



## PWS 3.3

### Three-phase Portable Working Standard and Power Quality Analyzer



The PWS 3.3 is a combination of a three-phase Portable Working Standard of class 0.05% or 0.1% and an IEC 61000-4-30 Class A compatible Power Quality Analyzer with 3 voltage and 4 current channels.

The Working Standard is used to test single and three phase meters, instrument transformers and installations on site.

The Power Quality Analyzer is used to resolve disputes at contractual applications, for statistical surveys, including EN 50160 reporting, and for online troubleshooting of different kind of power quality problems.

The unit can be used with various types of clamp-on CTs and current and voltage sensors. Therefore, it is possible to easily and accurately test both CT/PT and direct connected meters.

The unit can be powered either from the measuring circuit or from an auxiliary single-phase supply. Power Quality Analysis is battery buffered during min. 15 minutes in case of an outage.

#### Advantages

- Two instruments in one compact case
- Large 6.4" (640 x 480 pixels) colour TFT display with graphical user interface
- Data transfer and communication via USB or ETHERNET
- Data storage on removable Compact Flash memory card
- Independent UCT sets of clamp-on CTs allow service, calibration or later purchase of clamp-on CTs without factory return of the device.

#### Measurement Inputs

- 3 voltage inputs U1, U2, U3
- 3 direct current inputs I1, I2, I3
- 1 clamp-on CT current input for IN/IE
- 2 UCT clamp-on CT current inputs for I1, I2, I3

#### WORKING STANDARD - Functions

- Meter testing of pulse outputs (LED/disc mark/S0) and registers of active, reactive, apparent 1- or 3-phase, 3- or 4-wire energy meters with 2 pulse inputs (1 configurable as pulse output).
- Measurement of electrical parameters (UI  $\phi$ , PQS, f, PF) including vector diagram, harmonic analysis and wave form display.
- Instrument transformer testing (CT/PT burden, CT/PT ratio)

#### POWER QUALITY ANALYZER – Functions

- Dips / Swells / Interruptions
- Harmonics / Interharmonics / Signal voltages
- Voltage unbalance
- Flicker
- Transient capture  $\geq 100\mu\text{s}$  (22.7 kHz)

#### Options

- Software CALegration
- Analogue modem (integrated, order with instrument)
- GSM/GPRS modem (external)
- GPS Time Synchronisation (integrated, order with instrument)
- Set of 3 UCT 10.3 clamp-on CT 10A
- Set of 3 UCT120.3 clamp-on CT 120A (active error compensated)
- Set of 3 UCT 1000.3 clamp-on CT 1000A
- Set of 3 UCT LEM.3 flexible current probes FLEX 3000 (30/300/3000A)
- 1 clamp-on CT 100A for IN/IE
- 1 clamp-on CT 1000A for IN/IE
- UCT AMP-LiteWire 3-phase adapter set for AmpLiteWire
- Primary current sensor AmpLiteWire 2000 A
- UCT VOLT-LiteWire 3-phase adapter set for VoltLiteWire
- Primary voltage sensor VoltLiteWire 40 kV

## Technical Data PWS 3.3

### General

Auxiliary supply:	Power may be taken from the auxiliary supply or the measuring circuit at 46 V ... 300 V / 47 ... 63 Hz
Power consumption:	max. 50 VA
Battery:	Life keeping: $\geq 15$ min Recharging time: $\leq 2$ h (Load: + 10 VA)
Housing:	Hard Plastic
Dimensions:	W 307 x H 217 x D 80 mm (inclusive rubber protection)
Weight:	approx. 3.25 kg
Operation temperature:	-10 °C ... +60 °C
Storage temperature:	-20 °C ... +60 °C
Relative humidity:	$\leq 85\%$ at $T_a \leq 21^\circ\text{C}$ $\leq 95\%$ at $T_a \leq 25^\circ\text{C}$ , 30 days / year spread

### Safety

Isolation protection:	IEC 61010-1:2002
Measurement Category:	300V CAT IV, 600V CAT III
Degree of protection:	IP-40

### Measurement Range

Measuring Quantity	Range	Input / Sensor
<b>Voltage (phase - neutral)</b>	5 V ... 600 V	U1, U2, U3
	20 mV ... 5 V	U1 (Burden)
<b>Current</b>	1 mA ... 12 A	I1, I2, I3
	1 mA ... 10 A	UCT 10.3
	10 mA ... 120 A	UCT 120.3
	100 mA ... 1000 A	UCT 1000.3
	3 A ... 3000 A	FLEX 3000
<b>Primary current</b>	30 A ... 2000 A	AmpLiteWire 2000A
<b>Primary voltage</b>	500 V ... 40 kV	VoltLiteWire 40kV

### PORTABLE WORKING STANDARD

#### Measurement Accuracy

Voltage / Current		$\leq \pm E$ [%] <sup>1,2,4,5</sup>	
Measuring Quantity	Range	Cl. 0.05	Cl. 0.1
<b>Voltage (U1, U2, U3, N)</b>	25 V ... 600 V	0.05	0.1
	5 V ... 25 V	<u>0.05</u>	<u>0.1</u>
<b>Current direct (I1, I2, I3)</b>	10 mA ... 12 A	0.05	0.1
	1 mA ... 10 mA	<u>0.05</u>	<u>0.1</u>
<b>Current CT 10A UCT 10.3</b>	30mA ... 10 A	0.2	
<b>Current CT 120A UCT 120.3</b>	100 mA ... 120 A	0.2 (0.5)	
<b>Curr. CT 1000A UCT 1000.3</b>	10 A ... 1000 A	0.2 (0.5)	
<b>Current FLEX 3000 UCT LEM.3</b>	300 A ... 3000 A	0.1 + E <sub>M</sub>	
	30 A ... 300 A		
	3 A ... 30 A		
<b>Burden Voltage (U1)</b>	100 mV ... 5 V	0.5	
	20 mV ... 100 mV	<u>0.5</u>	
<b>Current AmpLiteWire 2000A</b>	300 A ... 2000 A	0.1 + E <sub>M</sub>	
	30 A ... 300 A	<u>0.1</u> + E <sub>M</sub>	
<b>Voltage VoltLiteWire 40kV</b>	6 kV ... 40 kV	0.1 + E <sub>M</sub>	
	500 V ... 6 kV	<u>0.1</u> + E <sub>M</sub>	

