



**μCore**  
Electronics

# UCE-CT221L FAULT LOCATOR

## USER MANUAL

UCORE ELECTRONICS  
<https://ucore-electronics.com>

## REVISION HISTORY

Version	Date	Changes
V1.0	21.06.09	Initial release.
V1.1	22.02.19	<ul style="list-style-type: none"><li>• Added high voltage charged capacitor detection feature (21.06.14).</li><li>• Added a checkbox to show all saved test points for database (21.06.21).</li><li>• Added Frequency scanning feature (21.08.05).</li><li>• Added Cursor feature (21.08.05).</li><li>• Removed Probe Calibration menu and added a more advanced Measurement Calibration menu (22.02.19).</li><li>• Capacitance meter feature added (22.02.19).</li><li>• Added 1V test voltage range (22.02.19).</li><li>• Added ability to read text files (22.02.19).</li></ul>

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# 1. Introduction

V-I test method is widely used in the World for PCB repairing. Fault detection can be done without energizing PCB boards.

52 different test conditions can be created with different combinations of test voltage, source resistance and frequency values.

With its internal 4.3-inch LCD screen, it provides the opportunity to analyze independent from the PC.

UCE-CT221L can transmit all data to a PC via USB connection. This USB connection provides the possibility to use the device with PC software. It uses the same communication protocol as the UCE-CT220S. Therefore, it can be used with the same PC software and the same benefits can be obtained.

There are two modes in the PC Software.

- Basic mode
- Advanced mode

In **Basic mode**, test steps can be set manually. By activating the dual mode, two PCB boards can be compared instantly. The comparison is made within a certain tolerance and this variable can be adjusted by the user. The result of the comparison is reported visually and audibly by the program. If audible warning is not preferred, it can be turned off by the user. Values of basic circuit elements such as capacity and resistance are displayed on the screen.

In **Advanced mode**, a database can be created for the PCBA board. The impedance curve of each point on the PCB is recorded. These records can be matched with the visual image of the PCB. Thus, when testing the same card in the future, it is seen which impedance corresponds to which coordinate on the PCBA.

Another feature of the product is that it can be used in **standalone mode** without being connected to the PC. In this case, impedance curves can be observed on the LCD. In stand-alone mode, the device operates similarly to the basic mode in the PC program. In the tests performed with the device, test results are reported both visually and audibly with a buzzer, similar to the PC program.

The most important feature of the UCE-CT221L is that it can read the database file created in the PC program and perform the database test independently from the computer. Thus, this device has more features than the UCE-CT220L and UCE-CT220S.

### **Specifications:**

- **Display:** 4.3 inch 480 × 272-pixel color LCD with Touch screen
- **Channels Number:** 2
- **Waveform:** Sine wave
- **Test Frequencies:** 10Hz, 100Hz, 500Hz, 2000Hz
- **Open circuit Voltage:**  $\pm 1.0V$ ,  $\pm 2.5V$ ,  $\pm 5V$ ,  $\pm 10V$ ,  $\pm 20V$
- **Source Resistance:** 47R (only @1.0V, 2.5V and @5V), 1k $\Omega$ , 10k $\Omega$
- **PC connection:** mini-USB connector (USB 2.0 HID protocol).
- **Storage:** internal 4GB disk (microSD card)
- **Power Consumption:** 8W
- **Dimensions:** 167 x 83 x 31 mm
- **Weight:** 300gr
- **Warranty:** 1 year

### **Package List:**

- Carrying Case
- UCE-CT221L Curve Tracer Device
- 2 pcs BNC to 4mm banana cable
- 2 sets multimeter pen (red and black), and with needle high-voltage cap
- 2 sets banana extension cable
- 5V 2A power supply (EU Type)
- 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. Energy 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. It can be powered from any 5V, 2A power supply for use in an independent mode from the PC.

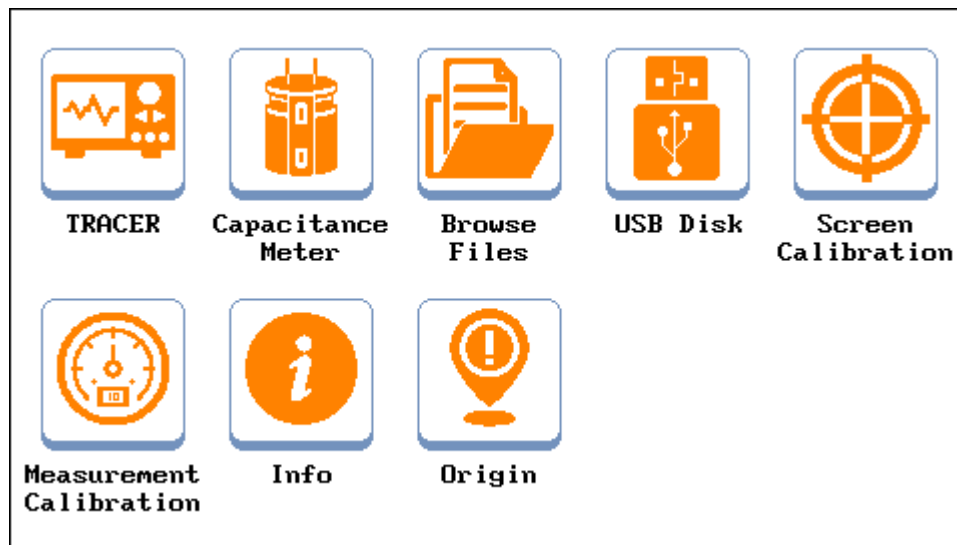


Figure 1. Main Menu

## 4. System Introduction

### 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.

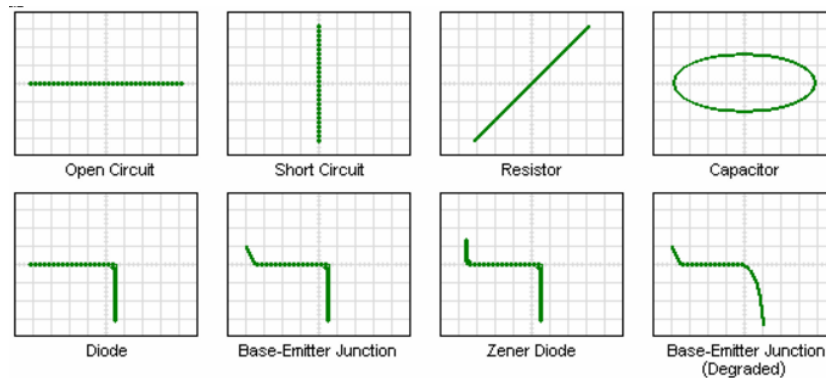


Figure 2. Component characteristics in XY mode (horizontal trace voltage, vertical trace current)

The UCE-CT221L 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 512 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. 40 different test conditions can be created with different combinations of these values.

### **Open Circuit Test Voltages:**

- $\pm 1.0V$
- $\pm 2.5V$
- $\pm 5V$
- $\pm 10V$
- $\pm 20V$

### **Test Frequencies:**

- 10Hz: Suitable for large capacity capacitors.
- 100Hz: Suitable for active components (integrated, diode, transistor, etc.).
- 500Hz: Suitable for active components and medium-low capacity capacitors.
- 2kHz: Suitable for coils and low-capacity capacitors.

### **Source resistance:**

- **47R:** Connects a 47R resistor to the voltage source to limit the current. (**High current mode!**).
- **1K:** Connects a 1K resistor to the voltage source to limit the current.
- **10K:** Connects a 10K resistor to the voltage source to limit the current.

**47R** Source resistance is used only at **1.0V**, **2.5V** and **5V** stages. It is ideal for testing large capacitors and power transistors. It is **not** suitable for active components. Since the test current is high, it can damage the components. In addition, capacitor measurements can be made up to **10 mF** at **47R** limit resistance and **10Hz** frequency levels. But the capacitor curve can be observed up to **20 mF**.

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.

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

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 1K $\Omega$ , the maximum current value;

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


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



### 4.3. Device Usage

This section describes the test mode usage of the UCE-CT221L device.

For accessing to Test mode, **Tracer** icon in the 'Main Menu' should be selected (Figure 1). The view of Test mode is seen in the Figure 3.

If the device is connected to the USB port of a PC, it communicates with the computer when entering the test menu. The driver is installed automatically by Windows. 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. Working with the PC program will be explained in detail in section 4.8.

If there is no touch anywhere for more than 15 minutes in Test Mode, 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
- Limit
- D.base

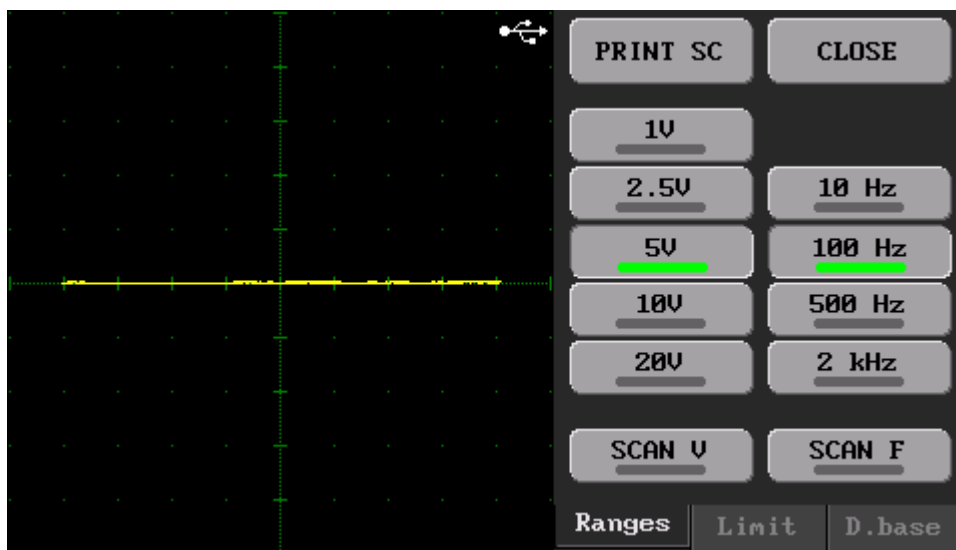


Figure 3. Test Mode overview (Ranges menu)

**Ranges Menu:** This is the menu where test voltages and test frequencies are selected.

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

**CLOSE:** it is used to return to the **Main Menu**. In addition, when **CLOSE** button is pressed, device data is stored in memory.

**SCAN\_V:** Scans the Test Voltage levels per second. When the level that is not wanted to be scanned is pressed for more than 2 seconds, that level is disabled. Inactive levels are marked in red. If it is desired to be activated again, 2 sec. is held down (Figure 4).

