UCE-CT321L FAULT LOCATOR

USER MANUAL

UCORE ELECTRONICS
https://ucore-electronics.com

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Contents

1. Introduction

UCE-CT321L is suitable for today's electronic circuit boards where Analog and Digital are mixed together.

Using the proven power-off testing method known as the V-I test method, it eliminates the risk of further circuit damage that typically occurs when power is applied.

There are three different models of UCE-CT321L. With one hardware configuration for all models, the UCE-CT321L series is a flexible and capable platform that will grow with your needs over the years. It allows users to upgrade device capabilities as their needs change.

- Expandable frequency range,
- Expandable voltage range,
- Expandable limit resistance range,
- Database feature with PC software,
- Database testing on the device, independent of the PC,
- Short circuit finder,
- Capacitance meter,
- Ohmmeter,
- HDMI output.

All Options can be installed by the customer himself without the need to send the device to a service center or recalibrate it. To add features, simply purchase emailed licenses.

The **Lite edition** has limited features. Voltage, frequency and limit resistances are limited. Suitable for beginner level users. In this version, connection to the PC program is not possible.

In the **Pro edition**, there are no voltage, frequency and limit resistance restrictions. Additionally, a database can be created with PC software and tests can be performed from the database.

In the **Expert edition**, all features on the device are active. Additional features compared to the Pro edition;

- Short circuit finder,
- Capacitance meter,
- Ohmmeter,
- LCD image can be mirrored to a TV or monitor via HDMI out.
- The device can read the database file created in the PC software and perform the database test independently from the PC.

1.1. License Features

The features of the device according to the license edition are as in the table below.

	Lite Edition	Pro Edition	Expert Edition
Short-circuit finder	NA	NA	Available
Frequency	20Hz, 50Hz, 60Hz, 200Hz, 2000Hz	20Hz ~ 5kHz (31 steps)	20Hz ~ 5kHz (31 steps)
Open circuit Voltage	±3V, ±5V, ±10V, ±15V, ±20V	±0.2V ~ ±20V (24 steps)	±0.2V ~ ±20V (24 steps)
Limit Resistor	100Ω, 1kΩ, 10kΩ	10Ω, 47Ω, 100Ω, 470Ω, 1kΩ, 4.7kΩ, 10kΩ, 47kΩ	10Ω, 47Ω, 100Ω, 470Ω, 1kΩ, 4.7kΩ, 10kΩ, 47kΩ
Database	NA	Available	Available
Database Test	NA	Only on PC	On PC & Device
Capacitance Meter	NA	NA	Available
Ohmmeter	NA	NA	Available
HDMI out	NA	NA	480×272 @60Hz
Mouse support	Available	Available	Available

Specifications:

- **Display:** 4.3 inch 480 × 272 pixel color LCD with Touch screen
- **Curve Tracer Channels:** 2
- **Test signal:** Sine
- **PC connection:** Type-C USB connector (USB 2.0 HID protocol)
- **Storage:** internal 4GB disk (microSD card)
- **Power Consumption:** 8W
- **Dimensions:** 167 x 83 x 31 mm

Package List:

- UCE-CT321L Curve Tracer Device
- 2 pcs BNC to 4mm banana cable
- 2 sets multimeter pen (red and black)
- 2 sets banana extension cable
- Touch pen
- USB cable

2. Before Test

Some rules must be followed before fault detection.

- The PCB to be measured **must** be powered off.
- Make sure that the capacitors on the PCB are discharged. Higher than 24V charged capacitors may damage the device. Otherwise, the product will be out of warranty.

3. Turning ON or Turning OFF

To turn on the device, plug the USB cable into any USB socket whose output voltage is 5V, 2A. Power sources such as computer, adapter and external power bank may be used as power source.

To turn off the device, disconnecting power supply will be sufficient. When the device is energized, the Main Menu in Figure 1 is displayed.

If the device is to be used with a PC program, the USB cable must be plugged into a USB 2.0 capable port of the computer.

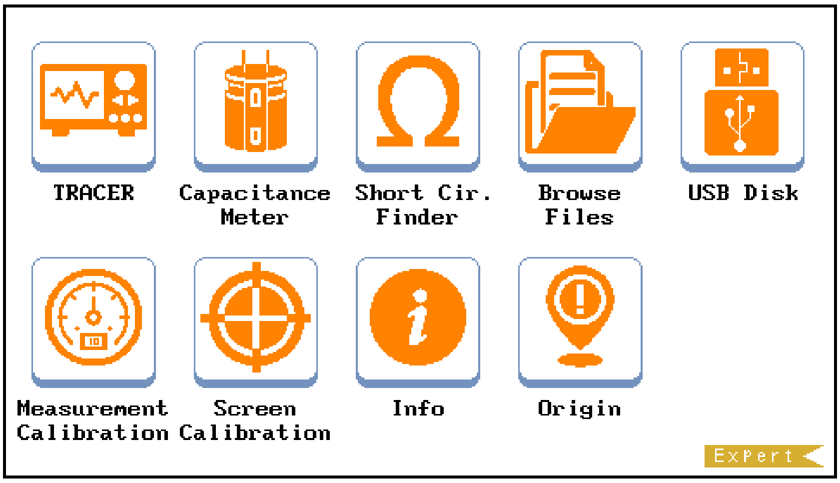


Figure 1. Main Menu (Expert edition)

4. Curve Tracer

4.1. Theory

The device works by applying a current-limited AC signal across two points of a component. The current flow causes a vertical trace deflection, while the applied voltage causes a horizontal deflection. Together they form a unique V-I signature that represents the overall health of the device under test.

The signature of all analog components is a combination of one or more of the four basic signatures: resistance, capacitance, inductance, and semiconductor. Each of these components reacts differently to the applied AC test signal. For this reason, recognizing the four basic signatures on the oscilloscope display is a key to understanding analog signature analysis.

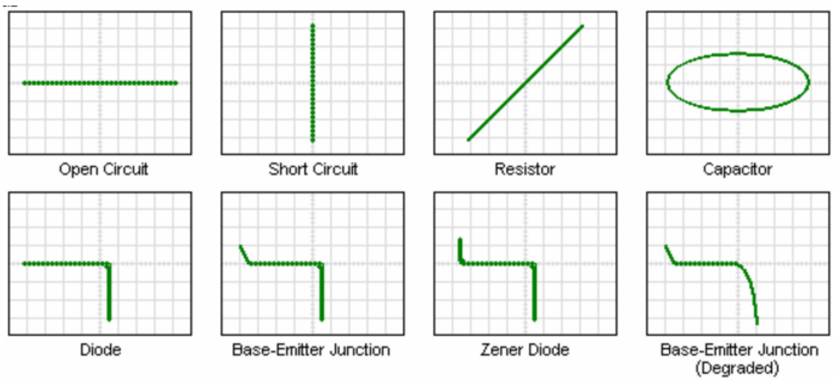


Figure 2. Component characteristics in XY mode (horizontal trace voltage, vertical trace current)

The UCE-CT321L is designed to diagnose the failures in all types of electronic circuit boards. The product is provided with two channels and allows the comparison of the defective boards with the intact boards. All V-I impedance curves consist of 12-bit 256 different measurements per channel.

The following components can be tested with this device.

Passive components: resistance, capacitor, coil

Diodes: general purpose, zener, varistor

Transistor: NPN, PNP, bipolar, darlington, JFET, MOSFET, UJT

Triggered components: SCR, TRIAC, relay

Optoelectronics: LED, photo-transistor, optocoupler

Integrated circuits: digital, analog

4.2. Technical Specifications

It may be desirable to test electronic components under different conditions. For this purpose, the device has Test voltage, Source resistance and Frequency values in different stages. Hundreds (65 in the Lite edition) different test conditions can be created with different combinations of these values.

Test voltage:

The test voltage and limit resistance also determine the test current. In order to limit the energy flow, the maximum value of the test voltage is limited depending on the limit resistor.

Voltage limitation due to limit resistor;

- 2V for 10R range,
- 7V for 47R range,
- 10V for 100R range,
- 18V for 470R range,
- 20V for 1K, 4.7K, 10K and 47K ranges.

One of the important features of the device is undoubtedly the 200mV test voltage stage (only in Pro and Expert editions). Since active components such as diodes and transistors are not triggered in the measurements made at this stage, only the curve of the passive components is obtained in the measurement.

Figure 3 shows the impedance curves of the parallel connected diode and 47R resistor at 5V and 0.2V stages. At 5V, a combination of resistor and diode characteristics is seen, while at 0.2V only the resistance curve is seen.

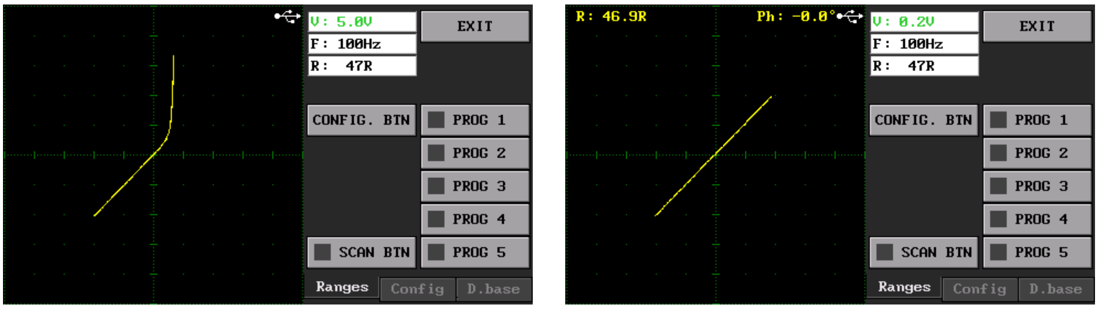


Figure 3. Impedance curve of parallel connected diode and resistor at different stages

Figure 4 shows the impedance curves of a parallel connected diode and 10uF capacitor at 5V and 0.2V stages. While a combination of diode and capacitor characteristics is seen at 5V, only the capacitor curve is seen at 0.2V.

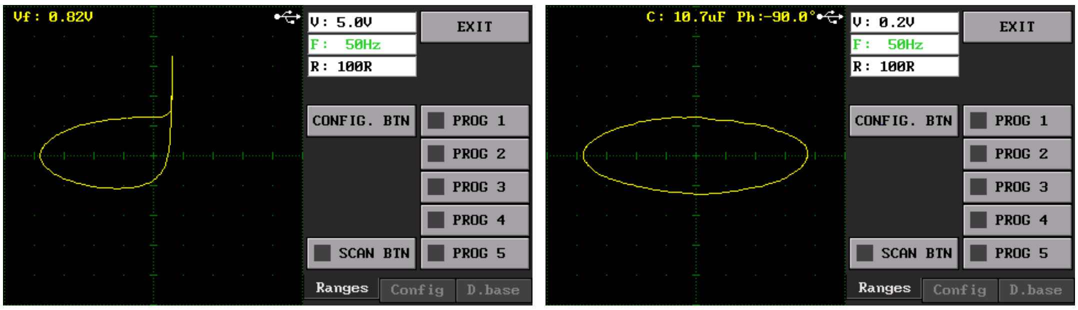


Figure 4. Impedance curve of parallel connected diode and capacitor at different stages

As seen in the examples above, the diode impedance is eliminated at the 0.2V stage and only the curves of passive components such as resistors and capacitors are obtained. Thus, in the testing of electronic boards, passive components can be tested independently of active components. There is a serious decrease in the number of components that need to be tested discretely by removing them from the electronic board.

Test frequency:

The test frequency can be adjusted between 20Hz and 5kHz (only in Pro and Expert editions). It is adjusted in 10Hz steps between 20Hz and 200Hz, in 100Hz steps between 200Hz and 1kHz, and in 1kHz steps between 1kHz and 5kHz. It consists of 31 levels in total.

Passive components such as capacitors and coils are frequency sensitive. Frequency ranges are often important in such component measurements.

- The low frequency - high current (e.g., 20Hz – 10R) range is suitable for high capacitance capacitors (mF).
- High frequency – low current (e.g., 5kHz – 1K) stage is suitable for low capacitance capacitors (nF).
- The high frequency – high current (e.g., 5kHz – 10R) stage is suitable for coils with low inductance (uH).

