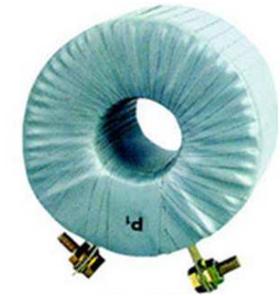
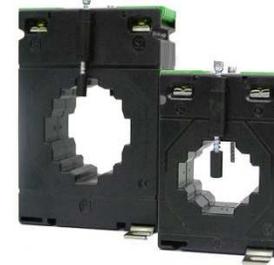


Testing whole measurement system!

Accuracy of all kind of
 Electricity Meters ϵ [%]

CT/PT burden,
 ratio, phase shift
 error



Electromechanical
 Meters



Electronic (static)
 Meters



4-Quadrants
 Meters



Max Demand
 Meters



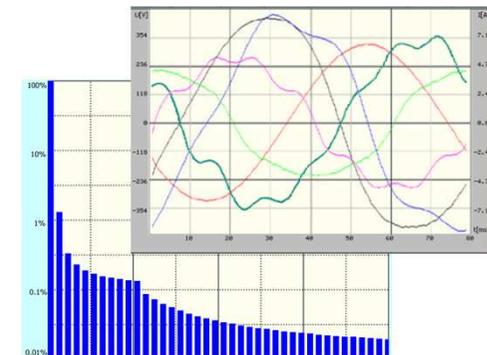
TE30



Connection
 errors

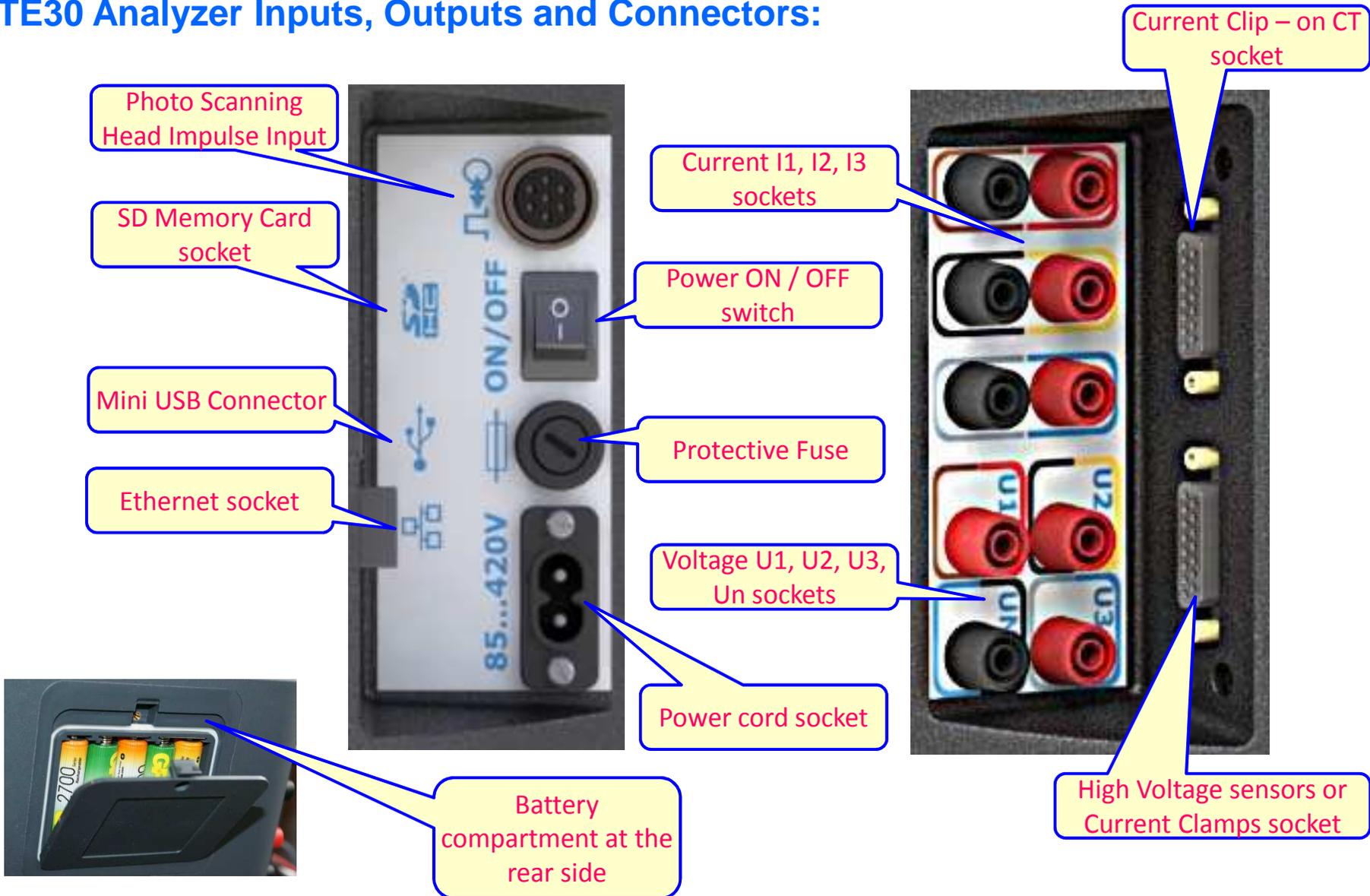


