USER MANUAL

RastreCurve Mini

Portable fault locator by Analog Signature Analysis



Figure 1 – RastreCurve Mini: start screen, 2-channel mode, main menu and Multi mode

100% portable • internal battery • no computer needed

Reference firmware Mini v1.16

RastreCurve Indústria de Equipamentos Eletrônicos Ltda • www.rastrecurve.com

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1. Introduction

The **RastreCurve Mini** is a **portable** fault locator for electronic boards and modules, based on **Analog Signature Analysis** (ASA, also known as Curve Tracer). It combines in a pocket-sized instrument a **signal generator**, an **XY oscilloscope** with a 2-inch color display and an **internal memory** where curves can be stored, all powered by a **battery**, with no computer and no software.

In a nutshell: the Mini injects a low-energy alternating signal into a point of the **powered-off** board, measures the resulting voltage and current and draws the **VI curve** – the "signature" of that point. By comparing the signature of a faulty board with that of a good board (connected to the other channel or stored in memory), the fault shows up as a difference in shape and percentage. The complete theory, applied to the Mini functions, is in **chapter 2**.

1.1 What the Mini offers

- **2 channels** for real-time comparison: good board on Channel 1, suspect board on Channel 2, with difference percentage, green (ok) / red (bad) thumb icon and audible alert.
- **Free adjustment** during testing and memorizing: **frequency** from 5 Hz to 300 Hz (5 Hz steps), **voltage** of 2, 4, 6 or 8 Vpp and **internal impedance** of 1k, 2k, 5k, 10k, 20k, 50k, 100k or 200k.
- **Multi Mode**: the same point seen at the same time by **4 different signals** (4 combinations of frequency and impedance), each with its own percentage.
- **Internal memory** for **50 components** with **100 pins** each, with manual or automatic recording (Auto-Record).
- Pin-by-pin **Test Mode** with automatic advance, "Go to pin" shortcut and a **final report** listing the failed pins.
- Adjustable comparison tolerance from 2% to 20% (default 5%), sound on/off and 3 languages (Portuguese, English and Spanish).
- 9 V Ni-MH rechargeable battery with about **1 hour** of autonomy, and a 12 V power supply included for continuous use and charging.

1.2 Mini × bench models (Lite and 2Plus)

The comparison principle is the same across the whole RastreCurve line. The difference is in the way of working: the bench models use the computer, **fixed profiles** and a 10 kΩ impedance; the Mini is **stand-alone** and lets the technician **freely adjust** the signal.

Characteristic	Lite / 2Plus (bench)	Mini (portable)
Use	Connected to the computer (USB)	Stand-alone, no computer
Power supply	Computer USB port	Internal 9 V battery + 12 V power supply
Test signal	4 fixed profiles (Low, Normal, Maximum, Auto)	Free adjustment: 5–300 Hz, 2–8 Vpp
Internal impedance	10 kΩ fixed	1k to 200k (8 values)
Storing	On the PC, with a photo of the board, point by point	Internal: 50 components × 100 pins
Curve cloud	Yes, free	Not available on this model (no PC connection)
Ideal for	Bench work, projects with photos, beginners	Field work, on-site maintenance, fine adjustments

> **NOTE**
>
> The Mini is the **USB-less** version of the portable line. The **Mini+** model adds the connection to the computer. This manual covers the Mini only.

1.3 Where it can be used

On virtually any electronic board: automotive (ECUs, modules, sensors), industrial (PLCs, inverters, CNC, control cards), home appliances, air conditioning, TV and audio, computers, telecommunications, medical and agricultural equipment – with the advantage of taking the instrument **to the machine**, without needing a bench with a computer.

2. How it works: the theory applied to the Mini

This chapter explains **why** the Mini finds faults without a schematic and without powering the board and, above all, **what happens to the curve when you change the frequency, the voltage and the impedance**. Since the Mini leaves these three parameters free, understanding the theory is what lets you choose the right setting for each circuit.

2.1 The central idea: comparing signatures

Every point of a circuit has its own electrical behavior: it lets more or less current through, stores energy (capacitors and inductors) or only conducts above a certain voltage (diodes, transistor junctions, IC pins). By applying a known signal and recording **how that point responds**, we get a drawing that works like a **fingerprint** – the signature of the point.

- Two **identical, good** boards have the **same signature** at the same point, **with the same signal** setting.
- If a component in the net changes (burns, shorts, opens, loses capacitance, becomes leaky), **the drawing changes**.
- That is why you do not need to know how the circuit works: just compare point by point. It is painstaking work, but very rewarding.

2.2 The Mini measuring circuit

Inside the Mini there is a digital **sine-wave generator** (adjustable frequency and amplitude) connected to the test point through a **selectable internal impedance (Z)**, chosen between 1k and 200k. The channel probe goes on the board point and the green (COM) lead on the board GND.

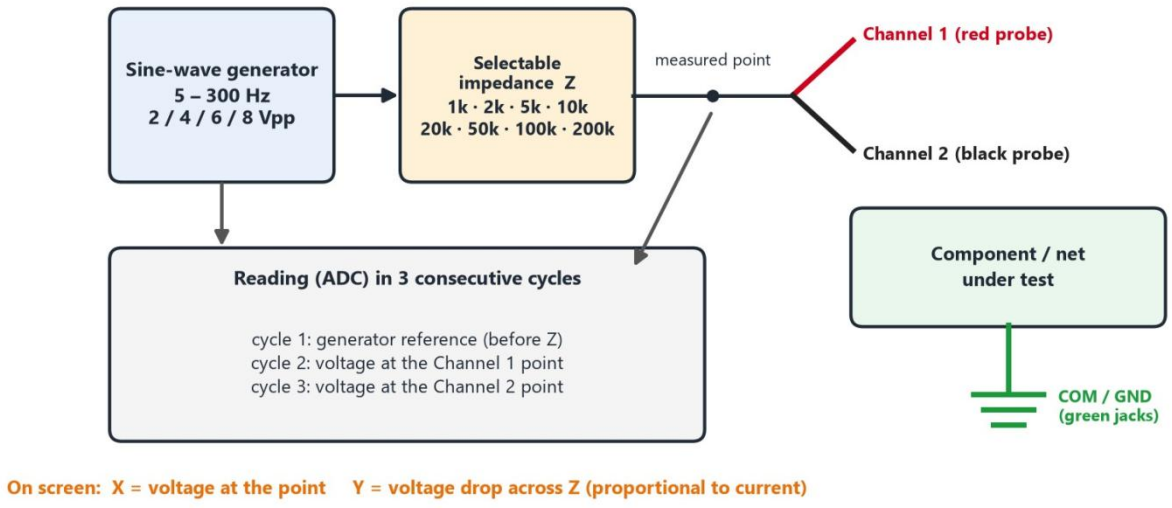


Figure 2 – Mini measuring circuit: generator, selectable impedance Z, channel probes and reading in 3 cycles

The internal impedance and the measured point form a **voltage divider**:

NOTE

V(point) = Vgenerator × Zpoint / (Zpoint + Z)

I = (Vgenerator − V(point)) / Z

The **X** axis shows the voltage at the point and the **Y** axis shows the voltage drop across Z, which is proportional to the current. The shape of the curve therefore depends on the **ratio between the impedance of the point and the chosen impedance Z**. Z also limits the current, protecting the circuit under test.

Impedance of the point	What happens in the divider	Curve on screen
≈ 0 (short)	All the voltage drops across Z; the voltage at the point is almost zero	**Vertical line**
Equal to Z	The voltage is split in half	Line tilted at ~45°
Much higher than Z (open)	All the voltage stays at the point; current almost zero	**Horizontal line**
Reactive (C or L)	Voltage and current shifted in time	**Spiral** (C clockwise, L counterclockwise)
Non-linear (diode, IC)	The impedance changes with the applied voltage	Curve with “knees”

2.3 The 3 monitored cycles

The Mini has a single generator and a single analog-to-digital converter (ADC) for both channels. To measure everything accurately, it reads the signal in **3 consecutive cycles**, switching the ADC input at each cycle:

- **Cycle 1 – reference**: the voltage of the generator itself, before the impedance Z.
- **Cycle 2 – Channel 1**: the voltage at the point touched by the red probe.
- **Cycle 3 – Channel 2**: the voltage at the point touched by the black probe.

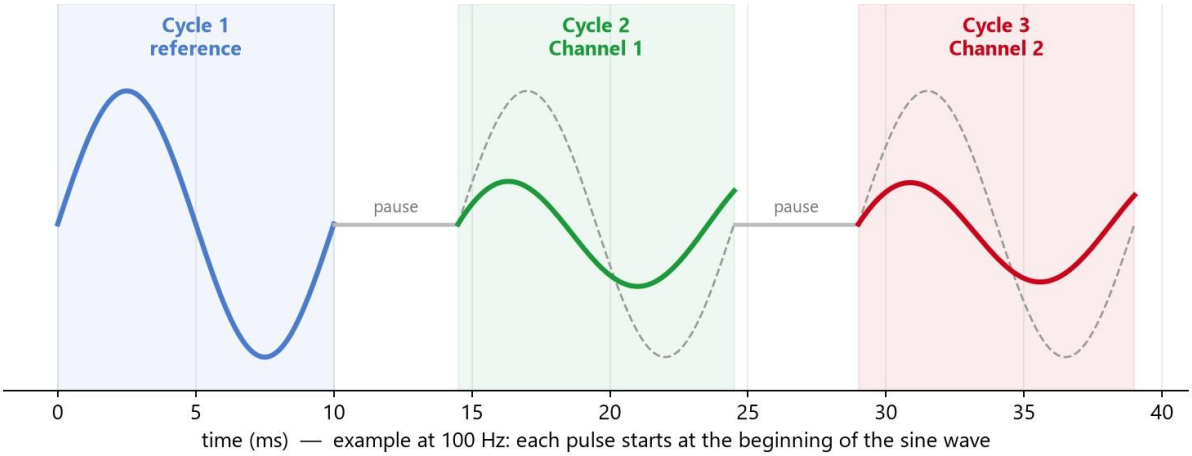


Figure 3 – Pulsed acquisition in 3 cycles: reference, Channel 1 and Channel 2 – each cycle starts at the beginning of the sine wave

The excitation is **pulsed**: each reading cycle always starts at the **beginning of the sine wave**, with a pause between captures. In each cycle **65 samples** are read. For each channel, the Mini calculates **X = voltage at the point** and **Y = reference − voltage at the point** (the drop across Z, that is, the current). Since the reference is measured at every sweep, the curve stays correct even as the battery discharges. Practical consequence: **at low frequencies the screen refreshes more slowly** – at 5 Hz each cycle lasts 200 ms and a complete sweep takes about 0.6 s; at 100 Hz, about 30 ms.

2.4 From the sine wave to the drawing on the screen

Each pair of values (X, Y) becomes a point on the graph – as in an oscilloscope in XY mode (Lissajous figure). In a capacitor the current **leads** the voltage; therefore, when the voltage passes through its maximum, the current is already falling, and the sequence of points draws a “round” curve.

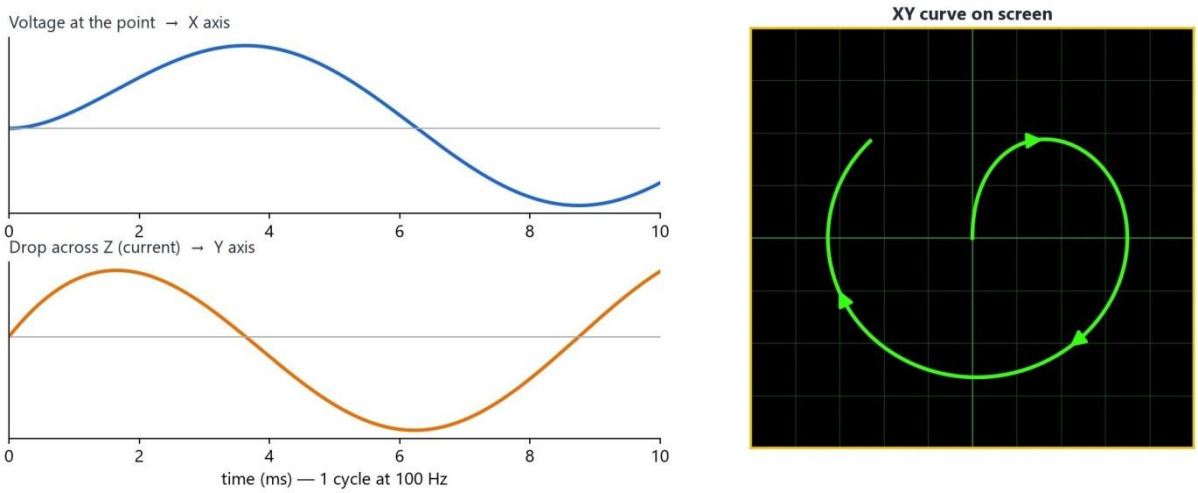


Figure 4 – The voltage at the point (X) and the current (Y) over time form the XY curve

Pulsed excitation and the direction of the spiral

Since the Mini excitation is **pulsed**, each capture starts with the component at rest (zero voltage at the point) and includes the **transient response** – the charging of the capacitor or the reaction of the inductor. That is why the curve of a reactive component **starts at the center and does not close**: it forms a **spiral**. The direction of rotation identifies the component: **capacitor clockwise** (current leads voltage) and **inductor counterclockwise** (current lags).

