CT Analyzer

User Manual

Article Number: VESD0605 - Manual Version: CTAnalyzerUM.AE.3

Contents

Preface

Using This Manual

This User Manual provides information on how to use the *CT Analyzer*. The CT Analyzer User Manual contains important safety instructions for working with the *CT Analyzer* and gets you familiar with operating the *CT Analyzer*. Read and observe the safety rules described in "Safety Rules" on page 9 and all relevant installation and operation instructions. Following the instructions in this User Manual will help you to prevent danger, repair costs, and avoid possible down time due to incorrect operation.

The CT Analyzer User Manual always has to be available at the site where the *CT Analyzer* is used. It must be read and observed by all users of the *CT Analyzer*. Reading the CT Analyzer User Manual alone does not release you from the duty to comply with all relevant national and international safety regulations.

Operator Qualifications and Safety Standards

Working on high-voltage power equipment can be extremely dangerous.

Testing with the *CT Analyzer* should only be carried out by authorized and qualified personnel. Before starting to work, clearly establish the responsibilities.

Personnel receiving training, instruction, direction, or education on the *CT Analyzer* should remain under the constant supervision of an experienced operator while working with the equipment.

Testing with the *CT Analyzer* must comply with the internal safety instructions as well as additional relevant documents.

In addition, observe the following safety standards, if applicable:

- EN 50191 (VDE 0104) "Erection and Operation of Electrical Equipment"
- EN 50110-1 (VDE 0105 Part 100) "Operation of Electrical Installations"
- IEEE 510 "IEEE Recommended Practices for Safety in High-Voltage and High-Power Testing"

Conventions and Symbols Used

In this manual, the following symbols indicate paragraphs with special safety relevant meaning:

Symbol	Description
	**Caution:** Equipment damage or loss of data possible
	**Warning:** Risk of electric shock! Personal injury or severe damage to objects possible

Related Documents

The following documents complete the information covered in the CT Analyzer User Manual:

Title	Description
CT SB2 User Manual	Contains information how to use and operate the optional *CT SB2* switch box for multi-ratio CT measurement with the *CT Analyzer* as well as safety instructions for working with the *CT SB2*.
Help System for *CT Analyzer PC Toolset*	Contains detailed information about the software tools provided with the *CT Analyzer PC Toolset*.

Safety Rules

Before operating the *CT Analyzer*, read the instructions in this section carefully. If you do not understand some safety rules, contact OMICRON before proceeding. When working with the *CT Analyzer*, observe the following safety rules.

Maintenance and repair is only permitted by qualified experts at OMICRON repair centers.

General Rules for Safe Operation

- Always observe the five safety rules:
  - Disconnect completely
  - Secure from reconnection
  - Verify that the installation is dead
  - Carry out grounding and short-circuiting
  - Provide protection against adjacent live parts
- Do not touch any terminals without a visible connection to ground.
- Always be aware of the danger of the high voltages and currents associated with this equipment. Pay attention to the information provided in this user manual.
- Use the *CT Analyzer* and its accessories only in a technically sound condition and when its use is in accordance with the safety regulations for the specific job site and application.
- Use only original accessories available from OMICRON.
- If the *CT Analyzer* or any add-on device or accessory seems to be functioning improperly, please call the OMICRON Hotline (refer to chapter "OMICRON Service Centers" on page 185).
- Do not operate the *CT Analyzer* when explosive gas or vapors are present.
- Do not operate the *CT Analyzer* under wet or moist conditions (condensation).
- Do not open the *CT Analyzer*. Opening the *CT Analyzer* invalidates all warranty claims. Do not repair, modify, extend, or adapt the *CT Analyzer* or any accessories.
- Do not insert objects (e.g. screwdrivers, etc.) into the ventilation slots or any input/output sockets.

- Do not stand right next to or directly underneath a connection point because the clamps may fall off and touch you.
- Full compliance with the regulations also includes following the instructions provided in this User Manual.

Orderly Measures

The CT Analyzer User Manual or the e-book version of the manual has always to be available on the site where the *CT Analyzer* is being used. All users of the *CT Analyzer* must read and observe the safety rules described in this section and all relevant installation and operation instructions.

The *CT Analyzer* may be used only as described in this User Manual. Any other use is not in accordance with the regulations. The manufacturer and the distributor are not liable for damage resulting from improper usage. The user alone assumes all responsibility and risk.

Disclaimer

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

1 Introduction

1.1 Designated Use

The *CT Analyzer* is intended to perform automatic testing and calibration of low leakage flux current transformers (i.e., CTs with non-gapped cores) in laboratories as well as on-site in utilities. Testing of CTs with gapped cores is also possible with restricted accuracy. The following tests can be performed using the *CT Analyzer*:

- Burden measurement
- Residual magnetism measurement of CTs
- CT winding resistance measurement
- CT excitation characteristic measurement according to IEC 61869-2, IEC 60044-1, IEC 60044-6 (TPS, TPX, TPY, TPZ) and IEEE C57.13.
- CT ratio measurement with consideration of a connected burden
- CT phase and polarity measurement
- Determination of accuracy limiting factor, instrument security factor, secondary time constant, symmetrical short-circuit current factor, transient dimensioning factor, remanence factor, knee point voltage/current, class, saturated inductance and non-saturated inductance.

Using the *Quick Test* feature it is also possible to use the *CT Analyzer* as a versatile multimeter with included power source, e.g. for:

- Quick and easy resistance measurement, e.g. for wiring checks on the secondary side of CTs.
- Quick voltage ratio checks for VTs.
- Measurement of burden values, e.g. to determine the new burden value after changes of the relay equipment. This allows the re-calculation of the CT test results for the new burden value by the *CT Analyzer* and thus makes it unnecessary to run an additional CT test in order to determine the behavior of the CT with the new burden.
- Quick wiring checks using the *CPOL* polarity checker from OMICRON. Using the *CPOL* in combination with the specific test signal provided by the *CT Analyzer*'s *Quick Test* feature you can check a series of test points (e.g., the burden wiring) for correct polarity.

The *CT Analyzer* is intended exclusively for the applications described above. Any other use is deemed not to be according to the regulations. The manufacturer and the distributor are not liable for damage resulting from improper usage. The user alone assumes all responsibility and risk.

1.2 Functional Components of the CT Analyzer

1.2.1 Overview

Figure 1-1 provides an overview of the operating and display elements and the connectors of the *CT Analyzer*.

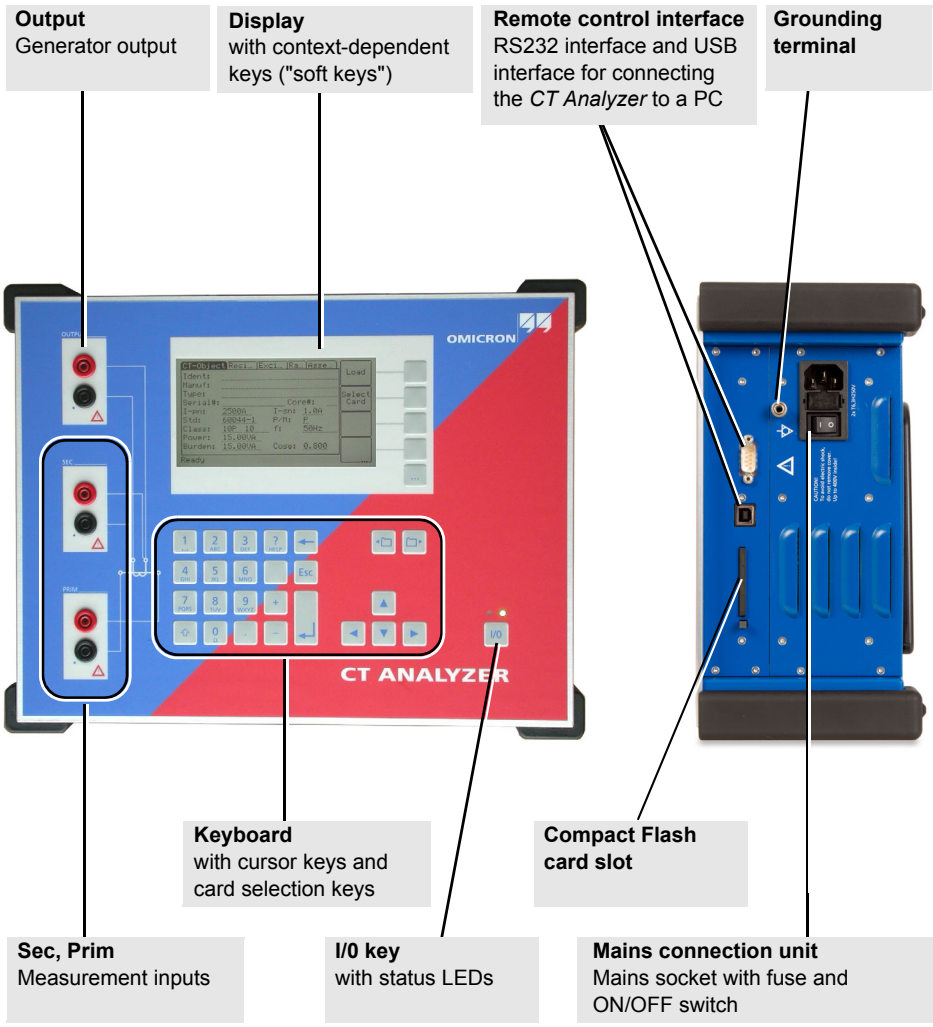


Figure 1-1 *CT Analyzer* overview

1.2.2 Mains Connection Unit and Grounding

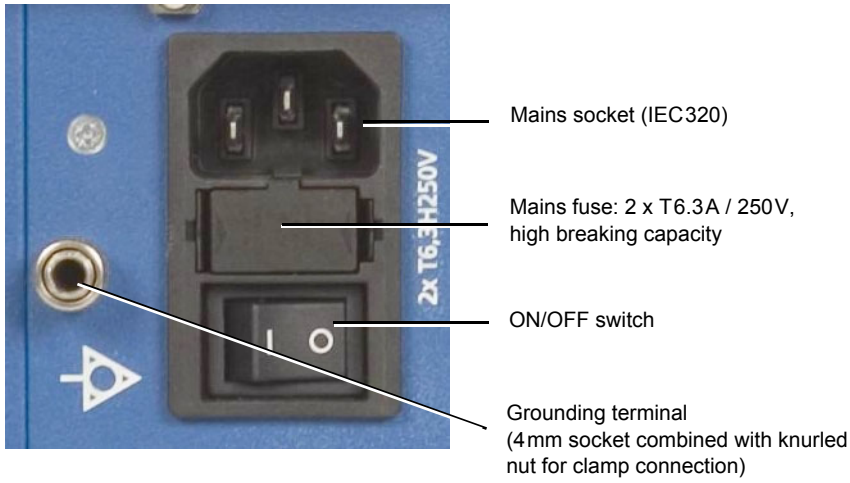


Figure 1-2 Mains connection unit and grounding terminal

1.2.3 Compact Flash Card Slot

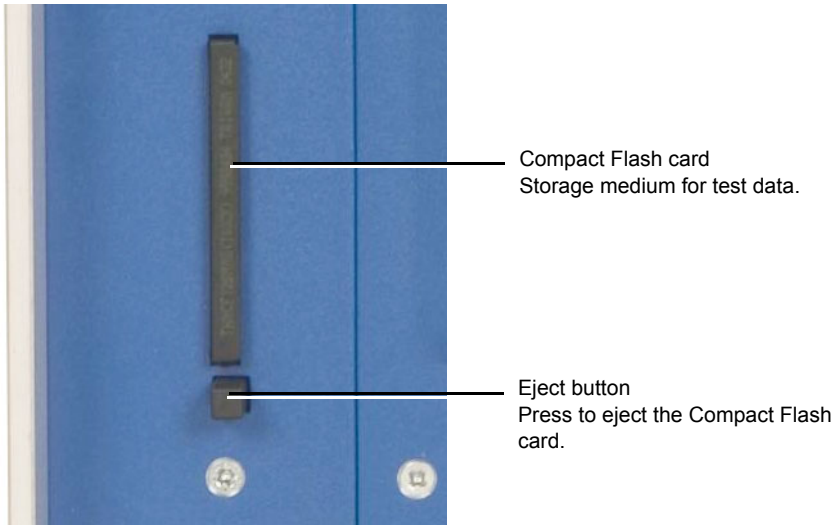


Figure 1-3 Compact Flash card slot

1.2.4 Remote Control Interface (PC Connection)

CT Analyzer devices as of serial number JHxxxx or newer are equipped with a USB interface and a RS232 interface. You can use both interfaces alternatively to connect the *CT Analyzer* to a computer.

OMICRON recommends to use the USB interface since communication via USB is considerably faster than communication via RS232.

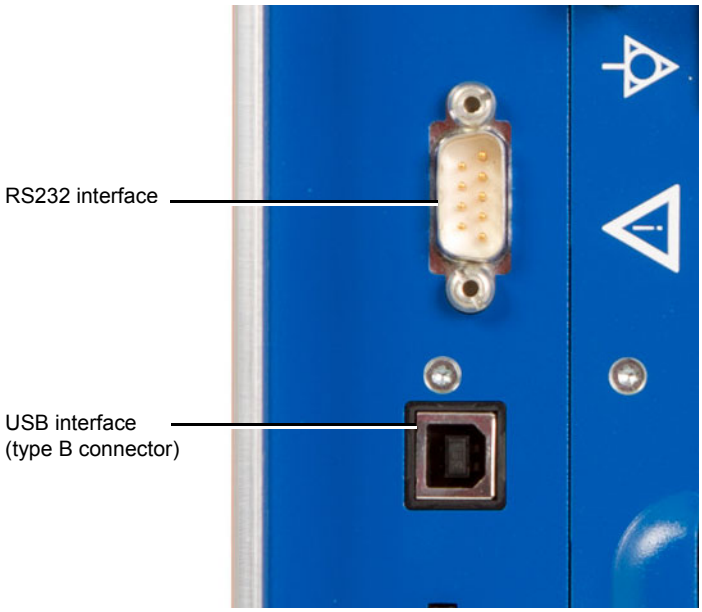


Figure 1-4 Remote control interface (RS232 and USB)

Since in this case the *CT Analyzer* provides two alternative interfaces, the user has to select the interface to be used (or check the selection) in the *CT Analyzer* settings before connecting the *CT Analyzer*. The factory default setting for those devices is **USB**.

1. Open the **Main Menu** on the *CT Analyzer* and select **Settings**.
2. In the **Setting Menu** page, select **Remote Interface**.
3. In the **Select remote interface port** page, select the interface actually used to connect the *CT Analyzer* to the computer: **USB** or **RS232**.

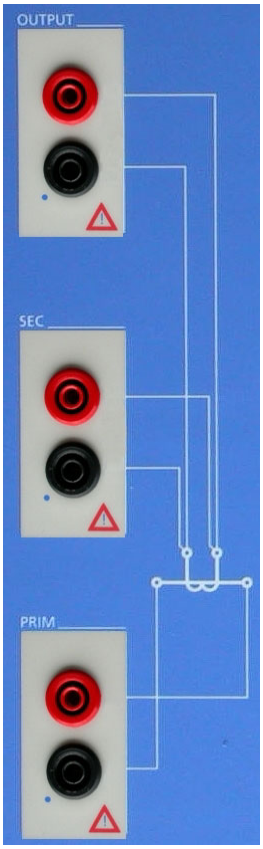
The *CT Analyzer* will only communicate via the selected interface. It will not be recognized by the computer if the *CT Analyzer* settings do not match the interface used for connection.

Note: Please refer to the following sections for more information:

- Section 2.3 on page 23 for information on how to connect the *CT Analyzer* to a PC.
- Chapter 5 on page 59 for general information on how to operate the *CT Analyzer*.
- Section 5.7 on page 65 for more detailed information about the **Setting Menu** page.

1.2.5 Inputs and Outputs

Warning: While the red LED of the I/0 key is flashing, voltage is applied at the output and the measurement inputs.



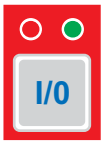
Output
Generator output.
AC: 40V_{rms}, 5A_{rms}
DC: 120V, 15A

Sec
Measurement input for secondary side of CT,
150V_{AC} max., 500kΩ input impedance

Prim
Measurement input for primary side of CT,
30V_{AC} max., 150kΩ input impedance

Figure 1-5 Inputs and outputs of the *CT Analyzer*

1.2.6 I/0 Key with Status LEDs



Red LED on the left, green LED on the right.

I/0 key to start the test.

During the boot process after switching the *CT Analyzer* on, both LEDs are on. The red LED is switched off when the boot process is finished and the *CT Analyzer* is ready for operation.

Green LED on:	The *CT Analyzer* is switched on and ready for operation.
Red LED flashing:	Test is running.

Warning: While the red LED is flashing, voltage is applied at the output and the measurement inputs.

Red LED steadily on:	Device error.

1.2.7 Display with Soft Keys

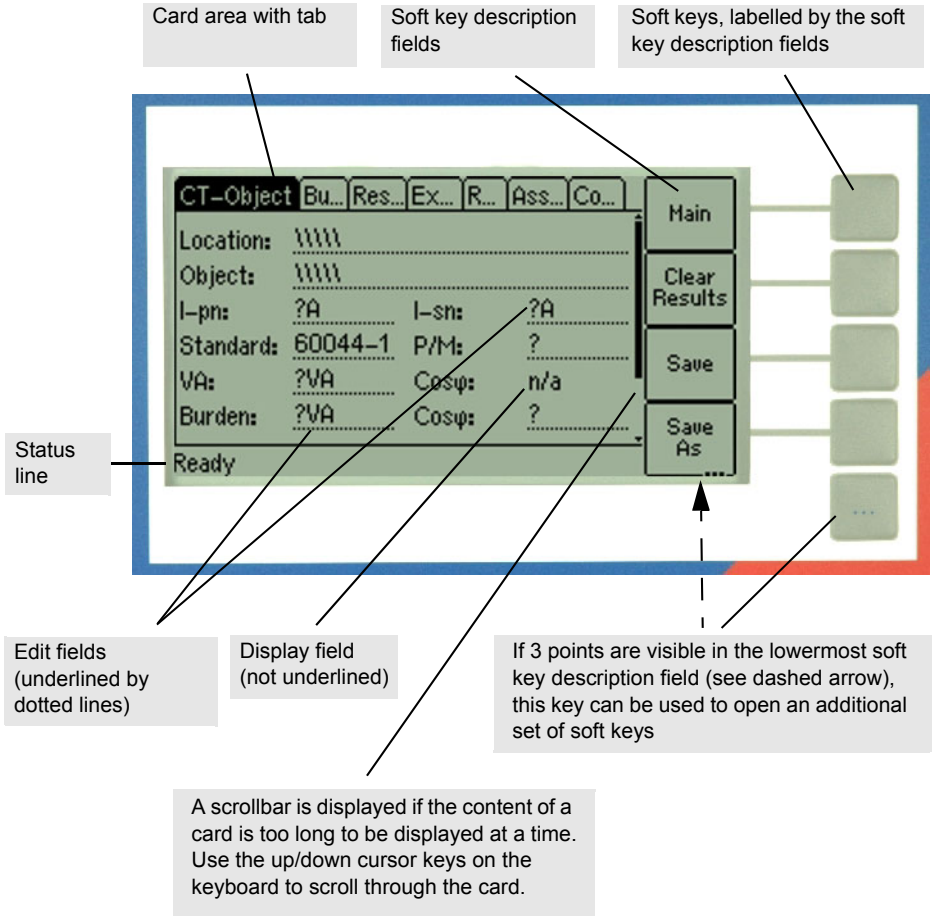


Figure 1-6 Display with context-dependent soft keys

The following icons may be displayed in the status line:

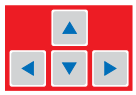
	Remote control. The *CT Analyzer* is connected to a computer and a software tool of the *CT Analyzer PC Toolset* (e.g. the *CTA Remote Excel File Loader*) running on that computer has established connection to the *CT Analyzer*.
	The keyboard on the *CT Analyzer* is locked until the running test is finished.

	Security key. The data measured with the *CT Analyzer* can be stored in XML files. Stored files are protected by a security checksum to prevent the data within these files from being edited. If the *CT Analyzer* displays the data of a previously stored test, and the data in this file are valid, a key is shown in the status line. If the file data are invalid since someone tried to edit them later, a broken key is displayed. **Note:** When loading older files containing no security checksum, no security information is shown.
OVL	Overload indication. The *CT Analyzer* could not output the required test current or take all necessary measurement points due to an overload.
X1-X4	Multi-ratio CT measurement. Indicates that a multi-ratio CT test using the optional *CT SB2* switch box has been initialized on the *CT Analyzer* (here: full tap combination X1-X4).

1.2.8 Keyboard

Figure 1-7 Keyboard

	Numeric / character keys for entering values and text. After pressing a key, the status line displays the character set available for the key. Press the key as often as required to scroll through the displayed character set. After 1 second or after pressing another key, the character selected in the status line is entered into the edit field in the display. **Note:** To quickly change between letters and numerics, hold the button pressed for a second.

	Press this key to enter capital letters.
	Press this key to display the context-sensitive help system (see section 5.9 on page 76).
	Press this key to delete the character left of the cursor position.
	Press this key to leave an edit field without applying a change or to leave the edit mode of a card or to go one level back in the user interface level. The **CT-Object** card is the top user interface level. Pressing this key several times will always bring you back to the **CT-Object** card.
	Press this key to apply a change for an edit field. When working in the *CT Analyzer* file system, use this key to open a selected folder or to confirm to move back to the next higher level in the file structure.
	Use the card selector keys to display a specific card.
	Use the cursor keys to select an edit field in the user interface or to move the cursor within an edit field. Use the ▼ cursor key to enter the edit mode of a displayed card.

1.3 License-Depending Functional Scope

The functional scope provided by the *CT Analyzer* depends on the licenses actually available on the device.

This User Manual describes the full functional scope provided when the complete set of licenses is available on the *CT Analyzer*. A lack of licenses may primarily result in functional restrictions regarding the selectable standards, classes, core types and frequencies as well as the availability of individual measurement functions and/or test cards.

For up-to-date information about the licenses and packages available for the *CT Analyzer* please refer to the OMICRON website.

1.4 Scope of Delivery, Accessories, Available Licenses

For up-to-date information about the scope of delivery and available accessories and licenses for the *CT Analyzer* please refer to the OMICRON website or the OMICRON office nearest you.

2 Setup and Connection

2.1 General Safety Rules for Connecting and Operating the CT Analyzer

Observe the following general safety rules when connecting and operating the *CT Analyzer*. The safety rules given here are supplemented by further notes and warnings applicable for specific actions only. Such specific notes and warnings are given where necessary in this user manual.

- Before putting the *CT Analyzer* into operation, check the test set for visible damages.
- When taking the *CT Analyzer* into operation, make sure that the air slots, the power switch and the power supply plug at the test set are not obstructed.
- Only use wires with 4 mm safety "banana" connectors and plastic housing for connection to the front panel input/output sockets.
- During the test always connect one terminal of the transformer's primary side to protective earth.

Warning: Make sure that the terminals of the test object to be connected to the *CT Analyzer* do not carry any voltage potential. During a test, the *CT Analyzer* is the only permitted power source for the test object.

Warning: Do not touch the equipment under test or the measurement leads while the red LED on the *CT Analyzer* is flashing. Never connect or disconnect measurement leads while the red LED on the *CT Analyzer* is flashing.

As long as the red LED is flashing, the output is active and lethal voltages can occur due to the high energy stored in external inductors.

Warning: Always make sure that the *CT Analyzer* output is connected to the correct side of the current transformer according to the wiring instructions given in sections 2.4 to 2.5 below. Accidentally mixing up the windings can cause life-threatening voltages within the transformer and/or destroy the connected CT or the *CT Analyzer*!

Warning: Feeding test voltage to a tap of a **multi-ratio CT** can cause life-threatening voltages on other taps with higher ratios. Do not touch these taps!

Using the optional *CT SB2* switch box can make the testing of multi-ratio CTs much safer. If necessary, the *CT Analyzer* then reduces the test voltage in a way that the maximum possible voltage within the measurement setup (i.e., the voltage occurring at the tap combination with the highest ratio) is limited to 200 V.

2.2 Setting Up the CT Analyzer

Proceed as follows to set up the *CT Analyzer*:

1. Make sure to position the *CT Analyzer* on dry, solid ground.
2. Connect the grounding terminal on the *CT Analyzer*'s side panel (see section 1.2 on page 12) to protective ground (PE). Use the original cable supplied by OMICRON or alternatively a solid connection of at least 6 mm^2. Use a ground point as close as possible to the test object.
3. Connect the *CT Analyzer* to mains using the supplied power cord. Supply the *CT Analyzer* only from a power outlet that is equipped with protective ground (PE). An error message (901) appears if the PE connection is defective or if the power supply has no galvanic connection to ground.

Warning: The error message 901 is a safety relevant message! This message may appear if protective ground or equipotential ground is not connected properly or if the power supply does not have galvanic connection to ground, which can be the case in very special grid applications or if the *CT Analyzer* is supplied by a generator or an isolating transformer. For safe operation always make sure that protective ground and equipotential ground are connected properly.

4. Connect the equipment under test according to the instructions given in this manual. Refer to sections 2.4 and 2.5 for detailed descriptions how to connect the *CT Analyzer* for a specific measurement and/or application.

2.3 Connecting the CT Analyzer to a PC (optional)

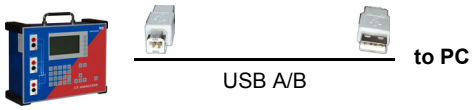
CT Analyzer devices as of serial number JHxxxx or newer are equipped with a USB interface and a RS232 interface. You can use both interfaces alternatively to connect the *CT Analyzer* to a computer.

Proceed as follows to connect the *CT Analyzer* to a PC:

1. Select the interface to be used (or check the selection) in the *CT Analyzer* settings:
   - Open the **Main Menu** on the *CT Analyzer* and select **Settings**.
   - In the **Setting Menu** page, select **Remote Interface**.
   - In the **Select remote interface port** page, select the interface actually used to connect the *CT Analyzer* to the computer: **USB** or **RS232**.
2. Connect the *CT Analyzer* to the PC using a RS232 cable or a USB cable as shown in the following figure.

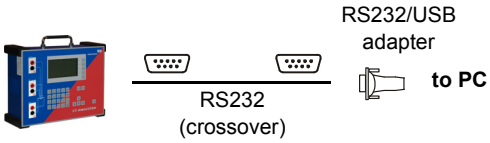
***CT Analyzer* connected via USB**

CT Analyzer settings:
Main Menu -> **Settings** -> **Remote Interface** -> **USB**



***CT Analyzer* connected via RS232 interface and a RS232/USB adapter on the PC side**

CT Analyzer settings:
Main Menu -> **Settings** -> **Remote Interface** -> **RS232**



***CT Analyzer* connected via RS232 interface**

CT Analyzer settings:
Main Menu -> **Settings** -> **Remote Interface** -> **RS232**

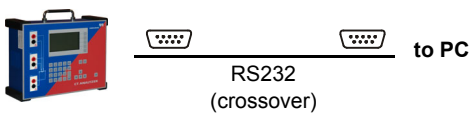


Figure 2-1 Connecting the CT Analyzer to a PC

2.4 Connection for Usual Applications

2.4.1 Wiring for a CT Test

This section shows the basic wiring of the *CT Analyzer* for a CT test.

Observe the general safety rules in section 2.1 on page 21 and the hints and instructions for improving the quality of the measurement results given in section 2.7 on page 42.

Warning: Feeding test voltage to a tap of a **multi-ratio CT** can cause life-threatening voltages on other taps with higher ratios. Do not touch these taps!

Caution: The grounded terminal on the secondary side of the CT always has to be connected to the black sockets of input "Sec" and the "Output" of the *CT Analyzer*. Connecting the red sockets of the *CT Analyzer* to PE can result in incorrect measurement and/or cause an automatic abortion of the measurement with an error message.

Caution: If it is necessary to use clamps for the connection of the measurement leads to the secondary side of the test object, always use the 4-wire connection technique as described in section 2.7.1 on page 42 in order to avoid measurement errors.

For a CT test, connect the *CT Analyzer* as shown in Figure 2-2:

1. Make sure that the primary side of the CT is connected to PE on one side and open on the other side.

Caution: It is absolutely important to avoid coupling of interferences into the primary circuit during measurement. Therefore, connect the side of the primary circuit that is able to receive more interferences to PE (e.g. the side with the longer line length). The ungrounded side should be the side that receives less interferences (refer to Figure 2-2).

2. Disconnect the hot side of all secondary windings of the CT in order to remove any load from the CT. Every kind of load remaining on the secondary side of the CT during measurement leads to incorrect measurement results or error messages.
3. Connect the black socket of *CT Analyzer* input "Prim" to the grounded side of the CT's primary circuit and the red socket of this input to the open (ungrounded) side.

4. Connect the black "Output" socket and the black socket of input "Sec" of the *CT Analyzer* to that terminal on the secondary side of the CT that is connected to PE.
5. Connect the red "Output" socket and the red socket of input "Sec" of the *CT Analyzer* to the other (ungrounded) terminal on the secondary side of the CT.

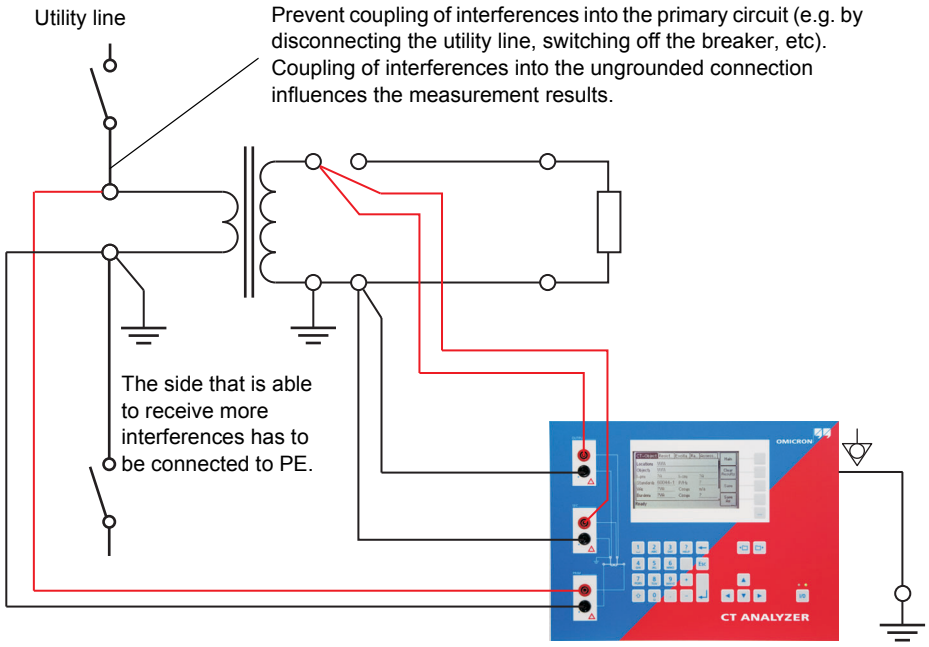


Figure 2-2 Basic wiring for a CT test

Note: The CT may make humming or buzzing noises of varying frequency during the CT test. This is completely normal and does not indicate a defective CT.

2.4.2 Wiring for a Burden Test

For a burden test, connect the *CT Analyzer* as shown in Figure 2-3. Observe the general safety rules in section 2.1 on page 21.

1. Open the connection line to the ungrounded side of the CT (refer to Figure 2-3).

Caution: If you do not disconnect the CT for the burden test, the *CT Analyzer* measures the parallel impedance of the burden and the CT winding instead of the burden itself. Although in many cases the impedance of the CT is many times higher than the burden impedance, this will cause a measuring error.

The *CT Analyzer* does not perform demagnetization after burden measurement. Therefore, CT saturation could occur if you do not disconnect the CT prior to the burden test.

2. Connect the black "Output" socket and the black socket of input "Sec" of the *CT Analyzer* to that side of the burden that is connected to PE.
3. Connect the red "Output" socket and the red socket of input "Sec" of the *CT Analyzer* to the other (ungrounded) side of the burden.

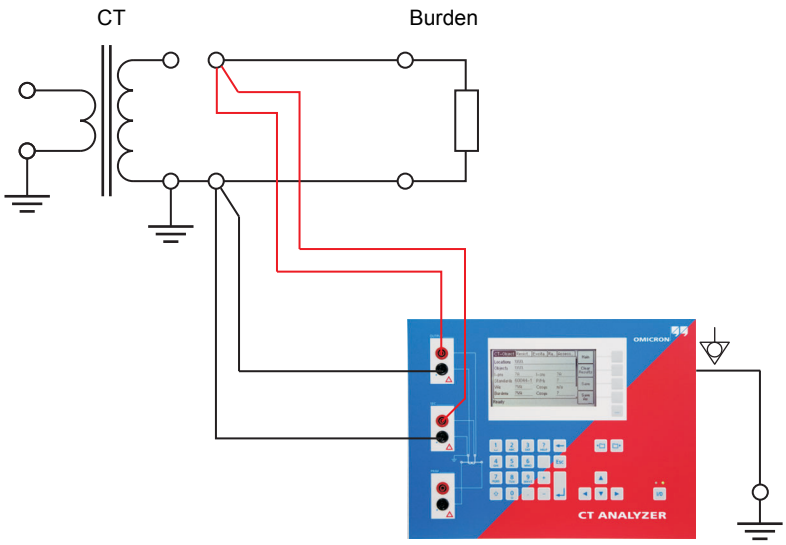


Figure 2-3 Basic wiring for a burden test

2.4.3 Wiring for Primary Resistance Measurement

For the primary winding resistance measurement, connect the *CT Analyzer* as shown in Figure 2-4. Observe the general safety rules in section 2.1 on page 21.

1. Make sure that the primary side of the CT is connected to PE on one side and open on the other side.
2. Disconnect the hot side of all secondary windings of the CT in order to remove any load from the CT. Every kind of load remaining on the secondary side of the CT during measurement leads to incorrect measurement results or error messages.
3. Connect the black socket of *CT Analyzer* input "Prim" to the grounded side of the CT's primary winding and the red socket of this input to the open (ungrounded) side.
4. Connect the black "Output" socket of the *CT Analyzer* to the grounded side of the CT's primary winding and the red "Output" socket to the ungrounded side of the primary winding.

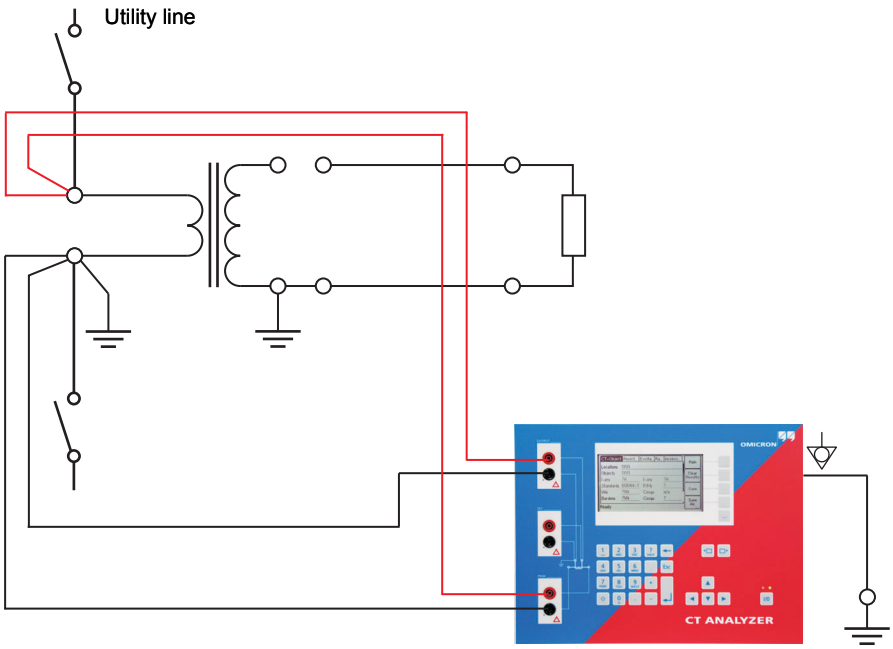


Figure 2-4 Basic wiring for primary winding resistance measurement

2.5 Connection for Special Applications

2.5.1 Measurement on a Gapped Core

For gapped cores, the position of the primary wire inside the core has a large influence on the ratio measurement results.

Therefore, in order to obtain correct measurement results, it is very important to arrange the primary wire during measurement to the same position inside the core as it is during real operation. Depending on the position of the primary wire inside the core, the measured ratio can differ by up to 20%.

