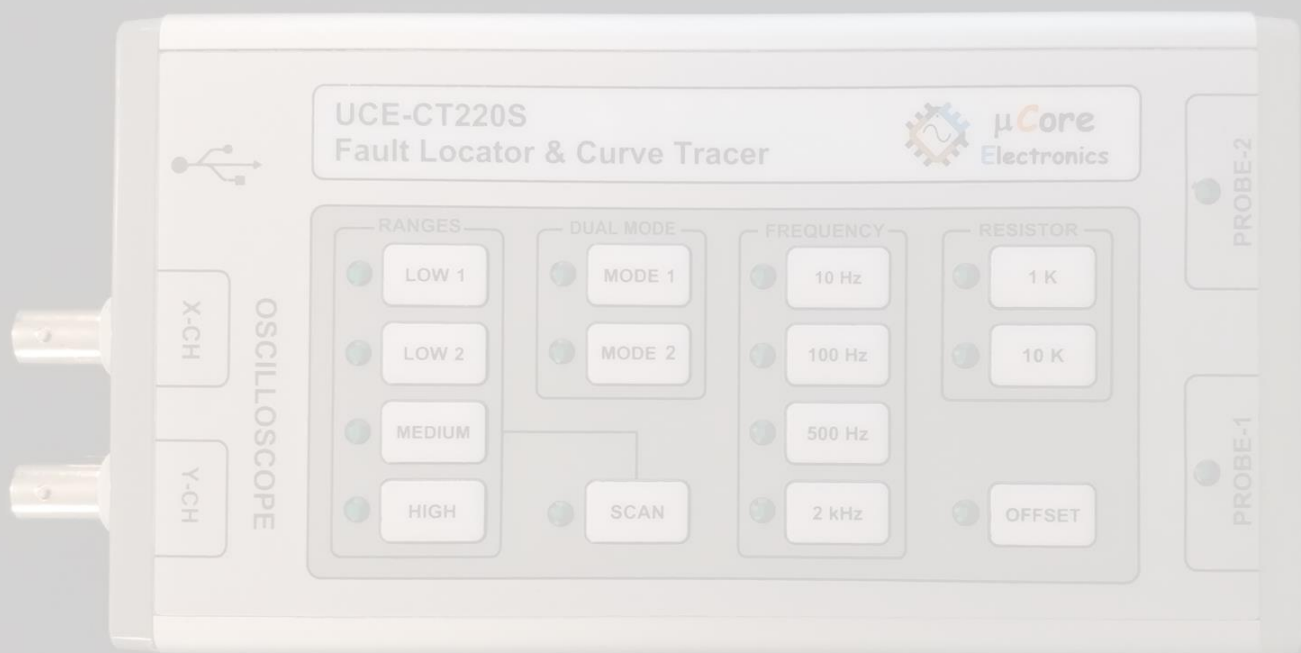




µCore
Electronics



UCE-CT220S FAULT LOCATOR

USER MANUAL

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

REVISION HISTORY

Version	Date	Changes
V1.0	20.03.09	Initial release.
V1.1	22.02.19	<ul style="list-style-type: none">• Added a checkbox to show all saved test points for database (21.06.21).• Added Frequency scanning feature (05.08.21).• Added Cursor feature (05.08.21).• Added 1V test voltage range (22.02.19).

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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.

With different combinations of test voltage, source resistance and frequency values, 52 different test conditions on the PC program.

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 chart.

In **Advanced mode**, a database can be created for the electronic 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 board in the future, it is seen which impedance corresponds to which coordinate on the board.

Another feature of the product is that it can be used in **standalone mode** regardless of the PC. In this case, impedance curves can be observed on any oscilloscope. In Standalone mode, the product works like the basic mode in the PC program. The result of comparison with a buzzer on the device can be audibly reported by the device.

Specifications:

- **Channel Number:** 2
- **Waveform:** Sine wave
- **Test frequency:** 10Hz, 100Hz, 500Hz, 2kHz
- **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 Ω , 10k Ω
- **Test probe connector:** 4mm banana plug standard multimeter probe
- **Oscilloscope output:** 2 BNC connector

- **PC connection:** mini USB connector (USB HID protocol)
- **Storage:** internal 8MB USB disk for firmware upgrade (bootload)
- **Power consumption:** 4W
- **Dimensions:** 169x83x31mm
- **Weight:** 245gr.

Package List:

- 1 pc UCE-CT220S Tracer
- 2 sets 4mm banana multimeter probes
- 1 pc Banana to crocodile cable
- 2pcs BNC to BNC cables for connection to any oscilloscope
- 1 pc 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. Figure 1 shows the overview of the device.

When the device is connected to the computer, the driver is automatically installed by Windows OS. No additional driver package is required.



Figure 1. Overview of the device

4. System Introduction

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.