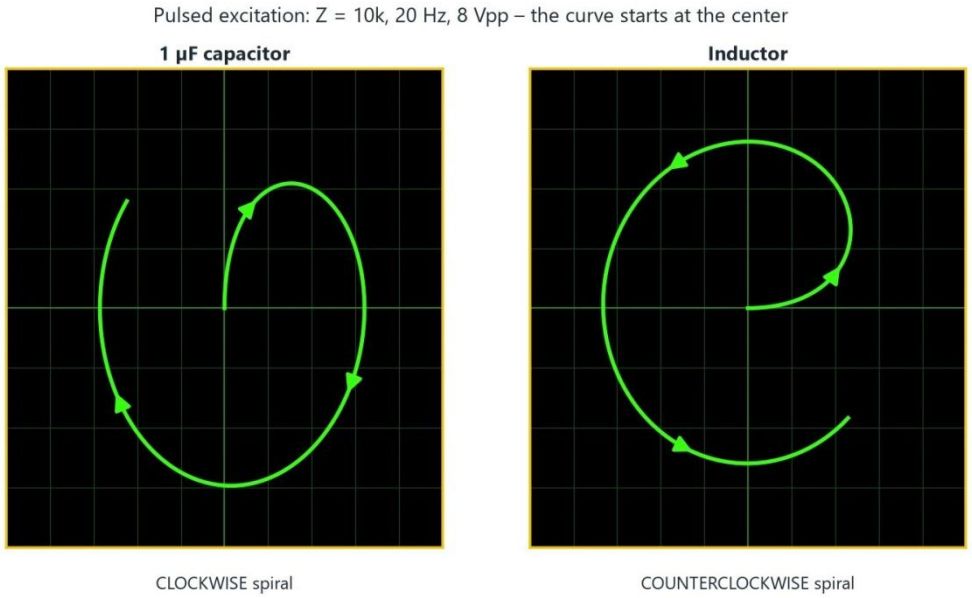


Figure 5 – Direction of rotation of the spiral on the Mini: capacitor (clockwise) and inductor (counterclockwise)

Characteristic	Continuous excitation	Pulsed excitation (Mini)
Start of capture	Any point, circuit already settled	Always at the beginning of the sine wave, starting from rest
Use of the transient	No (discarded)	Yes – it is a source of information
Typical shape of C and L	Closed ellipse	Spiral (direction indicates C or L)

Characteristic	Continuous excitation	Pulsed excitation (Mini)
Energy applied to the circuit	Continuous	Only during the pulse – safer for sensitive circuits

The screen uses **full scale**: the total width corresponds to the maximum generator voltage and the total height to the maximum current (all the voltage across Z). That is why a short is always a vertical line and an open is always a horizontal line, **whatever the setting**.

2.5 The internal impedance: the Mini "zoom"

This is the big difference of the Mini. On the bench models the impedance is fixed at 10 kΩ; on the Mini you choose Z – and **the same part changes shape according to Z**. With resistors this is very clear: a resistor **equal to Z** sits at 45°; lower values are more vertical; higher values, more horizontal.

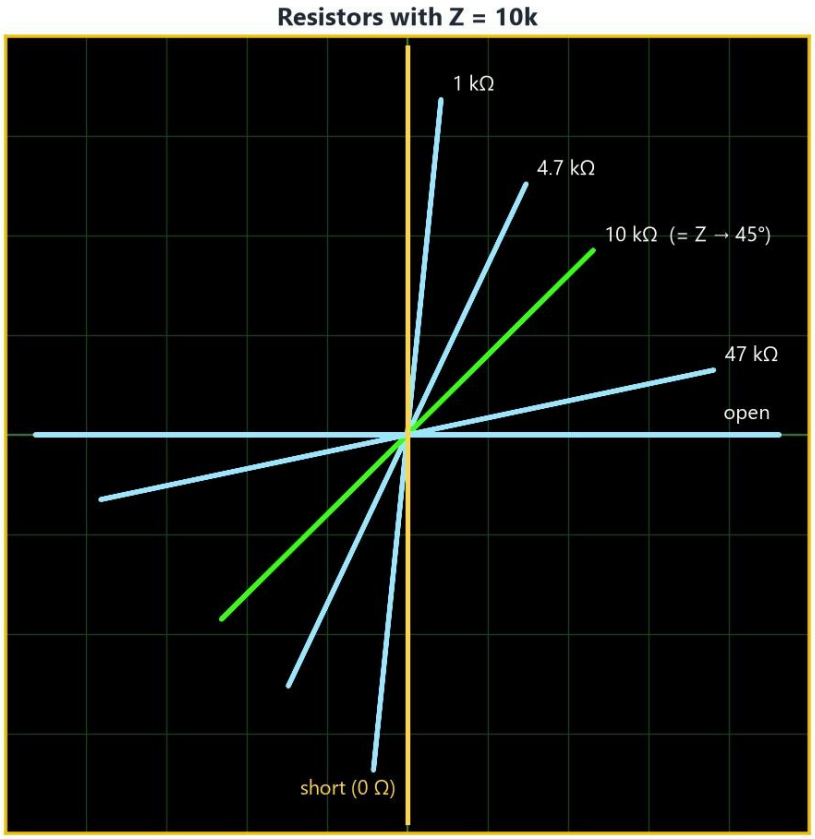


Figure 6 – Family of resistors with Z = 10k: from short (vertical) to open (horizontal)

Now look at the same three components with Z = 1k, 10k and 100k (100 Hz, 8 Vpp):

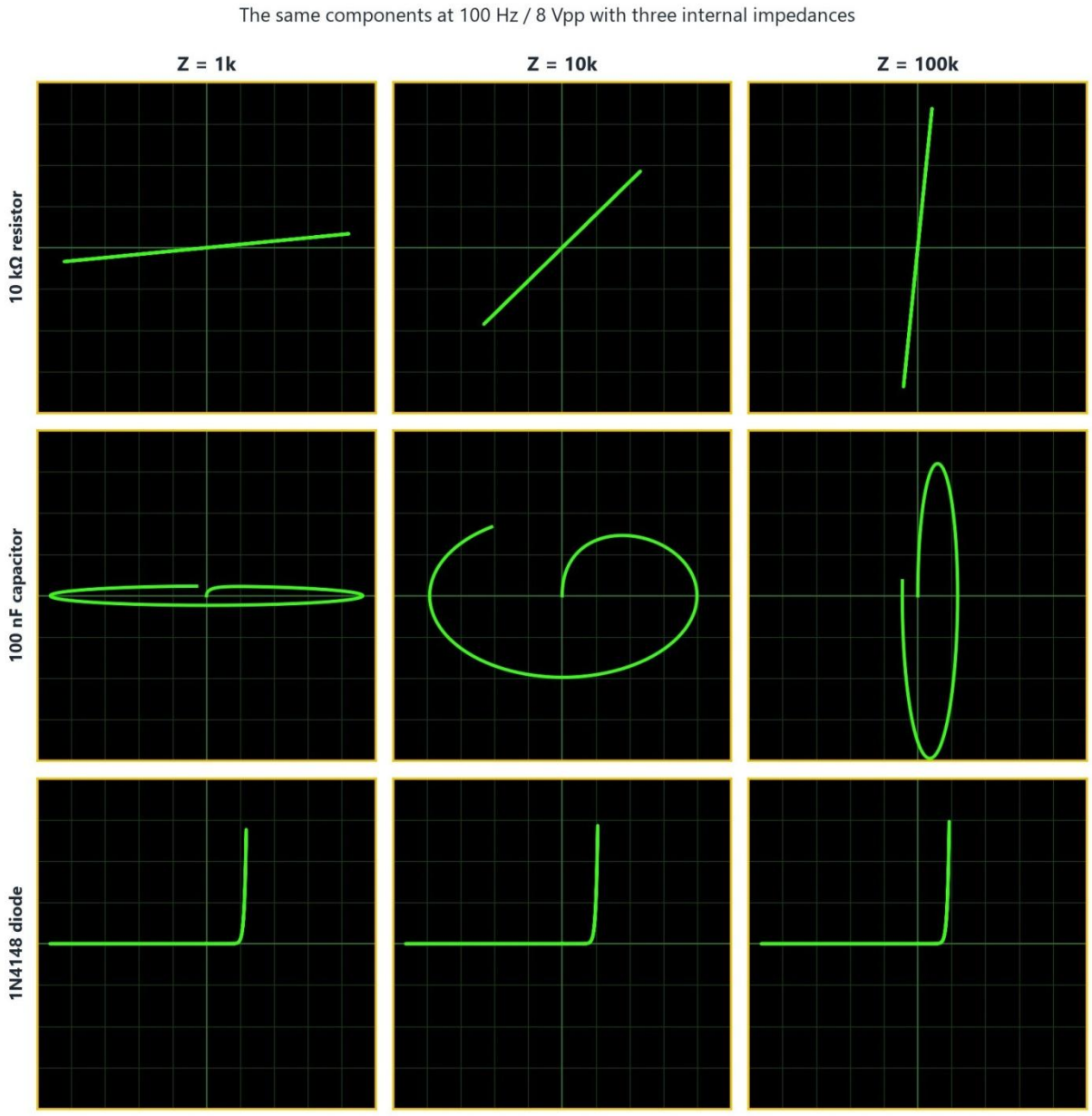


Figure 7 – 10 kΩ resistor, 100 nF capacitor and 1N4148 diode seen with three internal impedances

- **10 kΩ resistor**: with Z = 1k it looks almost “open” (horizontal); with Z = 10k it sits at 45°; with Z = 100k it looks almost “shorted” (vertical).
- **100 nF capacitor** (Xc ≈ 16 kΩ at 100 Hz): with Z = 1k it barely shows; with Z = 10k it forms a wide-open spiral – the **best reading**; with Z = 100k it dominates the point and becomes vertical.
- **Diode**: the knee appears in all of them, because the junction changes from “open” to “short” at about 0.6 V; what changes is the slope of the conducting part.

TIP

Golden rule: the curve shows more detail when the impedance of the point is **similar to Z**. Low-impedance points (power supplies, power stages, coils) call for a low Z (1k–5k); high-impedance points (CMOS inputs, sensors, very-low-power circuits) call for a high Z (20k–200k). The complete table is in **chapter 12**.

Impedance and test current

Z also sets the **maximum current** the Mini can drive through the point (shorted point, peak of the sine wave): **Imax ≈ (Vpp / 2) / Z**.

Z	1k	2k	5k	10k	20k	50k	100k	200k
Imax at 8 Vpp	4 mA	2 mA	0.8 mA	0.4 mA	0.2 mA	80 µA	40 µA	20 µA
Imax at 2 Vpp	1 mA	0.5 mA	0.2 mA	0.1 mA	50 µA	20 µA	10 µA	5 µA

WARNING

With impedances **below 10k** the test current is higher. On **ultra low-power** circuits (very-low-consumption microcontrollers, sensors, clocks, circuits with backup batteries), prefer **Z ≥ 10k** so as not to damage the circuit being measured.

2.6 Frequency: capacitors and inductors

Capacitors and inductors **store energy**, and the opposition they offer to the current – the **reactance** – depends on the frequency:

NOTE

Capacitor: **Xc = 1 / (2 × π × f × C)** – decreases as the frequency increases.
Inductor: **XL = 2 × π × f × L** – increases as the frequency increases.