The figure below shows how the ratio error can differ depending on the position of the primary wire inside the core.

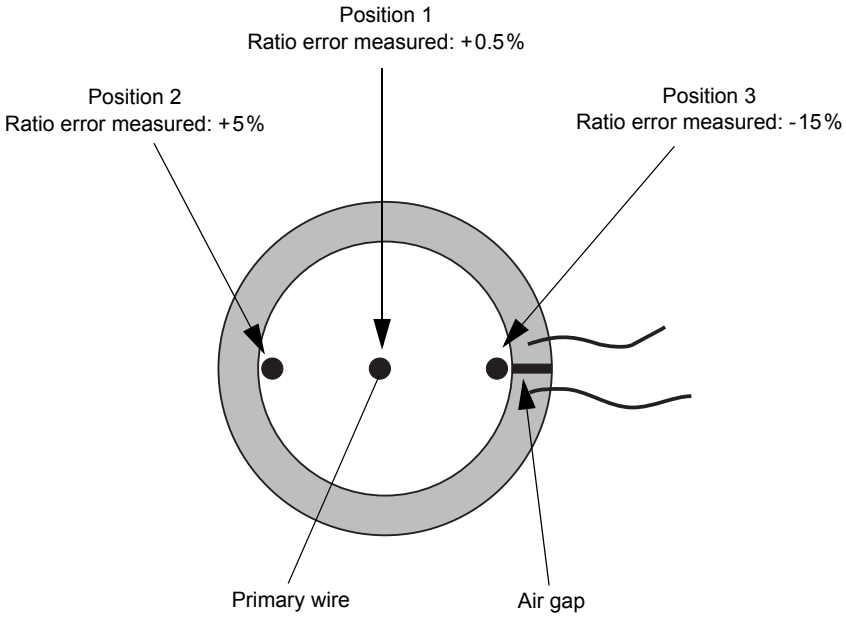


Figure 2-5 Ratio error depending on the position of the primary wire inside the gapped core

As shown in Figure 2-5, the measured ratio error may differ considerably depending on the position of the primary wire. Best measurement results are obtained if the primary wire is positioned exactly in the center of the core. As an alternative, a copper foil formed to a ring and placed to the inner side of the core can be used as shown in Figure 2-6.

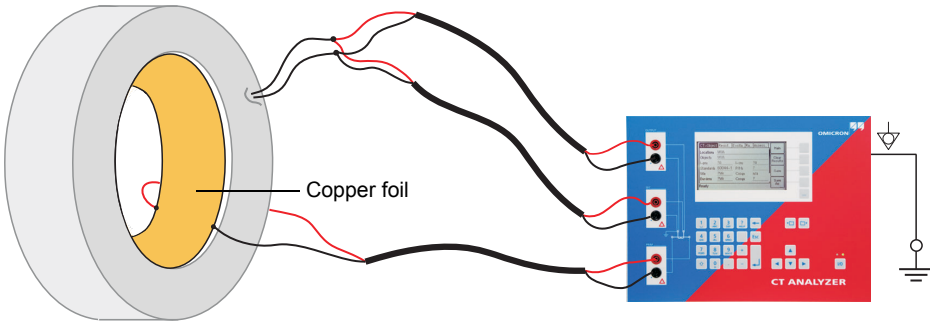


Figure 2-6 Using a copper foil formed to a ring as primary wire

Note: Exact measurement results are only possible if the primary wire is positioned exactly in the center of the core.

The *CT Analyzer* does not consider leakage inductances. The leakage inductances are neglected instead. This way, the *CT Analyzer* is able to reach a measurement error of approx. 0.1% for class PR and class TPY CTs and approx. 0.8% for class TPZ CTs.

2.5.2 Excitation Curve Measurement for an Unwound Iron Core

Using the *CT Analyzer* it is possible to measure the magnetic properties of an empty, unwound iron core. For this purpose, it is necessary to apply an "auxiliary winding" of at least 20 turns to the core.

For this purpose, OMICRON offers a special cable with 23 turns (VEHK0658) and a special Microsoft Excel template for the required calculations.

Proceed as follows to perform the measurement (refer to Figure 2-7 and Figure 2-8). Observe the general safety rules in section 2.1 on page 21.

1. Apply the "auxiliary winding" cable to the unwound core.
2. Connect the "Output" sockets and input "Sec" of the *CT Analyzer* to the cable as shown in Figure 2-7. For cores that require high currents to reach the knee point, several cables can be cascaded to increase the number of turns, see Figure 2-8.
3. Start the *CTA Remote Excel File Loader* with the special Excel template mentioned above.
4. Enter the iron parameters to the template.

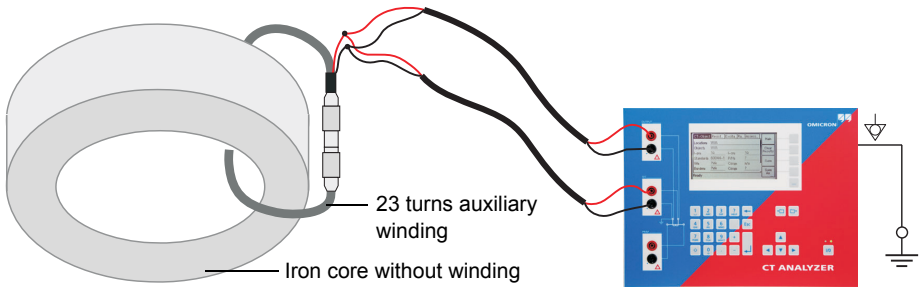


Figure 2-7 Excitation curve measurement using one "auxiliary winding" cable

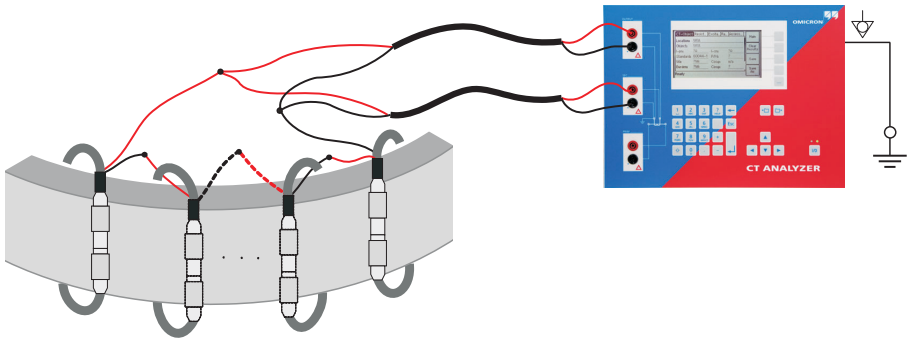


Figure 2-8 Excitation curve measurement using several cascaded "auxiliary winding" cables

2.5.3 Measurement on a GIS (SF6) Switch Gear

Proceed as follows to perform measurements on a GIS (SF6) switch gear (refer to Figure 2-9). Observe the general safety rules in section 2.1 on page 21.

1. Disconnect all utility lines.
2. Open all circuit breakers to the bus bars.
3. Close the earthing switch.
4. Connect one secondary side terminal of the CT to protective earth.

5. Connect the secondary side of the CT to the "Output" sockets and input "Sec" of the *CT Analyzer*:
   - Connect that side of the CT that is connected to PE to the black sockets of the *CT Analyzer*.
   - Connect that side of the CT that is open to the red sockets of the *CT Analyzer*.
6. Connect the primary side of the CT to *CT Analyzer* input "Prim". Make sure that the polarity is correct (same colors on same polarity).

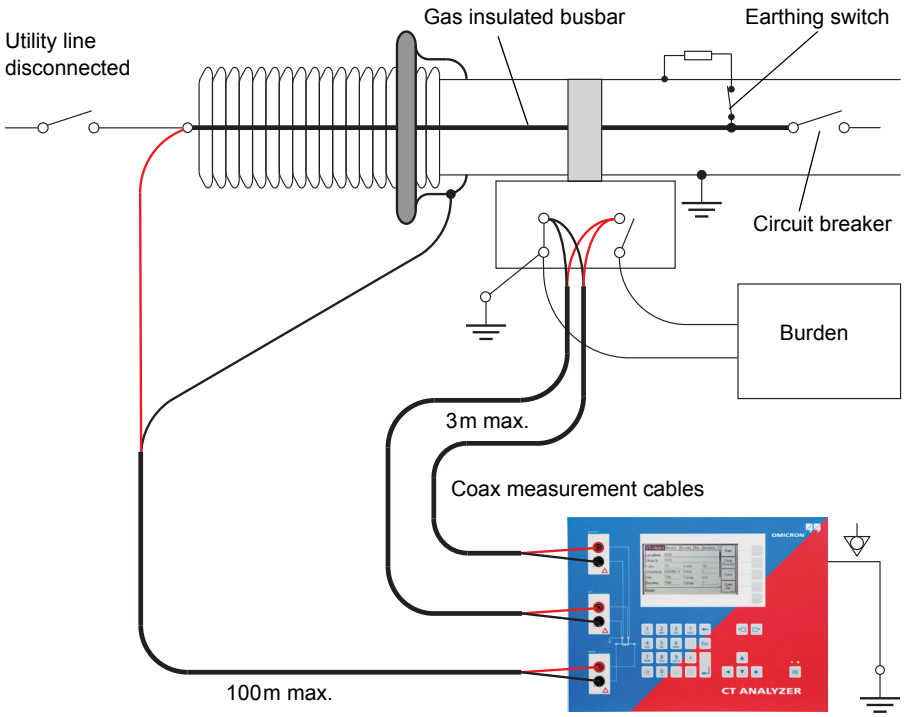


Figure 2-9 Measurement on a GIS (SF6) switch gear

2.5.4 Measurement on Bushing-Type CTs

Measurement on a Bushing-Type CT

Proceed as follows to perform measurements on a bushing-type CT (refer to Figure 2-10). Observe the general safety rules in section 2.1 on page 21.

1. Disconnect all utility lines from the transformer (i.e., isolate the transformer from the energized power system).
2. Connect all transformer terminals that are not used for measurement (in this example H2 and H3) to protective earth (PE) in order to minimize the external disturbances. External disturbances can influence the measurement results because the bushings are acting as an antenna.
3. Connect terminal H0 to protective earth.
4. Connect one secondary side terminal of the CT to protective earth.
5. Connect the secondary side of the CT to the "Output" sockets and the "Sec" sockets of the *CT Analyzer*:
   - Connect that side of the CT that is connected to PE to the black sockets of the *CT Analyzer*.
   - Connect that side of the CT that is open to the red sockets of the *CT Analyzer*.
6. Connect the primary side of the CT to *CT Analyzer* input "Prim". Make sure that the polarity is correct (same colors on same polarity).
7. Short-circuit and ground the free winding on the measured transformer leg to reduce the impedance of the winding that is connected in series to the primary side of the CT. The input impedance of *CT Analyzer* input "Prim" is only approx. 330 kΩ and can thus influence the measurement results, if no winding of that leg is short-circuited.
8. If the transformer has a tap changer installed, the position of the tap changer should be changed to a position where the regulation winding is completely bridged in order to ensure that the regulation winding cannot act as a voltage divider together with the main winding of the transformer.

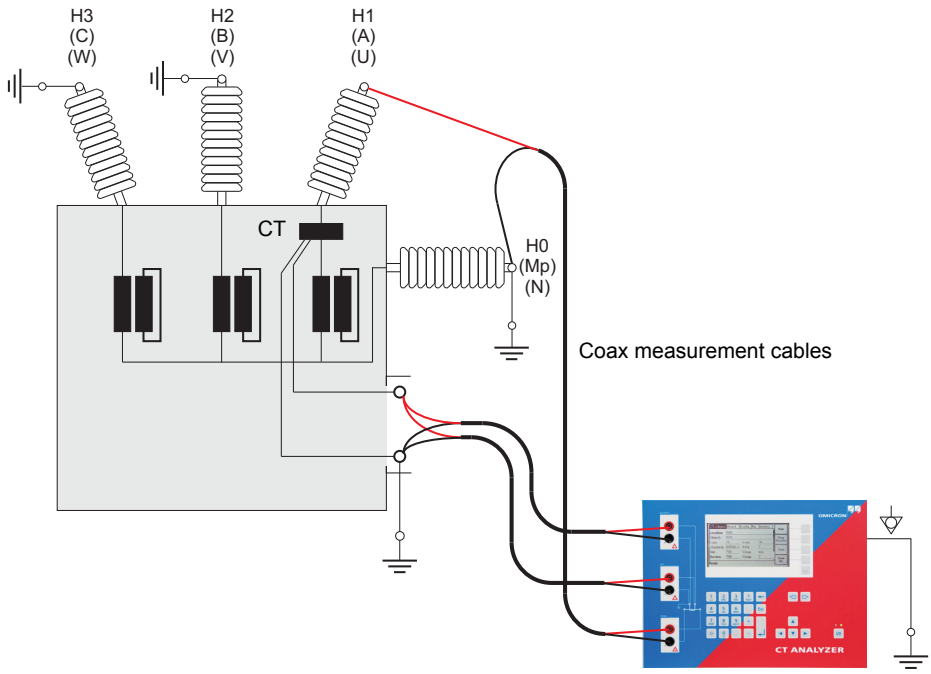


Figure 2-10 Measurement on a bushing-type CT

Note: Primary terminal H1 must be open. Otherwise the primary side is shorted and the *CT Analyzer* cannot obtain proper results.

Measurement on a Y (Wye) Winding Transformer

For measurements on current transformers in Y-connected transformer windings it has to be assured that the main impedance of the transformer does not influence the measurement results.

The *CT Analyzer* has an input impedance of approx. 330 kΩ. This measurement impedance can be low enough to influence the measurement results. In order to prevent any influence of the *CT Analyzer*'s input impedance to the measurement results, the transformer winding at the same leg should be short-circuited. Short-circuiting the windings on all legs of the transformer is even better.

Furthermore, all bushing terminals that are not connected to the *CT Analyzer* should be connected to protective earth in order to prevent influence of external disturbances (see Figure 2-11).

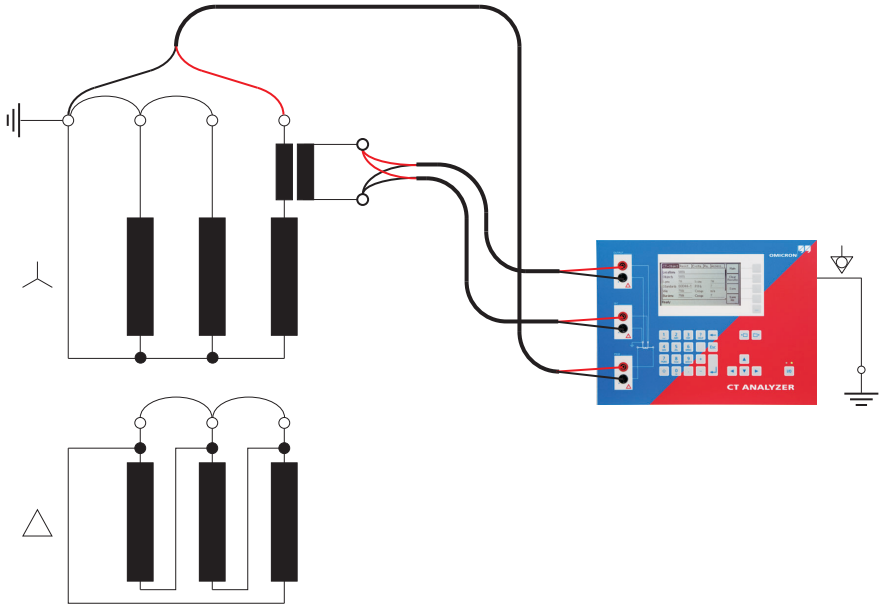


Figure 2-11 Measurement on a Y winding transformer

Measurement on a Δ (Delta) Winding Transformer

CTs outside the delta winding

For CTs that are located in the bushing outside of the delta winding (Figure 2-12), no delta compensation is needed.

In this case, only two parallel transformer windings are connected in series to the CT. This connection method provides least possible influence to the measurement result for the winding resistance of the CT.

The Y winding and the remaining windings of the power transformer's delta winding are short-circuited to avoid influence of the induced flux of the power transformer's core to the measurement.

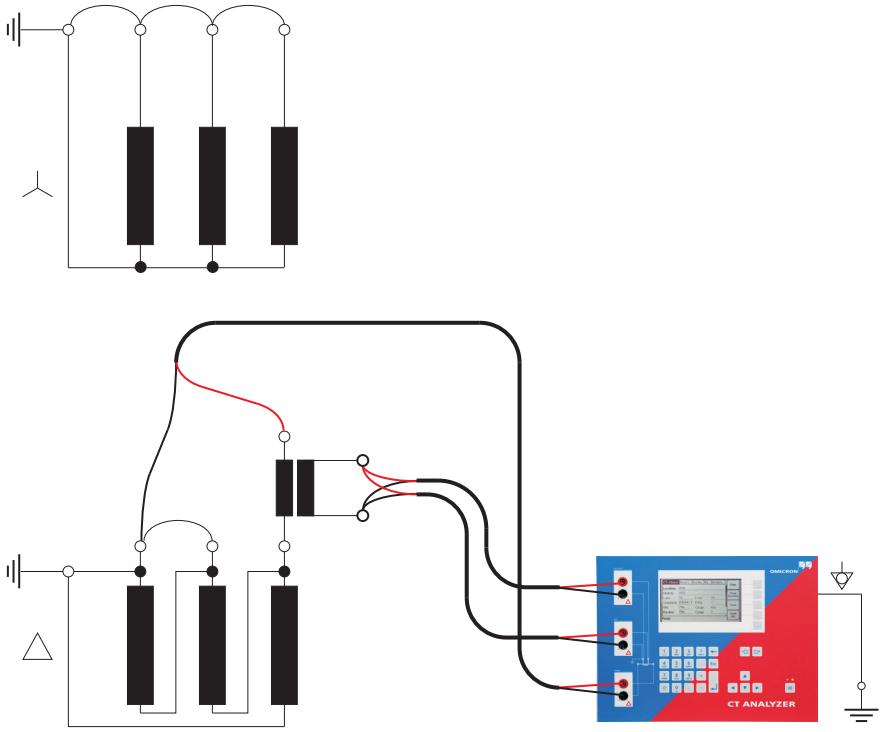


Figure 2-12 Bushing-type CT outside the delta winding power transformer

CTs inside the delta winding

For CTs that are integrated in the delta winding of the transformer, it is not possible to read the CT ratio directly since the delta winding acts as a voltage divider. In order to obtain the correct CT ratio, the ratio value determined by the *CT Analyzer* has to be corrected.

For this purpose, the *CT Analyzer* provides a "Delta Compensation" field on the **CT- Object** card where you can select the delta compensation factor depending on the bushing terminals that are used for primary signal measurement.

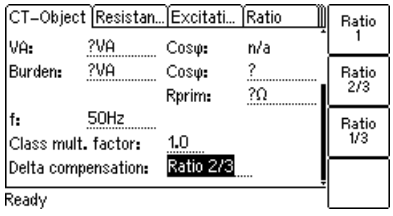


Figure 2-13 Setting the delta compensation on the **CT-Object** card

If it is possible to short-circuit the transformer winding at the same leg as the primary measurement is done (see Figure 2-15), the measurement should be performed with the winding short-circuited. In this case, no delta compensation is required since the voltage induced on the transformer's secondary winding is zero and thus the voltage induced on the primary side of the transformer is also zero.

For the measurement setup shown in Figure 2-14, the delta compensation factor on the **CT-Object** card has to be set to "Ratio 2/3" (see Figure 2-13).

If input "Prim" is connected between L1 and L2, the delta compensation has to be set to "Ratio 1/3".

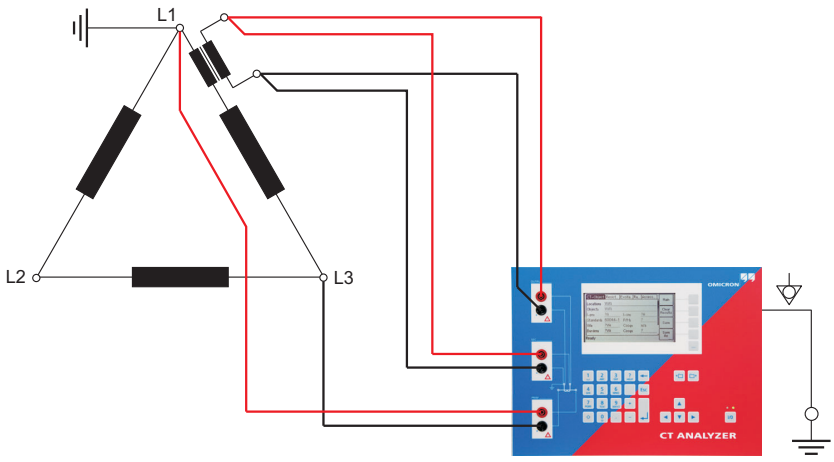


Figure 2-14 Measurement setup for delta compensation "Ratio 2/3"

In the configuration shown in Figure 2-15, no delta compensation is required since the main winding of the power transformer is short-circuited on the other side. This avoids the induction of flux in the main winding of the power transformer that could influence the measurement results.

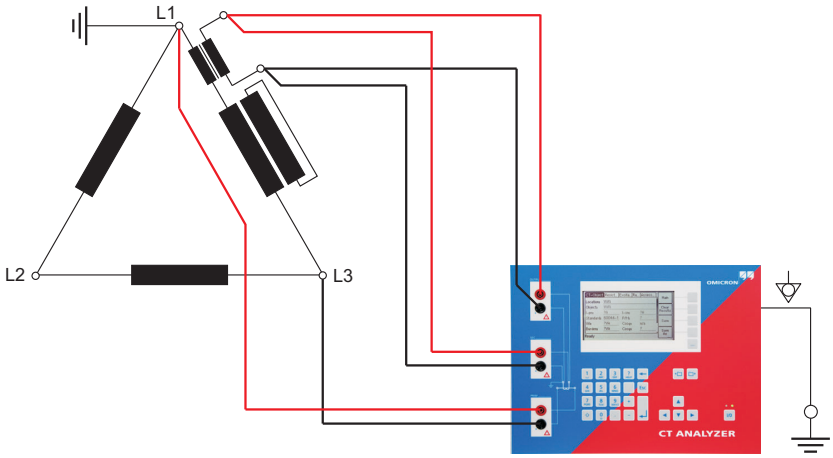


Figure 2-15 Measurement setup for delta compensation "Ratio 1"

2.5.5 VT Ratio Measurement Using QuickTest

To measure the ratio of VTs using the *CT Analyzer*, you can either use the *Quick Test* function of the *CT Analyzer* (see chapter 8 on page 135) or the *CTA QuickTest* PC tool which is part of the *CT Analyzer PC Toolset*.

Observe the general safety rules in section 2.1 on page 21.

Warning: For VT ratio measurement using the *Quick Test* feature, the *CT Analyzer* output has to be connected to the **primary side** of the VT. Connecting the *CT Analyzer* output to the secondary side of the VT by mistake will cause hazardous voltages on the primary side!

For VT ratio measurements using *Quick Test*, connect the *CT Analyzer* as shown in Figure 2-16. For a detailed description on how to perform such measurements, please refer to section 8.7 on page 151.

1. Connect the "Output" sockets and input "Sec" of the *CT Analyzer* to the primary side of the VT.
2. Connect input "Prim" of the *CT Analyzer* to the secondary winding of the VT.

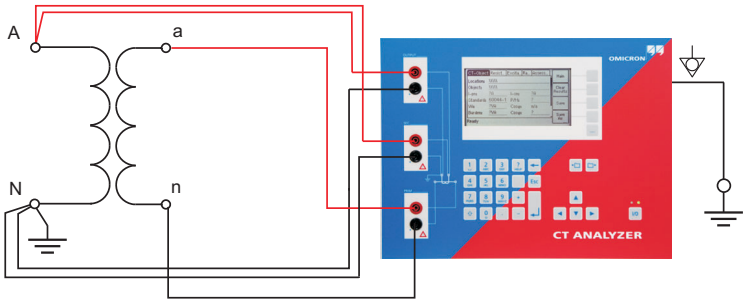


Figure 2-16 Connecting the VT for ratio measurement using the *CT Analyzer*

2.5.6 VT Winding Resistance Measurement Using QuickTest

To measure the winding resistance of VTs using the *CT Analyzer*, you can either use the *Quick Test* function of the *CT Analyzer* (see chapter 8 on page 135) or the *CTA QuickTest* PC tool which is part of the *CT Analyzer PC Toolset*.

Observe the general safety rules in section 2.1 on page 21.

For VT winding resistance measurements using *Quick Test*, connect the *CT Analyzer* as shown in Figure 2-17. For a detailed description on how to perform such measurements, please refer to section 8.8 on page 154.

Connect the "Output" sockets and input "Sec" of the *CT Analyzer* to the winding to be measured.

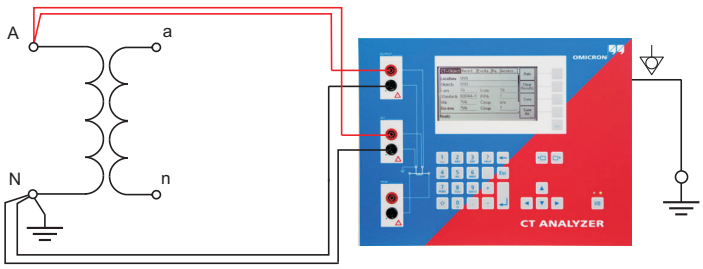


Figure 2-17 Connecting the VT for winding resistance measurement using the *CT Analyzer*

2.5.7 Polarity Check Using QuickTest and the CPOL Polarity Checker

Observe the general safety rules in section 2.1 on page 21.

For the polarity check using *Quick Test*, connect the *CT Analyzer* as shown in Figure 2-18. For a detailed description on how to perform the polarity check, please refer to section 8.5 on page 145.

1. Ensure that the ungrounded side of the CT winding is not connected to the wiring to be checked.
2. Connect the black "Output" socket and the black socket of input "Sec" of the *CT Analyzer* to that side of the burden that is connected to PE.

3. Connect the red "Output" socket and the red socket of input "Sec" of the *CT Analyzer* to the other (ungrounded) side of the burden.

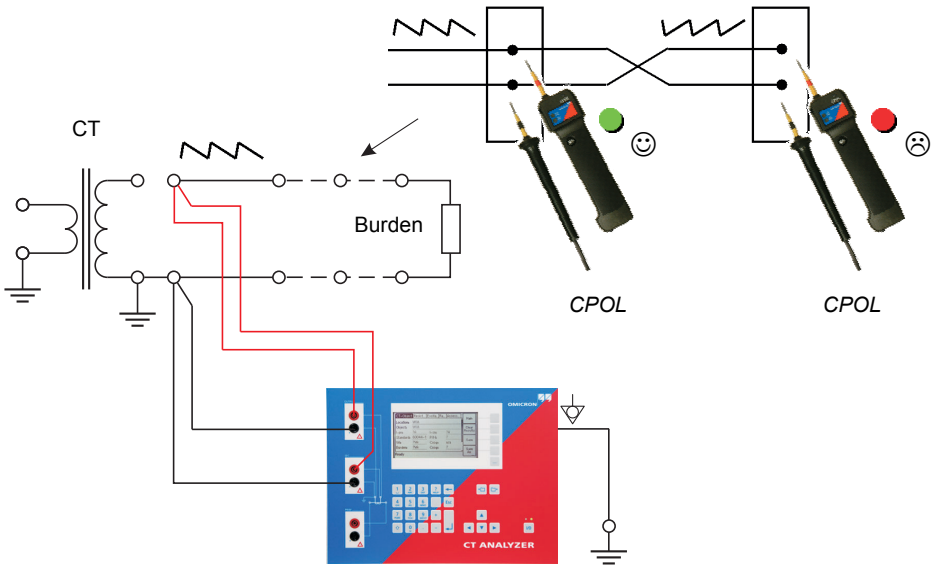


Figure 2-18 Wiring for a polarity check of the burden wiring using *Quick Test* and the *CPOL* polarity checker

Note: The *CT Analyzer* measures the voltage of the injected signal using input "Sec". Therefore, you should always connect this input when using the Polarity Check measurement type. The higher the resistance of the wiring checked (i.e., the burden wiring) or the current amplitude set on the *CT Analyzer*, the higher the terminal voltage generated by this current!

2.6 Disconnection

Proceed as follows to disconnect the *CT Analyzer*:

1. Wait until the red LED on the *CT Analyzer* is off.

Warning: Never disconnect measurement leads while the red LED on the *CT Analyzer* is flashing. As long as the red LED is flashing, the output is active and lethal voltages can occur due to the high energy stored in external inductors.

2. Disconnect the measurement leads starting at the *CT Analyzer*.

2.7 Improving the Quality of Measurement Results

2.7.1 4-Wire Measurement vs. 2-Wire Measurement

If the secondary side of the test object does not provide screw terminals for connecting the delivered terminal adapters or banana sockets to insert the measurement leads directly, and it is therefore necessary to use clamps (e.g. crocodile clamps or Kelvin clamps) for the connection of the measurement leads, always use the 4-wire connection technique as described below.

Otherwise, the possibly existing contact resistance of the clamps could affect the measurement results, i.e., the *CT Analyzer* possibly delivers incorrect measurement results.

Both connection techniques are shown in the following figure.

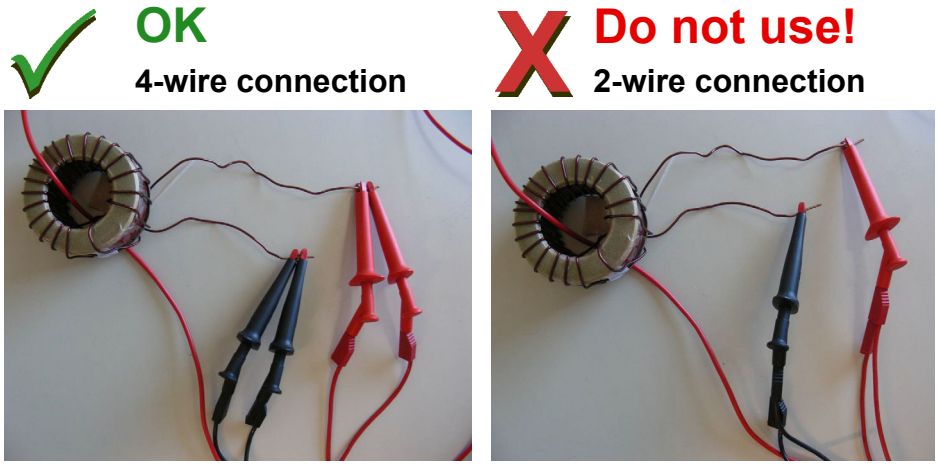


Figure 2-19 Demonstration of 2-wire and 4-wire connection technique

2.7.2 Noise Reduction Techniques

For proper test results it is important to consider the following:

- If possible, disconnect both primary terminals of the CT from the utility lines.
- If possible, always use the original coax measurement cables delivered by OMICRON. If it is necessary to use loose single-wire measurement cables, twist the wires to a twisted-pair line. Avoid open loops consisting of individual single-wire measurement cables in order to prevent interference voltages caused by magnetic fields.
- Connect one terminal of the CT's primary side to protective earth. If it is not possible to disconnect the utility lines from both primary terminals, connect that side of the primary circuit that is able to receive more interferences to PE (the primary side that is still connected to the utility lines or the side with the longer line length, respectively). The ungrounded side should be the side that receives less interferences.
- When testing a CT in a utility, take care that one side of the CT is connected to PE and at least the ungrounded terminal is disconnected from all utility lines.

Refer to Figure 2-20.

Note: Do not connect both primary terminals to PE! This would cause incorrect measurement results. Connecting both primary terminals to PE has the same effect as a short-circuit in the CT.

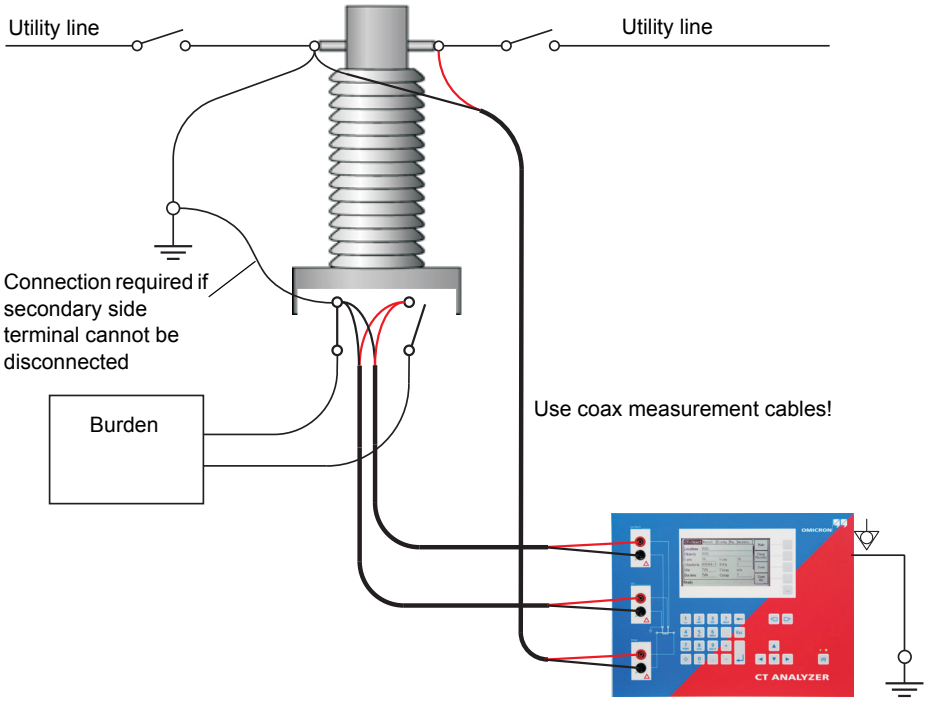


Figure 2-20 Noise reduction for CT measurement

3 Short Guide for Running a CT Test

This chapter provides a short guide for running a CT test using the *CT Analyzer*. This short guide is intended as an overview of a complete test procedure. For more detailed information, please refer to chapter 4 on page 49.

This short guide does not consider the residual magnetism measurement (see section 6.4 on page 102) and does not use the guesser function of the *CT Analyzer* (see chapter 7 on page 131).

When working with the *CT Analyzer*, always observe the safety rules given in section 2.1 on page 21.

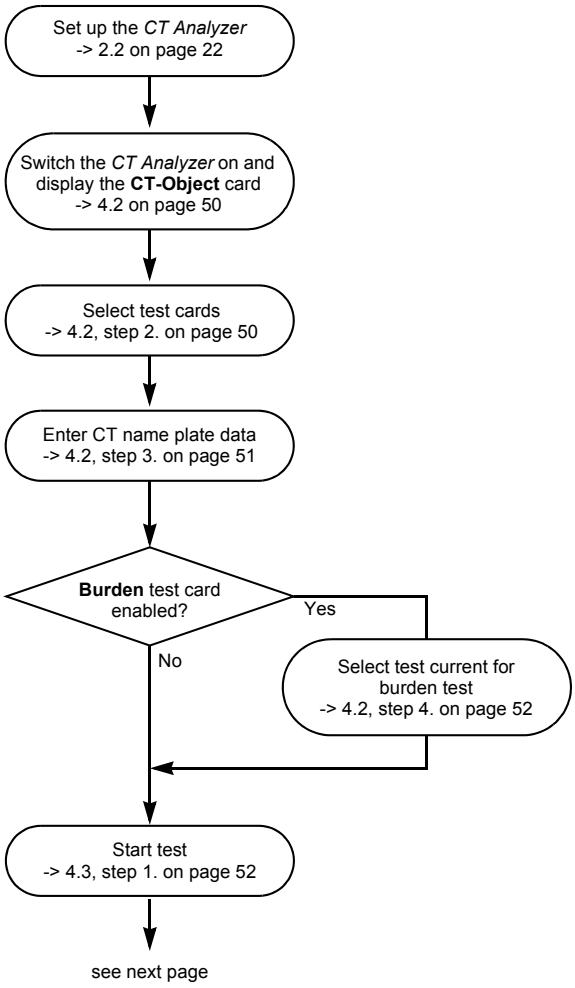
Note: The CT may make humming or buzzing noises of varying frequency during the CT test. This is completely normal and does not indicate a defective CT.

