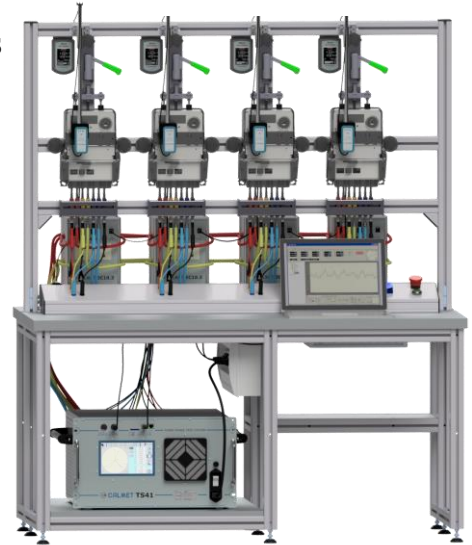# CALMET TB41

Four Position Meter Test Bench for smart meters

Calmet TB41
• New generation of the fully automated Smart Meter Test Bench
• Accuracy class 0.04% or 0.1% with internal – built in reference meter!
• Extremely high accuracy class with external reference meter
• Automatic Test Procedures and Test Reports
• Simultaneously testing up to 4 electricity meters with different constants
• Programmed form (harmonics) & special shapes of currents and voltages
• Three-phase current and voltage source in range 0.001A…120A (300VA) and 20V…600V (150VA) per channel
• Signal generation without additional auxiliary amplifiers
• Compact module design, size and light weight
• AC single phase power supply operation only (<2000VA)
• Isolation transformers ICT for meter with "closed link" (IP link)

The Calmet TB41 Four Position Meter Test Bench is used for calibration and simultaneously testing up to four single and three phase electromechanical and electronic active and reactive electricity meters with accuracy referenced to an internal reference meter.

The Calmet TB41 economic Test Bench employs modern precision power source with the internal reference (without need to use any additional external reference energy meter). By this conception may be achieved customer orientated solution characterised by extremely compact size, light weight, high metrological properties at reasonable price. In case of higher-accuracy application requirement, it is possible to upgrade the existing Calmet TB41 Test Bench by adding an external reference meter.
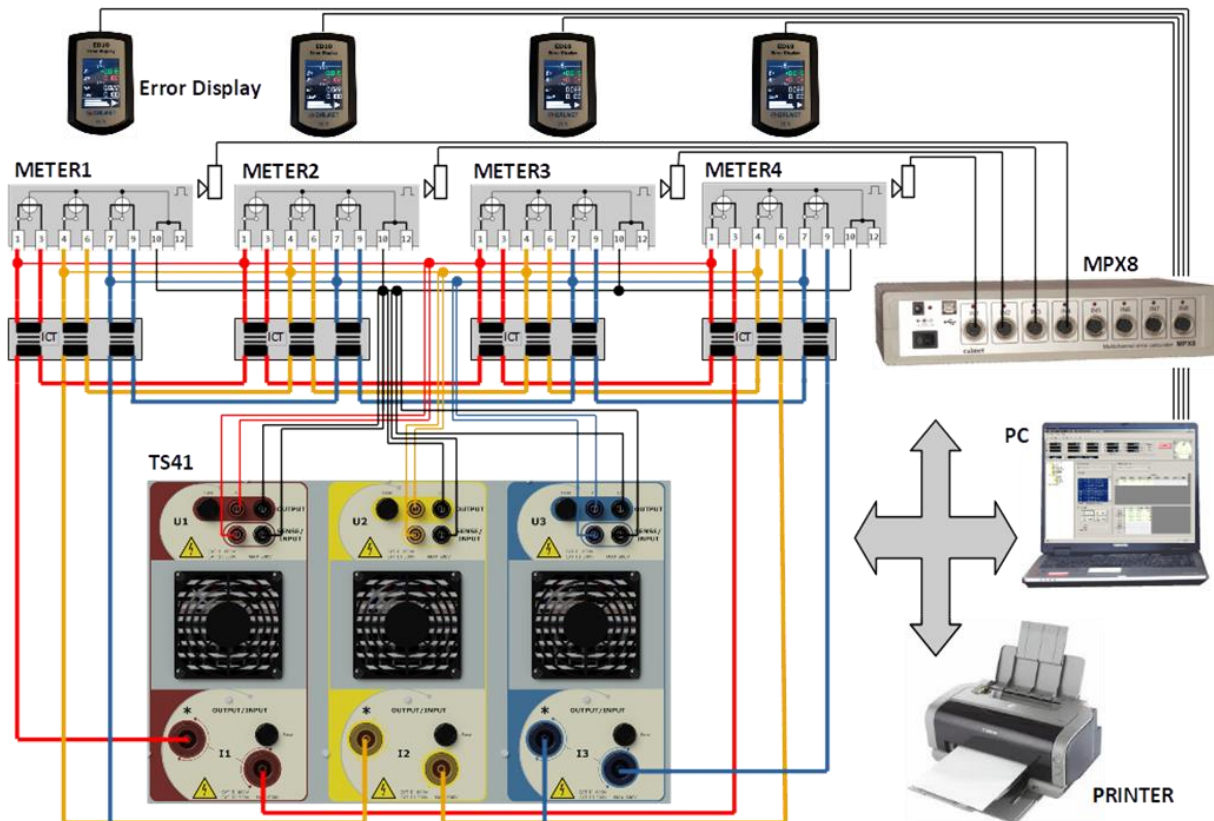
The Calmet TB41 Test Bench comprises:

• three phase power source with internal reference accuracy 0.04 or 0.1. Power source generates voltage up to 600V and current up to 120A with programmable shapes, frequency in 45…65Hz range and phase shifts in -180°… 0°…+180° range,

• four position testing stand with photo scanning heads, quick connectors and cables,

• four isolation transformers ICT for meters with permanent shunt between voltage and current "closed IP link",

• MPX8 Eight Inputs Meter Error Calculator and 4 individual error displays ED10,

• PC laptop with installed TB PC Soft for controlling of testing process.

The Calmet TB41 Test Bench performs the following automatic tests of electricity meters:

• measure the basic error characteristics and repeatability for power and energy: P, P+, P-, PH1, PH1+, PH1-, Q, Q+, Q-, QH1, QH1+, QH1-, S, S+, S-, SH1, SH1+, SH1-,

• checking the counter (register) error, starting current and no-load run,

• measure the influence of frequency, voltage, self-heating, reversed phase sequence, distortion and special shapes of currents and voltages.

Configuration of the Calmet TB41

Internal Reference Meter Specifications

Parameter	Range	Accuracy [1)2)3)4)]	
		class 0.04	class 0.1
Voltage	0.05…600V	±0.04%[5)]	±0.1% [5)]
Current	0.01…120A	±0.04%	±0.1%
	0.001…<u>0.01A</u>	±0.04%*	±0.1%*
Power and energy	0.01…120A / 10…600V	±0.04%	±0.1%
	0.001…<u>0.01A</u> / 10…600V	±0.04%*	±0.1%*
Frequency	40…70Hz	±0.01Hz	
Phase shift	-180…+180°	±0.02° [5)6)]	±0.04° [5)6)]
Power factor cosφ and sinφ	0…±1	±0.001 [5)6)]	
Temperature coefficient	0.001% per 1°C in range -10…+50°C		
Time stability	Short term [1h] = 0.01%, long term [1 year] = 0.03%		
Power short term [1h] stability		±0.010%	±0.020%
Power long term [1 year] stability		±0.025%	±0.050%
Power temperature coefficient per 1°C		±0.002%	±0.005%

[1)] % - related to the measuring value, %* - related to the measuring range final value (is underlined)
[2)] absolute extended uncertainty under confidence level of 95% covers reference uncertainty of standards, stability in 12 months, influence quantities (ambient temperature +20…+26°C, humidity and power supply voltage 85…265V, frequency 47…63Hz)
[4)] power and energy errors related to apparent power
[5)] in voltage range 10…600V
[6)] in current range 0.01…120A