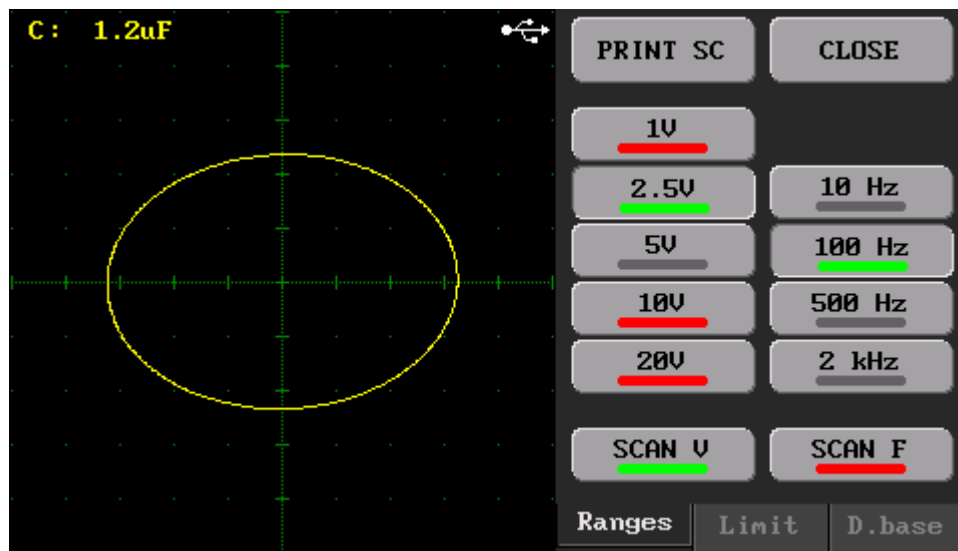


Figure 4. Scan\_V Mode overview (1.0V, 2.5V and 20V levels canceled)

**SCAN\_F:** Scans the Frequency levels per second. When the level that is not wanted to be scanned is pressed for more than 2 seconds, that level is disabled. Inactive levels are marked in red. If it is desired to be activated again, 2 sec. is held down (Figure 5).

Voltage and frequency scanning cannot be done at the same time. Whichever scan is performed, the other is automatically inactive and touches are not allowed.

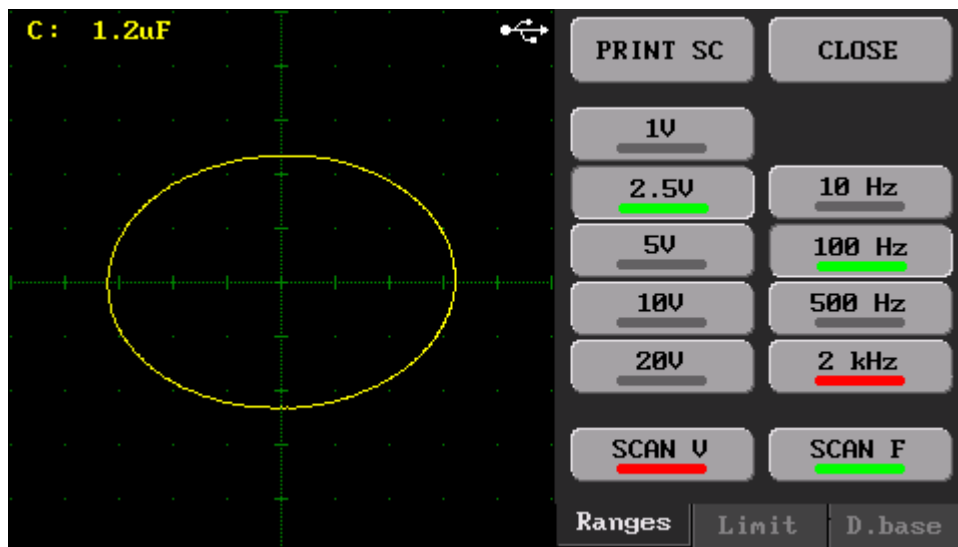


Figure 5. Scan\_F Mode overview (2kHz level canceled)

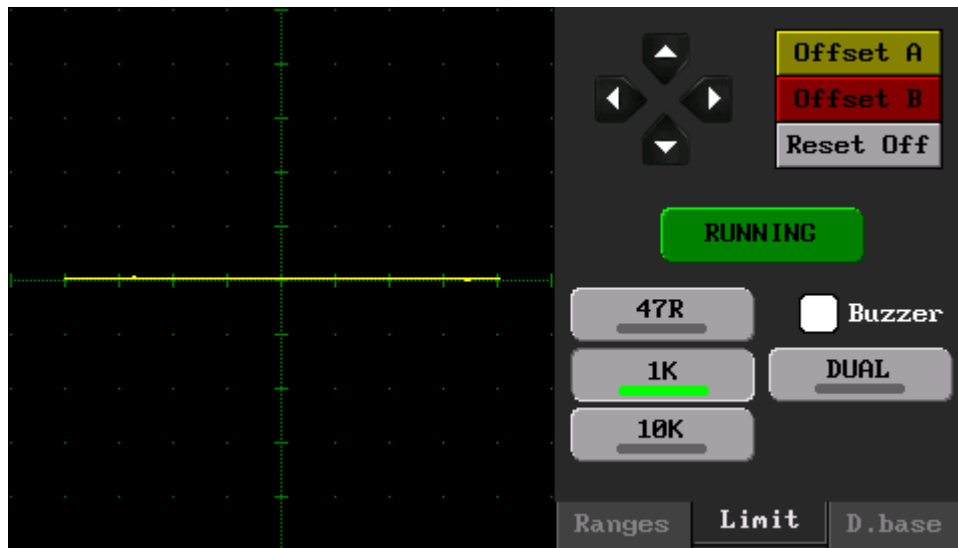


Figure 6. Test Mode overview (Limit menu)

**Limit Menu:** In this menu, offset settings and source resistance are set (Figure 6).

**Offset adjustment:** V-I impedance curves can be positioned horizontally and vertically when needed. Press the **Offset A** button to change the position of the Channel A and position using the 4-way button on the left. Similarly, to change the position of Channel B, press the **Offset B** button to change the position of the 4-way button. If you want to reset the position setting, press the **Reset Off** button.

**RUNNING (HOLD):** Used to freeze the screen at runtime. Pressing the button again to continue.

**Buzzer:** If this checkbox is selected, the buzzer inside the device gives an audible warning at button touches.

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

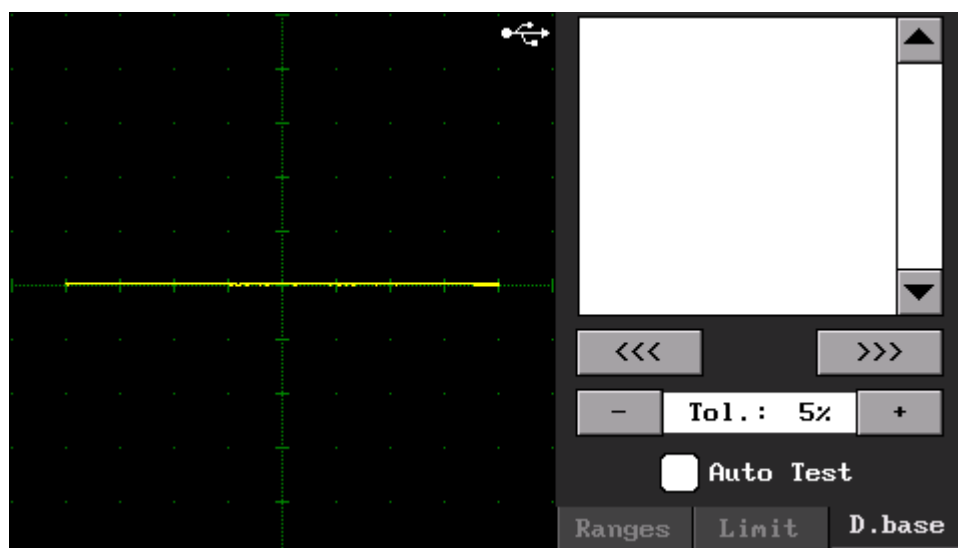


Figure 7. Database Test menu overview (D.base menu)

**D.base Menu:** The test of database files created with the PC program is performed in this menu. The use of this menu will be explained in detail later.

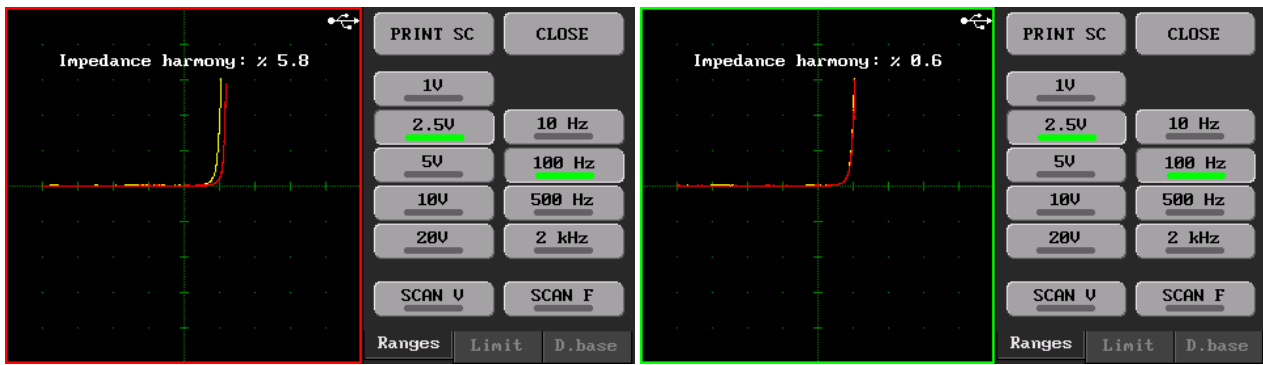


Figure 8. Comparison in Dual Mode

When the two channels are 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 harmony is calculated. If this value exceeds the tolerance value (Figure 7) set in the **D.base** tab, the comparison fails and a red frame appears around the graphics area. If it passes, a green frame is formed (Figure 8).

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

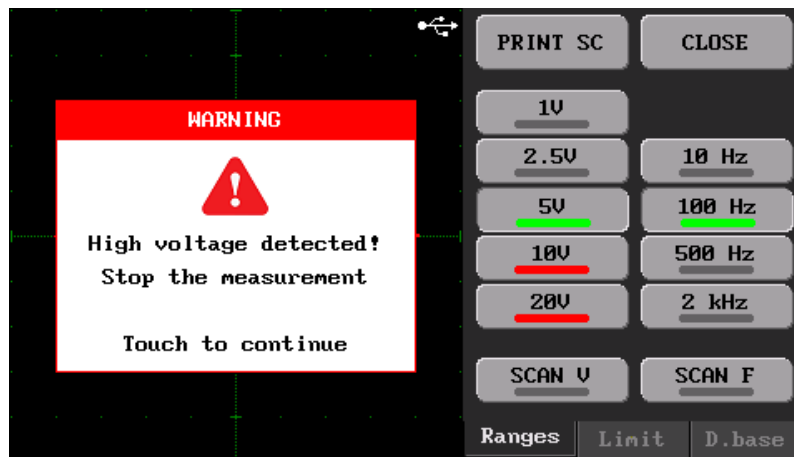


Figure 9. High voltage detection

There are protection and detection circuits on both inputs of the device against high voltage measurement. It gives a warning when high voltage is detected in any of the channels during the measurement. In this case, the measurement must be stopped immediately. Then touch anywhere on the screen to continue normal operation.

