

# VISIR REMOTE LAB USER MANUAL

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## 1. How is the user interface?

This is a concurrent lab. This means that it is possible to serve to multiple users at the same time. LabsLand system is in charge of managing all the users' connections and providing each one with the response of the lab according to the circuit under test.

Once a session in the lab is reserved, the experimentation framework is showed. It is divided in different areas:

- 1- Components area: where the components used in each practice are available.
- 2- Implementation area: where the circuits are built and the instruments are connected to test its behaviour.
- 3- Instrumentation area: where the available instruments in the lab can be set up.

These three areas are shown in the following figure.

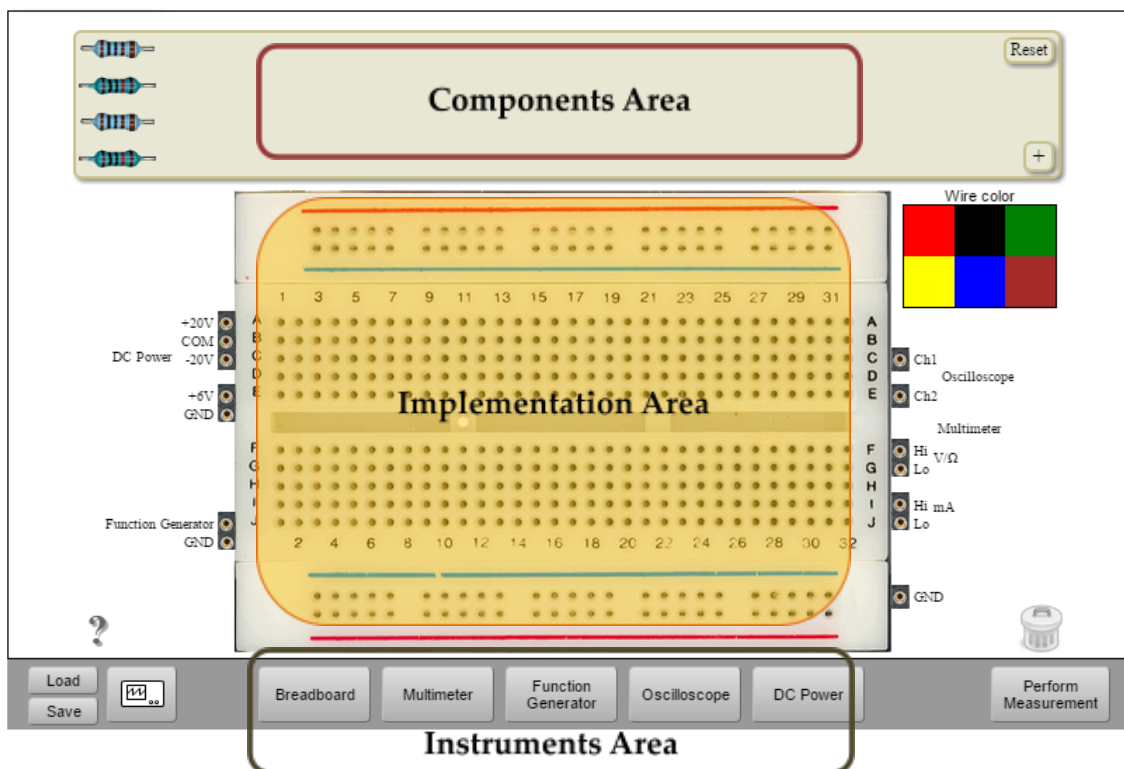



Figure 1. Analogue remote lab user interface

## 2. How components are selected

At the right side of the Components Area, the  button appears. Doing click over it, the list of available components appears. Each real component available on the lab is represented with its picture, type (resistor, capacitor, diode, etc) and value. Choose the component clicking over it and it will be added into the Components Area as it is shown at the following picture.

