

**Calmet TB51**  
Stationary Five Position  
Three-phase Meter Test Bench



### **CALMET Sp. z o.o.**

- ❑ Calmet = **CALibrators** + **METrology**
- ❑ 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 25 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
- ❑ since **2019** – new group of Automatic Test Systems

**Measurement Equipment since 1989**

**Customer Support in problems solving**

**Energy meter testers, Current Transformers testers, Power quality analysers**

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



**1 phase, 0,2%**

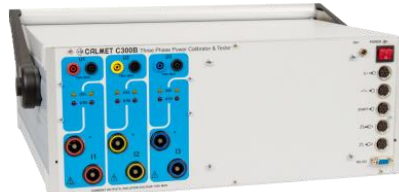
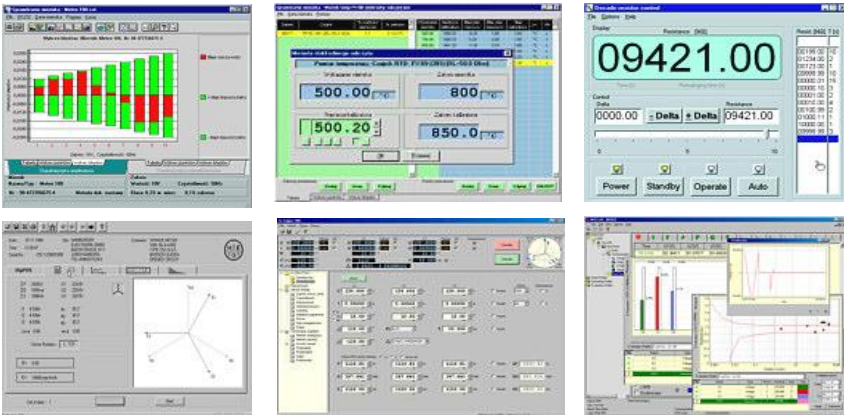


**3 phase, 0.05%**



**3 phase, 120A, 0.02%**

**Control Software for measurement equipment**



**3 phase U,I,φ,P,Q,S,E**



**1 phase U,I,φ,P,Q,S,E**



**3 phase Test Bench**

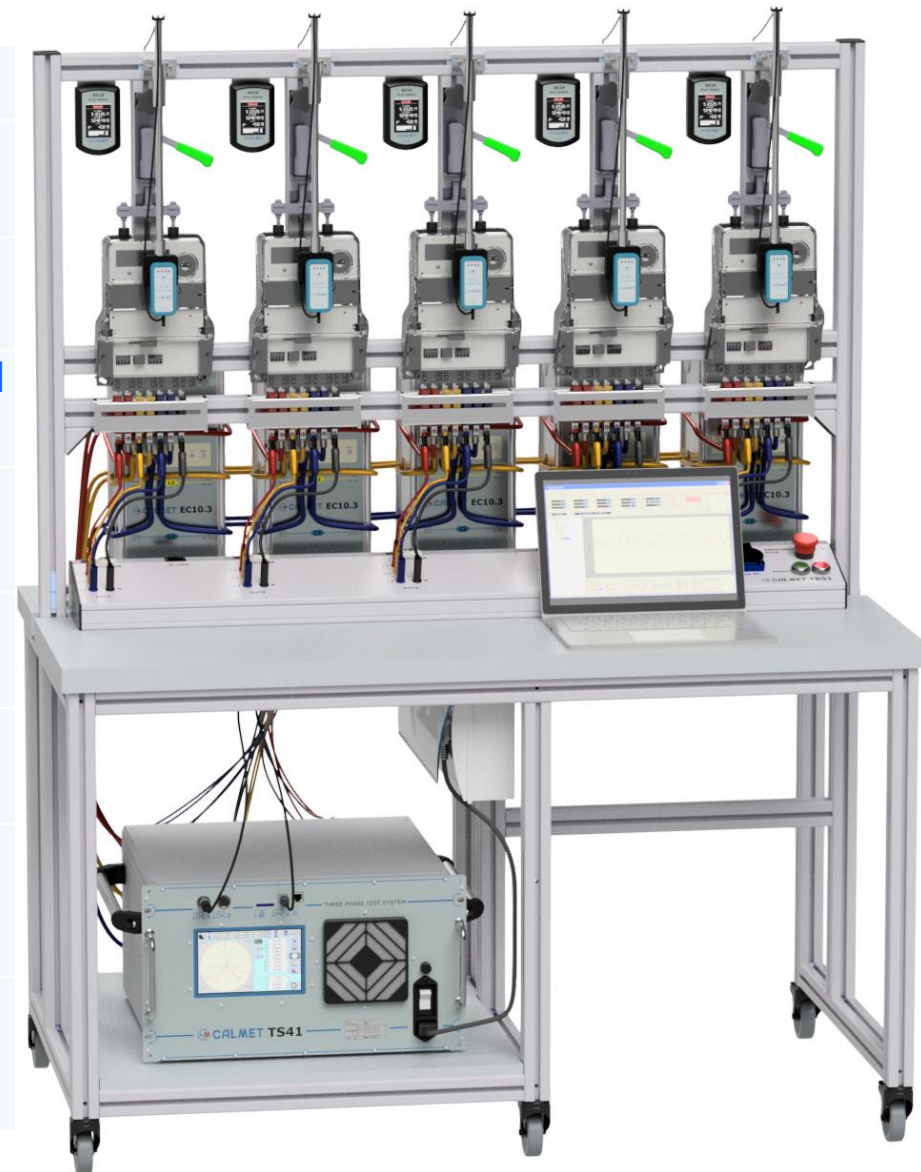


**Multifunctions DC/AC**

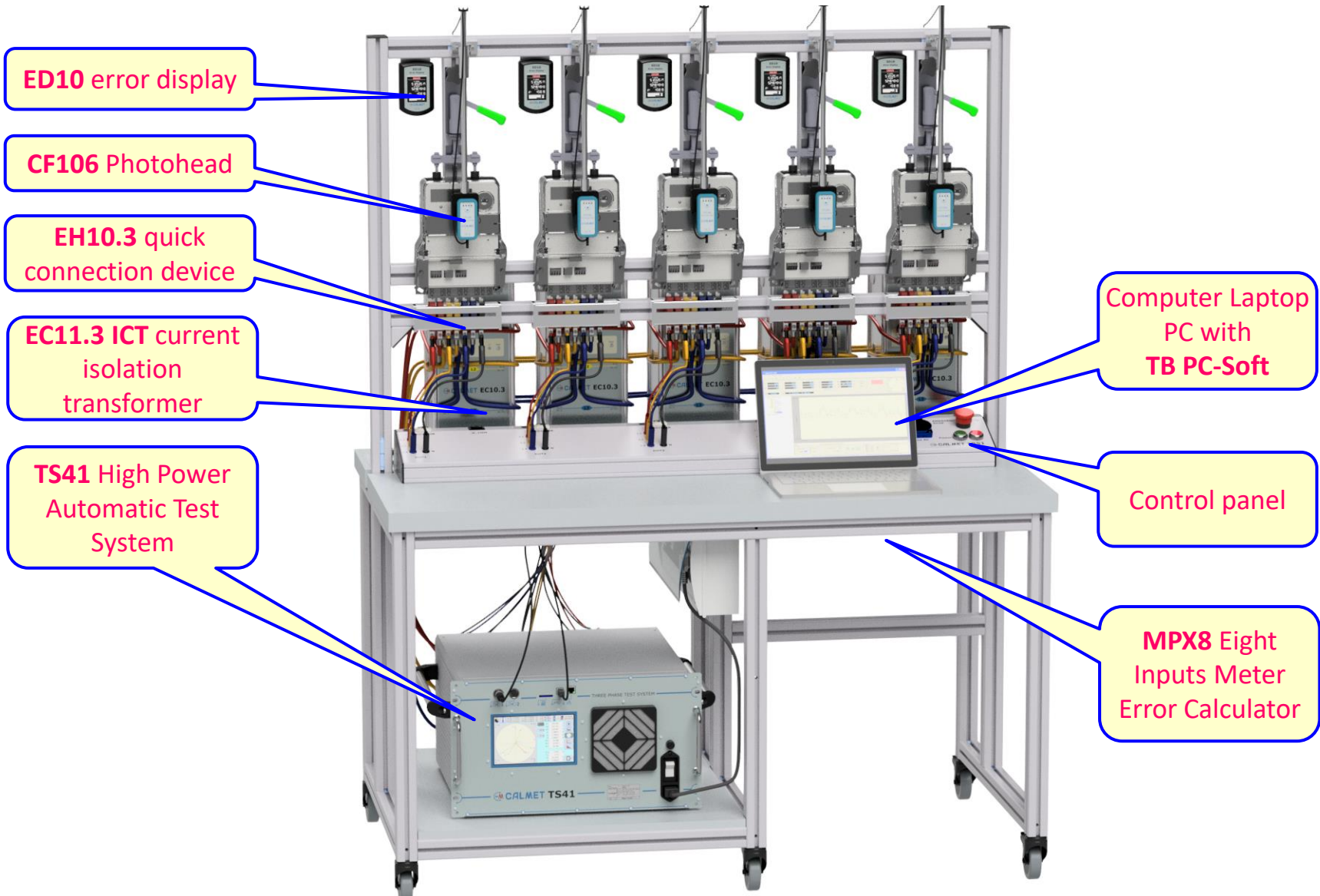
**Current and Voltage Source with Integrated Reference Standard**