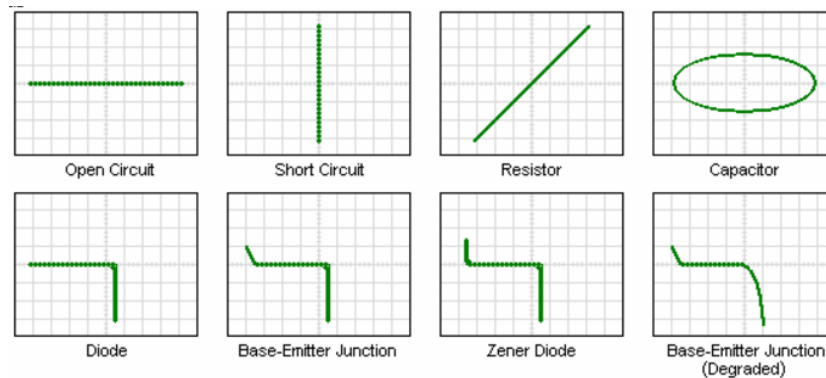


Figure 2. Component characteristics in XY mode (horizontal trace voltage, vertical trace current)

The UCE-CT220S 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

UCE-CT220S generally has two different uses. It can be controlled via the computer program or it can work in standalone mode without the need for a computer. In this case, impedance curves can be observed on any oscilloscope. The X-CH and Y-CH (Figure 1) outputs are connected to the oscilloscope with BNC cables. The X-CH output is the voltage axis, the Y-CH output is the current axis. In standalone mode, the control of the product is done with the buttons on it. The features of standalone work are more limited than the PC program.

The general view of the PC program is as in figure 3. 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

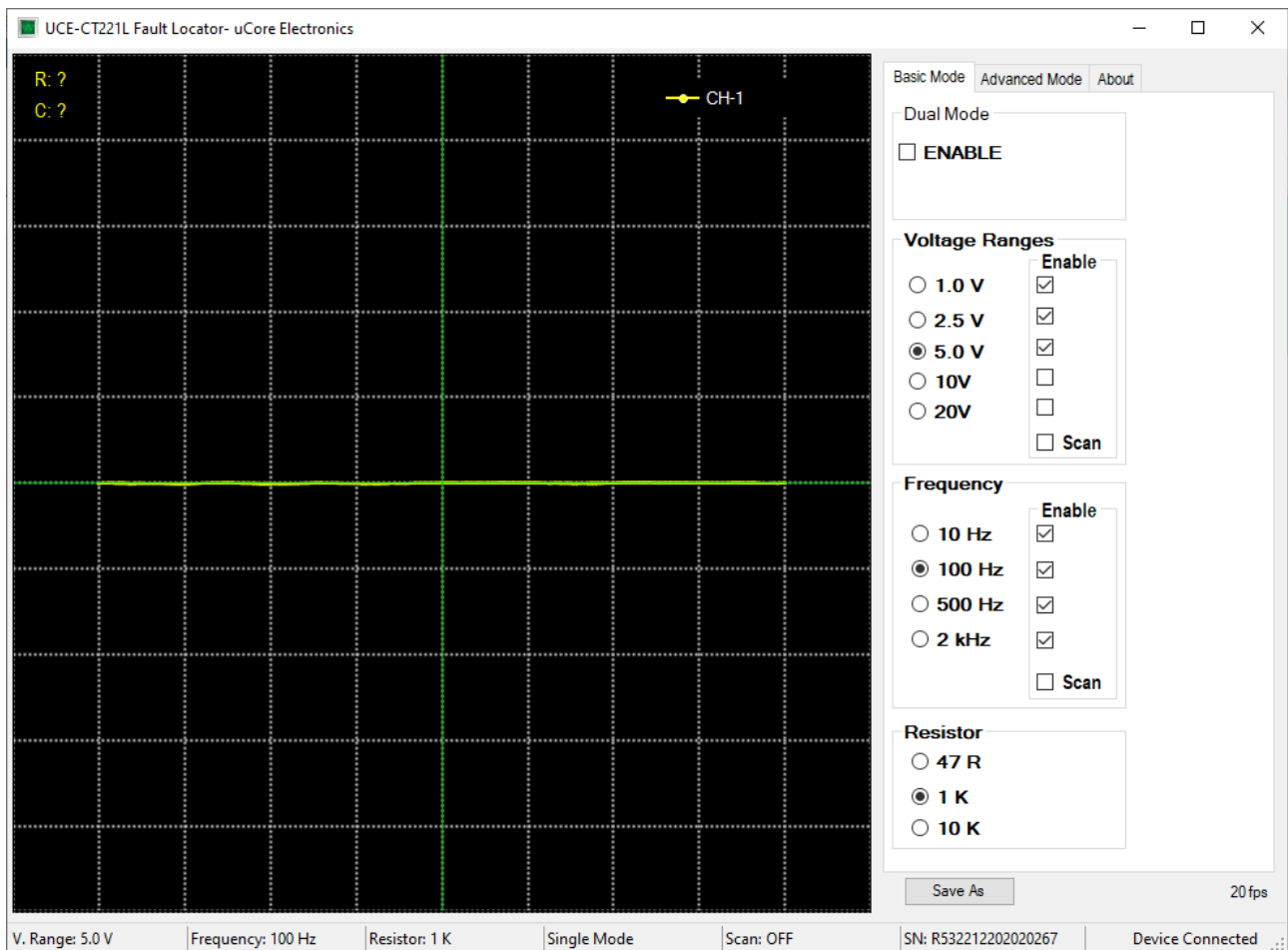


Figure 3. Overview of PC program (Basic Mode)

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 3).

