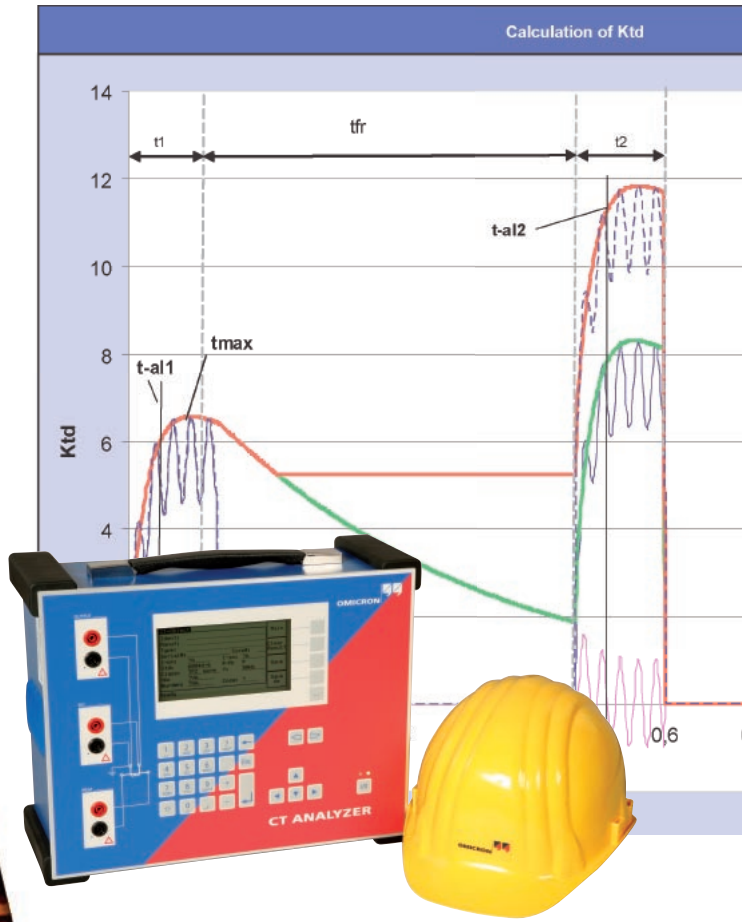
OMICRON

CT ANALYZER

The Revolution in Current Transformer Testing





The Unique Solution

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.

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.

A wide range of measurement functions can be provided:

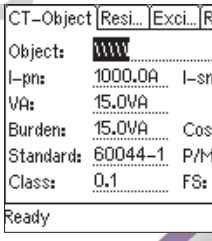
- Burden measurement
- CT Winding resistance measurement
- CT Excitation characteristic recording
- CT transient behavior measurement (IEC 60044-6)
- CT ratio measurement with consideration of nominal and connected burden
- CT phase and polarity measurement
- Determination of accuracy limiting factor (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: IEC 60044-1, IEC 60044-6, IEEE C57.13-1993

Unique Features & Benefits

- Extremely small and lightweight (< 8 kg / 17 lb), particularly beneficial for on-site testing.
- Reduced commissioning time due to fully automatic testing according to IEC 60044-1, IEC 60044-6 and IEEE C57.13. Results within seconds.
- First portable device that can test CTs built according to IEC 60044-6 with defined transient behavior.
- Calibration of measuring transformers: A typical accuracy of 0.02 % / 1' enables field calibration and verification of class 0.1 CTs for metering.
- Automated assessment according to the defined standards (IEC 60044-1, IEC 60044-6 or IEEE C57.13-1993) also of specialized CTs such as PX, TPS, TPX,TPY and TPZ
- Allows testing of CTs for power frequencies from 16 to 400 Hz.
- "Name plate guesser" function allows automatic parameter search and analysis of CTs with unknown data (European Patent EP1 653 238 B1).
- High level of safety - all tests use low voltages (120 V) (European Patent EP 1 398 644 B1).
- 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).
- Test of CTs with very high knee point voltages (up to 30kV)
- Automatic demagnetization of the CT after the test.