That is why the same capacitor changes shape when you change the frequency on the Mini: at low frequency the reactance is high and the spiral “lies down” (close to open); at high frequency the reactance drops and the spiral “stands up” (close to short).

The same 1 µF capacitor with Z = 10k: frequency changes the shape of the spiral

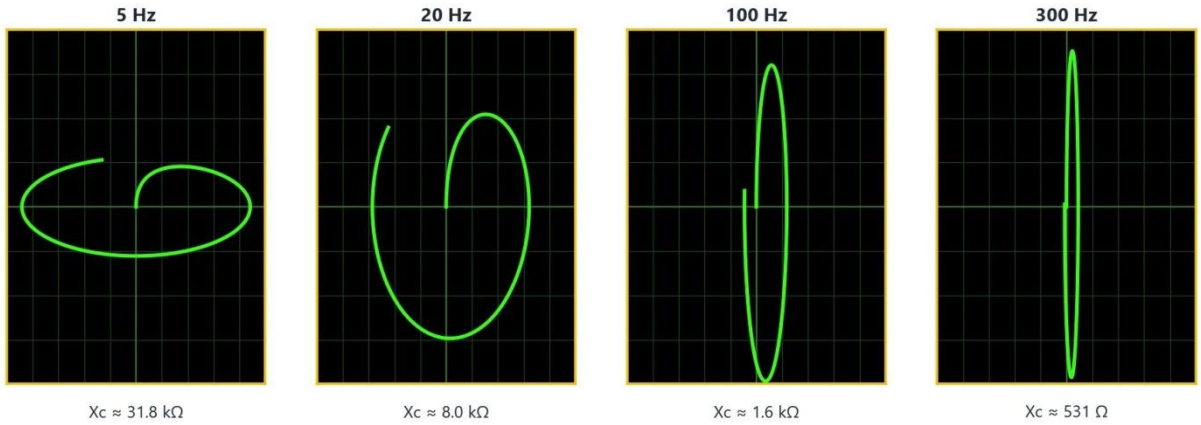


Figure 8 – 1 µF capacitor with Z = 10k at 5, 20, 100 and 300 Hz

Capacitor	5 Hz	20 Hz	50 Hz	100 Hz	300 Hz
100 nF	318 kΩ	80 kΩ	32 kΩ	16 kΩ	5.3 kΩ
1 µF	32 kΩ	8.0 kΩ	3.2 kΩ	1.6 kΩ	531 Ω
10 µF	3.2 kΩ	796 Ω	318 Ω	159 Ω	53 Ω
100 µF	318 Ω	80 Ω	32 Ω	16 Ω	5,3 Ω

Combining the two ideas (frequency and impedance): the spiral is most “open” – and the reading most sensitive – when **Xc ≈ Z**. The graph below shows, for each impedance, which capacitance forms this ideal curve at each frequency. The higher the chosen impedance, the **smaller** the capacitors it sees well; capacitors much larger than the range “pull down” the signal and become almost a vertical line.

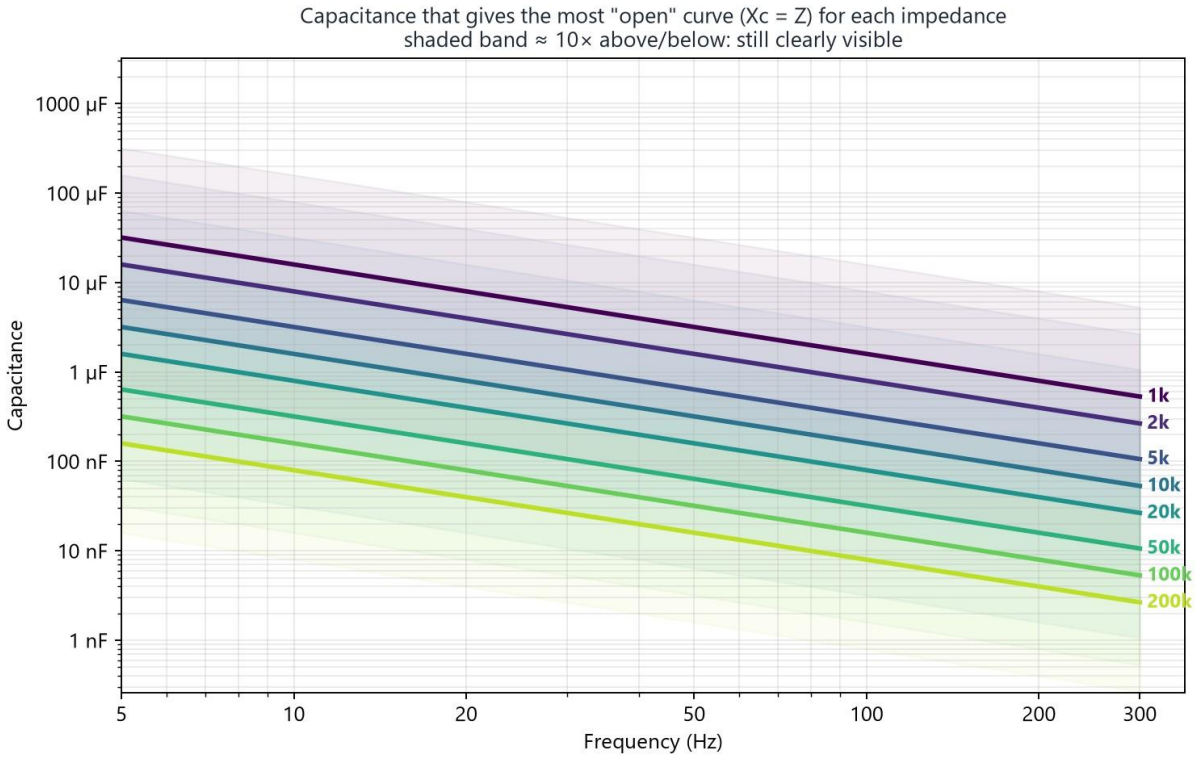


Figure 9 – Capacitance that forms the most open curve (Xc = Z) for each impedance and frequency

TIP

Board with **large electrolytic capacitors** in parallel with the point? Use a **low frequency** (5–20 Hz) and a **low impedance** (1k–2k). Want to see **small capacitors** (nF)? Raise the frequency and/or the impedance.

2.7 Voltage: exploring the junctions

The voltage (2, 4, 6 or 8 Vpp) defines how far the semiconductor junctions are “explored”. A silicon diode conducts from about 0.6 V; a red **LED** only from ~1.8 V; a **Zener** at its reverse breakdown voltage. If the peak voltage of the signal (half the Vpp) does not reach that value, the component looks **open**.

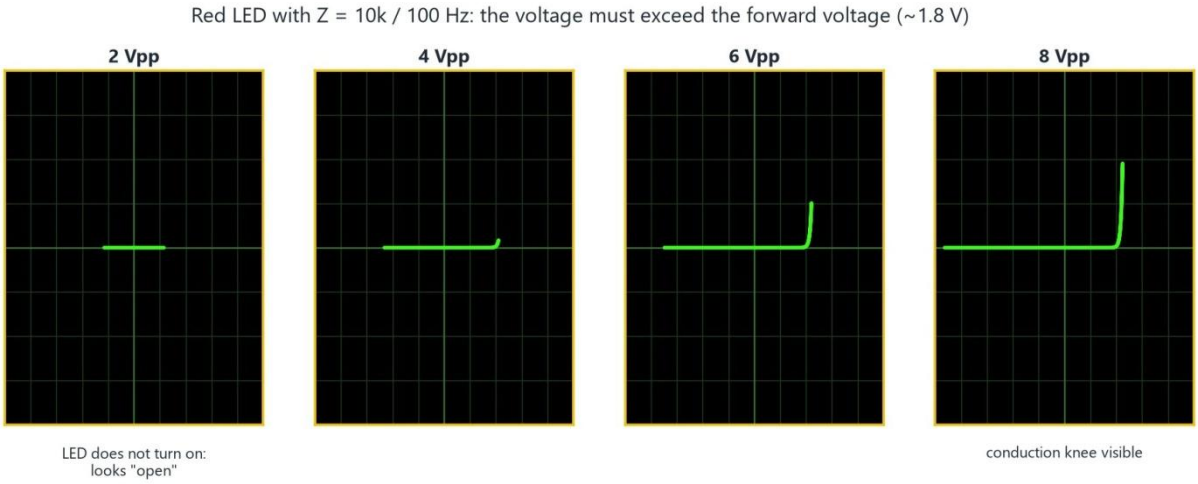


Figure 10 – Red LED with Z = 10k / 100 Hz at 2, 4, 6 and 8 Vpp

- **2–4 Vpp**: low-voltage and sensitive circuits (1.8 V / 3.3 V logic, delicate ICs).
- **6–8 Vpp: diodes, LEDs, low-voltage Zeners, transistor junctions and general comparison (factory default: 8 Vpp).**

2.8 Semiconductors and typical curves

A **PN junction** (diode, base-emitter or base-collector of a transistor) practically does not conduct when reverse-biased and conducts strongly after the knee. The result is a curve that is horizontal on one side and vertical on the other. IC pins usually show two knees (protection diodes to VCC and to GND). The sheet below gathers the most common signatures:

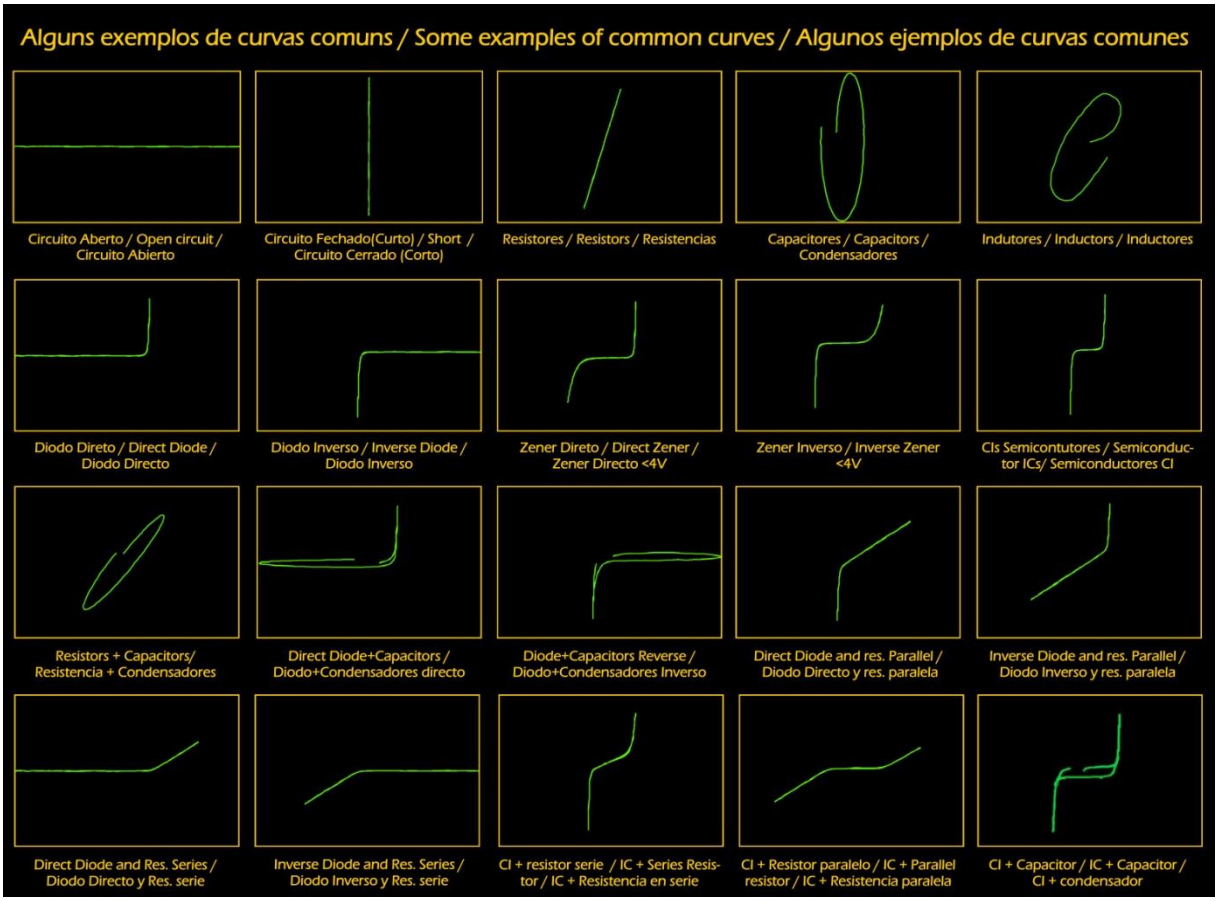


Figure 11 – Examples of common curves (RastreCurve reference sheet)

2.9 The curve belongs to the net, not to the component

With the components soldered in place, the Mini measures **everything connected to the point**. The curve is the sum of the behaviors: a diode alone shows the typical knee; with a resistor in parallel, the “open” part tilts; with a capacitor in parallel, a spiral appears that can hide the diode.