Limit resistance:

There are 8 different stages as 10R, 47R, 100R, 470R, 1K, 4.7K, 10K and 47K.

10R is high current mode and 47K is low current mode.

Maximum current calculation:

In the previous section, it was stated that the horizontal axis is the voltage and the vertical axis is the current. The voltage-division value (V/div) is 1/4 of the test voltage. Ex. V/div value for 5V test voltage is 1.25V.

The maximum test current value is the test voltage divided by the limit resistance.

$$I_{max} = V_{test} / R_{limit}$$

The current-division value is 1/4 of the maximum current value. For example, when the test voltage is 5V and the limit resistance is 1KΩ, the maximum current value;

$$I_{max} = 5V / 1K\Omega = 5mA$$

The current-division value (I/div) is 5mA / 4 = 1.25mA /square.

4.3. Parameter Settings

Parameters are set in three different ways on the device.

- With mouse,
- With PC program in Pro and Expert editions,
- With the optional “UCE-ENC3-M Remote encoder” control assistant.

Control with mouse:

UCE-CT321L can be controlled with a mouse connected to the USB port shown in Figure 5.

Figure 5. USB Mouse port

When you left-click on the parameter you want to adjust, the color of the parameter turns green. Parameter setting is done by rotating the scroll on the mouse.

Control with PC program:

The PC program will be explained in detail later.

Control with control assistant:

"UCE-ENC3-M Remote encoder" is an optional device and provides convenience in applications where range changes are made frequently. It is connected to the USB Mouse port in Figure 5 with a USB cable. There are 3 rotary encoders on it. It is very practical to adjust voltage, frequency and limit resistance with these. There is also a USB Mouse input on the device. By plugging a USB Mouse here, the UCE-ENC3-M can be used without losing mouse support.

Figure 6. UCE-ENC3-M Remote Encoder module

4.4. Menu Usage

In this section, the tracer menu usage of the UCE- CT321L device is explained.

To access the test mode, click the Tracer icon in the Main Menu (Figure 1). The general view of the Curve Tracer menu is as shown in Figure 7.

If the device is connected to the USB port of a PC, it communicates with the computer when entering the menu. The driver is installed automatically by Windows OS. There is no need for an additional driver package. If communication has been established with the computer, the USB symbol () appears at the top of the screen (in Pro and Expert editions). Working with the PC program will be explained in detail in later.

If there is no touch (or clicked) anywhere for more than 15 minutes in Menu, the screen will turn black to protect the structure of the LCD. If the USB connection is established, the device continues to transfer data. If any part of the screen is touched, the LCD returns to the normal operating mode.

The screen consists of two parts. On the left side is the V-I impedance curve and on the right side there is the menu area. The menu area consists of three parts:

- Ranges
- Config.
- D.base

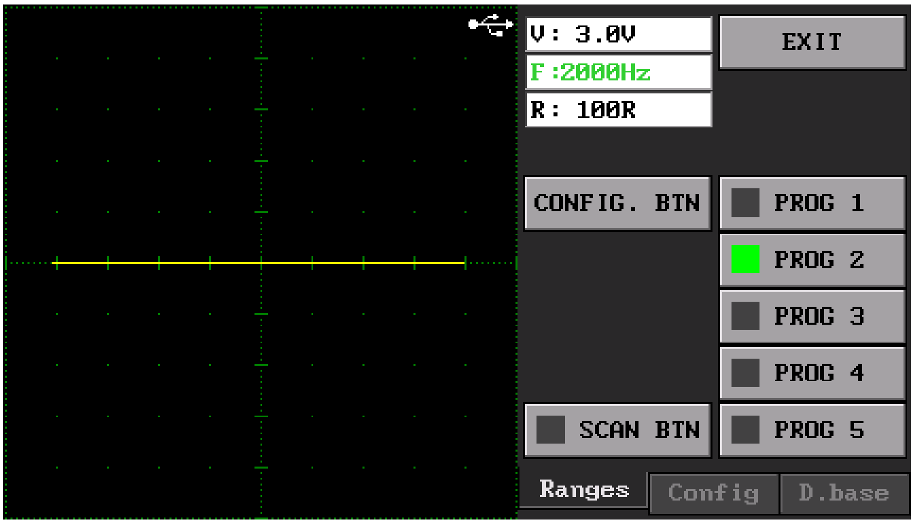
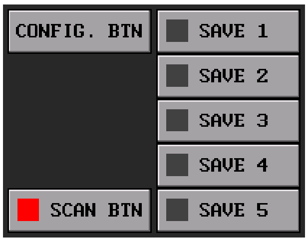


Figure 7. Curve tracer mode overview (Ranges menu)

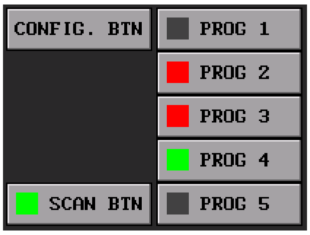
There are some buttons in the tracer menu in Figure 7;

EXIT: Used to return to the Main Menu. Also, during this process, the setting data is saved in the memory (ct_settings.cfg).



PROG 1-5: There are 5 programmable user buttons. The adjusted voltage, frequency and limit resistance combinations are stored in memory. Thus, these settings are restored very quickly when the button is clicked. Click the **CONFIG. BTN** button to memorize the set combination. When the button is clicked, the names of the user buttons change to **SAVE 1-5**. When the button to be saved is clicked, the button names return to their original state (PROG 1-5) and the save

process is completed. When **CONFIG. BTN** button is clicked, **SCAN BTN** becomes inactive and scan mode is disabled.



SCAN BTN: Scans user buttons at regular intervals. When scanning is active, the **SCAN BTN** button is marked in green. The user button marked with green color is the stage where the measurement is made at that moment. When the stage that does not want to be scanned is clicked, that stage is cancelled. Inactive stages are marked in red. Click again if it is desired to be reactivated. The buttons marked in gray are the levels that will be scanned but are not active at that moment.

When scan mode is active, the scan period appears at the bottom of the parameters. Indicates the time between two stages. The period time can be adjusted between 0.25 sec and 2 sec.

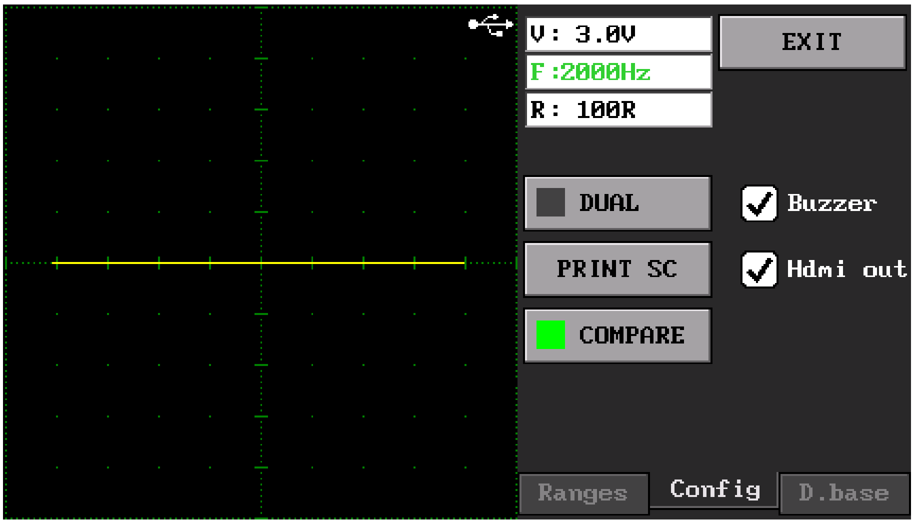


Figure 8. Curve tracer mode overview (Config menu)

Buzzer: If checked, the device gives an audible warning when the button is clicked with the built-in buzzer.

HDMI output: If checked, HDMI output is enabled. The LCD screen image can be mirrored onto a TV or monitor via the HDMI port. After choosing to enable or disable this feature, you must return to the main menu by clicking the **EXIT** button and restart the device by clicking the **RST** button on the device.

***DUAL*:** Allows simultaneous use of A (yellow color) and B (red color) channels. If a single channel is used, only channel A is active.

PRINT SC: The screen image is saved in internal memory in bmp format.

COMPARE: Compares similarity of impedance curves between channels. When the comparison is active, the button is marked in green. **DUAL** mode must also be enabled for comparison. If the **Buzzer** checkbox is selected, it warns with different sounds in case of success and failure as a result of the comparison.

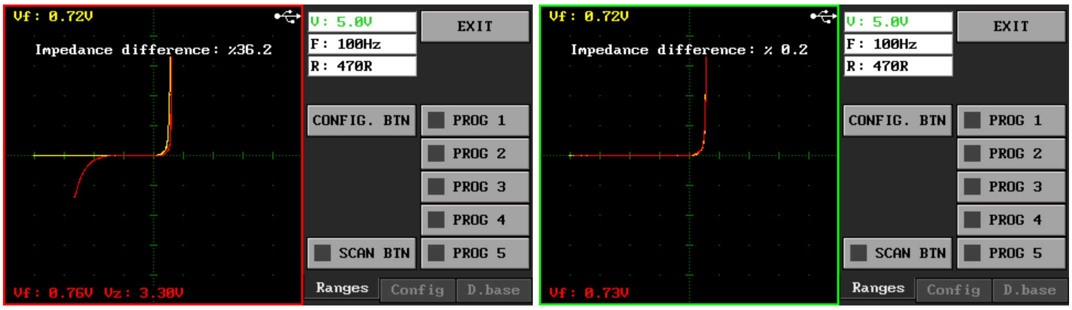


Figure 9. Comparison in dual mode

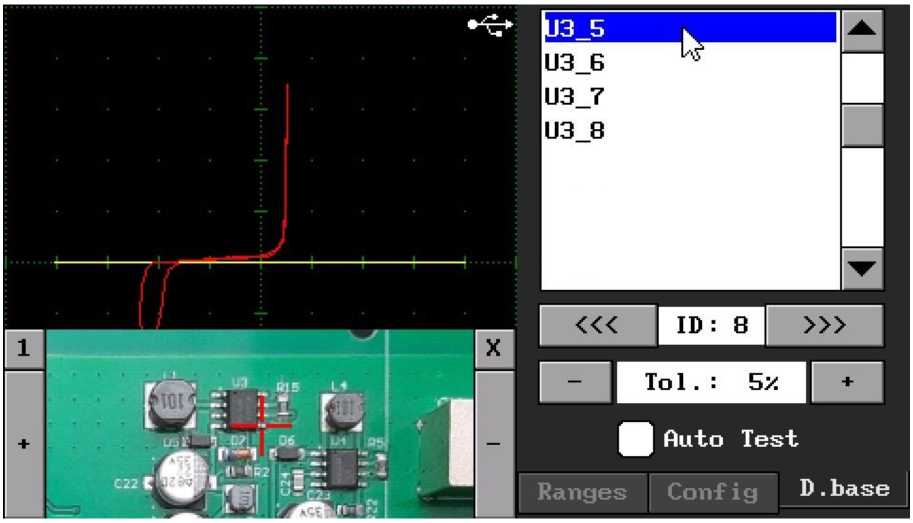


Figure 10. Curve tracer mode overview (D.base menu)

D.base Menu: In this menu, database files created with the PC program are read and tested. The use of this menu will be explained in detail later.