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**.

#### 4.4. Measurement Calibration

With the version 1.04 firmware, the **Probe Calibration** menu has been removed and the **Measurement Calibration** menu has been added. In the old algorithm, only probe impedance and offset calibration were performed. A more advanced calibration is performed with this menu. Thus, the measurement accuracy of the device is increased and more precise measurements are made. Measurement differences between different devices are minimized.

If the impedance curve that will occur when the probes are short-circuited is not vertical (90°)(especially at the 47R stage), then the probe calibration should be done. Also, if the **settings.cfg** file is deleted, the calibration parameters are lost, so a recalibration must be performed.

To calibrate the device, the **Measurement Calibration** icon in Figure 1 is pressed. Press the **START** button on the menu screen to begin the calibration (Figure 10).

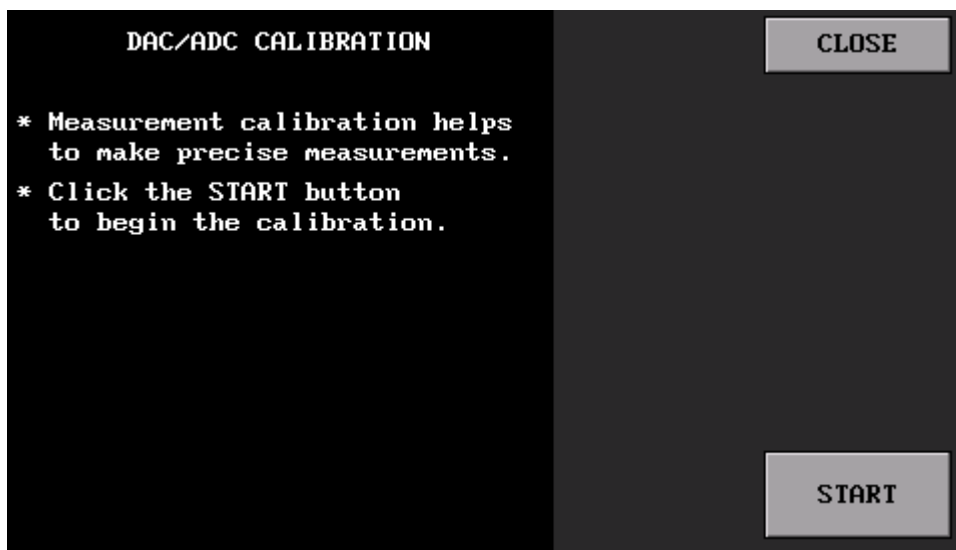


Figure 10. Measurement Calibration menu overview

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 (Figure 11). After the output is adjusted to zero Volt, the **NEXT** button is pressed to proceed to the next stage.



Figure 11. Signal Offset Calibration

The device both generates a signal and measures the value of that. Zero Volt produced in the previous step is read by the device in this step and its value is displayed on the screen. It is set the measured voltage is zero volts by using the + and - buttons (Figure 12).

**Note:** By using the **PREVIOUS** button, it is possible to return to the previous stage if desired.



Figure 12. ADC Offset Calibration

In the third step, the gain of the generated signal is adjusted. Here, similar to the first step, Channel A output is adjusted to **20.0V** by using the + and - buttons, while Channel A output is also measured in DC stage with a multimeter. After the output voltage is adjusted to 20V, the **NEXT** button is pressed to proceed to the next step (Figure 13).

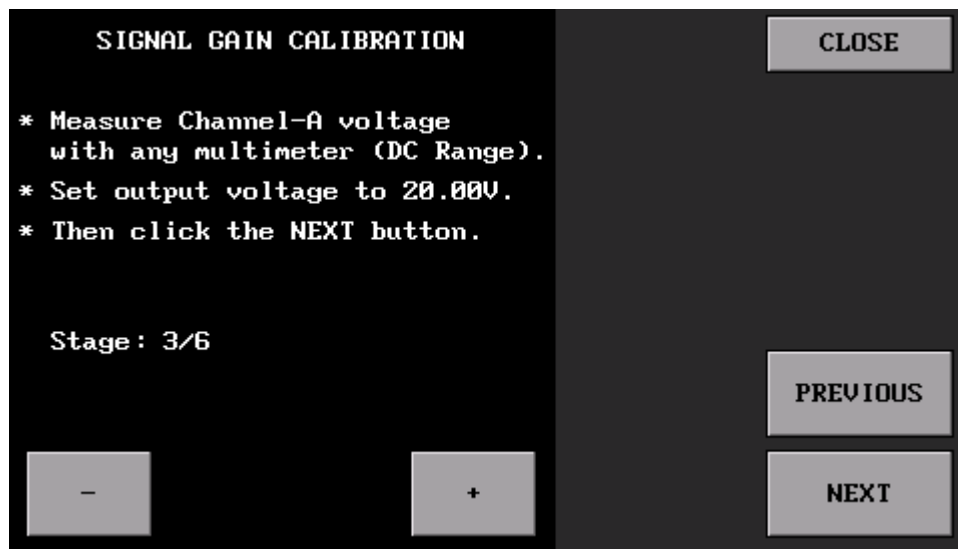


Figure 13. Signal Gain Calibration

In the fourth stage, the ADC reading gain of the device is adjusted. For this, it is set the measured voltage to 20V by using the + and - buttons (Figure 14).



Figure 14. ADC Gain Calibration

In the fifth 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 pressed 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 15).



Figure 15. Probe Calibration

In fifth stage, the calibration process is finished, but the calibration parameters have not been saved yet. In the last stage, these parameters are saved in the device's disk by pressing the **SAVE** button (Figure 16). Calibration is completed and pressing the **CLOSE** button returns to the main menu.

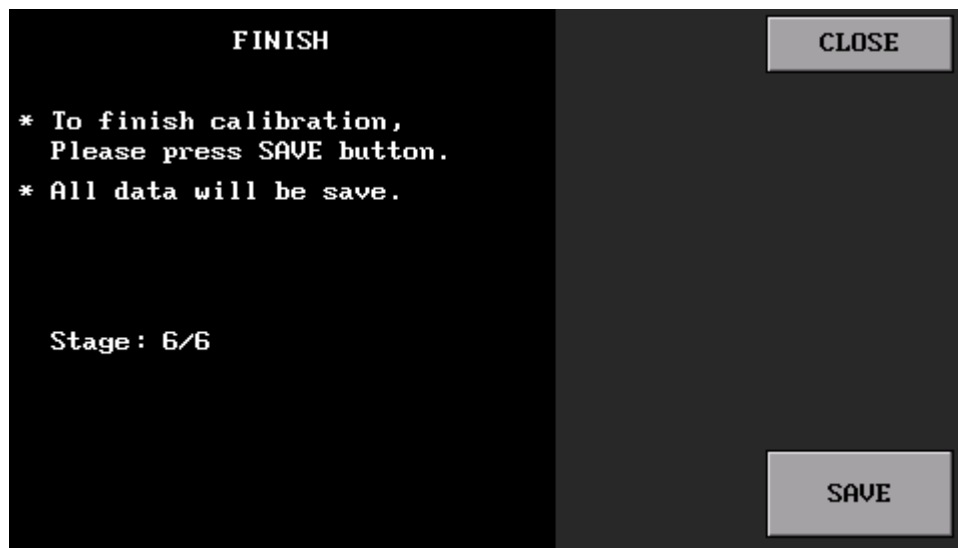


Figure 16. Saving parameters

**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 should not be expected to be the quality of a multimeter.

If the **CLOSE** button is pressed 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.



## 4.5. Capacitance Meter

Capacitance measurement feature has been added to the UCE-CT221L with version 1.04 firmware. It should be noted that as the UCE-CT221L is not designed as a capacitance meter, the measurements herein can be used for reference purposes only. The measuring range of the device is between **1nF-100mF**. The measurement accuracy is **8%**. 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 pressing the **Capacitance Meter** icon in the main menu in Figure 1.

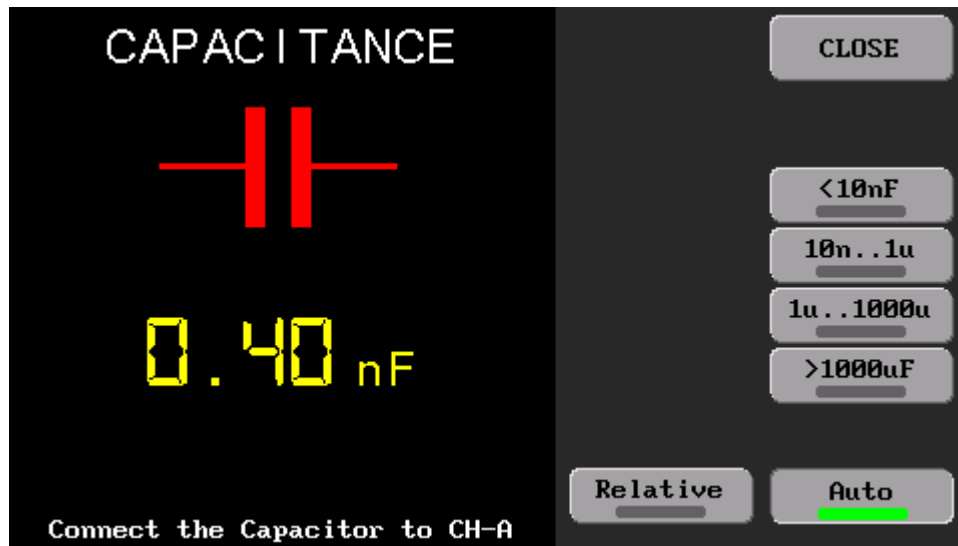


Figure 17. Capacitance Meter menu overview

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 the range of the measured capacitor is known, the measurement can be made by selecting that stage in manual mode. As an example, in Figure 18, measurements of capacitors with actual value of 480nF (label value 470nF) and capacitors with actual value of 2.55uF (label value 2.7uF) are shown.

In manual mode, if there is a capacitance on the screen while not measuring, this value can be reset by pressing the **Relative** button. The Relative button can only be used for manual measurement.

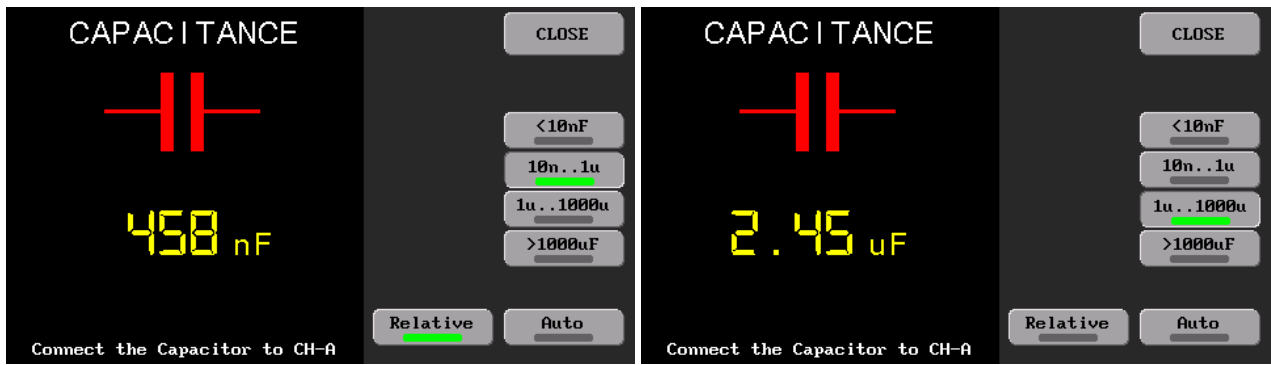


Figure 18. Manual mode measurement of 470nF and 2.7uF capacitors

Another measurement method is auto mode. It is activated by pressing the **Auto** button. In Auto mode, the capacitor is measured by scanning the stages automatically. Figure 19 shows the measurement of a 4080uF (label value 4700uF) capacitor in auto mode.