Power Quality
 in point of
 measurement





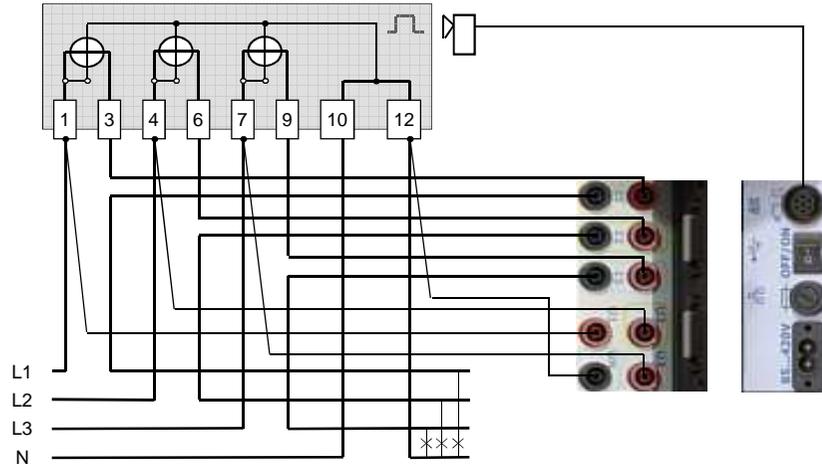
TE30 Analyzer Inputs, Outputs and Connectors:



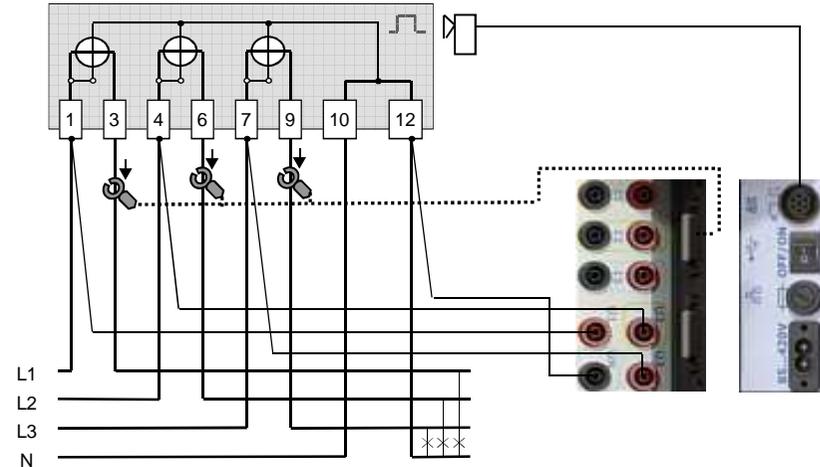


All possible types of connection: 1P2W, 3P4W, 3P3W, ... , direct or with clamps

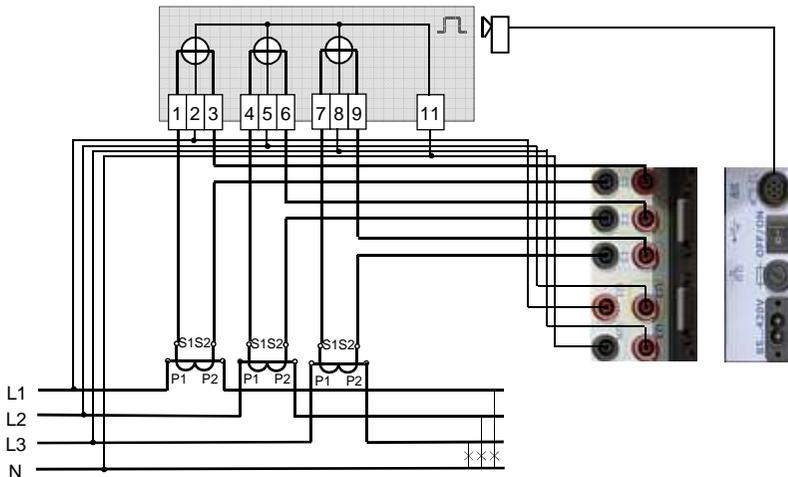
Electricity meter testing – direct connection



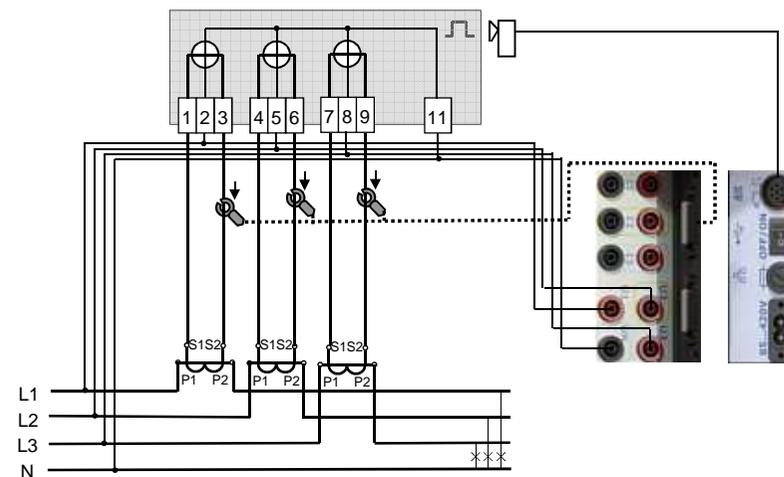
Electricity meter testing – connection with clamps