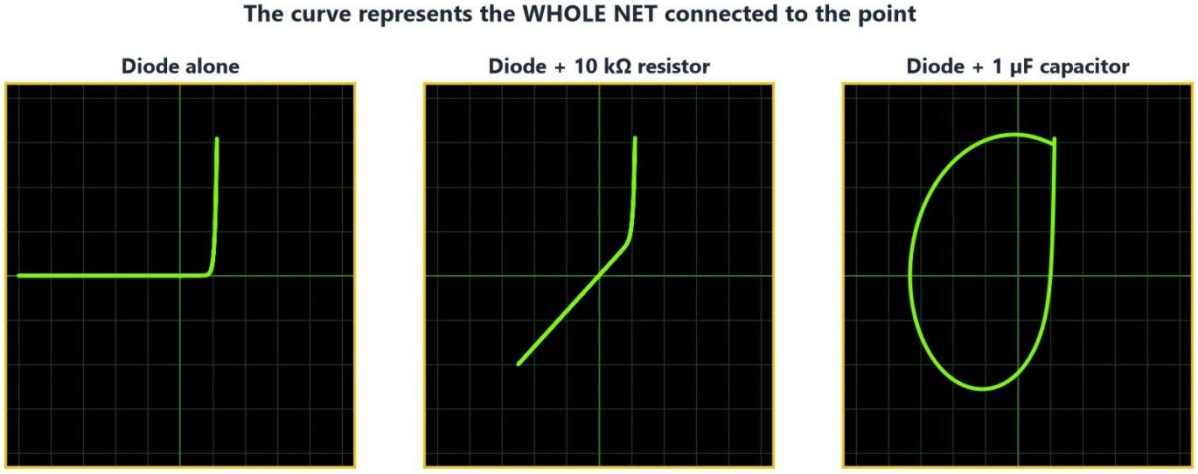


Figure 12 – The same diode with different components connected in parallel

- That is why the **same component in different circuits** has different curves – always compare the **same point**, on identical boards and **with the same F, V and Z setting**.
- A shorted capacitor makes **all points on the same line** show a short. To find the culprit, isolate sections and measure again.

2.10 Multi Mode: four signatures at once

Since each combination of frequency and impedance highlights a different part of the net, **Multi Mode** shows the same point with **4 signals** at the same time (default: 60 Hz/1k, 100 Hz/5k, 200 Hz/10k and 300 Hz/50k). A fault that goes unnoticed with one setting usually shows up with another:

Multi Mode: one point (diode + 2.2 kΩ + 1 µF) seen by 4 signals

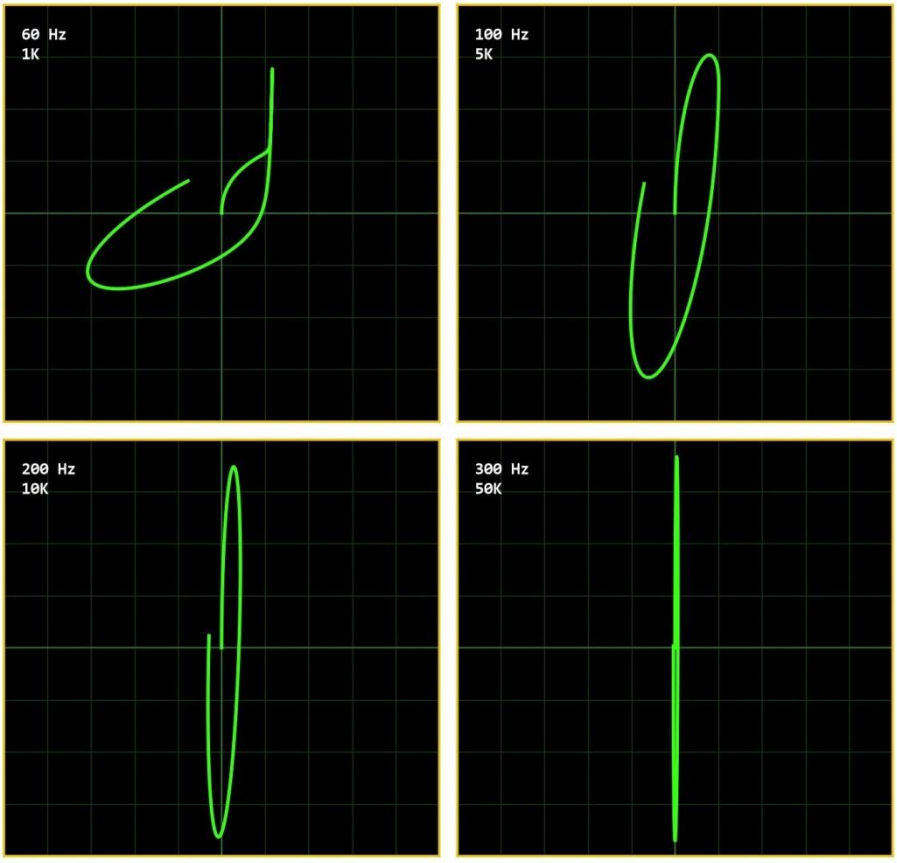


Figure 13 – One point (diode + 2.2 kΩ + 1 µF) seen by the 4 signals of Multi Mode

- At 60 Hz / 1k the diode and the resistor show up; the capacitor barely interferes.
- At **300 Hz / 50k** the capacitor dominates and the curve becomes almost a vertical line.
- If the difference between the boards **grows in the high-frequency quadrants**, suspect capacitors; if it is the same in all of them, the fault is resistive or in junctions.

2.11 How the Mini calculates the difference

When both channels are connected (or when a stored curve is compared with the measurement), the Mini compares the **65 samples** of the two curves one by one, calculates the relative difference at each sample and adds everything into a **percentage index**. Very small differences (up to 0.2%) are considered zero.

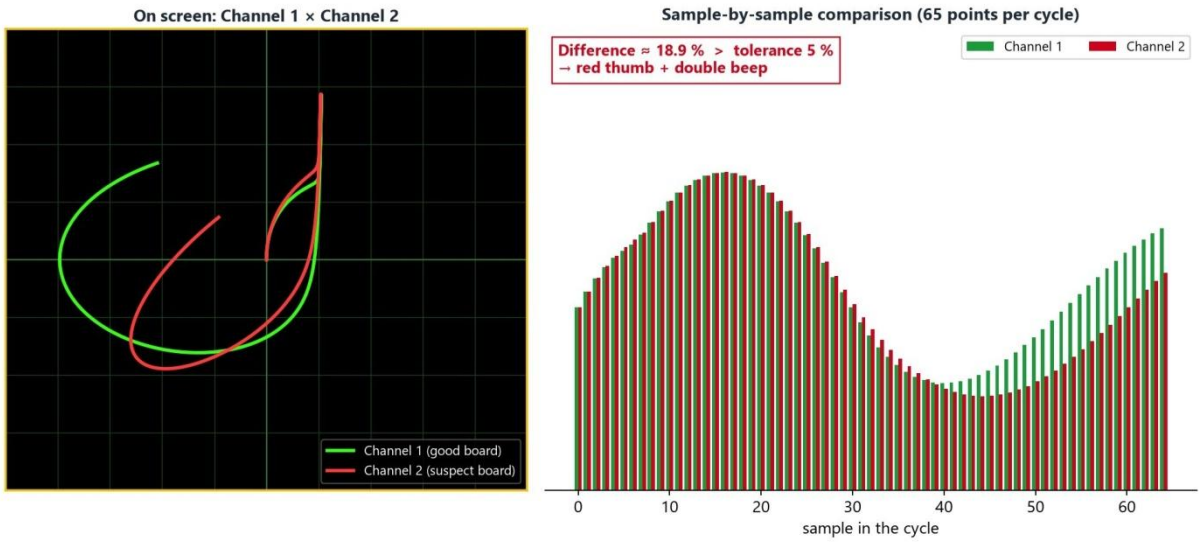


Figure 14 – Channel 1 × Channel 2 and the sample-by-sample comparison

Result	On screen	Sound (if S:ON)
Difference below tolerance P	**Green** thumb up and % in green	Short beep
Difference above tolerance P	**Red/orange** thumb down and % highlighted	Double beep

> **TIP**
>
> **The shape of the curve is the most important information**; the number is a support. Small differences **in the central part** of the curve deserve attention; differences only at one of the ends are usually tolerable. Components from different manufacturers may give a few points of difference.

2.12 Earth, GND and chassis ground

The **COM** jacks (green) are the Mini reference. Connect the green lead to the negative, chassis or GND of the board. If the board has **separate grounds** (for example, primary and secondary of a power supply), measure each section with its corresponding GND. To compare two boards, use **one green lead for each board**.

2.13 Limitations of the method

- The test is performed **with the board powered off**; it does not replace functional verification with the circuit powered.
- Components **in parallel** add up their curves – sometimes you need to isolate sections to find the culprit.
- Programmable components and ICs with a charge pump may show variable or unstable curves.
- Internal logic faults (corrupted memory, firmware) do not show up in the curve.

3. Safety and precautions

WARNING

All tests must be performed with the board or module **completely disconnected** from the mains and **without batteries**.

Discharge all capacitors before starting – especially the filter electrolytics of power supplies. If the circuit or board was powered recently, the capacitors may hold dangerous voltages. Confirm the discharge with a multimeter.

Never connect the Mini to a powered circuit.

- **Impedance below 10k**: take care with ultra low-power circuits; prefer Z ≥ 10k so as not to damage the circuit being measured (section 2.5).
- Use an antistatic wrist strap or mat when handling sensitive boards and components.
- Do not touch the board or the probe tips with your fingers during measurement – this adds noise and changes the curve.
- Do not inject external signals into the board during the test.
- If you link (“jumper”) separate grounds to make testing easier, **remove the jumpers** before powering the board again.
- Charge the Mini only with the **12 V power supply** supplied with the instrument. Do not leave the instrument in hot or humid places or exposed to the sun.

4. Getting to know the equipment

4.1 Box contents

- 1 RastreCurve Mini portable instrument;
- 1 rechargeable 9 V battery (already installed, complimentary);
- 1 12 V power / charging supply;
- 1 **red** needle probe (Channel 1) and 1 **black** needle probe (Channel 2);
- 2 **green** GND reference leads with alligator clips.

4.2 Front panel



Figure 15 – Front panel of the RastreCurve Mini

Item	Function
MENU button (home)	Opens the main menu. In Memorize/Test modes, opens the parameters or returns to the list.
UP button (	Moves up, increases values. In Record/Test Mode: goes back to the previous pin (hold 2 s in Record Mode: delete pin).
DOWN button (	Moves down, decreases values. In Record/Test Mode: advances to the next pin.
CONFIRM button (	Selects/confirms. On the 2 Channels screen, **hold** it to access parameters F, V, Z, P and S. In Record Mode it records the pin; in Test Mode it tests the pin.
Red jack (Channel 1)	Main probe: good board in the comparison; the only channel used when memorizing and testing.
Green jacks (COM)	GND reference. One jack for each channel/board.
Black jack (Channel 2)	Second probe: suspect board in the 2-channel comparison.
2” display	320 × 240 color display with curves, parameters, battery and result.
Charging LED	Indicates battery charging when the 12 V supply is connected.
Power button (side)	Turns the instrument on and off.

Item	Function
12 V power jack (side)	12 V power supply input (continuous use and battery charging).