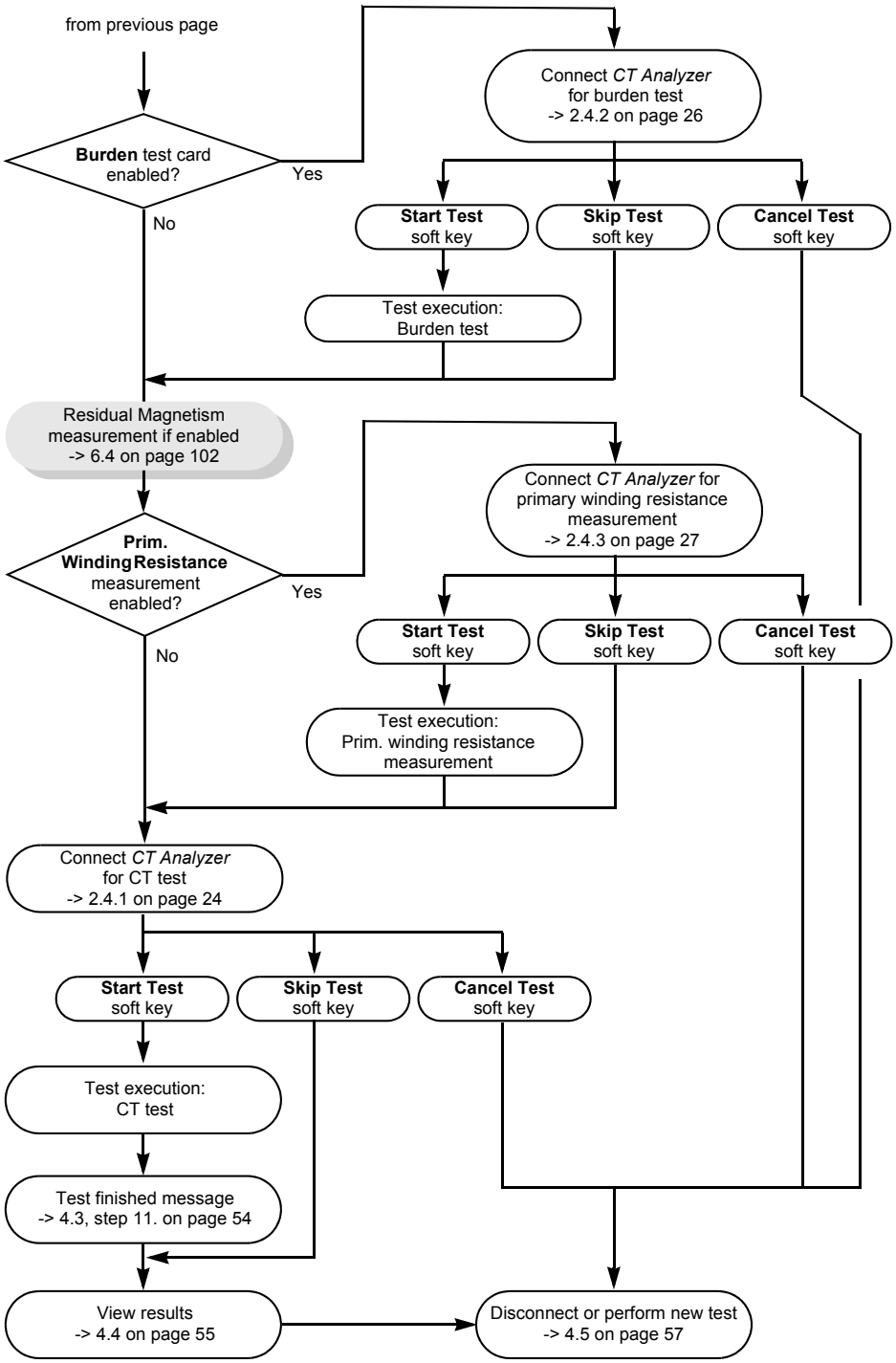
Warning: Do not touch the equipment under test or the measurement leads while the red LED on the *CT Analyzer* is flashing. Never connect or disconnect measurement leads while the red LED on the *CT Analyzer* is flashing.

As long as the red LED is flashing, the output is active and lethal voltages can occur due to the high energy stored in external inductors.

Warning: Always make sure that the *CT Analyzer* output is connected to the correct side of the current transformer according to the wiring instructions given in sections 2.4 and 2.5. Accidentally mixing up the windings can cause life-threatening voltages within the transformer and/or destroy the connected CT or the *CT Analyzer*!

Warning: Feeding test voltage to a tap of a **multi-ratio CT** can cause life-threatening voltages on other taps with higher ratios. Do not touch these taps!


Set up the *CT Analyzer*
-> 2.2 on page 22
Switch the *CT Analyzer* on and display the **CT-Object** card
-> 4.2 on page 50
Select test cards
-> 4.2, step 2. on page 50
Enter CT name plate data
-> 4.2, step 3. on page 51
Burden test card enabled?
Yes
No
Select test current for burden test
-> 4.2, step 4. on page 52
Start test
-> 4.3, step 1. on page 52
see next page


from previous page
Burden test card enabled?
Yes
No
Connect CT Analyzer for burden test -> 2.4.2 on page 26
Start Test soft key
Skip Test soft key
Cancel Test soft key
Test execution: Burden test
Residual Magnetism measurement if enabled -> 6.4 on page 102
Prim. Winding Resistance measurement enabled?
Yes
No
Connect CT Analyzer for primary winding resistance measurement -> 2.4.3 on page 27
Start Test soft key
Skip Test soft key
Cancel Test soft key
Test execution: Prim. winding resistance measurement
Connect CT Analyzer for CT test -> 2.4.1 on page 24
Start Test soft key
Skip Test soft key
Cancel Test soft key
Test execution: CT test
Test finished message -> 4.3, step 11. on page 54
View results -> 4.4 on page 55
Disconnect or perform new test -> 4.5 on page 57

4 Running a CT Test (Detailed)

This chapter provides a detailed description how to run a CT test using the *CT Analyzer*. Follow the sections 4.1 to 4.5 in the given order.

The example CT test described below does not use the guesser function, which is an aid for the user to find out single unknown name plate data of a CT, for example if parts of the CT's name plate are unreadable. For detailed information about the guesser function, please refer to chapter 7 on page 131.

When working with the *CT Analyzer*, always observe the safety rules given in section 2.1 on page 21.

Note: The CT may make humming or buzzing noises of varying frequency during the CT test. This is completely normal and does not indicate a defective CT.

Warning: Do not touch the equipment under test or the measurement leads while the red LED on the *CT Analyzer* is flashing. Never connect or disconnect measurement leads while the red LED on the *CT Analyzer* is flashing.

As long as the red LED is flashing, the output is active and lethal voltages can occur due to the high energy stored in external inductors.

Warning: Always make sure that the *CT Analyzer* output is connected to the correct side of the current transformer according to the wiring instructions given in sections 2.4 and 2.5. Accidentally mixing up the windings can cause life-threatening voltages within the transformer and/or destroy the connected CT or the *CT Analyzer*!

Warning: Feeding test voltage to a tap of a **multi-ratio CT** can cause life-threatening voltages on other taps with higher ratios. Do not touch these taps!

4.1 Setting Up the CT Analyzer

1. Set up the *CT Analyzer* as described in section 2.2 on page 22.

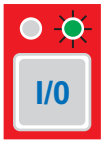
4.2 Preparing and Configuring the Test

1. Proceed as follows to display the **CT-Object** card with a new CT test.

   If the *CT Analyzer* is already switched on:

   – If necessary, display the **CT-Object** card and then press the **Main** soft key to display the main menu.
   – In the main menu, select "New CT Test" and press the **OK** soft key to initialize a new CT test.
   – The display shows the **CT-Object** card, ready to start a test.

   If the *CT Analyzer* is switched off:



   – Switch the *CT Analyzer* on.
   – After the boot process is finished, the green LED is on and the red LED is off.
   – The display shows the **CT-Object** card, ready to start a test.

2. For reasons of simplicity, we do not want to perform a residual magnetism measurement in our example CT test described here. Press the **Select Cards** soft key in the **CT-Object** card to open the **Select Cards** page. Check, and if necessary make the following test card selection (see Figure 4-1):

   The following test cards are required: **CT-Object**, **Burden**, **Primary Winding Resistance**, **Secondary Winding Resistance**, **Excitation**, **Ratio** and **Assessment**.

   The **Residual Magnetism** test card is not required. Deselect it if necessary.

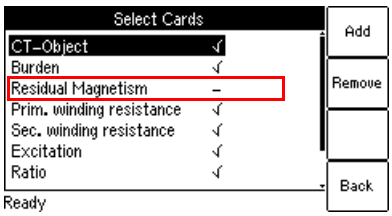


Figure 4-1 **Select Cards** page

When finished, press the **Back** soft key to return to the **CT-Object** card.

3. Enter the CT name plate data listed in the table below to the **CT-Object** card (see Figure 4-2).

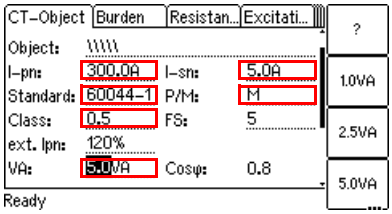


Figure 4-2 **CT-Object** card with name plate data entered

I-pn	Rated primary current of the CT.
I-sn	Rated secondary current of the CT.
Standard	Standard to be used for the CT test and the test assessment.
P/M	CT type. Set "P" for a protection CT or "M" for a metering CT.
Class	Rated accuracy class of the CT. This field becomes available after selecting the CT type (protection CT or metering CT).
VA	Rated power of the CT. **Note:** For protection CTs of the IEEE C57.13 classes C, K and T, the VA parameter is not available. Enter the rated secondary terminal voltage V_b instead (see also "Specific parameters and settings displayed for IEEE C57.13 protection CTs" on page 98).

Note: Depending on the selected standard and CT type, other or further CT data may be necessary for a correct assessment. If the "Check "*" settings before start" option is enabled in the default test settings (see section 5.7.3 on page 70), all parameters that are required for assessment are marked by a star "*" in the **CT-Object** card. In this case, no automatic assessment will be available if you do not enter data for one or more parameters marked by a star "*" (see section 6.2.3 on page 82).

4. If you enabled the **Burden** test card in step 2., display the **Burden** card and specify the test current for the burden measurement. Use the default test current derived from the I_{sn} previously entered in the **CT-Object** card or enter a test current of your choice to the "I-test" parameter.

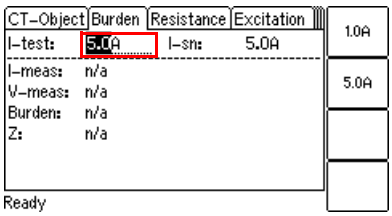
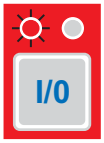


Figure 4-3 Defining the test current in the **Burden** card

4.3 Running the Automatic Test and Connecting the CT Analyzer



1. Start the test by pressing the I/0 key. The red LED flashes to indicate that the CT test is running.
2. If you enabled the **Burden** test card in section 4.2, step 2. on page 50 a message is displayed, asking you to change the wiring for the burden test. Connect the burden as described in chapter 2.
   - Make sure that the red LED on the *CT Analyzer* is off.
   - Refer to section 2.4.2 on page 26 for detailed information on how to connect the *CT Analyzer* for the burden test.
   - You can display the connection diagram by pressing the ? key while the wiring check message is displayed.

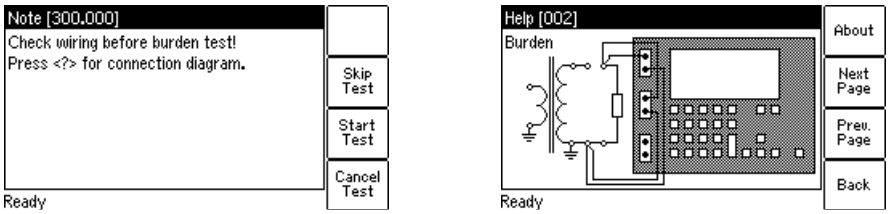


Figure 4-4 Burden test: Wiring check message (left) and wiring diagram (right)

3. Press the **Start Test** soft key to execute the automatic burden test.

   Note: If you do not want to perform the burden test, press **Skip Test** to skip the burden test and continue with the next test step or **Cancel Test** to abort the complete test.

Note: If the "Continuous burden measurement" option is enabled in the Settings (see section 5.7.3 on page 70), the burden test has to be stopped manually by pressing the I/0 key.

4. If you enabled the **Primary Winding Resistance** test card in section 4.2, step 2. on page 50, a message is displayed, asking you to change the wiring for the primary winding resistance measurement. Connect the primary winding of the CT as described in chapter 2.
   - Make sure that the red LED on the *CT Analyzer* is off.
   - Refer to section 2.4.3 on page 27 for detailed information on how to connect the *CT Analyzer* for the primary resistance measurement.
   - You can display the connection diagram by pressing the ? key while the wiring check message is displayed.

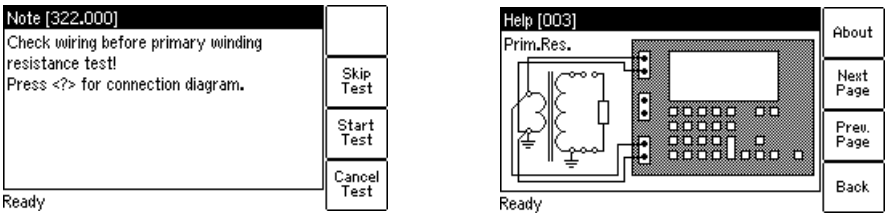


Figure 4-5 Primary winding resistance measurement: Wiring check message (left) and wiring diagram (right)

5. Press the **Start Test** soft key to execute the automatic primary winding resistance measurement.

   Note: If you do not want to perform the primary winding resistance measurement, press **Skip Test** to skip the primary winding resistance measurement and continue with the CT test or **Cancel Test** to abort the complete test.

6. A message is displayed asking you to change the wiring for the **CT test**. Connect the CT to the *CT Analyzer* as described in chapter 2.
   - Make sure that the red LED on the *CT Analyzer* is off.
   - Refer to section 2.4.1 on page 24 for detailed information on how to connect the *CT Analyzer* for the CT test.
   - Be sure that the polarity of all wires is correct.
   - You can display the connection diagram by pressing the ? key while the wiring check message is displayed.

   Note: If you do not want to execute the CT test, press the **Skip Test** soft key instead of changing the wiring. This will skip the CT test and immediately perform the demagnetization cycle to finish the test.

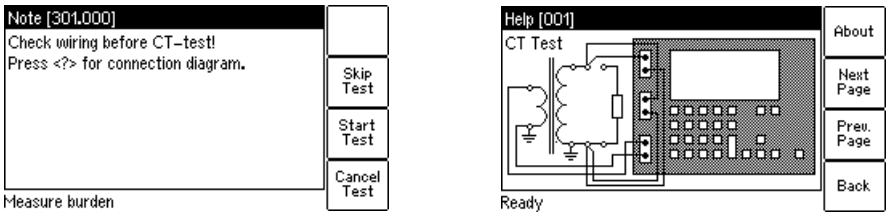


Figure 4-6 CT test: Wiring check message (left) and wiring diagram (right)

7. Press the **Start Test** soft key to execute the automatic CT test.

   Note: If you do not want to perform the CT test, press **Skip Test** to skip the CT test or **Cancel Test** to abort the complete test.

8. Automatic test step 1: CT resistance measurement

   The *CT Analyzer* measures the secondary winding resistance of the CT.

9. Automatic test step 2: Determination of the excitation characteristic

   The *CT Analyzer* measures the excitation curve and determines the knee point and other important CT data.

10. Automatic test step 3: Ratio measurement

    The *CT Analyzer* then measures the current ratio error, the phase error, the composite error and the polarity. The *CT Analyzer* calculates the ratio error for the operating burden (parameter "Burden" in the **CT-Object** card) and the nominal burden (parameter "VA" in the **CT-Object** card).

11. "Test finished" message

When the test is over, the red LED stops flashing and the green LED is on.

The *CT Analyzer* displays a "Test finished" message showing the status of the test execution and the overall test assessment (see Figure 4-7).

Press any key on the keyboard to close this message.

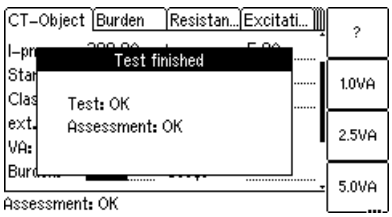


Figure 4-7 **Test finished** message when the test is over

Note: The test results and settings of each test finished with the "Test ok" status are automatically stored to the file **OMICRON\AutoSave\ CTAnalyzer.xml** on the Compact Flash card. The existing CTAnalyzer.xml file is overwritten with each successful test. Tests that could not be finished successfully or that were aborted by the user are not stored and thus do not overwrite the existing CTAnalyzer.xml file.

4.4 After the Test is Finished

After the test is finished, the **CT-Object** card displays the CT data determined during the test (refer to Figure 4-8).

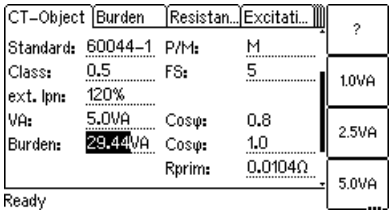


Figure 4-8 **CT-Object** card after the test is finished

Now, you can enter the "Location" and "Object" details and save the test (use the cursor keys to scroll within the card and select edit fields).

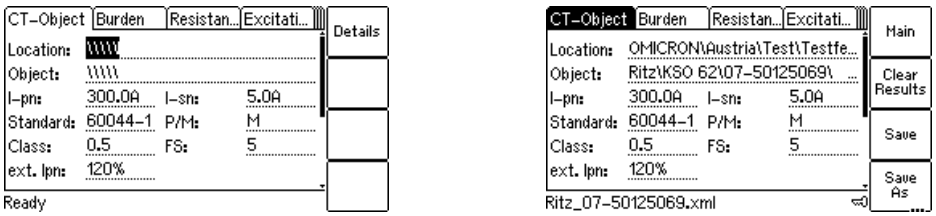


Figure 4-9 **CT-Object** card after the test, ready to enter location details (left) and after saving the test (right)

The assessment of the individual parameters can be viewed on the **Assessment** card (Figure 4-10).

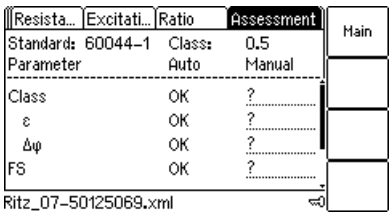


Figure 4-10 **Assessment** card after the test is finished

If desired, you can view the individual measurement results acquired during the test by viewing the **Burden**, **Resistance**, **Excitation** and **Ratio** cards, as shown in the following figures 4-11 to 4-14.

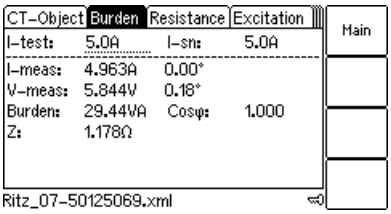


Figure 4-11 **Burden** card with measurement results after the test is finished

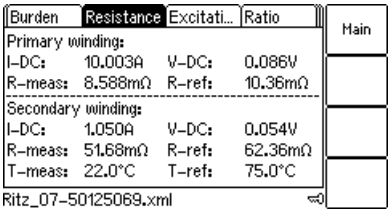


Figure 4-12 **Resistance** card with measurement results after the test is finished

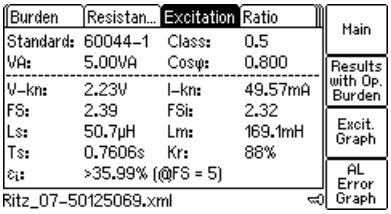


Figure 4-13 **Excitation** card with measurement results after the test is finished

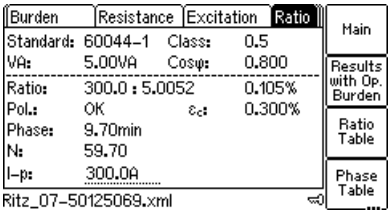


Figure 4-14 Ratio error and phase displacement at operating burden after the test is finished

4.5 Disconnection

After the CT test is finished, disconnect the CT under test from the *CT Analyzer*.

1. Wait until the red LED on the *CT Analyzer* is off.

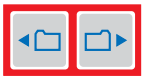
Warning: Never disconnect measurement leads while the red LED on the *CT Analyzer* is flashing. As long as the red LED is flashing, the output is active and lethal voltages can occur due to the high energy stored in external inductors.

2. Disconnect the measurement leads starting at the *CT Analyzer*.

5 Operating and Configuring the CT Analyzer

5.1 Working in the User Interface

5.1.1 Displaying a Specific Card



To display a specific card, select the card by pressing the card selection keys. The card's tab showing the name of the selected card is then highlighted (see Figure 5-1).

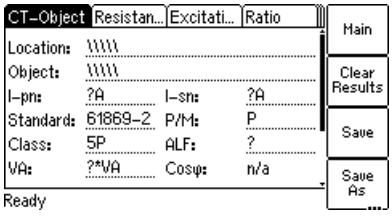


Figure 5-1 **CT-Object** card selected

5.1.2 Using the Soft Keys

Using the soft keys you can operate the *CT Analyzer* and change the user interface level of the software.

The functionality of the soft keys is context-dependent, i.e., the software offers different functions or selectable sets of parameters depending on the focus (i.e., depending on which card or field is highlighted or selected in the user interface).

If the lowermost soft key description field contains 3 points (see **Save As** in Figure 5-1), additional soft key functions are available. Then you can switch the set of displayed soft keys using the ... key located below the soft keys (see Figure 5-2).

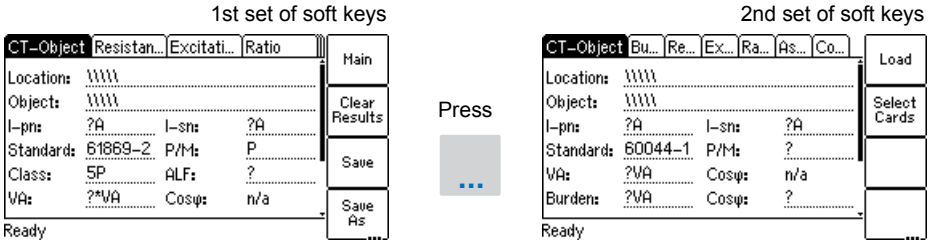
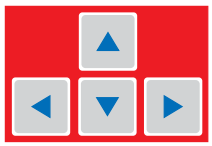


Figure 5-2 Switching the set of soft keys in the **CT-Object** card

5.1.3 Editing a Card



To open the edit mode for a displayed card, press the ▼ cursor key. The card's tab is then no longer highlighted (see Figure 5-3). Use the cursor keys to move the cursor and to select the desired edit field. Some edit fields have soft keys assigned. The soft keys available for an edit field are displayed if the field is selected.

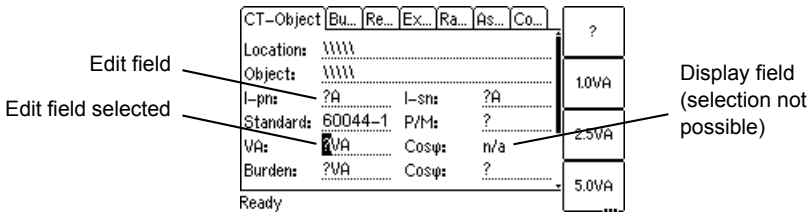


Figure 5-3 Edit field selected in the **CT-Object** card

Proceed as follows to edit a card:

1. Select the edit field using the cursor keys.
2. Enter or edit the value or text:
   - Select an entry offered by the soft keys (if available)
   - or enter the value or text using the keyboard and then press the ↵ key to confirm your input or use the ESC key to leave an edit field without applying and saving the entry.
3. Leave the edit mode either by moving the cursor to the card's tab using the ▲ cursor key or by pressing the ESC key. The focus is then set to the card's tab again (tab highlighted).

5.2 The Main Menu

How to get there:

Press the **Main** soft key in any test card

-> **Main Menu**

The Main Menu can be opened from any test card by pressing the **Main** soft key. The items in the list can be selected using the ▲ ▼ cursor keys. When an item is selected (highlighted), the soft keys are labeled with the functions available for this specific item.

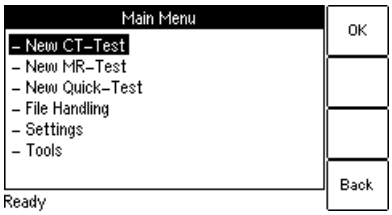


Figure 5-4 **Main Menu** page

5.3 New CT-Test

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- New CT-Test

OK soft key

-> **CT-Object** card

By selecting "New CT-Test" in the main menu and then pressing the **OK** soft key, a new CT test with the default parameter settings is loaded and displayed in the **CT-Object** card. Some of the default values can be defined in the default test settings (see section 5.7 on page 65).

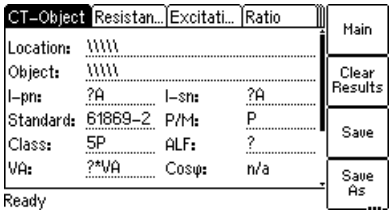


Figure 5-5 **CT-Object** card with default test settings after initializing a new CT test

Note: For more detailed information about the parameters and fields in the **CT-Object** card, please refer to section 6.2 on page 80.

5.4 New MR-Test

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- New MR-Test

OK soft key

-> **CT-Object** card

Using the "New MR-Test" option in the main menu you can initialize a new multi-ratio CT test using the optional *CT SB2* switch box.

This option is only available if you have purchased a corresponding license. For more detailed information about multi-ratio CT testing using the *CT SB2*, please refer to the CT SB2 User Manual.

5.5 New Quick-Test

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- New Quick-Test

OK soft key

-> **CT-Quick** card

Using the "New Quick-Test" option in the main menu you can open the optional *QuickTest* feature. With this feature you can use the *CT Analyzer* as a multimeter or perform polarity checks using the *CPOL* polarity checker.

This option is only available if you have purchased a corresponding license. For more detailed information about *QuickTest*, please refer to chapter 8 on page 135.

5.6 File Handling

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- File Handling

Select soft key

-> **File Menu** page

In the **File Menu** page you can access all available file operation functions by selecting the entry using the ▲ ▼ cursor keys and then pressing the **Select** soft key.

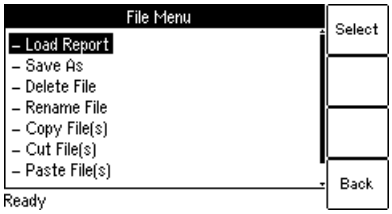


Figure 5-6 **File Menu** page

5.6.1 Available Functions

Load Report	Loading an existing report or settings file from the Compact Flash card. You can also load a file by pressing the **Load** soft key in the **CT-Object** card.
Save As	Saving the current file to the Compact Flash card. Saving a file is described in detail on page 64.
Delete File	Deleting a selected file or folder from the Compact Flash card. Only empty folders can be deleted. If you try to delete a folder still containing files or subfolders, an error message is displayed. To select several neighboring files at a time, keep the ⇧ key pressed while selecting the files or folders using the ▲ ▼ cursor keys.
Rename File	Renaming a selected file on the Compact Flash card. Only files can be renamed. Renaming of folders is not possible on the *CT Analyzer*.
Copy / Cut / Paste File(s)	Copying or cutting a file on the Compact Flash card and pasting it at another location on the Compact Flash card. Copying/cutting and pasting a file is described in detail on page 64.
Format CF card	Formatting the Compact Flash card. All data on the Compact Flash card will be lost!

Note: In the *CT Analyzer* file system, the root directory can contain a maximum of 240 files and the file name length (incl. the path) is limited to 240 characters.

5.6.2 Working in the File System

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- **File Handling**

Select soft key

File Menu:
- **Load Report** or
- **Save As** or
- **Delete File** or
- **Rename File** or
- **Copy File(s)** or
- **Cut File(s)** or
- **Paste File(s)**

After selecting one of the available file operation functions in the **File Menu**, the file system card is displayed showing the current path in its title bar and the file system elements in the card area (refer to Figure 5-7).

Navigating in the file system

- To open a folder, select its entry (see Figure 5-7, left) using the ▲ ▼ cursor keys and then press the ↵ key.
- To go one level higher in the directory structure, select the "one level higher" entry ↑.. and then press the ↵ key.

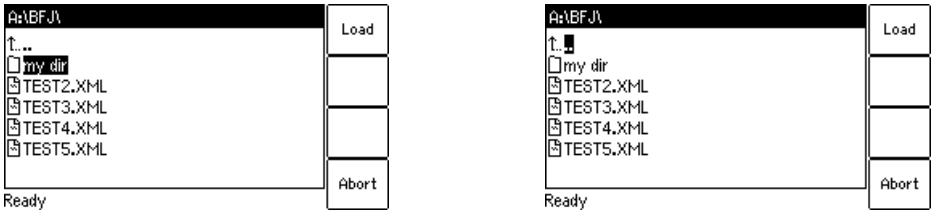


Figure 5-7 File system card for loading a report

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- **File Handling**

Select soft key

File Menu:
- **Save As** or
- **Paste File(s)**

Creating a new folder

Creating a new folder is only possible for the functions **Save As** and **Paste File(s)** of the **File Menu**.

To create a new folder in the file system, select **Save As** or **Paste Files(s)** in the file menu and then navigate to the desired location in the file system where you want to create the new folder. Then press the **New Dir** soft key. A new folder with an empty name is created. Enter a name for the folder and press the ↵ key.

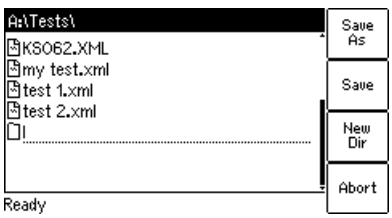


Figure 5-8 File system card after creating a new folder

Note: In the *CT Analyzer* file system, a directory can contain a maximum of 240 files and the maximum file name length is 240 characters. Renaming of folders is not supported by the *CT Analyzer*.

Saving a file

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- File Handling

Select soft key

File Menu:
- Save As

1. Open the file menu and select **Save As**.

   Note: You can also save a file by pressing the **Save** or the **Save As** soft key in the **CT-Object** card.

2. Navigate to the desired folder in the file system where you want to save the file:
   - If you like to save the file with the same name, press the **Save** soft key. A warning will pop up asking whether the existing file should be overwritten or not.
   - If you want to use a similar file name as an existing one in the selected folder, select this file using the ▲ ▼ cursor keys and press the **Save As** soft key or the ↵ key. A new `*.xml` file entry with the selected file name is added. Edit this file name and then press again **Save**, **Save As** or the ↵ key.

Note: The test results and settings of each test finished with the "Test ok" status are automatically stored to the file **OMICRON\AutoSave\CTAnalyzer.xml** on the Compact Flash card. The existing CTAnalyzer.xml file is overwritten with each successful test. Tests that could not be finished successfully or that were aborted by the user are not stored and thus do not overwrite the existing CTAnalyzer.xml file.

Copying / cutting and pasting a file on the Compact Flash card

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- File Handling

Select soft key

File Menu:
- Copy File(s) or
- Cut File(s)

Note: Copying / cutting and pasting folders is not possible with the *CT Analyzer*.

1. Open the file menu and select **Copy File(s)** or **Cut File(s)**.
2. The file system card appears. Navigate to the desired file you want to copy or cut.
3. Highlight the file and then press the **Copy** (or **Cut**) soft key.

   To go back to the main menu without copying or cutting a file, press **Abort**.

   Note: To select several neighboring files at a time, keep the ⇧ key pressed while selecting the files using the ▲ ▼ cursor keys.

4. The file system card is closed and the file menu is displayed. Select **Paste File(s)**.
5. The file system card appears again. Navigate to the desired location in the file system where you want to paste the file.
6. Press the **Paste** soft key to paste the file.

   In case of a cut/paste action, the file is not deleted from its old location until it has been pasted at its new location.

5.7 Settings

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- Settings

Select soft key

-> **Setting Menu** page

In the **Setting Menu** page you can access the device settings or the default settings for a new CT test. Select an entry using the ▲ ▼ cursor keys and then press the **Select** soft key to open the corresponding settings page.

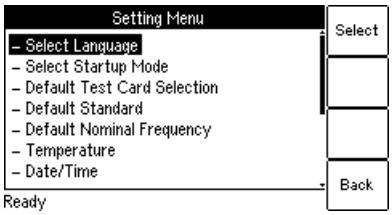


Figure 5-9 **Setting Menu** page

5.7.1 Available Options in the Settings Menu

Select Language	Selection of the user interface language. One user language can be installed on the *CT Analyzer*. The English user interface is part of the firmware and therefore always available. The second language can be installed by the user as required (refer to section 5.8 on page 73).
Select Startup Mode	Using this option you can select the default test mode the *CT Analyzer* comes up each time when it is switched on. Select the mode using the soft keys: **Single Tap**: The *CT Analyzer* automatically initializes a normal single-ratio CT test. **Multi-Ratio**: The *CT Analyzer* automatically initializes a multi-ratio CT test using the *CT SB2* switch box (see the CT SB2 User Manual for more detailed information). **Quick**: The *CT Analyzer* automatically initializes the *Quick Test* measurement function (see chapter 8 on page 135 for more detailed information).
Default Test Card Selection	Select the test cards a new CT test should contain by default. Please refer to section 5.7.2 on page 69.

Default Standard	Select the default I_{sn}, standard, class and CT type (P/M) setting to be used for a new CT test using the soft keys. "Isn": Select the default secondary current (**1A** or **5A**, or **?** if you want to use the guesser function by default). "Standard": Select **IEC 61869-2**, **IEC 60044-1**, **IEC 60044-6** or **IEEE C57.13**. "P/M": Select **Prot. CT** or **Meter. CT** (protection or metering CT), or **?** if you want to use the guesser function by default. "Class": The classes available for selection depend on the selected standard and CT type (P/M). Select a class or **?** if you want to use the guesser function by default. "Ktd" (IEC 60044-6 only): If IEC 60044-6 is selected for the standard, it is furthermore possible to select the calculation method for the K_{td} (transient dimensioning factor): **acc. to IEC 60044-6**: K_{td} is calculated exactly according to the standard. **acc. to OMICRON**: K_{td} calculation considers the CT remanence. **acc. to GB 16847**: K_{td} is calculated acc. to the Chinese standard GB16847. "TPX/Y/Z Spec. Mtd." (IEC 61869-2 protection CTs only): For IEC 61869-2 protection CTs of the classes TPX, TPY and TPY it is possible to select the default method for specifying the protection requirements used for the accuracy class assessment (refer to page 93 for more information). **by Duty**: Protection requirements specification by duty cycle and the necessary time constants (standard specification according to IEC 61869-2; the *CT Analyzer* then calculates the K_{td} automatically from the entered values). **by Ktd**: Protection requirements specification by the rated transient dimensioning factor K_{td} stated on the CT's name plate (alternative specification according to IEC 61869-2).
Default Nominal Frequency	Nominal frequency to be used for a new CT test: **16.7 Hz**, **50 Hz**, **60 Hz** or **400 Hz**.

Temperature	Select the temperature unit (**°C** or **°F**) and the default values for the ambient temperature and the reference temperature (for winding resistance measurement and calculation).
Date/Time	Clock settings for the device-internal clock.
Display Contrast	Display contrast adjustment.
Accur. Limiting Error Graph	Enable or disable the accuracy limiting error graph. This graph is primarily required for Chinese standards. It shows the maximum possible primary current (K * I_{pn}) that can flow over a specific burden without exceeding the accuracy limit (5% or 10%).
Start Delay	Allows the definition of a delay time of up to 10s for the actual test start after pressing the start button. You can apply the defined delay for the burden test, the residual magnetism measurememt, the primary winding resistance measurement and the secondary winding resistance measurement.
Min. VA at M cores Isn 5A	Applies to IEC 60044-1 metering CTs with I_{sn} = 5A only! Here you can set the minimum VA value used for the CT assessment to **3.75VA**. This means, selecting the **3.75VA** soft key will cause the *CT Analyzer* to assess the CT only up to a lower nominal burden limit of 3.75VA instead of 1VA. When 3.75VA is active, it is not possible to enter VA values lower than 3.75VA in the **CT-Object** card. Selecting **0VA** deactivates this option. Assessment is then performed up to a lower burden value of 1VA. This is the factory default which is suitable for most cases. You should not change it without important reason.
C57.13 electronic burdens	Applies to IEEE C57.13 metering CTs only! Enable or disable the use of the electronic burdens E-0.2 and/or E-0.04 for CT Assessment. If enabled, these values are offered in the set of soft keys available for the "VA" and "Burden" parameters in the **CT-Object** card. In this case, CT assessment is also performed for the electronic burden values in addition to the burden values defined in the standard.