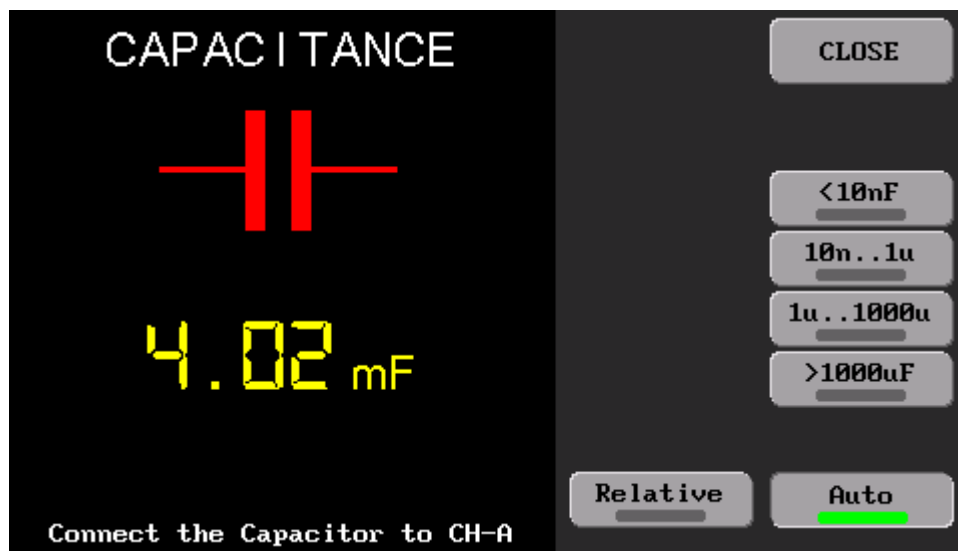


Figure 19. 4700uF capacitor measurement in auto mode

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

#### 4.6. File Browse

In the file browse menu, the files in the internal memory are managed. By pressing the **Browse Files** button in the main menu, the menu is accessed (Figure 20). 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 pressed, but to complete the process, the DELETE button should be pressed one more time.

**EXIT:** Exits the file browse menu.

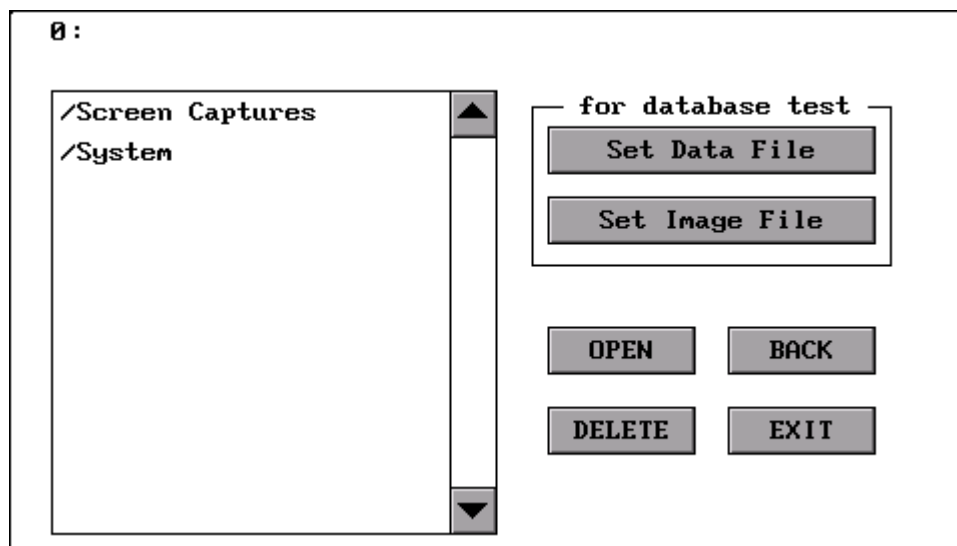


Figure 20. Browse file menu

In the **0:/System** folder, there are files that the device needs for its operation (aa428b.bin, Touch.cfg, settings.cfg) (Figure 21). **settings.cfg** is the file where the settings on the device are saved. This file can be deleted to reset the settings. The **Touch.cfg** file is the touchscreen calibration file. If this file is deleted, a screen calibration is requested at the first boot of the device. The **aa428b.bin** file is a special format file needed to boot the device. If this file is deleted, the device will not boot. In case of deletion, the file should be downloaded from the product's web page and copied to the **System** folder.

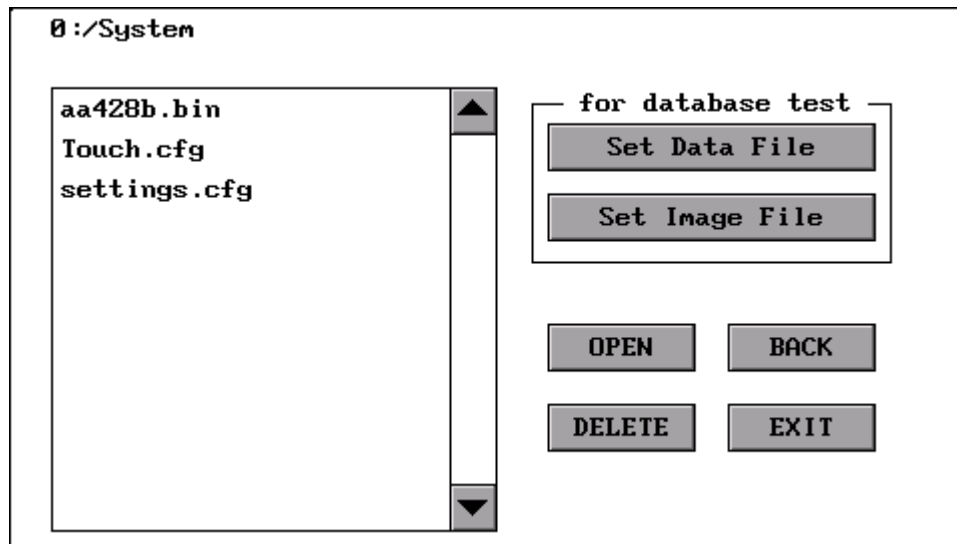


Figure 21. System folder

**0:/Screen Captures** folder is where screenshots are saved (Figure 22). When the desired file is selected from the list and the **OPEN** button is pressed, the picture file is displayed in full screen.

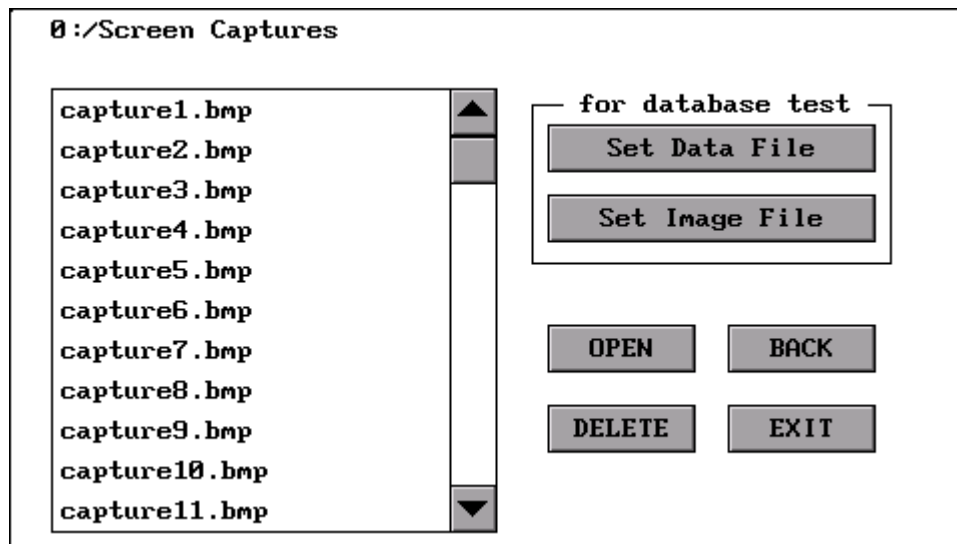


Figure 22. Screen capture folder

**Text** file support has been added with V1.04 firmware . So, notes about the database or test conditions can be added to the device disk and these text files can be viewed on the LCD.

#### 4.7. 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.config** file is created in the System folder.

Tip: Since the touch screen is a resistive type, use medium force touches instead of light force touches when calibrating. Make sure you do the calibration with a touch pen.

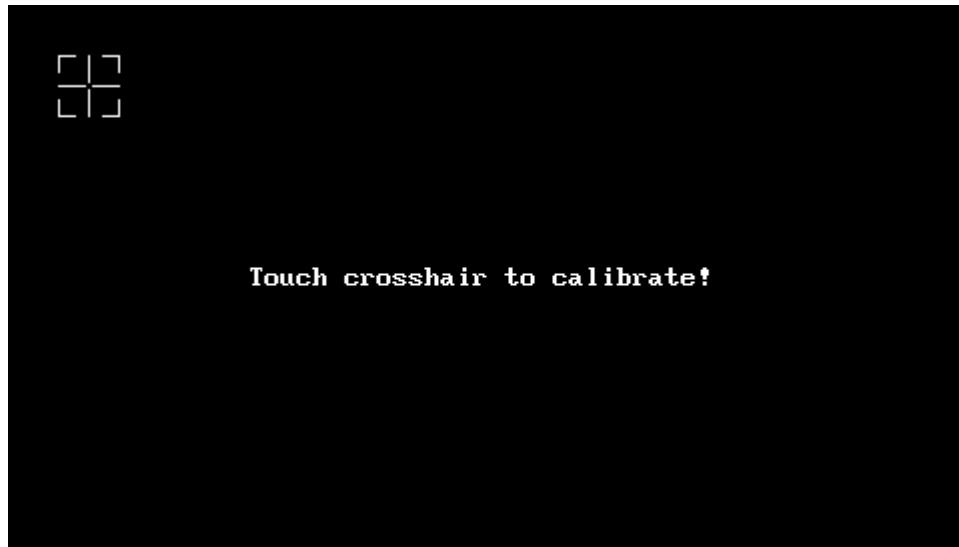


Figure 23. Screen Calibration

#### 4.8. USB Disk

When the **USB Disk** button in the Main Menu is pressed, the device connects to the computer as a USB Disk. The device is listed in the **Devices and drivers** section on the computer (Figure 25). 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 24).

