

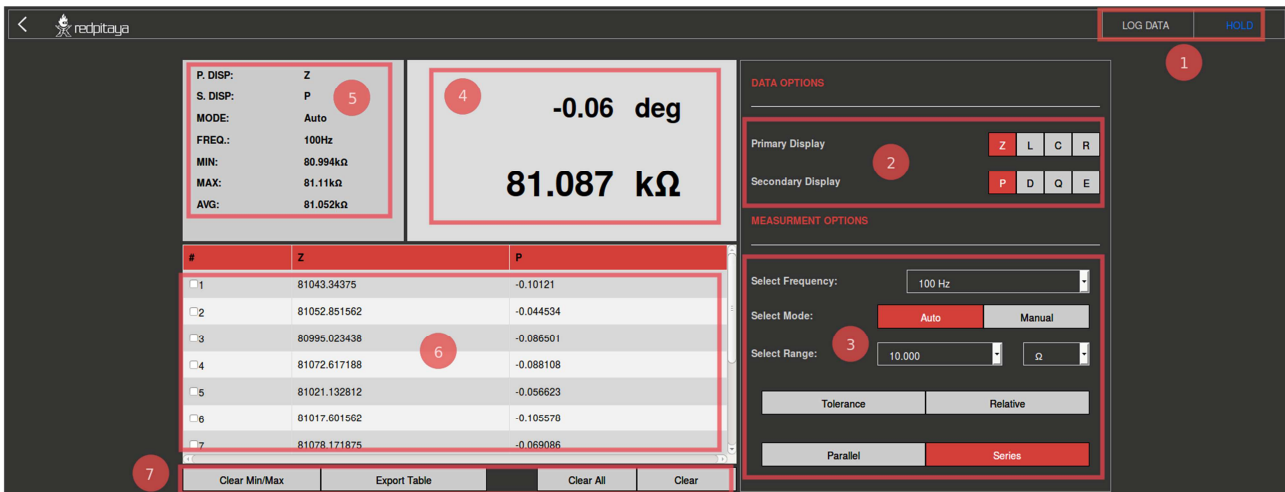
# STEMlab

## LCR meter

This application will turn your STEMLab into an affordable LCR meter. It is the perfect tool for educators, students, makers, hobbyists and professionals seeking affordable, highly functional test and measurement equipment. The Resistor, Capacitors and Inductors are basic components of all electrical circuits and working on your projects you will definitely need to measure some components laying around on your working bench. The STEMLab LCR meter will enable you to do that quickly and accurately just by switching from one application to another.

Notice: To use the LCR meter application an additional extension module is needed. All Red Pitaya applications are web-based and don't require the installation of any native software. Users can access them via a browser using their smartphone, tablet or a PC running any popular operating system (MAC, Linux, Windows, Android and iOS).

The elements on the LCR meter application are arranged logically and offer a familiar user interface similar to bench LCR meters.



The screenshot shows the LCR meter application interface with the following components:

- 1. LOG DATA / HOLD buttons:** Located in the top right corner.
- 2. DATA OPTIONS panel:** Contains 'Primary Display' (Z, L, C, R) and 'Secondary Display' (P, D, Q, E) buttons.
- 3. MEASUREMENT OPTIONS panel:** Includes 'Select Frequency' (100 Hz), 'Select Mode' (Auto, Manual), 'Select Range' (10.000, Ω), and 'Tolerance' (Parallel, Series) options.
- 4. Main window panel:** Displays the current measurement:  $-0.06 \text{ deg}$  and  $81.087 \text{ k}\Omega$ .
- 5. Parameter selection panel:** Shows 'P. DISP: Z', 'S. DISP: P', 'MODE: Auto', 'FREQ.: 100Hz', 'MIN: 80.994kΩ', 'MAX: 81.11kΩ', and 'AVG: 81.052kΩ'.
- 6. Data table:** A table with columns '#', 'Z', and 'P' containing measurement data for 7 items.
- 7. Control buttons:** 'Clear Min/Max', 'Export Table', 'Clear All', and 'Clear' buttons at the bottom.

#	Z	P
1	81043.34375	-0.10121
2	81052.851562	-0.044534
3	80995.023438	-0.086501
4	81072.617188	-0.088108
5	81021.132812	-0.056623
6	81017.601562	-0.105570
7	81078.171875	-0.069086

The graphical interface is divided into 6 main areas:

- 1. Hold/Run button:** It is used to start and stop measuring. **Log data button:** When selected, the measurements of parameters selected in the “Data options” field are logged in the table shown in area 6.
- 2. Data options panel:** It is used for selecting the desired parameter for which the measurement will be displayed on the **Main window** panel shown on area 4.
- 3. Measurement option panel:** It is used to select a measuring frequency, range mode and range value. The user can select between the Parallel and Series measuring modes as well as between the Tolerance, Relative or Normal modes (modes described in the features section)

4. **Main display:** On this panel the measurements of parameter selected in “Data option” field are shown. Where the Primary parameter is shown with a larger font and the secondary parameter with smaller one. This is a very common practice since by reading values from the display the user can automatically see the most important results.

