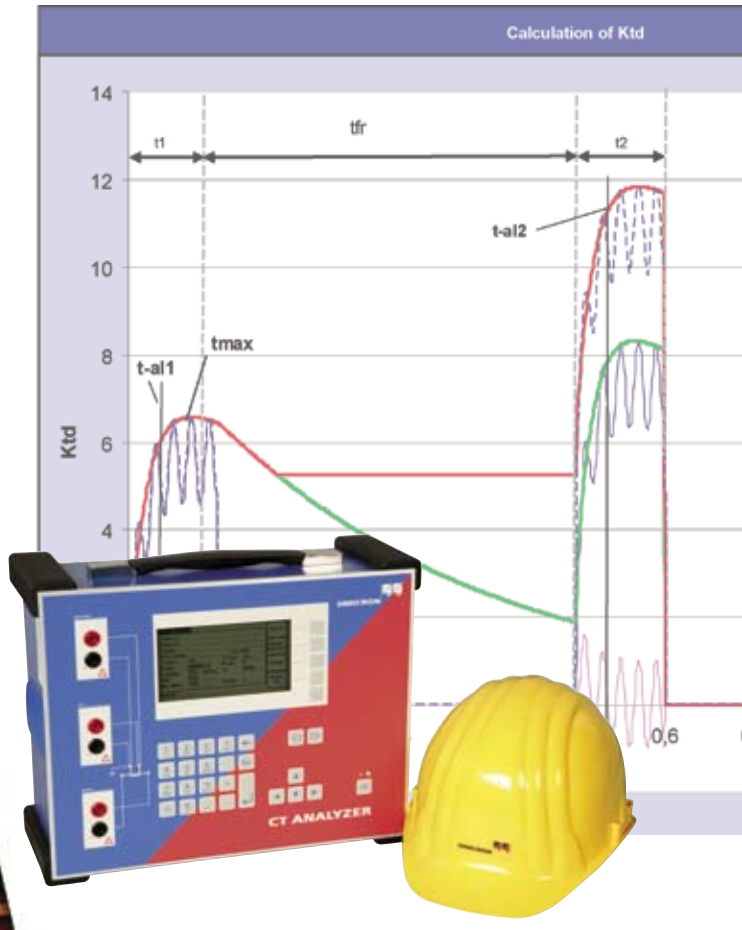
OMICRON

CT ANALYZER

The Revolution in Current Transformer Testing



The Unique Solution

OMICRON's CT Analyzer is a unique lightweight electronic multifunctional instrument designed to meet the highest standards for performing excitation, ratio, polarity and winding resistance tests on current transformers (CTs) as well as burden-impedance measurement.

The equipment provides automatic testing and calibration for all types of low leakage flux current transformers both on-site in the power system as well in the controlled environment of CT and switchgear manufacturers.

The CT Analyzer allows an automatic assessment of test results clearly indicating whether the parameters of the CT under test match its specification. It is the only known device able to test and assess CTs build according IEC60044-6 with defined transient performance (TPS, TPX, TPY and TPZ).

Because of the patented (EP 1 398 644 A1) low voltage test method it is possible to test CTs with a knee point voltage up to 15 kV without stressing the insulation of the CT (max. 120 V test voltage).

Testing of current transformers can be carried out to an extremely high level of accuracy. The accuracy level (0.02 % / 1 min.) makes the CT Analyzer the ideal tool for calibration and verification, not only for protection CTs but also for class 0.1 CTs for metering.

A wide range of measurement functionalities can be provided:

- Burden measurement
- CT Winding resistance measurement
- CT Excitation characteristic recording
- CT transient behavior measurement (IEC60044-6)
- CT ratio measurement with consideration of connected burden
- CT phase and polarity measurement
- Determination of accuracy limiting factor (ALF), instrument security factor (FS), secondary time constant (Ts), remanence factor (Kr), transient dimensioning factor (Ktd), knee point voltage/current, class, saturated and non saturated inductance
- Assessment according to defined standards: IEC60044-1, IEC60044-6, IEEE C57.13-1993

The extremely small and lightweight (< 8 kg / 17 lb) hardware is particularly beneficial for on-site testing.