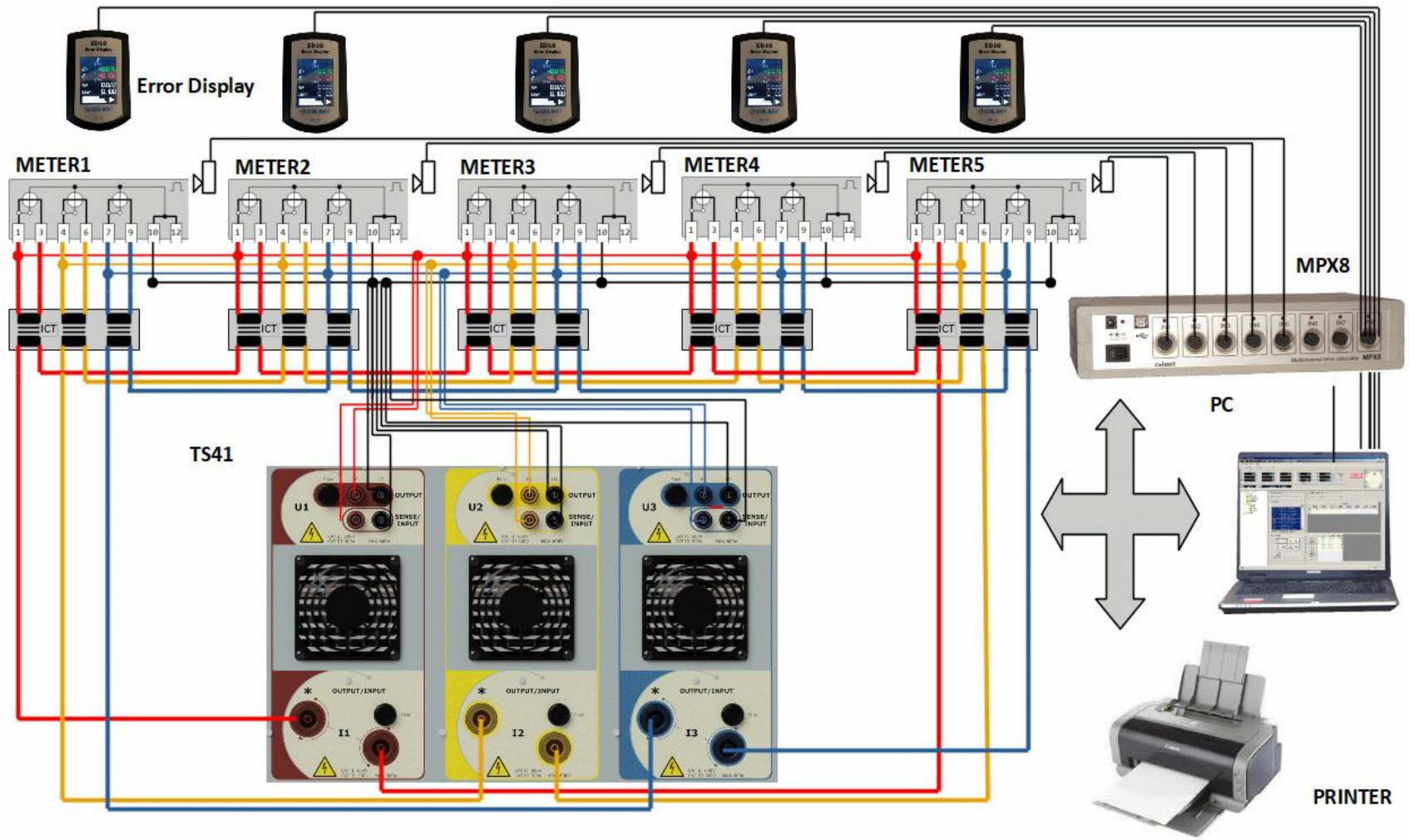
- ▶ Fully automatic procedures for meter testing
- ▶ Accuracy class **0.02%** or **0.04%** with internal reference standard
- ▶ Extremely high accuracy class with external reference standard
- ▶ Wide range of voltage **20...600V** at **150VA** and current **0.001...120A** at **300VA** per phase
- ▶ Harmonics up to 63rd and special shapes generation capability
- ▶ Simultaneously testing up to 5 meters with different constants
- ▶ Testing of single- & three-phase meters **with & without closed I-P links**
- ▶ Small size, light weight and economy powering max. 2000VA at fully possibilities according to EN-IEC 62057-1 standard
- ▶ Compact power source with internal reference standard can be applied as three-phase portable test system without need of an external PC



## TB51 Front view:

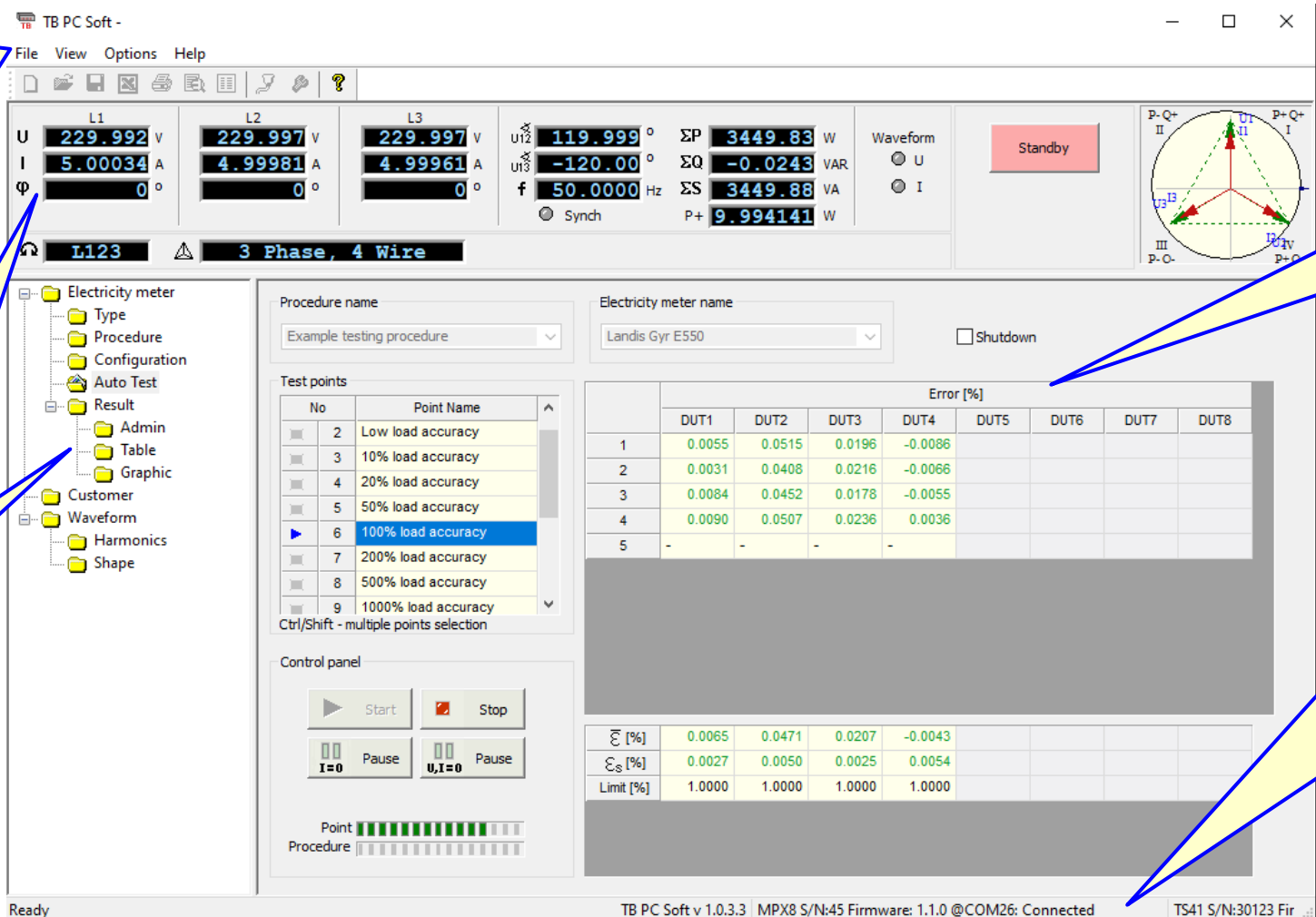


## Typical configuration of Calmet TB51 Test Bench Station



**TB PC-Soft functionality:** Computer software TB PC-Soft is designed for control MPX8 Multichannel Meter Error Calculator, Power Source and auxiliary devices in order to full automation of electricity meters testing process

## Start window of TB PC-Soft



The screenshot shows the TB PC-Soft interface with the following components:

- Toolbar of software with menu:** Located at the top left, containing icons for file operations and a help icon.
- Actual settings and measurements field:** The top center area displaying real-time data for three phases (L1, L2, L3) including voltage (U), current (I), phase angle (Φ), power (ΣP, ΣQ, ΣS), and frequency (f). It also shows a 'Standby' button and a three-phase diagram.
- Function field:** A tree view on the left side containing folders for 'Electricity meter', 'Auto Test', 'Result', 'Admin', 'Table', 'Graphic', 'Customer', 'Waveform', 'Harmonics', and 'Shape'.
- Operation field:** The central control area with dropdown menus for 'Procedure name' (Example testing procedure) and 'Electricity meter name' (Landis Gyr E550), a 'Shutdown' checkbox, and a 'Test points' table.
- Communication status bar with information about MPX8 Multiplexer:** A table at the bottom right showing error percentages for DUT1 through DUT8, along with average error (Σ [%]), standard deviation (Σs [%]), and a limit of 1.0000.