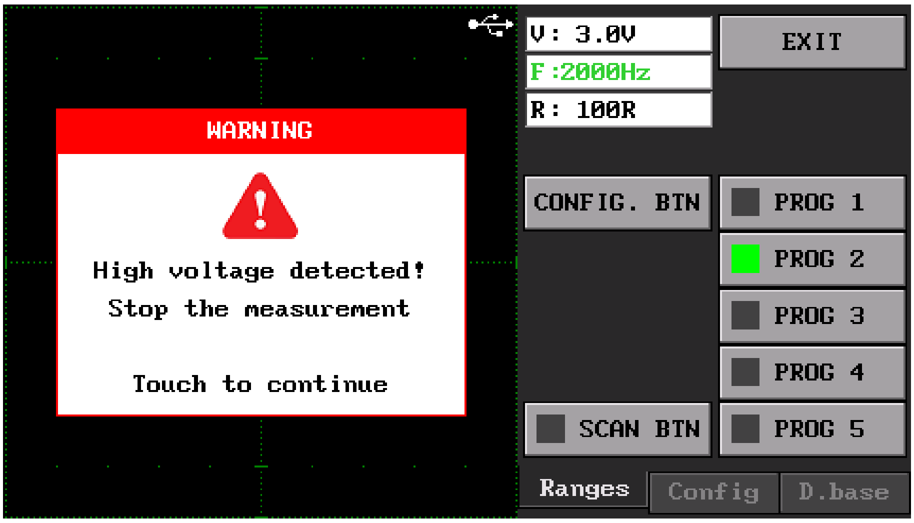


Figure 11. High voltage measurement detection

There are protection and detection circuits on both inputs of the device against high voltage measurement. The device gives a warning when high voltage is detected in any of the channels during the measurement. In this case, the measurement must be terminated immediately. Then the warning screen is touched to continue normal operation (Figure 11).

High voltage detection can occur in three different ways.

- Capacitor measurement with charge over 24V
- Voltage source measurement over 24V
- Coil with high inductance measurement

If a current-flowing coil is suddenly interrupted (in the case of measurement termination or switching between two channels in dual mode), an infinity reverse voltage may occur. In this case, high voltage measurement detection is triggered. Measuring the coils at lower test voltages can reduce such problems.

Long-term measurements in such cases may **damage the device**.

5. Measurement Calibration

In the Tracer menu, an impedance curve should appear as a horizontal (0 degree) line when the probes are idle, and a vertical (90 degree) line when they are short-circuited. Additionally, the size of the horizontal and vertical lines should be 8 squares (end to end). If there is a deviation in these values, the performance of the device can be increased by calibration.

To calibrate the device, the **Measurement Calibration** icon in Figure 1 is clicked. Click the **START** button on the menu screen to begin the calibration (Figure 12).

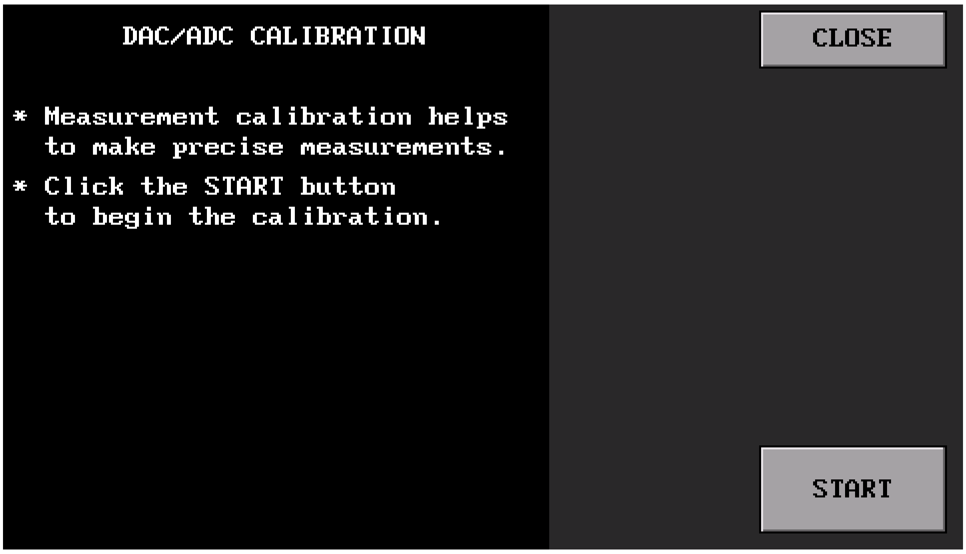


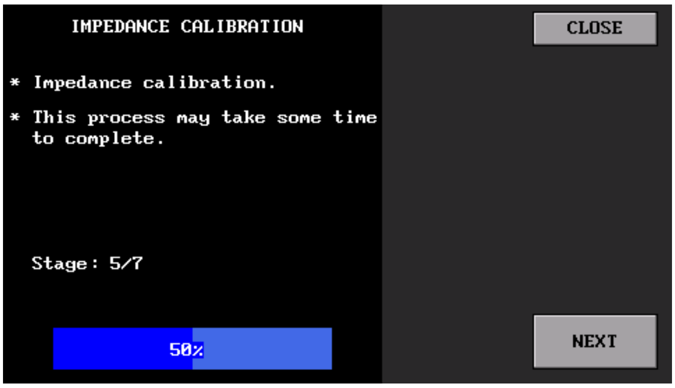
Figure 12. Measurement Calibration menu overview

The first stage is to set the offset of the signal generator. Here, the device generates a 0.0V DC signal. With any multimeter to be connected to the Channel A output, it is checked whether the output is zero (Measurements should be made in DC stage). If the Channel A output is not zero volts, it is set that the output is zero volts with the **+** and **-** buttons. After the output is adjusted to zero Volt, the **NEXT** button is clicked to proceed to the next stage.

In the second stage, the gain of the generated signal is adjusted. Here, similar to the first stage, the CH-A output voltage is adjusted to **14.14Vrms** with the **+** and **-** buttons and the measurement is made in AC range. After the adjustment is made, the **NEXT** button is clicked to proceed to the next stage. If there is a need to make corrections in the previous level, the **PREVIOUS** button is clicked.

In the 3rd stage, the gain adjustment is made automatically. This process may take some time to complete. When the stage is completed, moves on to the next one.

In the 4th stage, offset adjustment is made automatically. When the stage is completed, moves on to the next one.



In the 5th stage, the open circuit impedance adjustment is made automatically. When the stage is completed, moves on to the next one.

In the 6th stage, impedance calibration is performed. For this, a measurement probe is first attached to the input of **Channel A** and its leads are short-circuited. The impedance value is seen on the screen as Ohms and then the **NEXT** button is clicked to proceed to the next stage.

Note: When the probe leads are open circuit, it cannot be passed to the next stage and Open circuit warning is seen on the screen. When there is an open circuit warning, the **NEXT** button is not active (Figure 13).

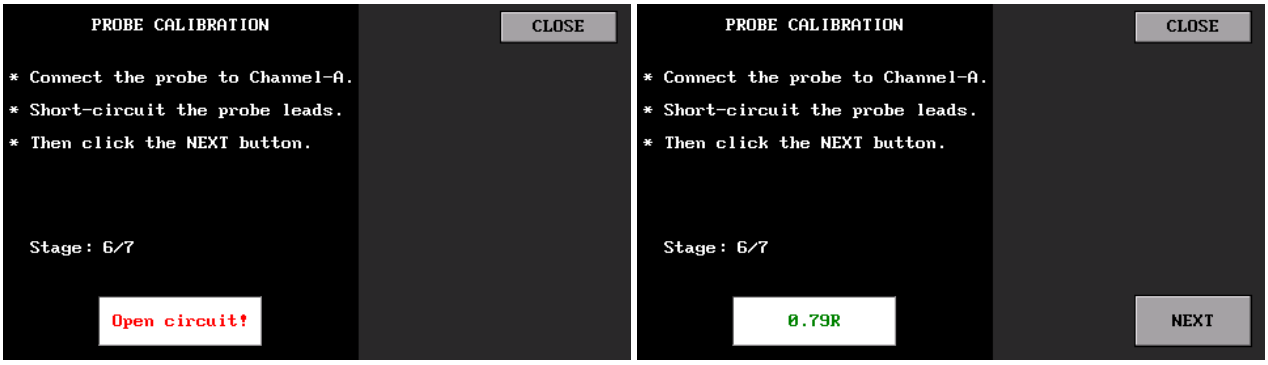


Figure 13. Probe Calibration

In 7th stage, the calibration process is finished, but the calibration parameters have not been saved yet. In the last step, by clicking the **SAVE** button, these parameters are saved in the “0:system/calibration” folder with the name “ct_cal_321.cfg” (Figure 14). Calibration is completed and clicking the **CLOSE** button returns to the main menu.

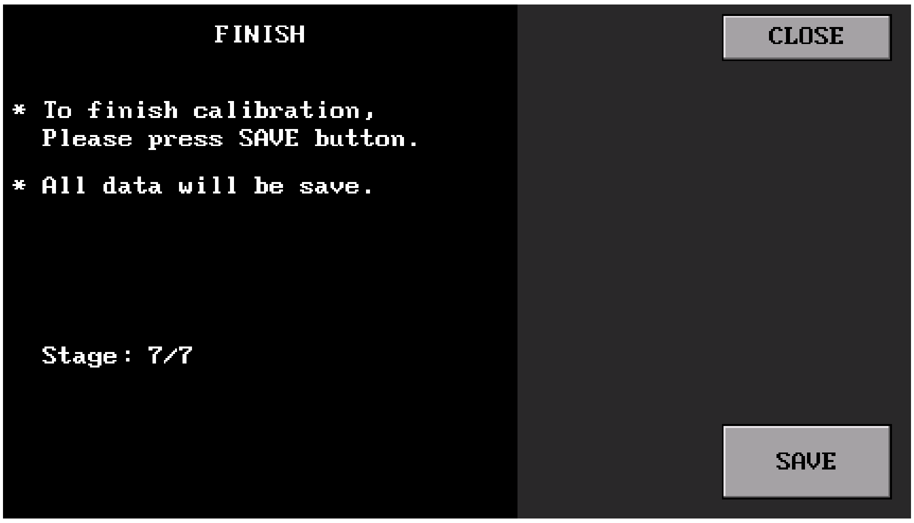


Figure 14. Saving parameters

Note: During the calibration, the output voltage and/or the measured voltage may not be adjusted to the desired values. In this case, it should be set to the closest possible value. This device is an impedance curve measuring device and measurements should not be expected to be accurate as a multimeter.

If the **CLOSE** button is clicked before the calibration is completed, it will return to the main menu. Calibration parameters are not saved, but may affect the operation of the device. When the device is restarted, the last saved parameters are loaded.

6. Capacitance Meter

This feature is only available in the Expert edition. It should be noted that since the UCE-CT321L is not designed as a capacitance meter, the measurements here can be used for reference purposes. The measuring range of the device is between **1nF-100mF**. The measurement accuracy is **5%**. The accuracy of the measurements is parallel to the calibration of the device. For this reason, it is important to perform the calibration procedures described in the previous section, as they will affect the measurements here. Capacitor measurements are made only from **Channel A**.

This menu is accessed by clicking the **Capacitance Meter** icon in the main menu in Figure 1. When you first enter the menu, the device makes offset adjustments. For this setting to be correct, no measurements should be made at the input.

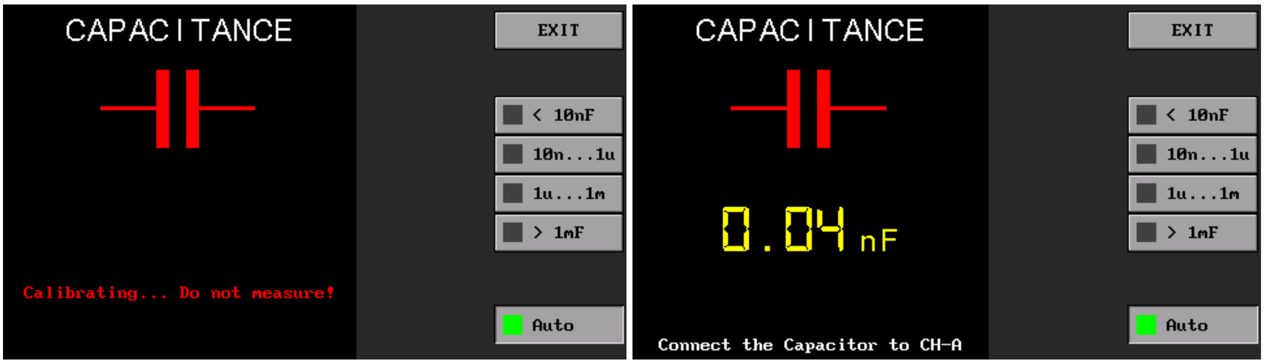


Figure 15. Capacitanse Meter menu overview

Measurements can be made in manual or auto mode. The device has 4 manual measurement levels. These;

- Lower than 10nF
- 10nF to 1uF
- 1uF to 1000uF
- Higher than 1000uF

If it is known in which range the measured capacitor will be, measurement can be made by selecting that range in manual mode.