Open Circuit Test Voltages:

- - $\pm 1.0V$
- LOW 1: $\pm 2.5V$
- LOW 2: $\pm 5V$
- MEDIUM: $\pm 10V$
- HIGH: $\pm 20V$

Test Frequencies:

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

Source resistance

- 47R: Connects a 47R resistor to the voltage source to limit the current.
- 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**.

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.

Dual Mode: Allows PROBE-1 (yellow color) and PROBE-2 (red color) channels to be used simultaneously (MODE 2 works when Dual mode activated from the computer). If single channel is used, only PROBE-1 is active.

There are 14 buttons on the UCE-CT220S (Figure 1). Control of the device can be achieved by using these buttons. Unlike the PC program, it has an extra OFFSET button and 2 different Dual Mode options.

OFFSET: Pressing this button gives an offset to both the current and voltage of the PROBE-2. Thus, while the signals are observing on the oscilloscope, if both channels have the same signal, the channel 2 signal can be removed slightly from the channel 1.

Note 1: OFFSET must be **passive** when comparing. Otherwise all signal comparisons will fail.

Note 2: This feature is only available when dual mode is active.

The difference between **MODE 1** and **MODE 2** is the scan speed between channels. Scanning between channels in MODE 1 is 1 second. While in MODE 2, scanning is performed at maximum speed. MODE 1 can be used for more convenient observation of channels when observing over the oscilloscope. In the PC program, MODE 2 is more convenient to use because there is a color difference between the channels.

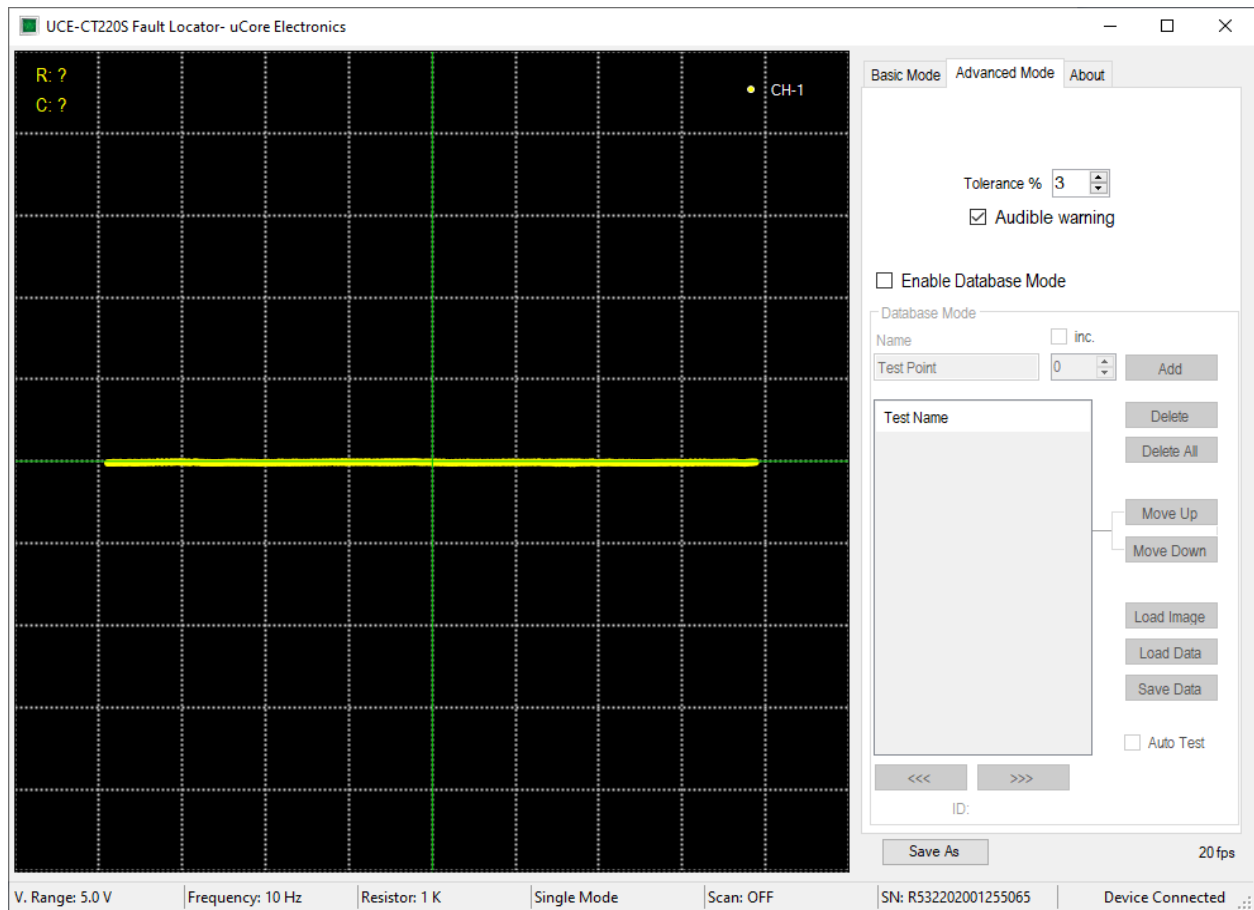


Figure 4. Overview of PC program (Advanced Mode)

Advanced Mode: It is the menu where database operations are performed (Figure 4).