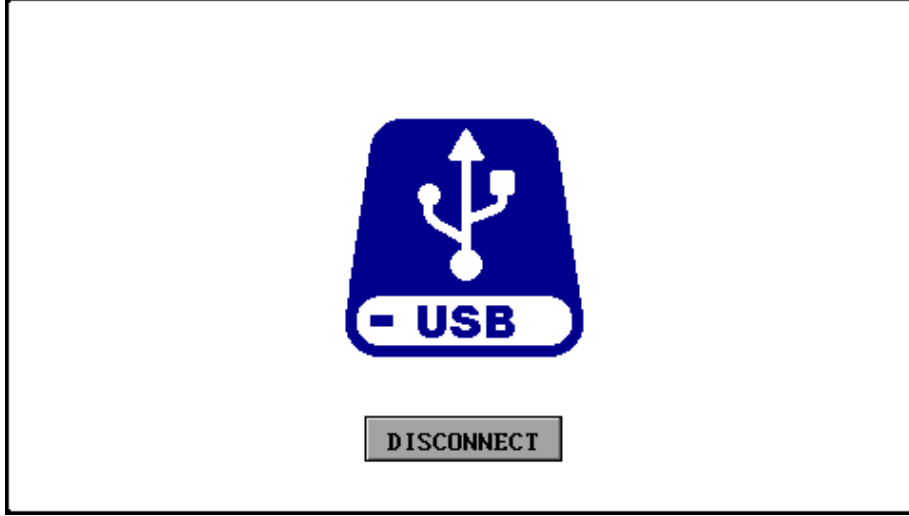


Figure 24. USB Disk LCD screen overview

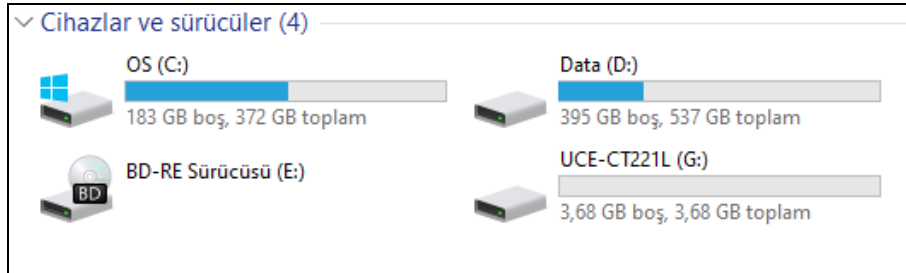


Figure 25. Devices and drivers

## 5. PC Software Usage

This section describes the use of UCE-CT221L with the PC program. 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.

The general view of the PC program is as in figure 26. 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 tabs:

- Basic Mode,
- Advanced Mode
- About

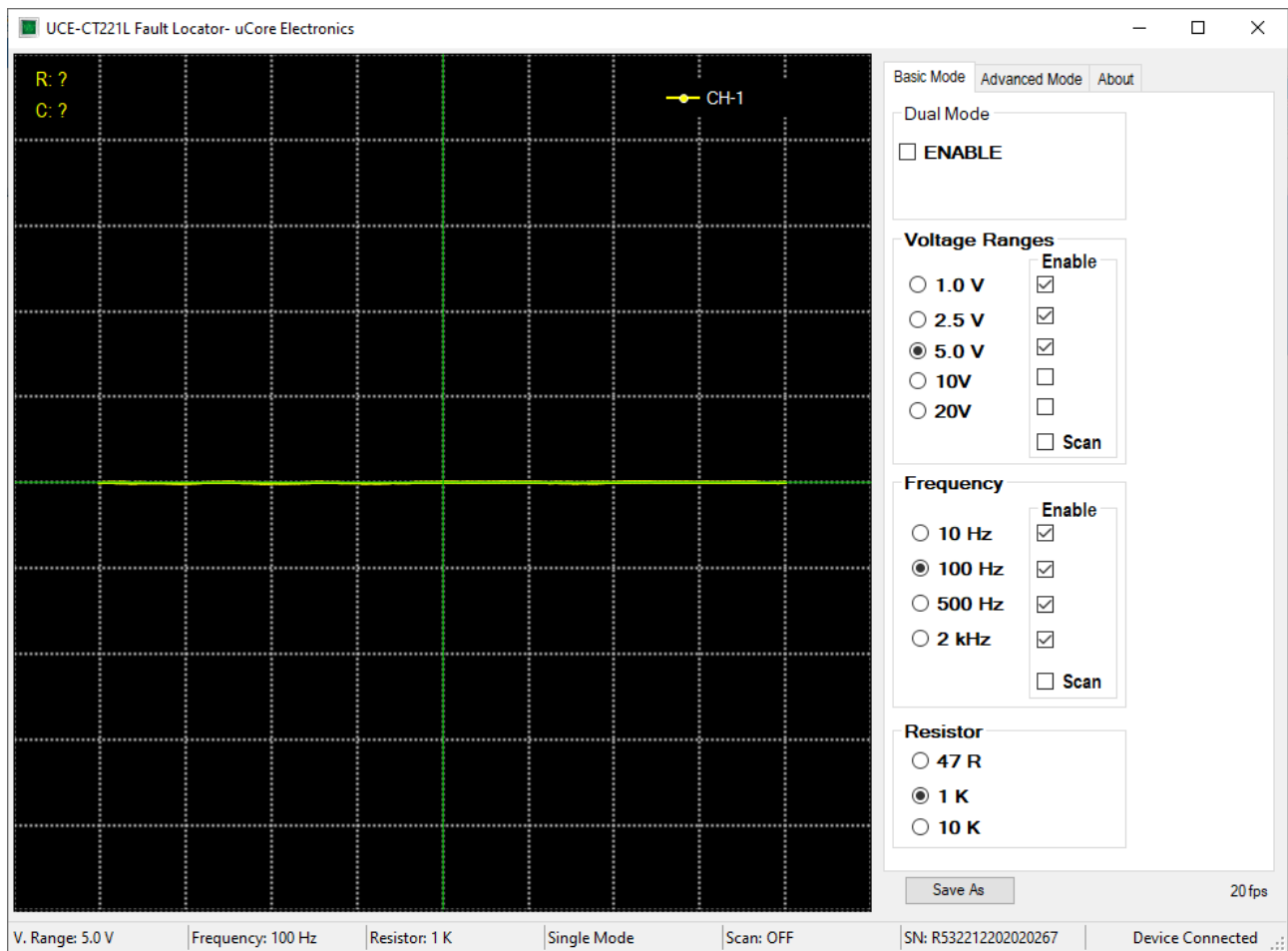


Figure 26. Overview of PC program (Basic Mode)

**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 26).

**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.

**Scan:** It scans the levels in the group per 1 second intervals. If a stage is desired to be removed from the Scan, the checkbox next to it is deselected and that range is disabled.

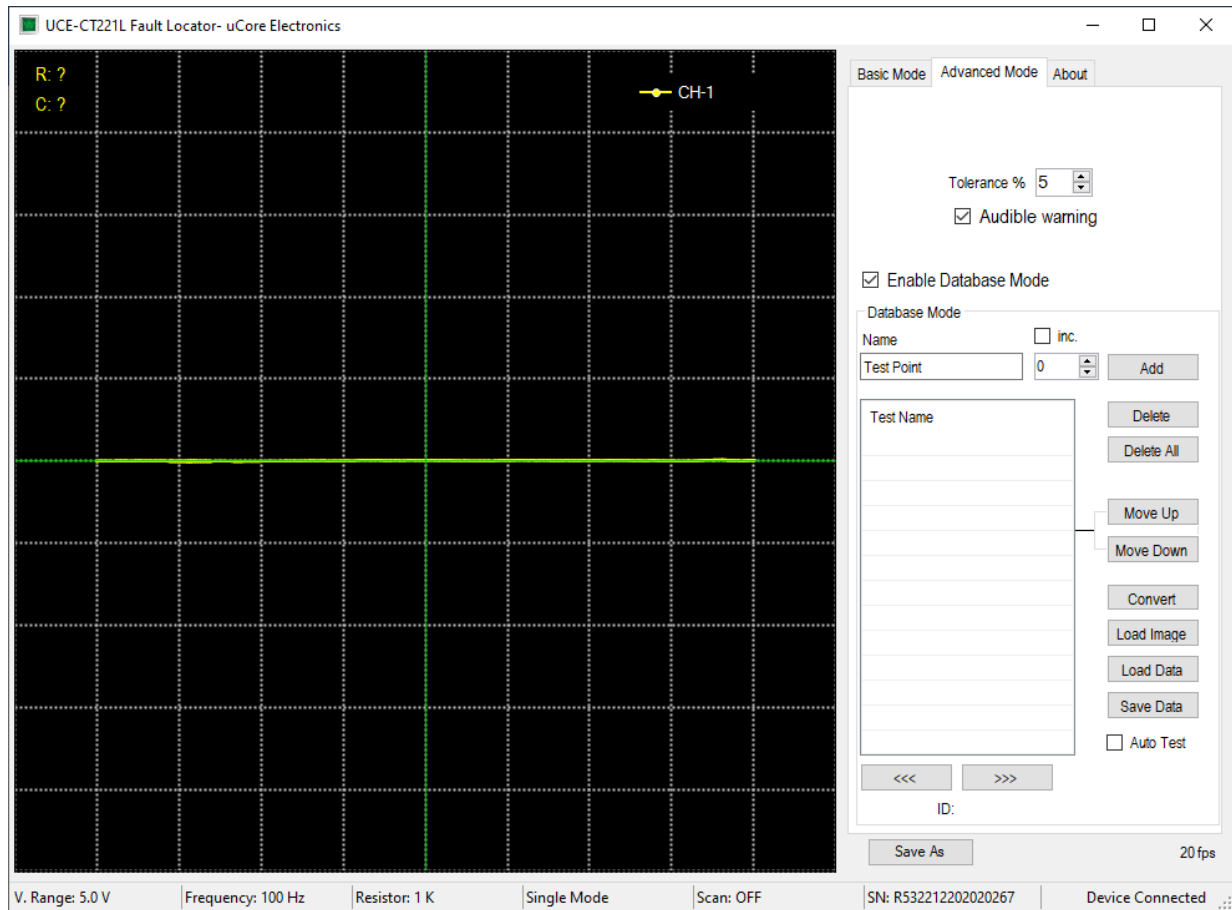


Figure 27. Overview of PC program (Advanced Mode)

**Advanced Mode:** It is the menu where database operations are performed (Figure 27).

Comparison tests are made within a certain tolerance and this variable can be set by the user in percent in this menu. 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 in this menu.

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 and when testing the same board in the future, it is seen which impedance curve is in which coordinate.

To use this feature, this mode must be activated first. When **Enable Database Mode** is checked, Access to Database Mode is provided.

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-CT221L. 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.

**>>>:** 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 pressed.

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

When the two channels are 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 harmony is calculated. If this value exceeds the tolerance value set in the **Advanced Mode** tab (Figure 27), the comparison fails and a red frame appears around the graphics area. If it passes, a green frame is formed (Figure 28).