Electricity meter (CT) testing – direct connection



Electricity meter testing (CT) – connection with clamps



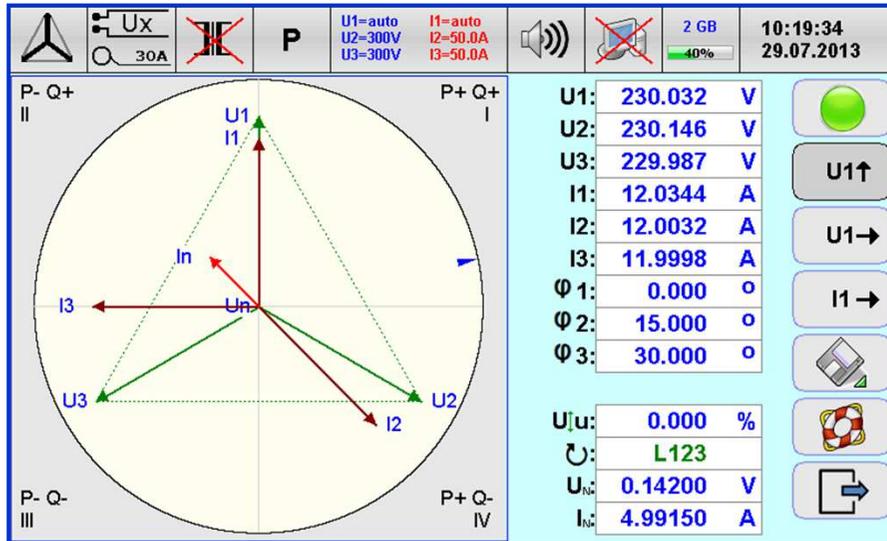
RMS measurement results and TE30 Analyzer configuration:

The screenshot shows the TE30 analyzer's main display with various callouts pointing to specific features and data points:

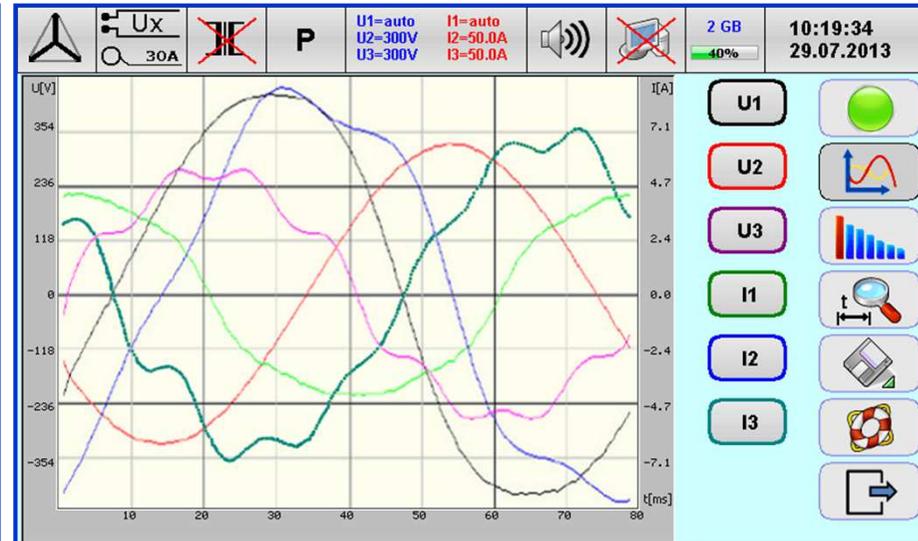
- 3-Phase Star or Delta connection:** Points to the connection type icon (Star).
- Voltage direct connection Current measured by flexible clamps:** Points to the current measurement icon (30A).
- Automatic or Costant range used for measurements:** Points to the range selection icon (P).
- Actual Date and Time:** Points to the date and time display (10:19:34 29.07.2013).
- Frequency:** Points to the frequency display (50.001 Hz).
- Neutral Voltage:** Points to the neutral voltage display (U_N: 0.14200 V).
- Neutral Current:** Points to the neutral current display (I_N: 4.99150 A).
- 3-Phase Power Factor:** Points to the total power factor display (Σ: 0.94399).
- 3-Phase Reactive Factor:** Points to the total reactive power factor display (Σ: 0.25293).
- 3-Phase Tangent φ:** Points to the total tangent φ display (Σ: 0.28177).
- 3-Phase Vector Rotation:** Points to the vector rotation icon.
- 3-Phase Active Power:** Points to the total active power display (Σ: 8870.23 W).
- 3-Phase Reactive Power:** Points to the total reactive power display (Σ: 2374.38 var).
- 3-Phase Apparent Power:** Points to the total apparent power display (Σ: 9370.88 VA).

	L1	L2	L3		
U:	230.032 V	230.146 V	229.987 V	f:	50.001 Hz
U _Δ :	398.526 V	398.487 V	398.388 V	U _N :	0.14200 V
I:	12.0344 A	12.0032 A	11.9998 A	I _N :	4.99150 A
φ:	0.000 °	15.000 °	30.000 °	Σ:	0.94399
PF:	1.00000	0.96593	0.86603	Σ:	0.25293
sin:	0.00000	0.25880	0.49999	Σ:	0.28177
tgφ:	0.00000	0.26795	0.57735	U:	L123
φ _{uv} :	120.000 °	-120.000 °	120.000 °	Σ:	8870.23 W
P:	2768.30 W	3711.86 W	2390.07 W	Σ:	2374.38 var
Q:	0.00000 var	994.511 var	1379.87 var	Σ:	9370.88 VA
S:	2768.30 VA	3842.78 VA	2759.80 VA		