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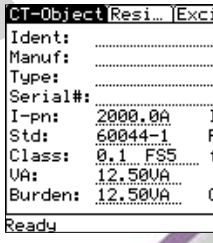
In the final step, the "CT-Object" card shows the measured values for rated primary and secondary current, the CT class and the CT designation; "M" for a measurement CT or "P" for a protection CT; VA (nominal burden), Burden (operating Burden) and CosPhi. All results are stored on the Compact Flash card and can be easily transferred to a PC.



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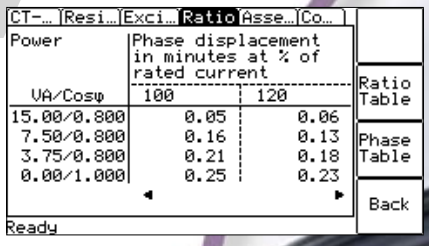
The "Phase Table" shows the phase error at nominal burden and at different currents and at 25 %, 50 % and 100 % of rated power.



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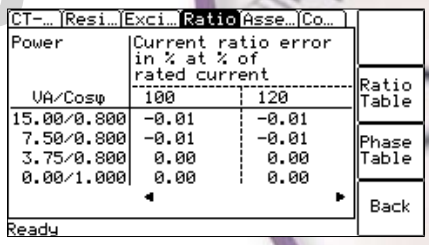
The "Ratio Table" shows ratio error at nominal burden and at different currents and at 25 %, 50 % and 100 % of the rated power.



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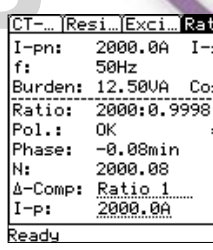
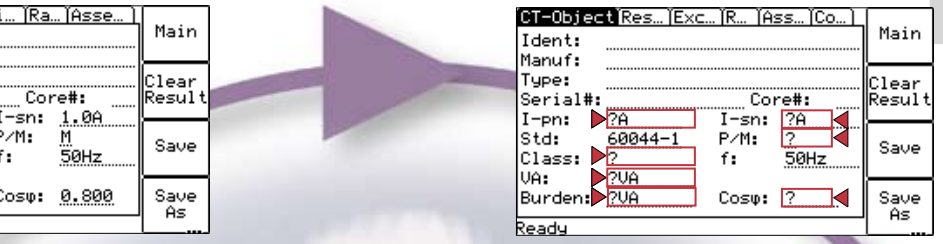
The ratio error, phase error and composite error for the operating burden can now be measured and displayed.



The results in seconds - even if the nominal CT data is unknown

The CT Analyzer performs an automatic parameter search and CT test - using the "Name plate guesser" function. For standard current transformers it allows the user to do a test with minimal training and no knowledge of the CT to be tested.

All that is needed is to follow these steps:



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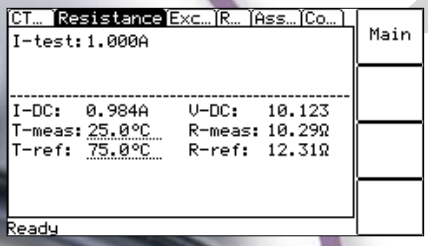
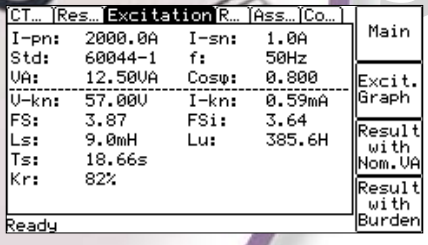
Connect the CT as indicated on the CT Analyzer front panel, activate the CT-object card on the user interface and start a CT test with default settings.

2



The device applies a 1A DC current to the secondary terminals of the CT and runs the fully automated test procedure - no settings are necessary. The Resistance Card displays the measured resistance (R ct).

3



The CT Analyzer measures the excitation curve and determines the knee point and other important CT data. Depending on the value of the knee point voltage the CT Analyzer identifies the test object as either a measurement CT or a protection CT and determines the nominal burden if not defined in the object page.