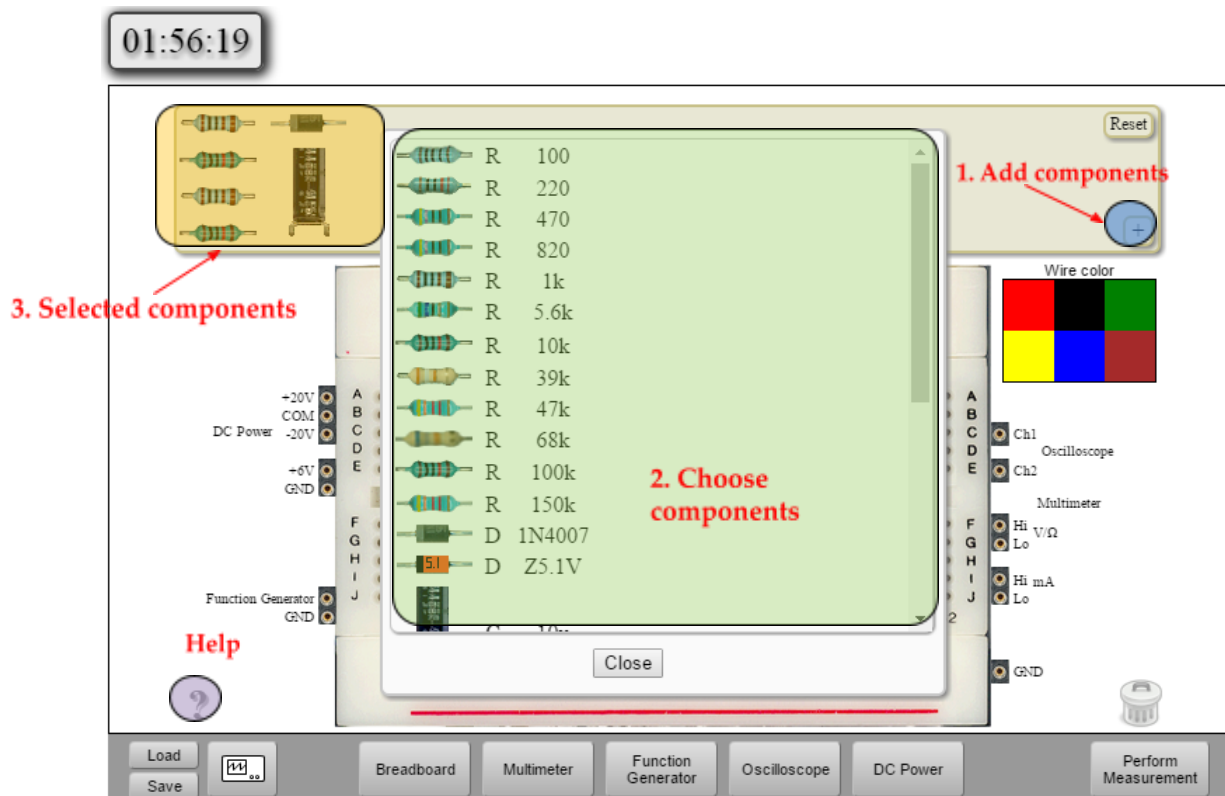


Figure 2. How components are selected

## 3. How a circuit is implemented

Once the components are selected, they can be placed at the Implemented Area to be interconnected and then, the circuit under test is built.

**Important:** as in a real protoboard, the holes in the same column are interconnected. The question symbol shows these connections.

Observe that at both sides of the protoboard, the connections of the instruments are located: power supply, function generator, oscilloscope, multimeter (DMM) and ground.

It is proposed in Figure 3 as example to follow up step by step its implementation and test.

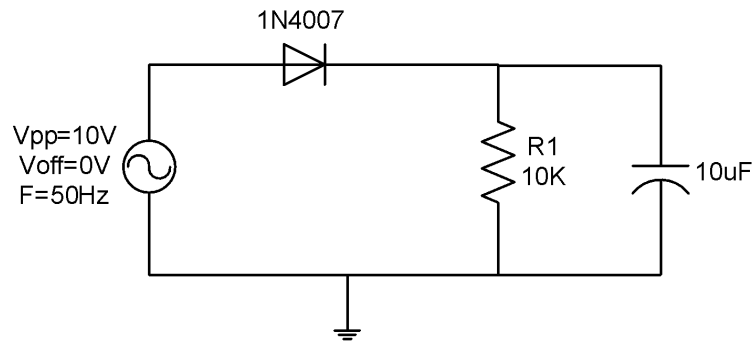


Figure 3. Circuit under test.

The required components and instruments to implement and test the circuit are:

- 1N4007 diode
- 10K $\Omega$  resistor
- 10uF capacitor
- Function Generator
- Oscilloscope

First step consists on choosing the components. If the mouse is placed over each component, its description appears in the right side of the interface.