No	Point Name
2	Low load accuracy
3	10% load accuracy
4	20% load accuracy
5	50% load accuracy
6	100% load accuracy
7	200% load accuracy
8	500% load accuracy
9	1000% load accuracy

	Error [%]							
	DUT1	DUT2	DUT3	DUT4	DUT5	DUT6	DUT7	DUT8
1	0.0055	0.0515	0.0196	-0.0086				
2	0.0031	0.0408	0.0216	-0.0066				
3	0.0084	0.0452	0.0178	-0.0055				
4	0.0090	0.0507	0.0236	0.0036				
5	-	-	-	-				

Σ [%]	0.0065	0.0471	0.0207	-0.0043				
Σs [%]	0.0027	0.0050	0.0025	0.0054				
Limit [%]	1.0000	1.0000	1.0000	1.0000				

Toolbar of software with menu

Actual settings and measurements field

Function field

Operation field

Communication status bar with information about MPX8 Multiplexer

## Functions of unrolling *Electricity meter* menu of TB PC-Soft

**Type** for entering parameters of meter under test (taken from specification data sheet or front plate) to testing electricity meters database

**Procedure** for entering data (load points, test conditions) to measuring procedures database

**Configuration** for activating impulse inputs of the MPX8 Multiplexer

**Auto Test** for performing automatic test of electricity meters, according to selected measuring procedure

**Result** for visualization, edition and storing measurements results:

- **Admin** for using clients database during reports edition

- **Table** for visualization, edition and saving results in form of tables

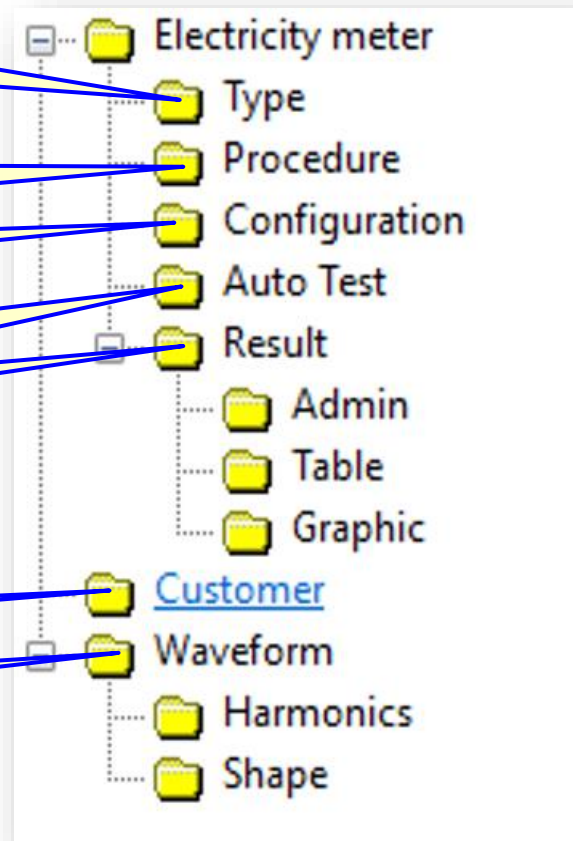
- **Graphic** for visualization, edition and saving results in form of diagrams

**Customer** function contains customer database

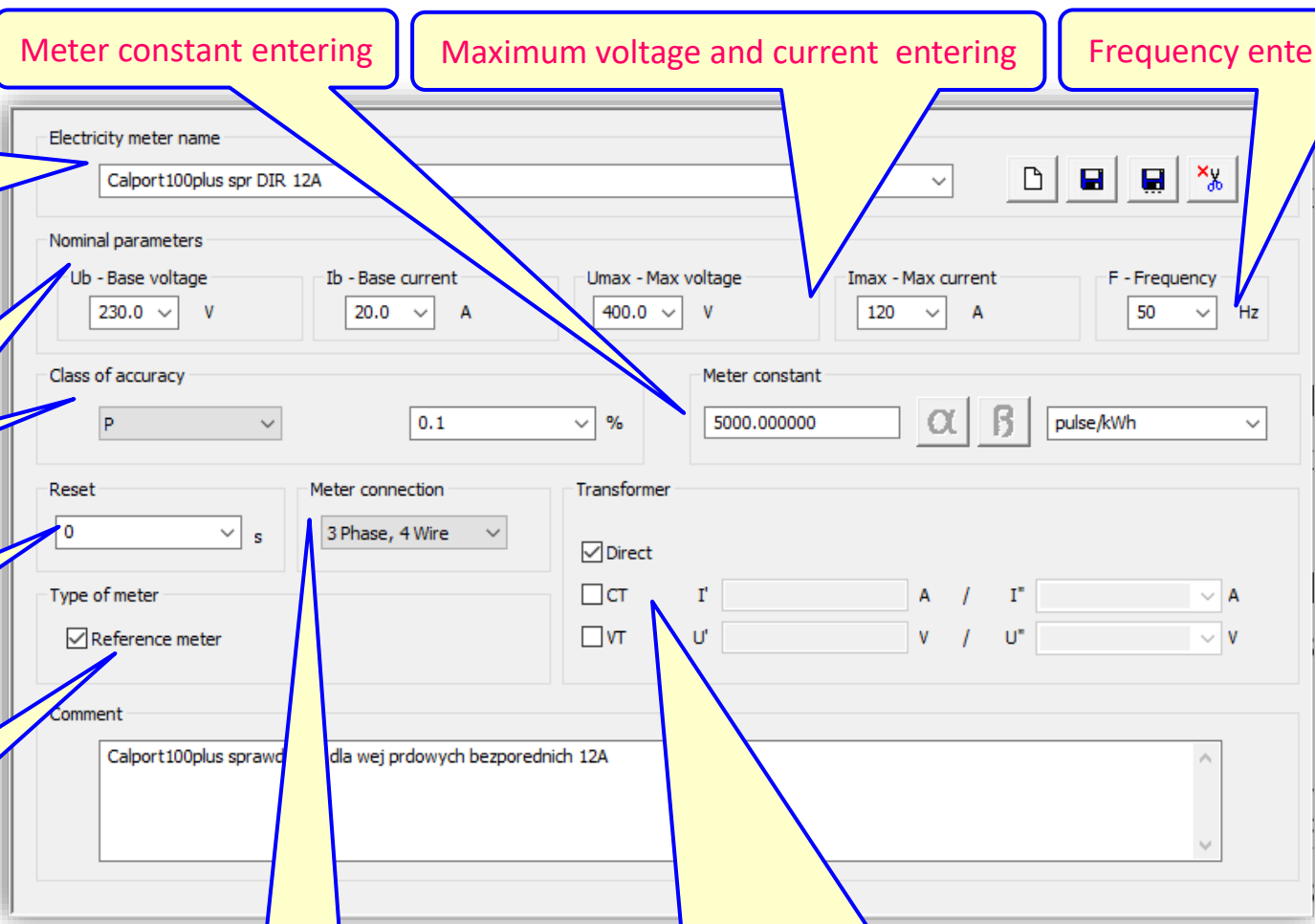
**Waveform** for setting harmonic contents and shape of output signal:

- **Harmonics** for programming value and phase shift of harmonics

- **Shape** for programming different non harmonics testing shapes



## TB PC-Soft - Electricity meter Type setting – entering meter parameters and data to electricity meters' database



The screenshot shows the 'Electricity meter Type setting' window. It contains several sections for data entry:

- Electricity meter name:** A text field containing 'Calport100plus spr DIR 12A'.
- Nominal parameters:** Fields for 'Ub - Base voltage' (230.0 V), 'Ib - Base current' (20.0 A), 'Umax - Max voltage' (400.0 V), 'Imax - Max current' (120 A), and 'F - Frequency' (50 Hz).
- Class of accuracy:** A dropdown menu set to 'P' and a percentage field set to '0.1 %'.
- Meter constant:** A text field with '5000.000000', a unit selector with 'α' and 'β' buttons, and a dropdown menu set to 'pulse/kWh'.
- Reset:** A dropdown menu set to '0' with a unit 's'.
- Meter connection:** A dropdown menu set to '3 Phase, 4 Wire'.
- Transformer:** A section with a checked 'Direct' checkbox and unchecked 'CT' and 'VT' checkboxes. It also includes input fields for current and voltage ratios (I' / I" and U' / U").
- Type of meter:** A checked 'Reference meter' checkbox.
- Comment:** A text area containing 'Calport100plus sprawo dla wej prdowych bezporednich 12A'.

