Simultaneous Testing of Active and Reactive Energy of an Energy Meter using the Calmet TS33 Test System

CALMET Smart Calibration Devices

Application note No51

The Calmet TS33 Three-Phase Automatic Test System has been used for precise testing in the power industry for many years. It combines a high-accuracy reference meter (0.02%, 0.04% or 0.1%) and an integrated current and voltage source with an output of up to 3×120 A/600 V in one portable device. The system is designed for comprehensive analysis of measurement installations and testing of energy meters directly on site, in accordance with international standards such as IEC 62053 and EN 50470.

One of the key advantages of the TS33 is the possibility to perform comprehensive energy meter tests using the same measurement setup. Depending on the test requirements, the system can generate the required load conditions and simultaneously read pulses corresponding to active and reactive energy. This allows the accuracy of the tested meter to be checked independently for both types of energy.

This application note describes how to use the **Calmet TS33** to simultaneously test active and reactive energy of one energy meter. It shows how to configure the system and set the required test parameters to verify the meter's accuracy for both types of energy within a single test setup.

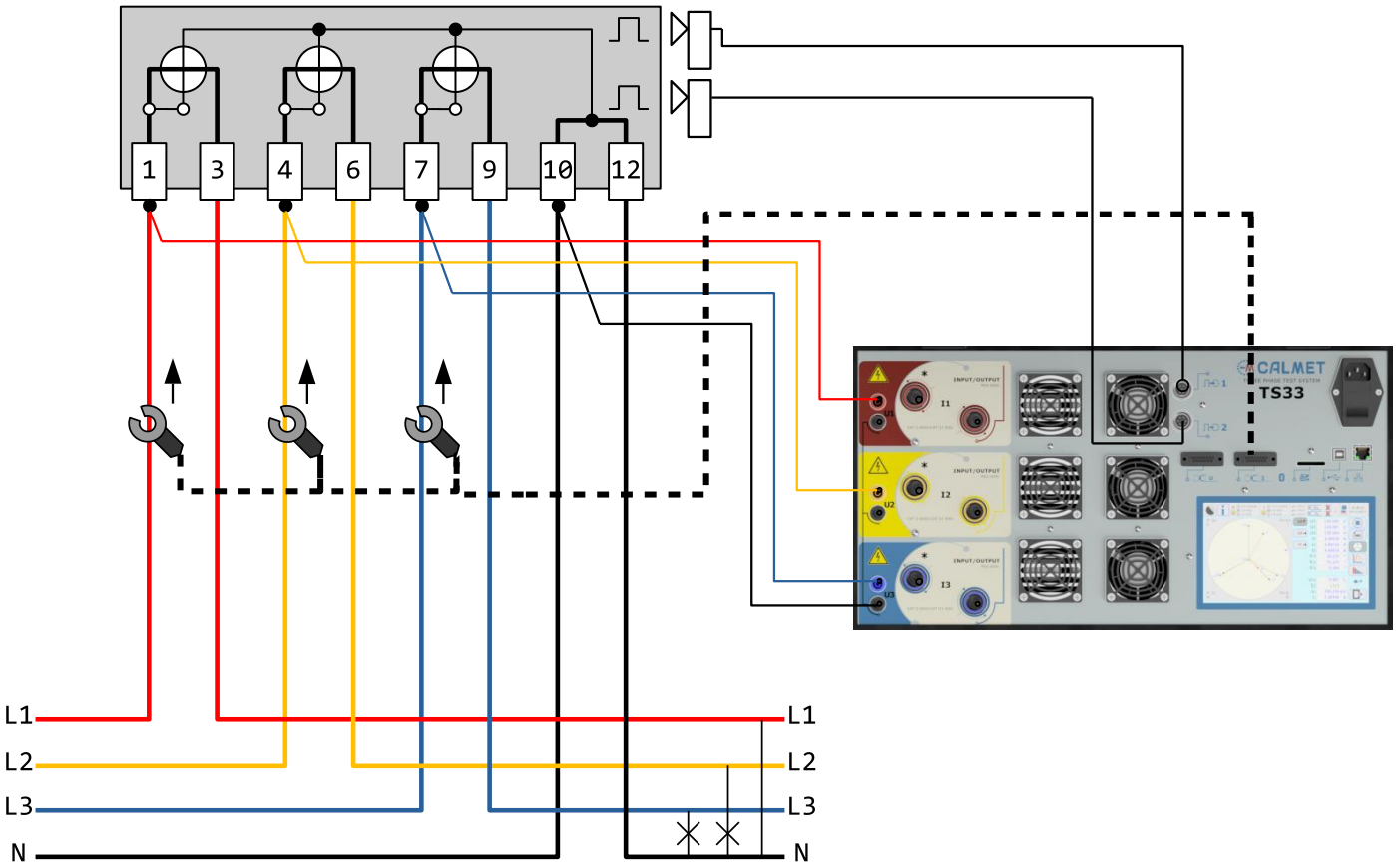
This solution simplifies the testing process and eliminates the need to perform separate tests for active and reactive energy. By using the integrated current and voltage source and the independent input channels of the TS33, the operator can perform a complete verification of the tested meter while maintaining high accuracy and full test automation.