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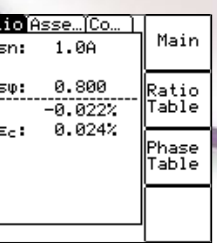
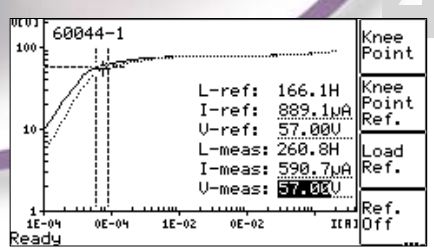
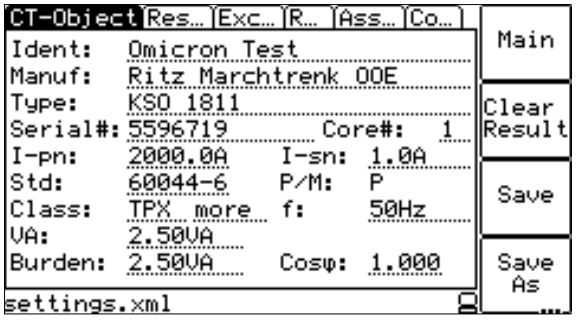


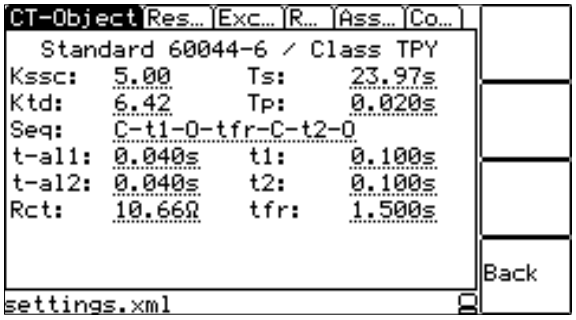


The excitation curve derived from the test is displayed on the unit. This curve can be compared with the result of a previous test loaded from a Compact Flash card.

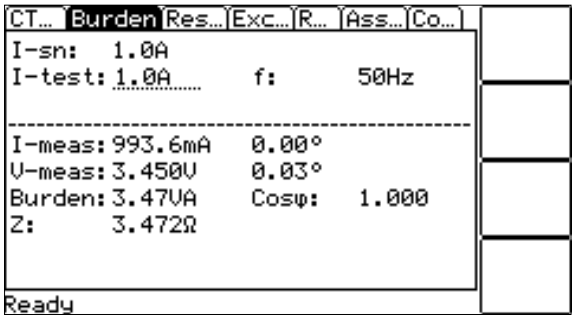
CT Analyzer Functionality



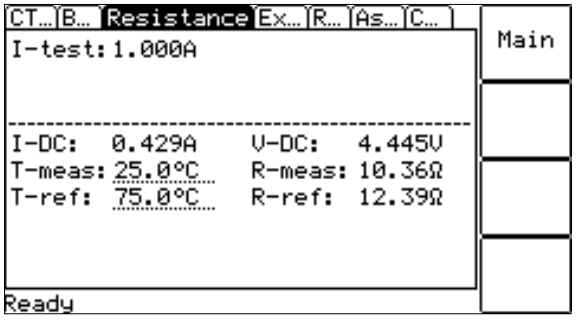
Completely edited CT-Object card



Extended CT-Object page



Results of the burden measurement



Results of the CT winding resistance measurement

CT-Object

The CT-Object card is the central element within the user interface which contains all of the necessary test settings for a CT test. Data is provided in the following fields:

- I-pn / I-sn: Rated primary / secondary current
- Std: Standard to which the test is to be performed
- P / M: CT type definition: protection or measurement
- Class / Freq: Class and rated frequency of CT
- VA: Rated burden
- Burden / cos φ: Operating burden and cos φ
- more: extended parameter page for IEC 60044-6 and IEC60044-1 class PX CTs

Extended Object Page

The extended object page is used to enter class dependent parameters for assessment or for the calculation of the transient behavior according IEC60044-6.

Following parameters can be found on this page:

- Kssc: rated symmetrical short circuit current factor
- Ktd: transient dimensioning factor
- Vkn: knee-point voltage according to IEC 60044-6
- Ikn: knee-point current according to IEC 60044-6
- Ts, Tp (secondary and primary time constant)
- Seq (duty of the protection)
- tal1, tal2, t1, t2, tfr (timing parameters for duty)
- Rct (expected winding resistance)
- Ek/Ual, Ie, Ial (accuracy limiting voltage and current)

Burden Test

The Burden Test Card allows the measurement of a current transformer's secondary burden by injecting AC current into the load (up to 5 A). The results of the burden test are shown on the display as follows:

- I-meas / V-meas: Current and voltage measured during the test
- Burden / cos φ / Z: Calculated values