Callouts point to the following elements:

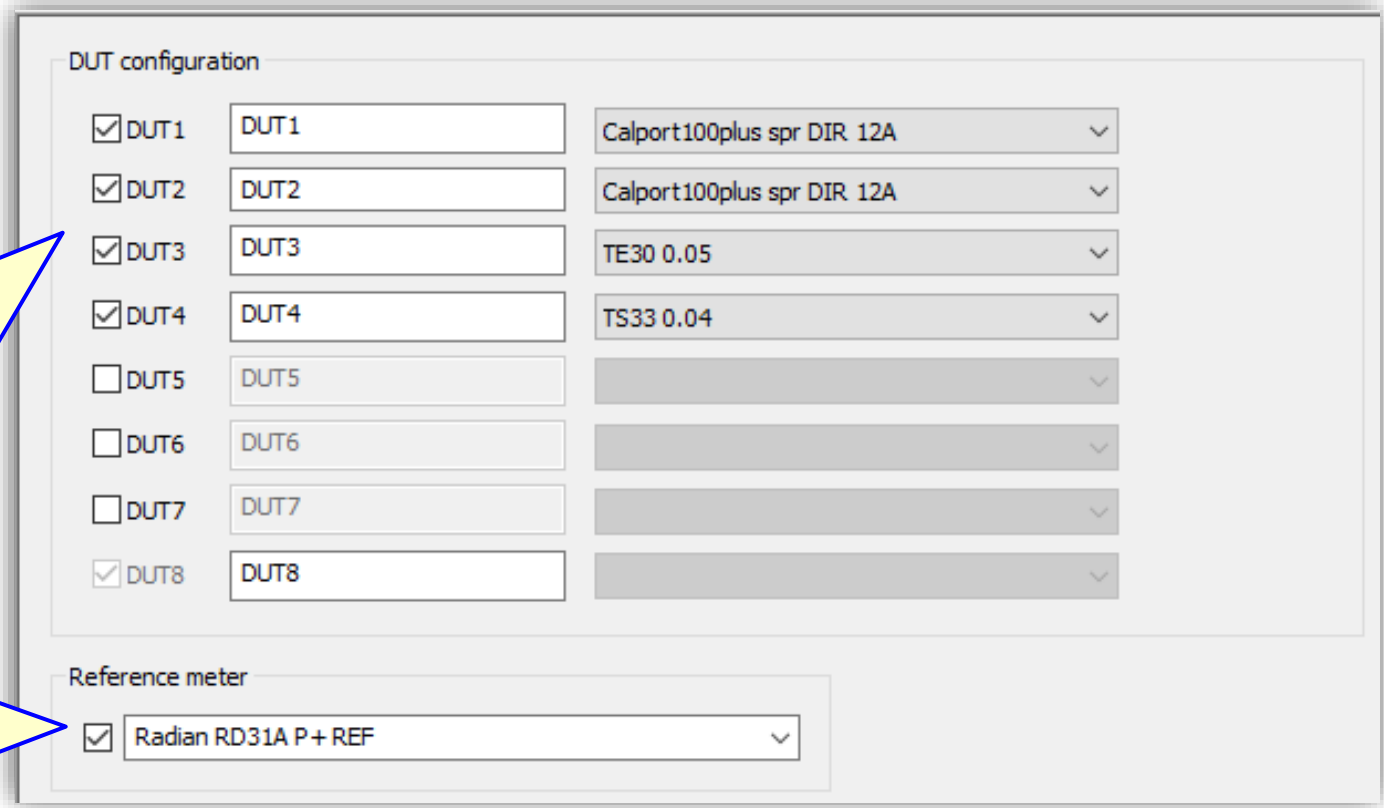
- Electricity meter name entering/reading** (points to the name field)
- Nominal / Base voltage and current entering** (points to Ub and Ib fields)
- Class of accuracy entering** (points to the accuracy dropdown)
- Reset time entering for prepaid energy meters** (points to the reset dropdown)
- Reference meter check box** (points to the 'Reference meter' checkbox)
- Meter constant entering** (points to the meter constant text field)
- Maximum voltage and current entering** (points to Umax and Imax fields)
- Frequency entering** (points to the frequency dropdown)
- Meter connection selection** (points to the meter connection dropdown)
- Direct, CT, VT buttons for selection direct electricity meter or with current and/or voltage transformer** (points to the transformer checkboxes)



## TB PC-Soft - Electricity meter testing Configuration setting – activating impulse inputs of the MPX8 Error Calculator

*DUT configuration – enabling or disabling consecutive MPX8 Multiplexer inputs for calculating error of connected device under test (DUT) with fields for entering type of DUT*

*Reference meter – enabling or disabling the last, eighth input of MPX8 Multiplexer as a reference meter input*

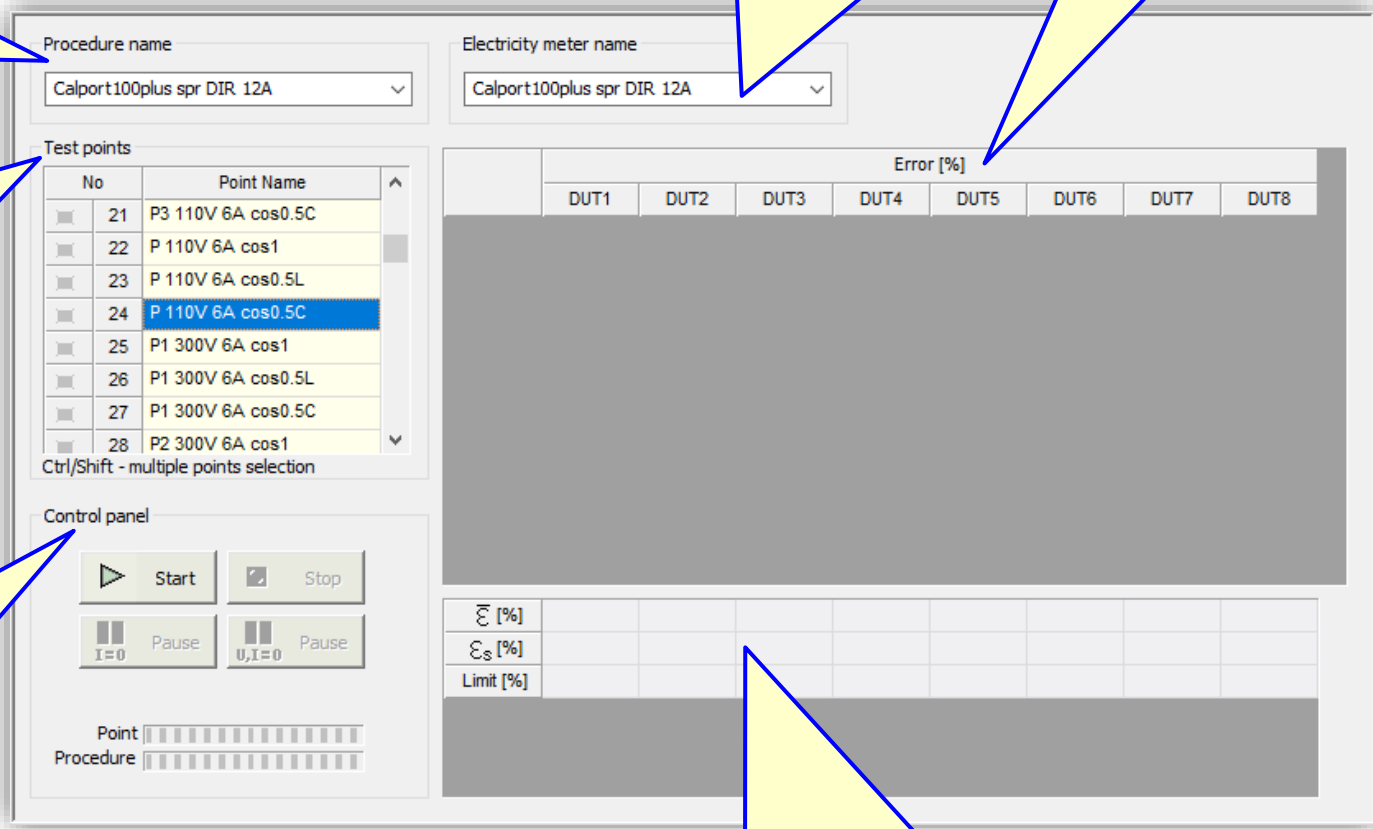


The screenshot shows a software configuration window titled "DUT configuration". It contains a list of eight DUT inputs, each with a checkbox, a text field for the DUT name, and a dropdown menu for the DUT type. DUT1 through DUT4 are checked and have their respective types set: DUT1 and DUT2 are "Calport100plus spr DIR 12A", DUT3 is "TE30 0.05", and DUT4 is "TS33 0.04". DUT5, DUT6, and DUT7 are unchecked and have empty dropdown menus. DUT8 is checked and has an empty dropdown menu. Below this section is a "Reference meter" section with a checked checkbox and a dropdown menu set to "Radian RD31A P+ REF".