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 (Figure 5).

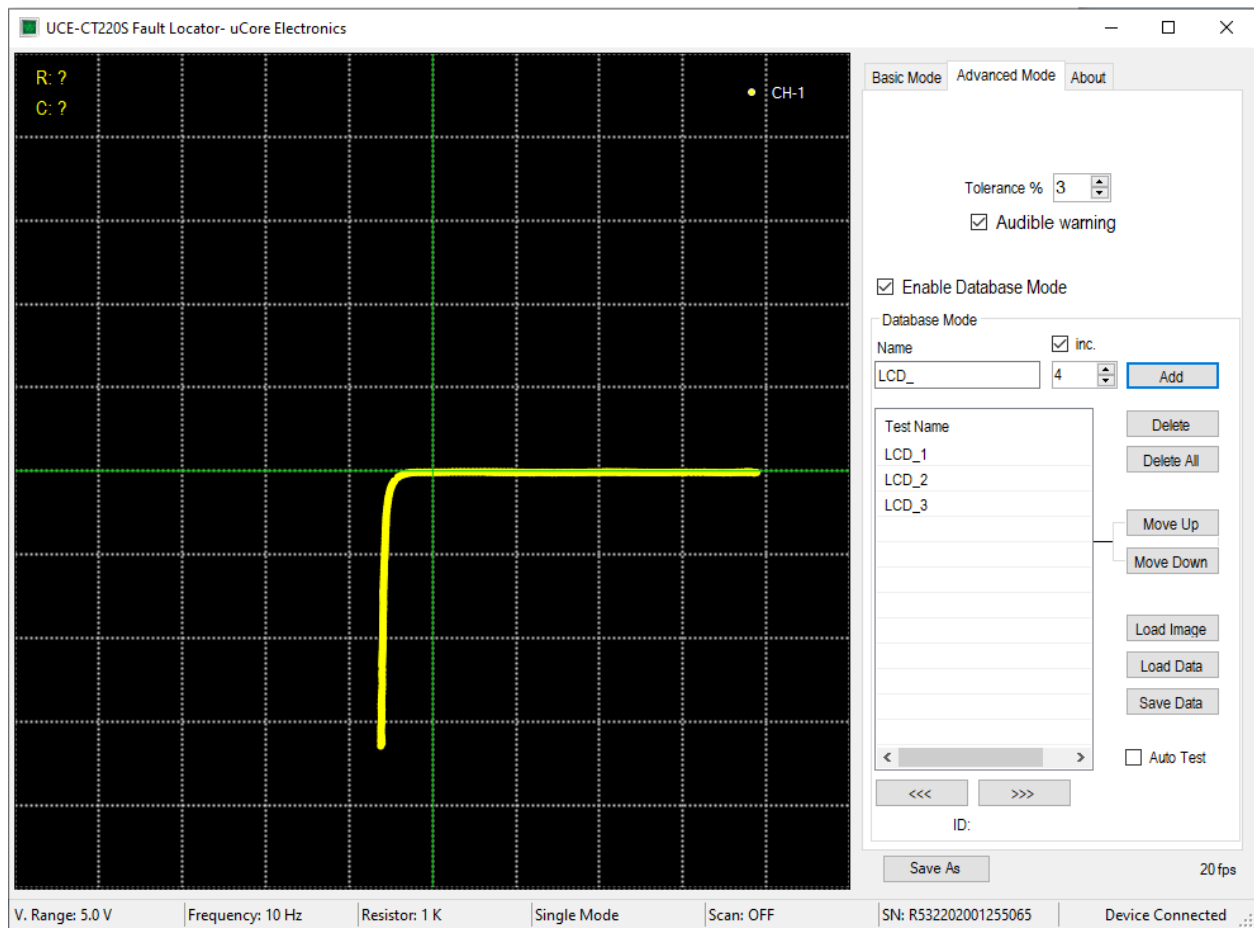


Figure 5. Database Mode

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.

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 5), the comparison fails and a red frame appears around the graphics area. If it passes, a green frame is formed (Figure 6).

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.