Remote interface[1]	If your *CT Analyzer* is equipped with a USB interface and a RS232 interface, use this option to display the **Select remote interface port** page. On this page you can select the interface used to connect the *CT Analyzer* to a PC: **USB** or **RS232**. If equipped with both interfaces, the *CT Analyzer* will only communicate via the selected interface. It will not be recognized by the computer if the *CT Analyzer* settings do not match the interface used for connection.
Misc. Settings	Use the **Miscellaneous Settings** page to • enable or disable automatic test assessment if a parameter marked with a star "*" in the **CT-Object** card was not entered by the user prior to the test. Parameters marked with a star are mandatory parameters that are required for assessment (and possibly for the calculation of further parameters). • enable or disable continuous burden measurement. • define the class multiplication factor. • define the thresholds for the decision algorithms of the guesser function. Please refer to section 5.7.3 on page 70 for more information.

1. Only available for *CT Analyzer* devices that are equipped with a USB interface (serial number JHxxxx or newer).

5.7.2 Default Test Card Selection

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- Settings

Select soft key

Setting Menu:
- Default Test Card Selection

Select soft key

-> **Select Cards** page

Enabling or disabling **test cards for the default test** is done using the **Default Test Card Selection** option from the **Setting Menu**. In this case, the test card selection made in this page becomes effective when starting a new CT test.

If you want to enable or disable **test cards for your currently active test** only, press the **Select Cards** soft key in the **CT-Object** card. In this case, the test card selection made in this page is immediately effective after pressing the **Back** soft key.

To enable or disable a test card, select its entry using the ▲ ▼ cursor keys and then press the **Add** or **Remove** soft key. Enabled cards are marked with a checkmark, see Figure 5-10.

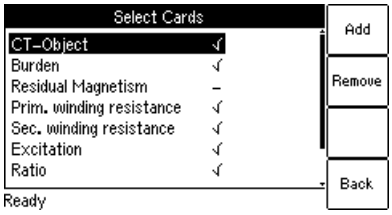


Figure 5-10 **Select Cards** page for selecting the default test cards

Some cards require the existence of other cards. This means that if you are adding such a card, the required other cards are automatically added, too. On the other hand, if you remove a card which is required by another card, the other card is removed, too. Figure 5-11 shows these dependencies.

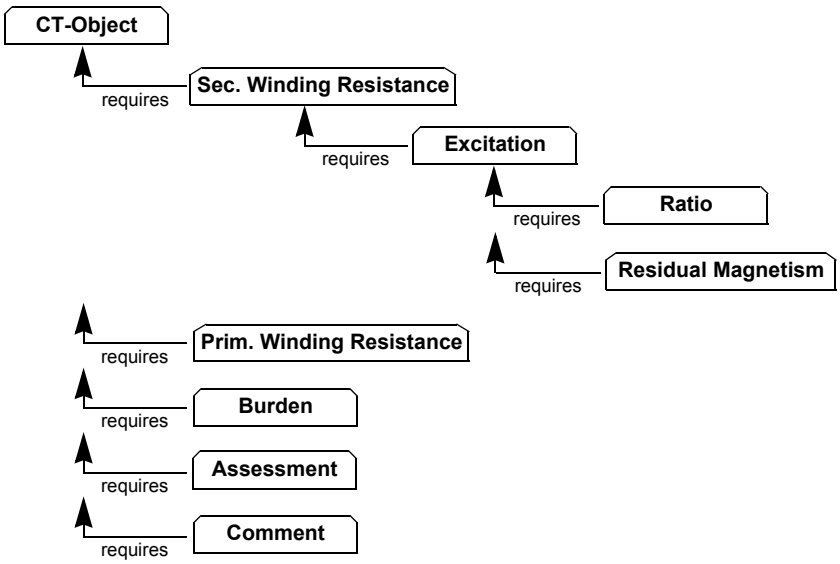


Figure 5-11 Dependencies of test cards

To save your selection and return to the setting menu press the **Back** soft key.
To return to the setting menu without saving the selection, press the ESC key.

5.7.3 Miscellaneous Settings

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- Settings

Select soft key

Setting Menu:
- Misc. Settings

Select soft key

-> **Miscellaneous Settings** page

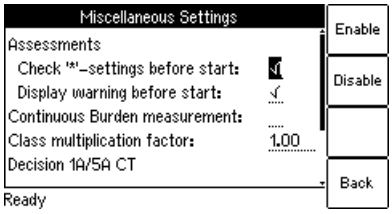


Figure 5-12 **Miscellaneous Settings** page

The following values can be defined in the **Miscellaneous Settings** page.

Assessments Check "*" settings before start Display warning before start	Depending on the selected standard and CT type, some parameters and data (for example, the nominal burden) are required to obtain a correct assessment of the CT. If the user does not specify these data prior to the test, the automatic assessment function of the *CT Analyzer* possibly performs the assessment based on the actual values determined for the CT during the test and not based on the CT's nominal data stated on the name plate. "Check "*" settings before start" If this option is enabled, the *CT Analyzer* checks whether the user has entered all necessary values and data relevant for an automatic assessment prior to the test start. The respective parameters are then marked by a star ("*") in the **CT-Object** card. If the user did not enter data for one or more of these mandatory parameters, no automatic assessment is performed and the *CT Analyzer* displays an "Assessment not available" message after the test is finished. This option can be used to avoid an automatic assessment if the user did not enter all required parameters and CT data prior to the test. "Display warning before start" This option is only relevant if the "Check "*" settings before start" option is enabled. It is enabled automatically when enabling the "Check "*" settings before start" option but can be disabled manually. Enabling the "Display warning before start" option displays a corresponding warning message prior to the test start if the user did not enter data for one or more of the mandatory parameters that are required for assessment.
Continuous burden measurement	Normally, the *CT Analyzer* stops the burden test automatically as soon as it obtains stable measurement values for the connected burden. If this option is enabled, the burden measurement is not stopped automatically but instead performed continuously until the user stops it manually by pressing the I/0 key.

Class multiplication factor	The default value for the class multiplying factor can be set. This default is used when the *CT Analyzer* is switched on or if a new CT test is selected in the main menu. The class multiplying factor increases the assessment level for the ratio test. For example, a class multiplier of 0.5 means that the maximum accepted tolerance for the ratio error is only half the standard tolerance. Possible values: 0.25 to 1.00. Default: 1.00
Decision 1A/5A CT	If the guesser function is active, the device uses the measured winding resistance to decide whether the CT is a 1A or 5A CT. This value specifies the decision threshold. Possible values: 0.5 to 2Ω. Default: 1Ω. If the measured winding resistance is higher than the defined value, the guesser function decides that the CT's nominal secondary current is 1A. Otherwise the secondary current is 5A.
Decision P/M CT	If the guesser function is active, the device uses the measured knee point voltage to decide whether the measured CT is a protection CT or a metering CT. This value specifies the decision threshold. If the knee point voltage is higher than the defined value, the guesser function decides that the measured CT is a protection CT. Otherwise it is a metering CT. • "1A: Prot. CT, if V-kn >" Possible values: 50 to 300V. Default: 100V. • "5A: Prot. CT, if V-kn >" Possible values: 15 to 60V. Default: 20V.

The **Reset Values** soft key resets all values to their default values.

5.8 Tools (Update Functions)

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- Tools

Select soft key

-> **Tools Menu** page

From the **Tools Menu** page you can access the update functions of the *CT Analyzer*.

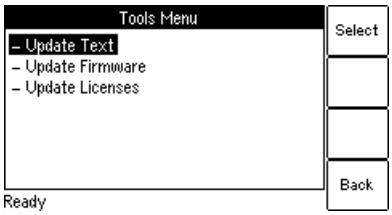
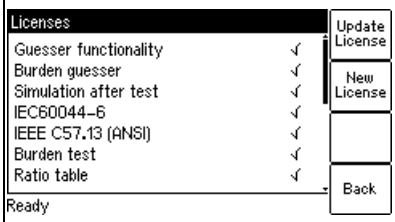


Figure 5-13 **Tools Menu** page

5.8.1 Available Functions

Update Text	Using this item you can install a new user interface language file. The file system page opened after selecting **Update Text** only displays files named **CTUser_*.bin**. Please refer to section 5.8.2 on page 74.
Update Firmware	Using this item you can update the firmware of your *CT Analyzer*. The file system page opened after selecting **Update Firmware** only displays files named **CTAnalyzer.bin**. Please refer to section 5.8.3 on page 75.

Update Licenses	This function allows to add additional licenses to your *CT Analyzer*.  Using the **Update License** soft key you can read a license file from the Compact Flash card. Using the **New License** soft key you can add new licenses manually. For information on how to receive new licenses or a new license key for additional functions, please contact your local OMICRON distributor or the OMICRON support.

5.8.2 Update Text

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- Tools

Select soft key

Tools Menu:
- Update Text

-> File system card

Note: Instead of using the **Update Text** function of the *CT Analyzer* you can also use the *Firmware Update* PC tool contained in the *CT Analyzer PC Toolset*. For detailed information, please refer to the help system of the *CT Analyzer PC Toolset*.

Using this function you can install a new user interface language file. The new language installed is then available for selection in the **Language** page.

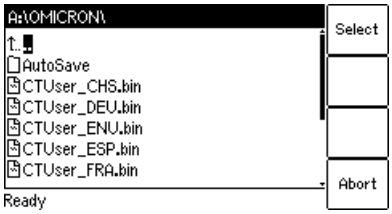


Figure 5-14 File system card for selecting a new language file

To install a new language, select the corresponding file **CTUser_xxx.bin** in the directory **A:\OMICRON** on the Compact Flash card using the ▲ ▼ cursor keys and press the **Select** soft key.

English is contained in the firmware and does not require a user language file.

Caution: Only install language files that are included in the package of the installed firmware version. If you install a language file that **does not belong to the same package**, the user interface may become unreadable.

Refer to the OMICRON website for available languages or ask your distributor for a special language file.

If the text update process is interrupted or fails, the device displays an error message and automatically resets the user interface to English when it is switched on the next time.

Press **Abort** to return to the tools menu without installing a new language.

5.8.3 Update Firmware

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- Tools

Select soft key

Tools Menu:
- Update Firmware

-> File system card

Note: Instead of using the **Update Firmware** function of the *CT Analyzer* you can also use the *Firmware Update* PC tool contained in the *CT Analyzer PC Toolset*. For detailed information, please refer to the help system of the *CT Analyzer PC Toolset*.

Using this function you can install new device firmware.

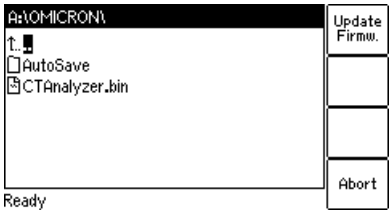


Figure 5-15 File system card for selecting a new firmware file

To perform a firmware update, a corresponding firmware file **CTAnalyzer.bin** has to be available in the directory **A:\OMICRON** on the Compact Flash card.

To update the firmware, select the desired firmware file **CTAnalyzer.bin** using the ▲ ▼ cursor keys and press the **Update Firmw.** soft key.

Note: The firmware update process may take some minutes. If the update process is interrupted or fails, switch the *CT Analyzer* off and on again. The device then tries to perform the firmware update again automatically.

It is also possible to install older firmware. In this case, the user interface text is deleted and the device automatically changes to the English user interface. After you have downgraded the firmware, you also have to install the user interface language file of this (older) firmware package.

After the installation of new firmware, the user interface language automatically changes to English if the installed user interface text is no longer compatible. If you are using a user interface language other than English, install the corresponding new user interface language file delivered with the new firmware.

Press **Abort** to return to the **Tools Menu** page without updating the firmware.

5.9 CT Analyzer Help System

The *CT Analyzer* provides a context-sensitive help system. Pressing the ? key displays a help page, the content of which depends on where the focus was set before the ? key was pressed.

For example:

- If the focus is set to the **CT-Object** card's tab, pressing the the ? key displays a help page showing the wiring for a CT test.
- If the focus is set to the **Burden** card's tab, pressing the the ? key displays a help page showing the wiring for a burden test.
- If a parameter field in the **CT-Object** card or the **Assessment** card is selected with the cursor, pressing the the ? key displays a help page with explanatory texts for this specific parameter.

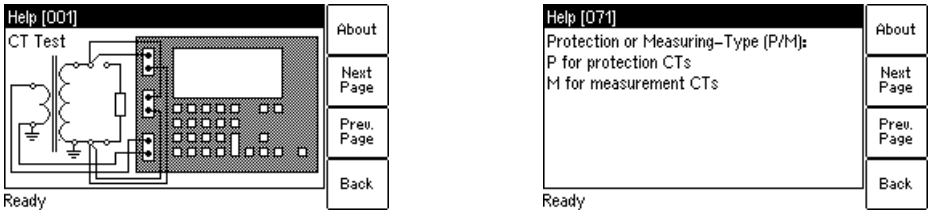


Figure 5-16 Help system showing the wiring diagram for a CT test (left) and explanatory text for a parameter (right)

When the help system is displayed, you can use the **Next Page** and **Prev. Page** soft keys to scroll through the available help pages. Pressing the **About** soft key opens a page with information about the *CT Analyzer* hardware, the installed firmware version, the serial number, etc.

5.10 Operating the CT Analyzer from a Computer

It is also possible to operate the *CT Analyzer* remote controlled from a computer. Diverse software tools are available from OMICRON for this purpose.

For a detailed description, please refer to the help system of the *CT Analyzer PC Toolset*.

6 The CT Analyzer Test Cards

6.1 Overview of Test Cards

The following table provides an overview of all test cards available for the *CT Analyzer*. **The set of test cards actually available on your *CT Analyzer* depends on your purchased license(s).**

Note: For up-to-date information about available licenses for the *CT Analyzer* please refer to the OMICRON website or contact your OMICRON sales contact.

Card	Short description
CT-Object	This card contains the basic CT data and is always required to perform a CT test. Refer to page 80.
Burden	This card is used to measure a current transformer's secondary burden with AC current. Refer to page 100.
Res. Magnetism	This card is used to measure the residual magnetism of CTs. Refer to page 102.
Resistance	This card is used to measure the secondary winding resistance and the primary winding resistance of the CT. Refer to page 105.
Excitation	This card is used to trace the excitation curve of the current transformer and to determine further CT-specific parameters. Refer to page 108.
Ratio	This card is used to measure the current ratio of the CT considering the external load or the nominal burden and to determine the current ratio error and the phase displacement. Refer to page 119.
Assessment	This card shows the automatic assessment of the tested parameters according to the selected standard. In this card you can also perform a manual assessment. Refer to page 125.
Comment	In this card you can enter any text, e.g. additional notes regarding the test. Refer to page 130.

6.2 CT-Object Card

The **CT-Object** card is the most important card and always required for all types of tests. In this card all necessary settings for a test are done. Some of the settings contained in the **CT-Object** card are also shown in other cards for information.

Note: The **CT-Object** card is the top user interface level. Pressing the ESC key several times will always bring you back to the **CT-Object** card.

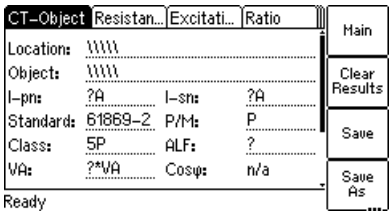


Figure 6-1 **CT-Object** card with default settings after initializing a new CT test

6.2.1 Available Soft Keys

Clear Results	Clears the results of the previous test and enables to start a new test. All measurement results as well as all the parameters previously determined using the "guesser function" are cleared. Text entries for "Location" and "Object" remain unchanged.
Save	Saves the test results and test settings to the currently loaded *CT Analyzer* report file. If the test results have not been saved yet, the **Save As** dialog is opened. Saving a file is described on page 64.
Save As	Saves the test results and test settings to a new .xml file. Saving a file is described on page 64.
Load	Allows to load a test stored on the Compact Flash card in order to check its results, to recalculate the results with different settings or to use its settings for a new test. **Note:** Recalculation of the existing CT test results in order to verify the behavior of the CT at different burdens or primary currents can be performed by changing the burden value on the **CT-Object** card or the primary current on the **Ratio** card. The recalculated results can then be stored again like for a regular test.

Select Cards	Opens the **Select Cards** page where you can select the test cards for the current test. The **Select Cards** page is described on page 69. **Note:** When loading a new CT test from the main menu (using the "New CT-Test" entry), the test card selection defined in the default test settings is used for this new test. The card selection performed in the **CT-Object** card will then be discarded.

6.2.2 Information Fields to be Filled by the User

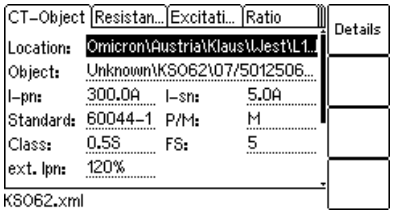


Figure 6-2 Editing the location settings in the **CT-Object** card

The "Location" and "Object" text fields are only used for reporting and documentation purposes. They can be filled by the user after the test is finished. These fields provide information about the location of the CT and the CT itself. The content of these fields is defined in the **Location settings** page and the **Object settings** page, respectively.

To open these settings pages, position the cursor on the "Location" or the "Object" field and then press the **Details** soft key or the ↵ key.

Location settings page	The **Location settings** page provides the following text fields. Each field can contain a maximum of 40 numbers or letters. • Company, Country, Station, Feeder: Information where the CT is installed. • Phase: Phase to which the CT is connected. • IEC-ID: IEC-ID of the CT or freely definable information.
Object settings page	The **Object settings** page provides the following text fields. Each field can contain a maximum of 40 numbers or letters. • Manufact.: Manufacturer of the CT under test. • Type: Type number or description of the CT under test. • Serial No.: Serial number of the CT under test. • Core: Number of the tested core. • Tap: Description of the tap (e.g. 1S1-1S3, X1-X4, ...). • Optional 1: Optional field for free use.

6.2.3 Parameters and Settings Used or Determined by the Test Process

The fields described in this section are used and/or determined by the test process.

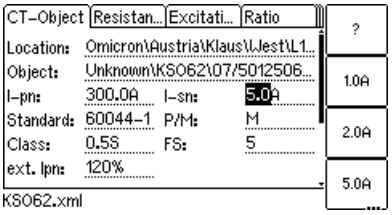


Figure 6-3 Editing the **CT-Object** card

Note: If the "Check "*" settings before start" option is enabled in the default test settings (see section 5.7.3 ”Miscellaneous Settings” on page 70), no automatic assessment will be available if you do not enter data for a parameter that is relevant for assessment. Such parameters are marked by a star "*" in the *CT Analyzer* user interface and in the following tables.

Common Parameters and settings displayed for all standards, CT types and classes

The table below lists all parameters and settings that are displayed for all standards, CT types and classes.

In addition to these common parameters, specific additional parameters are displayed in the **CT-Object** card depending on the selected standard, CT type (protection or metering CT) and class. For these specific parameters, please refer to the tables on pages 87 to 99.

Parameter	Description
I-pn	Rated primary current. Possible values: 1 to 99000A or **?**[1] soft key. Default: ?.
I-sn	Rated secondary current. Possible values: 0.0001 to 25A or soft keys **1.0**, **2.0**, **5.0**, **1.0A/√3**, **2.0A/√3**, **5.0A/√3** or **?**[1]. Default: ?.
Standard	Standard according to which the test has to be performed. Possible values: Soft keys **IEC 60044-1**, **IEC 60044-6**, **IEEE C57.13** or **IEC 61869-2** Default: Standard defined in the default test settings. **Note:** Using the IEEE C57.13 standard for transformers with gapped cores may possibly deliver incorrect results.
P/M *	Definition of CT type: Protection or metering CT. Possible values: Soft keys **Prot. CT**, **Meter. CT** or **?**[1]. Default: As defined in the default test settings. * This parameter is relevant for assessment. No automatic assessment is available if the user did not enter data for this parameter prior to the test (see page 82).

Parameter	Description
Class *	Accuracy class of the CT. Possible values: Depending on the selected standard or **?**[1]. Default: As defined in the default test settings. This parameter is only displayed, after the parameters "Standard" and "P/M" have been defined or determined by the *CT Analyzer*. Depending on these parameters, the parameters for the CT class can be selected using the soft keys. **Note:** The class can be selected by soft keys or is determined by the *CT Analyzer* during the test. Automatic determination during the test only works for IEC 61869-2 or IEC 60044-1 metering CTs and IEEE C57.13 metering CTs. If the question mark has been entered for the "P/M" parameter, the "Class" cannot be defined by the user but is automatically determined by the *CT Analyzer* instead. * This parameter is relevant for assessment. No automatic assessment is available if the user did not enter data for this parameter prior to the test (see page 82). For IEEE C57.13 metering CTs only: An additional soft key **Assess @ VA** is available for metering CTs according to IEEE C57.13. Use this option if the accuracy class of the CT only applies to one specific burden. CT assessment is normally performed for the maximum burden specified ("VA" or "Burden" parameter) **and** all lower burdens defined in the standard. Example: If the burden specified is B-0.9, the assessment is performed for the burdens B-0.9, B-0.5, B-0.2 and B-0.1 (and the electronic burdens E-0.2 and E-0.04). Selecting the **Assess @ VA** option in addition to the class setting will cause the *CT Analyzer* to consider **only** the burden value specified prior to testing for the CT assessment. The ratio table and the phase table in the **Ratio** card then only show the error for this specific burden (see section 6.7.5 on page 123). When **Assess @ VA** is selected, the soft key changes to **Assess all VA** to enable deactivation of this option.

Parameter	Description
VA * Cos φ	Nominal burden of the CT, used to calculate the behavior of the CT at the nominal burden. Possible values: 0 to 300 VA or soft keys **1.0VA** to **30VA** or **?**[1]. Depending on the burden and the selected test standard, the corresponding cos φ is used (cos φ not editable by the user). * This parameter is relevant for assessment. No automatic assessment is available if the user did not enter data for this parameter prior to the test (see page 82). If the IEEE C57.13 standard is selected with the type "metering CT", the *CT Analyzer* offers some soft keys (e.g. **B-0.1**, **B-0.2**, **B-0.5** etc.) with standard loads for the power. If these soft keys are used, the power is calculated according to table 9 of IEEE C57.13. If the rated current is not 5 A, the resistance and inductance of the table is multiplied by the factor $\alpha = \left(\frac{5}{I_{rated}}\right)^2$ If the IEEE C57.13 standard is selected with the type "protection CT" (class C, K or T), the VA and Cos φ parameters are not accessible to the user. In this case, the user has to enter the terminal voltage V_b instead. See "Specific parameters and settings displayed for IEEE C57.13 protection CTs" on page 98.
Burden Cos φ	"Burden" and "Cos φ" are used to define the operating burden connected to the CT. These parameters are used to calculate the behavior of the CT at the operating burden (connected burden) and the corresponding cos φ. Possible values for "Burden": 0 to 300 VA or soft keys **1.0VA** to **30VA** or **?**[1]. Possible values for "Cos φ": 0 to 1. These parameters can also be changed after the test or in a loaded test report in order to check the CT behavior at different burden values. Special behavior depending on available test cards: If the test contains a **Burden** card, a question mark is automatically entered to the fields "Burden" and "cos φ" and entering the burden is not possible until the test is finished. In this case, the value determined during the burden test is automatically entered after burden measurement. If I_{sn} is defined, the burden is updated immediately after the burden test is finished. If I_{sn} is not defined (entry "?"), the burden is updated after the resistance test.
f	Rated frequency of the CT. Possible values: Integer value between 16 and 400 Hz or soft keys **16.7 Hz**, **50 Hz**, **60 Hz** or **400 Hz**. Default: Frequency defined in the default test settings.

Parameter	Description
Rprim	Specified primary winding resistance (only available if primary winding resistance measurement is enabled for the test). Possible values: 0 to 3000 ohms or soft key **?**[1]. Default: ?.
Class mult. factor	Class multiplying factor. This factor increases the assessment level for the ratio test. E.g. a class multiplier of 0.5 means that the maximum accepted tolerance for the ratio error is only half the standard tolerance. Possible values: 0.25 to 1.00 or soft key **1.0**. Default: 1.0 (as set in the device settings: **Main Menu**, entry "Settings" -> **Setting Menu**, entry "Misc. Settings").
Delta compensation	Correction factor for the ratio measurement. This factor enables the ratio measurement for CTs that are installed inside a delta winding transformer. Possible values: Soft keys **Ratio 1**, **Ratio 2/3** or **Ratio 1/3**. Default: Ratio 1. Choose "Ratio 1" if no correction is required. Choose "Ratio 2/3" if input PRIM is connected to the two terminals of that transformer winding, the CT is in series with. Choose "Ratio 1/3" if input PRIM is connected to the terminals of a transformer winding, the CT is not in series with.

1. If the question mark is entered for this parameter and a new test is started, the *CT Analyzer* automatically tries to determine the value using its integrated guesser function (see chapter 7 on page 131).

Specific parameters and settings displayed for IEC 60044-1 protection CTs

The following parameters are only displayed in the **CT-Object** card if the standard IEC 60044-1 is selected with the type "Protection CT".

Param.	Description	Available for IEC 60044-1 protection CTs, class		
		2P, 3P, 4P, 5P, 6P, 10P	2PR, 3PR, 4PR, 5PR, 6PR, 10PR	PX
ALF	Accuracy limiting factor acc. to IEC 60044-1. Possible values: Integer value from 1 to 300 or soft keys **?**[1], **5**, **10**, **15**, **20** or **30**. Default: ?.	x	x	
Rct	Specified secondary winding resistance. Possible values: 0 to 3000 ohms or soft key **?**[1]. Default: ?		x	x
Ts	Specified secondary time constant. Possible values: 0.000 to 100.0 s or soft key **?**[1]. Default: 100 s.		x	
Kx	Dimensioning factor acc. to IEC 60044-1, PX. Possible values: 1 to 300 or soft key **?**[1]. Default: ?.			x
Ek	Rated knee point e.m.f. Possible values: 0 to 20000 or soft key **?**[1]. Default: ?.			x
Ie	Accuracy limiting current acc. to IEC 60044-1, PX. Possible values: 0.03 mA to 30 A or soft key **?**[1]. Default: ?.			x
E1	User-defined e.m.f. to verify the excitation current at this specific e.m.f. Possible values: 0.1 to 20000 V or soft key **?**[2]. Default: ?.			x
Ie1	Maximum allowed excitation current at E_1. Possible values: 0.03 mA to 30000 mA or soft key **?**[3]. Default: ?.			x

1. If the question mark is entered for this parameter and a new test is started, the *CT Analyzer* automatically tries to determine the value using its integrated guesser function (see chapter 7 on page 131).
2. If the question mark is entered, half the voltage entered or measured for E_k is used.
3. If the question mark is entered, the *CT Analyzer* uses the excitation current measured at the voltage value defined at E_1. In this case, the assessment for this parameter is OK.

Specific parameters and settings displayed for IEC 60044-1 metering CTs

The following parameters are only displayed in the **CT-Object** card if the standard IEC 60044-1 is selected with the type "Metering CT".

Param.	Description	Available for IEC 60044-1 metering CTs, class 0.1, 0.2, 0.2s, 0.5, 0.5s, 1, 3, 5
FS	Instrument security factor acc. to IEC 60044-1. Possible values: Integer value from 1 to 30 or soft keys **?**[1], **FS1**, **FS1.5**, **FS2**, **FS5**, **FS10**, **FS20** or **FS30**. Default: ?.	x
ext. Ipn	Extended current rating. Possible values: 100 to 400% or soft keys **120%**, **150%**, **200%**, **300%**, **400%**. Default: 120%.	x

1. If the question mark is entered for this parameter and a new test is started, the *CT Analyzer* automatically tries to determine the value using its integrated guesser function (see chapter 7 on page 131).

Specific parameters and settings displayed for IEC 60044-6

The following parameters are only displayed in the **CT-Object** card if the standard IEC 60044-6 is selected.

Param.	Description	Available for IEC 60044-6, class			
		TPS	TPX	TPY	TPZ
Rct	Specified secondary winding resistance. Possible values: 0 to 3000 ohms or soft key **?**[1]. Default: ?	x	x	x	x
Kssc	Rated symmetrical short-circuit current factor. Possible values: 1 to 300 or soft keys **?**[1], **3**, **5**, **7.5**, **10**, **12.5**, **15**, **17.5**, **20**, **25**, **30**, **40** or **50**. Default: ?.	x	x	x	x
Tp	Primary time constant. Possible values: 0.000 to 5.000 s or soft keys **20ms**, **40ms**, **60ms**, **80ms**, **100ms** or **120ms**. T_p depends on K as follows: $T_p = \frac{K-1}{\omega}$	x	x	x	x
K	Dimensioning factor. Possible values: 1 to 1572. K depends on T_p as described above for T_p.	x			
V-al	Rated equivalent excitation limiting secondary voltage. Possible values: 0 to 9999 V or soft key **?**[1]. Default: ?.	x			
I-al	Accuracy limiting secondary excitation current. Possible values: 0.03 mA to 30 A or soft key **?**[1]. Default: ?.	x			
E1	User-defined e.m.f. to verify the excitation current at this specific e.m.f. Possible values: 0.1 to 20000 V or soft key **?**[2].	x			
Ie1	Maximum allowed excitation current at E_1 (user-defined e.m.f.). Possible values: 0.03 mA to 30 A or soft key **?**[3].	x			
Ktd	Rated transient dimensioning factor. Possible values: 1.0 to 2043 or soft key **?**[1]. Default: ?.		x	x	x

Param.	Description	Available for IEC 60044-6, class			
		TPS	TPX	TPY	TPZ
Ts	Specified secondary time constant. Possible values: 0.000 to 100.0 s or soft key **?**[1]. Default: ?.			x	x
Duty	Specified duty cycle. Using the soft keys, two different energizing cycles can be selected: **C-O** or **C-O-C-O** Default: C-O.		x	x	
t1	Duration of first current flow. The specified accuracy limit must not be reached within time t_{al1}. Possible values: 0.000 to 5.000 s or soft key **100ms**. Default: 0.1 s.		x	x	
t-al1	Permissible time to accuracy limit for first energizing period of the duty cycle. Possible values: 0.000 to 5.000 s and max. t_1 or soft key **40ms**. Default: 0.04 s.		x	x	
t2	Duration of second current flow. The specified accuracy limit must not be reached within time t_{al2}. **Note:** Only displayed if "Duty" is C-O-C-O. Possible values: 0.000 to 5.000 s or soft key **100ms**. Default: 0.1 s.		x	x	
t-al2	Permissible time to accuracy limit for second energizing period of the duty cycle. **Note:** Only displayed if "Duty" is C-O-C-O. Possible values: 0.000 to 5.000 s and max. t_2 or soft key **40ms**. Default: 0.04 s.		x	x	
tfr	Dead time between first opening and reclosure. **Note:** Only displayed if "Duty" is C-O-C-O. Possible values: 0.00 to 5.00 s or soft key **300ms**. Default: 0.3 s.		x	x	

Param.	Description	Available for IEC 60044-6, class			
		TPS	TPX	TPY	TPZ
Ktd calculation	Calculation method for transient dimensioning factor K_{td}. Select a calculation method using the soft keys: **acc. to IEC 60044-1** (calculation exactly acc. to standard), **acc. to OMICRON** (calculation considers CT remanence) or **acc. to GB 16847** (acc. to Chinese standard GB 16847). Default: As defined in the default test settings (see "Default Standard" parameter in section 5.7.1 on page 65).		x	x	

1. If the question mark is entered for this parameter and a new test is started, the *CT Analyzer* automatically tries to determine the value using its integrated guesser function (see chapter 7 on page 131).
2. If the question mark is entered, half the voltage entered or measured for E_k is used.
3. If the question mark is entered, the *CT Analyzer* uses the excitation current measured at the voltage value defined at E_1. In this case, the assessment for this parameter is OK.

Specific parameters and settings displayed for IEC 61869-2 protection CTs

The following parameters are only displayed in the **CT-Object** card if the standard IEC 61869-2 is selected with the type "Protection CT".

Param.	Description	Available for IEC 61869-2 protection CTs, class						
		protection				transient protection		
		xP	xPR	PX	PXR	TPX	TPY	TPZ
ALF	Accuracy limiting factor acc. to IEC 61869-2. Possible values: Integer value from 1 to 300 or soft keys **?**[1], **5**, **10**, **15**, **20** or **30**. Default: ?.	x	x					
Rct	Specified secondary winding resistance. Possible values: 0 to 3000 ohms or soft key **?**[1]. Default: ?		x	x	x	x	x	x
Ts	Specified secondary time constant. Possible values: 0.000 to 100.0 s or soft key **?**[1]. Default: 100 s.		x			x	x	x
Kx	Dimensioning factor acc. to IEC 61869-2. Possible values: 1 to 300 or soft key **?**[1]. Default: ?.			x	x			
Ek	Rated knee point e.m.f. Possible values: 0 to 20000 or soft key **?**[1]. Default: ?.			x	x			
E1	User-defined e.m.f. to verify the excitation current at this specific e.m.f. Possible values: 0.1 to 20000 V or soft key **?**[2]. Default: ?.			x	x			
Ie	Accuracy limiting current acc. to IEC 61869-2. Possible values: 0.03 mA to 30 A or soft key **?**[1]. Default: ?.			x	x			
Ie1	Maximum allowed excitation current at E_1. Possible values: 0.03 mA to 30000 mA or soft key **?**[3]. Default: ?.			x	x			

Param.	Description	Available for IEC 61869-2 protection CTs, class						
		protection				transient protection		
		xP	xPR	PX	PXR	TPX	TPY	TPZ
Kssc	Rated symmetrical short-circuit current factor. Possible values: 1 to 300 or soft keys **?**[1], **3**, **5**, **7.5**, **10**, **12.5**, **15**, **17.5**, **20**, **25**, **30**, **40** or **50**. Default: ?.					x	x	x
Spec.	The accuracy class assessment has to be performed for the specific protection requirements the CT is built for. According to the standard, these requirements are normally stated by the duty cycle and the time constants. However, in some cases the choice of one specific duty cycle/time constant cannot describe all protection requirements. Therefore, the *CT Analyzer* offers the possibility to specify "more general requirements" (which cover the requirements of different duty cycles and time constants) by entering the K_{td} instead. Use the soft keys to choose if you want to specify the protection requirements used for the accuracy class assessment • by specifying the duty cycle and the necessary time constants (**by Duty**, standard specification according to IEC 61869-2; the *CT Analyzer* then calculates the K_{td} automatically from the entered values) • or alternatively by specifying the rated transient dimensioning factor K_{td} stated on the CT's name plate (**by Ktd**, alternative specification according to IEC 61869-2). The setting of this parameter displays or hides the parameters K_{td}, and T_p, Duty and t_{al1} (see parameter descriptions below). Possible values: Soft keys **by Duty** or **by Ktd**. Default: As defined in the default test settings.					x	x	x

Param.	Description	Available for IEC 61869-2 protection CTs, class						
		protection				transient protection		
		xP	xPR	PX	PXR	TPX	TPY	TPZ
Ktd *	Rated transient dimensioning factor according to the name plate. **Note:** Only displayed if parameter "Spec." is "by Ktd". Possible values: 1.0 to 2043 or soft key **?**[1]. Default: ? or ?*. * If displayed, this parameter is relevant for assessment. No automatic assessment is available if the user did not enter data for this parameter prior to the test (see page 82).					x	x	x
Tp *	Primary time constant. **Note:** Only displayed if parameter "Spec." is "by Duty". Possible values: 0.000 to 5.000 s or soft keys **20ms**, **40ms**, **60ms**, **80ms**, **100ms** or **120ms**. T_p depends on K as follows: $T_p = \frac{K-1}{\omega}$ Default: ? or ?*. * If displayed, this parameter is relevant for assessment. No automatic assessment is available if the user did not enter data for this parameter prior to the test (see page 82).					x	x	x
Duty	Specified duty cycle. **Note:** Only displayed if parameter "Spec." is "by Duty". Using the soft keys, two different energizing cycles can be selected: **C-O** or **CO-CO** Default: C-O.					x	x	x

Param.	Description	Available for IEC 61869-2 protection CTs, class						
		protection				transient protection		
		xP	xPR	PX	PXR	TPX	TPY	TPZ
t-al1 *	Permissible time to accuracy limit for first energizing period of the duty cycle. **Note:** Only displayed if parameter "Spec." is "by Duty". Possible values: 0.000 to 5.000s and max. t_1 or soft key **40ms**. Default: ? or ?*. * If displayed, this parameter is relevant for assessment. No automatic assessment is available if the user did not enter data for this parameter prior to the test (see page 82).					x	x	x
t1 *	Duration of first current flow. The specified accuracy limit must not be reached within time t_{al1}. **Note:** Only displayed if parameter "Spec." is "by Duty" and "Duty" is "CO-CO". Possible values: 0.000 to 5.000s or soft key **100ms**. Default: ? or ?*. * If displayed, this parameter is relevant for assessment. No automatic assessment is available if the user did not enter data for this parameter prior to the test (see page 82).					x	x	x
tfr *	Dead time between first opening and reclosure. **Note:** Only displayed if parameter "Spec." is "by Duty" and "Duty" is "CO-CO". Possible values: 0.00 to 5.00s or soft key **300ms**. Default: ? or ?*. * If displayed, this parameter is relevant for assessment. No automatic assessment is available if the user did not enter data for this parameter prior to the test (see page 82).					x	x	x

Param.	Description	Available for IEC 61869-2 protection CTs, class						
		protection				transient protection		
		xP	xPR	PX	PXR	TPX	TPY	TPZ
t-al2 *	Permissible time to accuracy limit for second energizing period of the duty cycle. **Note:** Only displayed if parameter "Spec." is "by Duty" and "Duty" is "CO-CO". Possible values: 0.000 to 5.000 s or soft key **40ms**. Default: ? or ?*. * If displayed, this parameter is relevant for assessment. No automatic assessment is available if the user did not enter data for this parameter prior to the test (see page 82).					x	x	x

1. If the question mark is entered for this parameter and a new test is started, the *CT Analyzer* automatically tries to determine the value using its integrated guesser function (see chapter 7 on page 131).
2. If the question mark is entered, half the voltage entered or measured for E_k is used.
3. If the question mark is entered, the *CT Analyzer* uses the excitation current measured at the voltage value defined at E_1. In this case, the assessment for this parameter is OK.