DUT	Enabled	DUT Name	DUT Type
DUT1	Yes	DUT1	Calport100plus spr DIR 12A
DUT2	Yes	DUT2	Calport100plus spr DIR 12A
DUT3	Yes	DUT3	TE30 0.05
DUT4	Yes	DUT4	TS33 0.04
DUT5	No	DUT5	
DUT6	No	DUT6	
DUT7	No	DUT7	
DUT8	Yes	DUT8	

Reference meter:  Radian RD31A P+ REF

## TB PC-Soft - Electricity meter testing **Auto Test** function – automatic test execution for selected meters, according to chosen procedure



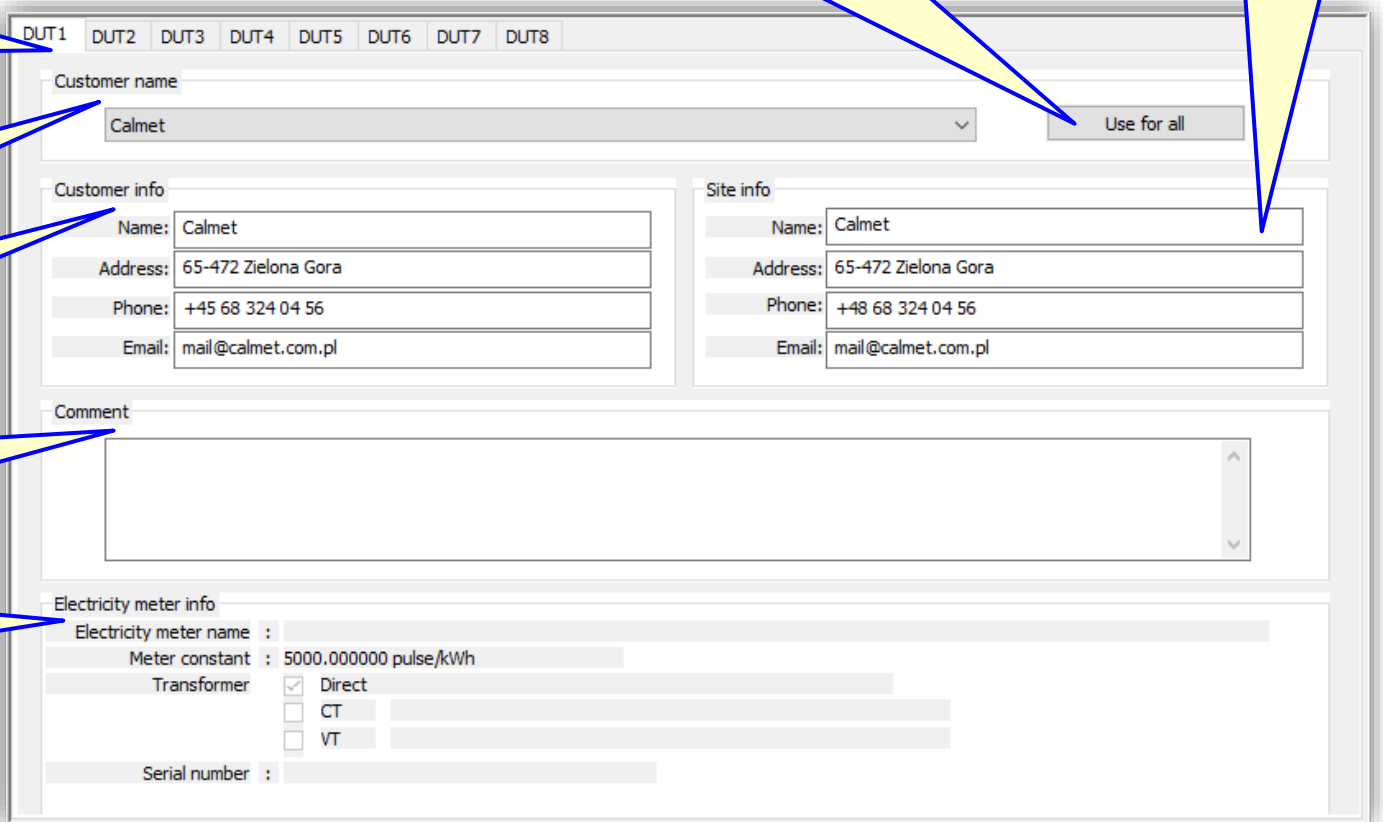
The screenshot shows the TB PC-Soft interface for electricity meter testing. It includes several key components:

- Procedure name selection:** A dropdown menu showing "Calport100plus spr DIR 12A".
- Electricity meter name selection:** A dropdown menu showing "Calport100plus spr DIR 12A".
- Test points table with columns of measuring points:** A table with columns for "No" and "Point Name". The selected point is "24 P 110V 6A cos0.5C".
- Control panel with Start / Stop button and Point / Procedure progress indicators:** A panel with "Start" and "Stop" buttons, "Pause" buttons for "I=0" and "U,I=0", and progress indicators for "Point" and "Procedure".
- Partial results table:** A table with columns for "Error [%]" and "DUT1" through "DUT8".

Callouts provide detailed descriptions of these features:

- Procedure name selection:** A callout pointing to the procedure name dropdown.
- Electricity meter name selection:** A callout pointing to the electricity meter name dropdown.
- Partial results table:** A callout pointing to the results table.
- Test points table with columns of measuring points:** A callout pointing to the test points table.
- Control panel with Start / Stop button and Point / Procedure progress indicators:** A callout pointing to the control panel.
- Control panel with Start / Stop button and Point / Procedure progress indicators:** A callout pointing to the control panel.

## TB PC-Soft - Electricity meter testing **Result / Admin** function – preparing description data for measuring report edition



The screenshot shows the TB PC-Soft software interface for configuring electricity meter testing. The interface includes a tabbed menu at the top with tabs for DUT1 through DUT8. Below the menu, there are several sections for data entry:

- Customer name:** A dropdown menu showing "Calmet" and a "Use for all" button. A callout explains: "Use for all – the same customer name is used for all DUTs".
- Customer info:** A form with fields for Name (Calmet), Address (65-472 Zielona Gora), Phone (+45 68 324 04 56), and Email (mail@calmet.com.pl). A callout points to this section: "Customer info frame".
- Site info:** A form with fields for Name (Calmet), Address (65-472 Zielona Gora), Phone (+48 68 324 04 56), and Email (mail@calmet.com.pl). A callout points to this section: "Site info frame".
- Comment:** A large text area for additional information. A callout explains: "Comment field for additional information".
- Electricity meter info:** A form with fields for Electricity meter name, Meter constant (5000.000000 pulse/kWh), Transformer (with radio buttons for Direct, CT, and VT), and Serial number. A callout points to this section: "Electricity meter info".

On the left side, there are three callouts pointing to the top tabs:

- "Number of device under test" points to the DUT1-DUT8 tabs.
- "Customer name entering" points to the Customer name dropdown.
- "Customer info frame" points to the Customer info form.

