C300 3-Phase Power Calibrator and Tester

3 x 0…560V, 3 x 0…120A, 40…500Hz

0°…±360°

Accuracy:

0.02% or 0.05%

Innovative-Developing Enterprise Calmet Ltd.

- Calmet = **CAL**ibrators + **MET**rology
- founded in **1989**, roots come from LUMEL, big factory of measurement equipment in Poland, Zielona Gora
- designing, production, selling and servicing new kind of calibrators and electric equipment testers
- employs over 15 engineers, including 3 with Ph.D.
- cooperates with University of Zielona Gora; common projects and lectures
- since 1996 – electricity meters testing and power network parameters analysing
- since 2002 – generating and measuring network quality parameters
- since 2006 – automation of electro-utility automatic protective equipment testing
- since 2011 – automatic Test Benches for energy meter testing

C300 3-Phase Power Calibrator and Tester

Mesurement Equipment since 1989

Customer Support in problems solving

Energy meter testers, Current Transformers testers, Power quality analysers

1 phase

3 phase

3 phase, 120A

3 phase, 0.05%

AC/DC Voltage, Current, Power & Resistance Calibrators, Test Benches

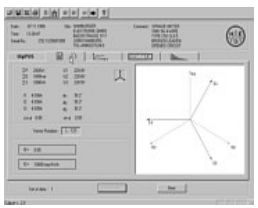
3 phase U,I,φ,P,Q,S,E

1 phase U,I,φ,P,Q,S,E

1 phase U,I,φ,F

Multifunctions DC/AC

Control Software for measurement equipment



3 phase Test Bench

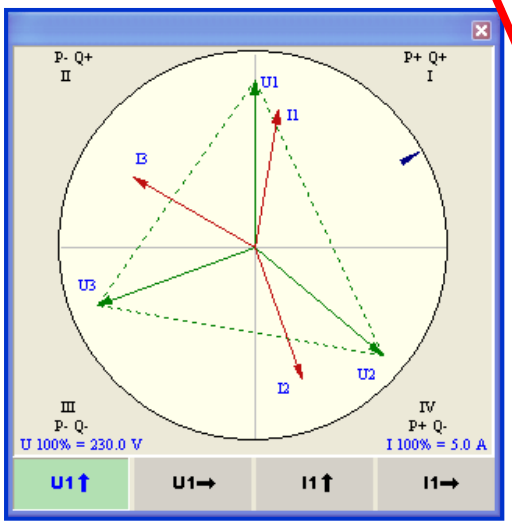
1 / 3phase Phatnom Load 0…5A

C300 3-Phase Power Calibrator and Tester
General view and functionality

In Manual Mode it is possible to set:

- Voltages up to 3 x 560V
- Currents up to 3 x 120A
- (360A in single phase connection)
- Frequency in range 40...500Hz
- Phase angles in range 0...360°
- Wave shapes of signals
- Signal changes in time

Settings by PC



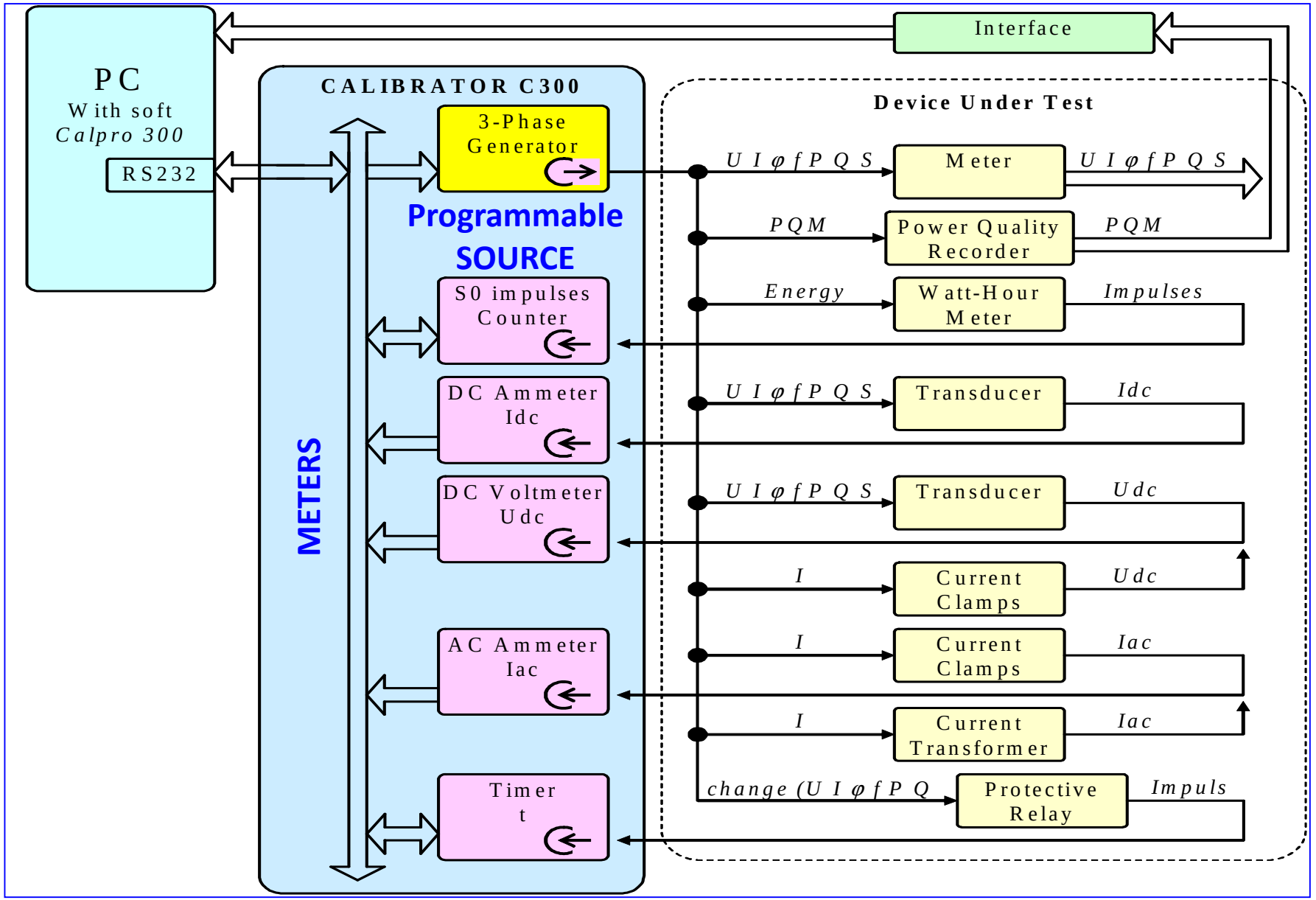
Device Under Test

Only in Automated Mode

In Automated Mode it is possible to test:

- Electricity meters
- Protective relays
- Current transformers
- Current clamps
- Measurement transducers

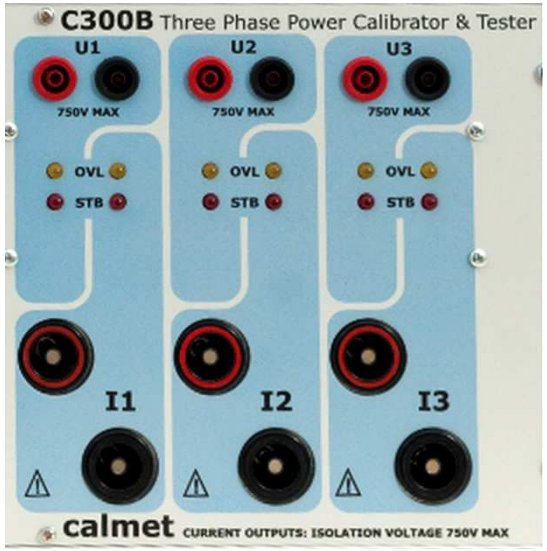
C300 3-Phase Power Calibrator and Tester
General Block Diagram



C300 3-Phase Power Calibrator and Tester OUTPUTS & settings

Voltage:

- range: 0.5000V … 560.000V
- uncertainty: ±0.02%
- short term stability: ±0.005%
- long term stability: ±0.01%
- temp. drift: ±0.0005%/1°C



Current:

- range: 0.001000A … 120.000A
- uncertainty: ±0.02%
- short term stability: ±0.005%
- long term stability: ±0.01%
- temp. drift: ±0.0005%/1°C

Maximum load:

- 560mA@70V
- 280mA@140V
- 140mA@280V
- 70mA@560V
- sin distortion: 0.05%

Frequency:

- range: 40.000Hz… 500.000Hz
- uncertainty: ±0.005%

Phase shift:

- range: 0.00°… ±360.00°
- uncertainty: ±0.05°

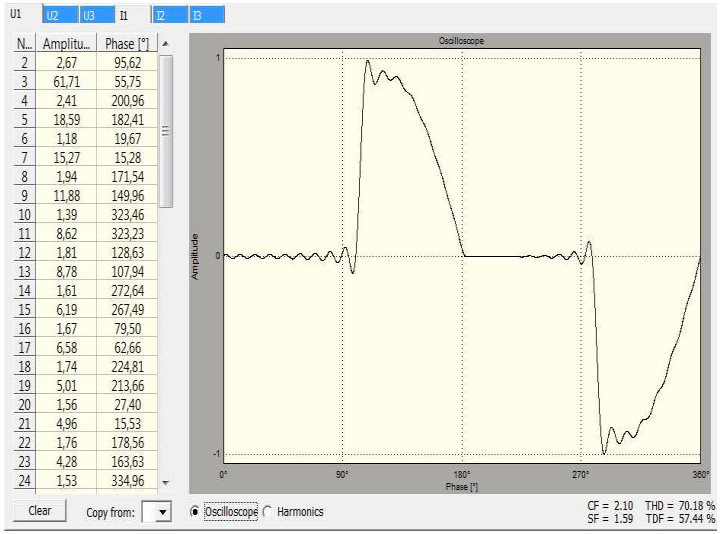
Power:

- range: 0…3 x 67200 W,var,VA
- resolution: 0.00001-1W,var,VA

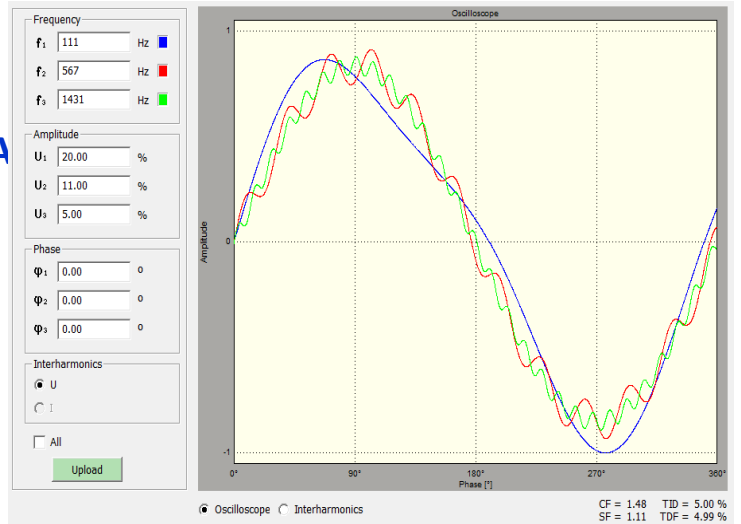
Maximum load:

- 17V@0.5A
- 8.5V@6A
- 3.3V@20A
- 0.70V@120A
- sin distortion: 0.1%

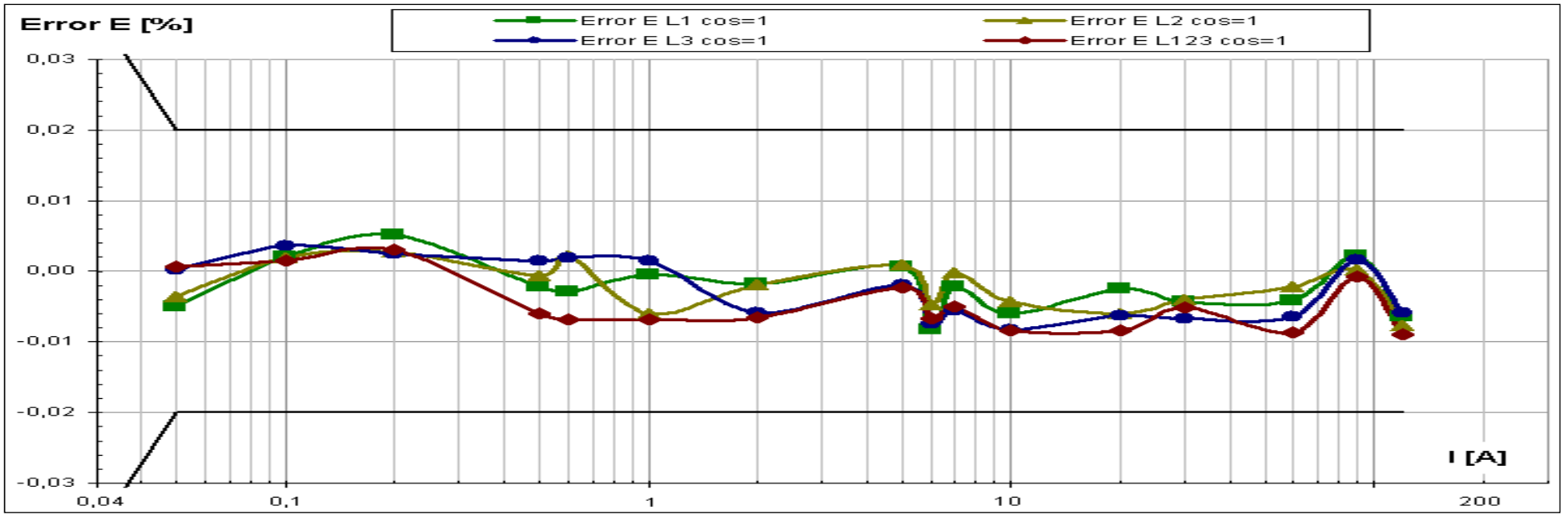
Waveform: harmonics (up to 3200Hz)

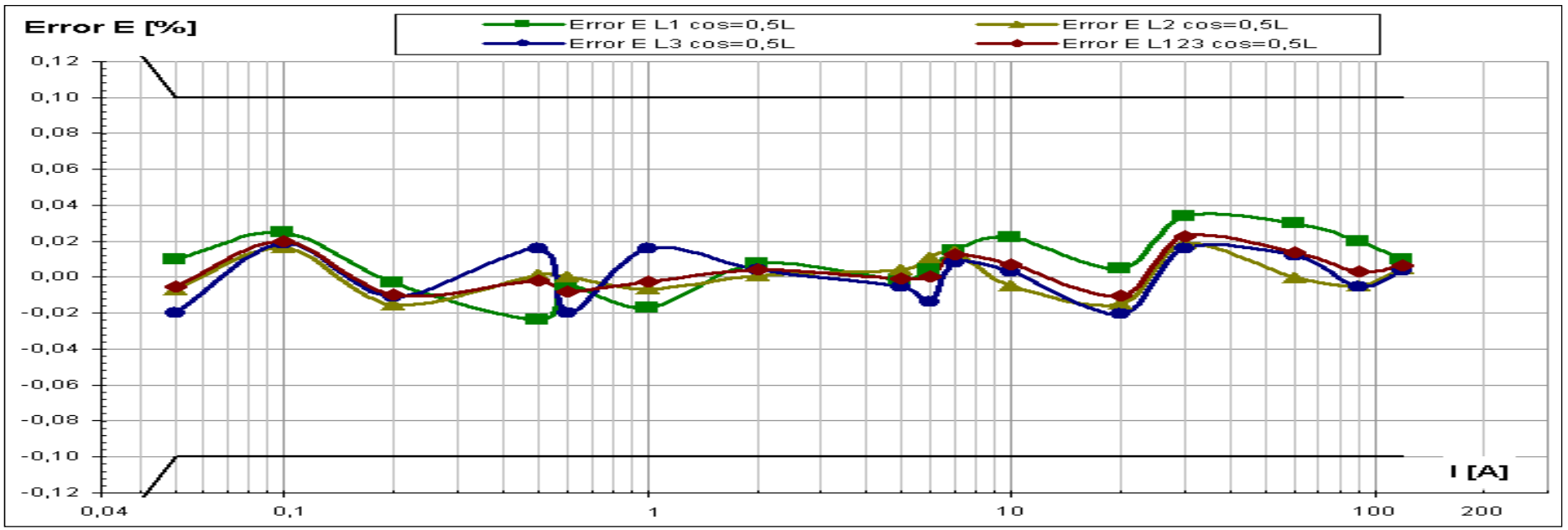


Waveform: interharmonics (up to 9kHz)



C300 3-Phase Power Calibrator and Tester
Example of E/P characteristics PF=1 & PF=0.5L