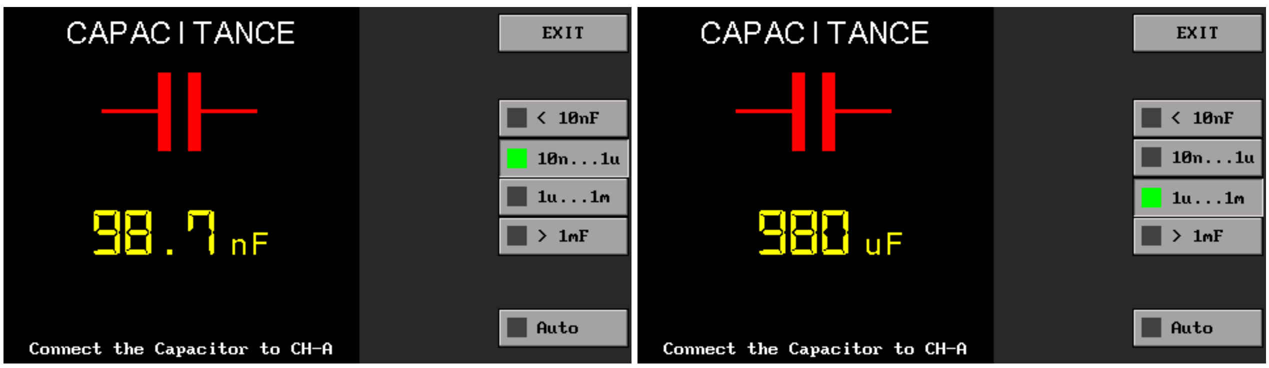


Figure 16. Manual mode measurement of 100nF and 1000uF capacitors

Another measurement method is auto mode. It is activated by clicking the **Auto** button. In Auto mode, the capacitor is measured by scanning the stages automatically. Figure 17 shows the measurement of a 4080uF (label value 4700uF) capacitor in auto mode.

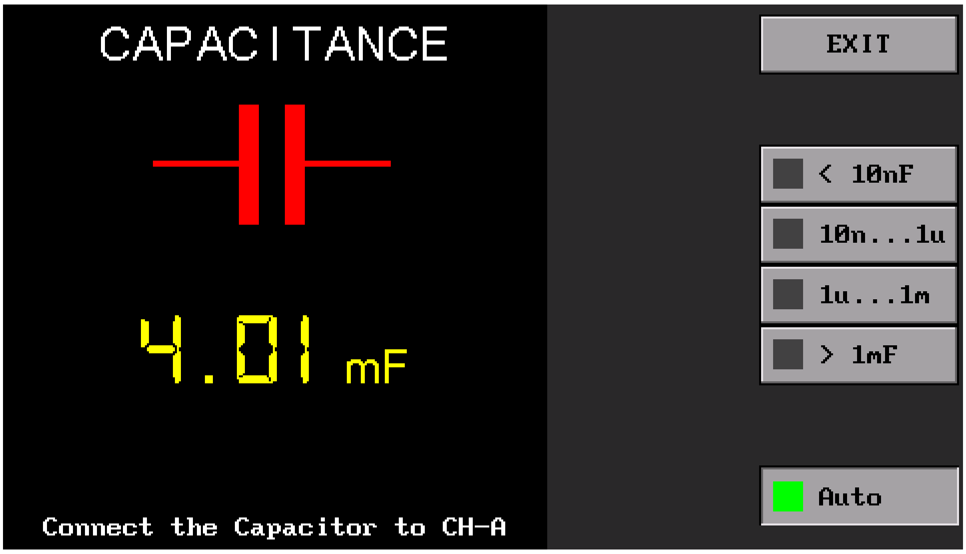


Figure 17. 4700uF capacitor measurement in auto mode

Note: Measurements may be different from device to device, depending on the tolerances of electronic components.

7. Short Circuit Finder Mode

One of the unique features of the UCE-CT321L is its ability to find the location of the short circuit. This feature is only available in the Expert edition. It is useful in finding short circuits in defective electronic boards. The menu is accessed by clicking the **Short Cir. Finder** icon in the **Main Menu**. Its general view is as in Figure 18.

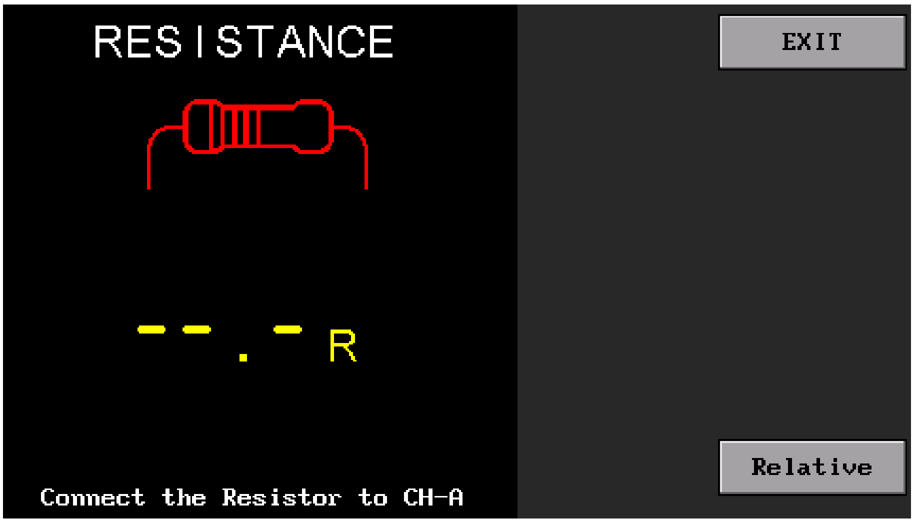


Figure 18. Short circuit finder mode overview

Figure 19. Offset calibration in short circuit

In short-circuit mode, the measurement input is **CH-A**. If 0.000R does not appear on the screen when the probe tips are short-circuited, the **Relative** button is clicked and the absolute resistance value is recorded (Figure 19). A message appears on the screen that the offset calibration is complete. The instrument is now ready for short circuit measurements.

When the measured resistance value is below 0.15Ω, the buzzer sounds intermittently depending on the distance to the short circuit point. At the point of short circuit, the buzzer sounds continuously.

The buzzer does not sound above 0.15Ω, but resistance measurement continues up to 500KΩ. It should be taken into consideration that the measured resistance values do not have the sensitivity and accuracy of a multimeter. Measurements are for reference only.

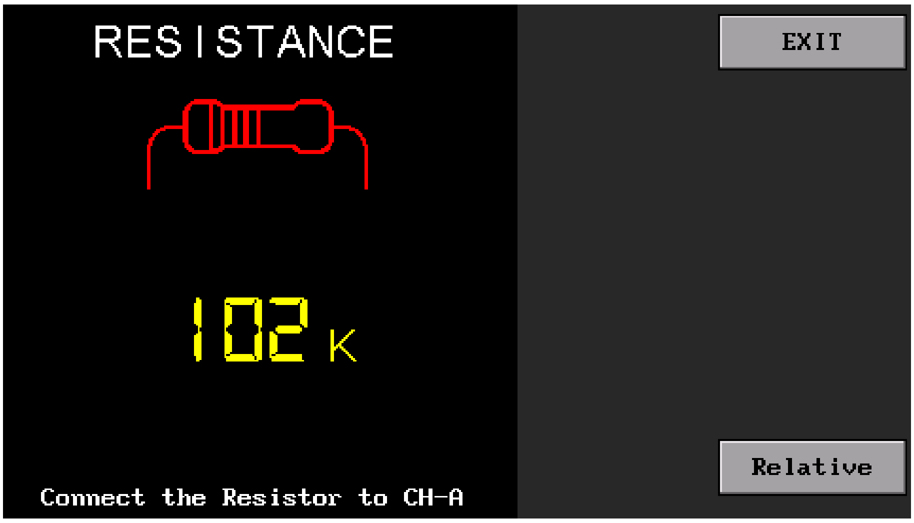


Figure 20. 100K resistance measurement in short circuit finder mode

Since the resistance measurement is made at 0.2V test voltage, active components do not affect the measurement in the measurements on the electronic board. However, since the test voltage is 50Hz AC voltage, capacitors and inductances on the circuit may affect the measurement. The most accurate result is obtained with measurements made with discrete components.

8. File Browse

In the file browse menu, the files in the internal memory are managed. By clicking the **Browse Files** button in the main menu, the menu is accessed (Figure 21). At the top of the screen is the disk directory (**0 :**).

On the left side of the screen is the list of files in the current directory. Names starting with slash (/) represent the folder. There are some buttons on the right side of the screen. These buttons:

Set Data File: Sets the data file of the database to be tested.

Set Image File: Sets the image file of the database to be tested.

OPEN: Opens the selected file or folder.

BACK: Returns back to the previous directory.

DELETE: To delete the any file or folder, The DELETE button should be clicked, but to complete the process, the DELETE button should be clicked one more time.

EXIT: Exits the file browse menu.

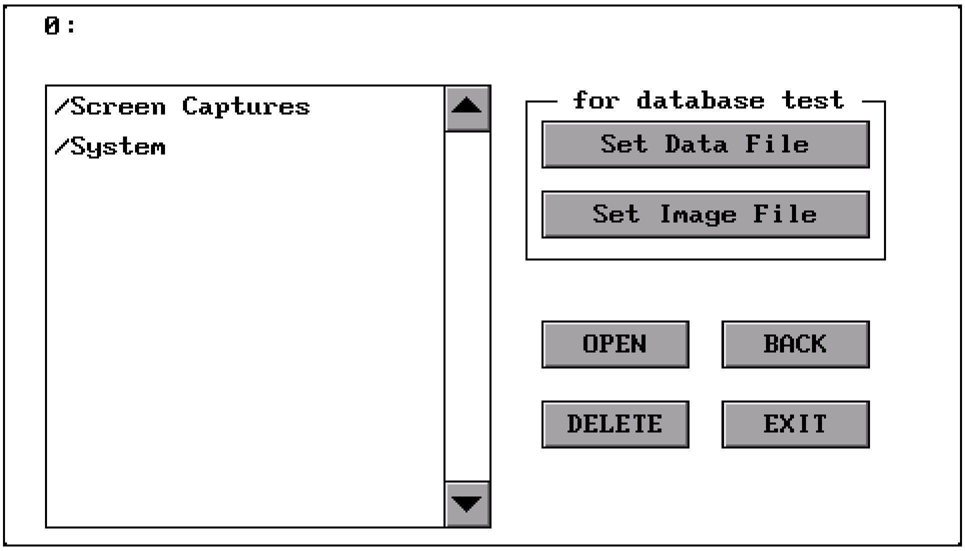


Figure 21. Browse file menu

In the **0:/Device Settings** folder, there are the files that the device needs to work: **ct_settings.cfg, db_settings.cfg, touch.cfg** (Figure 22). **ct_settings.cfg** is the file in which the settings on the device are recorded. This file can be deleted to reset the settings. **db_settings.cfg** is the file where information about the database on the device is recorded and is used only in the Expert version. The **touch.cfg** file is the touch screen calibration file. If this file is deleted, screen calibration is requested at startup.