## TB PC-Soft - Electricity meter testing Result / Table function – visualization and edition measured results in form of table

Tab's field makes possible switching between consecutive DUTs

Measurement results table

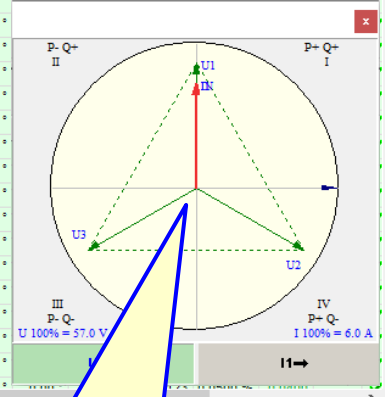
Button enables vector diagram window of selected measuring point

Button for deleting rows from the table

Advanced button for table edition

DUT1	DUT2	DUT3	DUT4	DUT5	DUT6	DUT7	DUT8	Σ											Advanced
No	Point name	Date	Time	U1 [V]	U2 [V]	U3 [V]	I1 [A]	I2 [A]	I3 [A]	F [Hz]	φ1	φ2	φ3	Limit	ε [%]	εg [%]	OK		
1	P1 57V 6A cos1	2012-03-12	09:02:11	57.0000	57.0000	57.0000	6.00000	0	0	50.300	0.00°	0.00°	0.00°	L123	0.0500 %	0.0336	✓		
2	P1 57V 6A cos0.5L	2012-03-12	09:05:52	57.0000	57.0000	57.0000	6.00000	0	0	50.300	60.00°	60.00°	60.00°	L123	0.1000 %	0.0462	✓		
3	P1 57V 6A cos0.5C	2012-03-12	09:09:32	57.0000	57.0000	57.0000	6.00000	0	0	50.300	-60.00°	-60.00°	-60.00°	L123	0.1000 %	0.0419	✓		
4	P2 57V 6A cos1	2012-03-12	09:13:09	57.0000	57.0000	57.0000	6.00000	0	0	50.300	0.00°	0.00°	0.00°	L123	0.0500 %	0.0081	✓		
5	P2 57V 6A cos0.5L	2012-03-12	09:16:48	57.0000	57.0000	57.0000	6.00000	0	0	50.300	60.00°	60.00°	60.00°	L123	0.1000 %	0.0107	✓		
6	P2 57V 6A cos0.5C	2012-03-12	09:20:30	57.0000	57.0000	57.0000	6.00000	0	0	50.300	-60.00°	-60.00°	-60.00°	L123	0.1000 %	0.0054	✓		
7	P3 57V 6A cos1	2012-03-12	09:24:07	57.0000	57.0000	57.0000	6.00000	0	0	50.300	0.00°	0.00°	0.00°	L123	0.0500 %	-0.0053	✓		
8	P3 57V 6A cos0.5L	2012-03-12	09:27:47	57.0000	57.0000	57.0000	6.00000	0	0	50.300	60.00°	60.00°	60.00°	L123	0.1000 %	-0.0262	✓		
9	P3 57V 6A cos0.5C	2012-03-12	09:31:29	57.0000	57.0000	57.0000	6.00000	0	0	50.300	-60.00°	-60.00°	-60.00°	L123	0.1000 %	0.0125	✓		
10	P 57V 6A cos1	2012-03-12	09:35:04	57.0000	57.0000	57.0000	6.00000	6.00000	6.00000	50.300	0.00°	0.00°	0.00°						
11	P 57V 6A cos0.5L	2012-03-12	09:38:42	57.0000	57.0000	57.0000	6.00000	6.00000	6.00000	50.300	60.00°	60.00°	60.00°						
12	P 57V 6A cos0.5C	2012-03-12	09:42:19	57.0000	57.0000	57.0000	6.00000	6.00000	6.00000	50.300	-60.00°	-60.00°	-60.00°						
13	P1 110V 6A cos1	2012-03-12	09:45:56	110.0000	110.0000	110.0000	6.00000	0	0	50.300	0.00°	0.00°	0.00°						
14	P1 110V 6A cos0.5L	2012-03-12	09:49:36	110.0000	110.0000	110.0000	6.00000	0	0	50.300	60.00°	60.00°	60.00°						
15	P1 110V 6A cos0.5C	2012-03-12	09:53:18	110.0000	110.0000	110.0000	6.00000	0	0	50.300	-60.00°	-60.00°	-60.00°						
16	P2 110V 6A cos1	2012-03-12	09:56:54	110.0000	110.0000	110.0000	6.00000	0	0	50.300	0.00°	0.00°	0.00°						
17	P2 110V 6A cos0.5L	2012-03-12	10:00:32	110.0000	110.0000	110.0000	6.00000	0	0	50.300	60.00°	60.00°	60.00°						
18	P2 110V 6A cos0.5C	2012-03-12	10:04:11	110.0000	110.0000	110.0000	6.00000	0	0	50.300	-60.00°	-60.00°	-60.00°						
19	P3 110V 6A cos1	2012-03-12	10:07:47	110.0000	110.0000	110.0000	6.00000	0	0	50.300	0.00°	0.00°	0.00°						
20	P3 110V 6A cos0.5L	2012-03-12	10:11:26	110.0000	110.0000	110.0000	6.00000	0	0	50.300	60.00°	60.00°	60.00°						
21	P3 110V 6A cos0.5C	2012-03-12	10:15:07	110.0000	110.0000	110.0000	6.00000	0	0	50.300	-60.00°	-60.00°	-60.00°						
22	P 110V 6A cos1	2012-03-12	10:18:41	110.0000	110.0000	110.0000	6.00000	6.00000	6.00000	50.300	0.00°	0.00°	0.00°						
23	P 110V 6A cos0.5L	2012-03-12	10:22:17	110.0000	110.0000	110.0000	6.00000	6.00000	6.00000	50.300	60.00°	60.00°	60.00°						
24	P 110V 6A cos0.5C	2012-03-12	10:25:53	110.0000	110.0000	110.0000	6.00000	6.00000	6.00000	50.300	-60.00°	-60.00°	-60.00°						
25	P1 300V 6A cos1	2012-03-12	10:29:27	300.0000	300.0000	300.0000	6.00000	0	0	50.300	0.00°	0.00°	0.00°						

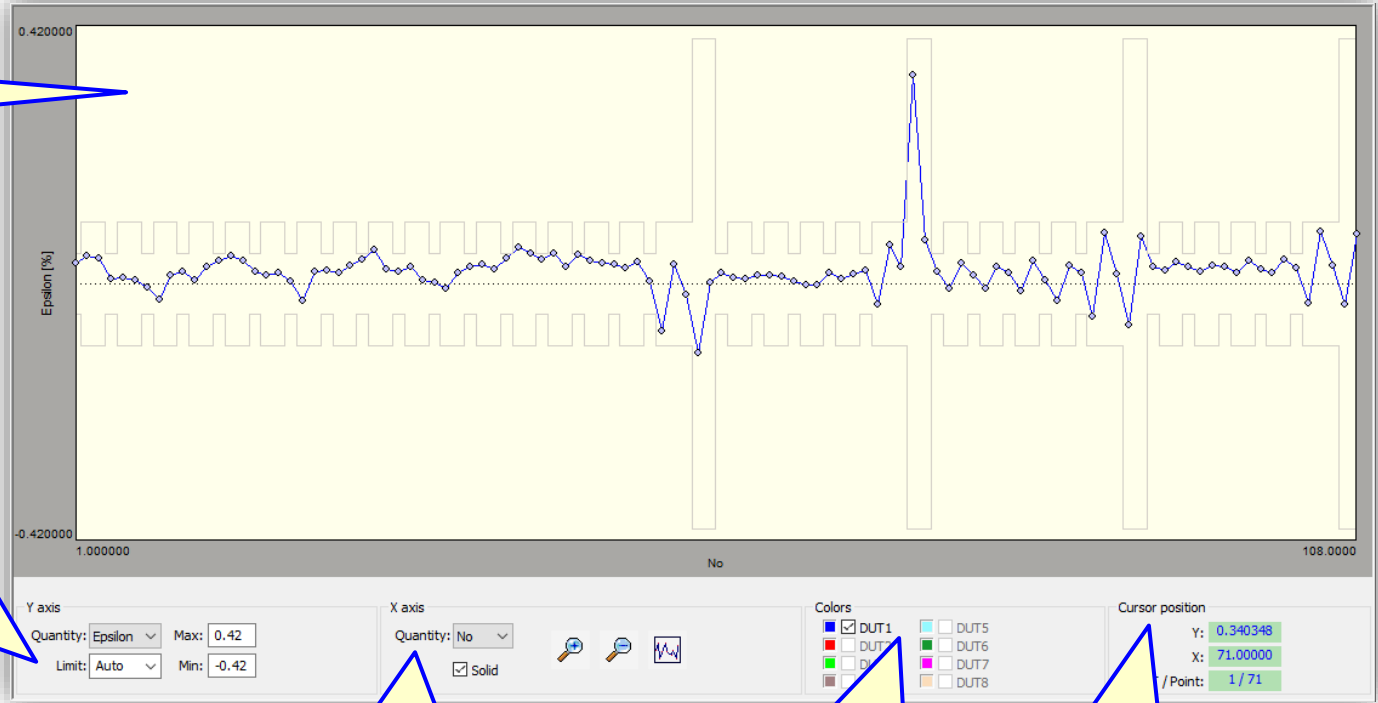
Vector diagram of selected measuring point



## TB PC-Soft - Electricity meter testing Result / Graphic function – visualization and edition measured results in form of graph

Diagram field of error function and error limits

Y axis frame includes:  
- Quantity field  
- Limit field  
- Max field – entering maximum function value  
- Min field – entering minimum function value