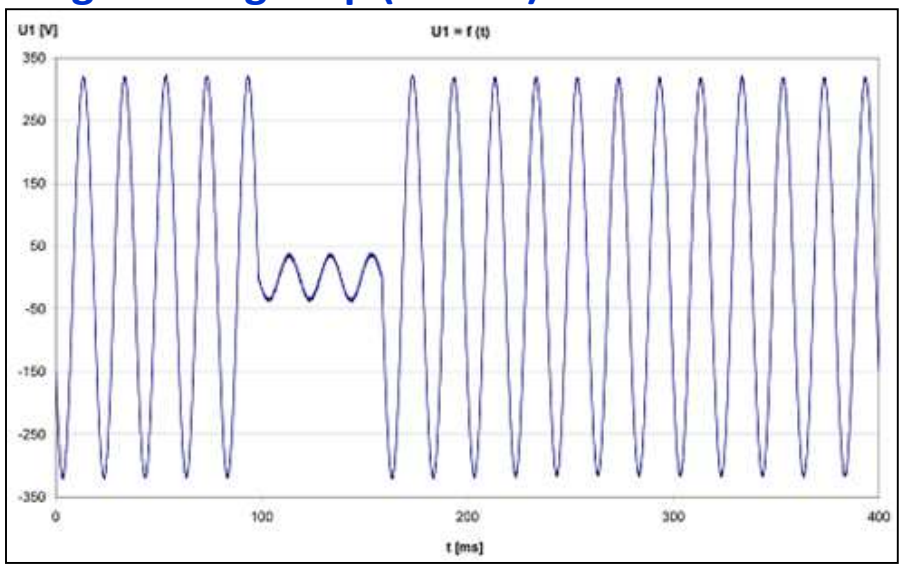




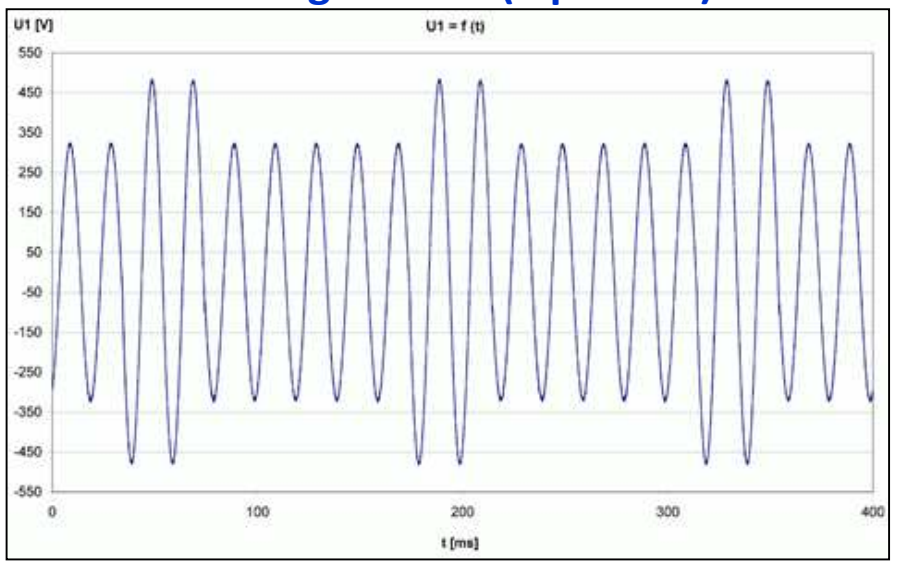
C300 3-Phase Power Calibrator and Tester
Dips, Interruptions, Swells, Shocs

Calibrator output signal change versus time

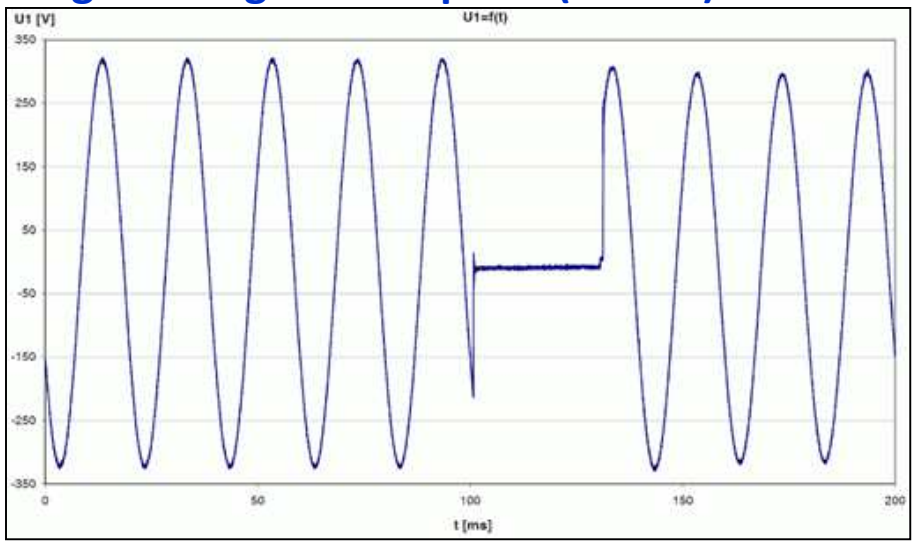
Single Voltage Dip (100ms)



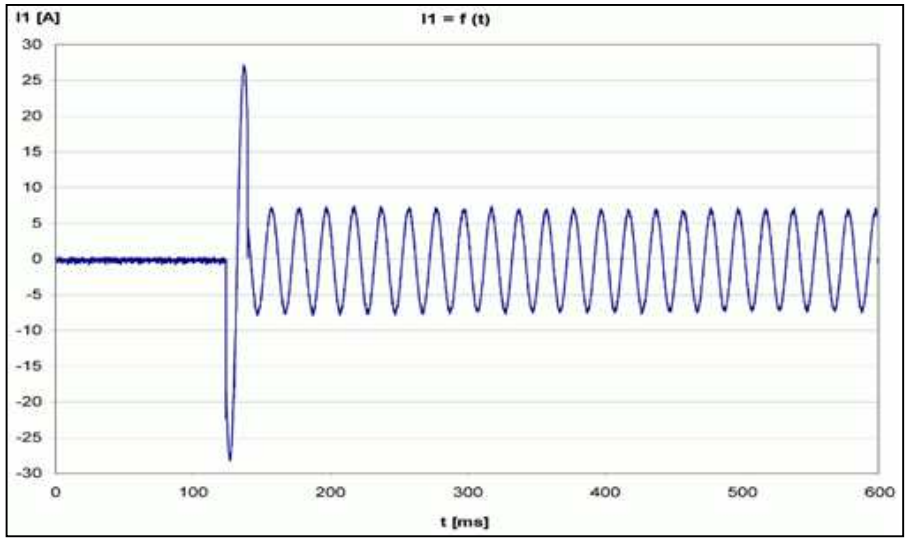
Periodic Voltage Swells (2 periods)