4.3 Button combinations (shortcuts)

Where	Combination	What it does
2 Channels screen	Hold ✓(~1 s)	Enters parameter selection (F, V, Z, P, S)
2 Channels screen	Hold ✓(~2 s) on the item	Edits the value of the selected item
2 Channels screen	Hold ▲+ ▼(~1 s)	Freezes the Channel 1 curve on the screen (work with Channel 1 only); repeat to release
Record Mode	Hold ▲(2 s)	Delete the current pin (“Del pin?”)
Record / Test Mode	▲ + ▼ together	Go directly to a pin (“Go to pin:”)

4.4 Battery and power

The Mini runs on its **rechargeable internal 9 V battery** or connected to the **12 V power supply** through the **power jack** on the side, which also charges the battery. With a fully charged battery, autonomy is about **1 hour** of use.

- The icon in the upper right corner shows the charge in **5 levels** (green, yellow, red).
- While charging, the **charging LED** lights up and the battery icon is **animated**.
- When the battery reaches its limit, the Mini **turns off the generator** and shows **“Please! / Charge Me”**. Connect the 12 V supply to continue.



Figure 16 – Low battery warning

> **TIP**
> For long working days, use the Mini with the power supply connected. The battery provides portability for quick on-site tests.

4.5 Turning on the Mini

Press the **power button** on the side. The Mini shows the logo and **“Starting...”**. On **first use** it asks for the language (**Idioma / Language**: Português, English, Español); choose with ▲/▼ and confirm with ✓. After

that it always opens on the **start screen** chosen in the settings (item 4-Ini: 1 x 2, Menu or Multi) – from the factory, the **2 Channels (1 x 2 Mode)** screen.



Figure 17 – Start-up screen



Figure 18 – Language selection on first use

5. Technical specifications

Parameter	Value
Channels	2 (comparison and memorizing) + 2 COM (GND) jacks
Test voltage	2, 4, 6 or 8 Vpp (default 8 Vpp)
Frequency	5 Hz to 300 Hz, in 5 Hz steps (default 100 Hz)
Internal impedance	1k, 2k, 5k, 10k, 20k, 50k, 100k and 200k (default 5k)
Maximum current	10 mA
Excitation	Pulsed: each capture starts at the beginning of the sine wave (test time 1.5 ms)
Acquisition	3 monitored cycles (reference, Channel 1, Channel 2); 65 samples per cycle
Comparison tolerance (P)	2% to 20% (default 5%)
Multi Mode	4 simultaneous signals with their own frequency and impedance; common voltage
Internal memory	50 components × 100 pins
Component name	Up to 8 characters (A–Z, 0–9 and “-”)
Screen	2” color (320 × 240)
Controls	4 buttons: Menu, ▲ ▼, Confirm (✓); audible alert on/off
Battery	9 V rechargeable, 450 mAh – autonomy of ~1 h on a full charge
External power	12 V power supply included, power jack (use and charging)
Indicators	Charging LED; 5-level battery icon on the screen
Languages	Portuguese, English and Spanish
Curve cloud / computer	Not available on this model

6. Navigation and main menu

The Mini is fully controlled by the **4 buttons** below the screen. The logic is always the same: **▲/▼choose**, **✓ confirms** and **Menu (home)** goes back.

6.1 Main menu

Press **Menu** to open "**Select what you want:**". The item in orange is the selected one; use ▲/▼ to change and ✓ to enter.

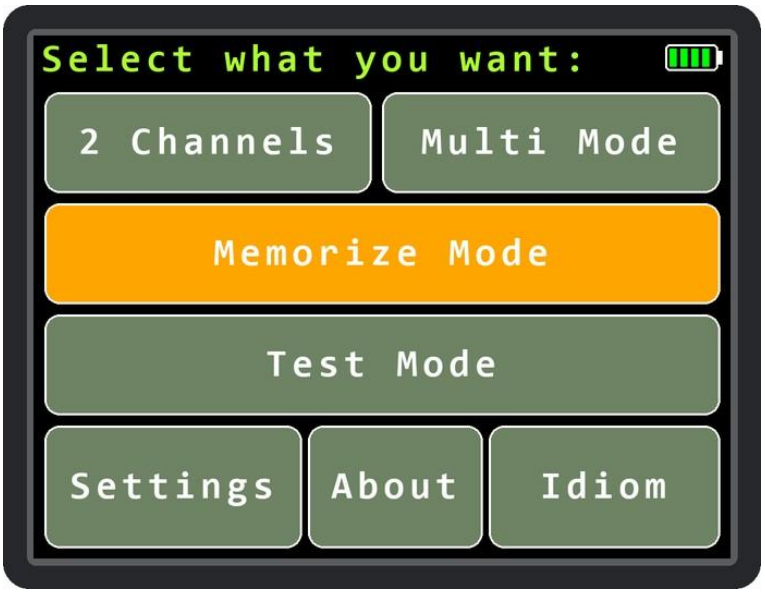


Figure 19 – Main menu

Option	What it does	Chapter
2 Channels	Main screen (1 x 2 Mode): Channel 1 and Channel 2 curves, F/V/Z/P/S settings and comparison	7
Multi Mode	The same point seen by 4 different signals at the same time	8
Memorize Mode	Record the curves of a good component/board in the internal memory	10
Test Mode	Test a board by comparing it pin by pin with the memory	11
Settings	Default values, start screen, memory bank, tolerance, language and sound	9
About	Firmware version, serial number and instrument ranges	13
Idiom (language)	Português, English or Español	13

7. 2 Channels Mode (1 x 2)

This is the main screen of the Mini and the most used one: it shows at the same time the **Channel 1 (green)** and **Channel 2 (red)** curves, with the difference percentage between them.



Figure 20 – 2 Channels screen: identical Channel 1 (green) and Channel 2 (red) curves – 2.1% with green thumb

Indication	Meaning
1 x 2 Mode	Current mode (2 channels)
F:100HZ	Signal frequency (5–300 Hz)
V:8VPP	Peak-to-peak voltage (2, 4, 6 or 8 Vpp)
Z:5K	Internal impedance (1k to 200k)
P:5%	Comparison tolerance (2% to 20%)
S:ON / OFF	Sound on or off
Battery icon	Charge level (animated while charging)
Thumb and % (lower right corner)	Channel 1 × Channel 2 comparison result

7.1 First test

1. With the board **powered off** and the capacitors discharged, connect the **green** lead (COM) to the GND/negative of the board.
2. Connect the **red** probe to the Channel 1 jack and touch a point on the board.
3. Watch the green curve. With the probe in the air (nothing connected), the curve is a **horizontal line** (open); touching the probe to GND, a **vertical line** (short).
4. Touch known diodes, resistors and capacitors to get familiar with the shapes (section 2.8).

7.2 Adjusting F, V, Z, P and S on the screen

The parameters can be changed **during the test**, without leaving the screen:

1. **Hold ✓**for about 1 second: the **<<-** arrow appears next to F (selection mode).
2. Use **▲/▼** to choose the item: F, V, Z, P or S.

3. **Hold ✓for about 2 seconds on the item: it changes color (edit mode).**
4. Use ▲ to increase and ▼ to decrease. The frequency changes in 5 Hz steps; the voltage between 2, 4, 6 and 8 Vpp; the impedance between 1k, 2k, 5k, 10k, 20k, 50k, 100k and 200k; the tolerance in 1% steps (2% to 20%); the sound toggles ON/OFF.
5. Press ✓ to apply and save the new value. If no button is pressed for a few seconds, the Mini leaves the selection automatically.

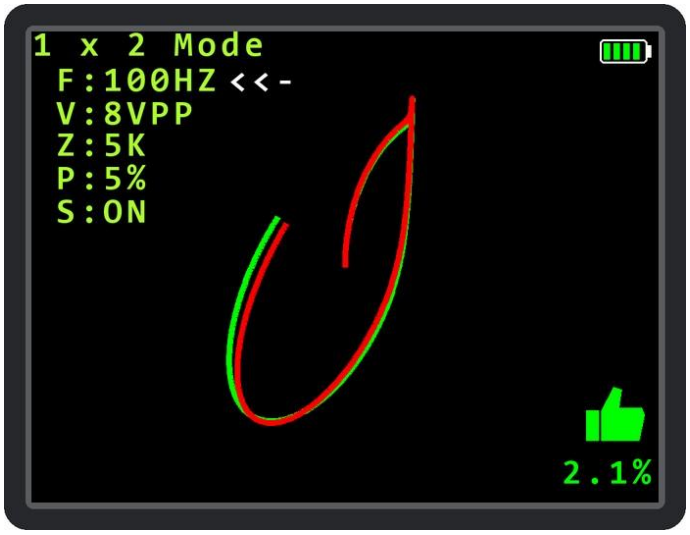


Figure 21 – Selection mode: <<- arrow next to the item



Figure 22 – Edit mode: the item changes color (here, Z changed to 10K)

> **NOTE**
>
> The applied values are saved and used the next time the Mini is turned on. The default values can also be set in **Settings** (chapter 9).

7.3 Comparing good board × suspect board

1. Connect one green lead to the GND of the **good board** and the other to the GND of the **suspect board** (or just one, if the boards share the same reference).
2. **Red** probe (Channel 1) on the good board; **black** probe (Channel 2) on the **same point** of the suspect board.
3. Compare the green and red curves and watch the percentage: **green** thumb = within tolerance; **red** thumb = difference above P.

4. Go through the points (IC pins, transistor terminals, connectors) always in the same order on both boards.

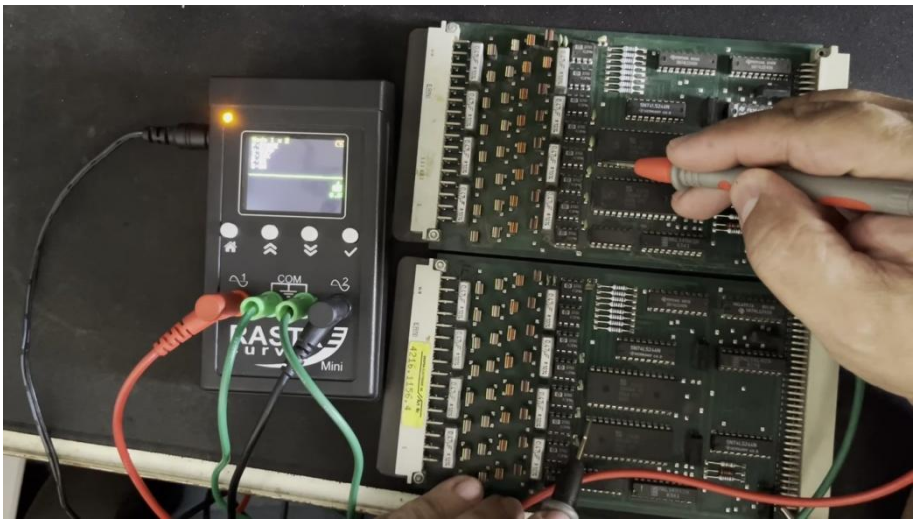


Figure 23 – Comparing two identical boards with Channel 1 and Channel 2



Figure 24 – Different curves: 38.5% with red thumb

> **TIP**
> On boards with **identical blocks** (for example, amplifier channels, inverter phases, PLC outputs), compare a good block with a bad one **on the same board** – no extra reference board needed.

7.4 Working with Channel 1 only (freezing the curve)

Want to compare using **one hand only**? Touch the red probe on the point of the good board and **hold ▲+ ▼ at the same time** for about 1 second: the Channel 1 curve is **stored on the screen**. Now take the same red probe to the corresponding point of the suspect board and compare with the frozen curve. To go back to comparing Channel 1 × Channel 2, **hold ▲+ ▼again**.

7.5 Center cross

Pressing ▲ + ▼ + ✓ together, the Mini turns the center cross (X and Y axes) on or off, useful to evaluate the symmetry of the curve and the knee point of the junctions.

8. Multi Mode

Multi Mode divides the screen into **4 quadrants** and applies **4 different signals** to the same point, each with its own frequency and impedance (the voltage is common to all four). Each quadrant shows the combination used, the difference percentage between Channel 1 and Channel 2 and the green/red thumb. The theoretical explanation is in section 2.10.