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

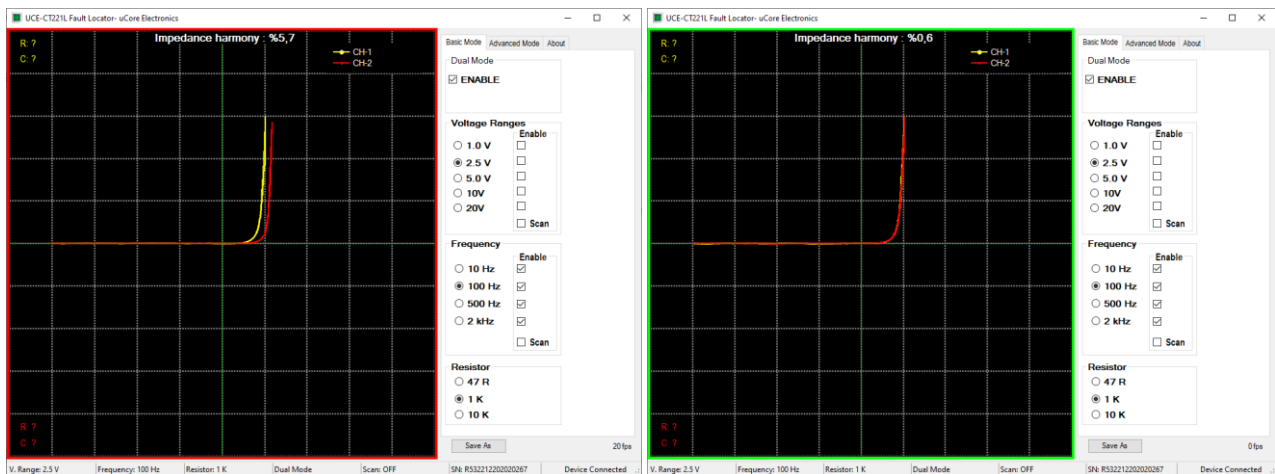


Figure 28. Two channel comparison in Dual Mode

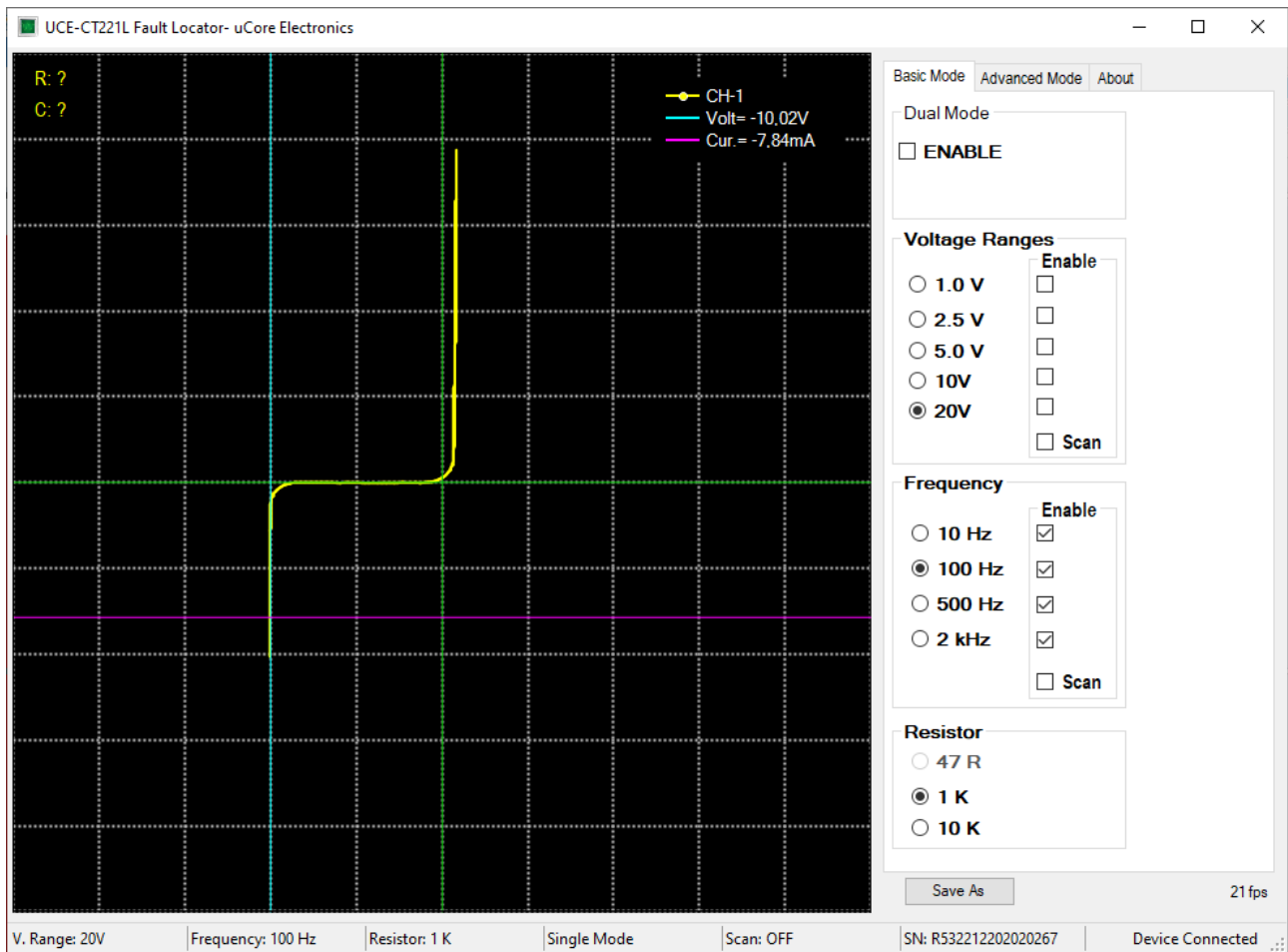


Figure 29. Analysis with Cursor

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. In Figure 29, a 10V zener diode test was performed. In the measurement in the Zener region, the voltage was measured as -10.02V.

Cursors and measurement values become inactive when changing the test stage or right-clicking.

## 6. Database

### 6.1. Creating a Database

The biggest feature of the PC program is the digital recording of the impedance curves of an electronic board to the computer. The first thing to do when creating a database is to load the board image. For this, the **Load Image** button is clicked. On the opened page (Figure 30), the image of the board to be recorded is loaded by clicking the **Load** button.

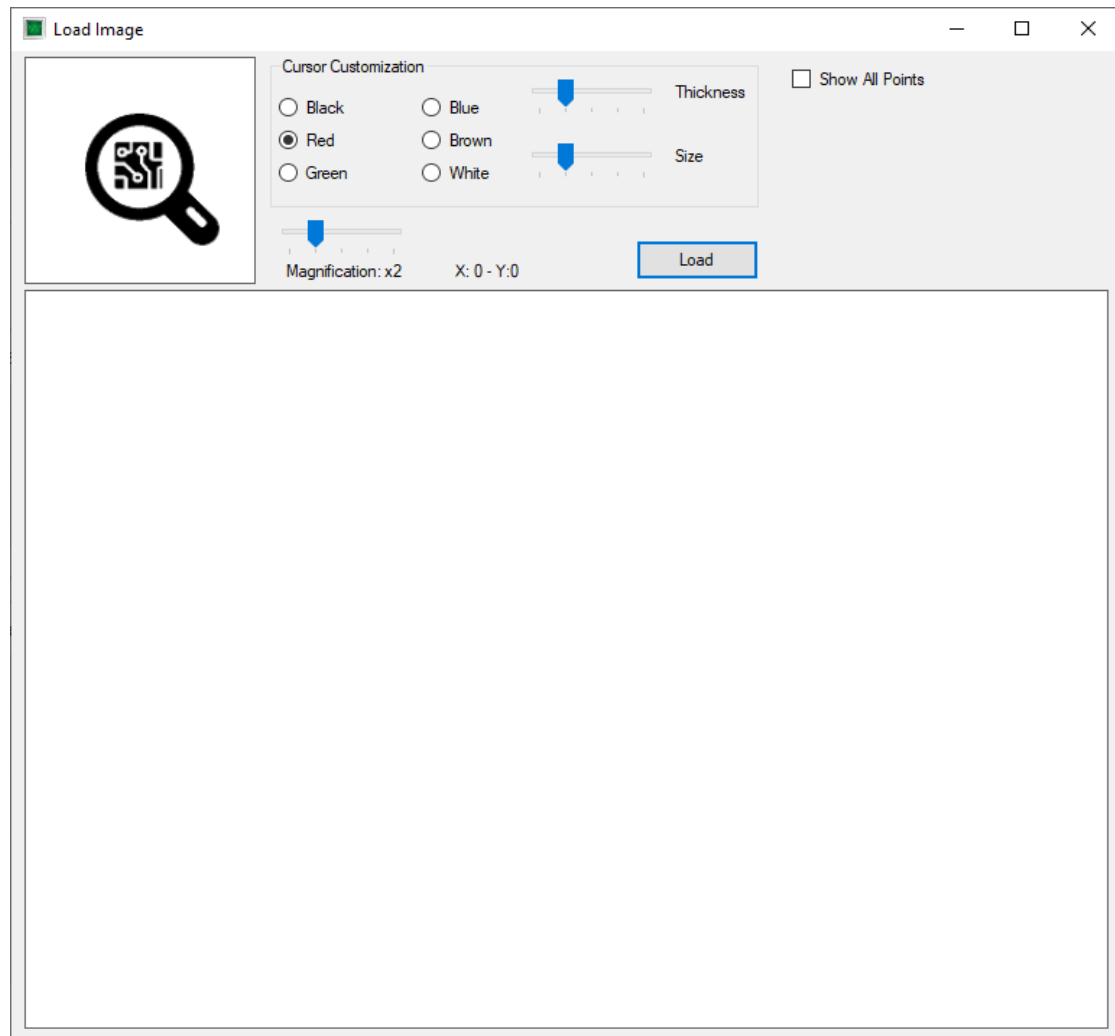


Figure 30. Load image

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 31). If the **Show All Points** checkbox is checked, all saved points will be displayed on the image.