Reference Meter Specifications for the power quality parameters

Parameter		Range		Accuracy [1)]
Harmonics in voltages, currents, P and Q powers	amplitude	0…100% of input	1st…63rd	±0.1% [2)]
	phase	-180…+180°		±0.5° [3)]
Total harmonic distortion THD in voltages and currents		0…100% of input	1st…63rd	±0.1% [2)]
Total interharmonic distortion TID in voltages and currents		0…15% of input	40…3200Hz	±0.2% [4)]

[1)] absolute extended uncertainty under confidence level of 95% covers reference uncertainty of standards, stability in 12 months, influence quantities (ambient temperature +20…+26°C, humidity and power supply voltage 85…265V, frequency 47…63Hz)
[2)] of input for 80-140Hz frequency range of harmonics with linear rise to 0.4% of input for 3200Hz
[3)] for 80-140Hz frequency range of harmonics with linear rise to 8° for 3200Hz
[4)] of input for 80-140Hz frequency range of interharmonics with linear rise to 5% of input for 3200Hz

Three Phase Power Source Specification for the sinusoidal signals

Parameter	Range	Settings span	Resolution	Accuracy [1)2)]	Maximum load
Voltage U	150V	20…150V	0.001V		1A@150V
	300V	150…300V	0.01V	±0.1%	500mA@300V
	600V	300…600V	0.01V		250mA@600V
Voltage short term [10min] stability				±0.01%	
Voltage short term [1h] stability				±0.03%	
Voltage distortion factor				< 0.5%	
Current I	0.12A	0.02…0.12A	0.00001A	±0.1%	5V@0.12A
		0.001…<u>0.02</u>		±0.1%*	
	1A	0.12A…1A	0.00001A		30V@1A
	12A	1…12A	0.0001A	±0.1%	14V@12A
	120A	12…120A	0.001A		3V@60A 2.5V@120A
Current short term [10min] stability				±0.01% [3)]	
Current short term [1h] stability				±0.03% [3)]	
Current distortion factor				< 0.5% [3)]	
Frequency f		45…65Hz	0.001Hz	±0.005Hz	
Phase shift φ		-180…+180°	0.001°	±0.10°	
Phase shift short term [10min] stability				±0.05°	

[1)] absolute extended uncertainty under confidence level of 95% covers reference uncertainty of standards, stability in 12 months, influence quantities (ambient temperature +20…+26°C, humidity and power supply voltage 85…265V, frequency 47…63Hz)
[2)] % - related to the setting value, %* - related to the setting span final value (is underlined)
[3)] in current range 0.02…120A

Three Phase Power Source Specification for the non-sinusoidal signals

Parameter		Settings span	Resolution	Conditions
Harmonics	amplitude	0…50% output value [1)]	0.1%	up to 40th or 2000Hz
	phase	-180…+180°	0.1°	

[1)] 50% of output value for frequency range of harmonics to 500Hz with linear decrease to 10% of output value for 2000Hz

Specifications for impulse input/output

Parameter	Voltage range	Frequency range	Uncertainty
Impulse Input for counting pulses (two inputs)	0…2V/4…30V	0.0001Hz…210kHz	0.001%@t≥1s
Impulse Output for Calmet TS41 testing	28V/100mA open collector	0.0001Hz…210kHz	

General parameters

Weight without EC10.3 / with EC10.3	140kg / 188kg
Dimensions: width x height x depth	(128 x 156,5 (159,5) x 70)cm
Power supply	85…265V / 47…63Hz / 2000VA
Safety: Isolation protection and Measurement Category	IEC 61010-1 and 300V CAT III
Degree of protection	IP-20
Operation / storage temperature	-10…+40°C / -20…+60°C
Operation / storage relative humidity	<90% @ +0…+30°C and <75% @ +30…+50°C / <95% @ 0…+50°C

The Calmet TB41 Test Bench is controlled by means of personal computer with installed TB PC Soft in MS Windows operating system.

TB PC Soft features:

- using a modern concept, which allows the operator to create own test procedures - this is very important because new requirements for new meter generations can be realized easily without changing the complete software,
- the automated mode - direct execution of the complete test procedure automatically and requires no more additional handling by operator unless it will not be defined in the test procedure,
- the manual mode - direct execution of single test step. It offers an ideal solution for tests and evaluation of entire specifications for devices under test without generating the complete test procedure,
- computer database of customers, devices, measurement procedures as well as edition of results, diagrams, tables of results and reports,
- export of results to MS Excel.