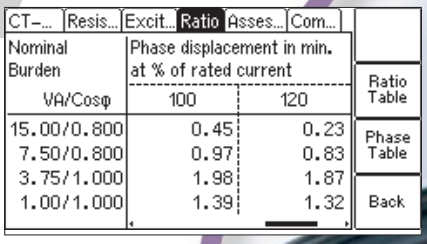
8

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.



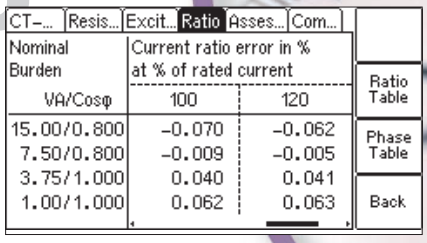
7

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



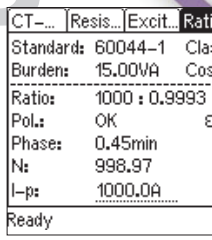
6

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



5

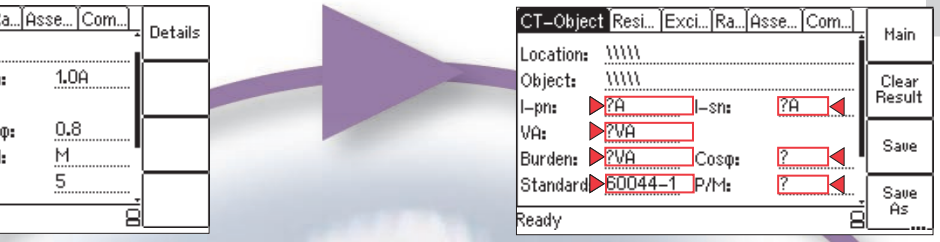
The ratio error, phase error and composite error for the operating burden can now be measured and displayed.



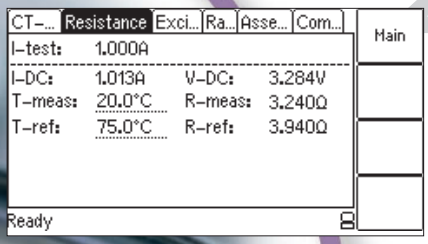
The results in seconds - even if the nominal CT data is unknown

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.

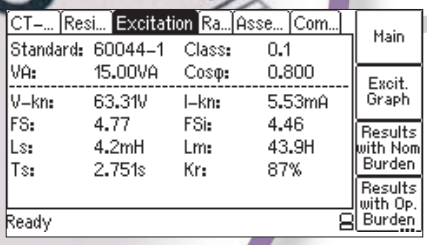
All that is needed is to follow these steps:



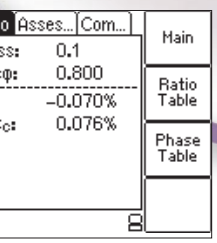
1 *Connect the CT as indicated on the CT Analyzer front panel, go to the CT-object card on the user interface and start a CT test with default settings. A fully automated test procedure will be started while no settings or rewiring is necessary.*

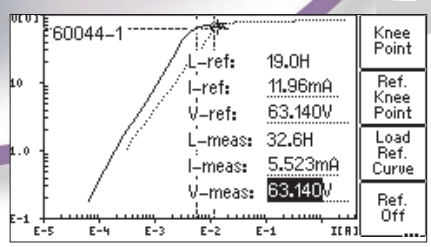


2 *First the device applies a 1 A DC current to the secondary terminals of the CT and measures the winding resistance. The Resistance Card displays the measured resistance (R ct).*