Figure 25 – Multi Mode with the 4 default signals (Channel 1 green, Channel 2 red)

Quadrant	Frequency	Impedance	Highlights
Curve 1 (upper left)	60 Hz	1k	Junctions, low resistors, large capacitors
Curve 2 (upper right)	100 Hz	5k	General use
Curve 3 (lower left)	200 Hz	10k	ICs, logic signals, medium capacitors
Curve 4 (lower right)	300 Hz	50k	High impedance, small capacitors, leakage

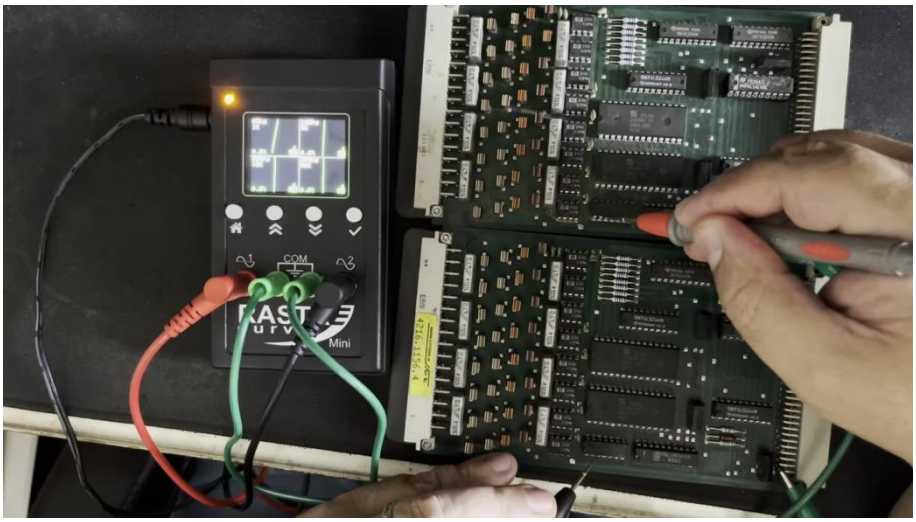


Figure 26 – Comparing two boards in Multi Mode

8.1 Configuring the 4 signals

Inside Multi Mode, press **Menu** to open "**Signal configuration:**".

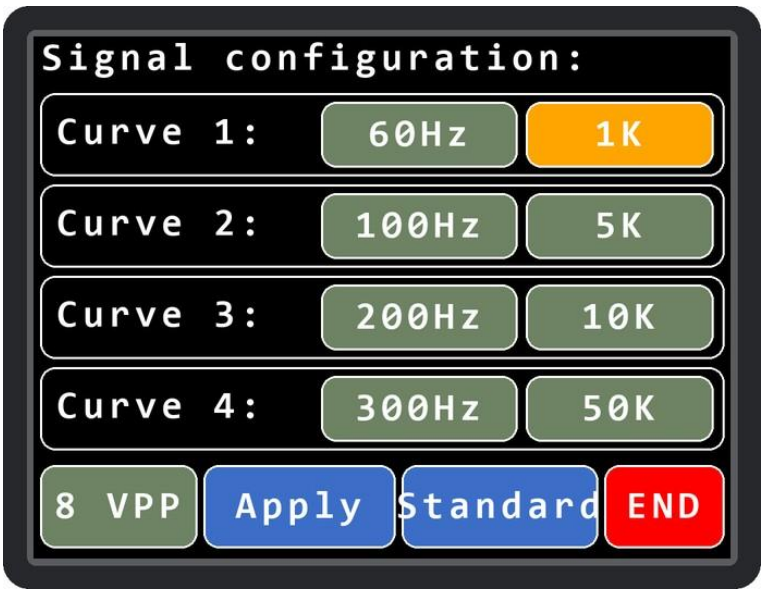


Figure 27 – Multi Mode signal configuration

1. Use ▲/▼ to go to the desired field: frequency or impedance of each curve, VPP (common voltage), Apply, Standard or END.
2. Press ✓ to edit the field (it is highlighted) and use ▲/▼ to change the value; press ✓ to confirm.
3. Select **Apply** and press ✓ to use the new signals.
4. **Standard** restores the 4 factory signals (60 Hz/1k, 100 Hz/5k, 200 Hz/10k, 300 Hz/50k).
5. **END** (or the Menu button) returns to the Multi Mode screen.

TIP

Set up Multi Mode according to the board: for example, for a power supply board use low frequencies and impedances from 1k to 5k; for a logic board, 10k to 50k. See **chapter 12**.

9. Settings

Menu → Settings holds the default values of the instrument. Use ▲▼to choose the item, ✓to enter editing (the value is highlighted), ▲▼to change and ✓to confirm. The allowed range is shown highlighted in yellow on the right. **Menu** exits the settings.

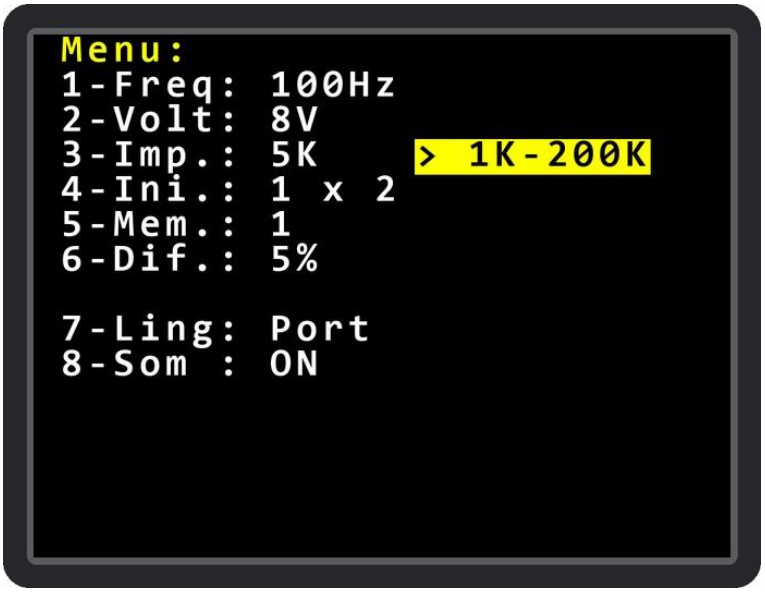


Figure 28 – Settings screen

Item	Range	Function
1-Freq	5–300 Hz	Default signal frequency
2-Volt	2–8 V	Default peak-to-peak voltage (2, 4, 6 or 8 Vpp)
3-Imp.	1K–200K	Default internal impedance
4-Ini.	1 x 2 / Menu / Multi	Screen that opens when the Mini is turned on
5-Mem.	1–50	Selected memory bank (position used in Memorize/Test Mode)
6-Dif.	1–20%	Comparison tolerance (P)
7-Ling	Port / Esp / Eng	Idiom (language)
8-Som	ON / OFF	Turns the audible alert on or off

NOTE

The settings are stored in the internal memory and are kept even with a discharged battery.

10. Memorize Mode

Memorize Mode records in the internal memory the curves of a **good component or board**, pin by pin, to later test faulty boards **without needing the good board nearby**. It holds **50 components** (banks 1 to 50) with up to **100 pins** each. Together with the curves, the Mini stores the component name and the settings used (frequency, voltage and impedance).

10.1 Curve list

In **Menu → Memorize Mode**, the Mini searches for the recorded curves ("Search...") and shows the "**Curves:**" list with the components already memorized. Use ▲/▼ to choose the option and ✓ to confirm:

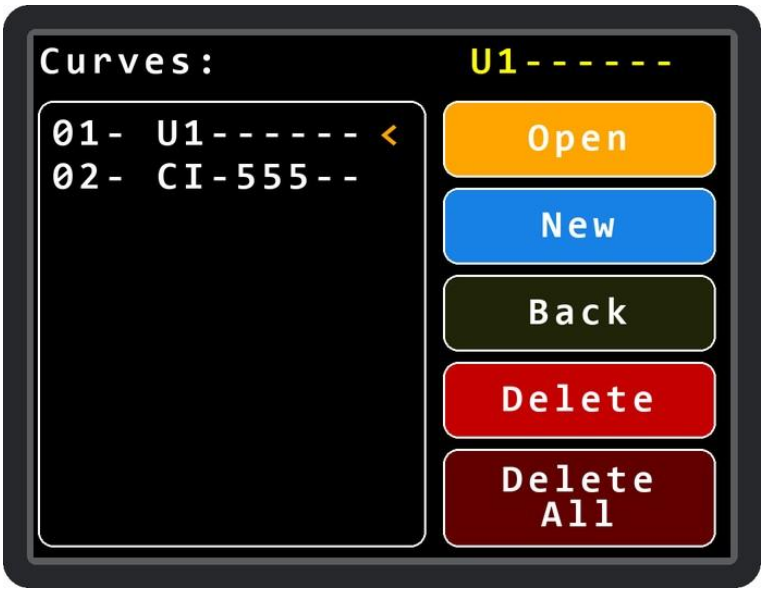


Figure 29 – Curve list in Memorize Mode

Button	Function
List (left box)	When selected (orange border), ✓scrolls through the recorded components (01, 02, ...)
Open	Opens the selected component to continue or redo the recording
New	Creates a new component
Back	Returns
Delete	Deletes the selected component (asks for confirmation)
Delete All	Deletes all components from the memory (asks for confirmation)

10.2 Creating a new component

1. In the list, select **New** and press ✓.
2. "**Chosen Database:**" shows the memory position (1 to 50). To change it, select the box and adjust with ▲/▼.
3. In "**Enter the name:**", select the field and press ✓: the current letter is marked with **^**. Use ▲to change the character (A–Z, "-", 0–9) and ✓to move to the next one. The name has up to **8 characters** (example: **U1**, **CI555**, **ECU-01**).
4. Select **OK! go!!** and press ✓ to start recording.

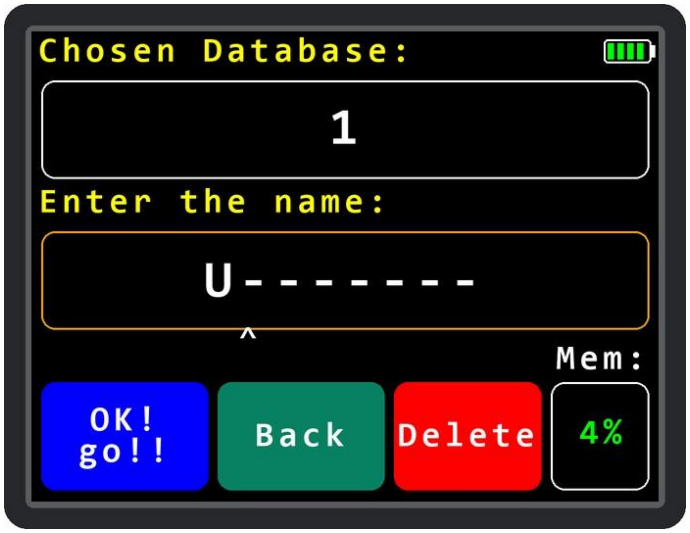


Figure 30 – Typing the component name

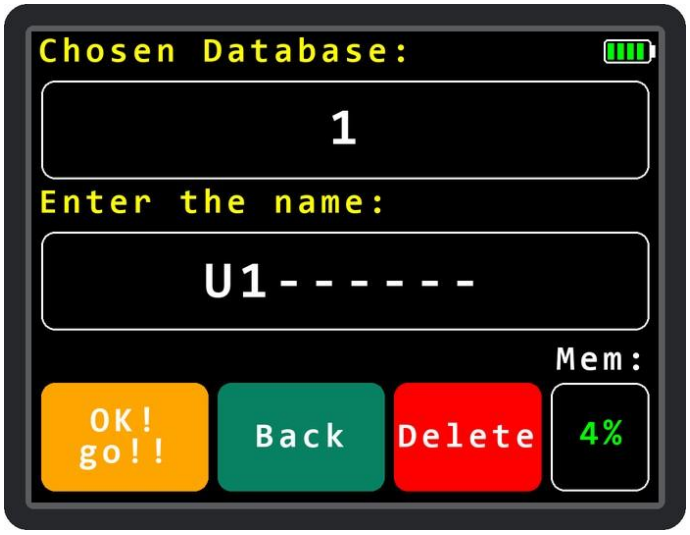


Figure 31 – Name ready (U1): select OK! go!!

On this screen, **Back** returns to the list and **Delete** deletes the component of the chosen bank. The **Mem:** box shows how much of the internal memory is already in use.

10.3 Recording the pins

The screen switches to **Record Mode**: it shows the settings (F, V, Z), the number of the **pin** to record (upper right corner), the **project** name and the Channel 1 curve.