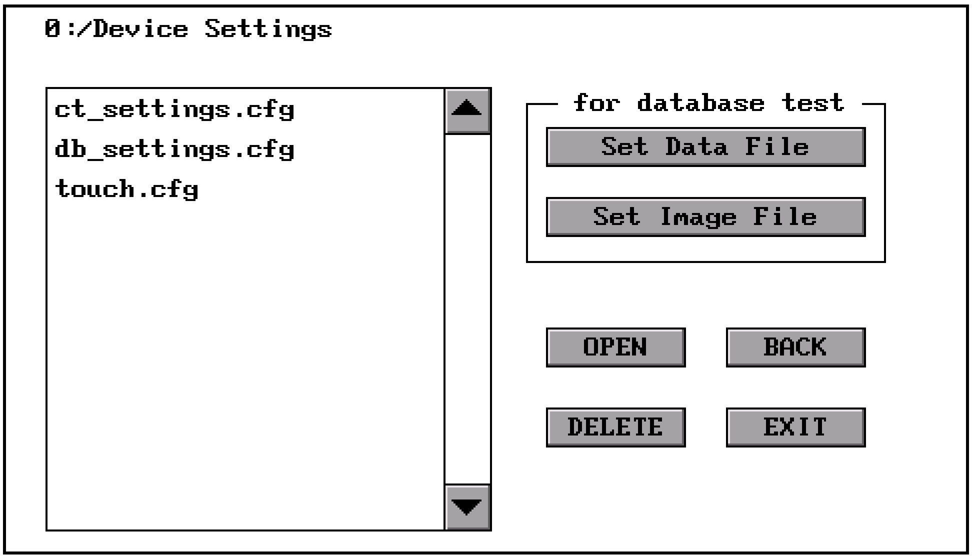


Figure 22. Device Settings folder

0:/Screen Captures folder is where screenshots are saved (Figure 23). When the desired file is selected from the list and the **OPEN** button is clicked, the picture file is displayed in full screen.

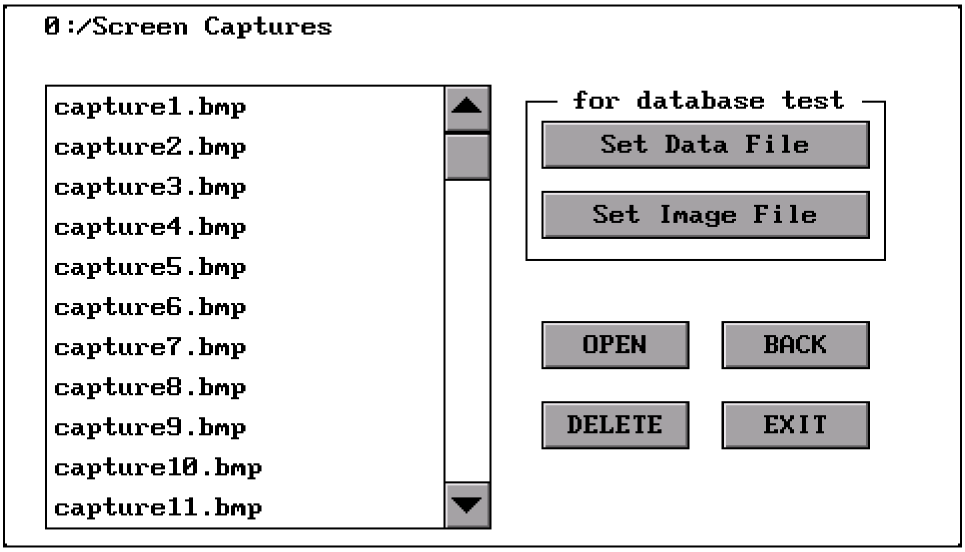


Figure 23. Screen Capture folder

Notes about the database or test conditions can be added to the device disk as a **txt** file and these text files can be displayed on the LCD.

9. Screen Calibration

Screen calibration can be done when more precise touch is needed. For this, touch the **Screen Calibration** button in the main menu. In the menu, the center of the crosshairs on the screen is pressed with a touch pen. After 4 different points, if the calibration is successful, the "smiling face" symbol appears on the screen and the program returns to the main menu. If the calibration fails, the program will return to the beginning and ask you to do the calibration again. If the calibration is successful, the **touch.cfg** file is created in the **Device Settings** folder.

<u>Tip:</u> The response of the screen to touch is different than the capacitive screens. Touching with fingers does not give good results on resistive type screens. For this reason, it is recommended to use a touch pen. If the pen is not to be used, good results can also be obtained by touching it with a fingernail. Touching with light pressure may cause erroneous operations. It should not be forgotten that since the resistive panels are mechanical in nature, it is necessary to press with a little pressure.

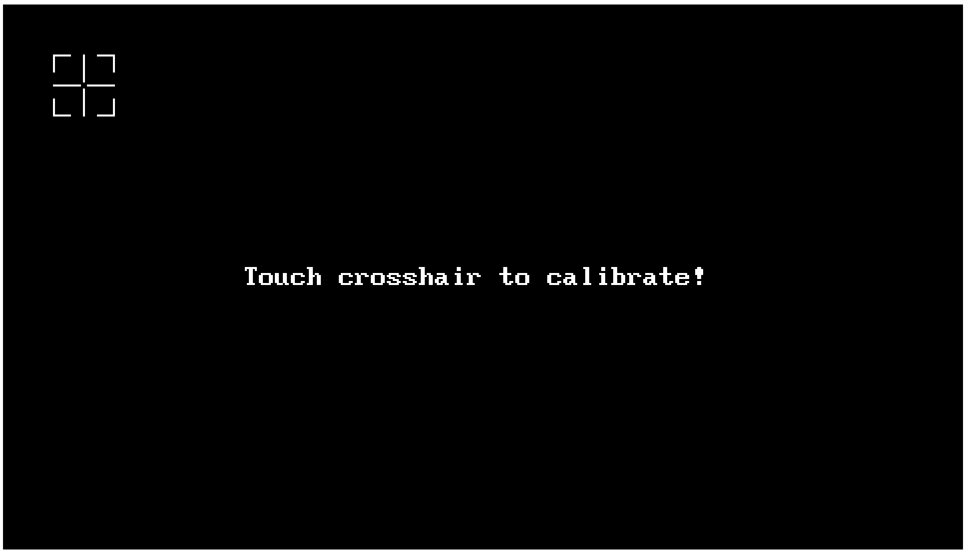


Figure 24. Screen Calibration

10. USB Disk

When the **USB Disk** button in the Main Menu is clicked, the device connects to the computer as a USB Disk. The device is listed in the **Devices and drives** section on the computer (Figure 26). Access to internal memory is provided via USB disk. Thus, files can be transferred between the computer and the device. To terminate the USB Disk connection and return to the main menu, touch the **DISCONNECT** button on the screen (Figure 25).

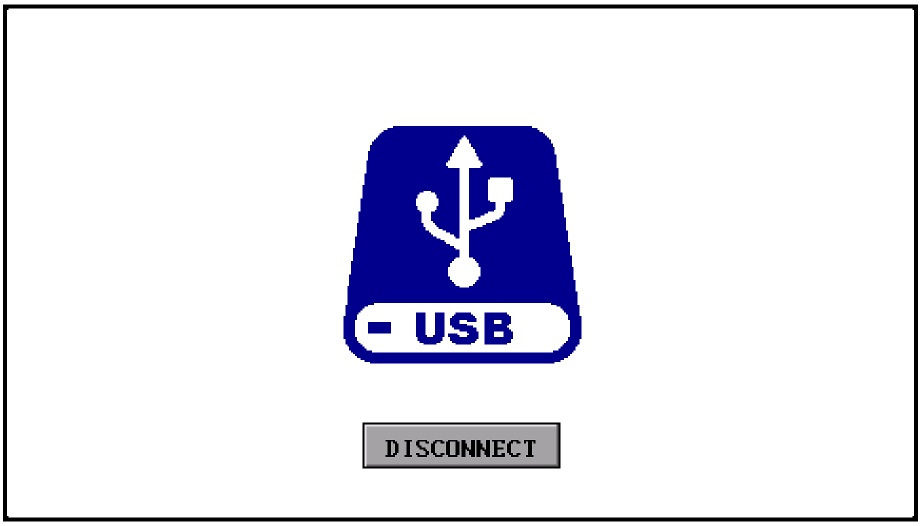


Figure 25. USB Disk LCD screen overview

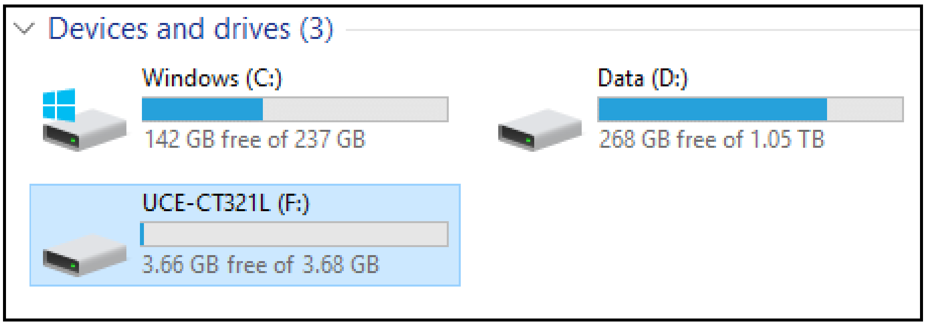


Figure 26. Devices and drives

11. PC Software Usage

This section explains the use of UCE-CT321L with the PC program. This feature is only available in Pro and Expert editions. In order to activate the program menus, the device must be connected to the computer's USB 2.0 port. Then, the Tracer menu should be entered and communication with the computer should be established.

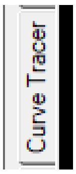
There are vertically arranged tabs on the left side of the screen (Figure 27).

- Oscilloscope,
- Signal Generator,
- Curve Tracer,
- About.

Only **Curve Tracer** and **About** tabs work on UCE-CT321L. Other tabs become active when working with the UCE-DSO4200C device.

11.1. Curve Tracer Menu

Click on the **Curve Tracer** tab on the left to open the curve tracer menu.



The screen consists of two parts. On the left is the V-I impedance curve and on the right is the menu area. The menu area consists of two tabs, **Basic Mode** and **Advanced Mode**.

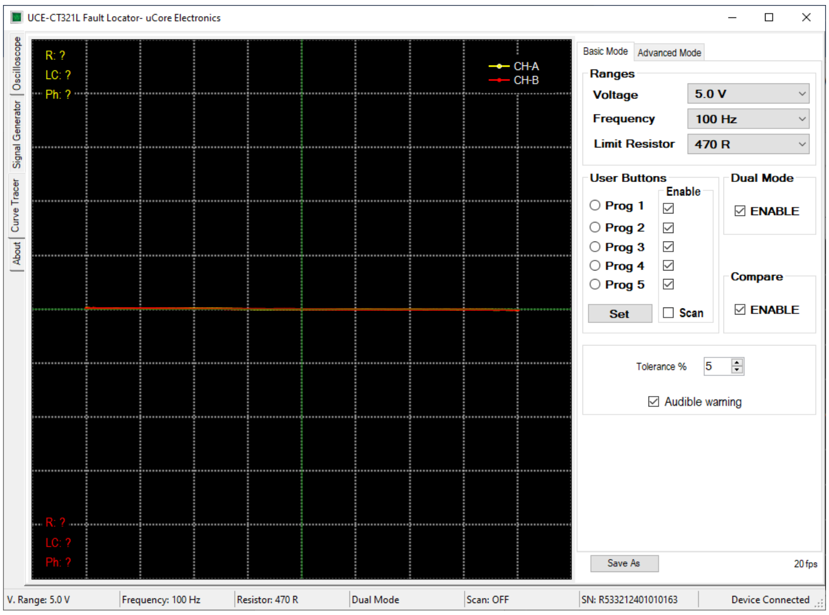
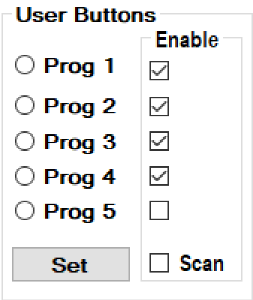


Figure 27. Overview of PC program (Basic Mode)

Basic Mode: It is the menu where basic settings such as test voltages, test frequencies and source resistance are made. In addition, voltage scanning mode and dual channel operating mode settings are also made in this menu (Figure 27).

Dual Mode: Allows CH-A (yellow color) and CH-B (red color) channels to be used simultaneously. If single channel is used, only CH-A is active.