Specific parameters and settings displayed for IEC 61869-2 metering CTs

The following parameters are only displayed in the **CT-Object** card if the standard IEC 61869-2 is selected with the type "Metering CT".

Param.	Description	Available for IEC 61869-2 metering CTs, class 0.1, 0.2, 0.2s, 0.5, 0.5s, 1, 3, 5
FS	Instrument security factor acc. to IEC 61869-2. Possible values: Integer value from 1 to 30 or soft keys **?**[1], **FS1**, **FS1.5**, **FS2**, **FS5**, **FS10**, **FS20** or **FS30**. Default: ?.	x
ext. Ipn	Extended current rating. Possible values: 100 to 400 % or soft keys **120%**, **150%**, **200%**, **300%**, **400%**. Default: 120 %.	x
ext. VA	Extended burden range for ratio error and phase displacement assessment according to IEC 61869-2. The assessment of the ratio error and the phase displacement is usuallly performed down to a burden of 12.5 % of the nominal burden. If the "ext. VA" parameter is set to "on", the assessment is performed for an extended range down to a burden of 1 VA if the limit of 12.5 % results in a burden higher than 1 VA. Possible values: Soft keys **On** or **Off**. Default: On.	x

1. If the question mark is entered for this parameter and a new test is started, the *CT Analyzer* automatically tries to determine the value using its integrated guesser function (see chapter 7 on page 131).

Specific parameters and settings displayed for IEEE C57.13 protection CTs

The following parameter is only displayed in the **CT-Object** card if the IEEE C57.13 standard is selected with the type "Prot. CT".

Param.	Description	Available for IEEE C57.13, class			
		C	T	X	K[1]
Vb *	Rated secondary terminal voltage. If the IEEE C57.13 standard is selected with the type "protection CT" (class C, K or T), the VA and Cos φ parameters are not accessible to the user. In this case, the user has to enter the terminal voltage V_b instead. Possible values: Integer values from 10 to 1200 V or soft keys **?**[2], **10V**, **20V**, **50V**, **100V**, **200V**, **400V** or **800V**. Default: ? or ?*. * This parameter is relevant for assessment. No automatic assessment is available if the user did not enter data for this parameter prior to the test (see page 82).	x	x		x
Vk Vk1	User-defined measuring point. User-defined measuring point 1. Possible values: Integer values from 0.1 V to 20.000 V or soft key **?**[1]. Default: ?.		x	x	
Ik Ik1	User-defined measuring point. User-defined measuring point 1. Possible values: Integer values from 0.03 mA to 30.000 mA or soft key **?**[2]. Default: ?.		x	x	
RE(20*Isn)	Ratio error at 20 * I_{sn}. Possible values: Integer values from 1 % to 99 %. Default: 10 %.			x	
Rct	Specified secondary winding resistance. Possible values: 0 to 3000 ohms or soft key **?**[1]. Default: ?			x	

1. Acc. to IEEE C57.13 (1993)
2. If the question mark is entered for this parameter and a new test is started, the *CT Analyzer* automatically tries to determine the value using its integrated guesser function (see chapter 7 on page 131).

Specific parameters and settings displayed for IEEE C57.13 metering CTs

The following parameter is only displayed in the **CT-Object** card if the IEEE C57.13 standard is selected with the type "Metering CT".

Param.	Description	Available for IEEE C57.13 metering CTs, class 0.15, 0.15s, 0.3, 0.6, 1.2
RF	Continuous current rating factor. Possible values: Value from 1.0 to 4.0 or soft keys **RF1.5**, **RF2**, **RF3** or **RF4**. Default: 2.	x

6.3 Burden Card

The **Burden** card is only available if it is enabled on the **Select Cards** page (Default Test Card Selection or **Select Cards** soft key in the **CT-Object** card).

Using the **Burden** card, a current transformer's secondary burden impedance can be measured with the selected secondary current (I_{sn}) at nominal frequency. If a current other than I_{sn} should be used to test the burden, the desired test current can be entered in the "I-test" parameter field.

No soft keys are available in the **Burden** card.

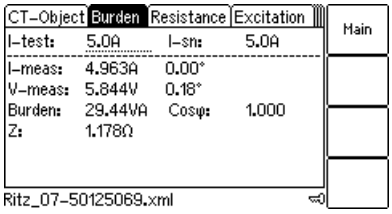


Figure 6-4 **Burden** card

If the *CT Analyzer* cannot reach the desired test current I_{test}, an overload message is displayed in the right-hand corner of the status line.

6.3.1 Test Settings

The following settings can be done in the **Burden** card.

Parameter	Description
I-test	Test current used to measure the external burden. After clearing the test results or when starting a new CT test, the test current is automatically chosen as follows: **Value for I-sn in CT-Object card** / **Value for I-test in Burden card** / **Test current used for burden test** "?" / none / 1A e.g. "?" / e.g. 5A / 5A (value of I-test) e.g. 5A / none / 5A (value of I-sn) e.g. 5A / e.g. 1A / 1A (value of I-test) It is possible to overwrite the default test current using the keyboard (0.1 to 5A). **Always verify the test current settings prior to starting the test in order to avoid damaging of the CT or other equipment.**

6.3.2 Test Results

The lower part of the **Burden** card shows the results of the burden test after the test is finished.

Parameter	Description
I-meas	Current measured during the test.
V-meas	Voltage measured at the load during the test.
Burden / Cos φ	Burden and cos φ calculated from the measured quantities. If the rated secondary current is not known, the result field will only show "n/a" as long as I_{sn} is not defined.
Z	Impedance of the burden calculated from the measured quantities.

6.3.3 Connecting the Burden and Running the Burden Test

1. Press the **Select Cards** key soft in the **CT-Object** card to open the **Select Cards** page. Enable the **Burden** test card in the **Select Cards** page. Press the **Back** soft key to apply your test card selection and return to the **CT-Object** card.

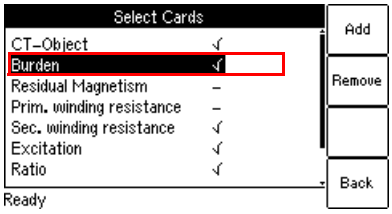


Figure 6-5 **Select Cards** page with **Burden** test card enabled

2. In the **Burden** card, use the default test current or enter the desired test current to parameter "I-test".
3. Execute the burden test as described in section 4.3 on page 52.

Possible test steps following the burden test:

- Residual magnetism measurement, see section 6.4.2 on page 103.
- Primary resistance measurement, see section 4.3, steps 4. & 5. on page 53.
- CT test, see section 4.3, steps 6. to 11. on page 54, and sections 4.4 on page 55 and 4.5 on page 57.

6.4 Residual Magnetism Card

Note: *Residual magnetism* is an optional feature. The functionality described below is only available if you have purchased a corresponding license. For further information, please contact your OMICRON sales contact or the OMICRON office nearest you.

The **Residual Magnetism** card is only available if it is enabled on the **Select Cards** page (Default Test Card Selection or **Select Cards** soft key in the **CT-Object** card).

High-transient currents or DC currents applied to the primary side of a CT can cause saturation effects inside the CT with a possible subsequent displacement of the operating point on the CT's excitation curve. The CT then has a residual magnetic flux in its core even if no current is applied on the primary side. The CT has residual magnetism.

Residual magnetism in CTs may cause erroneous tripping or prevent tripping of the connected protection relay since the behavior of the CT is no longer as specified and expected.

Using the **Residual Magnetism** card it is possible to measure the residual magnetism of CTs.

The *CT Analyzer* performs demagnetization of the CT after the test is finished. Please note that the residual magnetism the CT had prior to testing gets lost through the test.

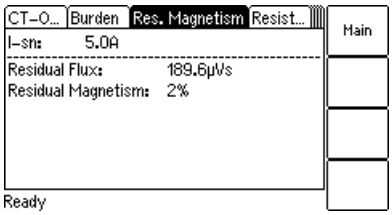


Figure 6-6 **Residual Magnetism** card

Note: The wiring for residual magnetism measurement is identical to the wiring for a normal CT test (see section 2.4.1 on page 24).

Note: Gapped cores normally have very low residual magnetism. The *CT Analyzer* is possibly not able to determine the knee point of gapped cores.

6.4.1 Test Settings and Results

The following settings and test results are displayed in the **Residual Magnetism** card.

Parameter	Description
I-sn	Nominal secondary current of the CT as entered in the **CT-Object** card. The I_{sn} of the CT has to be specified **prior to the execution** of the residual magnetism measurement. Otherwise, a corresponding message is displayed.
Residual Flux	Absolute value [in Vs] of the residual magnetic flux in the CT determined by the *CT Analyzer*. The residual flux is always displayed after measurement, even if the *CT Analyzer* could not determine the residual magnetism.
Residual Magnetism	Residual magnetism [in %] of the CT, calculated from the residual flux and the maximum flux of the CT. No value is displayed if the *CT Analyzer* was not able to reach the knee point of the excitation curve.

6.4.2 Running a Residual Magnetism Measurement

1. Press the **Select Cards** soft key in the **CT-Object** card to open the **Select Cards** page. Enable the **Residual Magnetism** test card in the **Select Cards** page. Press the **Back** soft key to apply your test card selection and return to the **CT-Object** card.

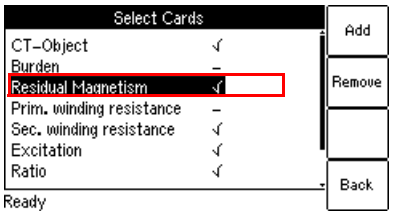


Figure 6-7 **Select Cards** page with **Residual Magnetism** test card enabled

2. If not already specified, enter the I_{sn} of the CT on the **CT-Object** card.

3. Connect the CT to the *CT Analyzer* as described in chapter 2.
   – Make sure that the red LED on the *CT Analyzer* is off.
   – Refer to section 2.4.1 on page 24 for detailed information on how to connect the *CT Analyzer*. The wiring for the residual magnetism measurement is identical to the wiring for the CT test.
   – Be sure that the polarity of all wires is correct.
   – You can display the connection diagram by pressing the ? key while the wiring check message is displayed.

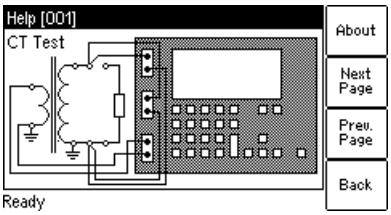


Figure 6-8 Wiring diagram for residual magnetism measurement and CT testing

4. Start the test by pressing the I/0 key.

Warning: Do not touch the equipment under test or the measurement leads while the red LED on the *CT Analyzer* is flashing. Never connect or disconnect measurement leads while the red LED on the *CT Analyzer* is flashing.

As long as the red LED is flashing, the output is active and lethal voltages can occur due to the high energy stored in external inductors.

5. **If the burden test is enabled**, the test halts and the *CT Analyzer* displays a corresponding message, asking you to check the wiring for the burden test. Connect the burden and run the burden test as described in section 4.3, steps 2. & 3. on page 52.
6. After the burden measurement is finished, the test halts to allow rewiring for the residual magnetism measurement. Make sure that the red LED on the *CT Analyzer* is off and reconnect the CT as described in step 3 above.
7. Continue testing by pressing the **Start Test** soft key.
8. The *CT Analyzer* runs the residual magnetism measurement.
9. **If the primary resistance measurement is enabled**, the test halts and the *CT Analyzer* displays a corresponding message, asking you to check the wiring for the test. Connect the *CT Analyzer* and run the primary winding resistance measurement as described in section 4.3, steps 4. & 5. on page 53.
10. After the primary resistance measurement is finished, the test halts to allow rewiring for the CT test. Connect the *CT Analyzer* and run the CT test as described in section 4.3, steps 6. to 11. on page 54.

6.5 Resistance Card

The **Resistance** card is only available if winding resistance measurement is enabled in the **Select Cards** page (Default Test Card Selection or **Select Cards** soft key in the **CT-Object** card).

The **Select Cards** page offers two different types of winding resistance measurements for selection:

- **Primary winding resistance measurement** (only required in case of a perceptible primary winding resistance, i.e., if the primary winding actually consists of multiple turns). See section 6.5.1 on page 106 for more information.
- **Secondary winding resistance measurement** (always required for CT testing for particular calculations in the excitation and ratio test). See section 6.5.2 on page 106 for more information.

Depending on your selection on the **Select Cards** page, the **Resistance card** shows the parameters and results for the primary winding resistance measurement or the secondary winding resistance measurement only, or for both measurements.

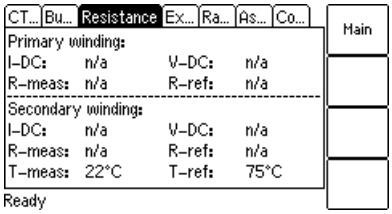


Figure 6-9 **Resistance card** showing parameters and results for primary ***and*** secondary winding resistance measurement

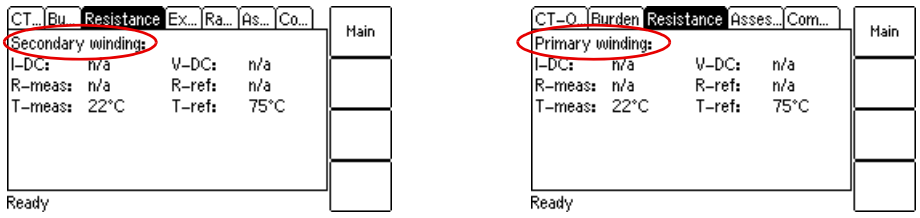


Figure 6-10 **Resistance card** for secondary winding resistance measurement only (left) and for primary winding resistance measurement only (right)

6.5.1 Primary Winding Resistance Measurement

Measuring the primary winding resistance is only required in case of a perceptible primary winding resistance, i.e., if the primary winding actually consists of multiple turns.

Primary winding resistance measurement is performed prior to the CT test and requires special wiring.

Note: If no CT test is performed following the primary winding resistance test, a demagnetizing cycle is performed after the test to guarantee complete demagnetization of the CT.

Running the primary winding resistance measurement

1. Press the **Select Cards** key soft in the **CT-Object** card to open the **Select Cards** page. Enable the **Primary winding resistance** measurement in the **Select Cards** page. Press the **Back** soft key to apply your selection and return to the **CT-Object** card.

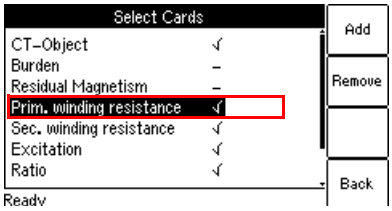


Figure 6-11 **Select Cards** page with **Primary winding resistance** measurement enabled

2. Execute the test as described in section 4.3 on page 52.

6.5.2 Secondary Winding Resistance Measurement

During the CT test, secondary winding resistance measurement is necessary since the CT winding resistance is needed for particular calculations in the excitation and ratio test. This measurement is performed completely automatically.

Note: If only the secondary winding resistance test is selected, a demagnetizing cycle is performed after the test to guarantee complete demagnetization of the CT.

6.5.3 Test Settings and Results

The following settings are required to perform a winding resistance test.

Parameter	Description
T-meas	Winding temperature of the CT at the time of measurement. Value used: Ambient Temperature defined in the **Settings** (main menu). If this temperature is not set correctly, the reference resistance value (R_{ref}) at reference temperature will not be calculated correctly.
T-ref	Reference temperature, i.e, temperature the CT is specified for. Value used: Reference temperature defined in the **Settings** (main menu). The winding resistance at reference temperature is calculated from the winding resistance measured at ambient temperature (T_{meas}) and the specified reference temperature.

The following parameters show the results of the winding resistance test after the test is finished.

Parameter	Description
I-DC	Current used for measurement. Selected automatically, cannot be changed by the user. **Secondary winding resistance measurement only:** If I_{sn} is between 0.1 and 1 A, I_{DC} is automatically set to I_{sn}. If I_{sn} is lower than 0.1 A, I_{DC} is automatically set to 0.1 A. Maximum value: 1 A. **Primary winding resistance measurement only:** Maximum value: 10 A.
V-DC	Measured voltage.
R-meas	Measured resistance at ambient temperature.
R-ref	Reference resistance (temperature-compensated resistance, compensated to T_{ref}).

6.6 Excitation Card

The **Excitation card** is only available if it is enabled in the **Select Cards** page (Default Test Card Selection or **Select Cards** soft key in the **CT-Object** card).

The excitation test is used to trace the excitation curve of the current transformer and to determine many CT-specific parameters (see test results below). The test is done completely automatically up to a current of 15 A_{peak}.

CTs with closed cores can be tested up to a knee point voltage of 30 kV. For CTs with gapped cores the maximum test voltage and current are limited depending on the maximum output power of the device. Typical maximum current and voltage values for a TPZ core are 9 A_{rms} at 1200 V_{rms}.

The settings for the excitation test are specified in the **CT-Object** card. For a better understanding of the test results, the most important settings from the **CT-Object** card are shown in the upper part of the **Excitation** card.

The test results displayed in the lower part of the **Excitation** card depend on the standard selected in the **CT-Object** card. Using the soft keys, the user can choose between different sets of results. If the **Results with Nom. Burden** soft key is pressed, the page shows the results related to the nominal burden ("VA" parameter in **CT-Object** card). If the **Results with Op. Burden** soft key is pressed, the page shows the results related to the operating burden ("Burden" parameter in **CT-Object** card).

Pressing the **Excit. Graph** soft key opens a page with a graph showing the maximum possible primary current (K * I_{pn}) that can flow over a specific burden without exceeding the accuracy limit (5 % or 10 %).

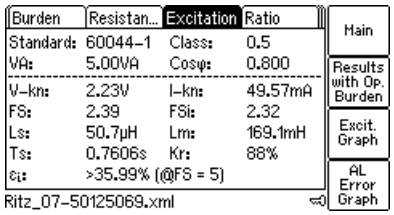


Figure 6-12 **Excitation** card with values related to nominal burden

If the *CT Analyzer* displays an overload in the **Excitation** card, either the desired knee point could not be reached or not all necessary measurement points could be taken (e.g. in the knee point area, not enough points for a proper calculation of the knee point could be measured).

6.6.1 Available Soft Keys

Results with Nom Burden or Results with Op. Burden	Displays the results related to the nominal burden of the CT. Displays the results related to the operating burden of the CT.
Excit. Graph	Opens the excitation graph page (refer to section 6.6.4 on page 114).
AL Error Graph	Opens the AL error graph page (refer to section 6.6.5 on page 117). This graph is part of Chinese standards and shows the maximum possible primary current (K * I_{pn}) that can flow over a specific burden without exceeding the accuracy limit.

6.6.2 Test Settings

The upper part of the **Excitation** card shows the test settings adjusted in the **CT-Object** card.

6.6.3 Test Results

The test results are displayed in the lower part of the **Excitation** card. The display of test results depends on the following:

- The standard defined in the **CT-Object** card, the class and the type of CT (metering or protection CT).

  The following tables provide an overview of which test results (parameters) are displayed for which standard.

- The burden selected with the soft key (**Results with Nom. Burden** or **Results with Op. Burden**).

  Depending on the selected burden, the **Excitation** card shows the results either calculated with the nominal burden (**Results with Nom. Burden**) or calculated with the operating burden (**Results with Op. Burden**).

  The displayed pages are identical to a large extend, except the field label for the burden parameter ("VA" in case of nominal burden and "Burden" in case of operating burden) and the result values.

Test results displayed in the Excitation card for IEC 60044-1

Param.	Description	Results displayed for IEC 60044-1			
		protection CTs			metering CTs
		xP	xPR	PX	
V-kn	Knee point voltage (acc. to standard) of the topmost knee point found.	x	x	x	x
I-kn	Knee point current (acc. to standard) of the topmost knee point found.	x	x	x	x
Ls	Saturated inductance.	x	x	x	x
Lm	Non-saturated inductance.	x	x	x	x
Ts	Secondary time constant.	x	x	x	x
Kr	Remanence factor.	x	x	x	x
ε_i	Indirect error (acc. to standard).	x	x		x
ALF	Accuracy limiting factor according to IEC 60044-1 direct measurement method, calculated for nominal and operating burden.[1]	x	x		
ALFi	Accuracy limiting factor according to IEC 60044-1 indirect measurement method, calculated for nominal and operating burden.[1]	x	x		
FS	Instrument security factor according to IEC 60044-1 direct measurement method, calculated for nominal and operating burden.[1]				x
FSi	Instrument security factor according to IEC 60044-1 indirect measurement method, calculated for nominal and operating burden.[1]				x
Kx	Dimensioning factor (acc. to IEC 60044-1 class PX) at accuracy limit with the selected load.			x	
Ek	Accuracy limiting voltage according to IEC 60044-1 for class PX (that point on the excitation graph where an increase of the e.m.f. r.m.s. voltage (core flux) by 10% causes an increase of the r.m.s. current by 50%).			x	
Ie	Accuracy limiting current according to IEC 60044-1 class PX (at E_k).			x	
E1	User-defined e.m.f. to verify the excitation current at this e.m.f.			x	
Ie1	Max. allowed excitation current at E_1.			x	

1. If the *CT Analyzer* is not able to measure up to the actual value, the prefix ">" is displayed to indicate that the measurement value is larger than the displayed value.

Test results displayed in the Excitation card for IEC 60044-6

Param.	Description	Results displayed for IEC 60044-6, class			
		TPS	TPX	TPY	TPZ
V-kn	Knee point voltage according to standard.	x	x	x	x
I-kn	Knee point current according to standard.	x	x	x	x
Ls	Saturated inductance.	x	x	x	x
Lm	Non-saturated inductance.	x	x	x	x
Ts	Secondary time constant.	x	x	x	x
Kr	Remanence factor.	x	x	x	x
Kssc	Rated symmetrical short-circuit current factor at accuracy limit with the selected load.[1]	x		x	x
Ktd	Theoretical transient dimensioning factor.		x	x	x
V-al	Accuracy limiting voltage according to IEC 60044-6 for class TPS (that point on the excitation graph where an increase of the e.m.f. r.m.s. voltage (core flux) by 10% causes an increase of the peak current by 100%).	x			
I-al	Accuracy limiting current according to IEC 60044-6 class TPS (at V_{al}).	x			
E1	User-defined e.m.f. to verify the excitation current at this e.m.f.	x			
Ie1	Max. allowed excitation current at E_1.	x			
E-max	Maximum e.m.f. voltage. This parameter allows the determination of the working point on the excitation curve that would be reached with the entered settings.		x	x	
$\hat{\varepsilon}$	Peak instantaneous error at voltage E_{max}.		x	x	

1. If the *CT Analyzer* is not able to measure up to the actual value, the prefix ">" is displayed to indicate that the measurement value is larger than the displayed value.

Test results displayed in the Excitation card for IEC 61869-2

Param.	Description	Results displayed for IEC 61869-2							
		protection CTs, class							metering CTs
		xP	xPR	PX	PXR	TPX	TPY	TPZ	
V-kn	Knee point voltage according to standard.	x	x	x	x	x	x	x	x
I-kn	Knee point current according to standard.	x	x	x	x	x	x	x	x
Ls	Saturated inductance.	x	x	x	x	x	x	x	x
Lm	Non-saturated inductance.	x	x	x	x	x	x	x	x
Ts	Secondary time constant.	x	x	x	x	x	x	x	x
Kr	Remanence factor.	x	x	x	x	x	x	x	x
ε_i	Indirect error (acc. to standard).	x	x						x
FS	Instrument security factor according to IEC 61869-2 direct measurement method, calculated for nominal and operating burden.[1]								x
FSi	Instrument security factor according to IEC 61869-2 indirect measurement method, calculated for nominal and operating burden.[1]								x
ALF	Accuracy limiting factor according to IEC 61869-2 direct measurement method, calculated for nominal and operating burden.[1]	x	x						
ALFi	Accuracy limiting factor according to IEC 61869-2 indirect measurement method, calculated for nominal and operating burden.[1]	x	x						
Kx	Dimensioning factor (acc. to IEC 61869-2) at accuracy limit with the selected load.			x	x				
Ek	Accuracy limiting voltage according to IEC 61869-2 (that point on the excitation graph where an increase of the e.m.f. r.m.s. voltage (core flux) by 10 % causes an increase of the r.m.s. current by 50 %).			x	x				
Ie	Accuracy limiting current according to IEC 61869-2 (at E_k).			x	x				
E1	User-defined e.m.f. to verify the excitation current at this e.m.f.			x	x				
Ie1	Max. allowed excitation current at E_1.			x	x				
Kssc	Rated symmetrical short-circuit current factor at accuracy limit with the selected load.[1, 2]					x	x	x	

Param.	Description	Results displayed for IEC 61869-2							
		protection CTs, class							metering CTs
		xP	xPR	PX	PXR	TPX	TPY	TPZ	
Ktd	Theoretical transient dimensioning factor.[3]					x	x	x	
E-max	Maximum e.m.f. voltage. This parameter allows the determination of the working point on the excitation curve that would be reached with the entered settings.					x	x		
$\hat{\varepsilon}$	Peak instantaneous error at voltage E_{max}.					x	x		

1. If the *CT Analyzer* is not able to measure up to the actual value, the prefix ">" is displayed to indicate that the measurement value is larger than the displayed value.
2. If parameter "Spec." is set to "by Duty" in the **CT-Object** card (see page 93), no calculation is performed for this parameter if the user did not specify values for T_p and t_{al1} in the **CT-Object** card prior to the test.
3. This parameter is only displayed if parameter "Spec." is set to "by Duty" in the **CT-Object** card (see page 93). No calculation is performed for this parameter if the user did not specify values for T_p and t_{al1} in the **CT-Object** card prior to the test.

Test results displayed in the Excitation card for IEEE C57.13

Param.	Description	Results displayed for IEEE C57.13	
		protection CTs	metering CTs
V-kn	Knee point voltage according to standard.	x	x
I-kn	Knee point current according to standard.	x	x
Ls	Saturated inductance.	x	x
Lm	Non-saturated inductance.	x	x
Ts	Secondary time constant.	x	x
Kr	Remanence factor.	x	x
Vb	Rated secondary terminal voltage.	x	
FS	Instrument security factor (direct measurement method), calculated for nominal and operating burden.[1]		x
FSi	Instrument security factor (indirect measurement method), calculated for nominal and operating burden.[1]		x

1. If the *CT Analyzer* is not able to measure up to the actual value, the prefix ">" is displayed to indicate that the measurement value is larger than the displayed value.

6.6.4 Excitation Graph

The excitation graph page shows the graph calculated from the test results. To display the excitation graph, press the **Excit. Graph** soft key in the **Excitation** card. The graph shows the r.m.s. terminal/core voltage over the r.m.s./peak current depending on the selected standard.

On the bottom right of the diagram the voltage, current and inductance values for the selected point in the graph are displayed. The currently selected point in the graph is marked by a horizontal and a vertical dashed line.

In this page it is possible to load the excitation graph of an already saved test from the Compact Flash card in order to compare this graph with the one of the current test.

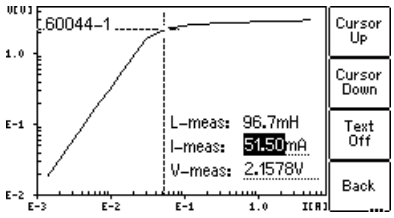


Figure 6-13 Excitation graph

Definition of axes in the excitation graph for different standards

Standard	Vertical axis	Horizontal axis
IEC 60044-1	r.m.s. terminal voltage	r.m.s. excitation current
IEC 60044-6	r.m.s. e.m.f. voltage	peak excitation current
IEC 61869-2	average rectified[1] terminal voltage	r.m.s. excitation current
IEEE C57.13	r.m.s. e.m.f. voltage	r.m.s. excitation current

1. Calibrated to r.m.s.

Available soft keys

Cursor Up	Moves the cursor upwards on the excitation graph.
Cursor Down	Moves the cursor downwards on the excitation graph.

Text Off	Switches off the display of values on the bottom right of the diagram. If you have switched off the values, this soft key changes to **Text On** to switch the values display on again.
Back	Closes the excitation graph and brings you back to the **Excitation** card.
Knee Point	Moves the cursor to the knee point on the graph according to the selected standard. If two or more knee points could be found on the graph, this soft key is alternately labelled **Knee Point 1** or **Knee Point 2**, depending on which knee point the cursor is actually positioned to. By pressing the soft key you can switch between knee point 1 and knee point 2. After opening the excitation graph, the cursor shows the topmost knee point (knee point 1) and the soft key is labelled **Knee Point 2**.
Ref. Knee Point	Moves the cursor to the knee point on the reference graph. This soft key is only available if a reference graph is loaded. If the reference graph loaded has two or more knee points, this soft key is alternately labelled **Ref. Knee Point 1** or **Ref. Knee Point 2**, depending on which knee point the cursor is actually positioned to. By pressing the soft key you can switch between knee point 1 and knee point 2. After loading the reference graph, the cursor shows the topmost knee point (knee point 1) and the soft key is labelled **Ref. Knee Point 2**.
Load Ref. Curve	Opens the file system card to select a previous test in order to load the excitation curve of this test as a reference curve and compare it with the current one. The reference curve is displayed as a dotted line in addition to the excitation curve of the actual test. If a reference curve is loaded, the values V_{ref}, I_{ref} and L_{ref} are displayed in addition to the measured values.
Ref. Off	Switches off the reference curve from the display. If you have switched off the reference curve, the soft key changes to **Ref. On** to switch the reference curve on again. This soft key is only available if a reference curve has been loaded.

IEC 60044-1 IEC 60044-6 IEEE C57.13 IEC 61869-2	By pressing one of these soft keys you can display the measured excitation graph and knee point as defined in the respective standard. **IEEE C57.13** displays the knee point for the 45° tangent. After pressing this soft key, its labeling changes to **IEEE C57.13 (30°)** to enable the display of the knee point for the 30° tangent. 30° is recommended for gapped cores in IEEE C37.110, chapter 4.3. **Note:** The test report only contains the graph for the standard selected in the **CT-Object** card.

Viewing the measured values for different points on the graph

By default, the knee point values are displayed after opening the excitation graph page. However, you can also view the corresponding voltage, current and inductance values for any point on the graph. To select a specific point on the graph,

- either use the soft keys (**Cursor Up**, **Cursor Down**, **Knee Point**)
- or enter a specific voltage or current value using the keyboard:
  - Select the desired edit field using the ▲ ▼ cursor keys.
  - Enter the desired voltage or current value using the keyboard.
  - Press the ↵ key to apply the entered value and read the corresponding values in the respective fields (e.g. "V-meas" and "L-meas" if you have entered a current "I-meas").

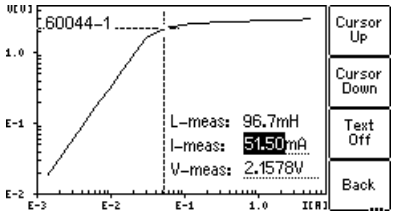


Figure 6-14 Entering a current value to display its corresponding voltage and inductance values on the excitation graph

6.6.5 Accuracy Limiting Error Graph*

* According to the "China Electric Regulations for protection CTs".

To display the AL error graph, press the **AL Error Graph** soft key in the **Excitation** card.

Note: The "AL Error Graph" function can be switched on or off in the device settings (**Main Menu**, entry "Settings" -> **Setting Menu**, entry "Accur. Limiting Error Graph"). If switched off, the AL error graph is not included in the test report.

All standards are supported, except IEC 60044-6 class TPZ.

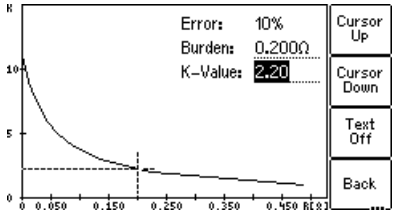


Figure 6-15 AL error graph

Available soft keys

Cursor Up	Moves the cursor upwards on the error graph.
Cursor Down	Moves the cursor downwards on the error graph.
Text Off	Switches off the display of values on the top right of the diagram. If you have switched off the values, this soft key changes to **Text On** to switch the values display on again.
Back	Closes the AL error graph and brings you back to the **Excitation** card.
Nominal Burden	Moves the cursor to that point on the error graph that corresponds to the nominal burden value defined in the "VA" field of the **CT-Object** card (value entered by the user or determined by the *CT Analyzer*).
Operat. Burden	Moves the cursor to that point on the error graph that corresponds to the operating burden value defined in the "Burden" field of the **CT-Object** card (value entered by the user or determined by the *CT Analyzer*).

Viewing the measured values for different points on the graph

By default, the cursor is positioned to the nominal burden values after opening this page.

To select a specific point on the graph:

- Select the desired edit field "K-Value" or "Burden" using the ▲ ▼ cursor keys and enter the desired value using the keyboard.
- Press the ↵ key to apply the entered value and read the corresponding value in the respective field.

6.7 Ratio Card

The **Ratio** card is only available if it is enabled in the **Select Cards** page (Default Test Settings or **Select Cards** soft key in the **CT-Object** card).

The ratio test measures the current ratio of the CT considering the operating burden (parameter "Burden" in **CT-Object** card) or the nominal burden (parameter "VA" in **CT-Object** card).

The results of the ratio test can be found in 3 pages:

- The **Ratio** card (refer to Figure 6-16) shows the polarity, the ratio error and the phase displacement for the primary current and the burden defined in the **CT-Object** card.

  If the **Results with Nom. Burden** soft key is pressed, the page shows the results related to the nominal burden ("VA" parameter in the **CT-Object** card). If the **Results with Op. Burden** soft key is pressed, the page shows the results related to the operating burden ("Burden" parameter in the **CT-Object** card).

- The **ratio table** shows the current ratio error for different currents (200% down to 1% of the rated current) at different burden values (depending on the selected standard, see section 6.7.4 on page 122 and 6.7.5 on page 123).
- The **phase table** shows the phase displacement for different currents at different burden values (depending on the selected standard, see section 6.7.4 on page 122 and 6.7.5 on page 123).

For a better understanding of the test results, the most important settings from the **CT-Object** card are shown once again in the upper part of the **Ratio** card.

Note: Although the test is not performed with the real current, the test results reflect the current ratio and not the voltage ratio.

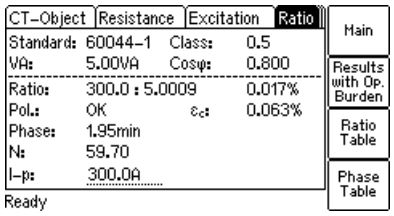


Figure 6-16 **Ratio** card

6.7.1 Available Soft Keys

Results with Op. Burden or Results with Nom Burden	Displays the results related to the operating burden of the CT. Displays the results related to the nominal burden of the CT.
Ratio Table	Displays the ratio table (refer to section 6.7.4 on page 122 and 6.7.5 on page 123). In the ratio table it is also possible to display the values related to the nominal burden or the operating burden of the CT.
Phase Table	Displays the phase table (refer to section 6.7.4 on page 122 and 6.7.5 on page 123). In the phase table it is also possible to display the values related to the nominal burden or the operating burden of the CT.

6.7.2 Test Settings

The following settings can be done in the **Ratio** test card.