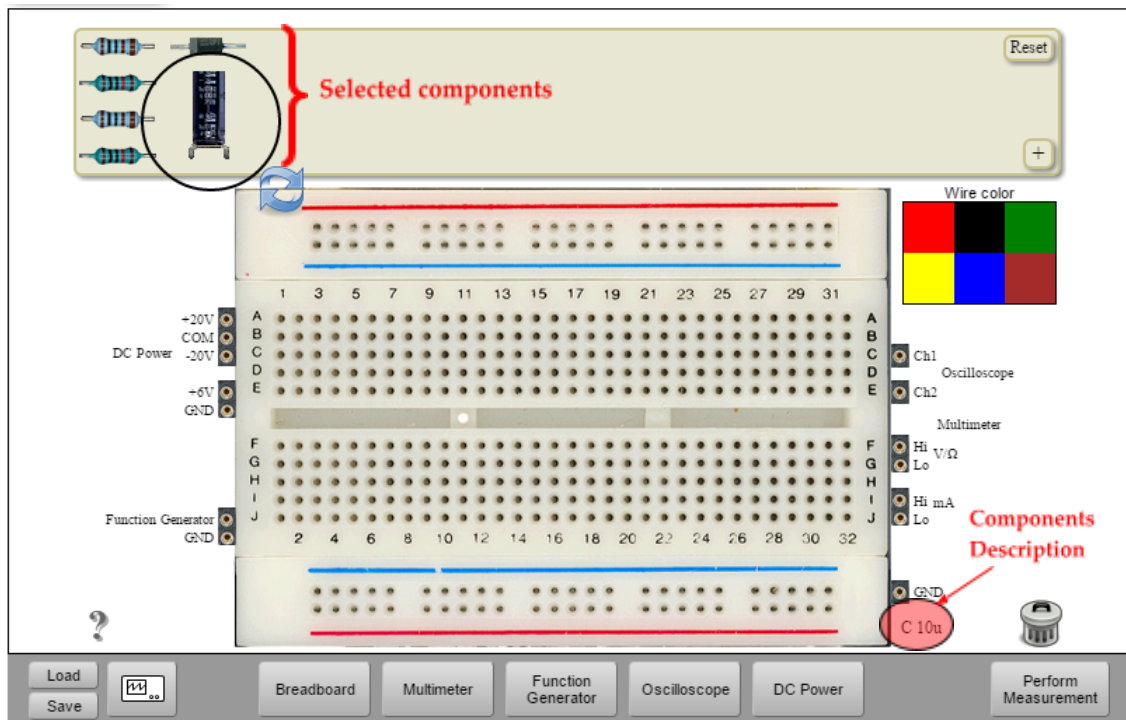




Figure 4. Selected components and description

Secondly, the components are placed at the Implementation Area to interconnect them according to the electrical schema (Figure 4). **Take into account that the holes in the same column are interconnected.**

Some components, not all of them, can be rotated. To do it, only click on the component and the symbol  will appear. With this selection, the component also can be deleted, thanks to the  icon.


On the right side of the protoboard are located the wires used to interconnect the components. Different colours can be selected. A wire can be also deleted mean the  icon.

Figure 6 shows how circuit described at Figure 4 is implemented over the protoboard at the remote lab user interface.