A key advantage of the **Calmet TS33** is its flexibility, which allows the system configuration and test parameters to be adapted to the requirements of the tested meter and the conditions at the test location. Simultaneous testing of active and reactive energy can be performed using appropriately configured measurement channels and the corresponding output signals from the tested meter.

1. Energy Meter Connected to the network (Reference Meter Mode)

In this setup, the natural load present in the power grid is used. The TS33 operates as a high-accuracy reference meter, and the measurement error is determined by comparing the energy measured by the tested meter with the energy measured by the reference meter.

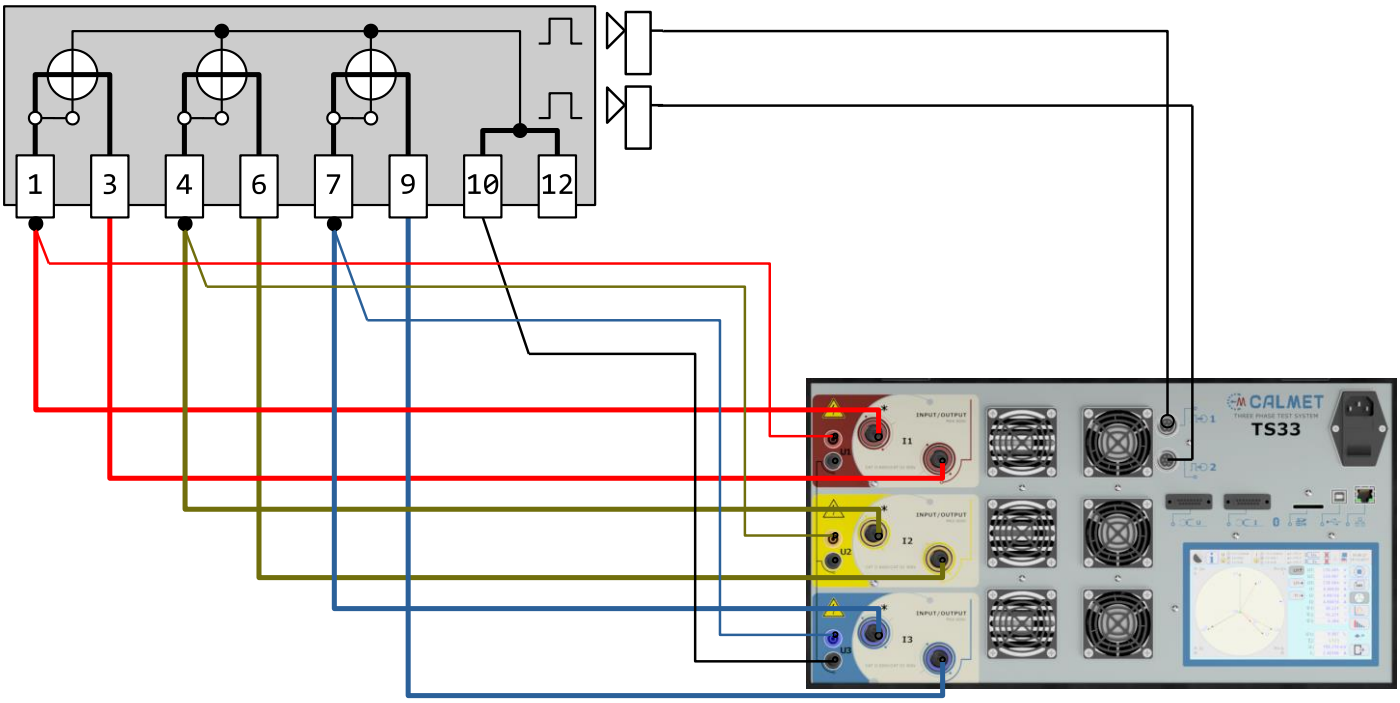
- **Application:** Quick verification of an energy meter directly at the customer's site without interrupting the power supply.
- **Connection:** Voltage and current signals (using clamps or direct connection) are taken from the installation, while the active and reactive energy pulses from the meter are connected to the two pulse inputs of the TS33.