Resistance Test

The CT winding resistance is needed for several calculations in the excitation and ratio test. During the test a DC current is applied to the CT until saturation is reached. The following results are shown on the Resistance card:

- I-DC / V-DC: Measurement current and voltage
- R-meas: Measured resistance
- R-ref: Temperature compensated resistance

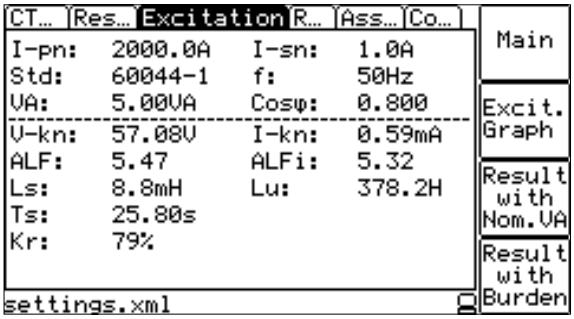
Excitation Test

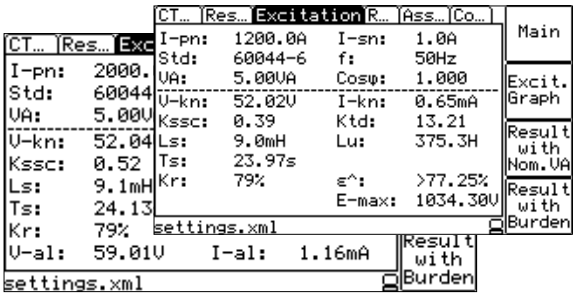
The Excitation test measures and displays the excitation curve of the current transformer and determines a wide range of other parameters of the CT using a current of up to 15 A peak. Parameters are calculated for nominal burden and operating burden.

According to the selected standard, terminal voltage, emf voltage, rms current or peak current is shown on the excitation graph.

Depending on the selected standard the corresponding results are:

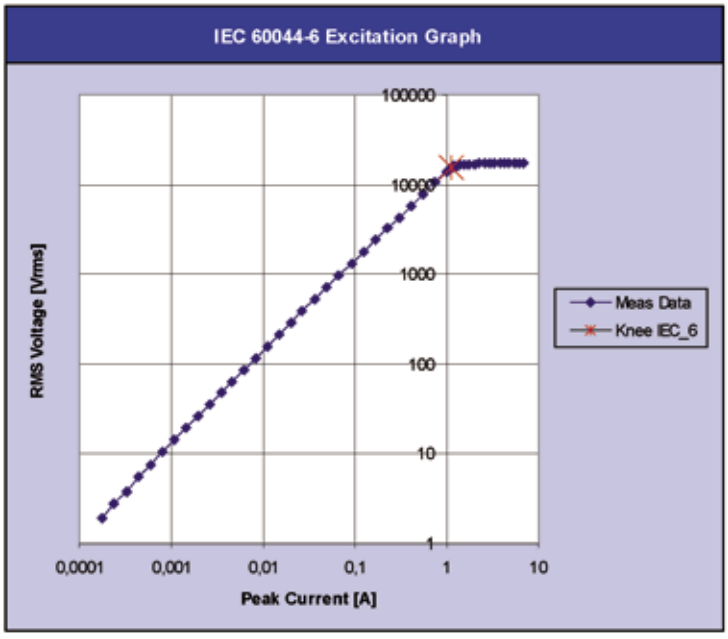
- V-kn / I-kn: Knee point voltage and current
- FS / ALF: Instrument Security Factor or Accuracy Limiting Factor according IEC60044-1 direct measurement method
- FSi / ALFi: Instrument Security Factor or Accuracy Limiting Factor according IEC60044-1 indirect measurement method
- Kssc, Ktd: Symmetrical short circuit current and transient dimensioning factor
- Ls / Lu: Saturated and non saturated inductivity
- Ts: Secondary time constant
- Kr: Remanence factor
- Val/Ial accuracy limiting voltage / current
- ε^ peak instantaneous error at Ipn * Kssc*Ktd
- E-max: Maximum e.m.f.