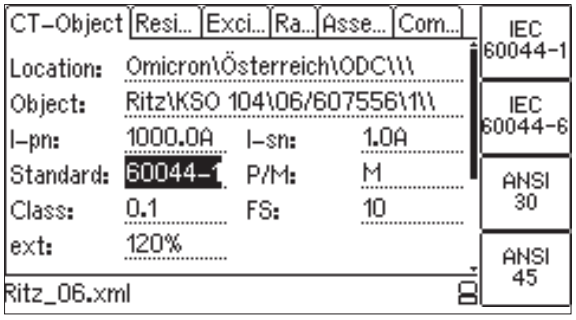
3 *The excitation curve is measured and the knee point voltage and other important CT data are determined. Depending on the value of the knee point voltage the CT Analyzer identifies the test object as either a measurement CT or a protection CT and determines the nominal burden if not defined in the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



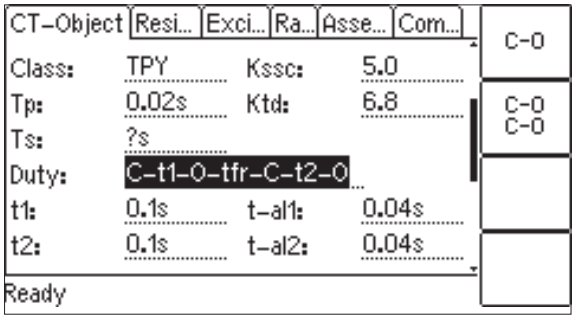


4 *The excitation curve derived from the test is displayed on the unit. This curve can be compared with the result of a previous test loaded from a Compact Flash card.*

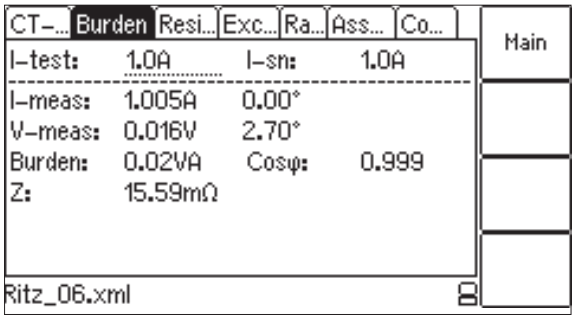
CT Analyzer Functionality



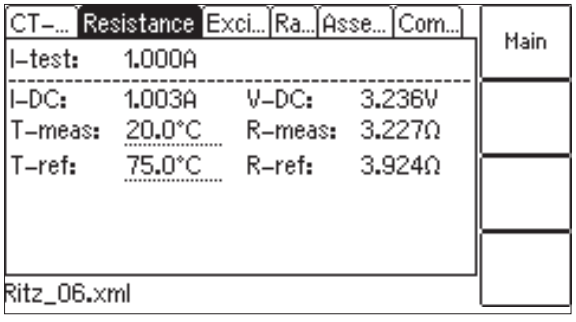
Completely edited CT-Object card



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.

Settings on this page:
- I-pn / I-sn: Rated primary / secondary current
- Standard: Standard to which the test is to be performed
- P / M: CT type definition: protection or measurement
- Class / f: 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 IEC 60044-1 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 IEC 60044-6.

Settings on this page:
- Kssc: rated symmetrical short circuit current factor
- Ktd: transient dimensioning factor
- 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, Ie, E1, Ie1, Ual, 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

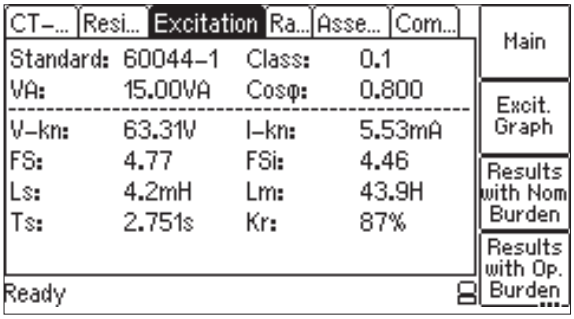
Excitation Test

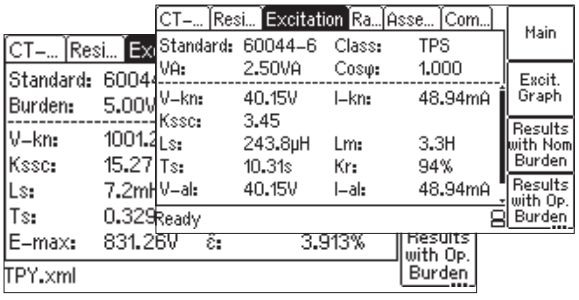
The Excitation test measures and displays the excitation curve of the current transformer and determines a wide range of other parameters of the CT.