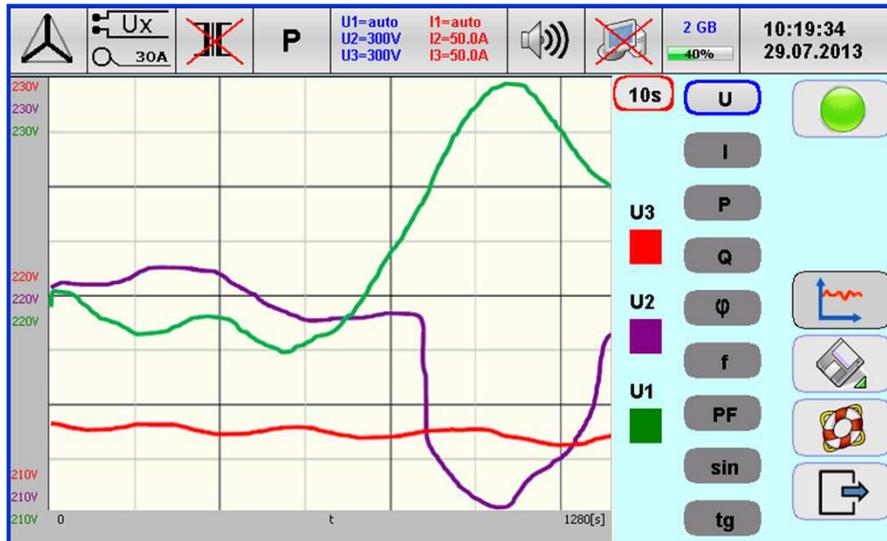
Vector diagram with calculated U_n & I_n



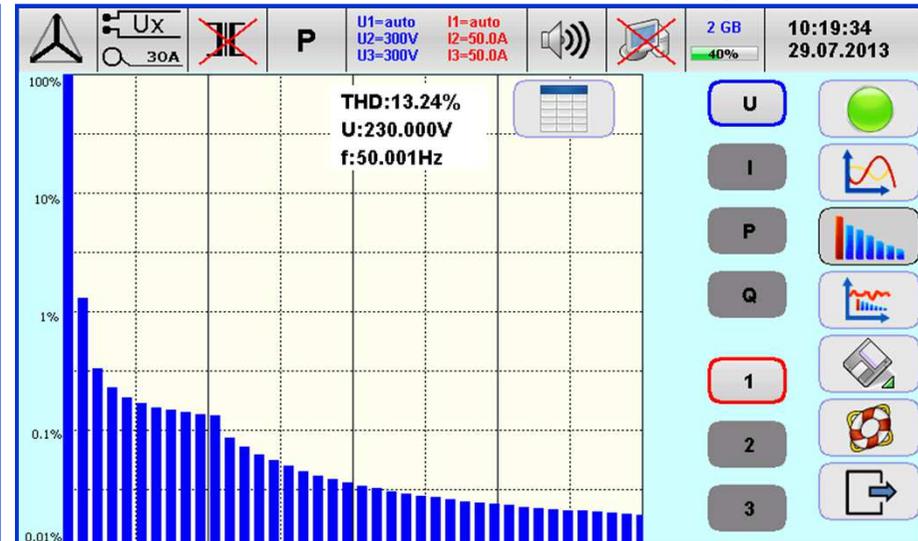
Oscilloscope of U1, U2, U3, I1, I2, I3



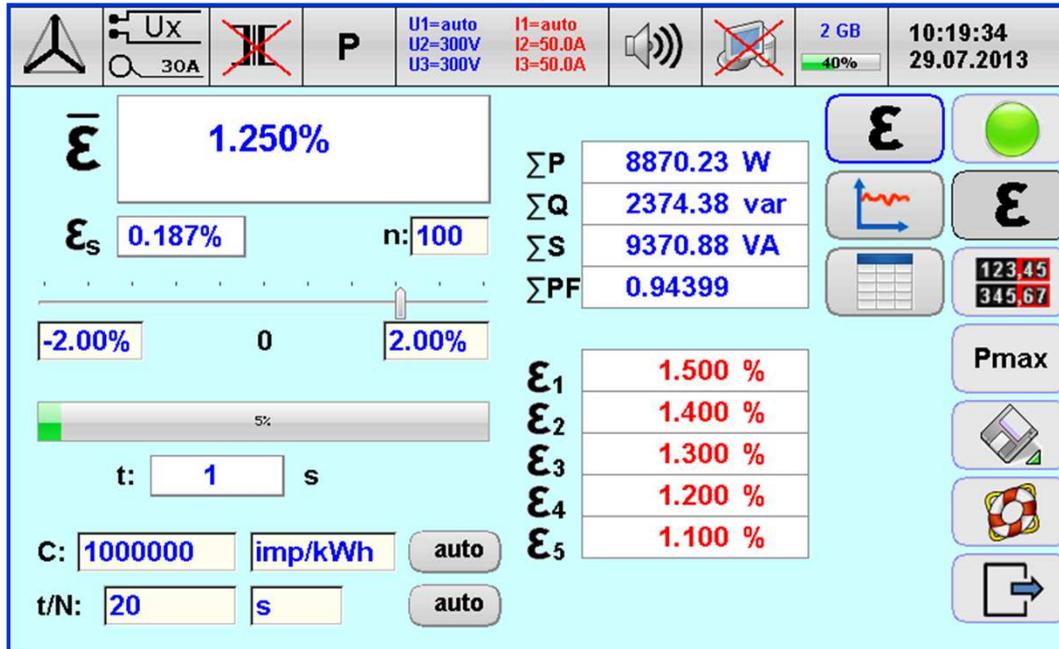
Time trend of U, I, P, Q, ϕ , f, PF,



Harmonics table & bar diagram



Energy meter testing on site and laboratory



- ▶ function of computing meter error (partial errors, average error, standard deviation) directly in percentages [%] with method of setting time of measurement or number of impulses,
- ▶ function of automatic identification energy meter constant,
- ▶ function of automatic determining measurement time or number of pulses.