Parameter	Description
I-p	Primary current for calculation of the ratio error and phase displacement with the burden (operating burden) defined in the **CT-Object** card. After the test is finished, it is possible to change the value for the primary current. The ratio error and/or the phase error are then recalculated and displayed again. When storing the test results, the currently displayed measurement results are stored. Changing this value only influences the results displayed in the **Ratio** card (operating burden related values). It does not affect the values displayed in the separate pages for the ratio and phase tables (values related to nominal burden). Default: Value of I_{pn}

6.7.3 Test Results

The following test results are displayed in the lower part of the **Ratio** card. In addition to the results displayed in the **Ratio** card you can view the ratio and phase table pages described in section 6.7.4 on page 122 and 6.7.5 on page 123.

Parameter	Description
Ratio	Current ratio error (in %) at the specified primary current (I_p) and burden.
Pol.	OK: Polarity OK, phase angle is in the range of 0° ± 45°. Failed: Wrong polarity of the CT or wrong polarity of the measurement leads.
ε_C	Composite error in % at the specified primary current (I_p) and operating burden. This parameter is only displayed if the IEC 60044-1 standard is selected in the **CT-Object** card.
Phase	Phase displacement (in minutes) at the specified primary current (I_p) and burden.
N	Winding turns ratio.
εt	Turns ratio error acc. to IEC 60044-6 class TPS or IEC 60044-1 class PX.
RCF	Ratio correction factor. This parameter is only displayed if the IEEE C57.13 standard is selected in the **CT-Object** card.
TCF	Transformer correction factor. This parameter is only displayed if the IEEE C57.13 standard is selected in the **CT-Object** card.

6.7.4 Ratio Table and Phase Table for IEC 60044-1, IEC 60044-6 and IEC 61869-2

To display the ratio table or the phase table, press the **Ratio Table** or **Phase Table** soft key in the **Ratio** card.

If the selected standard is **IEC 60044-1**, **IEC 60044-6** or **IEC 61869-2**, these tables show the ratio error and the phase displacement

- for different current values between 1% and 200% of the rated current, and
- at 100%, 50%, 25% and 12.5% of the **operating burden** defined in the **CT-Object** card ("Burden" parameter), and
- at 100%, 50%, 25% and 12.5% of the **nominal burden** defined in the **CT-Object** card ("VA" parameter) or at 1VA if one of these percentages results in a nominal burden smaller than 1VA.

Use the **Results with Op. Burden** or **Results with Nom. Burden** soft key to display the results related to the operating burden ("Burden" parameter in the **CT-Object** card) or related to the nominal burden ("VA" parameter in the **CT-Object** card).

The ratio table and the phase table contain all measurement points defined in the standards IEC 60044-1, IEC 60044-6 and IEC 61869-2.

Use the ◄ ► cursor keys to scroll through the table columns (1% of rated current to 200% of rated current).

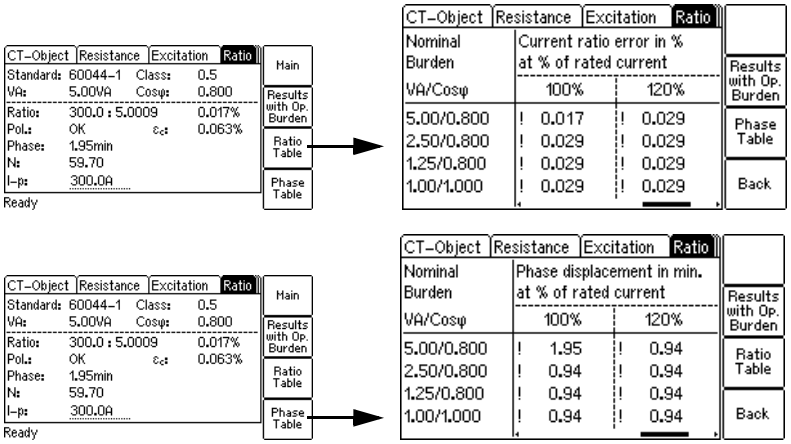


Figure 6-17 Displaying the ratio table and the phase table in the **Ratio** card (for IEC 60044-1, IEC 60044-6 and IEC 61869-2)

Note: Values that caused a failed assessment are highlighted by black background in the tables. Values without the prefix "!" have guaranteed accuracy. The accuracy of values marked with a "!" in the tables is reduced by factor 2.

Note: For IEC 60044-1 metering CTs with I_{sn} = 5A, it is possible to increase the minimum **nominal burden** used for the assessment to 3.75VA in the device settings (**Main Menu**, entry "Settings" -> **Setting Menu**, entry "Min. VA at M cores Isn 5A"). In this case, the lowest nominal burden value displayed in the ratio table and the phase table is 3.75VA instead of 1VA. Please note that this only applies if the results are displayed with the nominal burden. It has no effect if the results in the ratio table and the phase table are displayed with the operating burden.

6.7.5 Ratio Table and Phase Table for IEEE C57.13

To display the ratio table or the phase table, press the **Ratio Table** or **Phase Table** soft key in the **Ratio** card.

If the selected standard is **IEEE C57.13**, these tables show the ratio error and the phase displacement

- for different current values between 1% and 200% of the rated current.
- at the burden specified in the **CT-Object** card ("VA" or "Burden" parameter) and all burden values defined in the IEEE C57.13 standard that are smaller than the specified burden.

  Use the **Results with Op. Burden** or **Results with Nom. Burden** soft key to display the results related to the operating burden ("Burden" parameter in the **CT-Object** card) or related to the nominal burden ("VA" parameter in the **CT-Object** card).

  Note: If the **Assess @ VA** option has been selected for the "Class" parameter of an IEEE C57.13 metering CT in the **CT-Object** card, the tables only show the ratio error and the phase displacement for the burden value specified in the **CT-Object** card.

  Note: If a high accuracy license is available for IEEE C57.13, metering burdens also include the electronic burdens.

The ratio table and the phase table contain all measurement points defined in the IEEE C57.13 standard.

Use the ◄ ► and ▲ ▼ cursor keys to scroll through the table columns (1% of rated current to 200% of rated current) and table lines (burden values).

Note: Values that caused a failed assessment are highlighted by black background in the tables. Values without the prefix "!" have guaranteed accuracy. The accuracy of values marked with a "!" in the tables is reduced by factor 2.

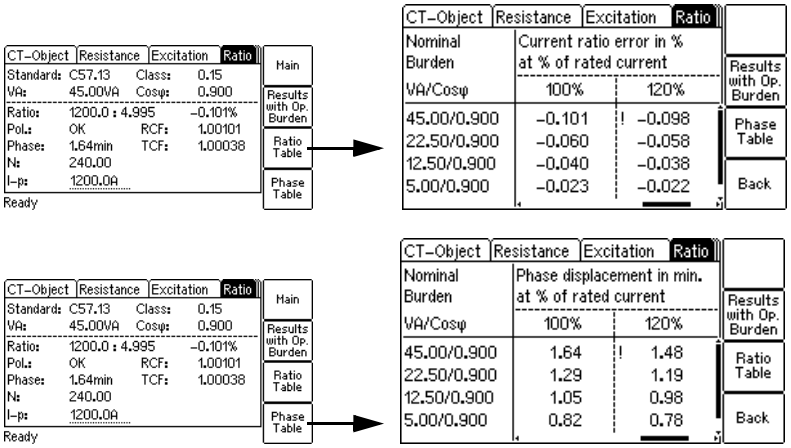


Figure 6-18 Displaying the ratio table and the phase table in the **Ratio** card (for IEEE C57.13)

6.8 Assessment Card

The **Assessment** card is only available if it is enabled in the **Select Cards** page (Default Test Card Selection or **Select Cards** soft key in the **CT-Object** card).

Depending on the standard and the type of CT (protection or metering CT), the according parameters are listed.

The column for automatic assessment ("Auto") is automatically filled after the test is finished. The following assessments are possible:

- "OK": The results measured for this parameter comply with the requirements defined by the selected standard and the parameters in the **CT-Object** card.
- "Failed": The results do not comply with the requirements.
- "n/a": No assessment possible due to one of the following reasons:
  - Comparison with input parameter is not possible.
  - Assessment does not make sense due to incorrect polarity or invalid measurement value.

It is also possible to perform a manual assessment for the individual parameters. To do this, select the parameter to be assessed using the ▲ ▼ cursor keys and apply your assessment using the **OK**, **Failed** or **?** soft key.

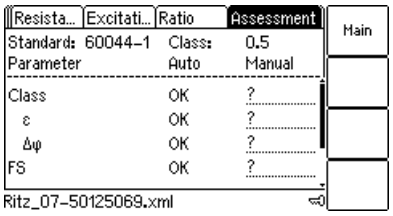


Figure 6-19 **Assessment** card (example)

Note: Automatic assessment is only performed for the CT behavior at nominal burden ("VA" parameter on the **CT-Object** card). For the CT behavior at operating burden ("Burden" parameter on the **CT-Object** card), no automatic assessment is performed.

6.8.1 Assessed Parameters

Parameters assessed for IEC 60044-1

Param.	Description	Parameter assessed for IEC 60044-1 protection CTs						
		standard classes					OMICRON extension	
		5P	10P	5PR	10PR	PX	2P, 3P, 4P, 6P	2PR, 3PR, 4PR, 6PR
Class	Accuracy class according to standard.	x	x	x	x	x	x	x
Rct	Secondary winding resistance.			x	x	x		x
$\Delta\varphi$	Phase deviation.	x		x			x	x
ε	Current ratio error.	x	x	x	x		x	x
ε_c	Composite error.	x	x	x	x		x	x
εt	Turns ratio error (incl. in class).					x		
Kr	Remanence factor			x	x			x
Ts	Secondary time constant.			x	x			x
ALF	Accuracy limiting factor (direct measurement method).	x	x	x	x		x	x
ALFi	Accuracy limiting factor (indirect measurement method).	x	x	x	x		x	x
Ek	Rated knee point e.m.f.					x		
Kx	Dimensioning factor (according to IEC 60044-1 class PX).					x		
Ie	Accuracy limiting secondary excitation current.					x		
Ie1	Max. allowed secondary excitation current at E_1.					x		

Param.	Description	Parameter assessed for IEC 60044-1 metering CTs	
		0.1, 0.2, 0.2s, 0.5, 0.5s, 1	3, 5
Class	Accuracy class according to standard.	x	x
$\Delta\varphi$	Phase deviation.	x	
ε	Current ratio error.	x	x
FS	Instrument security factor (direct measurement method).	x	x
FSi	Instrument security factor (indirect meas. method).	x	x

Parameters assessed for IEC 60044-6

Parameter	Description	Parameter assessed for IEC 60044-6			
		TPS	TPX	TPY	TPZ
Class	Accuracy class according to standard.	x	x	x	x
Rct	DC winding resistance.	x	x	x	x
$\Delta\varphi$	Phase deviation.		x	x	x
ε	Current ratio error.		x	x	x
εt	Turns ratio error (included in class).	x			
$\hat{\varepsilon}$	Peak instantaneous error at voltage E_{max}.		x	x	
Tp	Primary time constant.	x	x	x	x
Ts	Secondary time constant.			x	x
Kr	Remanence factor.			x	
Ktd * Kssc	Transient dimensioning factor (K_{td}) multiplied by the rated symmetrical short-circuit current factor (K_{ssc}).		x	x	x
K * Kssc	Dimensioning factor (K) multiplied by the rated symmetrical short-circuit current factor (K_{ssc}).	x			
V-al	Rated equivalent excitation limiting secondary voltage.	x			
I-al	Accuracy limiting secondary excitation current.	x			

Parameters assessed for IEC 61869-2

Param.	Description	Parameter assessed for IEC 61869-2 protection CTs							
		standard classes						OMICRON extension	
		5P	10P	5PR	10PR	PX	PXR	2P, 3P, 4P, 6P	2PR, 3PR, 4PR, 6PR
Class	Accuracy class according to standard.	x	x	x	x	x	x	x	x
Rct	Secondary winding resistance.			x	x	x	x		x
$\Delta\varphi$	Phase deviation.	x		x				x	x
ε	Current ratio error.	x	x	x	x			x	x
ε_c	Composite error.	x	x	x	x			x	x
εt	Turns ratio error (incl. in class).					x	x		
Kr	Remanence factor			x	x		x		x
Ts	Secondary time constant.			x	x				x
ALF	Accuracy limiting factor (direct measurement method).	x	x	x	x			x	x
ALFi	Accuracy limiting factor (indirect measurement method).	x	x	x	x			x	x
Ek	Rated knee point e.m.f.					x	x		
Kx	Dimensioning factor (according to IEC 61869-2).					x	x		
Ie	Accuracy limiting secondary excitation current.					x	x		
Ie1	Max. allowed secondary excitation current at E_1.					x	x		

Param.	Description	Parameter assessed for IEC 61869-2 transient protection CTs		
		TPX	TPY	TPZ
Class	Accuracy class according to standard.	x	x	x
Rct	Secondary winding resistance.	x	x	x
$\Delta\varphi$	Phase deviation.	x	x	x
ε	Current ratio error.	x	x	x
Ktd * Kssc	Transient dimensioning factor (K_{td}) multiplied by the rated symmetrical short-circuit current factor (K_{ssc}).	x	x	x
$\hat{\varepsilon}$	Peak instantaneous error at voltage E_{max}.	x	x	
Ts	Secondary time constant.		x	
Kr	Remanence factor		x	

Param.	Description	Parameter assessed for IEC 61869-2 metering CTs	
		0.1, 0.2, 0.2s, 0.5, 0.5s, 1	3, 5
Class	Accuracy class according to standard.	x	x
$\Delta\varphi$	Phase deviation.	x	
ε	Current ratio error.	x	x
FS	Instrument security factor (direct measurement method).	x	x
FSi	Instrument security factor (indirect meas. method).	x	x

Parameters assessed for IEEE C57.13

Parameter	Description	Parameter assessed for					
		IEEE C57.13					IEEE C57.13.6
		protection CTs, class				meter. CTs	high accuracy metering CTs
		C	T	X	K[1]	0.3, 0.6, 1.2	0.15, 0.15s
Class	Accuracy class according to standard.	x	x	x	x	x	x
Rct	DC winding resistance.			x			
$\Delta\varphi$	Phase deviation.					x	x
RCF	Ratio correction factor.					x	x
ε @ Isn	Current ratio error at secondary current I_{sn}.	x	x	x	x		
ε @ 20 * Isn	Current ratio error at 20 times the secondary current I_{sn}.	x	x	x	x		
Vb	Rated secondary terminal voltage.	x	x		x		
Vknee	Knee point voltage.				x		
Vk / Ik	User-defined measuring point.		x	x			
Vk1 / Ik1	User-defined measuring point 1.		x	x			

1. Acc. to IEEE C57.13 (1993)

6.9 Comment Card

The **Comment** card is only available if it is enabled in the **Select Cards** page (Default Test Card Selection or **Select Cards** soft key in the **CT-Object** card).

In the **Comment** card you can enter any text, e.g. additional notes regarding the current test.

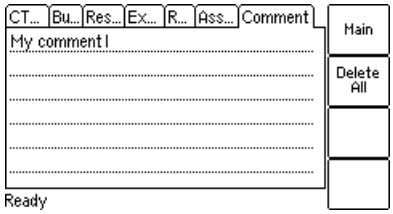


Figure 6-20 **Comment** card

7 CT Testing Using the Guesser Function

This chapter provides a detailed description how to run a CT test using the guesser function of the *CT Analyzer*. Follow the sections 7.2 to 7.5 in the given order.

For reasons of simplicity, the following example only considers a straight forward CT test without performing a **burden test**, a **primary winding resistance measurement** or a **residual magnetism measurement**.

When working with the *CT Analyzer*, always observe the safety rules given in section 2.1 on page 21.

Warning: Do not touch the equipment under test or the measurement leads while the red LED on the *CT Analyzer* is flashing. Never connect or disconnect measurement leads while the red LED on the *CT Analyzer* is flashing.

As long as the red LED is flashing, the output is active and lethal voltages can occur due to the high energy stored in external inductors.

Warning: Always make sure that the *CT Analyzer* output is connected to the correct side of the current transformer according to the wiring instructions given in sections 2.4 and 2.5. Accidentally mixing up the windings can cause life-threatening voltages within the transformer and/or destroy the connected CT or the *CT Analyzer*!

Warning: Feeding test voltage to a tap of a **multi-ratio CT** can cause life-threatening voltages on other taps with higher ratios. Do not touch these taps!

7.1 About the Guesser Function

The guesser function of the *CT Analyzer* is intended as an aid for the user to find out single unknown name plate data of a CT, for example if parts of the CT's name plate are unreadable. If sufficient other name plate data of the CT are available and specified by the user, this function is often able to reliably determine single missing CT data, for example I_{prim}, I_{sec}, class or ratio.

The guesser function cannot release the user from specifying the CT's name plate data prior to testing. Always specify as many CT data as possible to increase the reliability of the values guessed by the *CT Analyzer*!

Caution: The data and values determined by the *CT Analyzer* using the guesser function are not guaranteed and have to be verified by the user.

It is possible to configure the guesser function of the *CT Analyzer* in a way that it checks whether the user has entered all necessary values and data relevant for an automatic assessment prior to the test start. The respective parameters are then marked by a star ("*") in the **CT-Object** card. If the user did not enter data for one or more of these parameters, no automatic assessment is performed and the *CT Analyzer* displays an "Assessment not available" message after the test is finished.

This option can be used to avoid an automatic assessment if important parameters were guessed by the *CT Analyzer* and not entered by the user. This behavior can be selected using the "Check "*" settings before start" option in the default test settings (see section 5.7.3 "Miscellaneous Settings" on page 70). This settings page also provides an option to enable the display of a corresponding message prior to the test start.

7.2 Setting Up and Connecting the CT Analyzer

1. Set up the *CT Analyzer* as described in section 2.2 on page 22.
2. Connect the CT to the *CT Analyzer* as described in chapter 2.
   – Refer to section 2.4.1 on page 24 for detailed information on how to connect the *CT Analyzer* for the CT test.
   – Be sure that the polarity of all wires is correct.

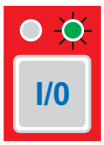
7.3 Preparing and Configuring the Test

1. Proceed as follows to display the **CT-Object** card with a new CT test.

   If the *CT Analyzer* is already switched on:

   – If necessary, display the **CT-Object** card and then press the **Main** soft key to display the main menu.
   – In the main menu, select "New CT Test" and press the **OK** soft key to initialize a new CT test.
   – The display shows the **CT-Object** card, ready to start a test.

   If the *CT Analyzer* is switched off:



   – Switch the *CT Analyzer* on.
   – After the boot process is finished, the green LED is on and the red LED is off.
   – The display shows the **CT-Object** card, ready to start a test.

7.4 Running the Automatic Test

1. After switching the *CT Analyzer* on or after initializing a new test from the main menu, the default **CT-Object** card is displayed.

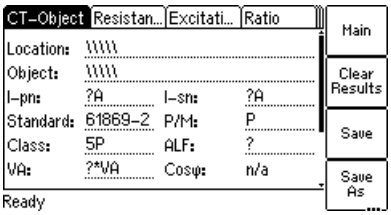


Figure 7-1 Empty **CT-Object** card after initializing a new test

2. Enter as many name plate data as available. The full set of CT data includes: I_{pn}, I_{sn}, standard, CT type (P/M), class and rated power of the CT (VA).

   Note: If the "Check "*" settings before start" option is enabled in the default test settings (see section 5.7.3 "Miscellaneous Settings" on page 70), no automatic assessment will be available if you do not enter data for a parameter that is relevant for assessment. Such parameters are marked by a star "*".

3. Execute the CT test as described in section 4.3 on page 52.

   If the "Display warning before start" option is enabled in the default test settings (see section 5.7.3 "Miscellaneous Settings" on page 70), a warning is displayed if you did not enter data for a parameter marked by a star "*".

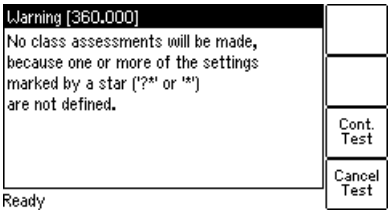


Figure 7-2 "No assessment" warning displayed if you did not enter data for a parameter relevant for assessment

Press **Cont. Test** to continue testing without an automatic assessment. Or press **Cancel Test** and enter data for all parameters marked with a star "*" in the **CT-Object** card and start the test again.

7.5 After the Test is Finished

After the test is finished, the **CT-Object** card displays the CT data determined during the test. Refer to section 4.4 on page 55 for more information.

7.6 Disconnection

After the CT test is finished, disconnect the CT under test from the *CT Analyzer*.

1. Wait until the red LED on the *CT Analyzer* is off.

Warning: Never disconnect measurement leads while the red LED on the *CT Analyzer* is flashing. As long as the red LED is flashing, the output is active and lethal voltages can occur due to the high energy stored in external inductors.

2. Disconnect the measurement leads starting at the *CT Analyzer*.

8 Using the Quick Test Feature

Quick Test is an optional feature. The functionality described in this chapter is only available if you have purchased a corresponding license. For further information, please contact your OMICRON sales contact or the OMICRON office nearest you.

If your *CT Analyzer* provides a vaild license for *Quick Test*, the functional scope described in this chapter is also available in the *CTA Quick Test* PC software included in the *CT Analyzer PC Toolset*.

The *Quick Test* feature cannot be used when a *CT SB2* switch box is connected to the remote control interface of the *CT Analyzer*.

Measurements using *Quick Test* are not automatically stopped by the *CT Analyzer*. Such measurements have to be stopped manually.

The *CT Analyzer* possibly switches off its output automatically after a long period (> 15 min) of continuous operation at its maximum output power to prevent thermal overload of the device.

8.1 Safety Notes and Notes for Using Quick Test

Warning: For VT ratio measurement, the *CT Analyzer* output has to be connected to the primary side of the VT. Connecting the *CT Analyzer* output to the secondary side of the VT by mistake will cause hazardous voltages on the primary side!

Warning: Using the DC current mode of the Advanced measurement type may be very dangerous! It is not possible to interrupt the circuit using a standard relay or a standard circuit breaker. Due to the arc, contact clearances of up to 10 mm are required to switch off the current.

Warning: Feeding an inductance with DC current will charge the inductance. The *CT Analyzer* does not perform automatic discharge of the inductance after measurements with *Quick Test*. Risk of electric shock! Wait until the inductance has discharged completely before touching any connections or disconnecting the measurement leads of the *CT Analyzer*.

Caution: When using *Quick Test*, input "Sec" of the *CT Analyzer* is able to measure voltages up to 150 V_{RMS}. Do not connect voltages above 150 V or even mains voltages to the *CT Analyzer* inputs! This will damage the *CT Analyzer*!

Caution: When performing measurements on CTs using *Quick Test*, consider that the *CT Analyzer* does not perform automatic demagnetization of the CT. Therefore, it may be necessary to additionally run a normal CT test with its automatic demagnetizing cycle following *Quick Test* measurements for a CT.

8.2 Introduction to Quick Test

Using *Quick Test* it is possible to use the *CT Analyzer* as a versatile multimeter with included power source or to perform polarity checks using the *CPOL* polarity checker from OMICRON.

Possible fields of application for *Quick Test* are:

- Quick and easy resistance measurement, e.g. for wiring checks on the secondary side of CTs.
- Quick voltage ratio checks for VTs.
- Measurement of burden values, e.g. to determine the new burden value after changes of the relay equipment. This allows the re-calculation of the CT test results for the new burden value by the *CT Analyzer* and thus makes it unnecessary to run an additional CT test in order to determine the behavior of the CT with the new burden.
- Quick wiring checks using the *CPOL* polarity checker from OMICRON. Using the *CPOL* in combination with the specific test signal provided by the *CT Analyzer*'s *Quick Test* feature you can check a series of test points (e.g., the connecting terminals of the burden wiring) for correct polarity.

The user interface of *Quick Test* consists of two test cards, the **CT-Quick** card containing the measurement parameters and the **Results** card showing the results of the measurement. Figure 8-1 shows the test cards for a resistance measurement as an example.

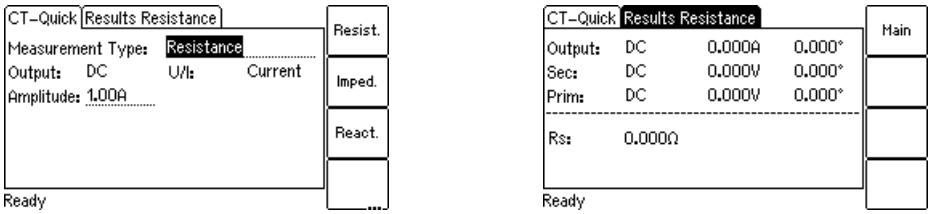


Figure 8-1 **CT-Quick** test card (left) and **Results** test card (right) for resistance measurement

Note: For a general description of the *CT Analyzer* user interface and basic procedures how to operate the *CT Analyzer* and the *Quick Test* tool, please refer to chapter 5 on page 59.

To select a measurement type, use the ▼ cursor key to move the cursor to the **Measurement Type** field in the **CT-Quick** card and then press the corresponding soft key of the measurement type.

The following measurement types are available in *Quick Test*.

Meas. type	Usage
Advanced 	Provides complete multimeter measurement functionality and free adjustment of all measurement quantities, such as AC or DC signal output, voltage or current output, output frequency, measurement mode (DC, RMS or frequency-selective) for the input, etc. For details, please refer to section 8.4 on page 139.
Polarity Check 	Predefined type, especially intended for polarity checks. The only adjustable measurement quantity is the output current. Requires the *CPOL* polarity checker from OMICRON. For details, please refer to section 8.5 on page 145.
CT Ratio 	Predefined type, especially intended for quick measurement of CT ratios. Adjustable measurement quantities are the voltage and the frequency of the output signal and the resistance and inductance of the CT to be measured. For details, please refer to section 8.6 on page 149.
VT Ratio 	Predefined type, especially intended for quick measurement of VT ratios. Adjustable measurement quantities are the voltage and the frequency of the output signal. For details, please refer to section 8.7 on page 151.
Resistance 	Predefined type, especially intended for quick measurement of resistances. The only adjustable measurement quantity is the value of the output current. For details, please refer to section 8.8 on page 154.
Impedance 	Predefined type, especially intended for quick measurement of impedances. Adjustable measurement quantities are the amplitude and the frequency of the current output signal. For details, please refer to section 8.9 on page 156.
Reactance 	Predefined type, especially intended for quick measurement of reactances. Adjustable measurement quantities are the voltage and the frequency of the output signal. For details, please refer to section 8.10 on page 158.

8.3 Performing Measurements with Quick Test

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- New Quick-Test

OK soft key

-> **CT-Quick** card

Measurements using *Quick Test* are not automatically stopped by the *CT Analyzer*. Such measurements have to be stopped manually by the user.

Proceed as follows to perform measurements using the *Quick Test* feature:

1. Select **New Quick-Test** from the main menu and press the **OK** soft key to open *Quick Test*. The display then shows the **CT-Quick** card.

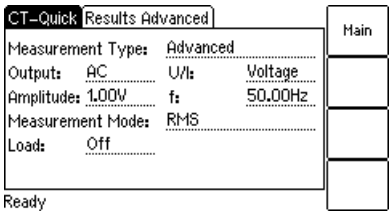


Figure 8-2 **CT-Quick** card

2. Select the measurement type and connect your test object to the *CT Analyzer* correspondingly (see sections 8.4 to 8.10 below).
3. Define your measurement quantities.
4. Start and stop your measurement by pressing the I/0 key.
5. After starting a measurement, the **Results** card is displayed automatically, showing the measurement results.

8.4 Advanced Measurement

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- New Quick-Test

OK soft key

CT-Quick card:
Measurement Type:
Advanced

The Advanced measurement type offers complete multimeter measurement functionality and free adjustment of all measurement quantities, such as AC or DC signal output, voltage or current output, output frequency, measurement mode (DC, RMS or frequency-selective) for the input, etc.

Using the Advanced measurement type it is also possible to use input "Sec" of the *CT Analyzer* as a voltmeter for **measuring external voltages** up to 150 V_{RMS} with frequencies up to 4 kHz.

Caution: When using *Quick Test*, input "Sec" of the *CT Analyzer* is able to measure voltages up to 150 V_{RMS}. Do not connect voltages above 150 V or even mains voltages to the *CT Analyzer* inputs! This will damage the *CT Analyzer*!

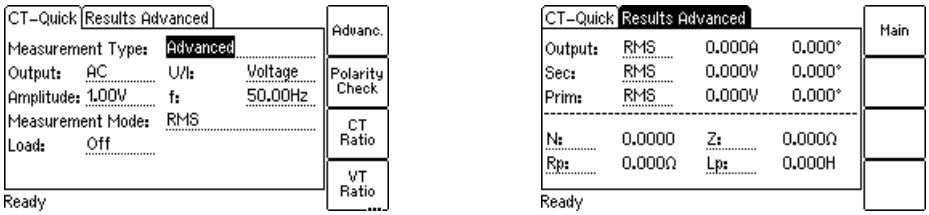


Figure 8-3 **CT-Quick** card and **Results** card for Advanced measurement type

For the Advanced measurement type, all measurement quantities available in the **CT-Quick** card can be adjusted by the user.

For this measurement type, the **CT-Quick** card holds the following measurement quantities:

Parameter	Description
Output	Output signal type AC or DC or output signal switched off. Possible values: **AC** or **DC** or **Off**. Default: AC.
U/I	Operating mode of the internal signal generator: voltage or current source. Possible values: **U** (voltage) or **I** (current). Default: Voltage **Warning:** Feeding an inductance with **DC current** will charge the inductance. The *CT Analyzer* does not perform automatic discharge of the inductance. Risk of electric shock! Wait until the inductance has discharged completely before touching any connections or disconnecting the measurement leads of the *CT Analyzer*.
Amplitude	RMS voltage or current value of the output signal. Possible values: Mode "AC" and "Voltage": 0 to 40V Mode "DC" and "Voltage": 0 to 120V Mode "AC" and "Current": 0 to 5A Mode "DC" and "Current": 0 to 10A Default: 1.00V or 1.00A. **Warning: DC current mode is very dangerous!** In this mode, it is not possible to interrupt the circuit using a standard relay or a standard circuit breaker. Due to the electric arc, contact clearances of up to 10mm are required to switch off the current.

Parameter	Description
f	Frequency of the output signal. Only available for AC voltage or current output. Possible values: Any value between 5.0 and 400.0 Hz or soft keys **16.7 Hz**, **50 Hz**, **60 Hz** or **400 Hz**. Default: 50 Hz
Measurement Mode	Measurement mode. Possible values: **DC**, **RMS** or **f-sel. filter**. Default: RMS DC measurement: Measures the DC part of the signal only. RMS measurement: Performs a standard true RMS measurement of the signal. Frequency selective measurement: Allows high precision measurement of the fundamental wave of an applied signal. All frequencies outside the output frequency plus/minus the filter bandwidth are supressed by at least 110 dB. This measurement mode is deactivated for output signal type DC. See also "B-width" below.
B-width	Filter bandwidth for frequency selective measurement. Only available for measurement mode **Freq. sel. filter**. Possible values: 3 Hz to 20 Hz. Default: 6 Hz Depending on the filter bandwidth selected, the measurement time can differ considerably. The typical time needed for a frequency selective measurement depends on the filter bandwidth as follows: Filter bandwidth — Measurement time 3 Hz — approx. 5 seconds 6 Hz — approx. 4 seconds
Load	Only available for AC signal output. Setting the **Load** parameter to "on" and specifying the winding resistance and the unsaturated inductance in the fields **R** and **L** will prevent saturation of the connected CT. The output generator of the *CT Analyzer* then keeps the DC part of the output current at zero using a current regulator permanently running during the output of AC signals. Possible values: **On** or **Off**. Default: Off

Parameter	Description
R, L	Only available if **Load** is set to "on". Winding resistance (R) and unsaturated inductance (L) of the CT, used by the internal output regulator to prevent saturation of the connected CT (see "Load" above). Possible values: 0 to 1000 Ω or 0 to 1000 H. Default: 1.00 Ω for **R** and 50.00 H for **L** If these values are not set correctly for the connected CT, the CT will saturate sooner or later, depending on the inaccuracy of the values used.

The **upper part** of the **Results Advanced** card (Figure 8-4) displays the measured values:

Value	Description
Output	Internally measured current value and phase of the output signal.[1]
Sec	Voltage measured at input "Sec".[1] Max. input voltage: 150 V_{RMS} Measurement is performed according to the measurement mode selected on the **CT-Quick** card. This input is considered as the phase reference, therefore the phase is always 0.
Prim	Value and phase of the voltage measured at input "Prim".[1] Max. input voltage: 30 V_{RMS} Measurement is performed according to the measurement mode" selected on the **CT-Quick** card.

1. Select the display mode for the current or voltage value using the soft keys: **RMS**, **DC**, **Peak+** (highest positive peak value) or **Peak-** (highest negative peak value).

The **lower part** of the **Results Advanced** card (Figure 8-4) displays the measurement results calculated from the measured values. In this area, you can freely define which result each single field should display.

Figure 8-4 shows the **Results Advanced** card with the default selection for the results fields.

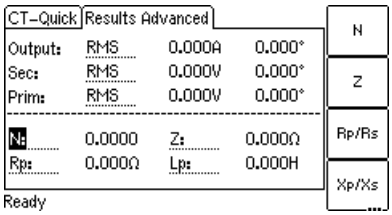


Figure 8-4 **Results Advanced** card with default selection for the displayed results

The following table lists the calculated results available for the Advanced measurement type. Use the cursor keys to move the cursor to a field and then select the result to be displayed in this field using the available soft keys.

Soft key / result	Description
N	Ratio calculated from the values measured at inputs "Sec" and "Prim".
Z	Impedance, calculated from the amplitude and phase angle of the output signal and the voltage measured at input "Sec".
Rp, Rs	Use the **Rp/Rs** soft key to switch between R_p and R_s. Parallel or serial resistance, calculated from the output signal and the voltage measured at input "Sec".
Xp, Xs	Use the **Xp/Xs** soft key to switch between X_p and X_s. Parallel or serial reactance, calculated from the output signal and the voltage measured at input "Sec".
cos φ	Power factor of the measured impedance.
Lp, Ls or Cp, Cs	Use the **Lp/Ls** (or **Cp/Cs**) soft key to switch between L_p (C_p) and L_s (C_s). Parallel or serial inductance or capacitance of the test object, calculated from the output signal and the voltage measured at input "Sec". The *CT Analyzer* automatically detects whether the test object is an inductance or a capacitance based on the phase angle.
f	Frequency measured at input "Sec".

Soft key / result	Description
Crest Out, Crest Sec, Crest Prim	Crest factor of the output signal or the signal measured at input sec or input prim. The crest factor is the peak/rms ratio of a waveform. For a sinusoidal waveform the crest factor is 1.414 (√2). The crest factor may indicate possible signal distortion. More detailed information can be found at http://en.wikipedia.org/wiki/Crest_factor.

Note: The results for $\mathbf{R_p}$, $\mathbf{X_p}$ and $\mathbf{L_p}$ ($\mathbf{C_p}$) are calculated using the parallel equivalent circuit diagram, the results for $\mathbf{R_s}$, $\mathbf{X_s}$ and $\mathbf{L_s}$ ($\mathbf{C_s}$) are calculated using the serial equivalent circuit diagram.

Use the following wiring (examples):

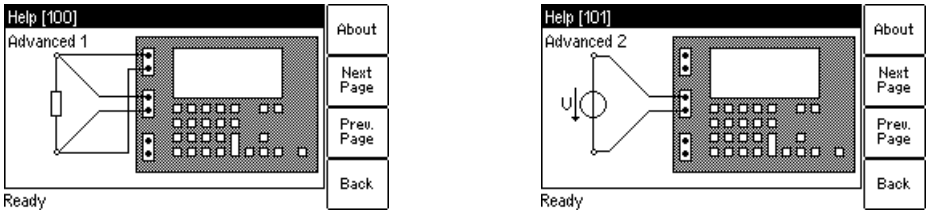


Figure 8-5 Wiring examples for Advanced measurement type

8.5 Polarity Check

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- New Quick-Test

OK soft key

CT-Quick card:
Measurement Type:
Polarity Check

This measurement type is exclusively intended for polarity checks using the *CPOL* polarity checker as described below. Do not use this mode for any other measurements!

Note: The Polarity Check measurement type requires the *CPOL* polarity checker from OMICRON (order number VEHZ 0650).

Polarity Check is a predefined measurement type, intended especially for checking a series of test points (e.g., the connecting terminals of the burden wiring) for correct polarity. For this purpose, the *CT Analyzer* injects a signal with a special waveform similar to a saw-tooth signal with a different steepness for the rising and the falling slope. The *CPOL* polarity checker from OMICRON checks the polarity of the injected signal and provides a clear indication as to whether the polarity is OK or not.

Checking the polarity using the Polarity Check measurement type is much faster than conventional methods and can easily be performed by a single person.

