with 2 kHz bins RMS for voltage and current
Harmonics Measurement Method	Grouped, sub-grouped and single harmonic bins according to IEC 61000-4-7. Method selected automatically based on configured PQ standard or user configurable.
Total Harmonic Distortion	Calculated on up to 50 harmonics (depends on selected PQ standard)
Mains Signaling.....	2 frequencies in the range from 110 Hz to 3000 Hz

Events

Voltage	Dip, swell, interruption, rapid voltage change, mains signaling, waveshape deviation, transients
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Current	Inrush current
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Triggered Recordings	Half cycle RMS of voltage and current for 10 s Waveform of voltage and current for 10/12 cycles
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Mains Signaling	200 ms RMS of mains signaling voltage up to 120 s
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Transients.....	Waveform of voltage
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1777.....	1 MS/s or 20 MS/s, 500,000 pts
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1775.....	1 MS/s, 25,000 pts
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Interfaces

Ethernet.....	1 Gbit/s 1000BASE-T
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USB Type A.....	USB 2.0 high speed for USB flash drives to transfer measurement data, firmware updates, and license installation. Max. supply current: 500 mA.
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USB-C	USB 2.0 high speed for data download to PC and calibration (requires USB type A to USB-C or USB-C to USB-C cable) Auxiliary power supply for the Analyzer (requires USB C power adapter PD 2.0 or higher with 9 V 1.8 A support) USB 3.0 super-speed for USB-C flash drives to transfer measurement data, firmware updates and license installation. Max. supply current: 900 mA.
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WiFi/BLE Module ^[1]	802.11 ac 2.4 GHz / 5 GHz, support for concurrent access point and client mode
TX/RX Frequencies in MHz	
2.4 GHz band	2400 to 2483.5
5 GHz band	5150 to 5875
Transmit Operating Power	<100 mW
Bandwidth	
2.4 GHz band	20, 40 MHz
5 GHz band	40, 80 MHz
Modulation Type	
2.4 GHz band	CCK, DQPSK, DBPSK
5 GHz band	BPSK, QPSK, 16 QAM, 64 QAM, 256 QAM
Encryption Algorithm	WPA2-AES
Wireless Output Power	<100 mW
Bluetooth	5.0/BLE
Antenna	Internal and external ^[2]
LTE/4G Module ^[3]	LTE-A Cat 12
	Worldwide LTE-A and UMTS/HSPA+ coverage
	Antenna: External ^[2]

[1] Not in 177X/BASIC versions.

[2] Requires Antenna Cable, 5 m, 50 Ω, 6 GHz. The gain of the antenna shall not exceed 12 dBi (max 2.89 dBi with cable losses).

[3] Availability and supported providers vary by country. Check with your local Fluke representative.

Power/Energy

Parameter	Direct Input ^[1]	i17xx-Flex1500-24	iFlex3000-24	iFlex6000-36	i40S-EL
Power Range W, VA, var	Clamp: 50 mV/500 mV Rogowski: 15 mV/150 mV	150 A / 1500 A	300 A / 3000 A	600 A / 6000 A	4 A / 40 A
	Clamp: 50 W/500 W Rogowski: 15 W/150 W	150 kW / 1.5 MW	300 kW / 3 MW	600 kW / 6 MW	4 kW / 40 kW
Max. Resolution W, VA, var	0.1 W	0.01 kW / 0.10 kW	1 kW / 10 kW	1 kW / 10 kW	0.1 W / 1 W
Max. Resolution PF, DPF	0.01				
Phase (Voltage to Current) ^[1]	±0.2 °	±0.28 °			±1 °
[1] In the range of 100 V ... 500 V; also known as U _{din}					