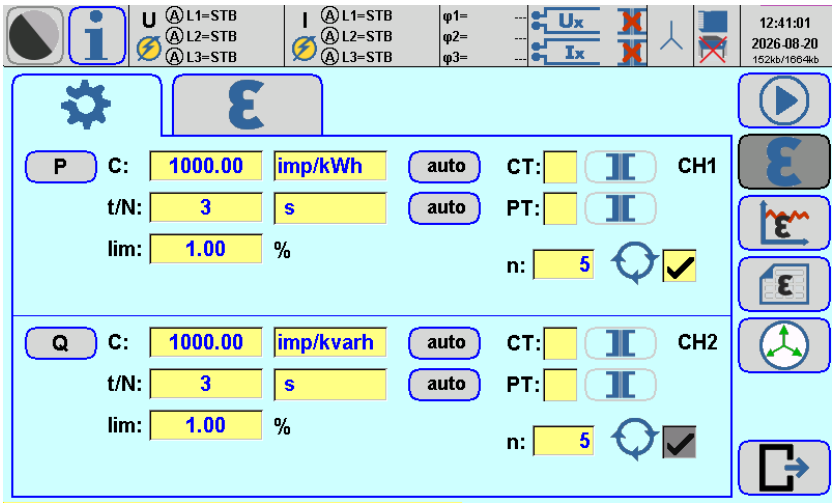


2. Energy Meter Disconnected from the network (Full Test System Mode)

For tests that require full independence from the power grid or specific load points according to IEC standards, the TS33 uses its integrated three-phase current and voltage source.

- **Application:** Meter laboratories, verification points and precision testing where the tested meter must be disconnected from the power supply.
- **Connection:** The TS33 acts as a power source for the tested meter. It generates precise voltage (up to 600 V) and current (up to 120 A), forcing energy flow through the meter.





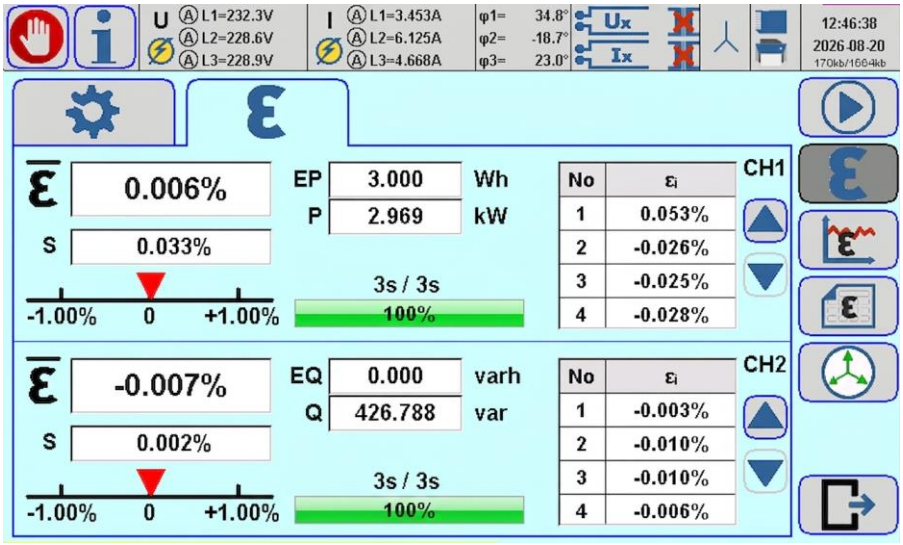
After physically connecting the TS33 system according to the selected connection diagram, the key to the test is the proper use of the two pulse inputs of the device. In this case, both inputs can be used to simultaneously read active and reactive energy pulses from one tested energy meter.

In practice, this requires two optical heads, such as the CF106H. The first optical head is placed over the LED corresponding to active energy, while the second is placed over the LED corresponding to reactive energy. Both optical heads are connected directly to the two pulse inputs of the TS33.