> **Advantages of TB PC Soft:**
>
> - user-friendly operation,
> - demonstration software allows training to be given before delivery of the test system,
> - database for meters and test procedures,
> - fully-automatic test procedures,
> - continuous monitoring of the test,
> - generation of harmonics,
> - generation of special test signals and waveforms acc. to the IEC 62052-11 and EN 50470-1,2,3,
> - tables and graphics for presentation of results,
> - operator interface available in several languages,
> - customers database for automatic measurements report generation.

Meter type window for entering data to tested devices database, contains the electrical and functional definitions of the **D**evice **U**nder **T**est – **DUT** (base voltage and current values, maximal current value, accuracy class of the DUT, meter constant, meter connection,…).

Procedure window for entering data to measuring procedures database, describes the order and content of the various test steps in a sequence. For each test step are specified following data:

- parameters of test point (point name, percentage value of the base voltage and current, phase angle or power factor, frequency, waveform of the voltages and currents,…),
- test type (error test, counting test, counter test),
- test method (impulses counting or time counting for error test) and percentage error limit of the DUT,
- test duration for calculating of the standard deviation of error (number of cycles, time of the test point, energy dosage to counting).

Configuration window describes configuration of the MPX8 Multiplexer inputs (active / not active) and description of connected DUT (name, serial number and other necessary information).

Additionally the configuration window allows to set the external reference meter (option) connected to the 8th of the MPX8 input.

Autotest window for performing test of the DUT (tests of accuracy at reference conditions, repeatability, meter constant, starting and no-load condition, effect of influence quantities and tests of effect of disturbances of long duration as reversed phase sequence, voltage unbalance, self-heating, odd harmonics, even harmonics, subharmonics,…) according to measuring procedure in the manual mode or in the automated mode. The autotest function allows to allocate to a measurement procedure a meter type and select a test sequence.

During the test, the operator will be informed about:

- point status (passed / not passed, active point),
- progress indicator (cycle, point and procedure),
- error values for all DUTs in consecutive cycles,
- values of average error, standard deviation and error limit for all DUTs.