To select the Polarity Check measurement type, use the ▼ cursor key to move the cursor to the **Measurement Type** field in the **CT-Quick** card and then press the **Polarity Check** soft key.

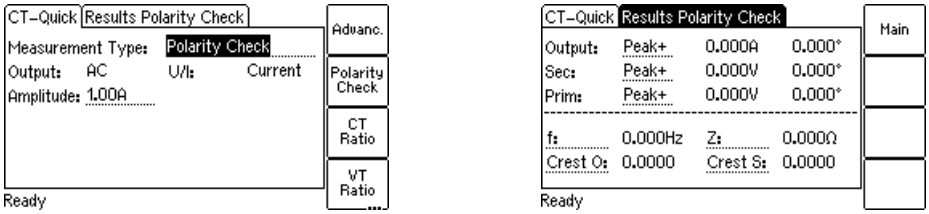


Figure 8-6 **CT-Quick** card and **Results** card for the Polarity Check measurement type

For the **Polarity Check** measurement type, the **CT-Quick** card holds the following measurement quantities:

Parameter	Description
Output	The output signal type is fixed to "AC".
U/I	Operating mode of the internal signal generator: voltage or current source. Fixed to "Current".
Amplitude	Current value of the polarity check signal. Adjustable by the user. Possible values: 0 to 7A. Default: 1.00A.

The **upper part** of the **Results Polarity Check** card (Figure 8-7) displays the following values:

Value	Description
Output	Internally measured current value and phase of the output signal.[1]
Sec	Voltage measured at input "Sec".[1] The higher the resistance of the wiring checked or the current amplitude set on the *CT Analyzer*, the higher the terminal voltage generated by the injected current signal. This input is considered as the phase reference, therefore the phase is always 0.
Prim	Value and phase of the voltage measured at input "Prim".[1] Input "Prim" is not used for the Polarity Check measurement type.

1. Select the display mode for the current or voltage value using the soft keys: **RMS**, **DC**, **Peak+** (highest positive peak value) or **Peak-** (highest negative peak value).

The **lower part** of the **Results Polarity Check** card (Figure 8-7) displays some quantities of the injected polarity check signal. In this area, you can freely define which quantity each single field should display.

Figure 8-7 shows the **Results Polarity Check** card with the default selection for the fields.

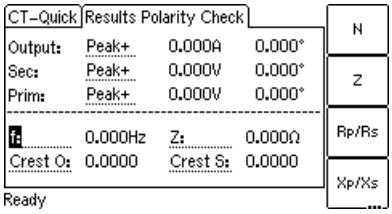


Figure 8-7 **Results Polarity Check** card with default selection for the displayed quantities

Use the cursor keys to move the cursor to a field and then select the quantity to be displayed in this field using the available soft keys. Please refer to page 143 (Advanced Measurement type) for a detailed description of the available quantities (soft keys).

Use the following wiring for the polarity check (example):

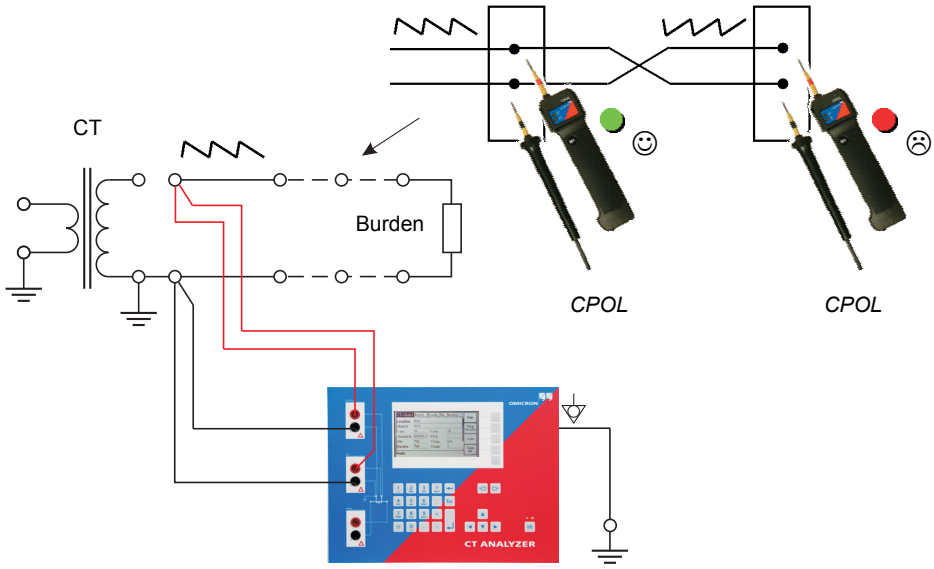


Figure 8-8 Wiring example for polarity check

Note: The *CT Analyzer* measures the voltage of the injected signal using input "Sec". Therefore, you should always connect this input when using the Polarity Check measurement type. The higher the resistance of the wiring checked (i.e., the burden wiring) or the current amplitude set on the *CT Analyzer*, the higher the terminal voltage generated by this current!

Proceed as follows to perform a polarity check

1. Make sure that the wiring to be checked is disconnected from the ungrounded side of the CT (see Figure 8-8).
2. Connect the "Output" sockets and input "Sec" of the *CT Analyzer* to the wiring to be checked (see Figure 8-8).
3. Open the *Quick Test* measurement function on the *CT Analyzer*.
4. Select the **Polarity Check** measurement type and set the amplitude of the polarity check signal appropriately.
5. Start the polarity check by pressing the I/0 key on the *CT Analyzer*.
6. The **Results Polarity Check** card displays the measured values as long as the measurement is active.

7. Use the *CPOL* polarity checker to check the polarity of the wiring (see Figure 8-8 on page 147).
   - If the *CPOL* detects the same signal characteristic at a test point, it considers the polarity as OK, and lights up the green LED.
   - If the signal characteristic is inverted, the *CPOL* considers the polarity not OK, and lights up the red LED.

Warning: If you detect a wrong polarity in the signal path, stop the measurement (see step 8) and turn off the *CT Analyzer* first. Only then disconnect the terminals.

   - If the *CPOL* does not detect any signal (for example, due to a too small signal magnitude), both LEDs light up at the same time.
   - If the wiring to be tested is open (disconnected or interrupted), the *CT Analyzer* indicates by an intermittent beep sound that no output current is flowing.

   If you are in doubt whether your measurement is correct, you can confirm it by reversing the probes of the *CPOL*. In that case, the other LED should light up.

8. Stop the measurement by pressing the I/0 key on the *CT Analyzer* again.

Note: Please refer to the CPOL User Manual for detailed information about the *CPOL* polarity checker.

8.6 CT Ratio Measurement

Caution: CT ratio measurement using *Quick Test* is not a complete CT test! This measurement only determines the current ratio of CTs. The *CT Analyzer* does not perform automatic demagnetization after the measurement.

How to get there:

Press the **Main** soft key in any test card

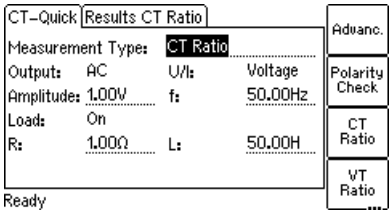
Main Menu:
- New Quick-Test

OK soft key

CT-Quick card:
Measurement Type:
CT Ratio

This is a predefined measurement type, intended especially for the quick measurement of CT ratios.

To select the CT Ratio measurement type, use the ▼ cursor key to move the cursor to the **Measurement Type** field in the **CT-Quick** card and then press the **CT Ratio** soft key.



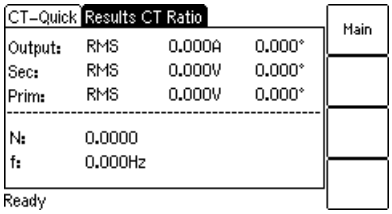


Figure 8-9 **CT-Quick** card and **Results** card for CT ratio measurement

For the **CT Ratio** measurement type, the **CT-Quick** card holds the following measurement quantities:

Parameter	Description
Output	The output signal type is fixed to "AC".
U/I	Operating mode of the internal signal generator: voltage or current source. Fixed to "Voltage".
Amplitude	RMS voltage of the output signal. Adjustable by the user. Possible values: 0 to 40 V. Default: 1.00 V.
f	Frequency of the output signal. Adjustable by the user. Possible values: 5.0 to 400.0 Hz or soft keys **16.7 Hz**, **50 Hz**, **60 Hz** or **400 Hz**. Default: 50 Hz
Load	Fixed to "On". Setting the **Load** parameter to "on" and specifying the winding resistance and the unsaturated inductance in the fields **R** and **L** will prevent saturation of the connected CT. The output generator of the *CT Analyzer* then keeps the DC part of the output current at zero using a current regulator permanently running during the output of AC signals.

Parameter	Description
R, L	Winding resistance (**R**) and unsaturated inductance (**L**) of the CT, used by the internal output regulator to prevent saturation of the connected CT (see **Load** above). Possible values: 0 to 1000 Ω or 0 to 1000 H. Default: 1.00 Ω for **R** and 50.00 H for **L** If these values are not set correctly for the connected CT, the CT will saturate sooner or later, depending on the inaccuracy of the values used.

The following values are displayed in the **Results CT Ratio** card:

Value	Description
Output	Internally measured RMS current value and phase of the output signal.
Sec	RMS value of the voltage measured at input "Sec". This input is considered as the phase reference, therefore the phase is always 0.
Prim	RMS value and phase of the voltage measured at input "Prim".
N	Current ratio of the CT calculated from the voltages measured at inputs "Sec" and "Prim".
f	Frequency measured at input "Sec".

Use the following wiring for CT ratio measurement (example):

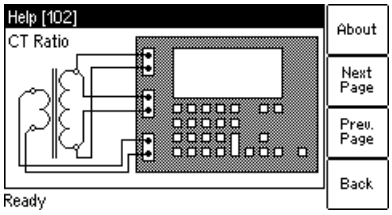


Figure 8-10 Wiring example for CT ratio measurement

8.7 VT Ratio Measurement

Warning: For VT ratio measurement, the *CT Analyzer* output has to be connected to the **primary side** of the VT. Connecting the *CT Analyzer* output to the secondary side of the VT by mistake will cause hazardous voltages on the primary side!

Caution: VT ratio measurement using *Quick Test* is not a complete VT test! This measurement only determines the voltage ratio of VTs. The *CT Analyzer* does not perform automatic demagnetization after the measurement.

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- New Quick-Test

OK soft key

CT-Quick card:
Measurement Type:
VT Ratio

This is a predefined measurement type, intended especially for the quick measurement of VT ratios.

To select the VT Ratio measurement type, use the ▼ cursor key to move the cursor to the **Measurement Type** field in the **CT-Quick** card and then press the **VT Ratio** soft key.

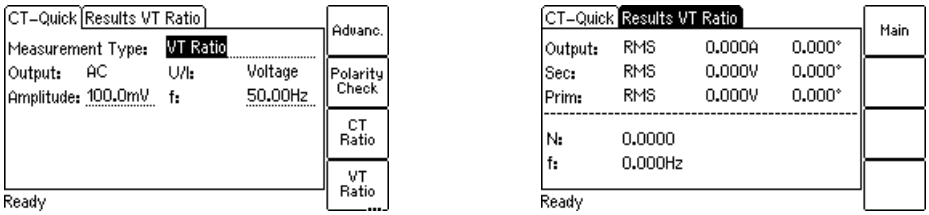


Figure 8-11 **CT-Quick** card and **Results** card for VT ratio measurement

For the **VT Ratio** measurement type, the **CT-Quick** card holds the following measurement quantities:

Parameter	Description
Output	The output signal type is fixed to "AC".
U/I	Operating mode of the internal signal generator: voltage or current source. Fixed to "Voltage".
Amplitude	RMS voltage of the output signal. Adjustable by the user. Possible values: 0 to 40 V. Default: 1.00 V.
f	Frequency of the output signal. Adjustable by the user. Possible values: 5.0 to 400.0 Hz or soft keys **16.7 Hz**, **50 Hz**, **60 Hz** or **400 Hz**. Default: 50 Hz

The following values are displayed in the **Results VT Ratio** card:

Value	Description
Output	Internally measured RMS current value and phase of the output signal.
Sec	RMS value of the voltage measured at input "Sec". This input is considered as the phase reference, therefore the phase is always 0.
Prim	RMS value and phase of the voltage measured at input "Prim".
N	Voltage ratio of the VT calculated from the voltages measured at inputs "Sec" and "Prim".
f	Frequency measured at input "Sec".

Proceed as follows to perform a VT ratio measurement:

1. Connect the "Output" sockets and input "Sec" of the *CT Analyzer* to the primary side of the VT and input "Prim" of the *CT Analyzer* to the secondary winding of the VT (see Figure 8-12).

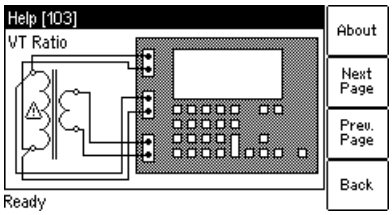


Figure 8-12 Wiring example for VT ratio measurement

Warning: Hazardous voltages will occur on the primary side of the VT if the *CT Analyzer* output is connected to the secondary side of the VT by mistake!

2. Open the *Quick Test* measurement function on the *CT Analyzer* or start the *CTA QuickTest* PC tool from the *CTA Start Page*.

3. Select the **VT Ratio** measurement type. Set the amplitude to the maximum output voltage of 40 V and the frequency to the mains frequency. Refer to Figure 8-13.

   Note: If it is necessary to suppress mains frequency interferences, use the **Advanced** measurement type with a frequency of e.g. 3 Hz above the mains frequency (e.g. 53 Hz) and choose the frequency-selective measurement mode with a filter bandwidth of 6 Hz. Mains frequency interferences are then suppressed by 120 dB.

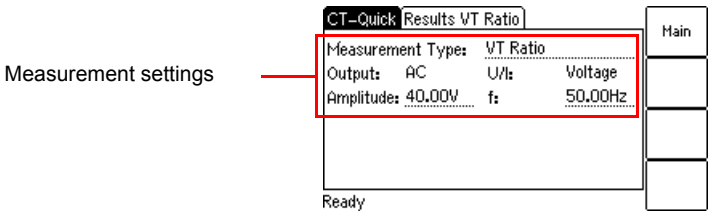


Figure 8-13 **CT-Quick** test card with settings for VT ratio measurement

4. Start the measurement by pressing the I/0 key on the *CT Analyzer* or clicking the **ON** button on the **VT Ratio** tab of the *CTA QuickTest* software. The measured values are displayed and permanently updated as long as the measurement is active. Refer to Figure 8-14.
5. Stop the measurement by pressing the I/0 key on the *CT Analyzer* again or clicking the **OFF** button on the **VT Ratio** tab of the *CTA QuickTest* software.

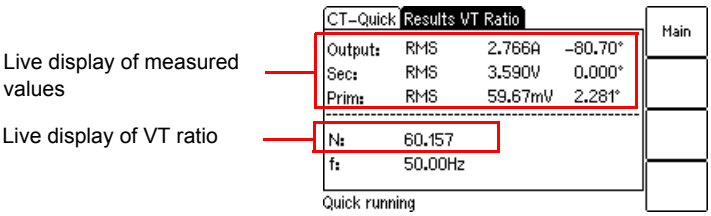


Figure 8-14 **Results** test card for VT ratio measurement

8.8 Resistance Measurement

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- New Quick-Test

OK soft key

CT-Quick card:
Measurement Type: Resistance

This is a predefined measurement type, intended especially for the quick measurement of resistances.

To select the Resistance measurement type, use the ▼ cursor key to move the cursor to the **Measurement Type** field in the **CT-Quick** card and then press the **Resist.** soft key.

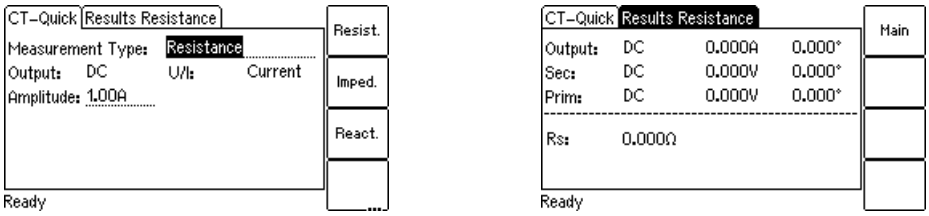


Figure 8-15 **CT-Quick** card and **Results** card for resistance measurement

For the **Resistance** measurement type, the **CT-Quick** card holds the following measurement quantities:

Parameter	Description
Output	The output signal type is fixed to "DC".
U/I	Operating mode of the internal signal generator: voltage or current source. Fixed to "Current".
Amplitude	Amplitude of the output current. Adjustable by the user. Possible values: 0 to 10A. Default: 1.00A.

Warning: Resistance measurement is performed with **DC current**. Feeding an inductance with DC current will charge the inductance. The *CT Analyzer* does not perform automatic discharge of the inductance. Risk of electric shock! Wait until the inductance has discharged completely before touching any connections or disconnecting the measurement leads of the *CT Analyzer*.

The following values are displayed in the **Results Resistance** card:

Value	Description
Output	Internally measured output current.
Sec	Voltage measured at input "Sec".
Prim	Not used for resistance measurement.
Rs	Serial resistance, calculated from the output current and the voltage measured at input "Sec".

Note: The resistance measurement uses the serial equivalent circuit diagram for results calculation.

Use the following wiring for resistance measurement (example):

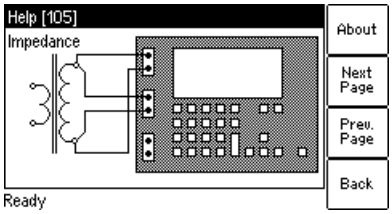


Figure 8-16 Wiring example for resistance measurement

Proceed as follows to perform winding resistance measurement on VTs:

1. Connect the "Output" sockets and input "Sec" of the *CT Analyzer* to the winding to be measured (see Figure 8-16).
2. Open the *Quick Test* measurement function on the *CT Analyzer* or start the *CTA QuickTest* PC tool from the *CTA Start Page*.
3. Select the **Resistance** measurement type and set the amplitude of the DC output current appropriately. Refer to Figure 8-17.

Caution: Use only low currents of e.g. 100 mA when measuring the primary side of VTs. **Too high currents could destroy the winding!**

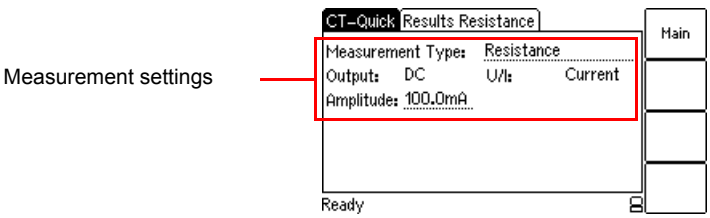


Figure 8-17 **CT-Quick** test card with settings for VT winding resistance measurement

4. Start the measurement by pressing the I/0 key on the *CT Analyzer* or clicking the **ON** button on the **Resistance** tab of the *CTA QuickTest* software. The measured values are displayed and permanently updated as long as the measurement is active. Refer to Figure 8-18.

5. Stop the measurement by pressing the I/0 key on the *CT Analyzer* again or clicking the **OFF** button on the **Resistance** tab of the *CTA QuickTest* software.

Live display of winding resistance

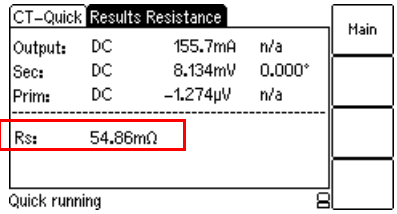


Figure 8-18 **Results** test card for VT winding resistance measurement

8.9 Impedance Measurement

How to get there:

Press the **Main** soft key in any test card

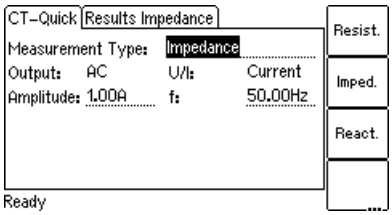
Main Menu:
- New Quick-Test

OK soft key

CT-Quick card:
Measurement Type: Impedance

This is a predefined measurement type, intended especially for the quick measurement of impedances.

To select the Impedance measurement type, use the ▼ cursor key to move the cursor to the **Measurement Type** field in the **CT-Quick** card and then press the **Imped.** soft key.



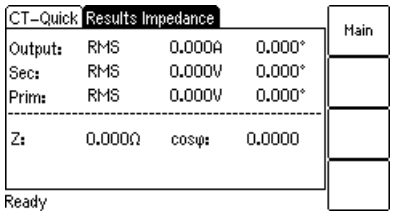


Figure 8-19 **CT-Quick** card and **Results** card for impedance measurement

For the **Impedance** measurement type, the **CT-Quick** card holds the following measurement quantities:

Parameter	Description
Output	The output signal type is fixed to "AC".
V/I	Operating mode of the internal signal generator: voltage or current source. Fixed to "Current".
Amplitude	RMS value of the output current. Adjustable by the user. Possible values: 0 to 5A. Default: 1.00A.

Parameter	Description
f	Frequency of the output signal. Adjustable by the user. Possible values: 5.0 to 400.0 Hz or soft keys **16.7 Hz**, **50 Hz**, **60 Hz** or **400 Hz**. Default: 50 Hz

The following values are displayed in the **Results Impedance** card:

Value	Description
Output	Internally measured RMS value and phase of the output current.
Sec	RMS value of the voltage measured at input "Sec". This input is considered as the phase reference, therefore the phase is always 0.
Prim	Not used for impedance measurement.
Z	Measured impedance, calculated from the magnitude and phase angle of the output signal and the voltage measured at input "Sec".
cos φ	Power factor of the measured impedance.

Use the following wiring for impedance measurement (example):

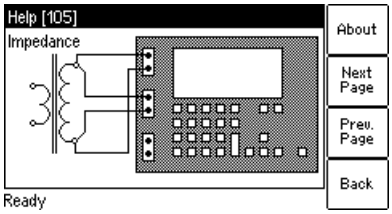


Figure 8-20 Wiring example for impedance measurement

8.10 Reactance Measurement

How to get there:

Press the **Main** soft key in any test card

Main Menu:
- New Quick-Test

OK soft key

CT-Quick card:
Measurement Type: Reactance

This is a predefined measurement type, intended especially for the quick measurement of reactances.

To select the Reactance measurement type, use the ▼ cursor key to move the cursor to the **Measurement Type** field in the **CT-Quick** card and then press the **React.** soft key.

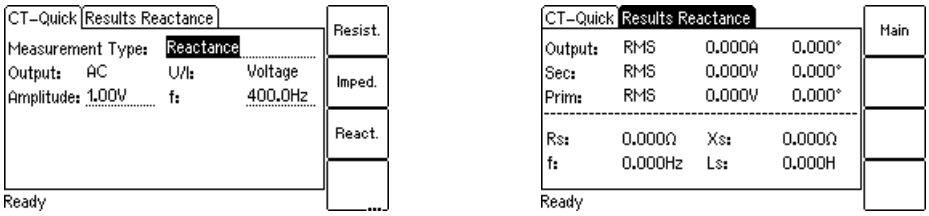


Figure 8-21 **CT-Quick** card and **Results** card for reactance measurement

For the **Reactance** measurement type, the **CT-Quick** card holds the following measurement quantities:

Parameter	Description
Output	The output signal type is fixed to "AC".
U/I	Operating mode of the internal signal generator: voltage or current source. Fixed to "Voltage".
Amplitude	RMS voltage of the output signal. Adjustable by the user. Possible values: 0 to 40 V. Default: 1.00 V.
f	Frequency of the output signal. Adjustable by the user. Possible values: 5.0 to 400.0 Hz or soft keys **16.7 Hz**, **50 Hz**, **60 Hz** or **400 Hz**. Default: 400 Hz

The following values are displayed in the **Results Reactance** card:

Value	Description
Output	Internally measured RMS current value and phase of the output signal.
Sec	RMS value of the voltage measured at input "Sec". This input is considered as the phase reference, therefore the phase is always 0.

Value	Description
Prim	Not used for reactance measurement.
Rs	Serial resistance, calculated from the output signal and the voltage measured at input "Sec".
Xs	Serial reactance, calculated from the magnitude and phase angle of the output signal and the voltage measured at input "Sec".
f	Frequency measured at input "Sec".
Ls or Cs	Serial inductance or capacitance of the test object, calculated from the measured values. The *CT Analyzer* automatically detects whether the test object is an inductance or a capacitance based on the phase angle.

Note: The reactance measurement uses the serial equivalent circuit diagram for results calculation.

Use the following wiring for reactance measurement (example):

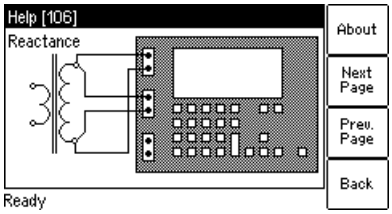


Figure 8-22 Wiring example for reactance measurement

9 CT Analyzer PC Toolset

The *CT Analyzer PC Toolset* contains a set of PC software that is necessary and helpful for your work with the *CT Analyzer* on a PC.

The following tools are installed with the *CT Analyzer PC Toolset*:

- *CTA Start Page*
- *CTA QuickTest*
- *CTA Firmware Update*
- *CT Report Tool (Remote Excel File Loader)* with templates for single-ratio CT measurement and multi-ratio CT measurement
- *Report Converter (XML to WORD)*
- *OMICRON Device Browser*
- *CTA Remote Control* incl. sample software
- CTA remote test sample for Visual Basic (VBA)
- CTA remote test sample for C++

For detailed information about the software of the *CT Analyzer PC Toolset*, please click the "CT Analyzer Help" hyperlink on the *CTA Start Page*.

9.1 System Requirements

The software of the *CT Analyzer PC Toolset* requires the following software installed on the system:

- Operating system:
  Windows XP SP3, Windows Vista SP1 32 bit, Windows 7 32 bit, Windows 7 64 bit.

  Note: Windows XP requires administrative rights for your local machine
- Microsoft Office® (required for *CT Report Tool* (Remote Excel File Loader) with *CTA Remote Control* software and *Report Converter (XML to WORD)*):
  Office 2002 (XP) SP3, Office 2003 SP3, Office 2007 SP2 or Office 2010.

9.2 Installing the CT Analyzer PC Toolset

The *CT Analyzer PC Toolset* and its installation program *Setup Wizard* are included on the "*CT Analyzer PC Toolset*" CD ROM accompanying the *CT Analyzer*. Proceed as follows to install the *CT Analyzer PC Toolset*:

1. Exit all other major programs running on your computer.

2. Insert the "*CT Analyzer PC Toolset*" CD ROM into your computer's CD ROM drive. The Setup Wizard starts automatically.

   Note: Should the Setup Wizard not start automatically a few seconds after the CD has been inserted into the CD ROM drive, change to the Windows Explorer and double-click **setup.exe** on the "*CT Analyzer PC Toolset*" CD ROM.

3. Follow the instructions displayed on the screen to install the software.

9.3 The CTA Start Page

The *CTA Start Page* is the central organizing element for the PC software tools available for the *CT Analyzer*.

There are two ways to launch the *CTA Start Page*:

1. Select **Programs | OMICRON | CT Analyzer | CTA Start Page** in the Windows **Start** menu.

2. Or double-click the **CTA Start Page** desktop icon.

Figure 9-1 CTA Start Page

In the *CTA Start Page*, click **CT Analyzer Help** to open the help system with detailed information about the software tools of the *CT Analyzer PC Toolset*.

10 Technical Data

Guaranteed data are specified for an ambient temperature of 23 °C ± 5 ° (73 °F ± 9 °), a power supply of 115/230 V_{AC}, and after a warm-up time longer than 15 minutes.

Guaranteed data are valid for the period of one year after factory adjustment.

10.1 Mains Power Supply

Mains power supply	
Connection	Connector according to IEC 60320
Mains voltage	100 - 240 V_{AC} / 50/60 Hz / 6 A Instead of supplying the *CT Analyzer* from phase-neutral (L1-N, A-N), it may also be supplied from phase-phase (e.g. L1-L2, A-B). However, the nominal voltage must not exceed 240 V_{AC}.
Mains fuses	2 x T6AH 250 V, (high-breaking capacity wire fuse 5 x 20 mm)

10.2 Generator Output

Generator output	
Output voltage / current	AC: 40 V_{rms} / 5 A_{rms} max. DC: 120 V / 15 A max.
Output power	400 VA_{rms} max.

10.3 Measurement Inputs

Measurement input "Sec"	
Voltage ranges	0 - 0.3 / 3 / 30 / 300 V_{AC} (auto ranging)
Accuracy	0.1 % (guaranteed)

Measurement input "Sec"	
Input impedance	0 - 15 V: 1 MΩ 15 - 150 V: 500 kΩ to 1 MΩ, depending on the voltage. Input current is compensated by the device.
Insulation	Reinforced insulation (R) to all other circuits

Measurement input "Prim"	
Voltage ranges	0 - 0.03 / 0.3 / 3 / 30 V_{AC} (auto ranging)
Accuracy	0.1 % (guaranteed)
Input impedance	0 - 15 V: 330 kΩ 15 - 30 V: 120 kΩ to 330 kΩ, depending on the voltage.
Insulation	Reinforced insulation (R) to all other circuits

10.4 Winding Resistance Measurement Accuracy

Winding resistance measurement accuracy	
Resolution	1 mΩ
Accuracy	0.05 % (typical) 0.1 % + 1 mΩ (guaranteed)

10.5 Ratio and Phase Measurement Accuracy

The values given in the following table are only valid under the following conditions:

- All utility lines to the primary side of the CT are disconnected.
- One terminal of the primary side of the CT is connected to PE.
- The original measurement cables delivered by OMICRON for the *CT Analyzer* are used.
- The CT under test is a CT with a non-gapped core.
- The knee point voltage according to IEEE C57.13 is > 3 V.

Under interfering conditions the device has reduced accuracy.

Values without the prefix "!" in the ratio table of the **Ratio** card have guaranteed accuracy. The accuracy of values marked with a "!" in the table is reduced by factor 2 since these values are not directly measured but calculated from the measured values instead.

Ratio measurement accuracy for 1 A CTs at rated current				
CT ratio	**I_{sn}**	**Rated power[1]**	**Typical accuracy**	**Guaranteed accuracy**
0.2 - 1	1	1.0 - 30VA	0.05%	0.1%
> 1 - 2000	1	0 - 30VA	0.02%	0.05%
> 2000 - 5000	1	0 - 30VA	0.03%	0.1%
> 5000 - 10000	1	0 - 30VA	0.05%	0.2%

1. Nominal burden of the CT.

Ratio measurement accuracy for 5 A CTs at rated current				
CT ratio	**I_{sn}**	**Rated power[1]**	**Typical accuracy**	**Guaranteed accuracy**
0.2 - 1	5	1.0 - 75VA	0.05%	0.1%
> 1 - 2000	5	0 - 75VA	0.02%	0.05%
> 2000 - 5000	5	0 - 75VA	0.03%	0.1%
> 5000 - 10000	5	0 - 75VA	0.05%	0.2%

1. Nominal burden of the CT.

Phase measurement accuracy at rated current	
Resolution	0.01min
Accuracy (cos φ 0.8 - 1)	1min (typical) 3min (guaranteed)

Turns ratio measurement accuracy	
Resolution	0.01 turns
Accuracy	0.05% (typical) 0.1% (guaranteed)

10.6 Compact Flash Card Interface

Compact Flash card interface	
Card type	CF type 1
Allowed memory size	16 MB - 2 GB

10.7 Remote Control Interface

The remote control interface of the *CT Analyzer* is exclusively intended to connect the *CT Analyzer* to a computer (e.g. running the *CT Analyzer PC Toolset* software) or to the optional *CT SB2* switch box (for multi-ratio CT measurement).

As of serial number JHxxxx or newer, the *CT Analyzer* is equipped with a USB interface and a RS232 interface.

Note: The user has to select the interface to be used in the *CT Analyzer* settings before connecting the *CT Analyzer* to a computer (refer to section 2.3 on page 23). The *CT Analyzer* will only communicate via the selected interface. It will not be recognized by the computer if the *CT Analyzer* settings do not match the interface used for connection.

10.7.1 RS232 Interface

The RS232 interface can be used to connect the *CT Analyzer* to a computer or to the optional *CT SB2* switch box.

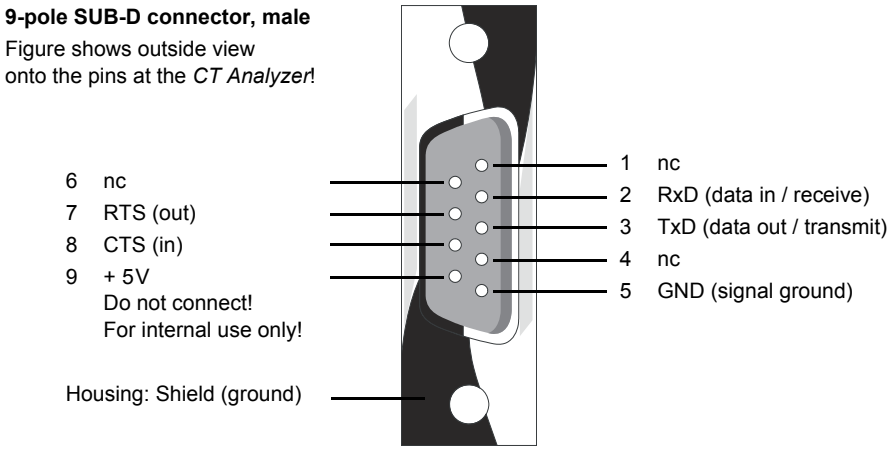


Figure 10-1 Pin assignment for RS232 remote control interface

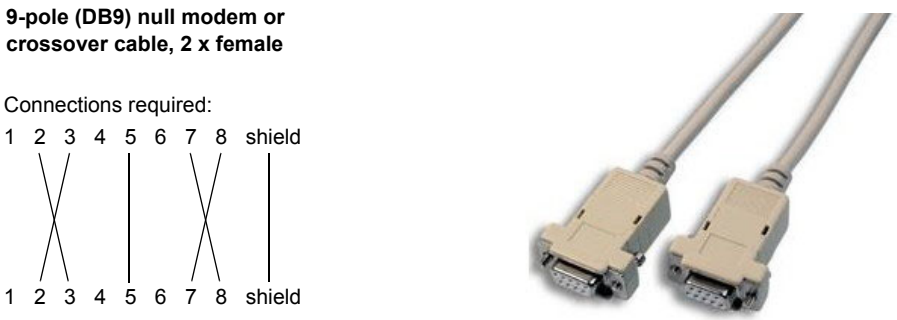


Figure 10-2 Connection cable for RS232 remote control interface

10.7.2 USB Interface

The USB interface can be used to connect the *CT Analyzer* to a computer. Communication via USB is considerably faster than communication via RS232.

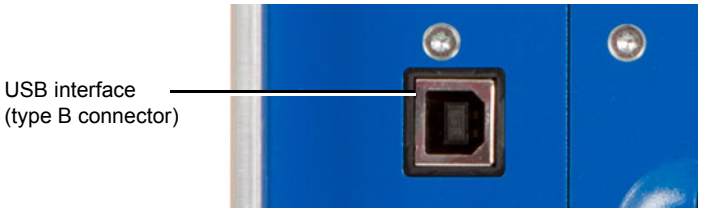


Figure 10-3 USB remote control interface (standard type B connector)

10.8 Environmental Conditions

10.8.1 Climate

Climate	
Operating temperature	–10 … +50 °C (14 … 122 °F)
Storage and transportation	–25 … +70 °C (–13 … 158 °F)
Max. altitude	2000 m
Humidity	5 … 95 % relative humidity, non-condensing Tested acc. to IEC 60068-2-78, Cab, Damp Heat: Temp. 40 °C, duration 48 h, rel. humidity 95 %

10.8.2 Shock and Vibration

Dynamics	
Vibration	Tested according to IEC 60068-2-6; frequency range 10 … 150 Hz; acceleration 2g continuous (20 m/s^2); 20 cycles per axis
Shock	Tested according to IEC 60068-2-27 (operating mode); 15g / 11ms, half-sinusoid, 3 shocks in each axis

10.8.3 Mechanical Data

Weight, Dimensions and Protection	
Weight	< 8kg (17.6lbs) without accessories
Dimensions W x H x D	360 x 285 x 145mm (14.2 x 11.2 x 5.7")

10.8.4 Safety Standards, Electromagnetic Compatibility (EMC)

CE Conformity, Requirements	
The product adheres to the specifications of the guidelines of the Council of the European Community for meeting the requirements of the member states regarding the electromagnetic compatibility (EMC) Directive 2004/108/EC and the low-voltage Directive 2006/95/EC.	
EMC	
Emission	
Europe International USA	EN 61326-1 Class A IEC 61326-1 Class A FCC Subpart B of Part 15 Class A
Immunity	
Europe International	EN 61326-1 IEC 61326-1
Certified Safety Standards	
Europe International USA	EN 61010-1 IEC 61010-1 UL 61010-1

11 User Maintenance

11.1 Care and Cleaning

The *CT Analyzer* does not require any special maintenance or care. Clean the device from time to time or as necessary using a cloth dampened with water or isopropanol alcohol. Always disconnect the *CT Analyzer* prior to cleaning!