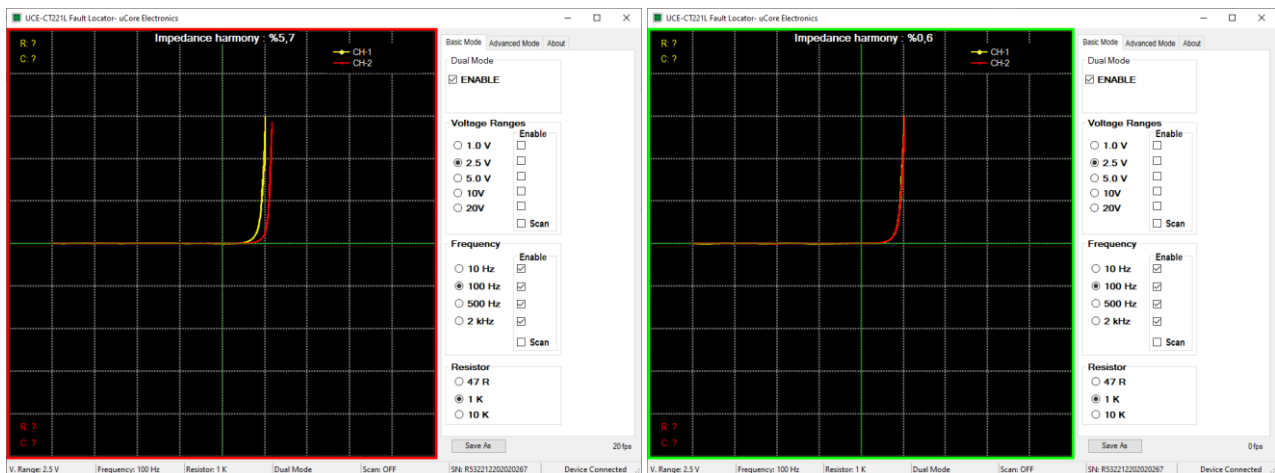


Figure 6. Two channel comparison in Dual Mode

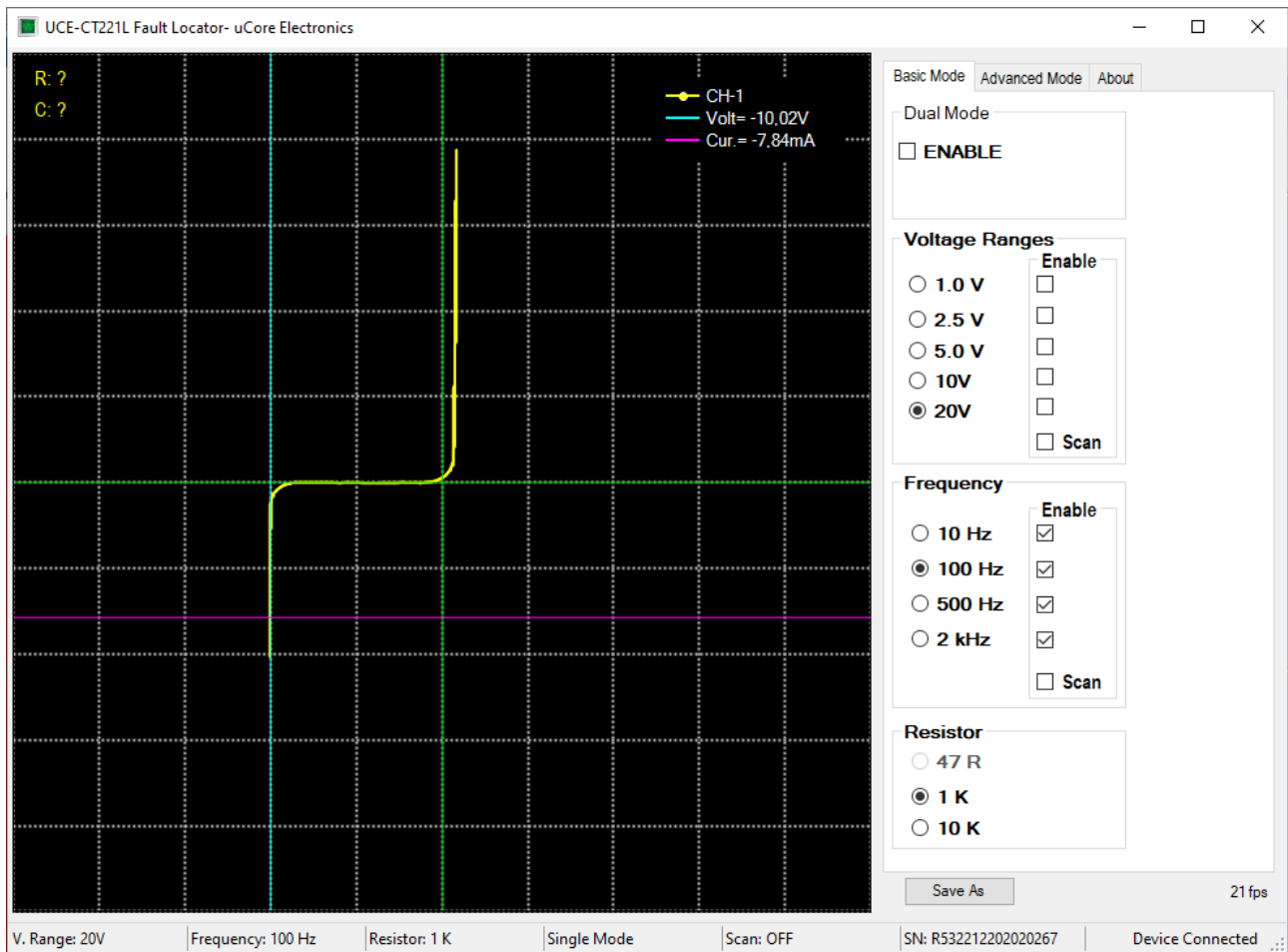


Figure 7. Analysis with Cursor

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 7, 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.