Once the voltage and current signals are stable, whether measured using current clamps or taken directly from the tested circuit, the test parameters can be configured in the TS33 menu. The pulse constant for each input can be set independently according to the output parameters of the tested energy meter.

After setting the required number of pulses, the TS33 simultaneously measures the reference energy and counts the pulses from both outputs of the tested meter. In a single measurement cycle, independent error results can be obtained for active and reactive energy.

This solution eliminates the **need to perform two separate tests** and reduces the total test time, especially when working with low load currents. The results of both measurements are displayed independently on the device screen, allowing the operator to monitor the accuracy of the tested meter for both active and reactive energy in real time.



All data from the completed test can be saved on the device's SD card and then exported to **TS PC-Soft**. Based on this data, a complete report can be prepared, including the active and reactive energy test results.Thanks to full integration with **TS PC-Soft**, the data saved on the device can be automatically processed and presented as a ready-to-use report. As shown in the attached example, the report clearly presents key network parameters, such as power, voltage and current, together with the percentage error results of the tested meter. When active and reactive energy are tested simultaneously, the report contains independent results for both pulse channels. This allows the active and reactive energy test results to be presented in a single document while maintaining full traceability of the tested meter. This solution simplifies the documentation of the entire test process, eliminates the need to prepare separate reports and makes it easier to archive and analyze the test results later.

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Channel 1

Admin

SN	36789
Customer	PAFAL
Site	CALMET, Kukulcza 18 street, 65-472 Zielona Gora, Poland, EU
Comment	Test of the PAFAL Active Power

Configuration

Type	Calmet TS33		
Firmware	1.7.8-RC2	PT	OFF
TS33 S/N	N160	CT	OFF
Input wiring	3P4W		
Power	P		
U	Generate	I	Generate
U	Direct	I	Direct

Settings

C	1000	imp/kWh

Error test

No	Time	Power type	Test power	Test energy	Limit [%]	ε [%]	Se [%]	U1 [V]	U2 [V]	U3 [V]	I1 [A]	I2 [A]	I3 [A]	Phi1 [°]	Phi2 [°]	Phi3 [°]	OK
1	2026-08-20 13:16:54	P [W]	1724,945	39600,000	1,000	-0,007	0,001	230,000	230,001	230,000	5,000	5,000	5,000	59,997	60,000	59,998	✓
2	2026-08-20 13:18:31	P [W]	1034,991	25200,000	1,000	0,007	0,017	230,001	229,993	229,997	3,001	3,000	3,000	60,001	59,986	60,014	✓
3	2026-08-20 13:24:45	P [W]	4139,539	90000,000	1,000	-0,002	0,005	230,003	229,999	229,998	6,000	6,000	6,001	0,799	0,800	0,800	✓
4	2026-08-20 13:25:38	P [W]	4153,714	43200,000	1,000	-0,003	0,010	229,998	229,993	229,994	7,000	7,000	7,000	30,687	30,683	30,684	✓
5	2026-08-20 13:27:27	P [W]	689,978	18000,000	1,000	0,003	0,002	230,000	230,000	230,004	2,000	2,000	2,000	60,011	59,994	59,992	✓
6	2026-08-20 13:38:28	P [W]	2069,761	28800,000	1,000	0,010	0,017	230,002	230,000	230,001	3,000	3,000	3,000	0,799	0,801	0,801	✓
7	2026-08-20 13:40:15	P [W]	482,968	10800,000	0,500	-0,008	0,036	229,995	229,997	230,000	1,000	1,000	1,000	45,573	45,574	45,575	✓
8	2026-08-20 13:42:28	P [W]	344,992	10800,000	0,500	-0,018	0,029	229,994	229,996	229,994	1,000	1,000	1,000	60,000	59,998	60,001	✓
9	2026-08-20 13:44:24	P [W]	552,023	14400,000	0,500	-0,013	0,031	229,995	229,998	230,002	1,000	1,000	1,000	-36,870	-36,869	-36,869	✓
10	2026-08-20 13:45:56	P [W]	1897,531	43200,000	0,500	0,003	0,001	230,004	229,997	229,996	5,500	5,500	5,500	60,001	59,997	60,000	✓