According to the selected standard, terminal voltage, emf voltage, rms current or peak current is shown on the excitation graph. Parameters are calculated for nominal burden and operating burden.

Depending on the selected standard the corresponding results are:

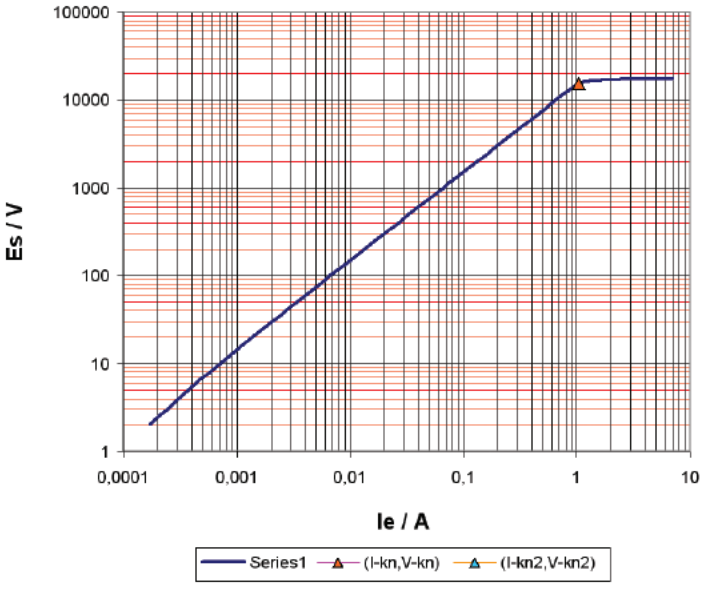
- V-kn / I-kn: Knee point voltage and current
- FS / ALF: Instrument Security Factor or Accuracy Limiting Factor according to IEC 60044-1 direct measurement method
- FSi / ALFi: Instrument Security Factor or Accuracy Limiting Factor according to IEC 60044-1 indirect measurement method
- Kssc, Ktd: Symmetrical 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.



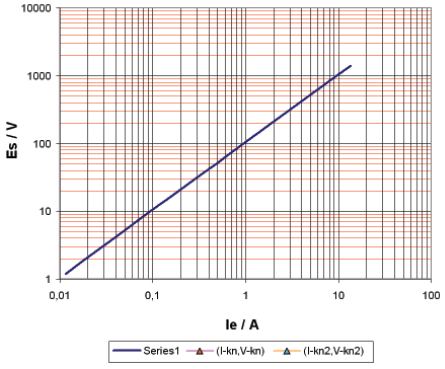


Excitation curve from 1 mV up to 30 kV

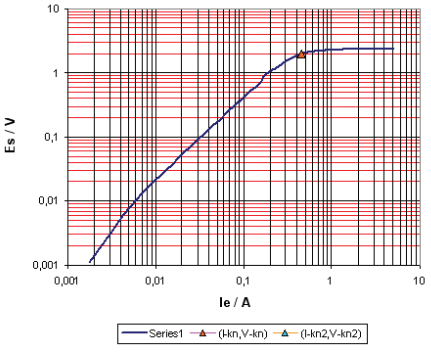
Test of CTs with a knee point voltage up to 30 kV. Only with our patented low frequency test principle it is possible to test such CTs without overstressing the insulation.