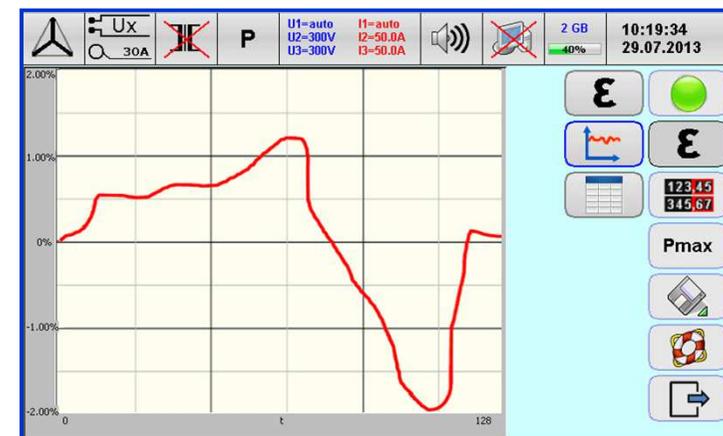
Results of testing are presented as:



No	Time	P[W]	Q[VAR]	Limit[%]	E[%]	Es[%]	OK
1	10:57:03	69000.0	0.00000	1.000	-0.485	0.000	✓
2	10:58:14	6900.00	0.00000	1.000	-0.343	0.011	✓
3	10:58:44	3450.00	5975.58	1.000	-0.165	0.000	✓
4	10:59:15	345.000	597.557	1.000	-0.222	0.025	✓
5	11:00:27	2300.00	0.00000	1.000	-0.389	0.009	✓
6	11:01:03	2300.00	0.00000	1.000	-0.326	0.009	✓
7	11:01:38	2300.00	0.00000	1.000	-0.320	0.000	✓
8	11:02:14	1150.00	1991.86	1.000	-0.225	0.055	✓
9	11:02:52	1150.00	1991.86	1.000	-0.103	0.009	✓
10	11:03:30	1150.00	1991.86	1.000	-0.135	0.040	✓

← TABLE

CHART →



Energy meter Register testing on site and laboratory

	P	P+	PH1
E1:	0.00kWh	0.01kWh	1234.00kWh
E2:	15.12kWh	16.18kWh	1249.89kWh
ΔE:	15.12kWh	16.17kWh	15.89kWh
Eref:	15.15kWh	15.15kWh	15.15kWh
ε:	-0.198%	6.733%	4.885%

▶ function of energy measurement with method of setting time periods for verification of energy meter Register directly in percent [%],

- P
- P+
- P-
- Q
- Q+
- Q-
- S
- PH1
- QH1

▶ function of energy measurement for power P, P+, P-, Q, Q+, Q-, S,

▶ function of energy measurement for the first (fundamental) harmonic of active power PH1 and reactive power QH1

IEC 62053-24/Ed.1 Static meters for reactive energy at fundamental frequency (classes 0,5 S, 1 S and 1)

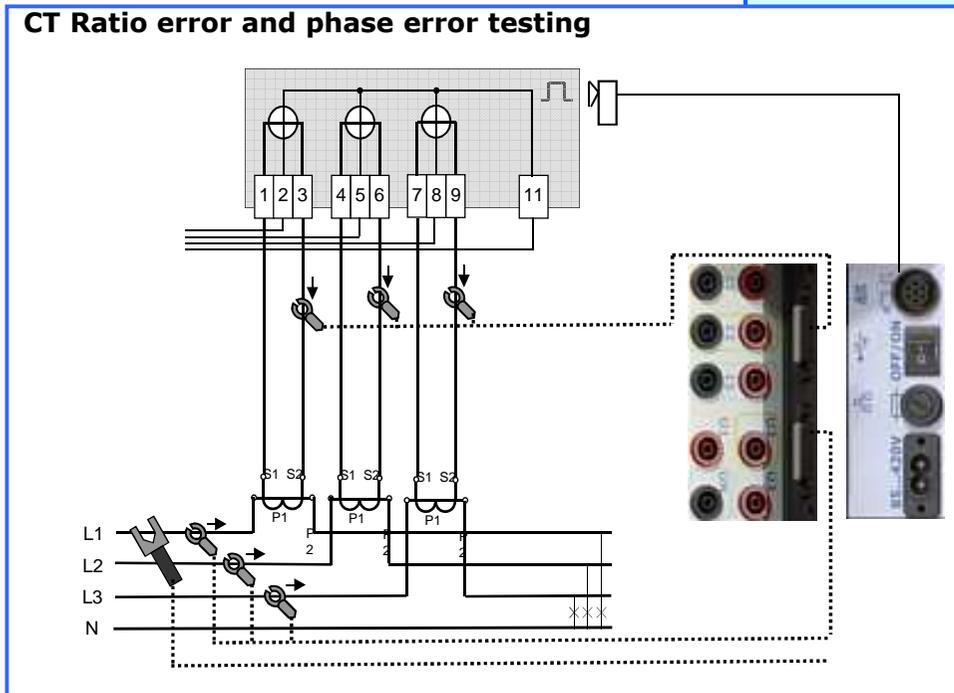
Maximum Demand Energy meter testing

	Date	Time	Pmax[kW]	Pmax-Pref
Pin: 80.000 kW	03.12.2013	12:34	80.032	0.032
t: 0 min	03.12.2013	13:34	83.343	3.343
Pref: 40.000 kW	03.12.2013	14:34	60.002	-19.998
T: 15 min	03.12.2013	15:34	92.989	12.989
	03.12.2013	17:34	101.132	21.132
	03.12.2013	18:34	80.111	0.111
	03.12.2013	19:34	156.309	76.309
	03.12.2013	21:34	80.898	0.898
	03.12.2013	22:34	89.325	9.325
	04.12.2013	01:34	80.786	0.786
	Σ			104.929

▶ function of maximum power measuring for testing of maximum demand energy meters,

CT, PT Transformers testing (LV & MV, voltage and current, simultaneously in three phases) directly on site: ratio error and phase shift error testing