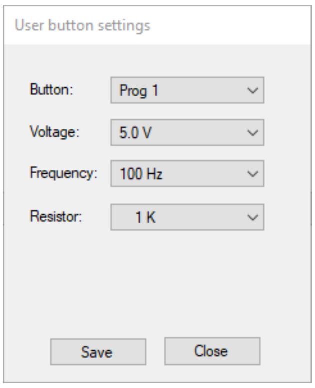
Compare: Compares the similarity between two channels. DUAL mode must be active for comparison.



Prog 1-5: There are 5 programmable user buttons. Selected voltage, frequency and limit resistor combinations are stored in the memory.

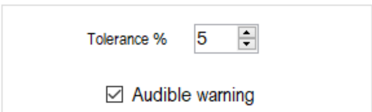
Scan: Scans user buttons at regular intervals. By removing the tick next to the stage that is undesirable to be scanned, it is canceled.

Set: Programs user buttons. Clicking the button opens a new window. Voltage, frequency, resistance combinations are created in the window that opens. Then the button to be saved at the top is selected and the settings are saved by clicking the **Save** button. Click the **Close** button to close the window.



Save As: When this button is clicked, the impedance graph is saved to the computer in picture format (bmp, jpg, png, gif) (Figure 27).

Comparison tests are performed within a certain tolerance and this variable can be set by the user in this menu in percent. The result of the comparison is reported visually and audibly by the program. If the audible warning is not preferred, this feature can be turned off by the user from this menu.



Advanced Mode: It is the menu where operations related to the database are made (Figure 28).

In this menu, a database can be created for different electronic boards. The impedance curve of each point on the PCB is recorded. These records are matched with the visual image of the PCB to see which impedance curve is at which coordinate when testing the same board in the future. Thus, a very fast test is provided.

In order to use this feature, this mode must be activated first. When **Enable Database Mode** is checked, **Database Mode** is accessed.

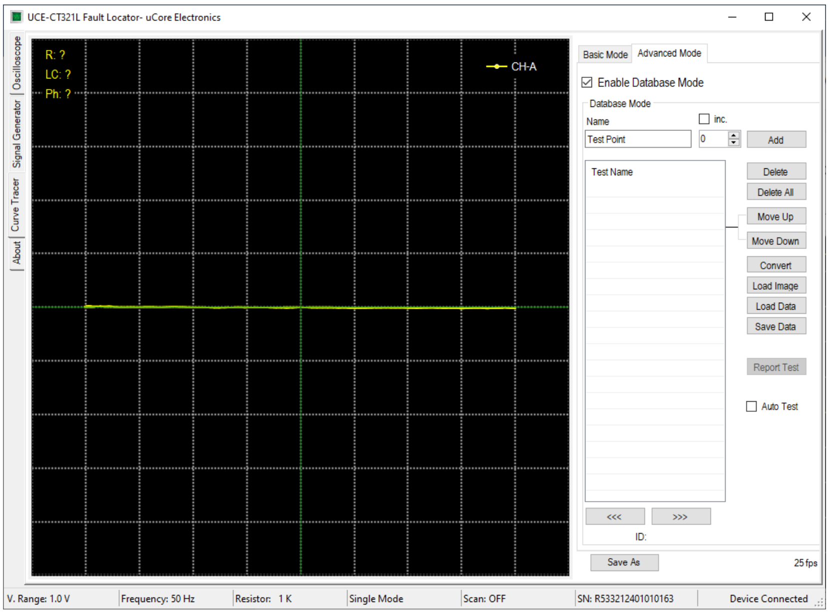


Figure 28. Overview of PC program (Advanced Mode)

There are many buttons in this section. If we mention these briefly;

Add: Adds a new test point to the database list.

Delete: Deletes the test point selected in the list.

Delete All: Deletes the entire list.

Move Up: Moves the selected test point up one position.

Move Down: Moves the selected test point down one position.

Convert: Converts the visual of the electronic card to be tested into a suitable format for use in the UCE-CT321L. A file with **pcb** extension is created with the name of the same image file in the same folder

Load Image: Opens a new window to load the visual of the electronic board to be tested.

Load Data: Loads a database saved on disk to the list.

Save Data: Saves the created database on disk.

Report Test: When the test with the database is completed, this button becomes active and when the button is clicked, the summary of the test is created in pdf format and saved to the computer disk.

>>>: Selects the next test point.

<<<: Selects the previous test point.

There are also two checkboxes in this section.

Inc.: This check box adds an incremental number to the end of the test name. Thus, a different test name is created each time when the **Add** button is clicked.

Auto Test: This check box is selected to start the comparison test from the database.

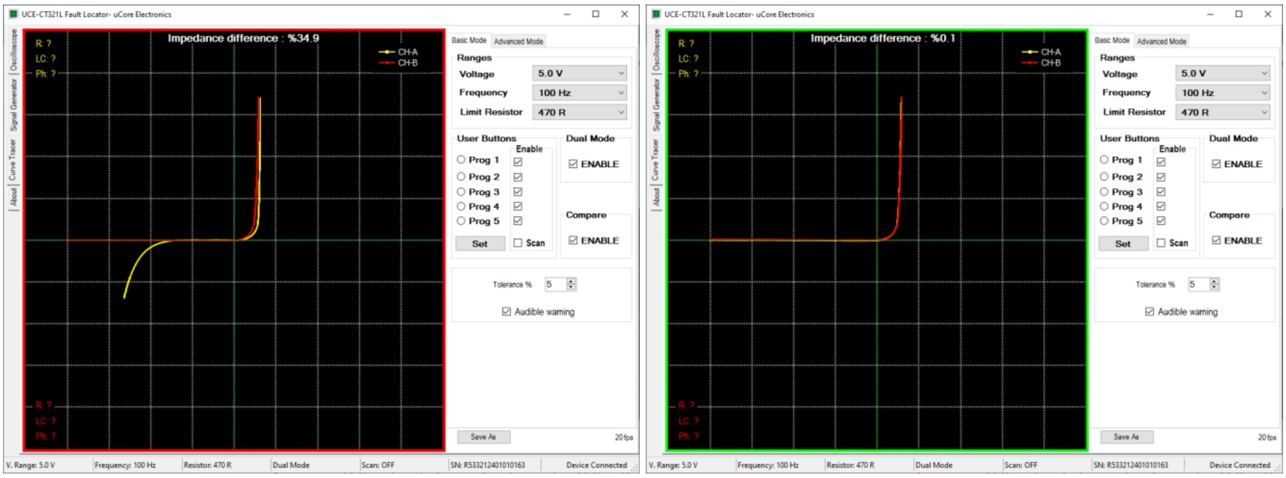


Figure 29. Two channel comparison in Dual Mode

When **Compare** is active, the comparison algorithm is also active. The impedance curve in both channels is compared with the algorithm. As a result of the comparison, a percentage value called **Impedance difference** is calculated. If this value exceeds the tolerance value set, the comparison will fail and a red frame will appear around the graphics area. If the comparison is successful, a green frame is formed (Figure 29).

If the **Audible warning** checkbox is checked, it gives a different sound warning in case of success and failure as a result of the comparison.

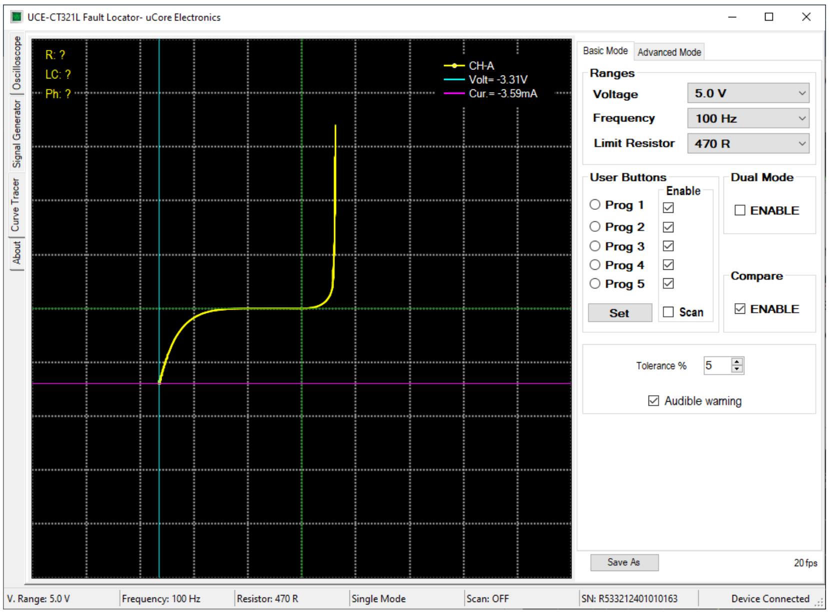


Figure 30. Analysis with Cursor

Cursor analysis becomes active when left-clicking anywhere on the graphics area. Two cursors appear on the graph. The vertical one is for the voltage and the horizontal one is the current. The current and voltage values at the intersection of the two cursors are seen in the upper right of the graph. With this feature, precise measurements can be made on the impedance curve. Cursors and measurement values become inactive when changing the test stage or right-clicking.

11.2. Creating a Database

In the **Advanced Mode** tab, the **Enable Database Mode** checkbox is checked to activate the database mode. The first thing to do when creating a database is to load the electronic board image. To do this, click the **Load Image** button. On the window that opens (Figure 31), the image of the electronic board to be recorded is loaded by clicking the **Load** button.

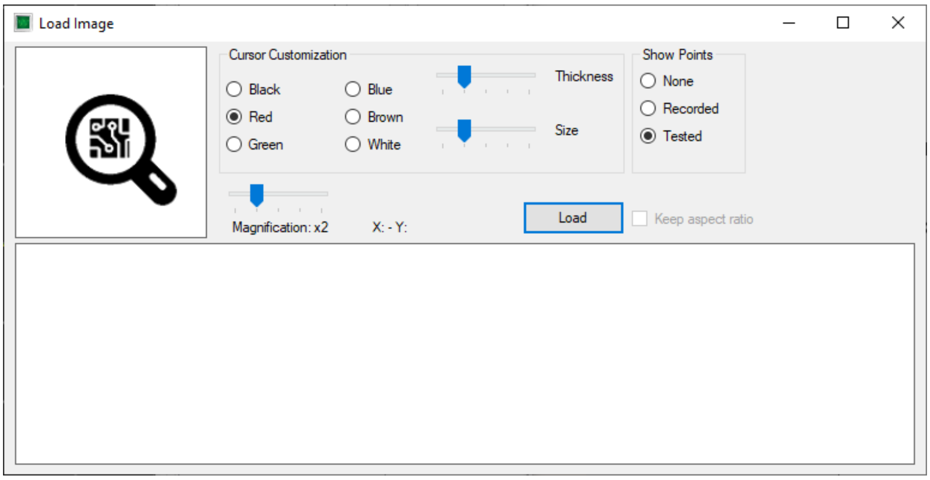


Figure 31. Overview of the Load Image window

On this window, cursor customization can be done. Depending on the color and density of the PCB, the color, size and thickness of the cursor can be changed by the user. There is also a magnifying screen. The position of the cursor on the PCB is seen more clearly in this area (Figure 32).

There are 3 features in the **Show Points** section.

- **None**: does not show any data on the image.
- **Recorded**: Shows all recorded points on the image.
- **Tested**: Marks the points according to the result of the test during the auto-test. The points that pass the test are marked in green, and those that fail the test are marked in red.