Excitation test example for 17 kV

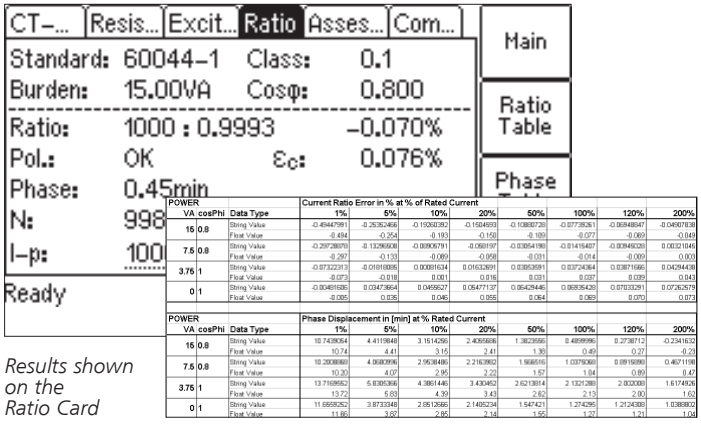


Excitation test up to 12.7 kVA on TPZ

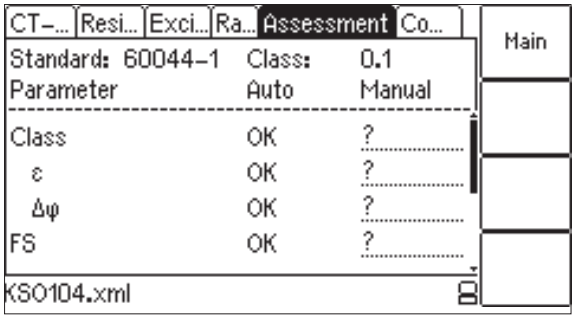


Excitation curve down to 1 mV

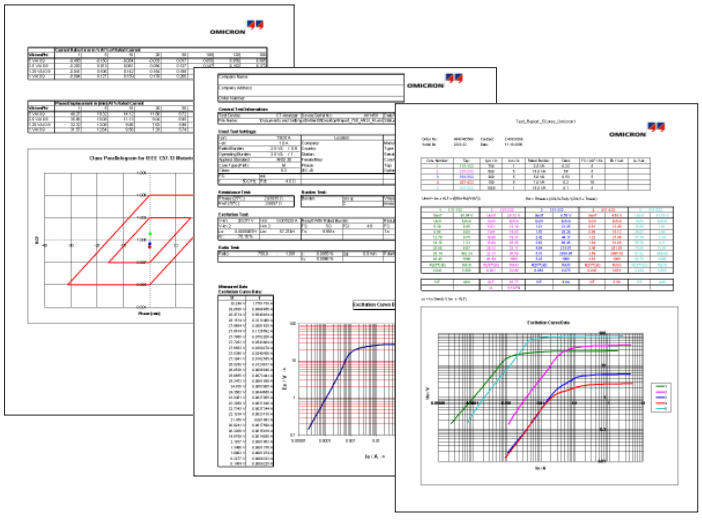
CT Analyzer Functionality (continued)



Results shown on the Ratio Card



Results shown on the Assessment Card



Report templates included in the Remote Excel File Loader

Ratio Test

The ratio test measures the current ratio of the CT with consideration of the nominal and operating burden. No external burden is necessary, burden is part of modeling therefore a recalculation of current ratio 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 and Phase table shows the ratio and phase error for all different values of primary current and burden variations that are defined in the standards.

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.

Adaptable Reporting Templates

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).

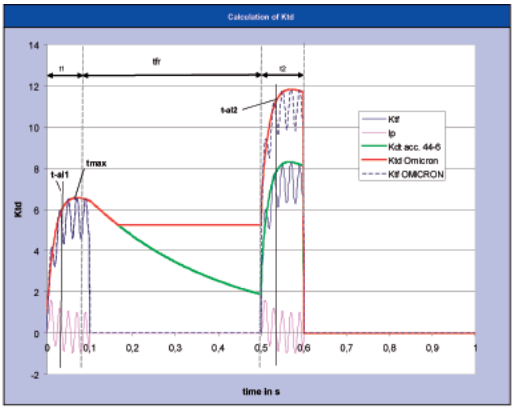
The included Microsoft Excel™ templates offer different reports (e.g. for single core cts, multicore cts, 3 phase test) and can be modified by the customer.
They also give comprehensive viewing and printing options of test reports for different applications, standards and classes. Via the templates the user interface and report language can be changed "on the fly", i.e. it is easy to test in one language and print in another language.