Accuracy at Reference Conditions

Parameter			Range	Maximum Resolution	Intrinsic Accuracy at Reference Conditions (% of Reading + % of Range)
Voltage			1000 V	0.1 V	±0.1 % of nominal voltage ^{[1] [2]} ±(0.04 % + 0.004 %)
Voltage Dips and Swells			1000 V	0.1 V	±0.2 % of nominal voltage ^{[1] [2]}
Voltage Transients			±8 kVpk	---	±(5 % + 0.25 %)
Voltage Harmonics/Interharmonics			100 %/1000 V	0.1 %/0.1 mV	≥ 1 % Vnom ^[1] : ±2.5 % of rdg. <1 % Vnom ^[1] : ±0.025 Vnom ^[1]
Voltage THD			100 %	0.1 %/0.1 mV	±(2.5 % + 0.05 %)
Voltage Distortions 2 kHz to 9 kHz			100 V	0.1 mV	±(2.5 % + 0.1 V)
Voltage Distortions 9kHz to 31 kHz			100 V	0.1 mV	±(2.5 % + 0.1 V)
Voltage Unbalance			100 %	0.01 %	±0.15 %
Flicker P _{inst} , P _{st} , P _{lt}			0 to 20	0.01	±5 %
Mains Signaling Voltage ≤3 kHz			0 %-15 % of Vnom	0.1 V/0.1 %	1-3 % Vnom: ±0.15 % of Vnom 3-15 % Vnom: ±5 % of rdg.
Voltage Min/Max			1000 V	0.1 V	±2 % of nominal input voltage ^[1]
Current	Direct Input ^[3]	Rogowski Mode	15 mV	0.01 mV	±(0.3 % + 0.2 %)
			150 mV	0.1 mV	±(0.3 % + 0.02 %)
		Clamp Mode	50 mV	0.01 mV	±(0.2 % + 0.02 %)
			500 mV	0.1 mV	±(0.2 % + 0.02 %)
	with iFlex 1500 A i17XX-FLEX1500-24		150 A	0.01 mA	±(1 % + 0.2 %)
			1500 A	0.1 mA	±(1 % + 0.02 %)
	with iFlex 3000 A i17XX-FLEX3000-24		300 A	1 mA	±(1 % + 0.3 %)
			3000 A	10 mA	±(1 % + 0.03 %)
	with iFlex 6000 A i17XX-FLEX6000-36		600 A	1 mA	±(1.5 % + 0.3 %)
			6000 A	10 mA	±(1.5 % + 0.03 %)
	with AC Clamp 40 A i40s-EL		4 A	1 mA	(0.7 % + 0.02 %)
			40 A	10 mA	(0.7 % + 0.02 %)
	with AC Clamp 400 A i400s-EL		40 A	0.01 A	±(2 % + 0.2 %)
			400 A	0.1 A	±(0.7 % + 0.2 %)
	with AC/DC Clamp 2000 A 80i-2010s-EL		200 A	0.01 A	±(0.8 % + 0.2 %)
			2000 A	0.1 A	
Current Min/Max			defined by accessory	defined by accessory	Intrinsic accuracy x 2
Current Harmonics/Interharmonics			100 %	defined by accessory	≥3 % Inom: ±2.5 % of rdg. ^[4] <3 % Inom: ±0.15 % of Inom
Current THD			100 %	0.1 %	±(2.5 % + 0.5 %)

Accuracy at Reference Conditions (cont.)

Parameter			Range	Maximum Resolution	Intrinsic Accuracy at Reference Conditions (% of Reading + % of Range)
Current Supra-Harmonics 2 kHz to 9 kHz	Direct Input ^[3]	Rogowski Mode	15 mV/150 mV	0.1 mV	±(2.5 % + 0.001 %)
		Current Mode	50 mV/500 mV	0.1 mV	±(2.5 % + 0.001 %)
	with iFlex 1500 A i17XX-FLEX1500-24		150 A	0.1 mA	±(2.5 % + 0.002 %) ^[6]
			1500 A	0.1 mA	
	with iFlex 3000 A i17XX-FLEX3000-24		300 A	0.1 mA	
			3000 A	0.1 mA	
	with iFlex 6000 A i17XX-FLEX6000-36		600 A	0.1 mA	
			6000 A	0.1 mA	
	with AC Clamp 40 A i40s-EL		4 A	0.1 mA	±(2.5 % + 0.005 %) ^[6]
			40 A	0.1 mA	
	with AC Clamp 400 A i400s-EL		40 A	0.01 A	±(4 % + 0.025 %) ^[6]
			400 A	0.1 A	
Current Supra-Harmonics 9 kHz to 30 kHz	Direct Input ^[3]	Rogowski Mode	15 mV/150 mV	0.1 mV	±(2.5 % + 0.01 %)
		Current Mode	50 mV/500 mV	0.1 mV	±(2.5 % + 0.01 %)
	with iFlex 1500 A i17XX-FLEX1500-24		150 A	0.1 mA	±(5 % + 0.01 %) ^[6]
			1500 A	0.1 mA	
	with iFlex 3000 A i17XX-FLEX3000-24		300 A	0.1 mA	
			3000 A	0.1 mA	
	with iFlex 6000 A i17XX-FLEX6000-36		600 A	0.1 mA	±(5 % + 0.01 %) ^[6]
			6000 A	0.1 mA	
	with AC Clamp 40 A i40s-EL		4 A	0.1 mA	intrinsic accuracy ±(5 % + 0.01 %) ^[6]
			40 A	0.1 mA	
	with AC Clamp 400 A i400s-EL		40 A	0.01 A	not available (3 dB bandwidth: 10 kHz)
			400 A	0.1 A	
Current Unbalance			100 %	0.01 %	±0.15 %
Frequency			42.5 Hz to 69 Hz	0.001 Hz	±0.01 Hz
Aux			±10 V	0.1 mV	±(0.2 % + 0.05 %)
[1] Nominal voltage in the range of 100 V to 690 V. Also know as Udin. [2] 0 °C ... 45 °C: Intrinsic accuracy x 2, outside of 0 °C ... 45 °C: Intrinsic accuracy x 3 [3] Only for calibration laboratories [4] with iFlex 1500 A i17xx-FLEX1500-24 [5] f Frequency in kHz [6] with firmware version 1.1 or higher					