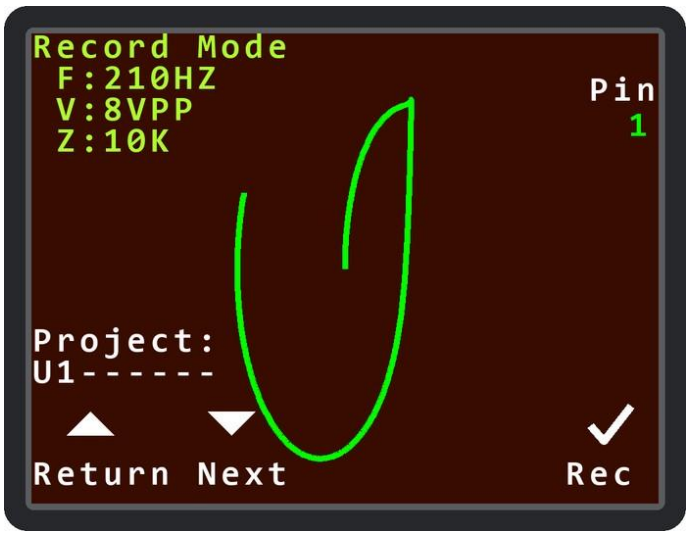


Figure 32 – Record Mode: ready to record pin 1

1. Connect the **green** lead to the GND/negative of the good board.
2. Touch the **red** probe (Channel 1) to **pin 1** of the component.
3. With a stable curve, press ✓ (Rec): the Mini records the pin (beep) and asks for the next one.
4. Repeat for all pins, always in the same order (pin 1, 2, 3...).
5. When finished, press **Menu** and exit with the exit icon to return to the list.

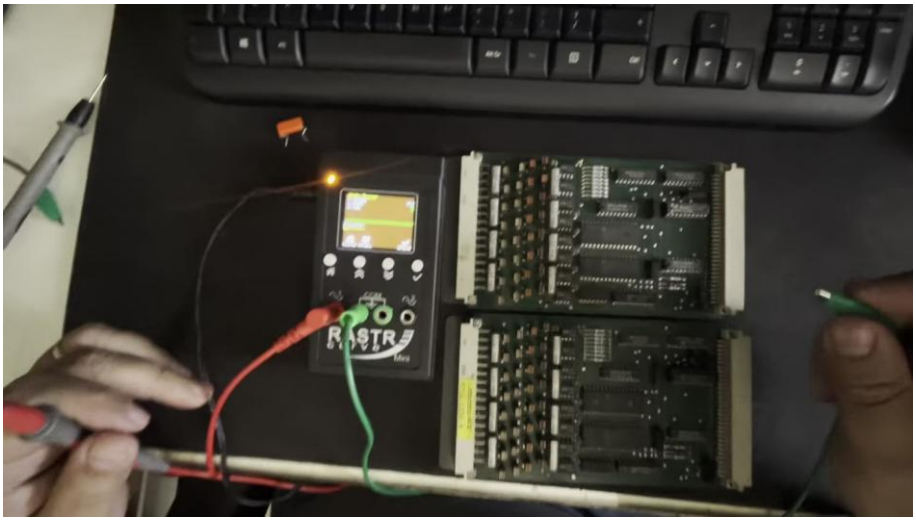


Figure 33 – Memorizing an IC: green lead on the board negative and red probe on the pin

> **TIP**
>
> The F, V and Z settings can be changed **during recording** – and are stored together with the curves. Choose them **before** starting, according to the component (chapter 12), so that all pins have the same setting.

10.4 Parameters and Auto-Record

In Record Mode, press **Menu** to open "**Parameters:**". Choose the item with ▲/▼ and edit with ✓:



Figure 34 – Record Mode parameters

Item	Function
V	Voltage (2, 4, 6 or 8 V-P-P)
F	Frequency (5–300 Hz)
Z	Impedance (1K–200K OHM)
Auto-Record	OFF or 1 to 6 s: records the pin automatically when the probe stays in contact, with a stable curve, for the chosen time
Apply / Back	Applies the values and returns to recording

With **Auto-Record at 2 s**, for example, just touch pin after pin: the Mini counts 2 seconds on each one, records and moves to the next – both hands stay free to hold the board and the probe.

10.5 Correcting pins

Action	How to do it
Go back to the previous pin	▲ (Return)
Go to the next already-recorded pin	▼ (Next)
Re-record a pin	Navigate to it and press ✓
Delete the current pin	**Hold ▲for 2 s** → “Del pin?” → confirm
Go directly to a pin	**▲ + ▼ together** → “Go to pin:” → choose with ▲/▼and confirm with ✓

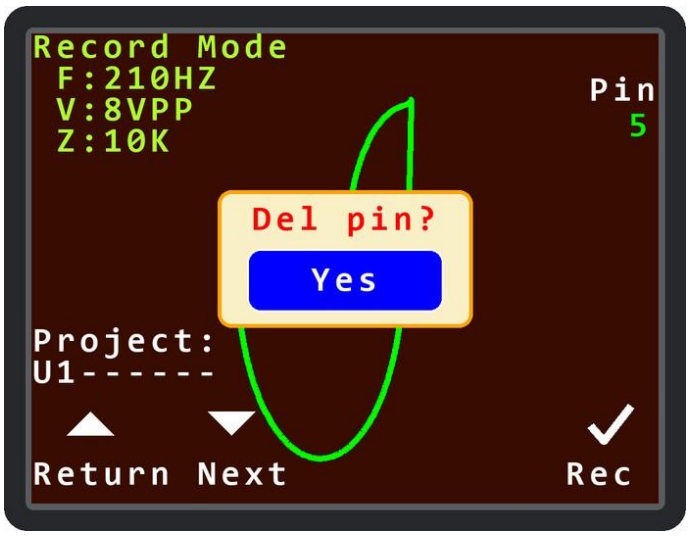


Figure 35 – Deleting a recorded pin

10.6 Deleting components

In the curve list, select the component and choose **Delete**; to clear the whole memory, **Delete All**. The Mini asks for confirmation ("**You sure want to delete?**" – **Yes!** / **No !**).

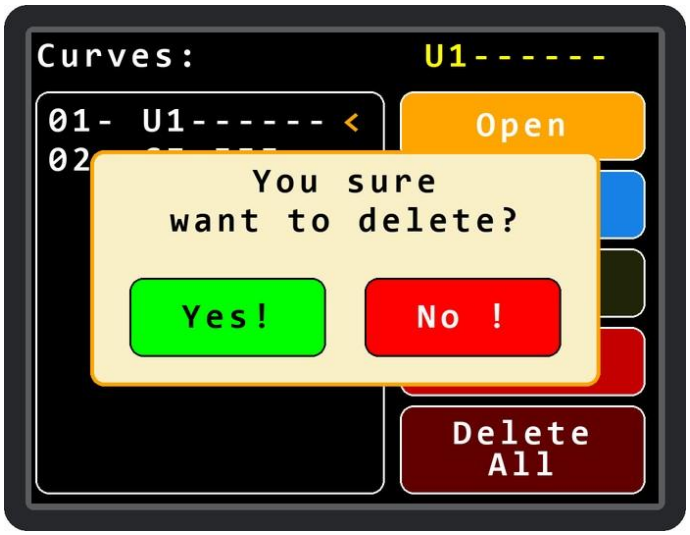


Figure 36 – Confirmation before deleting

> **WARNING**
>
> Deleted components **cannot be recovered**. Since the Mini does not connect to a computer, there is no external backup of the curves.

11. Test Mode

Test Mode compares, pin by pin, the board under test with the curves recorded in Memorize Mode. The Mini automatically loads the settings (F, V, Z) used in the recording, shows the stored curve and the real curve and indicates the difference.

11.1 Opening a component for testing

1. In **Menu → Test Mode**, select the component in the list and press **Open** (or **New Test**).
2. The next screen shows the bank and the **project name**.
3. Choose **OK! go!!** to start the test from pin 1.

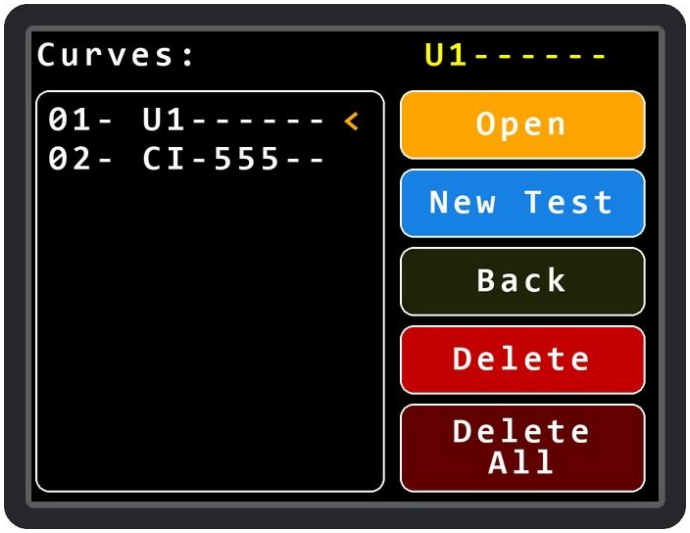


Figure 37 – Curve list in Test Mode

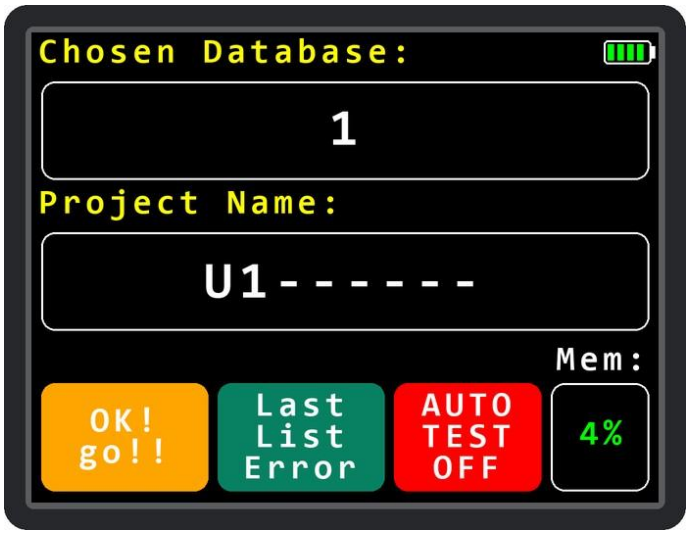


Figure 38 – Test opening screen

Button	Function
OK! go!!	Starts a new test (pin 1)
Last List Error	Shows the error report of the last test performed
AUTO TEST OFF / ON	Turns on automatic advance: when the curve matches the memory for the chosen time, the Mini moves on to the next pin by itself
Mem:	Internal memory usage

> **NOTE**
> If the chosen bank is empty, "**Empty Data!**" appears. If there is no previous test to show, "**Don t exist!**" appears.

11.2 Testing pin by pin

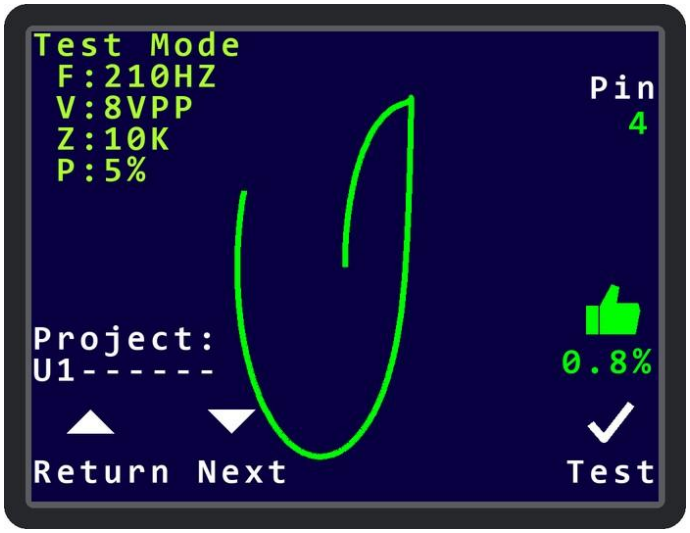


Figure 39 – Test Mode: pin 4 equal to memory (0.8%)

1. Connect the **green** lead to the GND of the board under test.
2. Touch the **red** probe to the pin shown in the upper right corner (Pin).
3. Compare the real curve with the stored one. With automatic advance on, the Mini **moves on by itself** to the next pin when the curves match.
4. If the curve **does not match**, the Mini **does not advance**: press **✓(Test)** to confirm – the pin is recorded as a **fault** together with the percentage – and the test moves on to the next pin.
5. Continue until the last recorded pin.