Support for IEC 60044-6

CT Analyzer is the first known portable device available on the market that allows the test of CTs according to IEC 60044-6.

The measurement is done according to the IEC 60044-6 standard (low frequency) and delivers all relevant results such as Kssc, Ktd, εt, ε^, Vkn, Ikn. After the test the timing parameter can be changed in order to check the effect on the results. CT Analyzer automatically carries out all necessary calculations which deliver the transient dimensioning factor.

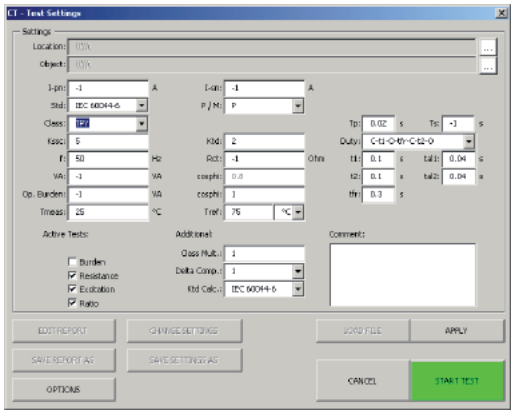
$$K_{td} = \left\{ \left[\frac{\omega T_p T_s}{(T_p - T_s)} \right] \left[e^{\frac{-t'}{T_p}} - e^{\frac{-t'_{alt}}{T_s}} \right] - \sin \omega t' \right\} e^{\frac{-(t_p + t''_{alt})}{T_s}} + \left[\frac{\omega T_p T_s}{(T_p - T_s)} \right] \left[e^{\frac{-t''_{alt}}{T_p}} - e^{\frac{-t''_{alt}}{T_s}} \right] + 1$$



Automated calculation of Ktd without remanence according to IEC 60044-6 and with remanence (Ktd OMICRON)

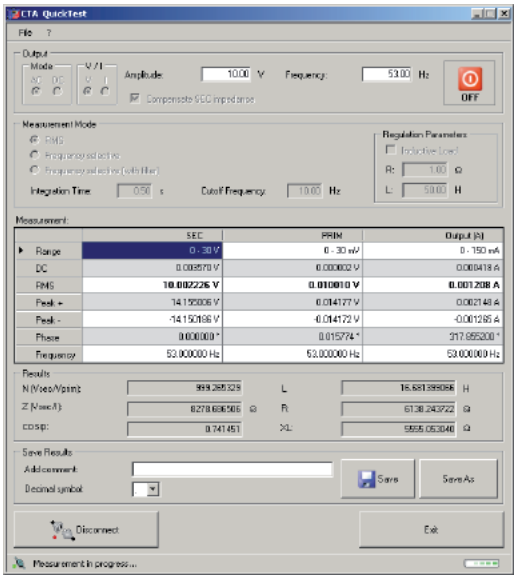
Remote control interface for full production integration

With the remote software it is possible to integrate the device in a fully automated test environment or to write your own customer-specific user interface. With the Remote Excel File Loader the device can be completely controlled via PC.
A test can be defined, started and the results can be imported back into Excel. As all test results are available in Excel it is quite easy to write customer-specific test reports. For an easy start with the remote interface, some working samples are delivered with the device.



CTA QuickTest

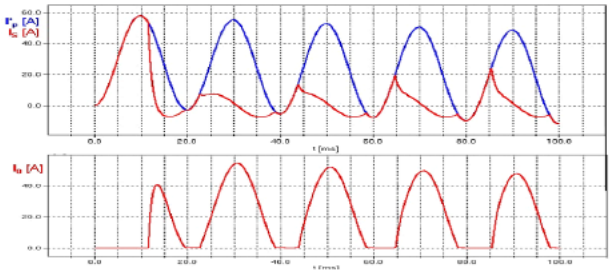
The CTA Quick Test is a PC Tool that does a large variety of measurements which are usually necessary in a utility by using CT Analyzer as Multimeter with integrated current/ voltage source (measurement of Burden, L, C, ratio, polarity, etc).