11.2 Replacing Fuses

1. Turn off the *CT Analyzer* and unplug the power cord.
2. Ground the test object, and disconnect it from the *CT Analyzer*. By disconnecting it you prevent a possibly faulty test object from feeding power back into the *CT Analyzer*.
3. Locate the blown fuse on the side panel of the *CT Analyzer* and replace it by an identical fuse type: T6.3H 250 V (6.3 Amps slow-acting high breaking capacity wire fuse 5 x 20mm). The *CT Analyzer* has two fuses of the same type.

11.3 Calibrating the CT Analyzer

OMICRON offers a reference CT (calibration CT VEHZ0649) to verify the calibration of the *CT Analyzer*. This reference CT is delivered together with a calibration certificate of a national test laboratory.

The calibration CT has a ratio of 2000:1 and 2000:5. Its class is 0.02.

To verify the calibration of the *CT Analyzer*, it is necessary to measure both ratios (2000:1 and 2000:5). The *CT Analyzer* is within the specifications, if all measurement results are within class 0.02.

If the measurement results are not within class 0.02, we recommend to send the *CT Analyzer* back to OMICRON for calibration in order to guarantee proper operation in accordance with the regulations.

12 Error and Warning Messages

001.xxx **Error [001] No valid CT software!**
Reason: No valid software in the device Flash memory or incorrect checksum.
Solution: Insert a Compact Flash card with valid software (**CTAnalyzer.bin**) in the **Omicron** directory and switch the *CT Analyzer* off and on again.

002.xxx **Error [002] Can't open file!**
Reason: The firmware cannot read the file **CTAnalyzer.bin** from the Compact Flash card since the CF card or the file is missing.
Solution: Insert a Compact Flash card with valid software (**CTAnalyzer.bin**) in the **Omicron** directory and switch the *CT Analyzer* off and on again.

003.xxx **Error [003] Download error!**
Reason: The downloaded software is corrupt.
Solution: Insert a Compact Flash card with valid software (**CTAnalyzer.bin**) in the **Omicron** directory and switch the *CT Analyzer* off and on again.

100.xxx **Warning [100.xxx] CT resistance > 3000 Ohms.**
Reason: The resistance measured during primary or secondary winding resistance measurement is > 3000Ω.
Solution: The test cannot be continued. Check the connections to the CT. If the connections are ok, the CT resistance is > 3000Ω. Such CTs cannot be tested using the *CT Analyzer*.

101.xxx **Warning [101.xxx] Timeout during measurement. No constant winding resistance can be determined within 10 sec.**
Reason: The *CT Analyzer* cannot determine a constant winding resistance within 10sec. during primary or secondary winding resistance measurement.
Solution: The test cannot be continued. Check the connections to the CT.

110.xxx **Warning [110.xxx] The impedance of the CT is too high.**
Reason: The impedance of the CT or the load is too high to reach the minimum toggle frequency of 0.2Hz / 0.8Hz.
Solution: The test cannot be continued. Check the connections to the CT. If the connections are ok, it is not possible to test this CT due to its too high inductance.

111.xxx **Warning [111.xxx] Inductance of load too low.**
Reason: Measurement frequency is too high and cannot be decreased because of too low CT inductance.
Solution: The test cannot be continued. Check the connections to the CT. If the connections are ok, it is not possible to test this CT due to its too low inductance.

112.xxx **Warning [112.xxx] Measurement error, reduce noise level.**
Reason: It is not possible to obtain stable measurement results due to incorrect wiring, wiring short-circuit, connected load or external interferences.
Solution: Check the wiring. The primary side of the CT must not be short-circuited. Disconnect the primary side of the CT from the transmission lines, connect one primary side terminal to PE and open the other one. Use the delivered original coax cables for measurement (see section 2.7.2 ”Noise Reduction Techniques” on page 43). Make sure that no burden is connected to the secondary side of the CT. This error may also indicate a winding short circuit of the CT.

113.xxx **Warning [113.xxx] Test not successful. Kneepoint not found.**
Reason: Knee point for specified standard not found.
Solution: The current required to reach the knee point for the specified standard cannot be delivered. The CT cannot be tested up to the knee point voltage.

114.xxx **Warning [114.xxx] Low inductance detected during excitation measurement.**
Reason: Low inductance was measured during the excitation test.
Solution: Verify that the primary side of the CT is not short-circuited.
This warning can also occur for CTs with very low excitation loss and high parasitic capacitance.

115.xxx **Warning [115.xxx] Invalid eddy loss measurement.**
Reason: Reliable determination of the eddy losses is not possible.
Solution: Verify the wiring and repeat the test. If the error message is displayed repeatedly, it is currently not possible to test this CT using the *CT Analyzer*.

116.xxx **Warning [116.xxx] Knee point too low! CTs with a knee point below 1 volt are not supported.**
Reason: The knee point voltage is smaller than 1 V.
Solution: Currently it is not possible to test CTs with such a low knee point using the *CT Analyzer*.

121.xxx **Warning [121.xxx] Test not successful! Reverse polarity. Check wiring and repeat the measurement.**
Reason: Measured polarity is wrong.
Solution: Reverse the polarity of the measurement cables on the primary or secondary side of the CT.

130.xxx **Warning [130.xxx] Burden impedance > 1kOhm.**
Reason: Burden impedance > 1 kΩ.
Solution: The test cannot be continued. Check the connections to the Burden.

131.xxx **Warning [131.xxx] Overload during Burden measurement.**
Reason: The required test current cannot be reached, even at the maximum output voltage.
Solution: The *CT Analyzer* cannot deliver enough current. Reduce the test current or the impedance of the burden. Check the wiring for proper contacts; one connection possibly has a bad connection.

140.xxx **Warning [140.xxx] Timeout during remanence test. Measured magnetic flux is unstable. Reduce noise level.**
Reason: The magnetic flux during remanence measurement is not stable.
Solution: The test cannot be continued. Check the connections to the CT. Try to reduce the noise level for the measurement.

200.xxx **Warning [200.xxx] Check connection. Make sure burden is properly wired.**
Reason: The measured input voltage differs by more than 5V from the input voltage expected during burden test.
Solution: Check whether the output generator ("Output") and measurement input "Sec" are connected correctly.

200.xxx **Warning [200.xxx] Check CT SB2 switch box wiring: CTA OUTPUT and/or BURDEN terminal may be disconnected.**
Reason: The measured input voltage differs by more than 5V from the input voltage expected during the burden test using the *CT SB2* switch box.
Solution: Check whether the BURDEN OUT and the BURDEN IN sockets on the *CT SB2* are connected correctly.

201.xxx **Warning [201.xxx] Check connection. Measured ratio > 50000:1.**
Reason: Measurement input "Prim" is possibly not connected properly.
Solution: Check whether the primary side measurement input "Prim" is connected properly.

202.xxx **Warning [202.xxx] Check connection. Polarity of input SEC and power output are not the same.**
Reason: Polarity of input "Sec" and "Output" are not the same.
Solution: Check whether the output generator ("Output") and measurement input "Sec" are connected properly and with correct polarity.

203.xxx **Warning [203.xxx] Check connection. Input SEC may be disconnected.**
Reason: Input signal at input "Sec" differs from the expected one.
Solution: Check whether the output generator ("Output") and measurement input "Sec" are connected properly.

204.xxx **Warning [204.xxx] Check connection. Polarity of input PRIM and power output are not the same.**
Reason: Input signal at input "Prim" differs from the expected one: Reverse polarity at input "Prim".
Solution: Check whether the output generator ("Output") and measurement input "Prim" are connected properly and with correct polarity.

204.xxx **Warning [204.xxx] Check CT SB2 switch box wiring: Wrong polarity at PRIM terminal.**
Reason: Input signal at input "PRIM" differs from the expected one: Reverse polarity at *CT SB2* input "PRIM".
Solution: Check whether the PRIM IN sockets on the *CT SB2* are connected properly and with correct polarity. If necessary, connect with changed polarity.

205.xxx **Warning [205.xxx] Check connection. Input PRIM may be disconnected.**
Reason: Input signal at input "Prim" differs from the expected one.
Solution: Check whether the output generator ("Output") and measurement input "Prim" are connected properly.

205.xxx **Warning [205.xxx] Check CT SB2 switch box wiring: PRIM IN terminal may be disconnected.**
Reason: Input signal at input "Prim" differs from the expected one.
Solution: Check whether the PRIM IN sockets on the *CT SB2* are connected properly.

206.xxx **Warning [206.xxx] Check connection. Ensure that the output is connected to the primary side of the CT.**
Reason: Input signal at input "Prim" differs from the expected one.
Solution: Check that the output generator ("Output") is connected to the CT and that the primary side of the CT is connected to input "Prim".

206.xxx **Warning [206.xxx] Check CT SB2 switch box wiring: CTA OUTPUT and/or PRIM OUT terminal may be disconnected.**
Reason: Input signal at input "Prim" differs from the expected one.
Solution: Check whether the PRIM OUT and the PRIM IN sockets on the *CT SB2* are connected correctly to the primary side of the CT.

207.xxx **Warning [207.xxx] Check connection! OUTPUT may be disconnected.**
Reason: The current signal differs from the expected one.
Solution: Check whether the output generator ("Output") and measurement input "SEC" are connected properly to the secondary side of the CT.

210.xxx **Warning [210.xxx] Permanent data overflow.**
Reason: Internal data buffer overflow. The data could not be fetched fast enough from the internal data buffer.
Solution: Try to repeat the measurement. If this error occurs more frequently, you should contact your next OMICRON service center.

211.xxx **Warning [211.xxx] AC mode measurement timeout.**
Reason: Measurement timeout due to frequent range switching or invalid data from the measurement inputs.
Solution: Check the wiring and repeat the measurement. Try to reduce noise for the measurement.

220.xxx **Warning [220.xxx] Test aborted!**
Reason: The test sequence has been interrupted by the user.
Solution: Repeat the test without interrupting it.

308.xxx **Note [308.xxx] I-sn value has to be specified in CT-Object Card prior to Residual Magnetism test!**
Reason: For the remanence test the I_{sn} value should be defined.
Solution: Enter valid I_{sn} value before starting the remanence test.

310.xxx **Note [310.xxx] License: <Guesser functionality> is missing! Values for: Ipn, Isn, P/M, Class, FS/ALF should be provided.**
Reason: The license required for class guessing is not available.
Solution: Specify the values for I_{pn}, I_{sn}, Class, P/M and FS/ALF before starting the test.

311.xxx **Warning [311.xxx] License: <Simulation after test> is missing!**
Reason: The license required for simulation is not available.
Solution: Simulation of the results for changed test settings (e.g. different burden values) after the test is not possible. Purchase a corresponding license.

312.xxx **Warning [312.xxx] License: <...> is missing!**
Reason: The license specified in the message is not available.
Solution: The functionality included in the license is not available. Purchase a corresponding license.

313.xxx **Warning [313.xxx] License: <All languages> is missing! Test can be performed only if the Chinese user interface is set.**
Reason: The license required to use all languages is not available.
Solution: Perform the test with the Chinese user interface or purchase a corresponding license.

318.xxx **Warning [318.xxx] License: <Burden guesser> is missing! Values for VA, Burden, Cosφ should be provided.**
Reason: The license required for the burden guesser functionality is not available.
Solution: Specify the values for nominal and operating burden (VA, Burden and cosφ) or purchase a corresponding license.

319.xxx **Warning [319.xxx] License: <Quick test> is missing!**
Reason: The license required for the Quick Test functionality is not available.
Solution: Purchase a corresponding license if you want to perform measurements using Quick Test.

331.xxx **Note [331.xxx] Ipn is invalid! The value must be between the Ipn values of the neighboring taps.**
Reason: An invalid I_{pn} value has been entered to the **MR-Config.** card.
Solution: Enter a valid I_{pn} value.

332.xxx **Note [332.xxx] I-sn has to be specified. Vb and VA are calculated dependent on I-sn.**
Reason: You tried to enter values for V_b or VA without specifying the I_{sn} value first.
Solution: Enter a valid I_{sn} value before specifying values for V_b and VA.

333.xxx **Note [333.xxx] First define I-pn for this tap.**
Reason: You tried to enter a nominal burden (VA) value for a tap without specifying the I_{pn} for this tap first.
Solution: Enter a valid I_{pn} value for the tap before specifying the nominal burden (VA).

334.xxx **Note [334.xxx] Test cannot be started. Nominal burden (VA) should be >= 3.75VA.**
Reason: The nominal burden (VA) entered is lower than the limit specified in the device settings (parameter "Min. VA at M cores Isn 5A").
Solution: Enter a nominal burden (VA) higher than or equal to 3.75VA.

356.xxx **Warning [356.xxx] License: <All frequencies support> is missing! Only 60 Hz nominal frequency is supported.**
Reason: The license required to use all frequencies is not available.
Solution: Measurements are only possible for 60 Hz. Purchase a corresponding license if you want to perform testing with other frequencies.

357.xxx **Note [357.xxx] License: <P cores support> is missing! Only metering CTs can be measured.**
Reason: The license required to perform testing of protection cores is not available.
Solution: Testing is only possible for metering cores. Purchase a corresponding license if you want to perform testing of protection cores.

358.xxx **Warning [358.xxx] License: <M cores support> is missing! Only protection CTs can be measured.**
Reason: The license required to perform testing of metering cores is not available.
Solution: Testing is only possible for protection cores. Purchase a corresponding license if you want to perform testing of metering cores.

360.xxx **Note [360.xxx] No class assessments will be made, because one or more of the settings marked by a star ('?*' or '*') "are not defined.**
Reason: Some of the assessment-relevant settings are not defined.
Solution: Make sure that all settings that are relevant for assessment (marked by '?*' or '*') are defined.

400.xxx **Warning [400.xxx] You cannot make a multi-ratio measurement without a CT SB2 switch box!**
Reason: No *CT SB2* is connected when starting a multi-ratio measurement.
Solution: Connect the *CT SB2* to the *CT Analyzer* before starting a multi-ratio test.

401.xxx **Warning [401.xxx] CT SB2 switch box is disconnected!**
Reason: The *CT SB2* is not properly connected to the *CT Analyzer*.
Solution: Restore proper connection between the *CT SB2* and the *CT Analyzer* and restart your test.

402.xxx **Warning [402.xxx] CT SB2 switch box communication error.**
Reason: Communication between the *CT SB2* and the *CT Analyzer* failed.
Solution: Restore proper connection between the *CT SB2* and the *CT Analyzer* and restart your test.

403.xxx **Warning [403.xxx] Check CT SB2 switch box wiring: CTA OUTPUT, TAPS XN and/or X1 may be disconnected.**

Reason: The CTA OUTPUT sockets of the *CT SB2* are not properly connected to the *CT Analyzer* output.

Solution: Make sure that the CTA OUTPUT sockets on the *CT SB2* are properly connected to the *CT Analyzer* and restart your test.

404.xxx **Warning [404.xxx] Check CT SB2 switch box wiring: CTA PRIM and/or PRIM IN terminal may be disconnected.**

Reason: The CTA PRIM sockets of the *CT SB2* are not properly connected to *CT Analyzer* input PRIM.

Solution: Make sure that the CTA PRIM sockets on the *CT SB2* are properly connected to *CT Analyzer* input PRIM and restart your test.

405.xxx **Warning [405.xxx] Check CT SB2 switch box wiring: CTA SEC terminal, TAPS XN IN and/or X1 IN may be disconnected.**

Reason: The CTA SEC sockets of the *CT SB2* are not properly connected to *CT Analyzer* input SEC.

Solution: Make sure that the CTA SEC sockets on the *CT SB2* are properly connected to *CT Analyzer* input SEC and restart your test.

406.xxx **Warning [406.xxx] Check CT SB2 switch box wiring: <text depending on connection actually detected>**

Reason: The CTA SEC sockets of the *CT SB2* are not properly connected to *CT Analyzer* input SEC.

Solution: Make sure that the CTA SEC sockets on the *CT SB2* are properly connected to *CT Analyzer* input SEC and restart your test.

407.xxx **Warning [407.xxx] Check CT SB2 switch box wiring: Wrong polarity at CTA SEC or CTA OUTPUT terminal**

Reason: Reverse polarity at the CTA SEC sockets or the CTA OUTPUT sockets of the *CT SB2*.

Solution: Make sure that the CTA SEC sockets and the CTA OUTPUT sockets on the *CT SB2* are properly connected to *CT Analyzer* and restart your test.

408.xxx **Warning [408.xxx] Check CT SB2 switch box wiring: <text depending on missing connection actually detected>**

Reason: At least one of the CT taps enabled for multi-ratio testing is not connected to the *CT SB2* correctly.

Solution: Make sure that all CT taps are connected correctly to the TAPS terminals on the *CT SB2* and restart your test.

409.xxx **Warning [409.xxx] Check CT SB2 switch box wiring: <text depending on incorrect connection actually detected>**

Reason: Wiring of at least two CT taps is mixed, e.g. CT tap X2 is connected to TAPS X3 on the *CT SB2* and vice versa.

Solution: Make sure that all CT taps are connected to the correct TAPS terminals on the *CT SB2* and restart your test.

411.xxx **Warning [411.xxx] Firmware download to switch box failed! Error: SBErrNo**

Reason: *CT SB2* firmware download failed.

Solution: Ensure that the *CT SB2* is connected to the *CT Analyzer* and repeat the firmware download to the *CT SB2*.

415.xxx **Warning [415.xxx] Quick measurement cannot be started. Please disconnect the CT SB2 switch box.**
Reason: You are trying to initiate a *Quick* measurement with the *CT SB2* switch box still connected to the *CT Analyzer*.
Solution: Measurements using *Quick Test* are not possible when the *CT SB2* is connected to the *CT Analyzer*. Remove all connections to the *CT SB2* and restart your *Quick* measurement on the *CT Analyzer*.

501.xxx No message displayed on the *CT Analyzer*. Message only displayed on remote PC connected to the *CT Analyzer*.
Reason: The remote interface handler couldn't decipher the command.
Solution: Remote interface error. Check the connection between *CT Analyzer* and PC.

504.xxx No message displayed on the *CT Analyzer*. Message only displayed on remote PC connected to the *CT Analyzer*.
Reason: Data transmission error.
Solution: Check the connection between *CT Analyzer* and PC.

505.xxx No message displayed on the *CT Analyzer*. Message only displayed on remote PC connected to the *CT Analyzer*.
Reason: Data transmission error.
Solution: Check the connection between *CT Analyzer* and PC.

510.xxx No message displayed on the *CT Analyzer*. Message only displayed on remote PC connected to the *CT Analyzer*.
Reason: Remote interface error: Failed to get the required measurement data because the measurement is still running.
Solution: Check the connection between *CT Analyzer* and PC.

511.xxx No message displayed on the *CT Analyzer*. Message only displayed on remote PC connected to the *CT Analyzer*.
Reason: Remote interface error: Failed to unzip the transmitted data block.
Solution: Check the connection between *CT Analyzer* and PC.

513.xxx No message displayed on the *CT Analyzer*. Message only displayed on remote PC connected to the *CT Analyzer*.
Reason: The current remote interface command is not allowed.
Solution: Make sure that the current *CT Analyzer* state allows the execution of the command.

514.xxx No message displayed on the *CT Analyzer*. Message only displayed on remote PC connected to the *CT Analyzer*.
Reason: Remote interface error: Remote command was submitted with an invalid parameter.
Solution: Verify the parameter (index) submitted with the remote interface command.

800.xxx **Warning [800.xxx] Flash card access error. Internal file system error.**
Reason: The file system sent an error message.
Solution: Compact Flash card is possibly corrupt. Use a new Compact Flash card.

801.xxx **Warning [801.xxx] Flash card access error. Invalid file name or path.**
Reason: The file system sent an error message.
Solution: The Compact Flash card is possibly corrupt. Try to save the data to a PC and format the CF card.

802.xxx **Warning [802.xxx] Flash card access error. Access denied.**
Reason: The file system sent an error message. You tried to open a "read only" file or a special directory.
Solution: Access the Compact Flash card on a PC and remove the "read-only" file attribute. File attributes cannot be modified with the *CT Analyzer*.

803.xxx **Warning [803.xxx] Flash card access error. File or folder already exists.**
Reason: The file system sent an error message.
Solution: Enter a different file or folder name.

804.xxx **Warning [804.xxx] Flash card access error. Disk full.**
Reason: The file system sent an error message.
Solution: Delete some files on the Compact Flash card or insert a new CF card.

805.xxx **Warning [805.xxx] Flash card access error. No or corrupt flash card.**
Reason: No or no valid CF card can be found.
Solution: Insert a valid Compact Flash card.

806.xxx **Warning [806.xxx] Flash card access error. Corrupt directory structure.**
Reason: The file system sent an error message.
Solution: Try to backup the data on the Compact Flash card to a PC and perform formatting of the Compact Flash card.

807.xxx **Warning [807.xxx] Nothing to paste.**
Reason: No file(s) selected to paste.
Solution: Select one or more files using the **Copy** or **Cut** function and try again.

808.xxx **Warning [808.xxx] Renaming of folders not supported.**
Reason: This action is not supported.
Solution: Renaming of folders is not supported by the *CT Analyzer*.

809.xxx **Warning [809.xxx] Are you sure you want to format the CF card? All data will be lost!**
Reason: This warning always appears before formatting of a Compact Flash card is executed, since all data stored on the Compact Flash card will be erased during formatting.
Solution: Press **Format** to start formatting or **Abort** to cancel the operation without formatting the Compact Flash card.

810.xxx **Warning [810.xxx] File exists. Do you want to overwrite it?**
Reason: The file name used to save the data already exists. This warning always appears before overwriting files on the Compact Flash card.
Solution: Enter another file name, if desired.

811.xxx **Warning [811.xxx] Are you sure you want to delete <File Name>?**
Reason: This warning always appears prior to the deletion of a file on the Compact Flash card.
Solution: Press **Yes** to delete the file or **No** to return to the file system card without deleting the file.

812.xxx **Warning [812.xxx] Are you sure you want to delete all selected files?**
Reason: This warning always appears prior to the deletion of files on the Compact Flash card.
Solution: Press **Yes** to delete the files or **No** to return to the file system card without deleting the files.

813.xxx **Warning [813.xxx] One or more parameters could not be found. Some calculations may not work.**

Reason: The .xml report file read from the Compact Flash card is of a newer format than the device can generate.

Solution: The loaded file is incompatible or the software version on your *CT Analyzer* is older than the software version that has generated the report. To enable your *CT Analyzer* to read this report, it is necessary to update the *CT Analyzer* software.

814.xxx **Warning [814.xxx] You tried to load an old report. One or more parameters could not be found. Some calculations may not work.**

Reason: One or more entries could not be found in the .xml report file.

Solution: The software version on the *CT Analyzer* is newer than the software version used to generate the report. The report probably does not contain all parameters supported by the new *CT Analyzer* software.

815.xxx **Error [815.xxx] Folder must be empty. Can't remove folder <Folder Name>.**

Reason: The folder selected for deletion is not empty. Only empty folders can be deleted.

Solution: Navigate to the folder you want to delete. Open the folder and delete all contained files and subfolders. Then you can delete the empty folder.

816.xxx **Error [816.xxx] You tried to load a report built with a <Device>.**

Reason: The .xml file seems to be not a *CT Analyzer* report.

Solution: The report cannot be loaded by the *CT Analyzer*.

817.xxx **Error [817.xxx] The xml file has no valid OMICRON report style.**

Reason: The .xml file has no valid OMICRON report style.

Solution: The report cannot be loaded by the *CT Analyzer*.

818.xxx **Warning [818.xxx] Moving of folders not supported.**

Reason: Moving of folders is not supported by the *CT Analyzer*.

Solution: Select only files to move, not folders. Using the shift key and the up/down cursor keys it is possible to select any number of files within a folder.

819.xxx **Warning [819.xxx] File name contains an invalid character.**

Reason: An invalid character was used to specify the file name.
Invalid characters: \ / : * ? \ < > |

Solution: Only use valid characters for the file name.

820.xxx **Error [820.xxx] Memory management error. Contact the next OMICRON service center.**

Reason: Memory management error.

Solution: Switch the *CT Analyzer* off, wait a second then switch it on again. If this error occurs more frequently, you should contact your next OMICRON service center.

821.xxx **Error [821.xxx] Could not update firmware.**

Reason: An error has occurred in the boot loader software.

Solution: Insert a Compact Flash card with valid software (**CTAnalyzer.bin**) in the directory **A:\Omicron** and switch the *CT Analyzer* off and on again.

823.xxx **Error [823.xxx] Could not update user text!**

Reason: An error has occurred in the user text loader software.

Solution: Insert a Compact Flash card with valid software (**CTUser_xxx.bin**) in the directory **A:\Omicron** and try again.

824.xxx **Error [824.xxx] An internal software error has occurred at address xxxxxxxH. To log this error, make sure that a CF card is inserted and then press OK. Please send the file \OMICRON\ErrorLog.xml on the CF card to the next OMICRON service center.**
Reason: Invalid result in a floating point operation (NaN).
Solution: Contact your next OMICRON service center.

825.xxx **Warning [825.xxx] Size of file [FileName] >= 1Mbyte.**
Reason: The size of the file copied to the *CT Analyzer* Compact Flash card or virtual disc is > 1 MB.
Solution: Avoid transfer of large files > 1 MB to the *CT Analyzer*.

830.xxx **License < ... > is invalid.**
Reason: An invalid license entry was found in the license file **Omicron.lic** on the CF Card.
Solution: Specify a valid license key.

831.xxx **Setting value for < ... > is invalid. The default value of < ... > is used.**
Reason: Invalid item in file **Settings.inf**.
Solution: The file **Settings.inf** in the **Omicron** directory on the CF card of the *CT Analyzer* has a formatting error in one of the parameters. Delete this file and check the settings in the menu **Main Menu -> Settings -> Misc. Settings**. If necessary, change the settings and store the file again.

832.xxx **Lifetime of relays near end. Contact the next OMICRON service center soon to arrange a hardware service.**
Reason: The relays inside the *CT Analyzer* near the end of their lifetime (more than 1,000,000 measurements performed).
Solution: Arrange a hardware service in order to replace the relays.

833.xxx **You are about to load a report with an invalid hash code. Some measurement values may not be authentic.**
Reason: The file checksum is not valid.
Solution: Check the authenticity of the report file loaded.

834.xxx **No valid license was found in this file!**
Reason: No valid license found.
Solution: Check the license file. The license possibly does not correspond to the serial number of the *CT Analyzer*.

835.xxx **Downgrade a firmware below version 3.53 is not supported.**
Reason: Attempt for a downgrade to a version number < 3.53.
Solution: Make sure that die FW version number for the upgrade/downgrade is not below 3.53.

900.xxx **Error [900.xxx] Power supply error. Switch off the device and wait 1 minute to restart.**
Reason: The output power was larger than 350 VA or the power supply is defective.
Solution: Switch the *CT Analyzer* off, wait 1 minute and then switch it on again. If this error occurs more frequently, you should contact your next OMICRON service center.

901.xxx **Warning [901.xxx] Protective earth (PE) connection in power supply cord missing. Connect PE to equipotential terminal. Lethal voltage may occur on housing and all terminals.**

Reason: Earth wire break, no earth wire connected or device is supplied via an isolation transformer.

Solution: The mains supply does not have reference to protective earth or protective earth is not connected. The mains supply must have galvanic connection to PE. If you are using an isolation transformer, connect one supply line of the *CT Analyzer* to PE.

Warning: Lethal voltages may occur at the housing if the grounding terminal of the device is not connected to protective earth potential!

Caution: If the mains supply is galvanically isolated from earth potential, the device may become damaged.

Comment: If a galvanically isolated mains supply is used, voltage stress may occur for the insulation system, the device is not constructed for. **Safety is no longer guranteed!** Therefore, always use a mains power cord with a protective earthing conductor connected to PE of the mains supply. Connect the grounding terminal of the device to protective earth in order to prevent electric shock caused by lethal voltages possibly present at the housing. If this error is ignored, the device will probably work but safety is no longer guaranteed.

903.xxx **Warning [903.xxx] Excessive reverse power, don't disconnect any wires, don't switch off mains, wait until power is dissipated.**
ATTENTION: Lethal voltages on output terminals!

Reason: The device receives excessive reverse power so that the power output had to be shortened to prevent overload of the internal output stage.

Solution: This error is displayed if an excess amount of energy is fed back into the *CT Analyzer*. The *CT Analyzer* discharges the connected inductor with approximately 20 Ws, but depending on the connected inductance the discharge process may take some time.

Safety action: All measurements are stopped until reverse power is dissipated.

Warning: Lethal voltages of up to many kV may occur. Do not disconnect any wires and do not switch off the *CT Analyzer*. Wait until the power is dissipated.

904.xxx **Error [904.xxx] Power supply error. Contact next Omicron service center.**

Reason: Temperature limit of secondary power supply exceeded.

Solution: It is not possible to acknowledge this error until the temperature is back in safe limits. If this error occurs, please contact your next OMICRON service center.

Safety action: All measurements are stopped.

905.xxx **Error [905.xxx] Over-temperature of power supply, wait until device has cooled down.**

Reason: Secondary side power supply has reached the warning temperature limit and entered save mode to cool down.

Solution: When this error is acknowledged as long it is active, the popup window is closed and only the message in the status line remains active until the overtemperature disappears. If the error is not acknowledged, the popup window remains active.

Comment: The status line displays the flashing message "905.xxx Overtemp.".

Safety action: All measurements are stopped and the error message is displayed in the status line and a popup window. After acknowledgement, the software waits at least 1 minute before the test can be started again.

906.xxx **Error [906.xxx] Excess temperature of power supply, wait until device has cooled down.**

Reason: The primary side power supply has reached its warning temperature limit and entered save mode to cool down.

Solution: When this error is acknowledged as long it is active, the popup window is closed and only the message in the status line remains active until the overtemperature disappears. If the error is not acknowledged, the popup window remains active.

Comment: The status line displays the flashing message "906.xxx Overtemp.".

Safety action: All measurements are stopped and the error message is displayed in the status line and a popup window. After acknowledgement, the software waits at least 1 minute before the test can be started again.

908.xxx **Error [908.xxx] Device shut down.**

Reason: Internal power failure on the measurement interface module.

Solution: The message is active as long as the internal power for the measurement interface fails. Contact the next OMICRON service center if the error does not disappear.

911.xxx **Error [911.xxx] Power supply error, contact next Omicron service center. Desired voltage xxxx, measured voltage yyyy.**

Reason: One supply voltage on the measurement interface boards is out of tolerance.

Solution: Contact your next OMICRON service center.

Comment: It is no longer possible to work with the device.

912.xxx **Error [912.xxx] Excess internal temperature, wait until device has cooled down.**

Reason: Device-internal temperature at measurement interface > 75°C.

Solution: Excessive heating of the device. Prevent the device from direct sunlight and wait until it has cooled down. If the error occurs without previous exposure to direct sunlight, the error is probably caused by a hardware error. Please contact your next OMICRON service center.

Comment: The status line displays the flashing message "912.xxx Overtemp.".

Safety action: All measurements are stopped and the error is displayed in the status line and in a popup window. The error is active until the temperature falls below 60°C.

929.xxx **Error [929.xxx] Hardware failure, contact next Omicron service center.**

Reason: The circuit for reverse power dissipation does not work properly.

Solution: Contact your next OMICRON service center.

Safety action: All measurements are stopped and the power supply is switched off.

930.xxx **Error [930.xxx] Measurement input Vsec defective, contact next Omicron service center.**
Reason: Power supply for analog input "Sec" is defective.
Solution: Contact your next OMICRON service center.

931.xxx **Error [931.xxx] Measurement input Vprim defective, contact next Omicron service center.**
Reason: Power supply for analog input "Prim" is defective.
Solution: Contact your next OMICRON service center.

932.xxx **Error [932.xxx] Data error.**
Reason: The sequence of reading of the analog input channels is not correct.
Solution: If this error occurs more frequently, contact your next OMICRON service center.

933.xxx **Error [933.xxx] Hardware failure, contact next Omicron service center.**
Reason: Temperature detection circuit on secondary side is defective.
Solution: Send the device to your next OMICRON service center.
Safety action: Power supply is switched off and all measurements are disabled.

934.xxx **Warning [934.xxx] Reverse power, don't disconnect any wires, don't switch off mains, wait until power is dissipated. I = xxxxA.**
Reason: The device receives reverse power of > 20 mA.
Solution: Wait until the power is dissipated within the device and the error message disappears.
Safety action: All measurements are stopped until reverse power is dissipated.

935.xxx **Error [935.xxx] No valid CT Analyzer software. Insert a CF-Card with valid Software and press "Update Firmw.".**
Reason: Cannot find valid *CT Analyzer* software.
Solution: Insert a Compact Flash card with valid software (**CTAnalyzer.bin**) in the directory **A:\Omicron**.

936.xxx **Warning [936.xxx] Corrupt Calibration Data for voltage inputs. Change to tools menu and try to reset factory calibration. Until update of calibration data the device will be not calibrated.**
Reason: The calibration data checksum for the analog inputs is not correct.
Solution: Try to update the factory calibration using the tools menu. If this does not solve the problem, contact your next OMICRON service center.

937.xxx **Warning [937.xxx] Corrupt Calibration Data for power output. Change to tools menu and try to update factory calibration. Until update of calibration data the device will be not calibrated.**
Reason: The calibration data checksum for the power output is not correct.
Solution: Try to update the factory calibration using the tools menu. If this does not solve the problem, contact your next OMICRON service center.

938.xxx **Warning [938.xxx] MIF data block 1 corrupt.**
Reason: The checksum of the factory settings data is faulty.
Solution: Licensing or device settings data are possibly corrupt. Contact your next OMICRON service center.

939.xxx **Warning [939.xxx] MIF data block 2 corrupt.**
Reason: The checksum of the factory settings data is faulty.
Solution: Licensing or device settings data are possibly corrupt. Contact your next OMICRON service center.

940.xxx **Warning [940.xxx] CMOS data block corrupt. Check all device settings. Press Clear Values to work with default values. Press OK to work with corrupt device settings.**
Reason: Device settings data block corrupt.
Solution: Check all device settings.

941.xxx **Error [941.xxx] Corrupt factory calibration data for voltage inputs. Contact next Omicron service center.**
Reason: Factory calibration data block for voltage inputs corrupt.
Solution: Contact your next OMICRON service center.

942.xxx **Error [942.xxx] Corrupt factory calibration data for power unit. Contact next Omicron service center.**
Reason: Factory calibration data corrupt.
Solution: Contact your next OMICRON service center.

943.xxx **Error [943.xxx] Error overwriting calibration data.**
Reason: Factory calibration data cannot be restored.
Solution: Contact your next OMICRON service center.

944.xxx **Warning [944.xxx] Corrupt user text! Change to tools menu and try to update text. Until update of user text, the device will use default text.**
Reason: Checksum for user language support data invalid.
Solution: Copy a user text file (**CTUser_xxx.bin**) to the directory **A:\Omicron** on the Compact Flash card and try to update the user language support data using the "Update Text" function in the tools menu.

OMICRON Service Centers

Americas

OMICRON electronics Corp. USA
3550 Willowbend Blvd.
Houston, TX 77054, USA
Phone: +1 713 830-4660
1 800-OMICRON
Fax: +1 713 830-4661
techsupport@omicronusa.com
www.omicronusa.com

Asia – Pacific

OMICRON electronics Asia Ltd.
Suite 2006, 20/F, Tower 2
The Gateway, Harbour City
Kowloon, Hong Kong S.A.R.
Phone: +852 3767 5500
Fax: +852 3767 5400
support@asia.omicron.at
www.omicron.at

Europe, Middle East, Africa

OMICRON electronics GmbH
Oberes Ried 1
A-6833 Klaus, Austria
Phone: +43 5523 507-333
Fax: +43 5523 507-999
support@omicron.at
www.omicron.at

For addresses of OMICRON electronics offices with customer service centers, regional sales offices or offices for training, consulting and commissioning please visit our Web site.

Index

E

F

G

H

I

K

L

M

N

O

P

Q

R

S

T

U

V

W

Y