TS PC-Soft, 1.5.2.2 2026-08-20 13:15:25 CALMET www.calmet.com.pl 1/2

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Channel 2

Admin

SN	36789
Customer	PAFAL
Site	CALMET, Kukulcza 18 street, 65-472 Zielona Gora, Poland, EU
Comment	Test of the PAFAL Reactive Power

Configuration

Type	Calmet TS33		
Firmware	1.7.8-RC2	PT	OFF
TS33 S/N	N160	CT	OFF
Input wiring	3P4W		
Power	P		
U	Generate	I	Generate
U	Direct	I	Direct

Settings

C	1000	imp/kvarh

Error test

No	Time	Power type	Test power	Test energy	Limit [%]	ε [%]	Se [%]	U1 [V]	U2 [V]	U3 [V]	I1 [A]	I2 [A]	I3 [A]	Phi1 [°]	Phi2 [°]	Phi3 [°]	OK
1	2026-08-20 13:16:54	P [W]	2987,840	64800,000	1,000	0,000	0,000	230,000	230,001	230,000	5,000	5,000	5,000	59,997	60,000	59,998	✓
2	2026-08-20 13:18:31	P [W]	1792,663	39600,000	1,000	-0,001	0,000	230,001	229,993	229,997	3,001	3,000	3,000	60,001	59,986	60,014	✓
3	2026-08-20 13:24:45	P [W]	57,780	3600,000	1,000	-0,390	0,107	230,003	229,999	229,998	6,000	6,000	6,001	0,799	0,800	0,800	✓
4	2026-08-20 13:25:38	P [W]	2464,680	25200,000	1,000	-0,013	0,010	229,998	229,993	229,994	7,000	7,000	7,000	30,683	30,683	30,684	✓
5	2026-08-20 13:27:27	P [W]	1194,953	25200,000	1,000	0,009	0,019	230,000	230,000	230,004	2,000	2,000	2,000	60,011	59,994	59,992	✓
6	2026-08-20 13:38:28	P [W]	28,913	3600,000	1,000	-0,370	0,106	230,002	230,000	230,001	3,000	3,000	3,000	0,799	0,801	0,801	✓
7	2026-08-20 13:40:15	P [W]	492,727	10800,000	0,500	-0,009	0,037	229,995	229,997	230,000	1,000	1,000	1,000	45,573	45,574	45,575	✓
8	2026-08-20 13:42:28	P [W]	597,538	14400,000	0,500	-0,016	0,034	229,994	229,996	229,994	1,000	1,000	1,000	60,000	59,998	60,001	✓
9	2026-08-20 13:44:24	P [W]	-413,977	10800,000	0,500	-0,013	0,035	229,995	229,998	230,002	1,000	1,000	1,000	-36,870	-36,869	-36,869	✓
10	2026-08-20 13:45:56	P [W]	3286,457	72000,000	0,500	-0,012	0,000	230,004	229,997	229,996	5,500	5,500	5,500	60,001	59,997	60,000	✓