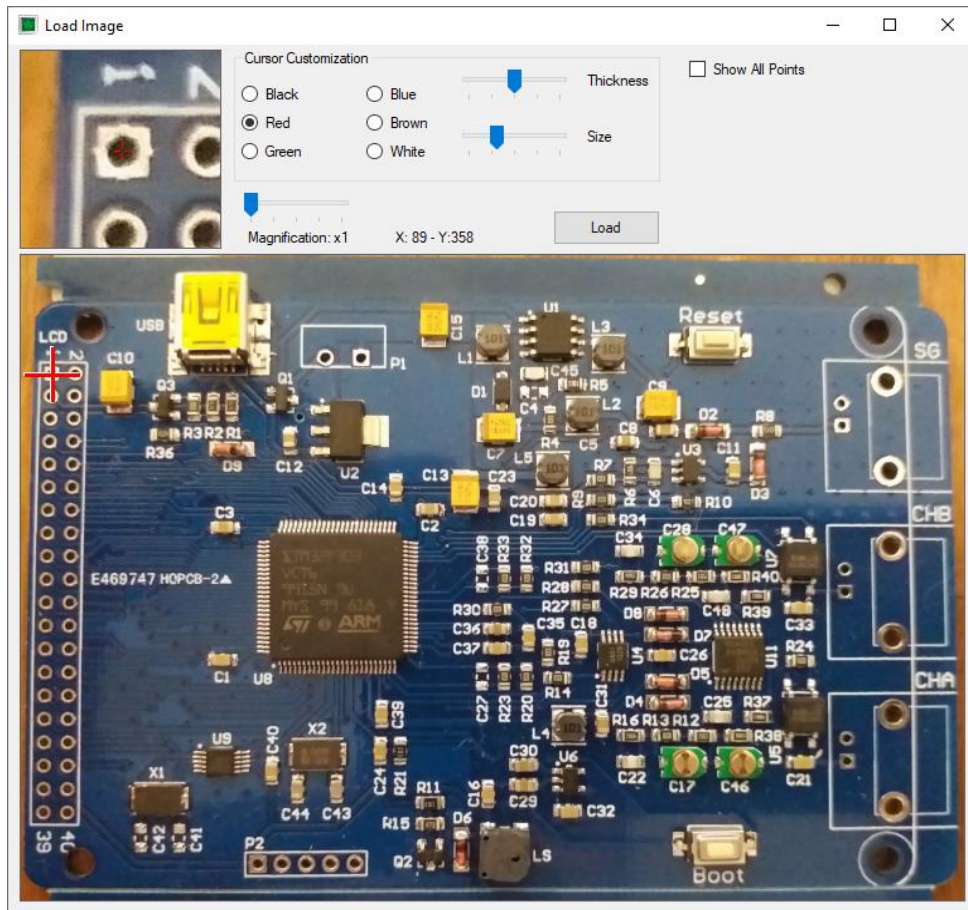


Figure 31. Loading an image

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 of the UCE-CT221L.

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 31). 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 32). In this way, all the points to be tested are added to the list. 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. When the list is completed, the **Save Data** button is clicked and recorded to the disk. The extension of the recorded file is **uce** and does not include the product image. Therefore, it must be stored together with the image of the board.

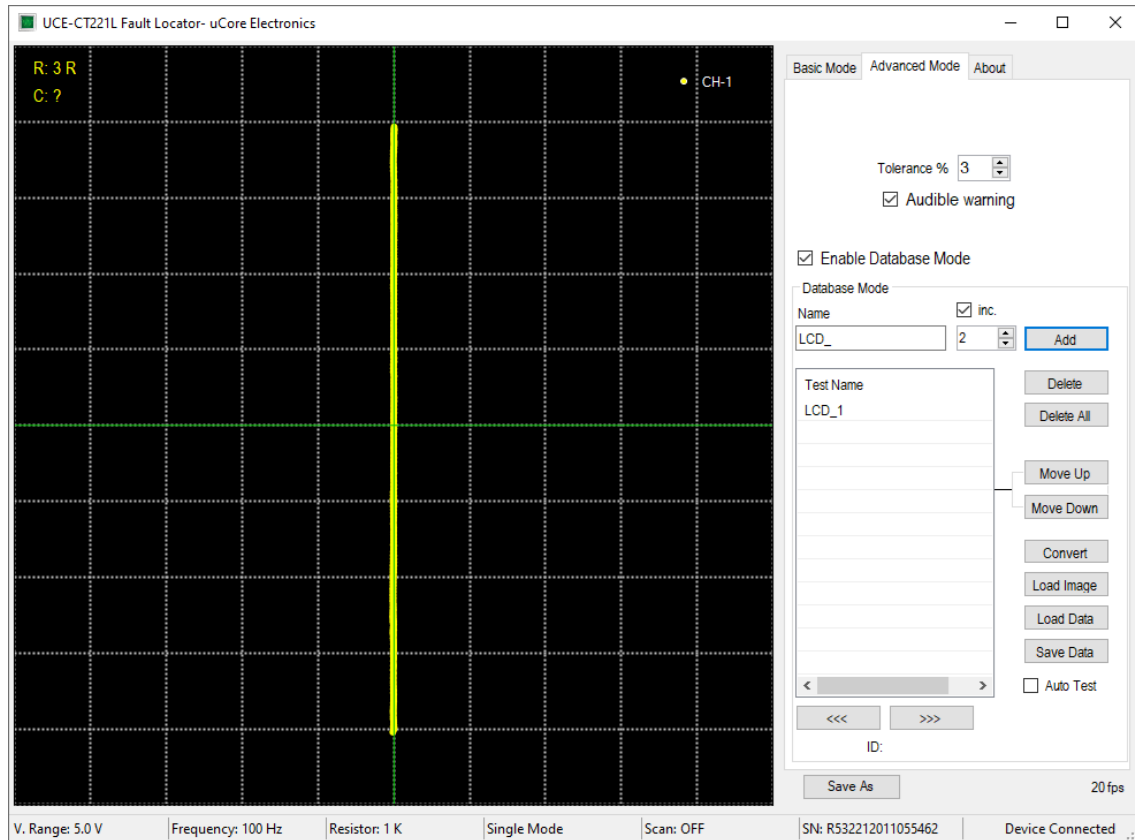


Figure 32. Creating a database.

## 6.2. Comparison Test from Database on PC Software

By clicking the **Load Image** button, the image of the electronic board is loaded on the opened window. Then, by pressing the **Load Data** button, the digital data is loaded into the list. When the points in the list are clicked, the impedance curve with its position on the PCB can be seen on the program. In Figure 33, the coordinate of the point registered as Q2\_3 on the PCB and its impedance curve on the graph are seen. The red curve on the chart is the impedance curve of this point. The yellow curve is the impedance curve measured from the CH-A input.

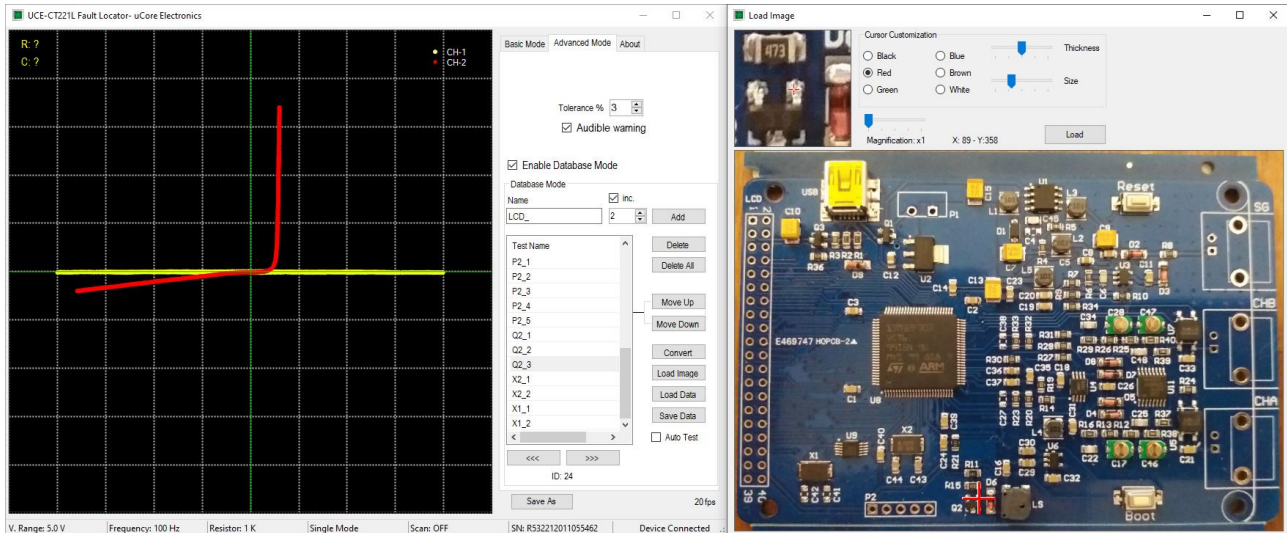


Figure 33. Comparison from the database

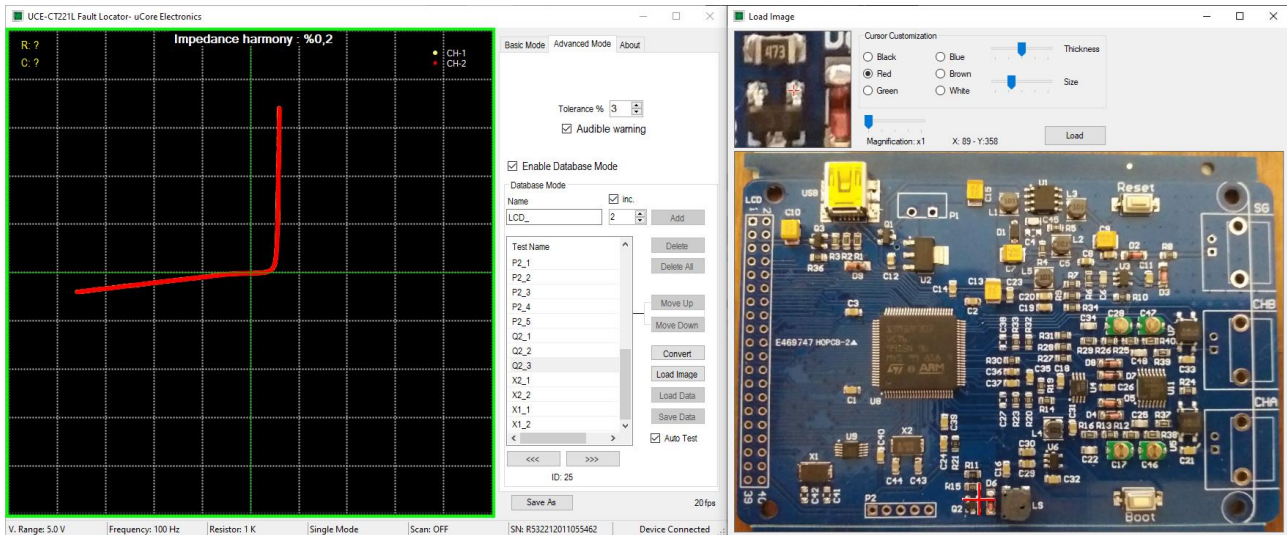


Figure 34. Auto-test mode

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. In addition, both impedances can be observed on the chart. If the tolerance limit is not exceeded as a result of the comparison, the algorithm passes to the next point by confirming the test result. If the test is successful, a green frame is formed around the chart. If not successful, the color of this frame turns red. Also, impedance harmony between the two data is seen as a percentage at the top of the graph. The



test will fail if this value exceeds the tolerance value. As mentioned earlier, test results are reported audibly and visually. The audible alert allows the test to be done very quickly.

There may be some incompatibilities in the impedance curves due to the production differences of electronic materials. For this reason, comparisons are made within a certain tolerance. Another important issue affecting the impedance compatibility is the use of the same probes when creating the database and then performing the test. The difference in probe impedance can affect the impedance curve. It is useful to reference the same GND point when creating and testing the database.