Intrinsic Uncertainty ±(% of measurement value + % of power range)

Parameter	Influence Quantity	Direct Input ^[1]	i17xx-Flex1500-24	iFlex3000-24	iFlex6000-36	i40S-EL
		Clamp: 50 mV/500 mV Rogowski: 15 mV/150 mV	150 A 1500 A	300 A 3000 A	600 A 6000 A	4 A 40 A
Active Power P Active Energy E _a	PF ≥ 0.99	0.5 % + 0.005 %	1.2 % + 0.005 %	1.2 % + 0.0075 %	1.7 % + 0.0075 %	1.2 % + 0.005 %
	0.1 ≤ PF < 0.99	see Formula 1	see Formula 2	see Formula 3	see Formula 4	see Formula 5
Apparent Power S Apparent Energy E _{ap}	0 ≤ PF ≤ 1	0.5 % + 0.005 %	1.2 % + 0.005 %	1.2 % + 0.0075 %	1.2 % + 0.0075 %	1.2 % + 0.005 %
Reactive Power Q Reactive Energy E _r	0 ≤ PF ≤ 1	2.5 % of measured apparent power/energy				
Power Factor PF Displacement Power Factor DPF/cosφ	-	Reading ±0.025				
Additional uncertainty (% of power high-range)	V _{P-N} > 250 V	0.015 %	0.015 %	0.0225 %	0.0225 %	0.015 %

[1] Only for calibration laboratories

Reference Conditions:

Environmental: 23 °C ± 5 °C, instrument operating for at least 30 minutes, no external electrical/magnetic field, RH < 65 %

Input conditions: Cosφ/PF=1, Sinusoidal signal f=50/60 Hz, power supply 120 V/230 V ± 10 %

Current and power specifications: Input voltage 1ph: 120 V/230 V or 3ph wye/delta: 230 V/400 V

Input current > 10 % of current range

Primary conductor of clamps or Rogowski coil in center position

Temperature Coefficient: Add 0.1 x specified accuracy for each degree C above 28 °C or below 18 °C

Formula 1: $\left(0.5 + \frac{\sqrt{1-PF^2}}{3 \times PF}\right) \% + 0.005 \%$

Formula 2: $\left(1.2 + \frac{\sqrt{1-PF^2}}{2 \times PF}\right) \% + 0.005 \%$

Formula 3: $\left(1.2 + \frac{\sqrt{1-PF^2}}{2 \times PF}\right) \% + 0.0075 \%$

Formula 4: $\left(1.7 + \frac{\sqrt{1-PF^2}}{2 \times PF}\right) \% + 0.0075 \%$

Formula 5: $\left(1.2 + 1.7 \times \frac{\sqrt{1-PF^2}}{PF}\right) \% + 0.005 \%$

Example:

Measurement at 120 V/16 A using an iFlex1500-12 in low range. Power Factor is 0.8

Active power uncertainty σ_P :

$$\sigma_P = \pm \left(\left(1.2 \% + \frac{\sqrt{1-0.8^2}}{2 \times 0.8} \right) + 0.005 \% \times P_{\text{Range}} \right) = \pm (1.575 \% + 0.005 \% \times 1000 \text{ V} \times 150 \text{ A}) = \pm (1.575 \% + 7.5 \text{ W})$$

The uncertainty in W is $\pm (1.575 \% \times 120 \text{ V} \times 16 \text{ A} \times 0.8 + 7.5 \text{ W}) = \pm 31.7 \text{ W}$

Apparent power uncertainty σ_S :

$$\sigma_S = \pm (1.2 \% + 0.005 \% \times S_{\text{Range}}) = \pm (1.2 \% + 0.005 \% \times 1000 \text{ V} \times 150 \text{ A}) = \pm (1.2 \% + 7.5 \text{ VA})$$

The uncertainty in VA is $\pm (1.2 \% \times 120 \text{ V} \times 16 \text{ A} + 7.5 \text{ VA}) = \pm 30.54 \text{ VA}$

Reactive/non-active power uncertainty σ_Q :

$$\sigma_Q = \pm (2.5 \% \times S) = \pm (2.5 \% \times 120 \text{ V} \times 16 \text{ A}) = \pm 48 \text{ var}$$

In case of a measured voltage that is > 250 V, the additional error is calculated with:

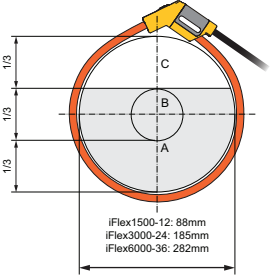
$$\text{Adder} = 0.015 \% \times S_{\text{High Range}} = 0.015 \% \times 1000 \text{ V} \times 1500 \text{ A} = 225 \text{ W/VA/var}$$

iFlex Probe Specifications

Flexible Current Probe Specifications	i17XX-FLEX1500-24	i17XX-FLEX3000-24	i17XX-FLEX6000-36
Measuring range	1 A ac to 150 A ac 10 A ac to 1500 A ac	3 A ac to 300 A ac 30 A ac to 3000 A ac	6 A ac to 600 A ac 60 A ac to 6000 A ac
Weight	170 g (0.38 lb)	170 g (0.38 lb)	190 g (0.42 lb)
Probe Cable Length	610 mm (24 in)	610 mm (24 in)	915 mm (36 in)
Probe Cable Diameter	7.5 mm (0.3 in)		
Minimum Bending Radius	38 mm (1.5 in)		
Nondestructive current	100 kA (50/60 Hz)		
Intrinsic Error at reference condition	±0.7 % of reading [Reference Condition: Environmental: 23 °C ±5 °C, no external electrical/magnetic field, RH 65 %. Primary conductor in center position]		
Temperature Coefficient over operating temperature range	0.05 % of reading / °C (0.028 % of reading / °F)		0.1 % of reading / °C (0.056 % of reading / °F)
Working Voltage	1000 V CAT III, 600 V CAT IV		
Output Cable length	2 m (6.6 ft)		
Probe Cable Material	TPR		
Coupling Material	POM + ABS/PC		
Output Cable Material	TPR/PVC		
Temperature, operating	-25 °C to +70 °C (-13 °F to +158 °F) temperature of conductor under test shall not exceed 80 °C (176 °F)		
Temperature, non-operating	-40 °C to +80 °C (-40 °F to +176 °F)		
Altitude, operating	2000 m (6500 ft) up to 4000 m (13 000 ft) derate to 1000 V CAT II/600 V CAT III/300 V CAT IV		
Altitude, storage	12 km (40 000 ft)		
IP Rating	IEC 60529:IP40		
Warranty	1 year		
External magnetic field rejection in reference to external current (with cable >100 mm from the head-coupling and r-coil)	40 dB		

3 Phase Power Quality Analyzer

Product Specifications

Flexible Current Probe Specifications	i17XX-FLEX1500-24	i17XX-FLEX3000-24	i17XX-FLEX6000-36
Phase shift	< $\pm 0.5^\circ$		
Bandwidth	10 Hz to 23.5 kHz (for accuracy specifications of higher frequencies, see <i>Accuracy at Reference Conditions</i>)		
Frequency derating	$I \times f \leq 385 \text{ kA Hz}$		
Positioning error with position of conductor in the probe window.  iFlex1500-12: 88mm iFlex3000-24: 185mm iFlex6000-36: 282mm	A: $\pm(1 \% \text{ of reading} + 0.02 \% \text{ of range})$	$\pm(1.5 \% \text{ of reading} + 0.03 \% \text{ of range})$	
	B: $\pm(1.5 \% \text{ of reading} + 0.02 \% \text{ of range})$	$\pm(2.0 \% \text{ of reading} + 0.03 \% \text{ of range})$	
	C: $\pm(2.5 \% \text{ of reading} + 0.02 \% \text{ of range})$	$\pm(4 \% \text{ of reading} + 0.03 \% \text{ of range})$	