Connection diagram





Ux
30A



P

U1=auto
U2=300V
U3=300V

I1=auto
I2=50.0A
I3=50.0A




2 GB
40%

10:19:34
29.07.2013

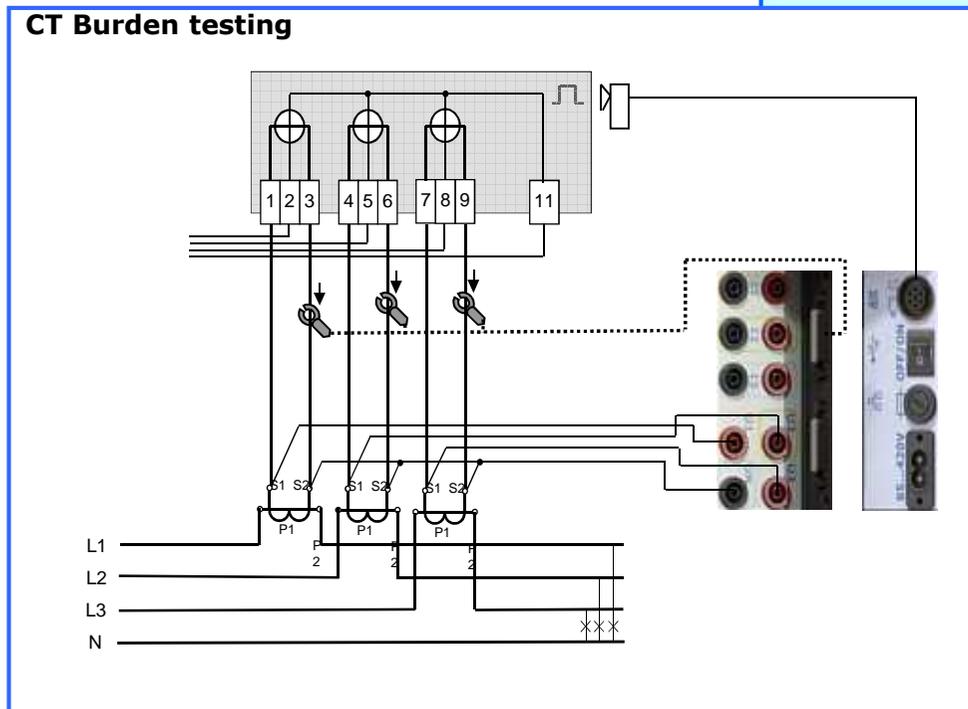
n:

	L1	L2	L3
Ip:	80.0320 A	79.0320 A	80.5320 A
Is:	4.00234 A	3.99234 A	4.10234 A
φ:	0.00100 °	0.00200 °	-0.00100 °
Ip/Is:	19.9963	19.7959	19.6307
δ:	0.01849 %	1.03097 %	1.88099 %
δs:	0.00232 %	0.00893 %	0.01864 %
δlim:	1.00 %	1.00 %	1.00 %
l _{pn} :	100.000 A	100.000 A	100.000 A
l _{pn} :	5.00000 A	5.00000 A	5.00000 A

- ▶ function of computing transformer ratio error directly in percent [%]
- ▶ function of computing phase shift error [°]

CT, PT Transformers testing (LV i MV, voltage and current, simultaneously in three phases) directly on site: CT / PT burden testing

Test can be done by taking into account the length (L) and cross-section of connection wires and serial fuse (Rf) resistance



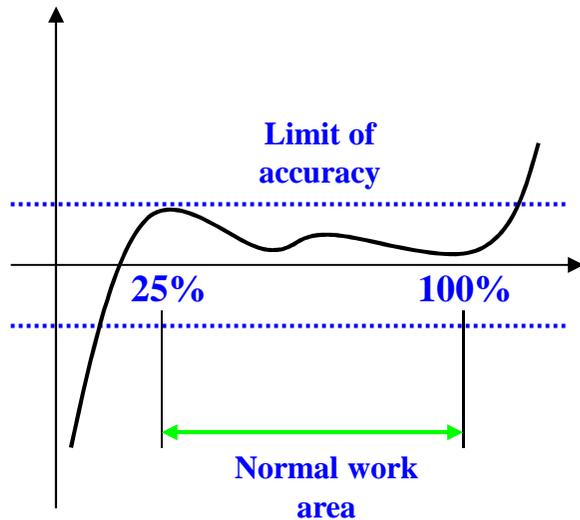
				U1=auto U2=300V U3=300V	I1=auto I2=50.0A I3=50.0A			2 GB 40%	10:19:34 29.07.2013	
PT <input type="radio"/>				L1	L2	L3				
CT <input checked="" type="radio"/>	U:	2.64332 V	2.64332 V	2.64332 V	I:	5.00021 A	5.00001 A	4.99983 A		
	φ:	0.001 °	0.002 °	- 0.001 °	PF:	1.00000	1.00000	1.00000		
	S:	13.2167VA	13.2167VA	13.2167VA	Sn:	15VA	15VA	15VA		
	%Sn:	88.0991 %	88.0991 %	88.0991 %	S@n:	88.0991 %	88.0991 %	88.0991 %		
	L:	0.000 m								
	∅:	0.0 mm ²								
	Rf:	0.000 Ω								

Why the transformer burden (load) is so important?!