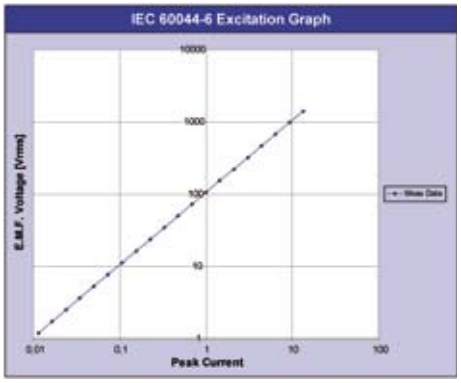


Excitation curve from 1 mV up to 17 kV

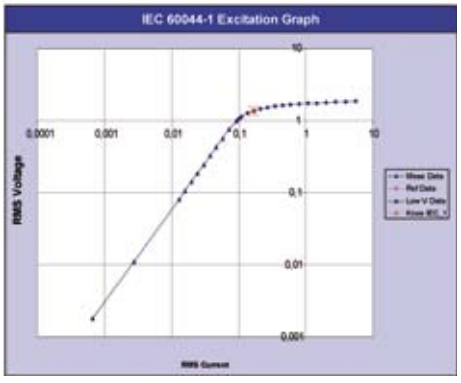
Test of CT's with a knee point voltage up to 15 kV. Only with our patented low frequency test principle it is possible to test such CTs without overstressing the insulation.



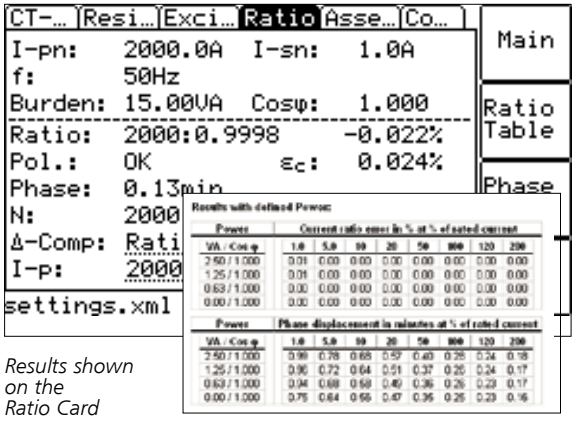
Excitation test up to 15 kV



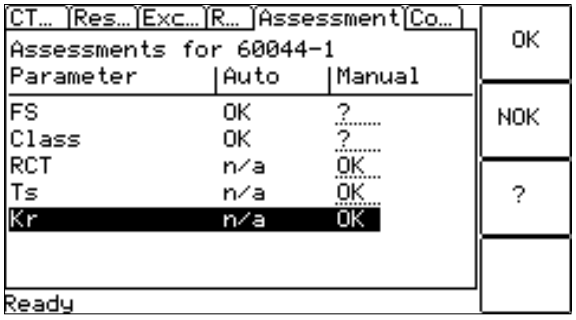
Excitation test up to 12.7 kVA on TPZ



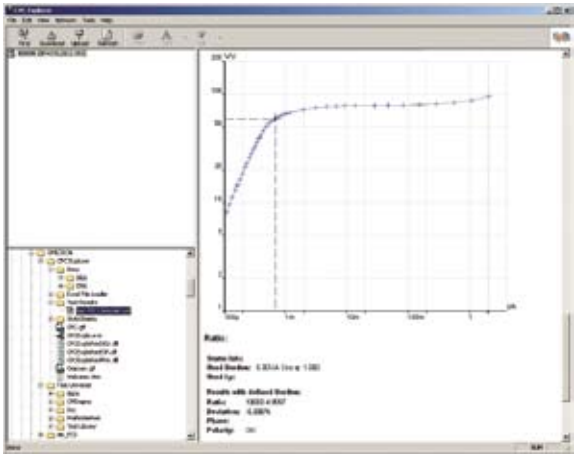
Excitation curve down to 1 mV



Results shown on the Ratio Card



Results shown on the Assessment Card



Abstract of the test report viewed within the CPC Explorer

Ratio Test

The ratio test measures the current ratio of the CT with consideration of the external burden or the rated power. No external burden is necessary, burden is part of modeling therefore a recalculation of current error with different burden is also possible after the test. The results from the ratio test are displayed on the screen in different cards:

- The Ratio card shows the polarity, the turns ratio error, composite error, current ratio error and the phase displacement dependent on primary current and operating burden (defined in the CT-Object card).
- The Ratio table shows the current ratio error dependent on current and the nominal burden
- The Phase table shows the phase displacement dependent on current and nominal burden.