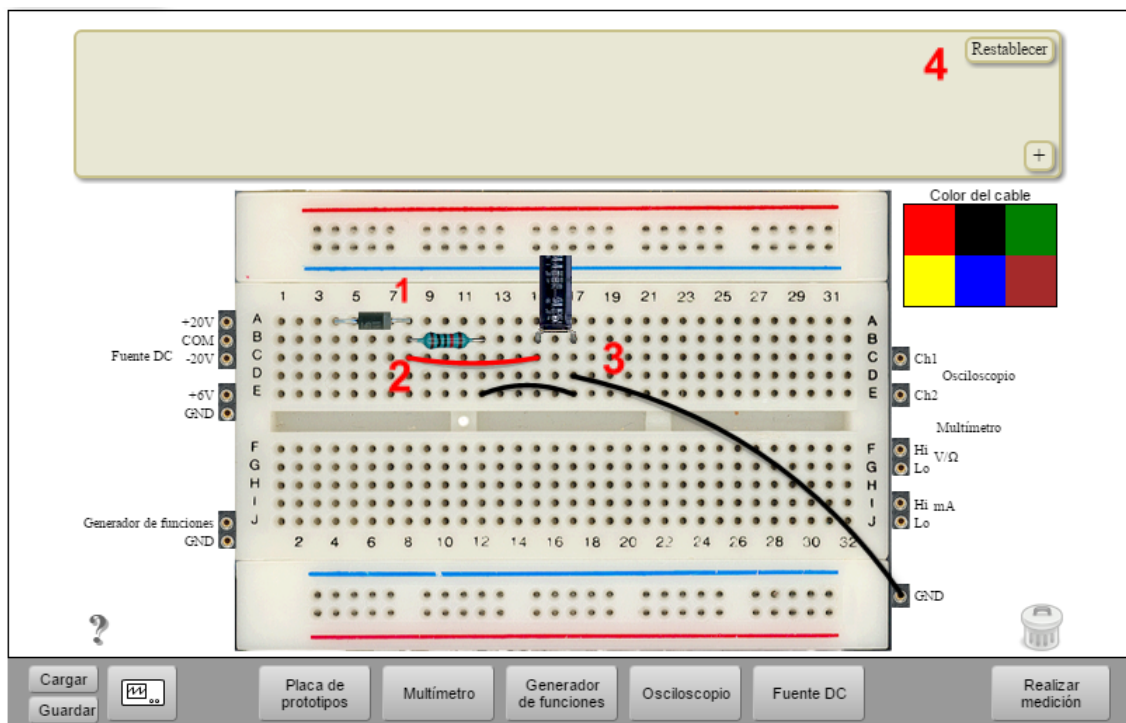


Figure 5. Half-wave rectifier

At Figure 5:

1. Diode's cathode and the resistor are connected because they are placed at the same column on the protoboard.
2. The cathode, the resistor and positive terminal of the capacitor are interconnected through the red wire.
3. The resistor and negative terminal of the capacitor are interconnected and joined to ground through the black wires.
4. If "restart" button is clicked, all the components are back on the Components Area

#### 4. How the instruments are connected.

Following the schema at Figure 3, the circuit will be tested using the function generator and the oscilloscope. Then, the function generator must be connected to the diode's anode. The oscilloscope has two channels, so each one can be

connected where the user wants. For example, channel 1 (CH1) can be connected at the circuit's input and channel 2 (CH2) at the output.

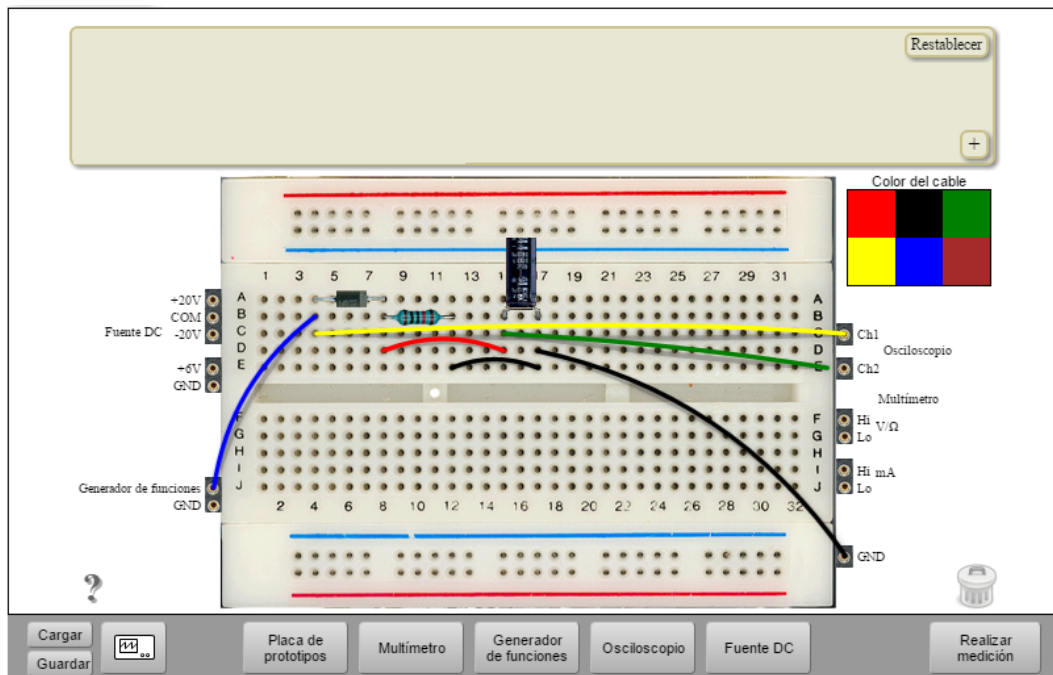


Figure 6. Connecting instruments

At Figure 6:

1. Blue wire joins the function generator and the diode's anode. Function generator's ground is not required to be connected to ground because it is the same as the GND terminal at the right side.
2. Yellow wire joins the input of the circuit with CH1 at the oscilloscope.
3. Green wire connects the output of the circuit with CH2. .