5. **Secondary display:** On the secondary display the main settings are shown: current selected parameters, measuring frequency and range mode. Also the Min, Max and Average value of Primary parameters are shown.

6. **Logging table:** Is used to log and export measured data. Logging is started by selecting the “Log data” button.

7. **Option buttons field:** I used to manipulate with the table. The “Clear Min/Max” button will reset the Min and Max value on the Secondary display.

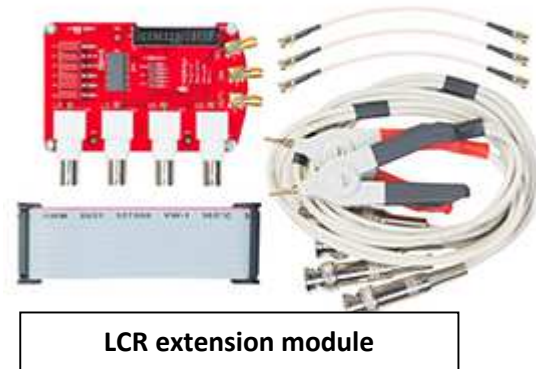
#### **- Features**

The main features of the LCR meter applications are described below:

- Measured primary parameters: Z, L, C, R  
LCR meter application will enable you to measure basic parameters of the passive electrical components: R – resistance, C – capacitance, L – inductance and Z – impedance.
- Measured secondary parameters: P, D, Q, E  
Alongside main parameters the secondary parameters are also measured and calculated. These parameters are common in describing the properties and the quality of the passive components.  
P – phase of the impedance (phase between current and voltage on measured component), D – dissipation factor (often used to quantify the quality of the capacitor), Q – quality factor (often used to quantify the quality of the inductor), ESR – equivalent series resistance
- Selectable frequencies: 100Hz, 1kHz, 10kHz, 100kHz  
LCR meter enables measurements at 4 different frequencies (100Hz, 1kHz, 10kHz, 100kHz). The user can select desired frequency and the LCR application will use sine signals with the selected frequency to measure the impedance.
- Range modes: Auto, Manual  
Since the measured values are unknown, the LCR meter will adjust the measuring range providing the best accuracy. If the user expects some value in creating ranges, then the Manual mode can be used.
- Measurements modes: Tolerance, Relative, Normal  
The “Tolerance” and “Relative” buttons are used for measuring in the Tolerance and Relative mode. When deselected, the LCR meter measures in the Normal mode.  
- Tolerance mode: the last value measured before clicking the Tolerance button is saved and used to calculate the percentage difference between the new value and the saved one.  
- Relative mode: the last value measured before clicking the Relative button is saved and used to calculate relative difference between the new value and the saved one.
- Equivalent Parameters calculation circuit: Parallel, Series  
The Parallel and Series measuring modes refer to using the Series or Parallel equivalent circuit for the parameters (R, C, L...) calculation from the measured Impedance  $\underline{Z}^*$ . LCR meters will only measure Z as the complex value  $Z=|Z|e^{jP}$  where P is the measured phase and |Z| is the impedance amplitude. All other parameters are calculated from the Series or the Parallel equivalent circuit.
- Export of measured data in .csv format
- Min, Max, Average measurements
- 1000 logging points

## What is needed to use STEMLab board as Logic Analyzer?

For using Red Pitaya STEMLab boards as LCR meter it is required to have additional HW extension module.



## Specifications:

	STEMLab 125 - 10	STEMLab 125 - 14
Measured primary parameters	Z, L, C, R	Z, L, C, R
Measured secondary parameters	P, D, Q, E	P, D, Q, E
Selectable frequencies	100Hz, 1kHz, 10kHz, 100kHz	100Hz, 1kHz, 10kHz, 100kHz
Impedance range	1 Ohm-10 MOhm	1 Ohm-10 MOhm
DC bias	0.5 V	0.5 V
Basic accuracy	5,00%	1,00%
Max input voltage	0.5Vpp	0.5Vpp
Input protection	Yes	Yes
Parameter range <b>Z</b>	1 Ohm-10 MOhm	1 Ohm-10 MOhm
Parameter range <b>Rs, Rp</b>	1 Ohm-10 MOhm	1 Ohm-10 MOhm
Parameter range <b>Ls, Lp</b>	100nH-1000 H	100nH-1000 H
Parameter range <b>Cs, Cp</b>	10pF - 100 mF	1pF - 100 mF
Parameter range <b>P</b>	+/- 180 deg	+/- 180 deg