After the measurement is completed, the Ratio card allows the burden and / or primary current (I-p) to be changed to allow the effect on the ratio and / or phase error to be observed. Possibility to compensate the ratio error of a CT used within a delta connected Transformer. All results that are visible on the screen will be stored automatically in the test result file

Assessment

The Assessment card shows the automatic and manual assessment of the CT as a result of the testing.

The automatic assessments are based on a comparison of the measured values to the requirements of the selected standard and the selected parameters on the CT-Object card. Additionally a manual assessment can be done.

Comprehensive Test Reports

All measured results can be saved as a standard XML file on a removable Compact Flash card. This card can be read by a Windows™ PC allowing the test report to be easily imported into Microsoft Office™ software for further processing (e.g. Microsoft Excel™, Microsoft Word™, Microsoft HTML).

The Compact Flash card can also be used for any future software updates that may be required for the *CT Analyzer*. This can be carried out by downloading the latest firmware updates from OMICRON's website and transferring it to the device.

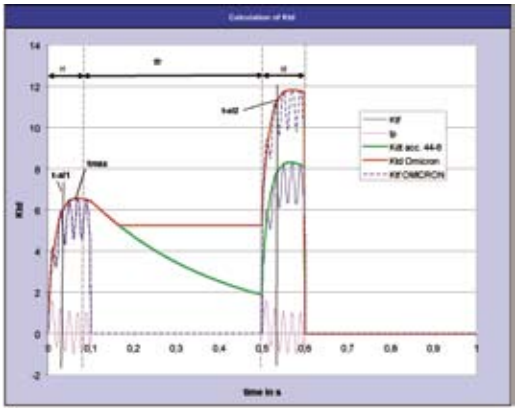
With the reomote control interface it's possible to fully control the device from PC and to up and download test reports to the CT Analyzer.

Support for IEC60044-6

CT-Analyzer is the only probably device available on the market that allows the test of CT's according IEC 60044-6.

The measurement is done according the standard (low frequency) and delivers all parameters that are relevant for the IEC60044-6 standard as Kssc, Ktd, εt, ε^, Vkn, Ikn under consideration of duty cycle and misc. time constants. After the test the device allows to assess if the CT fulfills the specified timing requirements or not.

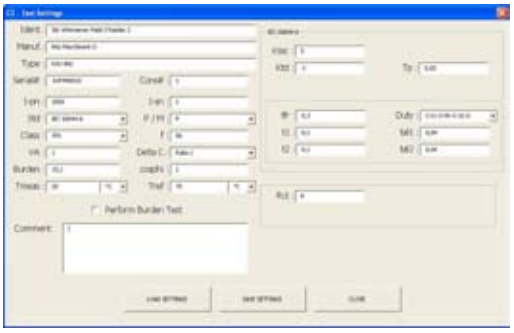
CT-Analyzer does all the calculation necessary to deliver the transient dimensioning factor.



Calculation of Ktd without remanence according IEC60044-6 and with remanence (Ktd OMICRON)

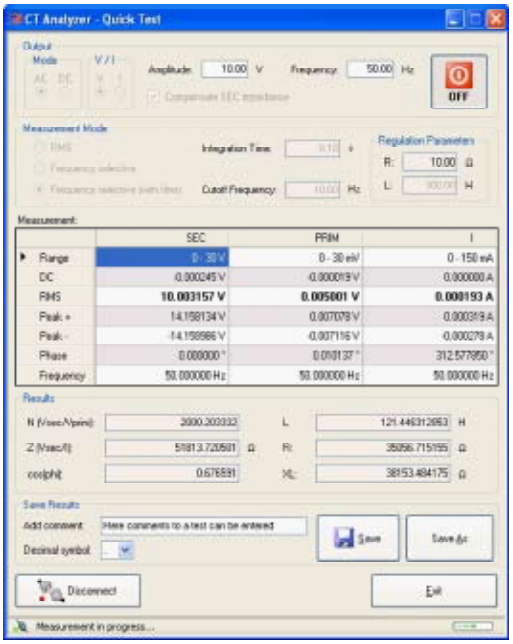
Remote control interface for full production integration

With the remote software it is possible to integrate the device in a fully automatic test environment or to write the own customer specific User Interface. Excel File Loader or Remote Excel File loader allows to import the XML output files from CT-Analyzer into Excel and to build customer specific test reports. For an easy start in working with the remote interface working samples are delivered with the device.