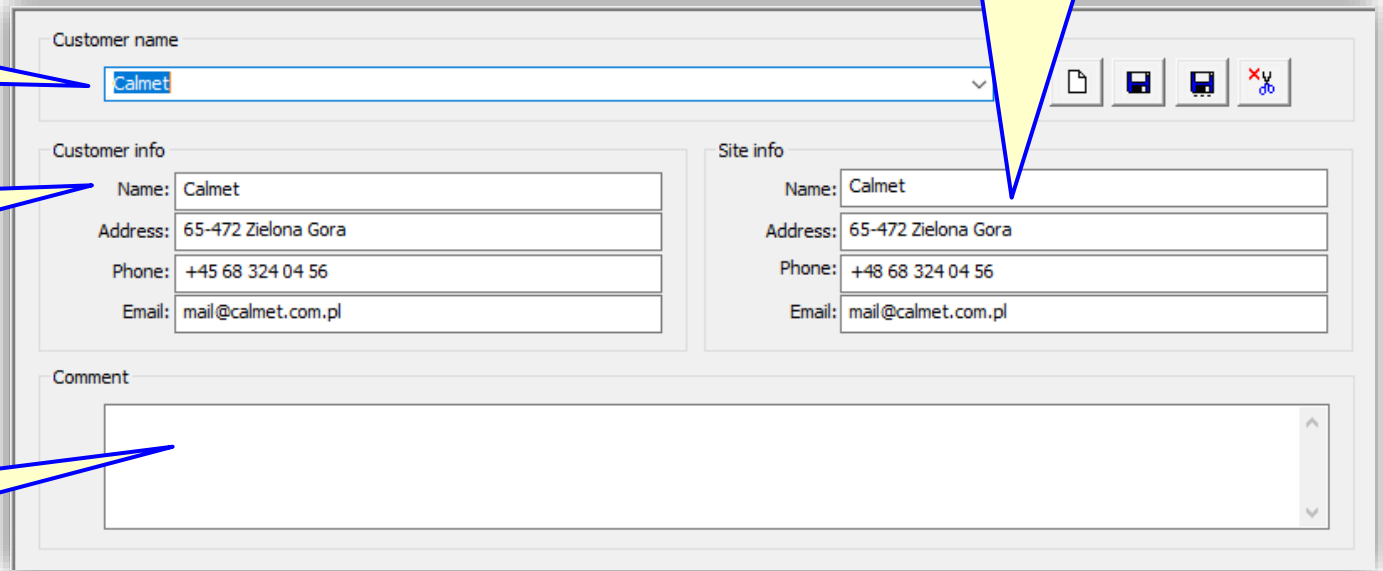


X axis frame includes:  
- Quantity field  
- Buttons for zooming in and zooming out

Colours frame makes possible to enable/disable consecutive DUTs' charts and change their colour

Cursor position frame contains cursor's coordinates

## TB PC-Soft - Customer function – preparing predefined description data for measuring report



The screenshot shows a software interface for entering customer and site information. It features a 'Customer name' dropdown menu, two side-by-side 'Customer info' and 'Site info' frames, and a 'Comment' text area. Callouts highlight the 'Customer name' field, the 'Customer info' frame, the 'Site info' frame, and the 'Comment' field.

**Customer name entering**

**Customer info frame with edition fields**

**Site info frame with edition fields**

**Comment field for additional information**

Field	Customer info	Site info
Name:	Calmet	Calmet
Address:	65-472 Zielona Gora	65-472 Zielona Gora
Phone:	+45 68 324 04 56	+48 68 324 04 56
Email:	mail@calmet.com.pl	mail@calmet.com.pl

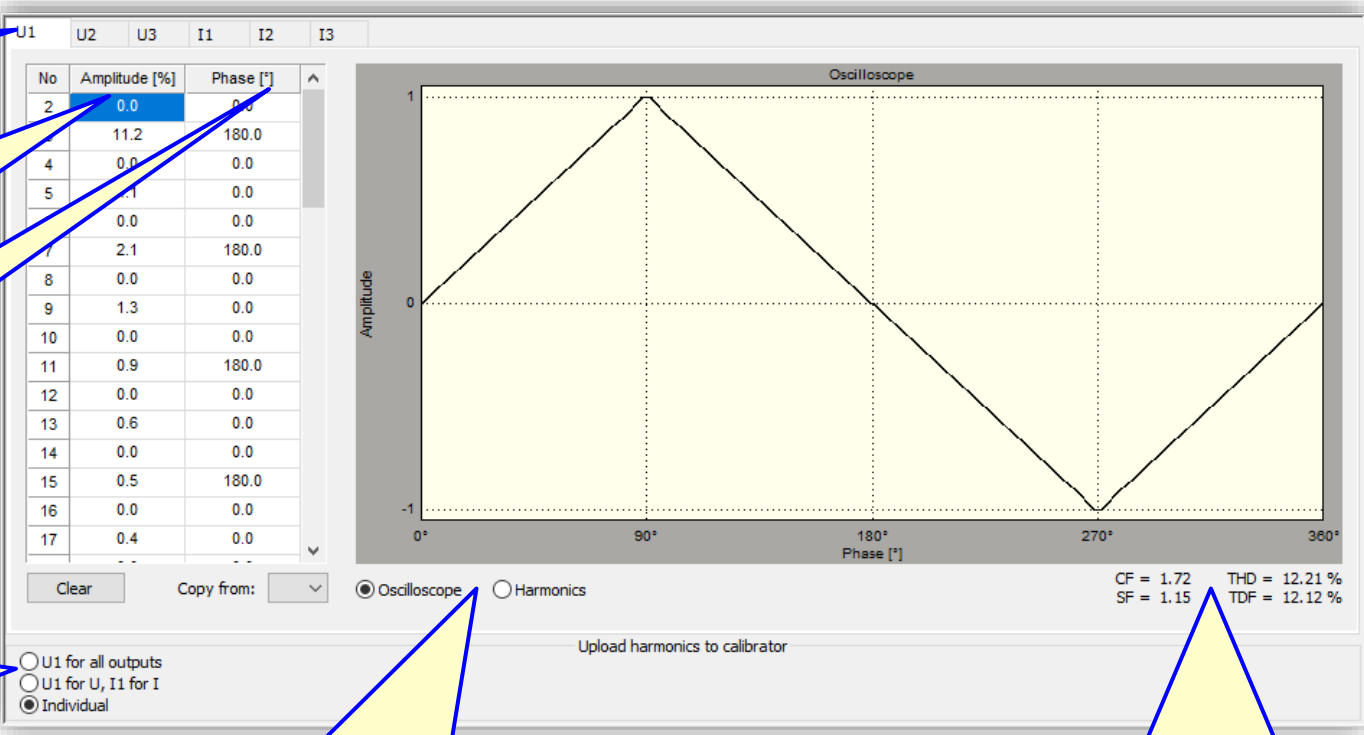
## TB PC-Soft - Harmonics function – setting the magnitude and phase of harmonics

Selecting channel to set harmonics

Setting the magnitude of harmonic in percent of first harmonic magnitude

Setting the phase shift of harmonic in degrees with reference to the first harmonic

Fields for selecting channels in which harmonics will be programmed



No	Amplitude [%]	Phase [°]
2	0.0	0.0
3	11.2	180.0
4	0.0	0.0
5	2.1	0.0
6	0.0	0.0
7	2.1	180.0
8	0.0	0.0
9	1.3	0.0
10	0.0	0.0
11	0.9	180.0
12	0.0	0.0
13	0.6	0.0
14	0.0	0.0
15	0.5	180.0
16	0.0	0.0
17	0.4	0.0

Oscilloscope     Harmonics  
 CF = 1.72    THD = 12.21 %  
 SF = 1.15    TDF = 12.12 %