Supported Parameters

	min/max	Measurement Unit	Interval	PQ Meter / PQ Logger	Single Phase Single Phase IT	Split Phase (2P-3W)	3- ϕ Wye (3P-4W)	3- ϕ Delta (3P-3W) 3- ϕ Wye IT	2 Element Delta (Aron/Blondel)	3- ϕ Delta Open Leg (3P-3W)	3- ϕ High Leg Delta
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Basic Parameters											
V _{AN}	U _{rms} (%) ^[1] U _{DC} 10/12 cycles (typ. 200ms)	V _{RMS} , V _{PK} , CF, V _{DC}	Trend: 1s-30min PQ: 10min	• / •	•	•	•	• ^[2]	• ^[2]	• ^[2]	• ^[2]
V _{BN}	U _{rms} (%) ^[1] U _{DC} 10/12 cycles (typ. 200ms)	V _{RMS} , V _{PK} , CF, V _{DC}	Trend: 1s-30min PQ: 10min	• / •		•	•	• ^[2]	• ^[2]	• ^[2]	• ^[2]
V _{CN}	U _{rms} (%) ^[1] U _{DC} 10/12 cycles (typ. 200ms)	V _{RMS} , V _{PK} , CF, V _{DC}	Trend: 1s-30min PQ: 10min	• / •			•	• ^[2]	• ^[2]	• ^[2]	• ^[2]
V _{NG}	U _{rms} (%) ^[1] U _{DC} 10/12 cycles (typ. 200ms)	V _{RMS} , V _{PK} , CF, V _{DC}	Trend: 1s-30min PQ: 10min	• / •	•	•	•				
V _{AB}	U _{rms} (%) ^[1] U _{DC} 10/12 cycles (typ. 200ms)	V _{RMS} , V _{PK} , CF, V _{DC}	Trend: 1s-30min PQ: 10min	• / •		• ^[2]	• ^[2]	•	•	•	•
V _{BC}	U _{rms} (%) ^[1] U _{DC} 10/12 cycles (typ. 200ms)	V _{RMS} , V _{PK} , CF, V _{DC}	Trend: 1s-30min PQ: 10min	• / •			• ^[2]	•	•	•	•
V _{CA}	U _{rms} (%) ^[1] U _{DC} 10/12 cycles (typ. 200ms)	V _{RMS} , V _{PK} , CF, V _{DC}	Trend: 1s-30min PQ: 10min	• / •			• ^[2]	•	•	•	•
I _A	I _{rms} (%) ^[1] I _{DC} 10/12 cycles (typ. 200ms)	A _{RMS} , A _{PK} , CF, A _{DC}	Trend: 1s-30min	• / •	•	•	•	•	•	•	•
I _B	I _{rms} (%) ^[1] I _{DC} 10/12 cycles (typ. 200ms)	A _{RMS} , A _{PK} , CF, A _{DC}	Trend: 1s-30min	• / •		•	•	•	Δ	•	•
I _C	I _{rms} (%) ^[1] I _{DC} 10/12 cycles (typ. 200ms)	A _{RMS} , A _{PK} , CF, A _{DC}	Trend: 1s-30min	• / •			•	•	•	•	•
I _N	I _{rms} (%) ^[1] I _{DC} 10/12 cycles (typ. 200ms)	A _{RMS} , A _{PK} , CF, A _{DC}	Trend: 1s-30min	• / •		•	•				
f	10/12 cycles (typ. 200ms)	Hz	Trend: 1s-30min PQ: 10s	• / •	•	•	•	•	•	•	•
Aux 1, 2	10/12 cycles (typ. 200ms)	mV, user defined	Trend: 1s-30min	– / •	•	•	•	•	•	•	•
Unbalance											
Voltage unbalance	10/12 cycles (typ. 200ms) (Trend only)	%	Trend: 1s-30min PQ: 10min	• / •			•	•	•	•	•
Voltage positive sequence component	n/a	V	Trend: 1s-30min PQ: 10min	• / •			•	•	•	•	•
Voltage negative sequence component	n/a	V	Trend: 1s-30min PQ: 10min	• / •			•	•	•	•	•
Voltage zero sequence component	n/a	V	Trend: 1s-30min PQ: 10min	• / •			•				
Current unbalance	10/12 cycles (typ. 200ms) (Trend only)	%	Trend: 1s-30min PQ: 10min	• / •			•	•	•	•	•
Current positive sequence component	n/a	A	Trend: 1s-30min PQ: 10min	• / •			•	•	•	•	•
Current negative sequence component	n/a	A	Trend: 1s-30min PQ: 10min	• / •			•	•	•	•	•
Current zero sequence component	n/a	A	Trend: 1s-30min PQ: 10min	• / •			•				
Flicker											
Flicker P _{st} , P _{lt} phase A	n/a	1	PQ: 10min, 2hrs	• / •	•	•	•				
Flicker P _{st} , P _{lt} phase B	n/a	1	PQ: 10min, 2hrs	• / •		•	•				
Flicker P _{st} , P _{lt} phase C	n/a	1	PQ: 10min, 2hrs	• / •			•				
Flicker P _{st} , P _{lt} phase-phase AB	n/a	1	PQ: 10min, 2hrs	• / •				•	•	•	•
Flicker P _{st} , P _{lt} phase-phase BC	n/a	1	PQ: 10min, 2hrs	• / •				•	•	•	•
Flicker P _{st} , P _{lt} phase-phase CA	n/a	1	PQ: 10min, 2hrs	• / •				•	•	•	•
Factor-k, k-Factor phase A	10/12 cycles (typ. 200ms)	%	Trend: 1s-30min	• / •							
Factor-k, k-Factor phase B	10/12 cycles (typ. 200ms)	%	Trend: 1s-30min	• / •							
Factor-k, k-Factor phase C	10/12 cycles (typ. 200ms)	%	Trend: 1s-30min	• / •							
Over- and Underdeviation											
Over-, underdeviation V _A	n/a	V	PQ: 10min	• / •	•	•	•				
Over-, underdeviation V _B	n/a	V	PQ: 10min	• / •		•	•				
Over-, underdeviation V _C	n/a	V	PQ: 10min	• / •			•				
Over-, underdeviation V _{AB}	n/a	V	PQ: 10min	• / •				•	•	•	•
Over-, underdeviation V _{BC}	n/a	V	PQ: 10min	• / •				•	•	•	•
Over-, underdeviation V _{CA}	n/a	V	PQ: 10min	• / •				•	•	•	•
Harmonics											
THD V _{AN} TID V _{AN} (PQ only)	10/12 cycles (typ. 200ms)	V, %	Trend: 1s-30min PQ: 10min, 150/180 cycles	• / •	•	•	•				
THD V _{BN} TID V _{BN} (PQ only)	10/12 cycles (typ. 200ms)	V, %	Trend: 1s-30min PQ: 10min, 150/180 cycles	• / •		•	•				