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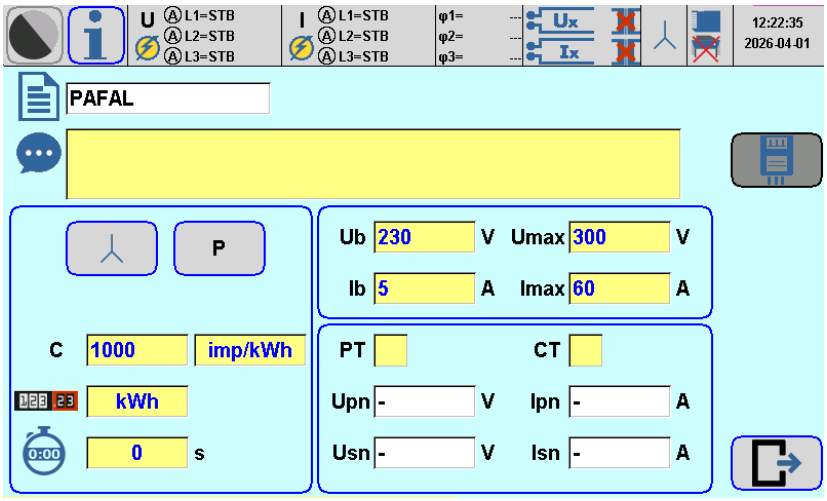