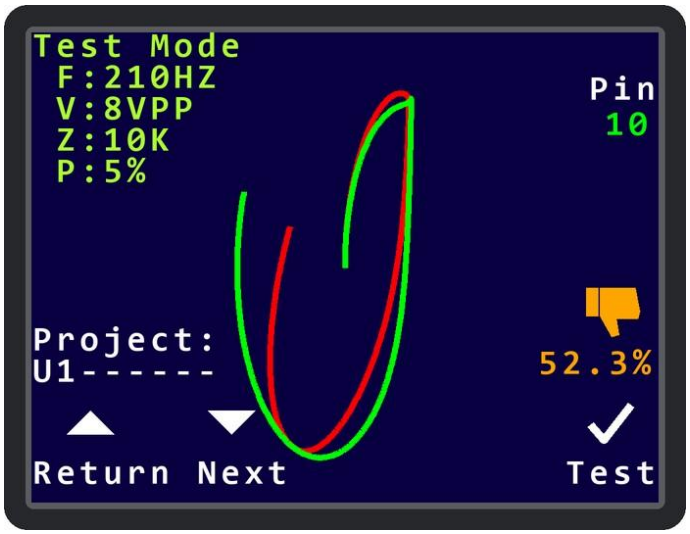


Figure 40 – Pin 10 different from memory (52.3%)



Figure 41 – Testing the suspect board with the recorded curves

11.3 Jumping to a pin

To start or continue from a specific pin (for example, pin 10), press ▲ + ▼ at the same time: “Go to pin:” appears. Choose the number with ▲/▼ and confirm with ✓. ▲ (Return) and ▼ (Next) also move between pins.

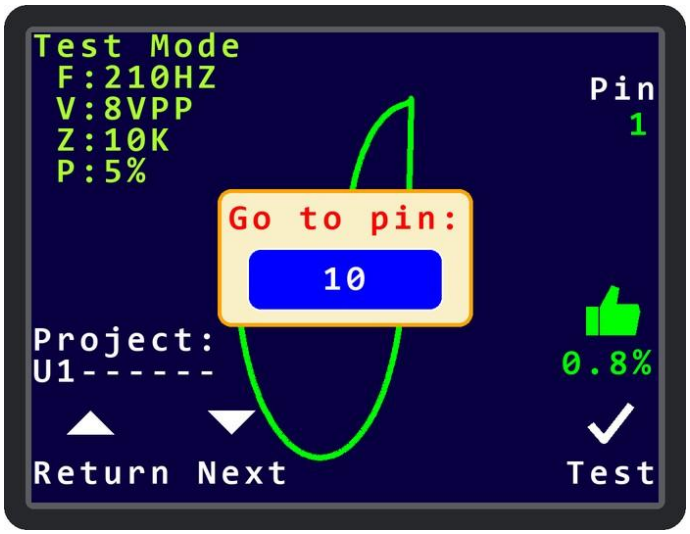


Figure 42 – Go to pin shortcut

11.4 Final report

When finished, the Mini shows the **Final Report** with “**Error Found!**” and the **Faults/Error** list with each failed pin and its percentage. The report is stored and can be viewed later in **Last List Error**.

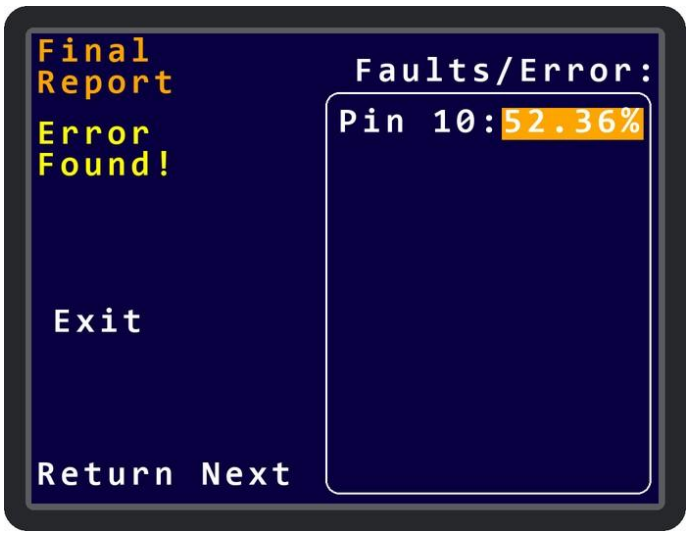


Figure 43 – Final report: pin 10 with 52.36%

TIP

A failed pin indicates that **the net connected to it** is different – not necessarily the component itself. Check the components connected to that pin (section 2.9).

12. Choosing impedance, frequency and voltage

This chapter summarizes, as a quick guide, how to apply the theory of chapter 2 in daily work. Start with the default (**100 Hz, 8 Vpp, 5k**) and adjust according to the circuit.

12.1 Impedance by circuit type

Z	Typical applications
1k	Power circuits, power MOSFETs, relays, coils, motor drivers
2k	Medium MOSFETs, LEDs, rectifier diodes
5k	General-purpose transistors (BC548, 2N3904), signal diodes (1N4148) – **default**
10k	Operational amplifiers, TTL logic, analog sensors
20k	CMOS circuits, microcontrollers, ADCs
50k	JFETs, MOSFET gates, instrumentation circuits
100k	Piezoelectric sensors, crystals, touch circuits, ultra low-power
200k	Biomedical circuits, radiation detectors, high-impedance Hall sensors

12.2 Frequency ranges

Range	Use
Low (5–20 Hz)	Large electrolytic capacitors, circuits with a lot of capacitance, power supplies
Medium (50–100 Hz)	General use, discrete components, ICs
High (200–300 Hz)	Small and ceramic capacitors, detection of leakage and subtle differences

12.3 Capacitors: combining impedance and frequency

The higher the impedance, the more the capacitance “pulls down” the signal (the curve becomes almost a vertical line). Use the table to choose the setting on points with capacitors (see also the figure in section 2.6):

Z	Recommended frequencies	Avoid / note
1k	5–300 Hz	Capacitors up to ~100 µF
2k	5–300 Hz up to ~47 µF	Above that, use ≤ 50 Hz
5k	20–100 Hz	Avoid 300 Hz with capacitors > 10 µF
10k	10–50 Hz	Avoid 300 Hz with capacitors > 4.7 µF
20k	5–20 Hz	Capacitors > 2.2 µF pull down the signal
50k	5–10 Hz	Capacitors > 1 µF pull down the signal
100k	5 Hz	Capacitors > 470 nF pull down the signal
200k	5 Hz	Capacitors > 220 nF pull down the signal at any frequency

12.4 Voltage

- **8 Vpp** (default): general comparison, diodes, LEDs, transistor junctions.
- **4–6 Vpp**: 3.3 V and 5 V ICs when you want to apply less voltage.
- **2 Vpp**: very sensitive and low-voltage circuits (remember that LEDs and Zeners may look open – section 2.7).

12.5 Suggested procedure

1. Start with **100 Hz / 8 Vpp / 5k** and compare the points.
2. If everything looks “shorted” (vertical lines), **increase Z** or **lower the frequency** (large capacitors).
3. If everything looks “open” (horizontal lines), **lower Z**.
4. Sensitive or low-power circuit? Use **Z ≥ 10k** and a lower voltage.
5. When in doubt, use **Multi Mode** to see the point with 4 settings at once.
6. When memorizing, note down (or standardize) the setting used – it is stored with the curves and re-applied in the test.

13. About and Idiom

Menu → About shows the manufacturer name, the firmware version (**Mini v1.16**), the **serial number** of the instrument, the frequency, voltage and impedance ranges and the contacts. Write down the serial number when asking for support. **Back** returns to the menu.

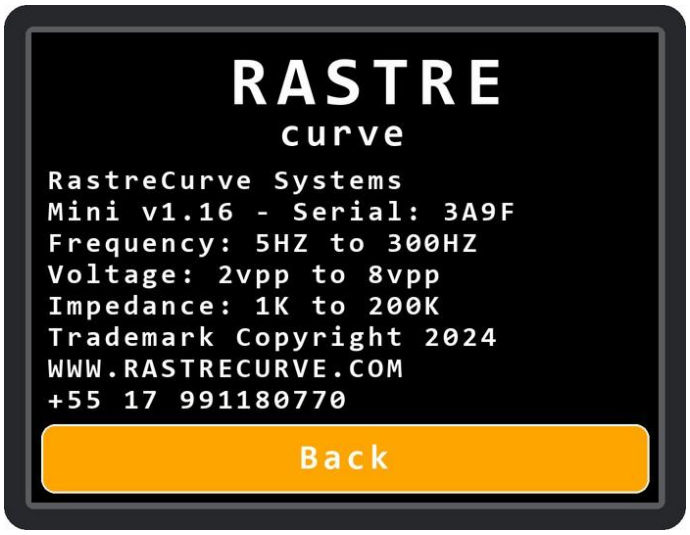


Figure 44 – About screen

Menu → Idiom lets you choose Português, English or Español at any time (the language can also be changed in Settings → 7-Ling).

14. Tips and troubleshooting

Situation	What to do
The curve is always a horizontal line	Probe without contact or GND not connected. Check the green lead, clean the point (varnish, oxidation) and confirm the jack used.
The curve is always a vertical line	Point shorted to GND – or impedance/frequency too high for the capacitors of the net. Lower Z or the frequency.
Unstable, “shaking” curve	Poor probe contact, fingers on the board or noise. Hold the probe firmly and do not touch the board. Programmable circuits may have variable curves.
Screen refreshes slowly	Normal at very low frequencies (5–10 Hz): each sweep takes 3 cycles (section 2.3).
High difference between good boards	Make sure the two points are equivalent and the setting is the same; components from different manufacturers may give a few points of difference. Adjust the tolerance P if necessary.
Nothing matches in Test Mode	Check that the GND is on the same point used during recording and that the component/pin order is the same.
“Empty Data!”	The chosen bank has no recorded curves. Choose another bank in the list or in Settings → 5-Mem.
“Without Space..”	The memory is full. Delete components you no longer use.
“Please! / Charge Me”	Battery at its limit. Connect the 12 V power supply.
No sound	Check S:ON on the 2 Channels screen or Settings → 8-Som.

TIP

Discharge the capacitors before each test and **always compare with the same setting**. These two rules prevent most false results.

15. Button quick reference

Screen	Menu	▲	▼	✓
Main menu	—	Previous item	Next item	Enter
2 Channels	Main menu	(in selection) item above / increase	(in selection) item below / decrease	Hold: select/edit F, V, Z, P, S; confirm
Multi Mode	Signal configuration	Field above / increase	Field below / decrease	Edit / confirm
Settings	Exit	Item above / increase	Item below / decrease	Edit / confirm
Curve list	Exit	Previous option	Next option	Confirm
Record Mode	Parameters	Previous pin (hold 2 s: delete pin)	Next pin	Record pin
Test Mode	Back to the list	Previous pin	Next pin	Test / confirm fault

Shortcut	Function
▲ + ▼ (2 Channels)	Freeze/release the Channel 1 curve
▲ + ▼ + ✓	Center cross on/off
▲ + ▼ (Record/Test)	Go to pin

16. Warranty and support

The RastreCurve Mini has a **3-month** warranty against manufacturing defects, counted from the invoice date. Returns only by prior agreement and within **7 days**.

Join the RastreCurve community: enter the **WhatsApp Group & Forum** at +55 17 99118-0770 – we are a family that helps each other and learns together!

Channel	Contact
Website	www.rastrecurve.com
Mini step-by-step video	youtu.be/KsVnMwLrtFA
Help center	https://rastrecurve.tawk.help
Sales	comercial@rastrecurve.com • +55 17 99118-0770
Support / WhatsApp	+55 17 99118-0770 • ricardo@rastrecurve.com
YouTube	youtube.com/@Rastrecurve
Company	RastreCurve Indústria de Equipamentos Eletrônicos Ltda – CNPJ (Brazilian company ID) 48.044.677/0001-58 – Rua Silvio Caldas, 2049, Nato Vetorasso – ZIP 15042-103 – São José do Rio Preto, SP – Brazil



Thank you for being part of this family!!!