THD V_{CN} TID V_{CN} (PQ only)	10/12 cycles (typ. 200ms)	V, %	Trend: 1s-30min PQ: 10min, 150/180 cycles	• / •			•				
THD V_{NG} TID V_{NG} (PQ only)	10/12 cycles (typ. 200ms)	V, %	Trend: 1s-30min PQ: 10min, 150/180 cycles	• / •			•				
THD V_{AB} TID V_{AB} (PQ only)	10/12 cycles (typ. 200ms)	V, %	Trend: 1s-30min PQ: 10min, 150/180 cycles	• / •				•	•	•	•
THD V_{BC} TID V_{BC} (PQ only)	10/12 cycles (typ. 200ms)	V, %	Trend: 1s-30min PQ: 10min, 150/180 cycles	• / •				•	•	•	•
THD V_{CA} TID V_{CA} (PQ only)	10/12 cycles (typ. 200ms)	V, %	Trend: 1s-30min PQ: 10min, 150/180 cycles	• / •				•	•	•	•
Harmonics h00-50 V_{AN} Interharmonics ih00-50 V_{AN}	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	• / •	•	•	•				
Harmonics h00-50 V_{BN} Interharmonics ih00-50 V_{BN}	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	• / •		•	•				
Harmonics h00-50 V_{CN} Interharmonics ih00-50 V_{CN}	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	• / •			•				
Harmonics h00-50 V_{NG} Interharmonics ih00-50 V_{NG}	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	• / •			•				
Harmonics h00-50 V_{AB} Interharmonics ih00-50 V_{AB}	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	• / •				•	•	•	•
Harmonics h00-50 V_{BC} Interharmonics ih00-50 V_{BC}	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	• / •				•	•	•	•
Harmonics h00-50 V_{CA} Interharmonics ih00-50 V_{CA}	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	• / •				•	•	•	•
Voltage Phase Angle $\varphi_{A,fund}$	10/12 cycles (typ. 200ms)	°	Trend: 1s-30min	• / •		•	•	•	•	•	•
Voltage Phase Angle $\varphi_{B,fund}$ (relative to $\varphi_{A,fund}$)	10/12 cycles (typ. 200ms)	°	Trend: 1s-30min	• / •		•	•	•	•	•	•
Voltage Phase Angle $\varphi_{C,fund}$ (relative to $\varphi_{A,fund}$)	10/12 cycles (typ. 200ms)	°	Trend: 1s-30min	• / •			•	•	•	•	•
Voltage Phase Angle φ_A h02-11	10/12 cycles (typ. 200ms)	°	Trend: 1s-30min	• / •		•	•	•	•	•	•
Voltage Phase Angle φ_B h02-11	10/12 cycles (typ. 200ms)	°	Trend: 1s-30min	• / •		•	•	•	•	•	•
Voltage Phase Angle φ_C h02-11	10/12 cycles (typ. 200ms)	°	Trend: 1s-30min	• / •			•	•	•	•	•
THD I_A TID I_A (PQ only)	10/12 cycles (typ. 200ms)	A, %	Trend: 1s-30min PQ: 10min, 150/180 cycles	• / •	•	•	•	•	•	•	•
THD I_B TID I_B (PQ only)	10/12 cycles (typ. 200ms)	A, %	Trend: 1s-30min PQ: 10min, 150/180 cycles	• / •		•	•	•	•	•	•
THD I_C TID I_C (PQ only)	10/12 cycles (typ. 200ms)	A, %	Trend: 1s-30min PQ: 10min, 150/180 cycles	• / •			•	•	•	•	•
THD I_N TID I_N (PQ only)	10/12 cycles (typ. 200ms)	A, %	Trend: 1s-30min PQ: 10min, 150/180 cycles	• / •		•	•				
TDD $IA^{[4]}$	10/12 cycles (typ. 200ms)	%	PQ: 10min, 150/180 cycles	• / •	•	•	•	•	•	•	•
TDD $IB^{[4]}$	10/12 cycles (typ. 200ms)	%	PQ: 10min, 150/180 cycles	• / •		•	•	•	•	•	•
TDD $IC^{[4]}$	10/12 cycles (typ. 200ms)	%	PQ: 10min, 150/180 cycles	• / •			•	•	•	•	•
Harmonics h00-50 I_A Interharmonics ih00-50 I_A	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	• / •	•	•	•				
Harmonics h00-50 I_B Interharmonics ih00-50 I_B	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	• / •		•	•				
Harmonics h00-50 I_C Interharmonics ih00-50 I_C	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	• / •			•				
Harmonics h00-50 I_N Interharmonics ih00-50 I_N	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	• / •			•				
Current Phase Angle $\varphi_{A,fund}$	10/12 cycles (typ. 200ms)	°	Trend: 1s-30min	• / •		•	•	•	•	•	•
Current Phase Angle $\varphi_{B,fund}$ (relative to $\varphi_{A,fund}$)	10/12 cycles (typ. 200ms)	°	Trend: 1s-30min	• / •		•	•	•	•	•	•
Current Phase Angle $\varphi_{C,fund}$ (relative to $\varphi_{A,fund}$)	10/12 cycles (typ. 200ms)	°	Trend: 1s-30min	• / •			•	•	•	•	•
Current Phase Angle φ_A h02-11	10/12 cycles (typ. 200ms)	°	Trend: 1s-30min	• / •		•	•	•	•	•	•
Current Phase Angle φ_B h02-11	10/12 cycles (typ. 200ms)	°	Trend: 1s-30min	• / •		•	•	•	•	•	•
Current Phase Angle φ_C h02-h11	10/12 cycles (typ. 200ms)	°	Trend: 1s-30min	• / •			•	•	•	•	•
Power harmonics h00-50 A, Power THC_A	10/12 cycles (typ. 200ms)	W, %	PQ: 10min, 150/180 cycles	• / •	•	•	•	•	•	•	•
Power harmonics h00-50 B Power THC_B	10/12 cycles (typ. 200ms)	W, %	PQ: 10min, 150/180 cycles	• / •		•	•	•	•	•	•
Power harmonics h00-50 C Power THC_C	10/12 cycles (typ. 200ms)	W, %	PQ: 10min, 150/180 cycles	• / •			•	•	•	•	•
Mains Signaling											
Mains signaling f1,f2 V_A	n/a	V, % Vnom	150/180 cycles	– / •	•	•	•				
Mains signaling f1,f2 V_B	n/a	V, % Vnom	150/180 cycles	– / •		•	•				
Mains signaling f1,f2 V_C	n/a	V, % Vnom	150/180 cycles	– / •			•				
Mains signaling f1,f2 V_{AB}	n/a	V, % Vnom	150/180 cycles	– / •				•	•	•	•
Mains signaling f1,f2 V_{BC}	n/a	V, % Vnom	150/180 cycles	– / •				•	•	•	•
Mains signaling f1,f2 V_{CA}	n/a	V, % Vnom	150/180 cycles	– / •				•	•	•	•