CTA QuickTest

The CTA Quick Test is a PC Tool to do a large variety of measurements usually necessary in a utility by using CT Analyzer as Multimeter with integrated current/voltage source (measurement of Burden, L, C, ratio, polarity, etc)



CT Analyzer Benefits

OMICRON´s CT Analyzer delivers a unique capability for the fast comprehensive testing and calibration of current transformers, for protection and metering engineers as well as CT and switchgear manufacturers.

Unique Features

- Very small and lightweight (< 8kg/17lb), particularly beneficial for on-site testing.
- First portable device that can test CTs build according IEC60044-6 with defined transient behaviour.
- Reduced commissioning time due to fully automatic testing according EC 60044-1, IEC 60044-6 and IEEE C57.13 within seconds.
- Save operation due to a maximum output voltage of 120 V.
- Automatic analysis of CTs with unknown data ("guesser" function patent pending).
- Test of CTs with very high knee point voltages (up to 15 kV)
- Precise measurement of ratio error and phase displacement up to x-times the rated current and for all burden values without the need to connect burden hardware, independent of the application (e.g. bushings and GIS).
- Automatic demagnetization of the CT after the test.
- Data storage on a removable Compact Flash (CF) card, which can be read by any standard memory card reader.

Calibration and Assessment

- Calibration of measuring transformers: A typical accuracy of 0.02 % / 1' enables field calibration and verification of class 0.1 CTs for metering.
- Assessment of protection transformers: Automatic result assessment according to the defined standard (IEC 60044-1, IEC 60044-6 or IEEE C57.13-1993) using implemented expert knowledge (regarding standards, etc.) even for CTs defined according to IEC 60044-6 with defined transient performance (TPS, TPX, TPY, TPZ).

Reporting

- Automatic test report generation. Viewing and printing of test reports on a PC using the CPC Explorer or Excel File Loader.

Advantage of Simulation

- Existing test reports can be loaded at any time to recalculate the test results for different burden values and primary currents. This way, no further on-site measurements are necessary to verify whether a changed burden influences the behavior of a CT. The recalculation of the test results can be easily performed in the laboratory using the existing measurement data either on the CT-Analyzer, within Excel File Loader or by using the remote control interface.

Remote Control and Test Automation

- Remote interface to integrate CT-Analyzer into an automatic production process. CT-Analyzer can fully be controlled over the remote interface. All parameters can be read from the device or from a test report with a simple to use software interface.
- Possibility to create user defined test reports using the Excel File Loader by adaptation of sample software running under visual basic or C++.
- The "CTA Quick Test" enables a large variety of measurements by using the CT Analyzer as Multimeter with integrated current/voltage source (e.g. measurement of Burden, L, C, ratio, polarity).

CT ANALYZER
The unique analyzing solution for current transformers.
[European Patent EP 1 398 644 A1]

Measurement of CT parameters

General

- Ls (saturated inductance)
- Lu (unsaturated inductance)
- Kr (remanence flux)
- Ts (secondary time constant)
- Rct (winding resistance)
- current ratio error and phase error for all measurement points defined in the standard
- Ratio up to 50 000 : 1
- Primary current up to 999 000 A

IEC 60044-1

- ALF/ALFI (accuracy limiting factor according direct / indirect measurement method)
- FS/FSI (instrument security factor according direct / indirect measurement methode)
- Kx (dimensioning factor according to class PX)
- Ek / Ie (accuracy limiting voltage/current according to class PX)
- N (turns ratio according to class PX)
- εt , εc (turns ratio and composite error)
- Vkn / Ikn (knee-point voltage/current according to IEC 60044-1)

IEC 60044-6

- Kssc (rated symmetrical short-circuit current factor)
- Ktd (transient dimensioning factor)
- N (turns ratio according to class TPS)
- εt (turns ratio error according to class TPS)
- ε^ (peak instantaneous error)
- Emax (maximum emf voltage incl. the transient component)
- Vkn / Ikn (knee-point voltage/current according to IEC 60044-6)

IEEE C57.13 (ANSI)

- Vb (secondary terminal voltage rating according to IEEE C57.13)
- Vkn / Ikn (knee-point voltage/current according to IEEE C57.13 (30° and 45° tangent))

Technical Data

OMICRON's CT Analyzer hardware includes:

- Galvanically insulated electronic generator output
- Two galvanically insulated voltage measurement inputs
- Internal current measurement
- Compact flash card to store test results and update the device software

The CT Analyzer conforms to CE and fulfills the requirements of IEC in terms of EMC and safety standards.