Power / Energy		Voltage: 25 V... 600 V (U - N)		$\leq \pm E$ [%] <sup>1,2,3</sup>	
Measuring quantity / Input I	Range	Cl. 0.05	Cl. 0.1	Cl. 0.05	Cl. 0.1
<b>Active (P), Apparent (S) Power / Energy</b>					
Direct (I1, I2, I3)	10 mA ... 12 A	0.05	0.1	<u>0.05</u>	<u>0.1</u>
	1 mA ... 10 mA				
Current CT 10A UCT 10.3	30 mA ... 10 A	0.2			
Current CT 120A UCT 120.3	100 mA ... 120 A	0.2			
Current CT 1000A UCT 1000.3	10 A ... 1000 A	0.2			
<b>Reactive (Q) Power / Energy</b>					
Direct (I1, I2, I3)	10 mA ... 12 A	0.1	0.2	<u>0.1</u>	<u>0.2</u>
	1 mA ... 10 mA				
Current CT 10A UCT 10.3	30 mA ... 10 A	0.4			
Current CT 120A UCT 120.3	100 mA ... 120 A	0.4			
Current CT 1000A UCT 1000.3	10 A ... 1000 A	0.4			
<b>Drift / year at Power / Energy (PQS) (I direct)</b>		0.015	0.03		

Temperature coefficient (TC):		$\leq \pm TC$ [%/°C] <sup>3</sup>	
Range		Cl. 0.05	Cl. 0.1
0° C ... +40°C		0.003	0.005
-10° C ... +60°C		0.006	0.010

Frequency / Phase Angle / Power Factor		$\leq \pm E$	
Measuring Quantity	Range	Cl. 0.05	Cl. 0.1
<b>Frequency (f)</b>	40 Hz ... 70 Hz	0.01 Hz	
<b>Phase Angle (φ)</b>	0.00 ° ... 359.99°	0.1 °	
<b>Power Factor (PF)</b>	-1.000... +1.000	0.002	

CT/PT Ratio	$\leq \pm E$ [%] <sup>1,2</sup>
<b>Ratio error E:</b> Sum of errors of inputs used for primary (IP, UP) and secondary (IS, US) measurements.	E <sub>P</sub> + E <sub>S</sub>

CT/PT Burden	$\leq \pm E$ [%] <sup>1,2</sup>
<b>Operating burden S<sub>n</sub>:</b> Sum of errors of inputs used for voltage (U) and current (I) measurement.	E <sub>U</sub> + E <sub>I</sub>

### Notes

- x.x : Related to the measuring value  
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E(M) = FS/M \* x.x (e.g. 0.1 at FS = 10 mA, E(2mA) = 10/2 \* 0.1 = 0.5 %)
- Fundamental frequency in the range 45 ... 66 Hz
- S: x.x, P, Q: x.x / PF (related to apparent power), 3- and 4-wire networks
- E<sub>M</sub>: Accuracy specified by manufacturer of clamp-on CT or sensor
- Value in brackets () valid for IN/IE input, used for PQ analysis

### Pulse Input / output

Input level:	4 ... 12 VDC (24 VDC)
Input frequency:	max. 200 kHz
Supply:	12 VDC (I < 60 mA)
Output level:	5V
Pulse length:	$\geq 10\mu\text{s}$
<b>Meter constant:</b> Active, Reactive, Apparent [imp/Wh(varh,VAh)]	C = 36'000'000 / (ln * Un) The meter constant depends on the highest selected internal ranges ln, Un. Example: Un = 300V, ln = 12 A C = 10'000 [imp/Wh(varh,VAh)]
Output frequency:	C' = C / 3'600 [imp/Ws(vars, VAs)] fo = C' * PΣ(QΣ, SΣ) f <sub>max</sub> = 36'000'000 / (12 * 300 * 3'600) * 3 * 12 * 300 = 30'000 [imp/s]

### POWER QUALITY ANALYZER

Voltage	
Inputs	3
Accuracy class	■ 0.1%
Dips / Swells / Interruptions	■ U <sub>RMS</sub> ½
Harmonics	■ 2 ... 64
Interharmonics	■ 1-2 ... 63-64
Signal Voltages	■ fs < 3 kHz
Flicker P <sub>st</sub> , P <sub>It</sub>	■ up to 40 Hz
Unbalance	■
Transients	● 0.9 kV/≥ 100 μs (22.7 kHz)
EN 50160	●
Current	
Inputs	4
Accuracy class	■ 0.1%
Inrush	■
Harmonics	■ 2 ... 64
Interharmonics	■ 1-2 ... 63-64
Transients	● ≥ 100 μs (22.7 kHz)
Neutral(IN) or Earth(IE) current	●
Power	
Active (P) / Reactive (Q) / Apparent (S)	●
Harmonics P, Q, S	●
Energy	●
Communication	
USB	●
ETHERNET	●
Analogue modem (integrated)	○
GSM/GPRS modem (external)	○
Other functions	
Battery buffering at outage	● ≥ 15 min
Removable Compact Flash card memory	●
GPS time synchronisation (integrated)	○

### Notes

- Function according IEC 61000-4-30 Class A
- Option