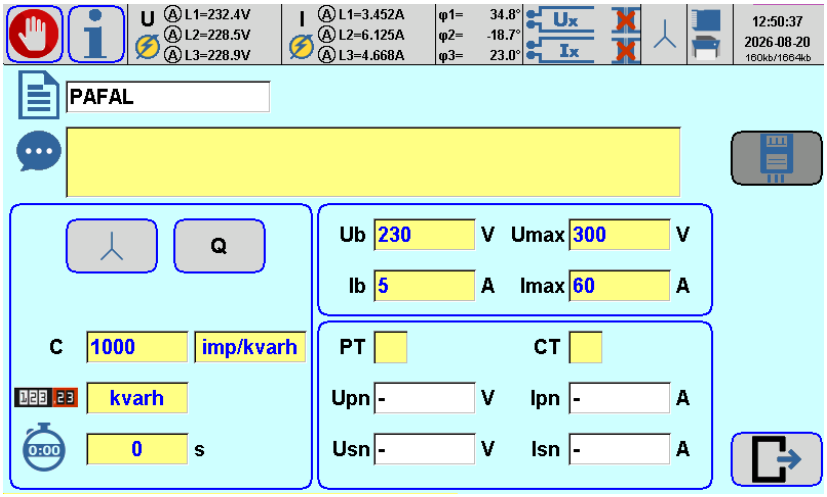
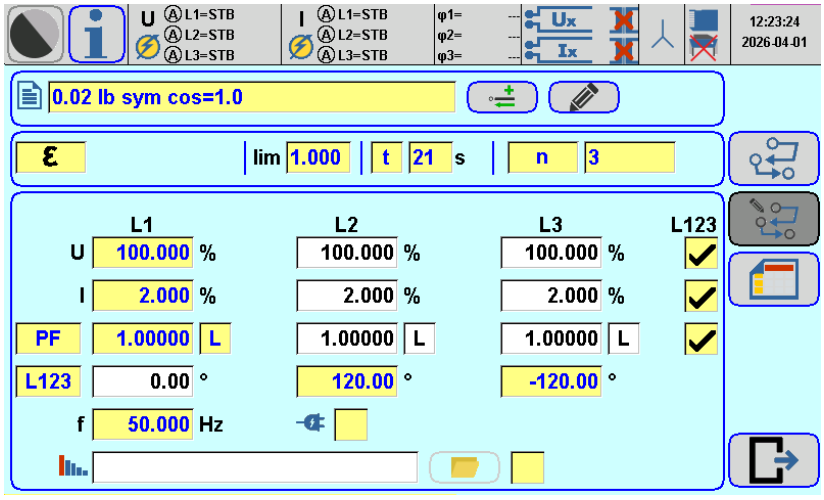
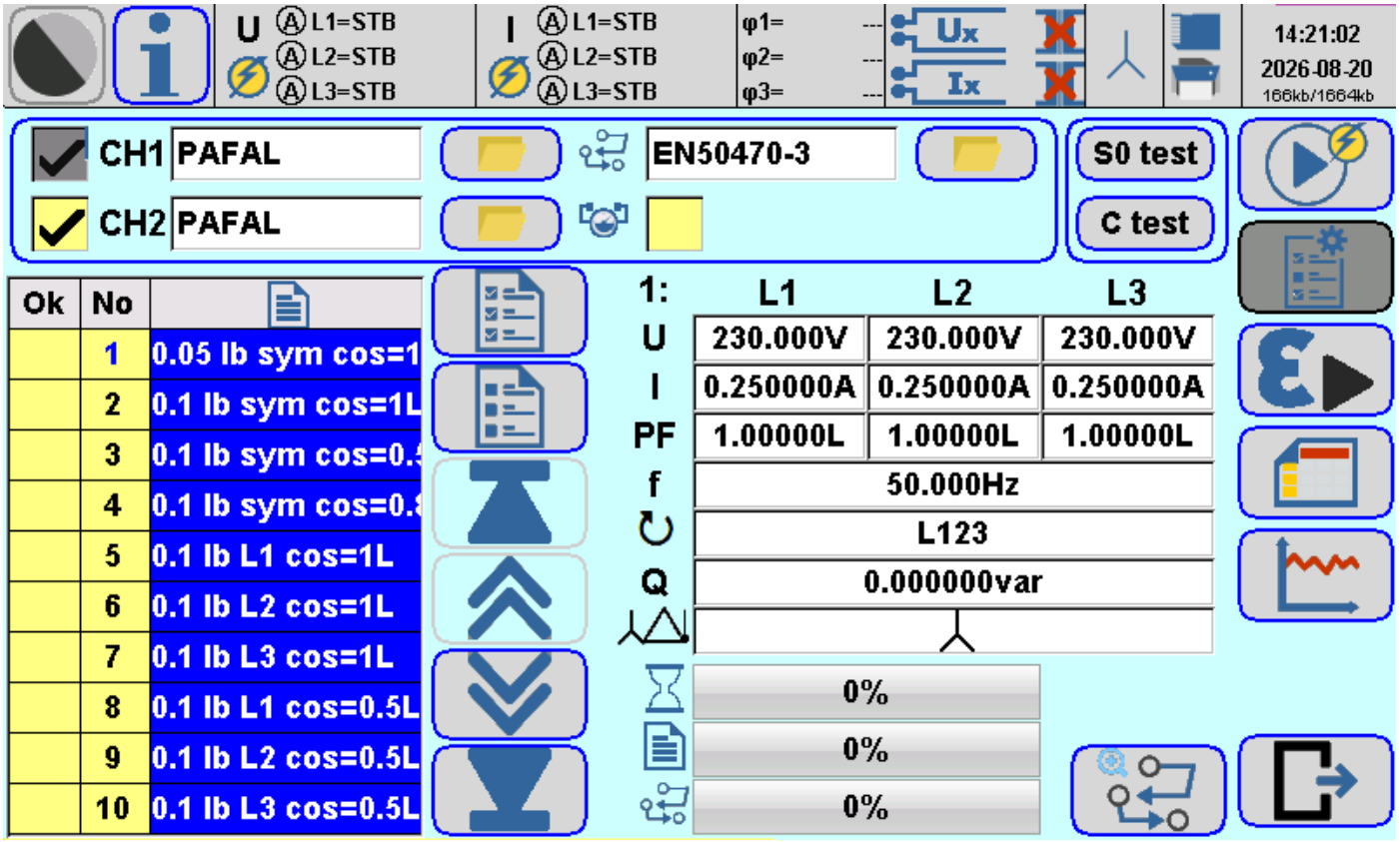