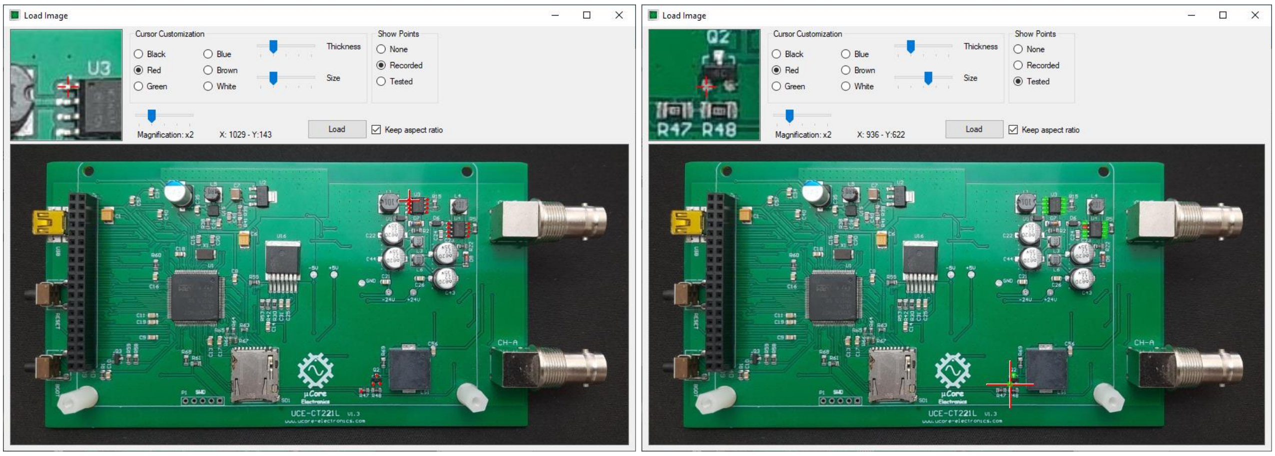


Figure 32. Load Image window (display of recorded and tested points)

Before starting the database creation, an electrical connection must be established between the GND point of the electronic board to be registered and the black probe at the CH-A input.

After the PCB image is loaded, the database creation can be started. First, the point to be measured is marked by clicking on the PCB image (Figure 32). Then, by touching the same point on the board with the probe and the impedance curve appears on the chart, it is added to the list by clicking the **Add** button (Figure 33). If no test point is selected in the list, the new point is added to the end of the list. If a new record is added by selecting a point from the list, then it is added below the selected point. Thus, new data can be added between the points in the list later.

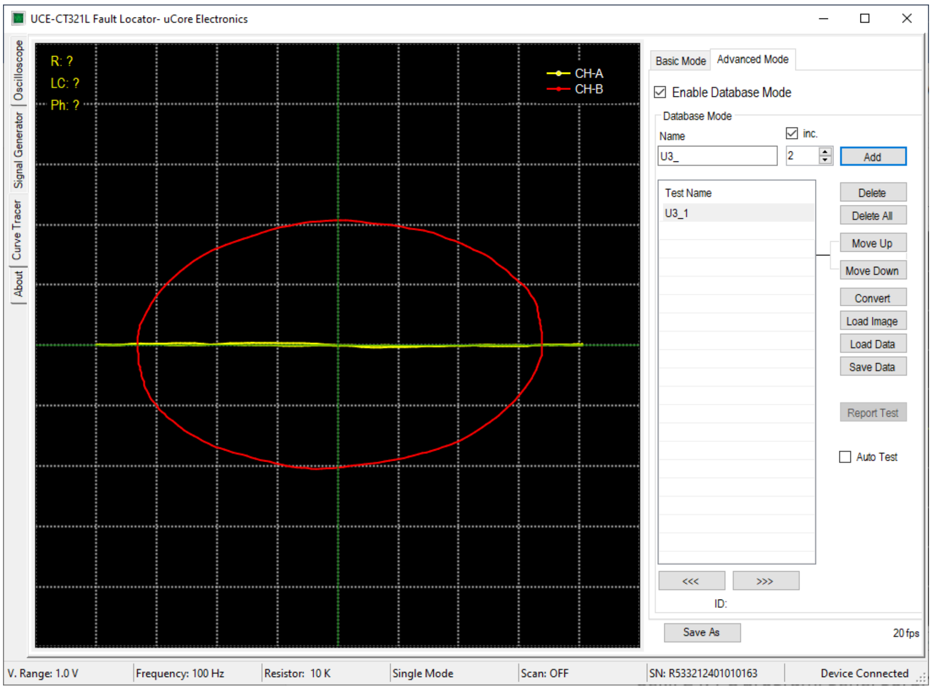


Figure 33. Creating a database

If the name of a point in the list is desired to be changed, that point is selected first and then the **F2** key is pressed. The name of the test point can now be changed.

If there are incorrect or undesired test points, they can be deleted from the list with the **Delete** button. Or, if you want to change the order in the list, **Move Up** and **Move Down** buttons can be used. The item can also be shifted by drag and drop method.

When the list is completed, the **Save Data** button is clicked and recorded to the disk. The extension of the recorded file is **uce3** and does not include the board image. Therefore, it must be stored together with the image of the board.

11.3. Comparison from Database

In the **Advanced Mode** tab, the **Enable Database Mode** checkbox is checked to activate the database mode. Then click the **Load Image** button. In the window that opens, the image of the electronic board to be tested is loaded by clicking the **Load** button. Then, by clicking the **Load Data** button in the main window, the digital data of the electronic board is loaded into the list. When the points in the list are clicked, the position on the board and the impedance curve can be seen in the program. In Figure 34, when the point recorded with the name U3_1 is clicked on the list, its position on the board image can be seen. The red colored curve in the graph is the impedance curve for this point. The yellow curve is the impedance curve read from the CH-A input.

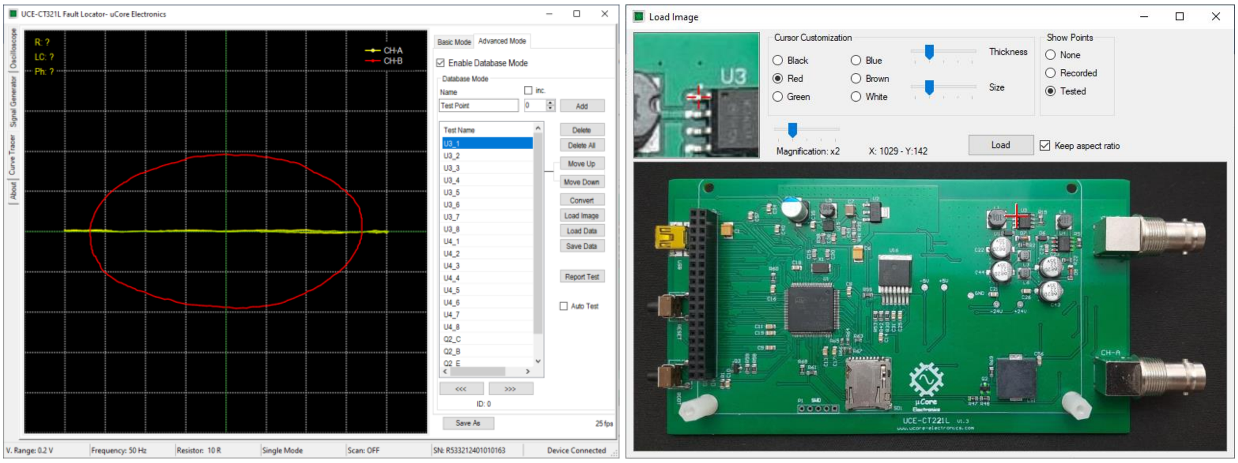


Figure 34. Comparison from database

When the **Auto Test** checkbox is checked, it switches to auto-test mode. From which point the test is desired, that point is selected by clicking on the list. Testing can now begin. When measuring with a probe on the real board, in the coordinate shown on the board image, impedance curves are compared by the algorithm. Both impedances can be observed on the chart. In addition, the impedance difference between the two data is also seen as a percentage at the top of the graph. If this value does not exceed the tolerance limit, the test passes, an audible warning sounds and a green frame is formed around the graph (Figure 35). Upon termination of the measurement, the next point is automatically moved. If the impedance difference exceeds the tolerance limit, the test fails and the color of the frame around the graph becomes red, giving a warning with a different tone. In this case, the next point is not automatically passed. In this case, the next point is not automatically moved. Clicking on the **>>>** button moves to the next point. When the test is terminated or finished, the **Report Test** button becomes active. Clicking on it generates the report of the test. You can find the details of the test steps in this file in pdf format.

There may be some differences in the impedance curves caused by the production of electronic materials. Therefore, comparisons are made within tolerance. Another important factor affecting the impedance is the probe impedance. The same probes should be used when creating a database and testing afterwards. The difference in probe impedance can affect the curve. Also, in the database test, the GND point of the board should be the same as the reference point when creating it.

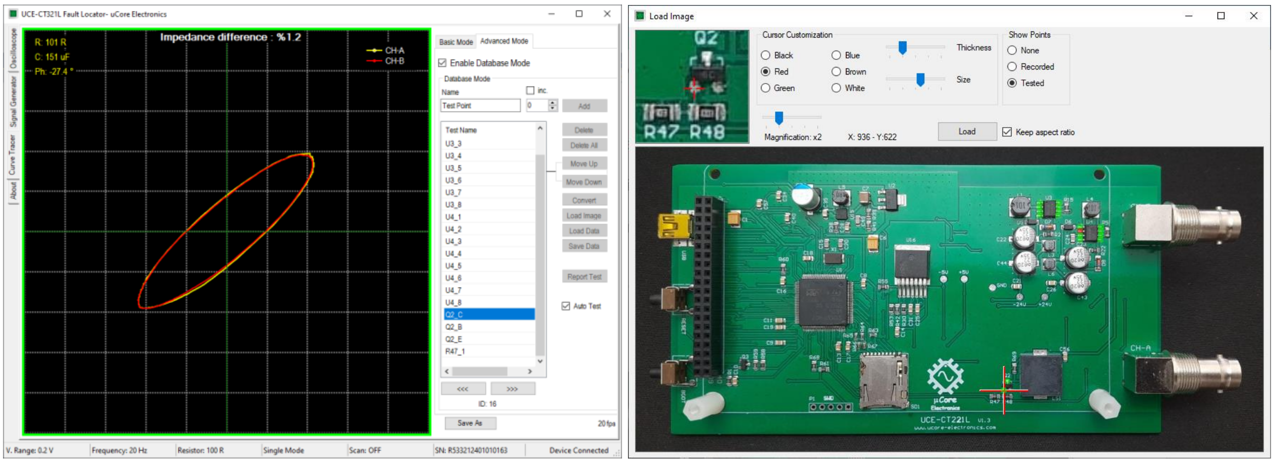
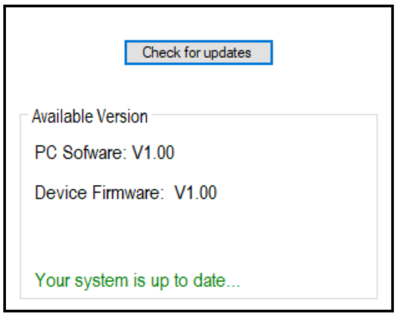


Figure 35. Auto-test mode

11.4. About Tab

Click the **About** tab on the left to open the about menu.

Figure 36. About tab overview



This is the section with information about the device and the PC program. It contains version information of device and PC program software. There is also a **Check for updates** button on the menu. When the button is clicked, it is checked whether there is a software update related to the system. For this, the computer must be connected to the internet network. If new software is available, the download buttons are activated and related files are downloaded. The files are available in the **downloads** folder on the computer.

12. Comparison Test from Database on Device

One of the most important features of the UCE-CT321L Expert edition is that it can read the database file created in the PC program and perform the database test independently from the computer.

When performing a database test on the device, firstly, data and image files must be selected for testing. In other words, the addresses of the two files must be defined.

Note: the database data file has the extension "uce3". The image file has a "pcb" extension. Image extensions that can be used in the PC program are "jpg", "bmp", "png" and "gif". The image file used in the database should be converted to a **pcb** file and copied to the device memory. For this, the **Convert** button is used in the PC program (Figure 28). When the **Convert** button is clicked, the image file used in the database is selected and the **Open** button is clicked. A file with **pcb** extension is created with the name of the same image file in the same folder. This file must be used as an image file in the database test on the device.

After the database files are copied to the device memory, the **Browse Files** menu in the main menu opens. The data file with **uce3** extension is selected and then the **Set Data File** button is clicked.