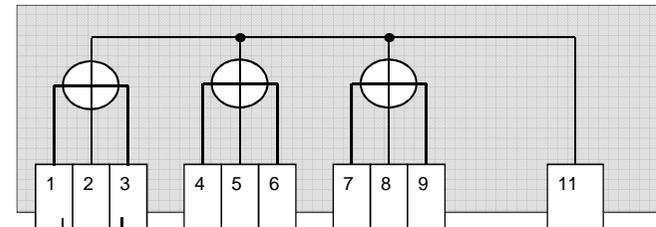
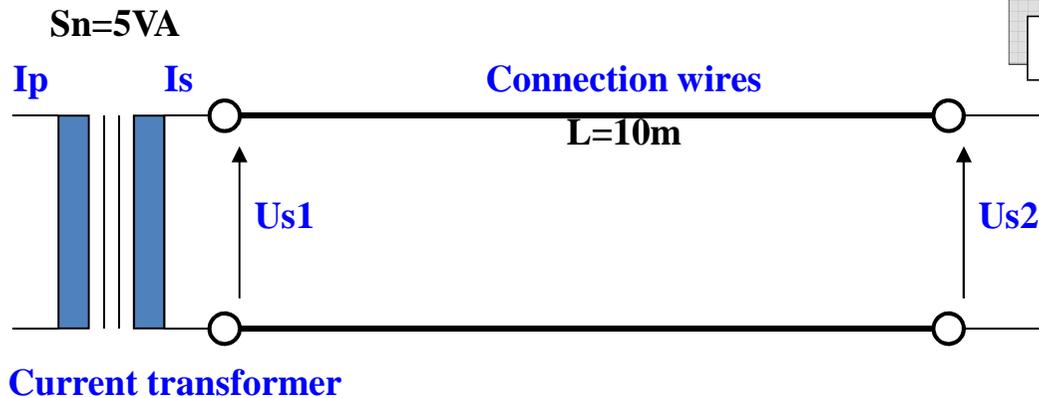
CT Transformer testing: burden testing

ϵ – ratio error [%]



CT – current transformer can operate with stated accuracy only between 25% - 100% of burden (load). In case of **too long**, or **too thin** wire dimension or **too small load**, the result, secondary current can be **out of accuracy limits**

[%] transformer power rating S_n

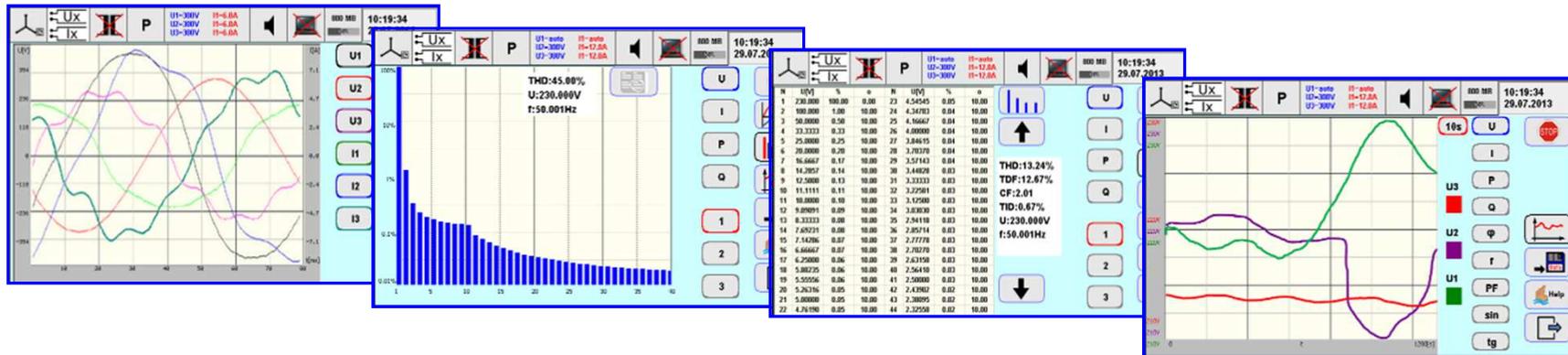


Example (power loss in cables):

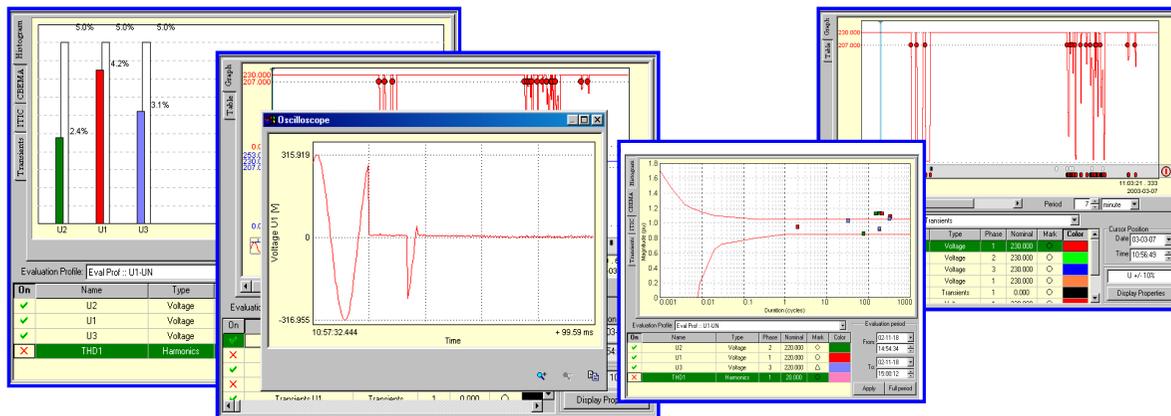
$$R_p = \frac{\rho_{Cu} \cdot l}{S} = \frac{0,0175\Omega \frac{mm^2}{m} \cdot 2 \cdot 10m}{1mm^2} = 0,35\Omega$$

$$P_p = I_2^2 \cdot R_p = 5^2 A \cdot 0,35\Omega = 8,75VA$$

Function of power quality analyser + recording



▶ measuring of power quality parameters according to IEC 61000-4-30 class A with visualization of measurement results in the real time mode



▶ analyzing of measurement results for EN 50160 compatibility or individual requirements of user

▶ recording of power network parameters in the SD Flash 4-32GB memory, which gives $(8÷64) \times 10^6$ sets of network parameters or long-term registration of power quality