### 6.3. Comparison Test from Database on Device

The most important feature of the UCE-CT221L is that it can read the database file created in the PC program and perform the database test independently from the computer. Also, database files created with the UCE-CT220S can be used with this device.

**Note:** Due to the different hardware of UCE-CT220S and UCE-CT221L, there may be differences in impedance harmony values in the same database file test. Therefore, there may be a difference in the tolerance value selection for the test.

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 "uce". 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 27). When the **Convert** button is pressed, the image file used in the database is selected and the **Open** button is pressed. 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 **uce** extension is selected and then the **Set Data File** button is pressed.

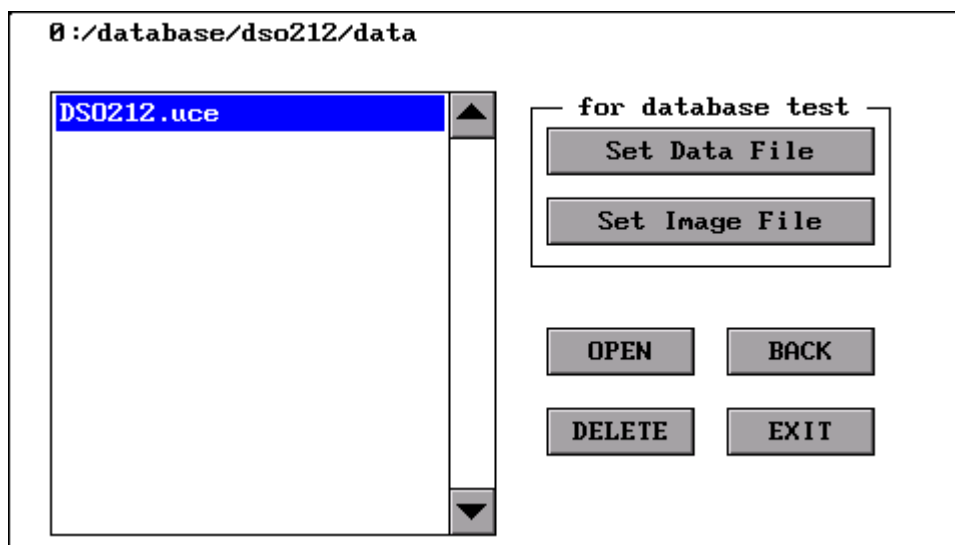


Figure 35. Database data file selection

After the button is pressed, the file is analyzed first. And during the database test, a helpful **bin** 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 36).

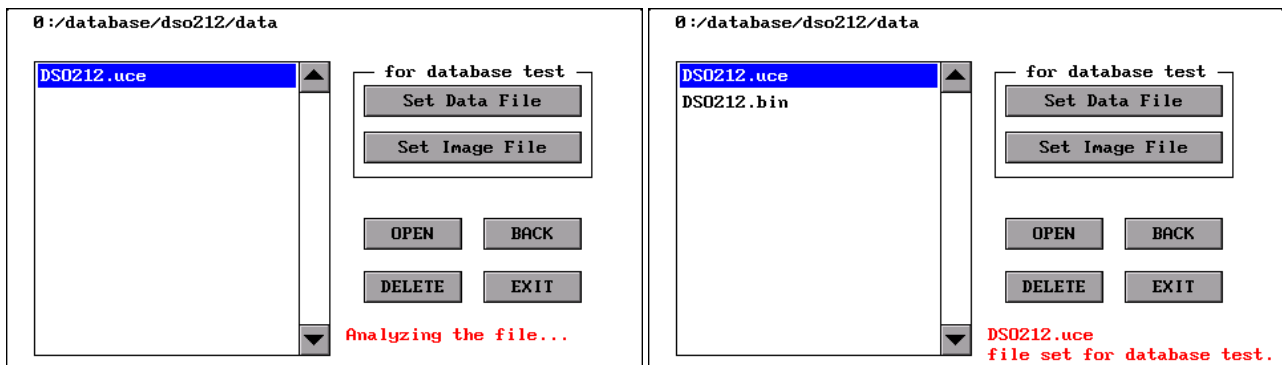


Figure 36. Database data file selection

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 pressed. A text will appear in the lower right corner of the screen indicating that the selected file is set for database testing (Figure 37).

If desired, the image file can be displayed on the screen visually by pressing 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.

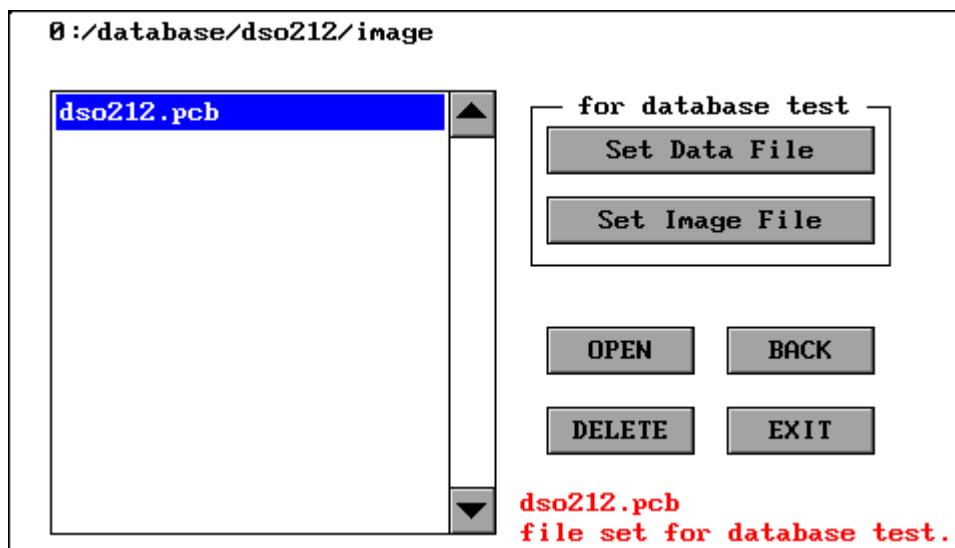


Figure 37. Database image file selection

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 38).



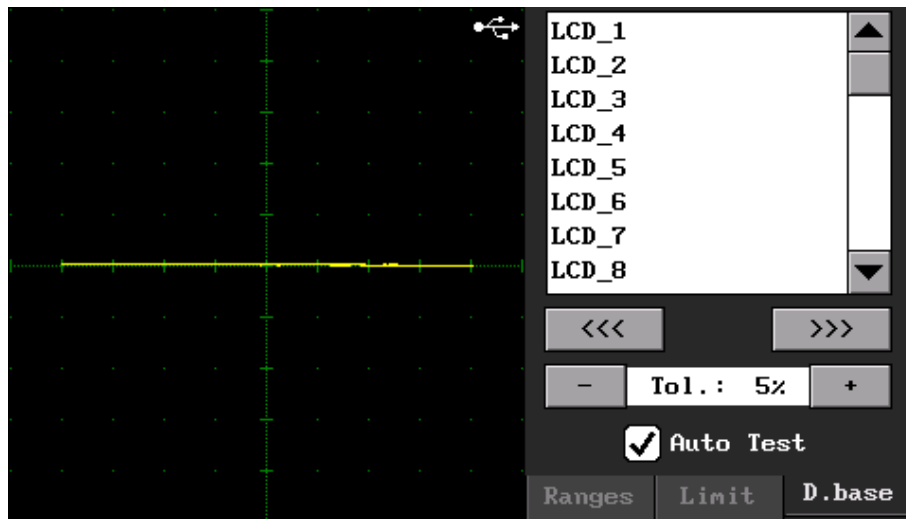


Figure 38. Database tab

When pressed 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 39).

There are some buttons on the sides of the electronic card 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.

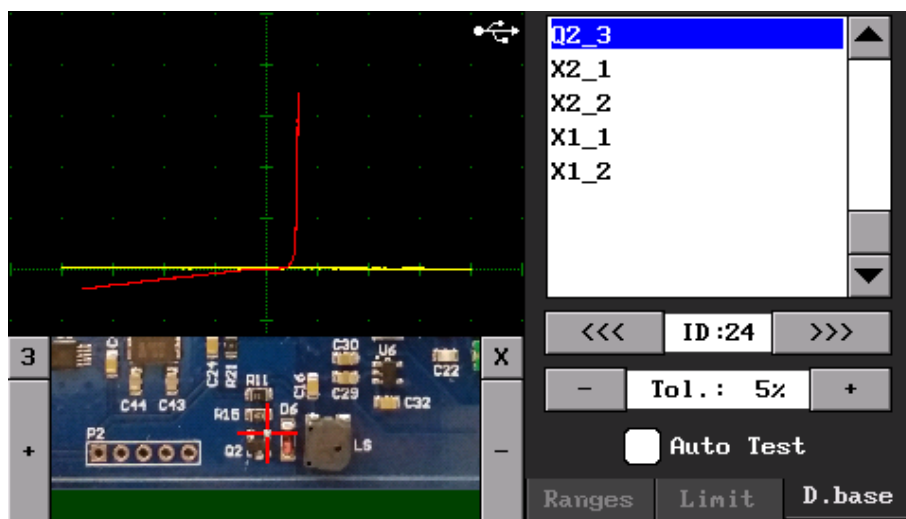


Figure 39. Database test

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 pressing 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 card 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 harmony between the two data is also seen on the graph as a percentage. If this value exceeds the tolerance value, the test will fail. 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.

As mentioned before, test results are reported audibly and visually. The audible warning allows the test to be done very quickly.

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

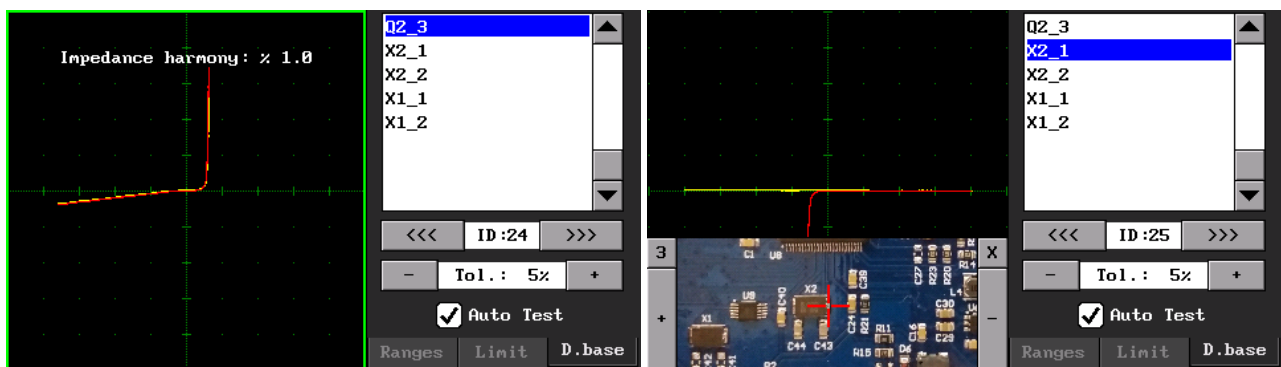


Figure 40. Database test (Auto Test)