When the energy meter is disconnected from the grid (off-line mode), the TS33 changes from a reference meter to a fully automated test system. Using the integrated current and voltage source, the system can precisely set the test conditions and fully automate the verification of active and reactive energy of one meter. A key advantage is the possibility to define the **Meter Type** and **Test Procedure** in advance in TS PC-Soft or directly in the device menu. Once the test template is prepared, including specific load points, accuracy class and test duration, the test can be started quickly without configuring the system each time. As part of one test procedure, the system can automatically test both active and reactive energy and provide independent results for each type of energy.



In this mode, the TS33 automatically applies the required energy flow through the tested meter over the full range – from starting current, through rated load, up to maximum values and no-load tests. The system automatically moves between the different test points and records independent error results for active and reactive energy. For the user, this means high test repeatability and significant time savings. Simply start the **"Autotest"** function and, after the procedure is completed, receive complete test results for both types of energy.


U
Ⓐ L1=STB
Ⓐ L2=STB
Ⓐ L3=STB
I
Ⓐ L1=STB
Ⓐ L2=STB
Ⓐ L3=STB
φ1=
φ2=
φ3=
Ux
Ix
14:21:02
2026-08-20
166kb/1664kb
CH1 PAFAL
CH2 PAFAL
EN50470-3
S0 test
C test
Ok
No
1 0.05 lb sym cos=1
2 0.1 lb sym cos=1L
3 0.1 lb sym cos=0.5
4 0.1 lb sym cos=0.8
5 0.1 lb L1 cos=1L
6 0.1 lb L2 cos=1L
7 0.1 lb L3 cos=1L
8 0.1 lb L1 cos=0.5L
9 0.1 lb L2 cos=0.5L
10 0.1 lb L3 cos=0.5L
1:
L1
L2
L3
U
230.000V
230.000V
230.000V
I
0.250000A
0.250000A
0.250000A
PF
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f
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L123
Q
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0%
0%
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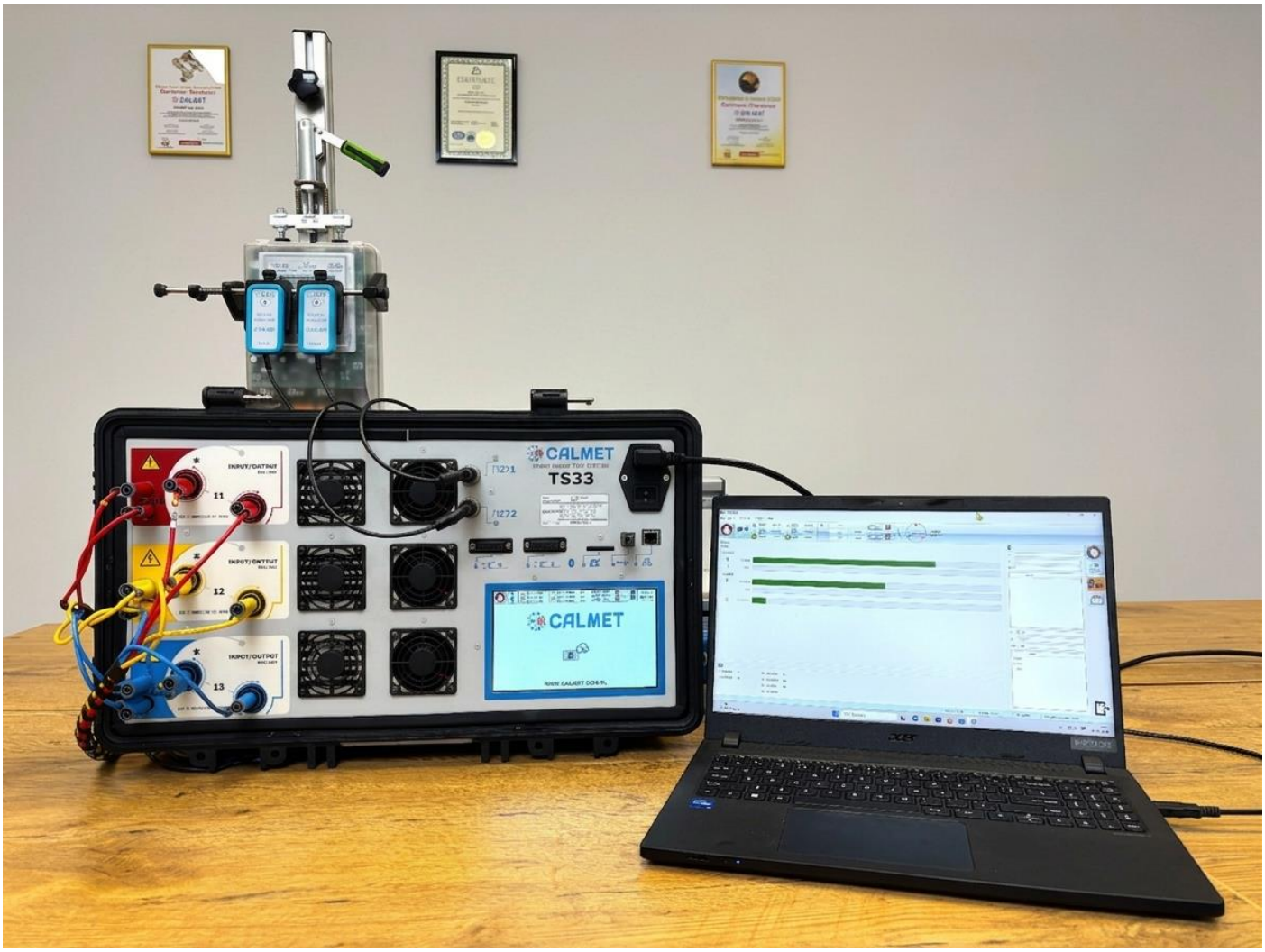
CALMET
TS33
CALMET

The introduction of simultaneous active and reactive energy testing in the **Calmet TS33** system meets the needs of engineers and technicians involved in energy meter verification. Testing both types of energy within a single test provides several important benefits:

- **Time saving:** Shorter test procedures by testing active and reactive energy at the same time.
- **Versatility:** Ability to test different types of energy in one meter, with independent parameter settings for each pulse channel.
- **Automation:** Reduced risk of operator errors through predefined test procedures and automatic report generation.
- **Comprehensive verification:** Ability to verify the meter accuracy for both active and reactive energy within one test procedure.
- **Flexibility:** The system can be used both for on-site testing and in a controlled laboratory environment.

With this new functionality, the **Calmet TS33** provides fast and comprehensive energy meter testing, allowing active and reactive energy to be verified simultaneously while maintaining high accuracy and full test automation.