Hardware Specifications

Generator / amplifier section

Output current	0 ... 5 A rms (15 A peak)
Output voltage	0 ... 120 V
Output power	0 ... 400 VA (1500 VA peak)

Ratio accuracy

For 0 VA up to rated power

ratio 1 ... 2000	0.02 %
ratio 2000 ... 5000	0.03 %
ratio 5000 ... 10000	0.05 %

Phase measurement

Resolution	0.1 min
Accuracy	1 min (for cos φ 0.8 ... 1)

User interface

Display readable in bright sunlight.

Numerical keyboard and function keys for operation.

Data transfer

Compact flash card to store test results and for transfer of data to a PC. Data can be read with a standard PC and the CPC explorer. Remote interface toe read/write data from PC and to fully control the device with the PC.

Standards

Safety	EN60950 and EN61010

Calibration

It is possible to buy a calibration CT certified from a national test institute with a ratio accuracy of 0.02 %. With this calibration CT a permanent check of the CT-Analyzer accuracy is possible. The device must not be sent back for calibration, only the calibration CT.

Mechanical Data

Weight	8 kg / 17.4 lb (without accessories)
Dimensions (W x H x D)	360 x 285 x 145 mm / 9.2 x 7.2 x 3.7 in.

Supply voltage

Nominal voltage	110 V – 240 V ±10 % 50 / 60 Hz (500 VA)
Permissible range	85 V – 265 V
Ambient temperature	-10 … 50 °C / 14 ... 122 °F

Ordering Information

CT Analyzer CT1 incl. accessories	**VE000652**
CT Analyzer standard package	VE000650
Accessories set for CT Analyzer	VEHK0650

CT Analyzer standard package	**VE000650**
CT Analyzer hardware	VEGG0650
Compact Flash card 128 MB (memory space for at least 416 test reports)	VEHZ0653
USB 2.0 Compact Flash card reader	VEHZ0655
USB - RS232 Converter and Cable	VEHZ0014
RS232 Nullmodem Cable 3m	VEHK0032
Power cord (country-dependent)	
User Manual	VESD0605
CT Analyzer PC Toolset software for CT Analyzer with remote control software, CTA Quick Test, CT Excel File Loader and other tools.	VESM0800
CPC Explorer software, PC software for visualization and handling of test reports	VESD6004

Accessories set for the CT Analyzer
VEHK0650

Coax measurement cable set with banana plugs, 2 x 3 m, 1 x 10 m	VEHK0651
Battery clamp set with 4mm banana sockets for primary side connection, consisting of one red and one black battery clamp	VEHZ0652
Crocodile clamp set (2 x red, 2 x black), 20 mm opening width	VEHZ0656
Grounding (PE) cable (gn/ye), 1 x 6 m, 6 mm^2, used for protective earth connection	VEHK0615
Flexible terminal adapters with 4 mm banana socket (6 x)	none
Carry bag for the CT Analyzer	VEHP0018

Additional Accessories for CT Analyzer

Coax measurement cable with banana plugs, 3 m	VEHK0654
Coax measurement cable with banana plugs, 6 m	VEHK0652
Coax measurement cable with banana plugs, 10 m	VEHK0653
Coax measurement cable with banana plugs, 15 m	VEHK0655
Coax measurement cable with banana plugs, 100 m	E0521400
Crocodile clamp for secondary side connection with 4 mm banana socket (1 black and 1 red clamp)	VEHZ0651
Transport case for the CT Analyzer with wheels	VEHP0068
Calibration CT, 2000:1 / 2000:5, class 0.02	VEHZ0649
CT Analyzer Add-On Manual	VESD0607

OMICRON is an international company providing innovative power system testing solutions. With sales in more than 120 countries, offices in Europe, the North America, and Asia, and a worldwide network of sales partners, OMICRON has established a reputation as a supplier of leading edge technology.

OMICRON's automated primary and secondary testing capabilities are important benefits in light of the changing market conditions resulting in restructured organizations required to "do more with less". Services in the area of consulting, commissioning, testing, and training make the product range complete.

Specialization and visionary leadership allows OMICRON to continue with revolutionizing developments for its solutions to meet the customer needs of the 21st century.

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