Function of power quality analyser + recording

Ux 30A P U1=auto U2=300V U3=300V I1=auto I2=50.0A I3=50.0A 2 GB 10:19:34 29.07.2013

	t	No	t
<input checked="" type="checkbox"/> U	20 ms	<input checked="" type="checkbox"/> <	25 10 min
<input checked="" type="checkbox"/> I	20 ms	<input checked="" type="checkbox"/> <	25 10 min
<input checked="" type="checkbox"/> PQS	10 s	<input checked="" type="checkbox"/> <	63 10 s
<input checked="" type="checkbox"/> ϕ	10 s	<input checked="" type="checkbox"/> F	10 s
<input checked="" type="checkbox"/> THDU	10 s	<input checked="" type="checkbox"/> TIDU	10 s
<input checked="" type="checkbox"/> THDI	10 s	<input checked="" type="checkbox"/> TIDI	10 s
<input checked="" type="checkbox"/> SignU	10 s	<input checked="" type="checkbox"/> Flick	10 min
<input checked="" type="checkbox"/> U _l u	10 s		

EN50160

Ux 30A P U1=auto U2=300V U3=300V I1=auto I2=50.0A I3=50.0A 2 GB 10:19:34 29.07.2013

\bar{x} + MIN MAX
 \bar{x} + $U \geq 230.000$ V ± 10.0000 % +
 \bar{x} + $I > 5.00000$ A +

Ux 30A P U1=auto U2=300V U3=300V I1=auto I2=50.0A I3=50.0A 2 GB 10:19:34 29.07.2013

0%

66:22:22
hh:mm:ss

>> 1 week 4.44 MB

1 h

03.03.2014 12:12
dd.mm.yyyy hh:mm

selecting recording method: average value, max / min value, outside limits, every Energy Meter error

selecting recorded parameters and averaging times

selecting time length of recording and start date & time

TE30 Analyzer's equipment delivered in price:

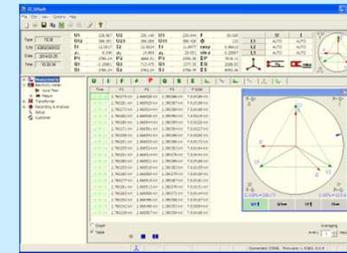
- TE30 Analyzer class 0.05 or 0.1;
- Power supply cord;
- Fuse T250mA@230V or T500mA@110V (2 units);
- Memory SD card (8GB);
- Operation manual of analyzer;
- Warranty card;
- Manufacturer calibration certificate;





TE30 Analyzer's optional equipment:

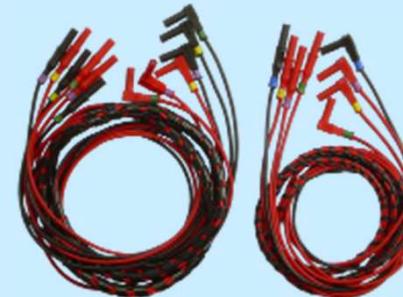
- Calmet TE30 PC Soft with operation manual (for Windows XP and higher versions) and USB mini / USB A interface cable,



- AD100EXT extension for powering TE30 from measurement network,



- EA30 set of safety measurement cables (10pcs) for voltage and current,



- AKD100 additional accessories (handlers, terminals, aligator clips, fork, banana plugs - 42pcs) for safety cables,





TE30 Analyzer's optional equipment:

- CF102 photo head with holder for inductive meter and meter with LED,



- DR200B miniature thermal printer with Bluetooth,



- ET30 transportation case,



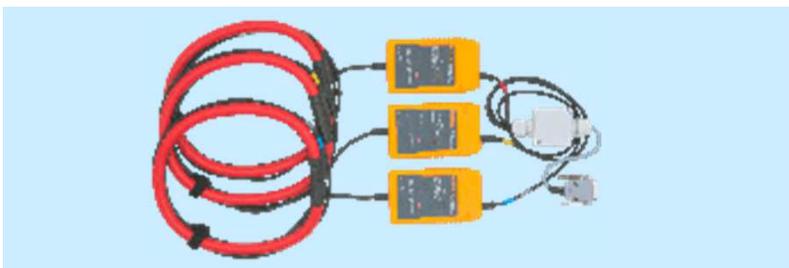
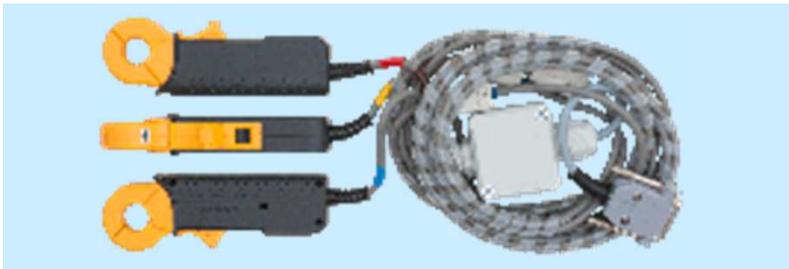
- ET32 transportation case for additional accessories,





TE30 Analyzer's optional equipment:

- CT10AC electronic compensated clamps up to 10A (1compl),
- CT100AC electronic compensated clamps up to 100A (1compl),
- CT1000AC electronic compensated clamps up to 1000A (1compl),
- FCT3000AC electronic compensated flexible clamps in ranges 30/300/3000A (1compl),



TE30 Analyzer's optional equipment:

- AmpLiteWire 2000A primary current sensors up to 2000A for LV and MV nets (1pc),



- VoltLiteWire 40kV primary sensors up to 40kV (1pc),



- rechargeable battery NiMH AA R6 1.2V 2700mAh (5pcs),



- TE30 option set 01 (TE30+ET30+CT100AC+CF102+EA30+AKD100).