U1 for all outputs  
 U1 for U, I1 for I  
 Individual

Upload harmonics to calibrator

Selecting mode of visualization as graphic oscilloscope diagram

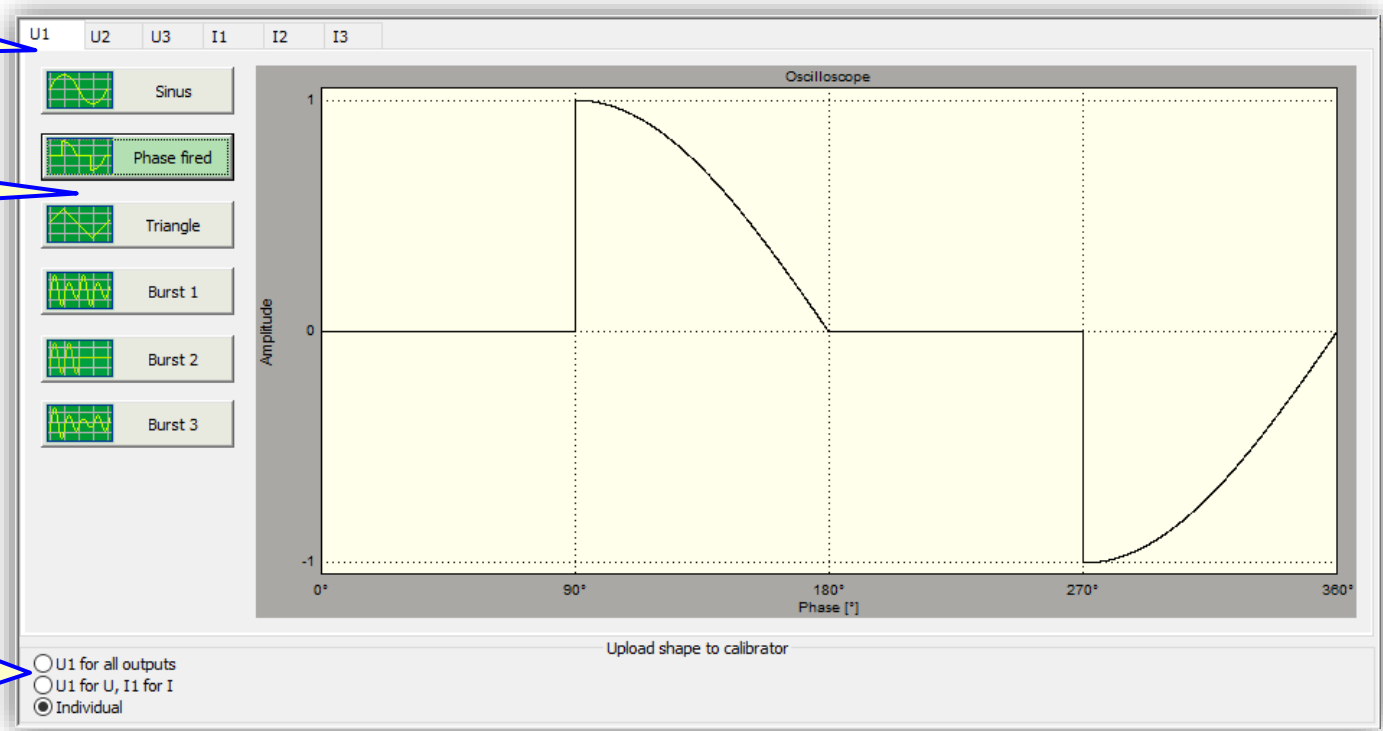
Coefficients field of programmed shape of signal

## TB PC-Soft - Shape function – selecting the wave shape of voltage and current

Selecting channel to set wave shape

Selecting wave shapes

Fields for selecting channels in which shape will be programmed



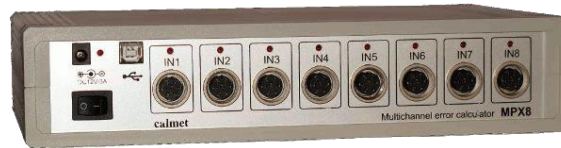
The screenshot shows the TB PC-Soft software interface. At the top, there are tabs for channels: U1, U2, U3, I1, I2, and I3. Below these are buttons for selecting wave shapes: Sinus, Phase fired (highlighted), Triangle, Burst 1, Burst 2, and Burst 3. To the right is an oscilloscope window titled "Oscilloscope" showing a graph of Amplitude (y-axis, -1 to 1) versus Phase [°] (x-axis, 0° to 360°). The graph displays a sine wave starting at 0 at 90°, reaching a peak of 1 at 180°, crossing 0 at 270°, and reaching a trough of -1 at 360°. Below the oscilloscope, there are radio buttons for channel selection:  U1 for all outputs,  U1 for U, I1 for I, and  Individual. An "Upload shape to calibrator" button is also present.

## TB51: how to order – versions, options, accessories

TB51 versions: accuracy class 0.02% or 0.04%



TS41 Automatic Test System



MPX8 Eight Inputs Meter Error Calculator



Computer Laptop PC with PC software

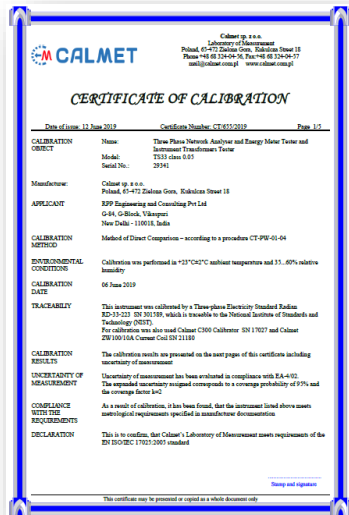
### Standard scope of delivery



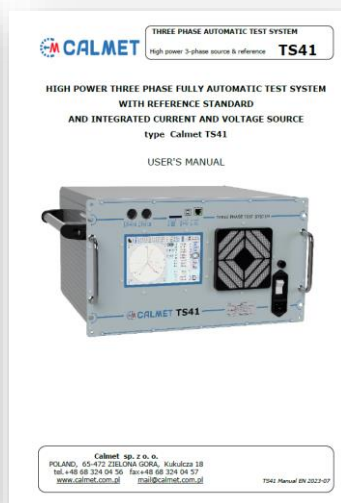
CF106 photo head (4 units)



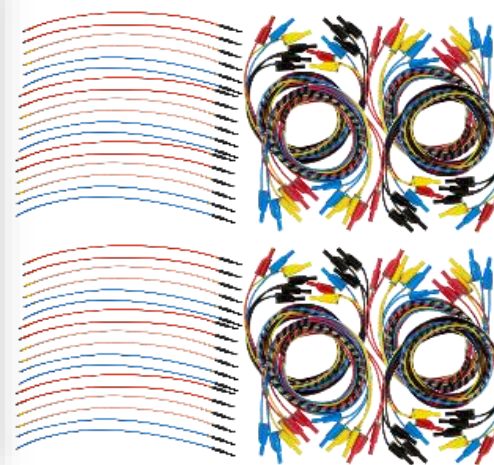
ER51H.3 four position testing stand for hanging 3-phase meters



Manufacturer Calibration Certificate



Operation manual



Set of voltage and current cables

## TB51: how to order – versions, options, accessories

### TB51 optional accessories:

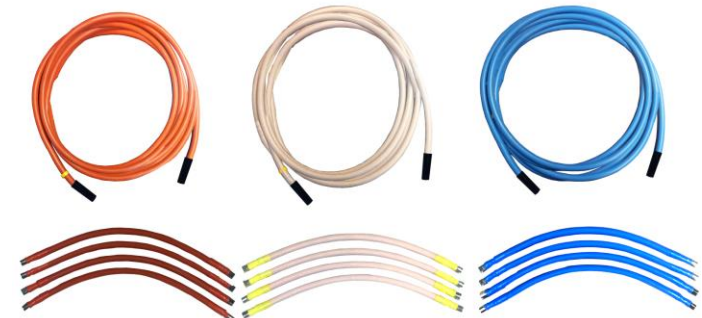
### Optional scope of delivery 1



**EC11.3 Isolation Transformer (4 units)**



**ED10 Individual Error Display (4 units)**



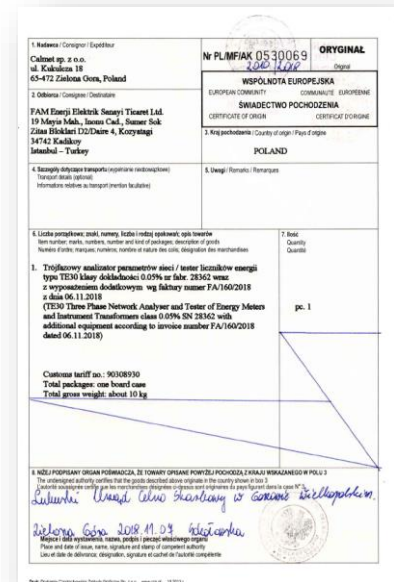
**EA45 set of current cables up to 120A (18 units) for working with ICT**



**External high accuracy reference meter Radian Research**



**Calibration Certificate from ISO17025 accredited lab**



**Certificate of Origin from Customs and Chamber of Commerce**

To see more devices and information visit our Web site: [www.calmet.com.pl](http://www.calmet.com.pl)

TOP PRODUCTS

- TS33 - Three phase Fully Automatic Test System
- C300B - Power Calibrator
- TE30 - Working Standard
- TE30 Lite - Meter Tester
- TB51 - Five Position Meter Test Bench for smart meters

PRODUCTS BY CATEGORY

- Power calibrators and power quality calibrators
- Multifunction calibrators
- Electricity meters testers and reference standards
- Instrument transformers testers
- Protection relays testers
- Network quality analysers
- Meter test stations

Meter test stations



**TB51 - Five Position Meter Test Bench for smart meters**

Three phase electricity meter test bench with extremely compact design size and light weight for simultaneous and automatic testing of 5 electricity meters with different constants and with "closed link"

 [Data sheet](#)

[Read more ...](#)



**TS33 option set TB1 - Three phase meter test station**

Single position three phase fully automated 0.02%, 0.04% or 0.01% accuracy class test station for electricity active and reactive meter testing up to 120A with accuracy referenced to an internal reference meter

 [Data sheet](#)

[Read more ...](#)



**TS41 - High Power Three-phase Fully Automatic Test System with Reference Standard and Integrated Current and Voltage Source**

The Calmet TS41 test system consists of a three-phase reference meter of accuracy class 0.02% (or 0.04%) and an integrated three-phase current and voltage source up to 3x120A/600V. It makes possible automatic testing of electricity meters in meter test station

or contact by e-mail: [mail@calmet.com.pl](mailto:mail@calmet.com.pl)