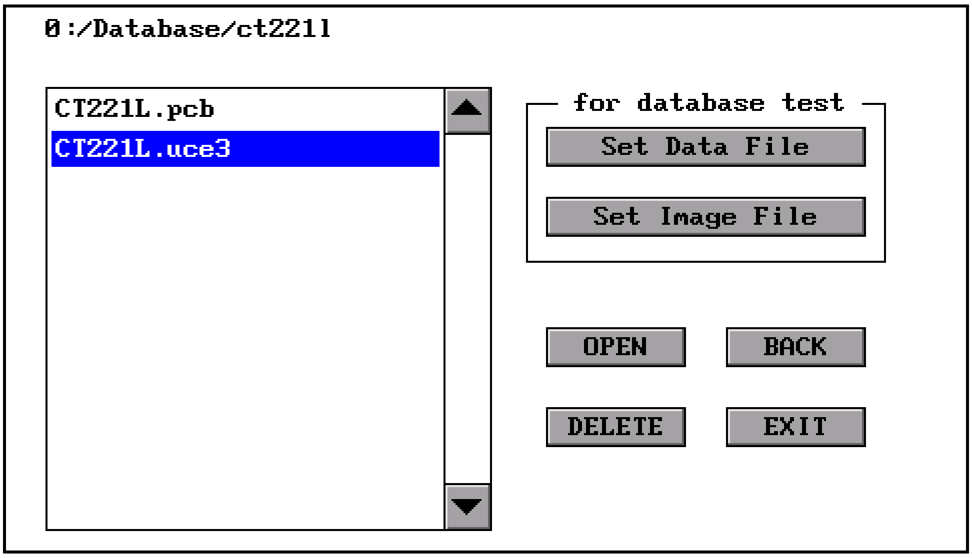


Figure 37. Database data file selection

After the button is clicked, the file is analyzed first. And during the database test, a helpful **ubin** extension file is created to make the process faster. Then, a text will appear in the lower right corner of the screen indicating that the file is set for database testing (Figure 38).

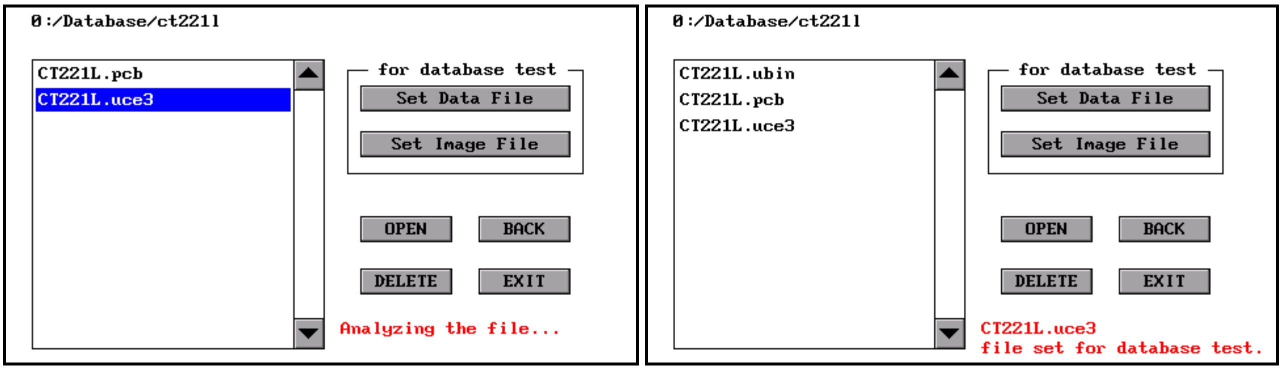


Figure 38. Database data file selection

After the data file has been set, the similar process should be done for the image file. After the directory location of the image file is opened, the file is selected from the list and then the **Set Image File** button is clicked. A text will appear in the lower right corner of the screen indicating that the selected file is set for database testing (Figure 39).

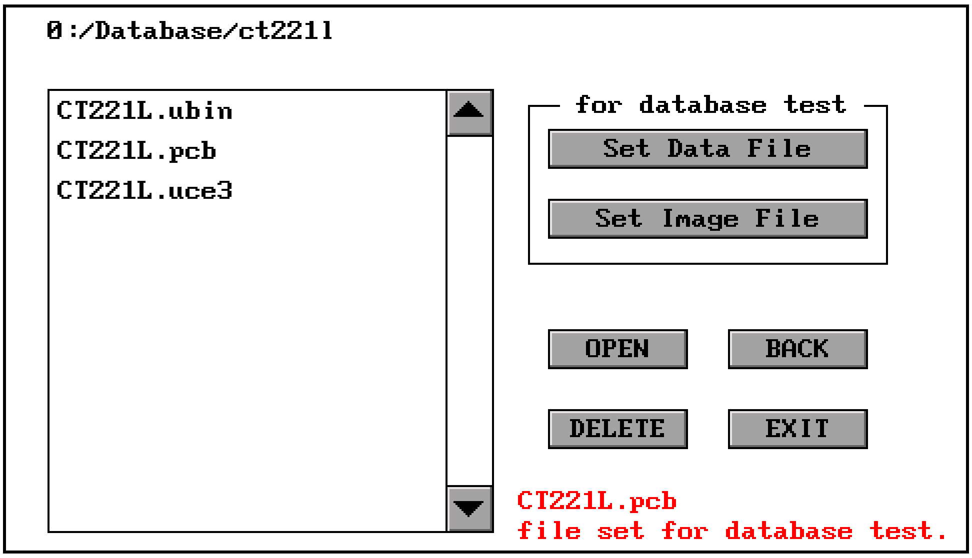


Figure 39. Database image file selection

If desired, the image file can be displayed on the screen visually by clicking the **OPEN** button. Depending on the size of the image file, it may take a while to open the file. Using very large image files should be avoided whenever possible. Otherwise, the processing time of the image file may cause the database test to slow down.

After selecting the files, you can enter the **Tracer** menu in the main menu for database testing. When entering the **D.base** tab, it is seen that the test points are listed (Figure 40).

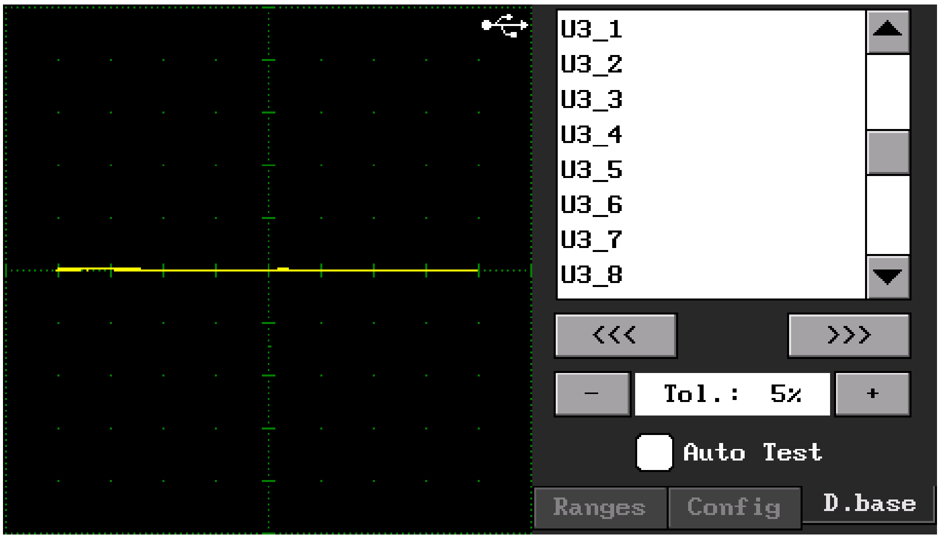


Figure 40. Database tab

When clicked on any line in the list, the red colored impedance curve is seen in the graphic. In addition, the point where this curve is on the tested card is also shown bottom of the graph (Figure 41).

There are some buttons on the sides of the electronic board visual.

+: Zooming in the image.

-: Zooming out the image.

X: Closes the image. If you want to open it again, it should be selected from the list again.

The zoom in/out value is indicated by a number in the upper left corner of the image; where **1** is the maximum zoom to the image and **4** is the maximum zoom out value.

>>>: Selects the next test point.

<<<: Selects the previous test point.

Comparison tests are made within a certain **tolerance** and this variable can be set in this menu.

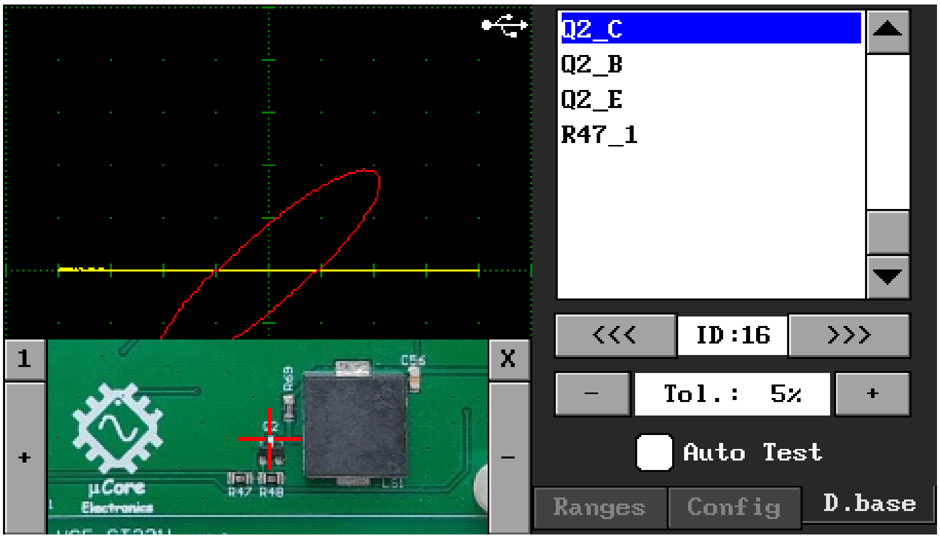


Figure 41. Database test

When the **Auto Test** checkbox is checked, the automatic test mode is enabled. From which point the test is desired to be performed, that point is selected by clicking on the list. When the selection is made, its position on the board is also seen below the graph. When the measurement is made, the board visual is turned off so that the impedance curves can be seen more clearly. Impedance curves are compared by the algorithm. In addition, both impedances can be observed on the graph. If the tolerance limit determined as a result of the comparison is not exceeded, a green frame is formed around the graphic. If it is not successful, the color of this frame is red. In addition, the impedance difference between the two data is also seen on the graph as a percentage. If this value exceeds the tolerance value, the test will fail. As mentioned before, test results are reported audibly and visually. The audible warning allows the test to be done very quickly. When the test result is successful, the next test point is passed when the measurement on the board is terminated. If the test fails, there will be no transition to the next test point.

When **Auto Test** is activated, communication with the computer is disconnected. If the PC program is open, it closes automatically.

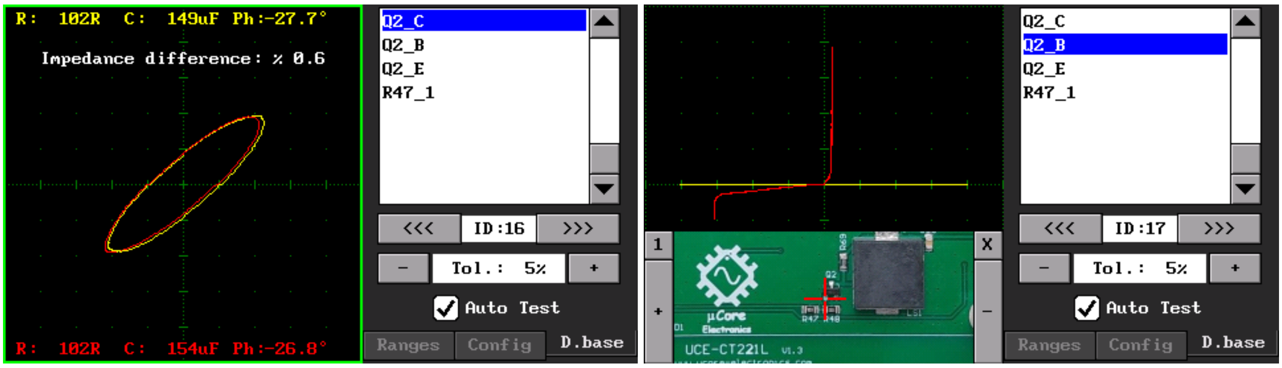


Figure 42. Database test (Auto Test)