Events											
Dip / Swell / Interruption		% Unom % sliding reference	½ cycle RMS	● / ●	●	●	●	●	●	●	●
Rapid voltage change		% Unom	½ cycle RMS	● / ●	●	●	●	●	●	●	●
Mains Signalling		% Unom	200ms RMS	● / ●	●	●	●	●	●	●	●
Waveform deviation		% Unom	10.24kHz	● / ●	●	●	●	●	●	●	●
Inrush current		A	½ cycle RMS	● / ●	●	●	●	●	●	●	●
Power											
Active Power P _A Fund. Active Power P _{A fund}	10/12 cycles (typ. 200ms)	W	Trend: 1s-30min	● / ●	●	●	●				
Active Power P _B Fund. Active Power P _{B fund}	10/12 cycles (typ. 200ms)	W	Trend: 1s-30min	● / ●		●	●				
Active Power P _C Fund. Active Power P _{C fund}	10/12 cycles (typ. 200ms)	W	Trend: 1s-30min	● / ●			●				
Active Power P _{Total} Fund. Active Power P _{Total fund}	10/12 cycles (typ. 200ms)	W	Trend: 1s-30min	● / ●		●	●	●	●	●	●
Non-active Power N _A Fund. Reactive Power Q _A	10/12 cycles (typ. 200ms)	var	Trend: 1s-30min	● / ●	●	●	●				
Non-active Power N _B Fund. Reactive Power Q _B	10/12 cycles (typ. 200ms)	var	Trend: 1s-30min	● / ●		●	●				
Non-active Power N _C Fund. Reactive Power Q _C	10/12 cycles (typ. 200ms)	var	Trend: 1s-30min	● / ●			●				
Non-active Power N _{Total} Fund. Reactive Power Q _{Total}	10/12 cycles (typ. 200ms)	var	Trend: 1s-30min	● / ●			●	●	●	●	●
Apparent Power S _A Fund. Apparent Power S _{A fund}	10/12 cycles (typ. 200ms)	VA	Trend: 1s-30min	● / ●	●	●	●				
Apparent Power S _B Fund. Apparent Power S _B	10/12 cycles (typ. 200ms)	VA	Trend: 1s-30min	● / ●		●	●				
Apparent Power S _C Fund. Apparent Power S _C	10/12 cycles (typ. 200ms)	VA	Trend: 1s-30min	● / ●			●				
Apparent Power S _{Total} Fund. Apparent Power S _{Total}	10/12 cycles (typ. 200ms)	VA	Trend: 1s-30min	● / ●		●	●	●	●	●	●
Distortion Harmonic Power SH _A	10/12 cycles (typ. 200ms)	VA	Trend: 1s-30min	● / ●	●	●	●				
Distortion Harmonic Power SH _B	10/12 cycles (typ. 200ms)	VA	Trend: 1s-30min	● / ●		●	●				
Distortion Harmonic Power SH _C	10/12 cycles (typ. 200ms)	VA	Trend: 1s-30min	● / ●			●				
Distortion Harmonic Power SH _{Total}	10/12 cycles (typ. 200ms)	VA	Trend: 1s-30min	● / ●		●	●	●	●	●	●
Distortion Unbalance Power SU _{Total}	10/12 cycles (typ. 200ms)	VA	Trend: 1s-30min	● / ●		●	●	●	●	●	●
Power Factor PF _A Displacement Power Factor DPF _A /Cos Phi _A Tangens Phi - Phase A	10/12 cycles (typ. 200ms)	1	Trend: 1s-30min	● / ●	●	●	●				
Power Factor PF _B Displacement Power Factor DPF _B /Cos Phi _B Tangens Phi - Phase B	10/12 cycles (typ. 200ms)	1	Trend: 1s-30min	● / ●		●	●				
Power Factor PF _C Displacement Power Factor DPF _C /Cos Phi _C Tangens Phi - Phase C	10/12 cycles (typ. 200ms)	1	Trend: 1s-30min	● / ●			●				
Power Factor PF _{Total} Displacement Power Factor DPF _{Total} /Cos Phi _{Total} Tangens Phi - Total	10/12 cycles (typ. 200ms)	1	Trend: 1s-30min	● / ●		●	●	●	●	●	●
Energy											
Active Energy E _A	n/a	Wh	Trend: 1s-30min	● / ●	●	●	●				
Active Energy E _B	n/a	Wh	Trend: 1s-30min	● / ●		●	●				
Active Energy E _C	n/a	Wh	Trend: 1s-30min	● / ●			●				
Active Energy E _{Total} Active Energy E _{Total} forward Active Energy E _{Total} reverse	n/a	Wh	Trend: 1s-30min	● / ●		●	●	●	●	●	●
Non-active Energy E _{IA}	n/a	varh	Trend: 1s-30min	● / ●	●	●	●				
Non-active Energy E _{IB}	n/a	varh	Trend: 1s-30min	● / ●		●	●				
Non-active Energy E _{IC}	n/a	varh	Trend: 1s-30min	● / ●			●				
Non-active Energy E _{Total}	n/a	varh	Trend: 1s-30min	● / ●			●	●	●	●	●
Apparent Energy E _{aA}	n/a	VAh	Trend: 1s-30min	● / ●	●	●	●				
Apparent Energy E _{aB}	n/a	VAh	Trend: 1s-30min	● / ●		●	●				
Apparent Energy E _{aC}	n/a	VAh	Trend: 1s-30min	● / ●			●				
Apparent Energy E _{aTotal}	n/a	VAh	Trend: 1s-30min	● / ●		●	●	●	●	●	●
1775, 1777											
Events											
Transients		V	trigger on voltage > 1.5kHz	● / ●	●	●	●	●	●	●	●