Single Voltage Interruption (100ms)



Single Current Shock (1 period)



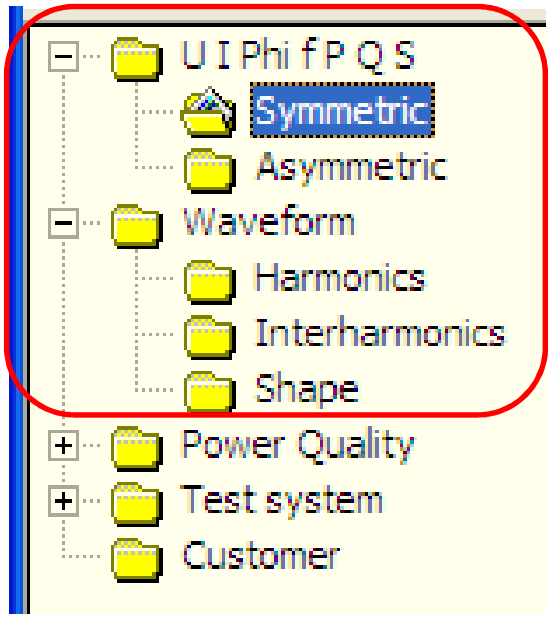
C300 3-Phase Power Calibrator and Tester
Calpro300 PC Software - Basic

C300 is controlled via RS232/USB by PC Software

The transmission protocol (simple text eg.: U_230,57.70,1[CR][LF]**) is available for customers**

Calpro 300 Basic version enables setting:

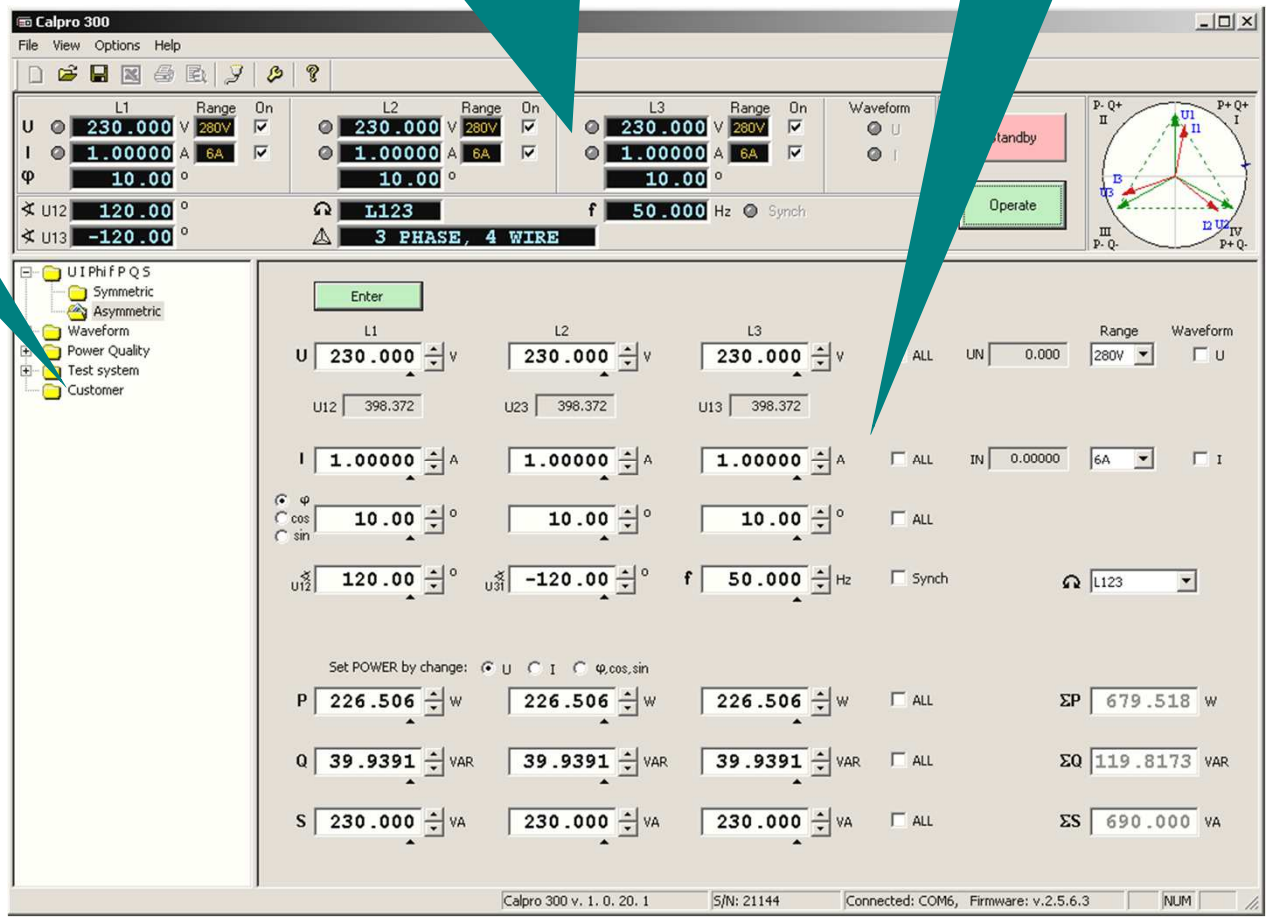
- ❑ voltages, currents, frequency, phase angles and powers (Symmetric and Asymmetric)
- ❑ Harmonics, Interharmonics and Special Shapes of signals



Function field

Calibrator status field

Operation field



C300 3-Phase Power Calibrator and Tester
Calpro300 PC Software – Test System

Calpro 300 PC Software allows to create Data Base with:

- **Type** of Device Under Test – properties of device like meter constant, range, class of accuracy etc.
- **Procedure** – set of load points for testing (settings of U, I, φ, f, P, Q, S, harmonics, no. of impulses…)

and then to perform testing:

- **Auto Test** – automatic testing based on **Type** and **Procedure**

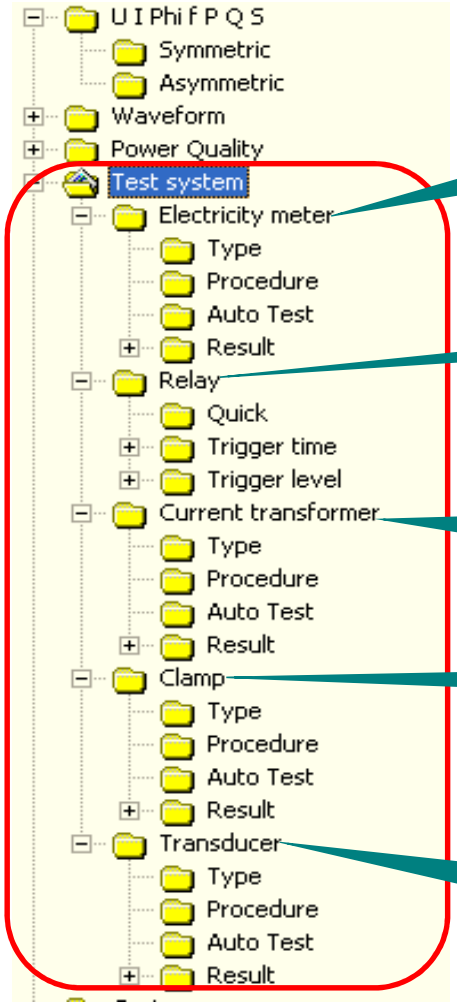
and Result evaluation:

- **Result** – presentation in form of **Table** (user editable) or **Diagram** with possiblility of printout or export to Excel

Error test | Counting | Counter test

No	Point name	Time	U1 [V]	U2 [V]	U3 [V]	I1 [A]	I2 [A]	I3 [A]	f [Hz]	Phi1	Phi2	Phi3			Limit [%]	ε [%]	εs [%]	OK
1	100A sym cos=1,0	10:57:03	230.000	230.000	230.000	100.000	100.000	100.000	50.000	Cos 1.00 L	Cos 1.00 L	Cos 1.00 L		L123	1.000	-0.485	0.000	✔
2	10A sym cos=1,0	10:58:14	230.000	230.000	230.000	10.0000	10.0000	10.0000	50.000	Cos 1.00 L	Cos 1.00 L	Cos 1.00 L		L123	1.000	-0.343	0.011	✔
3	10A sym cos=0,5L	10:58:44	230.000	230.000	230.000	10.0000	10.0000	10.0000	50.000	Cos 0.50 L	Cos 0.50 L	Cos 0.50 L		L123	1.000	-0.165	0.000	✔
4	1A sym cos=1,0	10:59:15	230.000	230.000	230.000	1.00000	1.00000	1.00000	50.000	Cos 0.50 L	Cos 0.50 L	Cos 0.50 L		L123	1.000	-0.222	0.025	✔
5	10A L1 cos=1,0	11:00:27	230.000	230.000	230.000	10.0000	0.000000	0.000000	50.000	Cos 1.00 L	Cos 1.00 L	Cos 1.00 L		L123	1.000	-0.389	0.009	✔
6	10A L2 cos=1,0	11:01:03	230.000	230.000	230.000	0.000000	10.0000	0.000000	50.000	Cos 1.00 L	Cos 1.00 L	Cos 1.00 L		L123	1.000	-0.326	0.009	✔
7	10A L3 cos=1,0	11:01:38	230.000	230.000	230.000	0.000000	0.000000	10.0000	50.000	Cos 1.00 L	Cos 1.00 L	Cos 1.00 L		L123	1.000	-0.320	0.000	✔
8	10A L1 cos=0,5L	11:02:14	230.000	230.000	230.000	10.0000	0.000000	0.000000	50.000	Cos 0.50 L	Cos 0.50 L	Cos 0.50 L		L123	1.000	-0.225	0.055	✔
9	10A L2 cos=0,5L	11:02:52	230.000	230.000	230.000	0.000000	10.0000	0.000000	50.000	Cos 0.50 L	Cos 0.50 L	Cos 0.50 L		L123	1.000	-0.103	0.009	✔
10	10A L3 cos=0,5L	11:03:30	230.000	230.000	230.000	0.000000	0.000000	10.0000	50.000	Cos 0.50 L	Cos 0.50 L	Cos 0.50 L		L123	1.000	-0.135	0.040	✔

Calpro 300 TS (Test System) version enables automatic testing the following devices:



Electricity meter function for automatic testing of meters

Relay function for automatic testing of protective relays

Current transformer function for automatic testing of current transformers

Clamp function for automatic testing of current clamps

Transducer function for automatic testing of measurement transducers

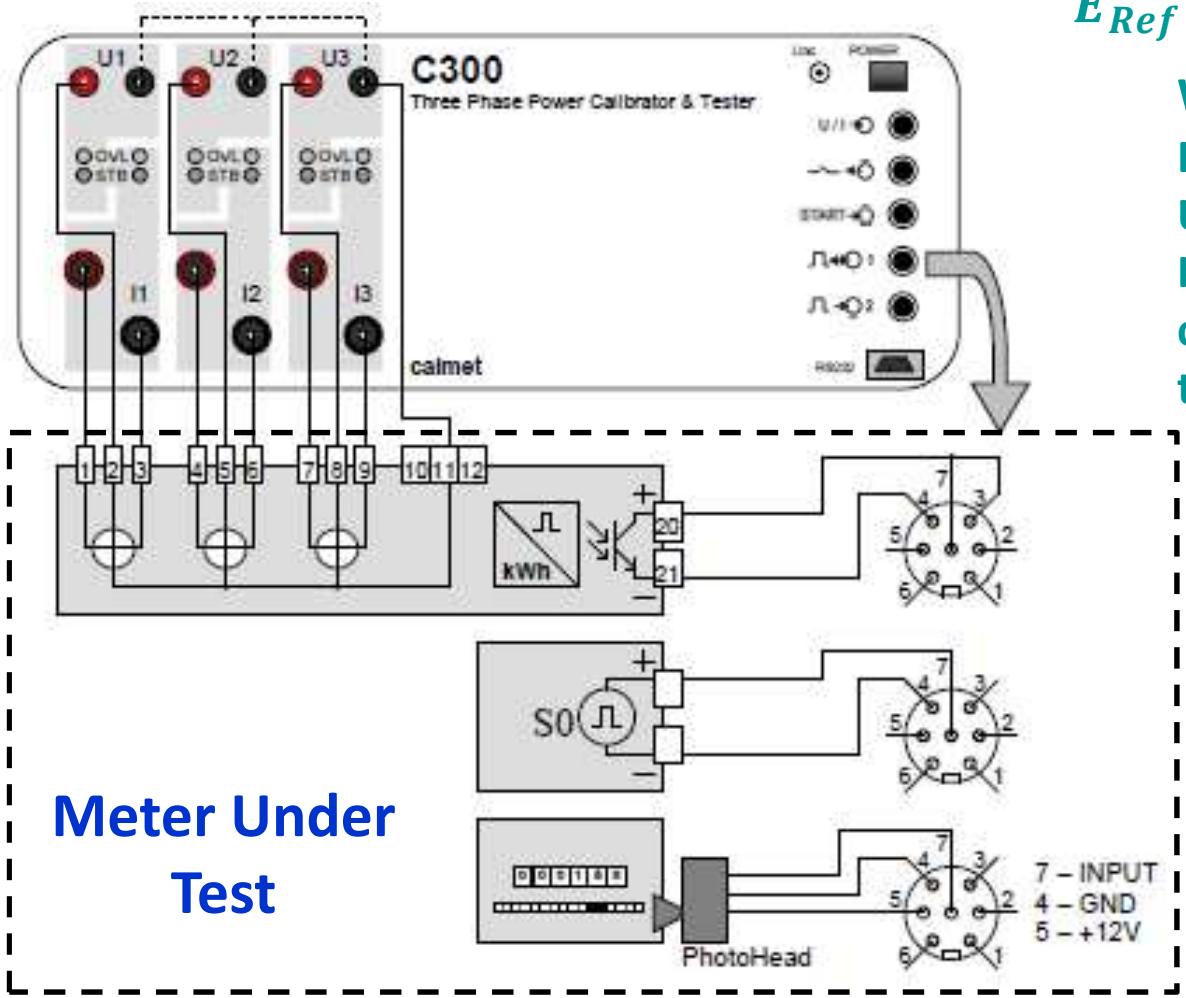
Testing Energy meter with C300 as a Source and Reference

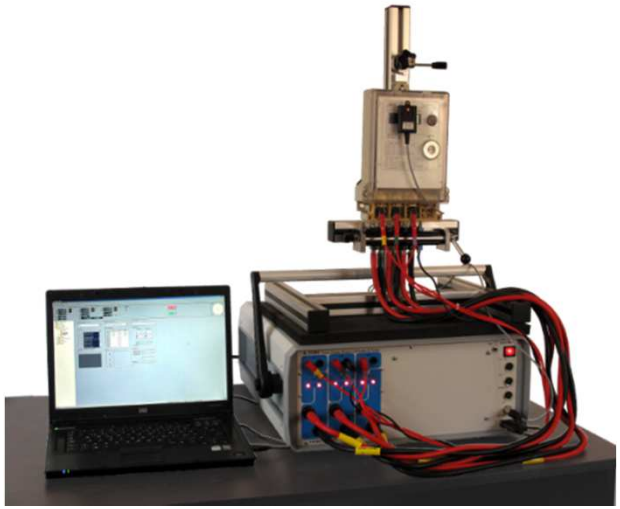
Reference Energy is calculated on base of equation:

$$E_{Ref} = U \times I \times cos\varphi(sin\varphi) \times t$$

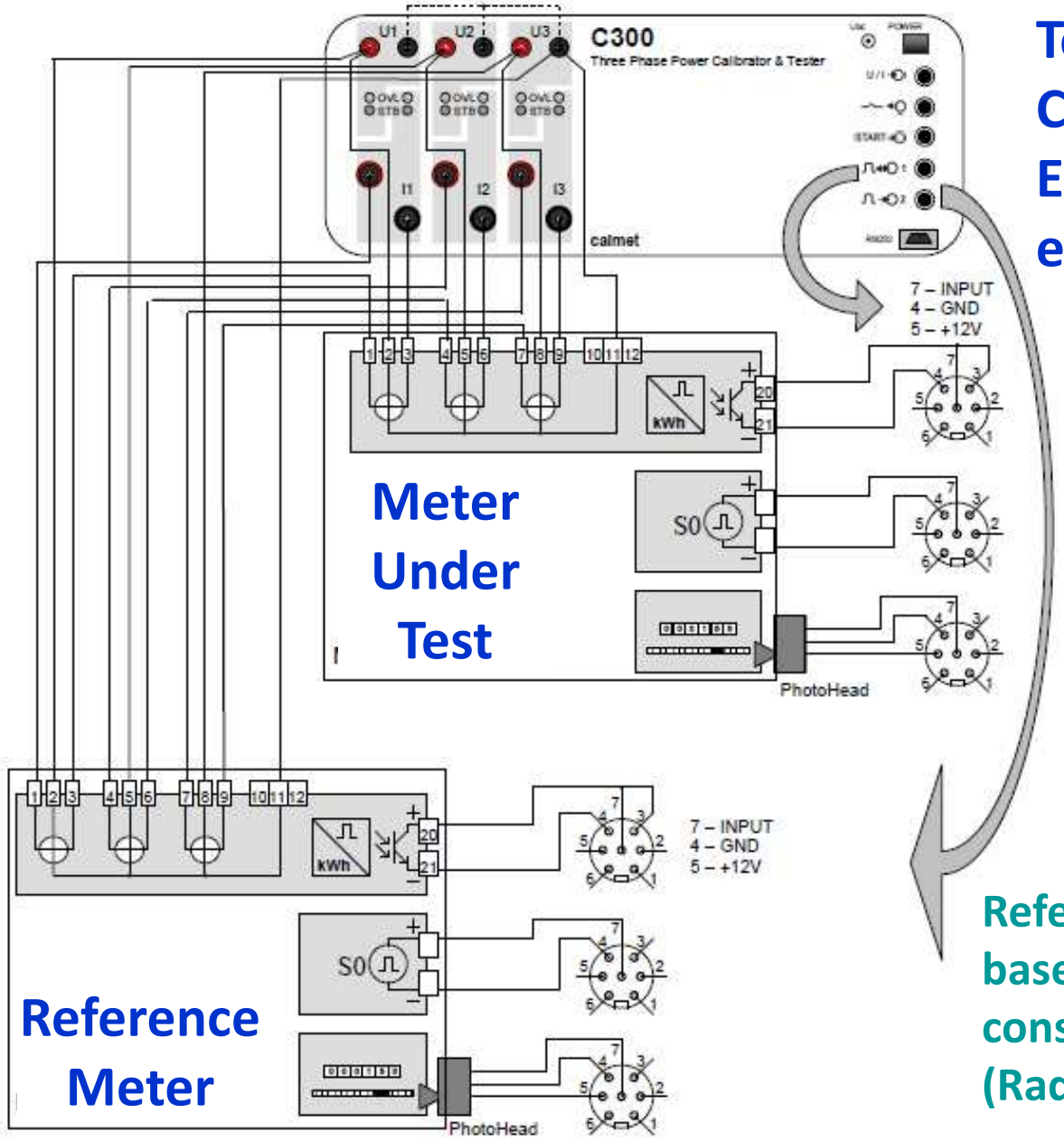
Where:

Eref – reference energy
U – set value of voltage
I – set value of current
cos/sinφ – power factor
t – time of impulses counting





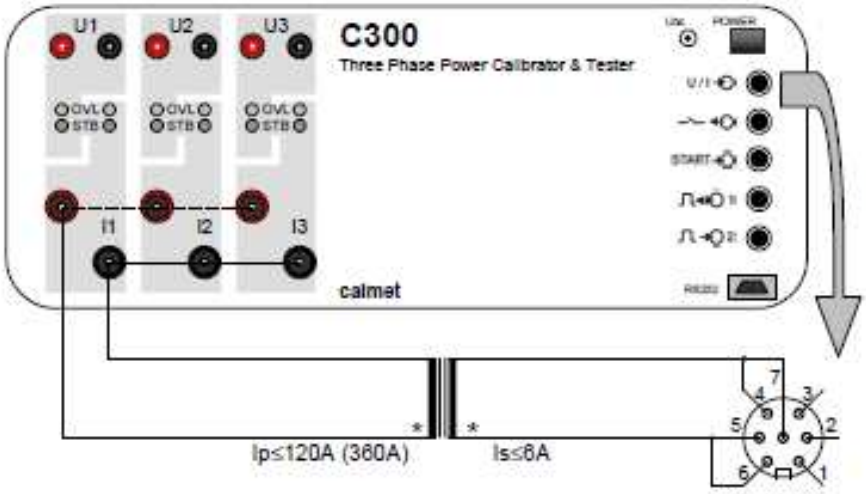
C300 3-Phase Power Calibrator and Tester
Energy Meter Testing



Testing Energy meter with C300 as a Source and Error Calculator with external Reference Meter

Reference Energy is calculated on base of number of impulses and constant of any Reference Meter (Radian, ZERA, MTE….)

C300 3-Phase Power Calibrator and Tester
Current Transformer and Clamps Testing

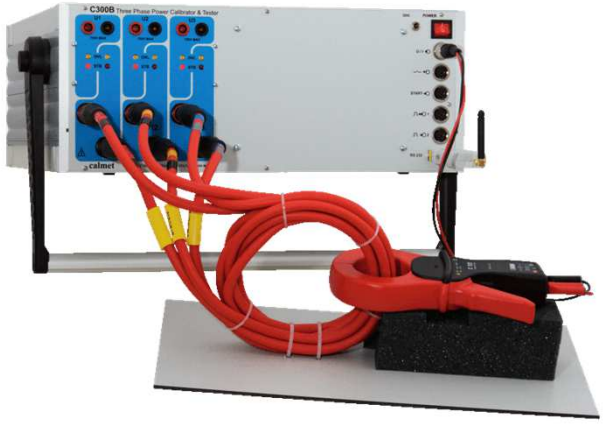


Ipmax=120A
when using current I1 only

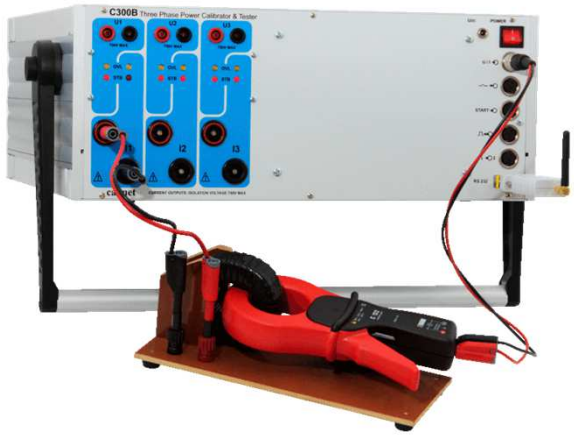
Ipmax=360A
when shorted I1, I2 and I3
HI terminals and I1, I2, I3
LO terminals

Up to 360A in parallel

CT 100A / 5A



1000A clamp and sum of currents



1000A clamp with 100 turns coil

100A clamp and 100A cable