CT Analyzer Functionality (continued)

Netsim Support

The CTA to NETSIM export Tool allows to import the CT data from a CT Analyzer test report into the Test Universe network simulation software NetSim to use the measured data for network simulation.



Network simulation software NetSim

Calibration

A typical accuracy of 0.02 % / 1' enables field calibration and verification of class 0.1 CTs for metering.

Assessment

Automatic result assessment according to the defined standards (IEC 60044-1, IEC 60044-6 or IEEE C57.13-1993) using implemented expert knowledge also of specialized CTs such as PX, TPS, TPX,TPY and TPZ.

Reporting

Comprehensive viewing and printing of test reports on a PC for different applications, standards and classes using the predefined Microsoft Excel™ templates.

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 back in the office using the existing measurement data.

Remote Control and Test Automation

Remote interface to integrate CT Analyzer into an automatic production process. CT Analyzer can be fully 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 Remote Excel File Loader or 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 1 653 238 B1]

Measurement of CT parameters

General

- Ls (saturated inductance)
- Lm (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 to direct / indirect measurement method)
- FS / FSI (instrument security factor according to direct / indirect measurement method)
- 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)
- $E_{max} = K_{td_meas} \bullet K_{ssc} \bullet \left(I_{sn} \bullet \sqrt{(R_{CT} + R_b)^2 + X_b^{\,2}} \right)$

  (= maximum emf voltage)
- 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 on a standard PC with the delivered software. Remote interface to 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 (VEHZ20649) 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	
Compact Flash card 128 MB (memory space for at least 416 test reports)	VEHZ0654
USB 2.0 Compact Flash card reader	VEHZ0655
USB - RS232 converter cable with Nullmodem cable	VEHZ0014
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 4 mm 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) - (reorder in sets of 12)	VEHS0009
Carry bag for the CT Analyzer	VEHP0018

Additional Accessories for CT Analyzer	
Coax measurement cable set with banana plugs, 2 x 3 m, 1 x 10 m	VEHK0651
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, 100m	VEHK0656
Coax measurement cable set with Kelvin clamps, 3 m (for measurement on 5 A CTs during production)	VEHK0657
Pluggable 23 turns winding	VEHK0658
Battery clamp set with 4 mm banana sockets for primary side connection, consisting of one red and one black battery clamp	VEHZ0652
Crocodile clamp for secondary side connection with 4 mm banana socket (1 black and 1 red clamp)	VEHZ0651
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	VEHS0009
Compact Flash card 32 MB (memory space for at least 100 test reports)	VEHZ0653
Compact Flash card 128 MB (memory space for at least 416 test reports)	VEHZ0654
USB 2.0 Compact Flash card reader	VEHZ0655
USB - RS232 converter cable with Nullmodem cable	VEHZ0014
Training CT, 300:5, class 0.5 FS 5	VEHZ0643
Calibration CT, 2000:1 / 2000:5, class 0.02 (for CT-Analyzer calibration)	VEHZ0649
Transport case for the CT Analyzer with wheels	VEHP0068
Carry bag for the CT Analyzer	VEHP0018
CT Analyzer Add-On Manual (provides theoretical backgrounds and normative definitions) (only available in English)	VESD0607

OMICRON electronics is an international company that develops, manufactures and markets innovative systems for the advanced testing of primary and secondary substation equipment, including protection systems and power transformers.
By combining innovation, leading edge technology and creative software solutions OMICRON is a leader in these markets. With sales in 130 countries, offices in Europe, North America, Asia and Australasia, and a worldwide network of distributors and representatives, OMICRON has truly established a reputation as a supplier of the highest quality.



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