5. 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 8), the image of the board to be recorded is loaded by clicking the **Load** button.

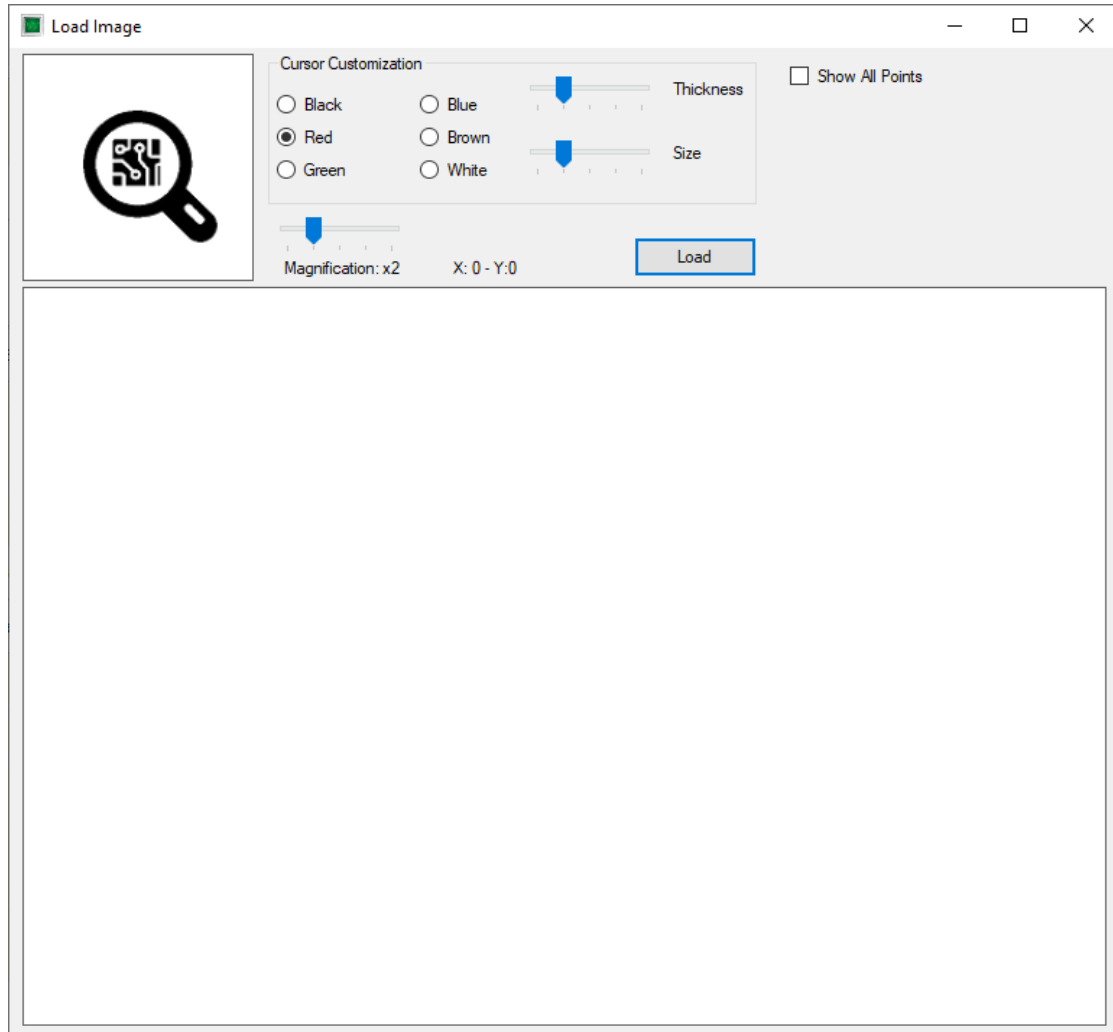


Figure 8. Load image

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

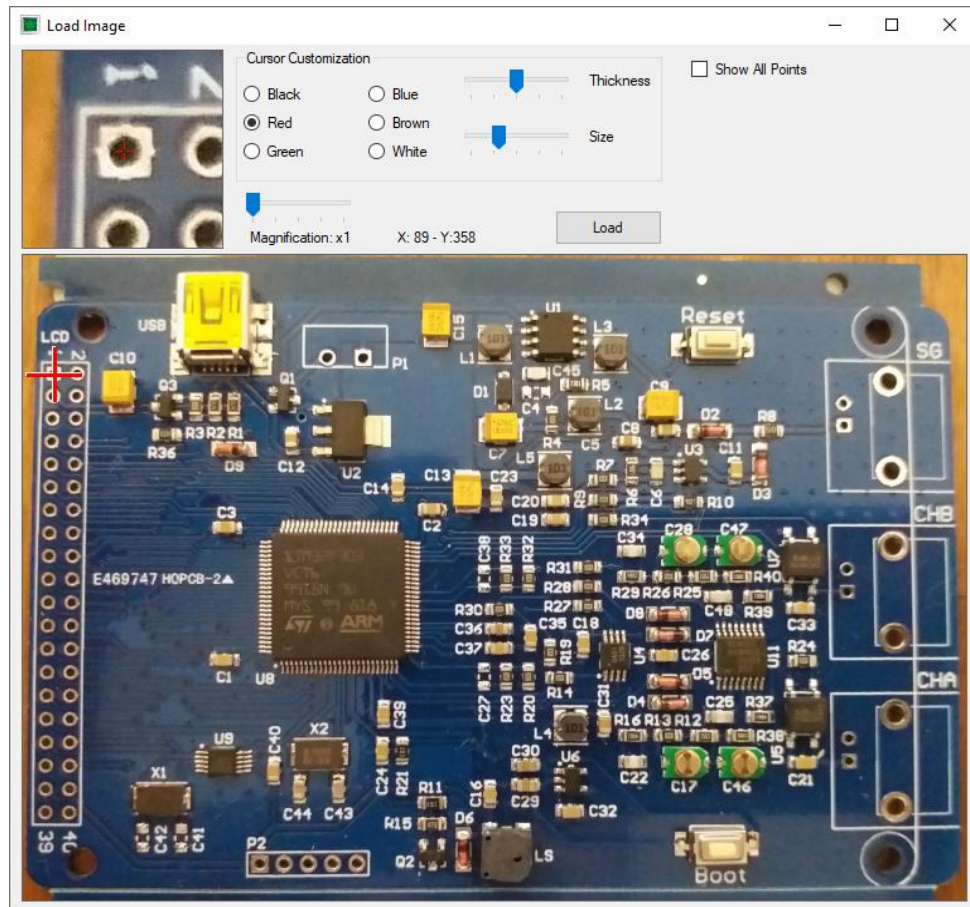


Figure 9. Loading an image