Event Recordings											
RMS profile		V, A	½ cycle RMS up to 10s	● / ●	●	●	●	●	●	●	●
Waveform		V, A	80kS/s up to 10 cycles	● / ●	●	●	●	●	●	●	●
Transients		V	1MS/s, 25,000 samples	● / ●	●	●	●	●	●	●	●
Mains Signaling RMS profile		V,A	10/12 cycles up to 120s	– / ●	●	●	●	●	●	●	●
Supra-Harmonics											
Supra-harmonics 2-31 kHz V _{AN}	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	● / ●	●	●	●				
Supra-harmonics 2-31 kHz V _{BN}	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	● / ●		●	●				
Supra-harmonics 2-31 kHz V _{CN}	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	● / ●			●				
Supra-harmonics 2-31 kHz V _{NG}	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	● / ●			●				
Supra-harmonics 2-31 kHz V _{AB}	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	● / ●				●	●	●	●
Supra-harmonics 2-31 kHz V _{BC}	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	● / ●				●	●	●	●
Supra-harmonics 2-31 kHz V _{CA}	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	● / ●				●	●	●	●
Supra-harmonics 2-31 kHz I _A	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	● / ●	●	●	●				
Supra-harmonics 2-31 kHz I _B	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	● / ●		●	●				
Supra-harmonics 2-31 kHz I _C	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	● / ●			●				
Supra-harmonics 2-31 kHz I _N	10/12 cycles (typ. 200ms)	V, %	PQ: 10min, 150/180 cycles	● / ●			●				
1777											
Event Recordings											
Transients		V	1MS/s, 20MS/s 500,000 samples	● / ●	●	●	●	●	●	●	●

● = Measured values
[1]: U_{rms}(½), I_{rms}(½): 1-cycle rms values, refreshed each half cycle
[2] Available in Fluke Energy Analyze - Advanced graphs