Additionally, in any time, the operator can pause or stop a procedure and repeat selected point.
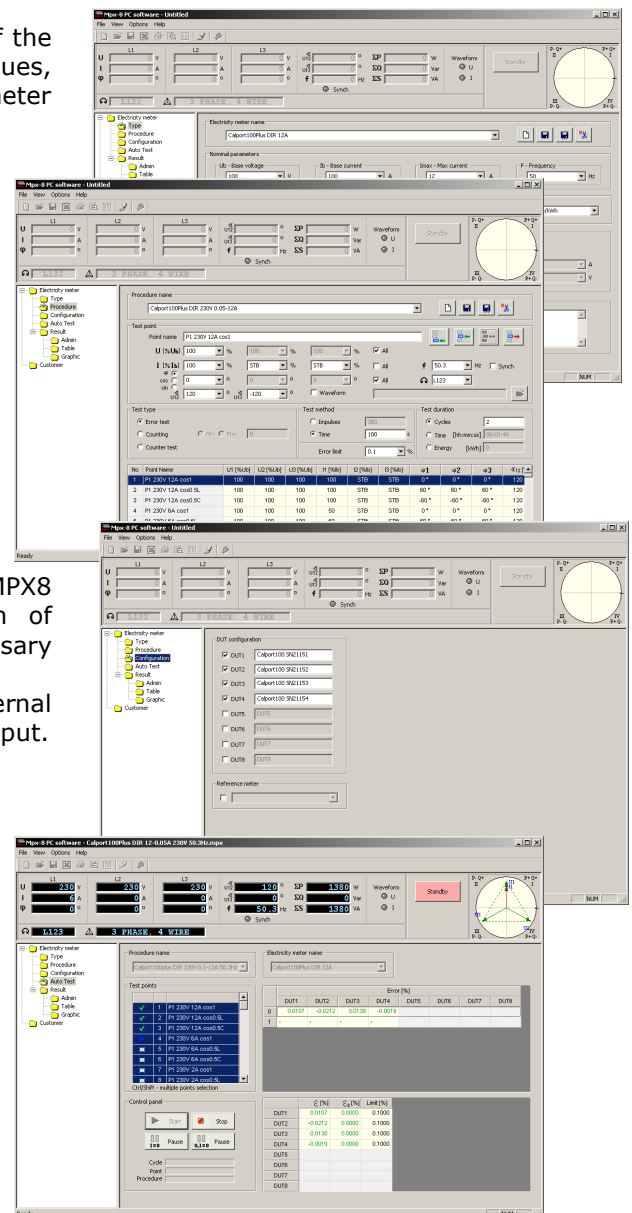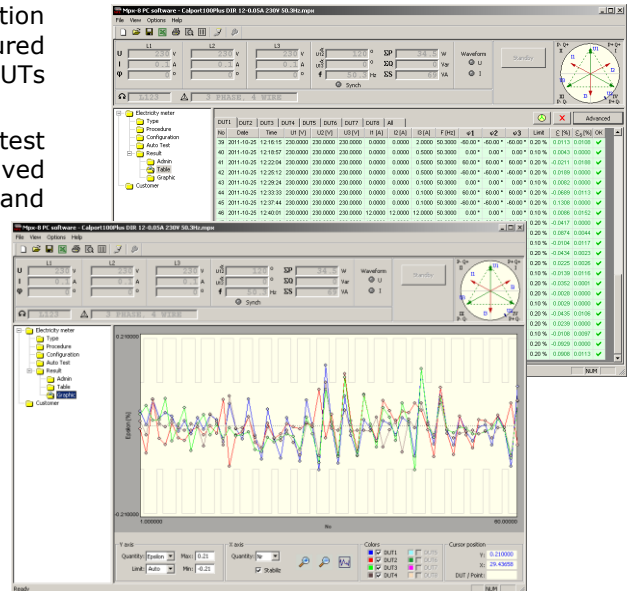
Table result window makes possible visualization and edition measured results in form of table and consists of measured results of DUTs in two kinds of table: table of individual DUTs results and table of all DUTs results.

During an automatic test sequence it is possible to view test results and after executing an automatic test sequence all saved results are available for further data processing (printing and exporting data to MS Excel).

Graphic result window makes possible visualization of measured results in form of diagram of error function with error limits.

The graphic result is fully customizable. The operator can change:

- add or hide graph of selected DUT to diagram,
- color of any graph,
- quantity of X axis (no, time, current, voltage,…),
- zoom in and out of diagram.

The Calmet TB41 Meter Test Bench's set

Calmet TB41
All completed Calmet TB41 Test Bench's set consists of:

- TS41 automatic test system class 0.04 or 0.1
- MPX8 Eight Inputs Meter Error Calculator with TB PC Soft (for controlling the process of simultaneously testing up to 4 energy meters),
- ER41H.3 four position testing stand including:
  o ER41 4-positions test rack for hanging 3-phase meters,
  o EH10.3 quick connection device (4units),
  o EA39 set of safety voltage cables (16units),
  o EA37 set of current cables up to 120A (15units) for working without ICT **),
- Computer Laptop PC with PC software,
- CF106 photo head for inductive meter and meter with LED (4units),
- AD300 sockets adapter,
- power cord (2units),
- USB hub,
- fuse T4A, 250V, 5x20 (2units),
- C091A T3475-001 plug Amphenol for Calibrator inputs,
- operation manuals and assembly manual,
- warranty card and manufacturer calibration certificate.

Optionally for Calmet TB41 Test Bench are available:			
• EC10.3 ICT current isolation transformer up to 120A (4 units) with EA38 set of current cables up to 120A (15 units) for working with ICT		• ED10 individual error display (4 units) with cables	
• External high accuracy reference meter Radian Research		• C091A T3475-001 plug Amphenol for TS41 system inputs	

*) All images are for illustrative purposes only and are subject to change
**) In case of choosing the option with EC10.3 ICT current isolation transformer, the EA37 current cables are replaced with EA38 cables

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