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 PROBE-1 input of the UCE-CT220S.

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 9). 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 10). 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.

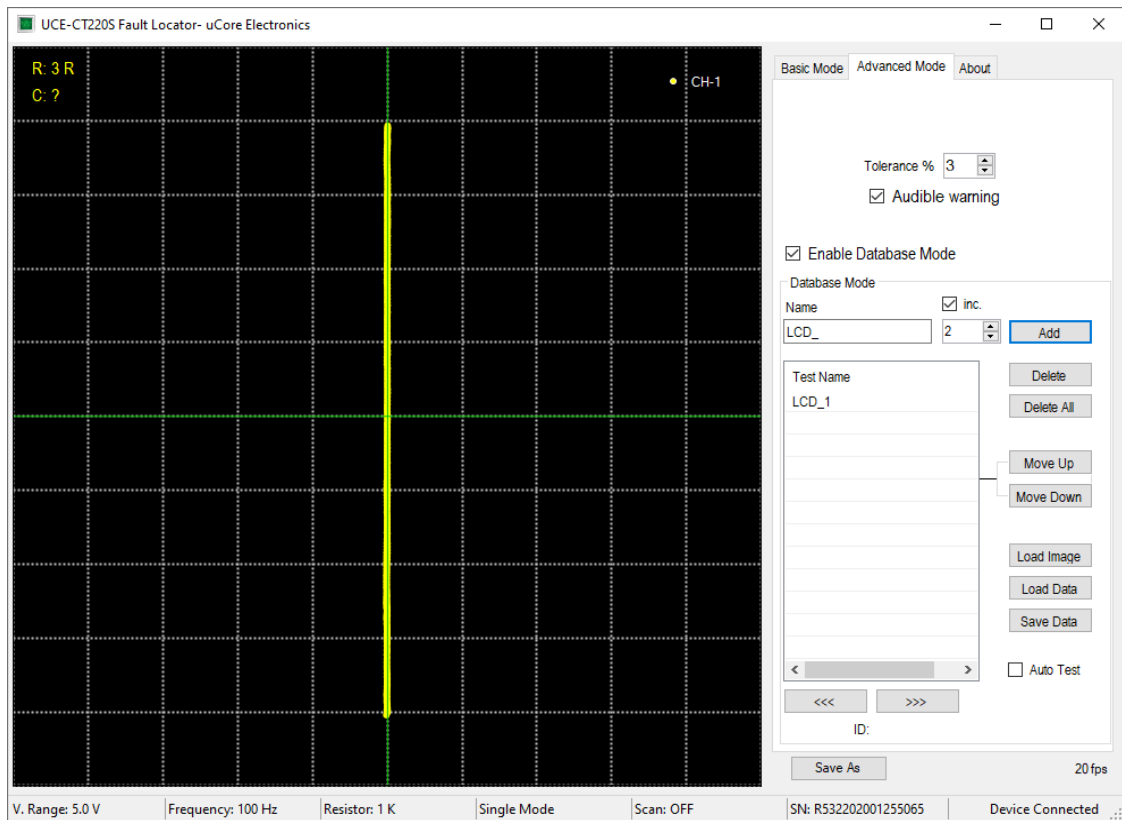


Figure 10. Creating a database.

6. Comparison from the database

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 11, 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 PROBE-1 input.

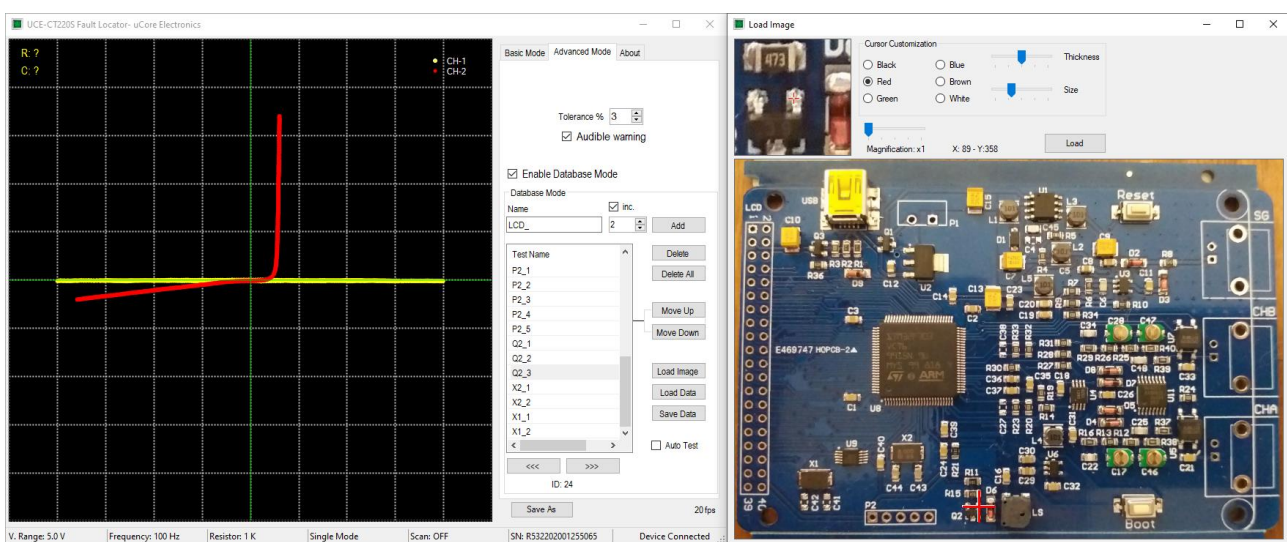


Figure 11. Comparison from the database

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. 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.

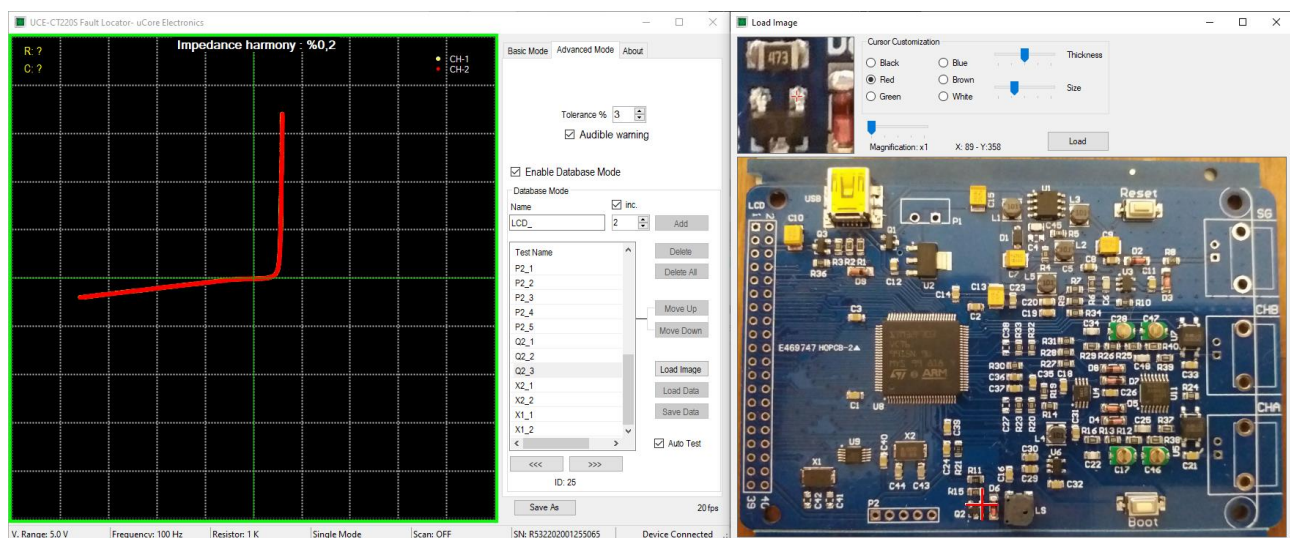


Figure 12. Auto-test mode