## 4.1 Setting up the function generator

To set up the function generator, click on the "Function Generator" button at Instruments Area (Figure 2). This front panel pop ups.



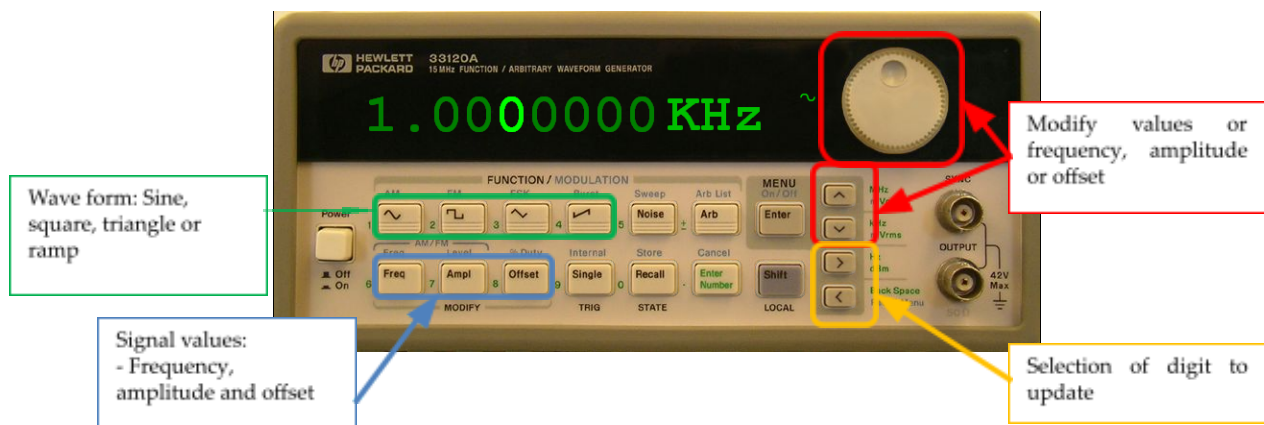



Figure 7. Function generator front panel

To modify frequency, amplitude or offset value, the appropriate digit must be selected. This digit is the green one that is blinking on the front panel (Figure 8). The digit is chosen with the right and left arrow buttons framed in yellow at Figure 8.

As example, in the circuit described at Figure 3, input signal has a frequency of 50Hz and  $10V_{pp}$ . To set up the frequency, click on **Freq** button, and then select the appropriate digit and modify it thanks to the  button or using the wheel.

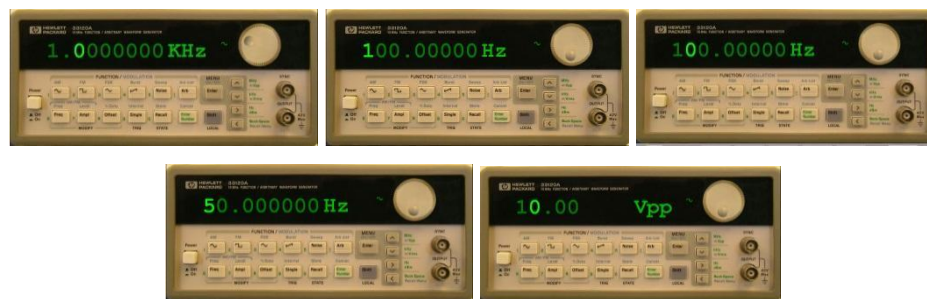


Figure 8. Function generator. Frequency and amplitude set up

To set up signal amplitude, click on **Ampl** button. Maximum allowed amplitude is  $10V_{pp}$ . Maximum offset depends on the selected  $V_{pp}$  amplitude.

**Important:** the  $V_{pp}$  generated by the function generator and the  $V_{pp}$  visualized on the oscilloscope depends on the  $Z_{out}=50\Omega$  and  $Z_{in}$  of each instruments. In this case, as the scope has a  $Z_{in}=1M\Omega$ , the voltage displayed on the screen will be two times the value setting up on the function generator.



Once the circuit has been defined and the function generator has been set up, the circuit must be executed in order to be implemented physically using the real components of the remote lab. Then, click on the “Perform Experiment” button. If the circuit has been built right, then no error message will appear and the output can be displayed on the oscilloscope.

If there is any error, the lab never specifies where the error is. The user should be able to check the circuit and fix it.

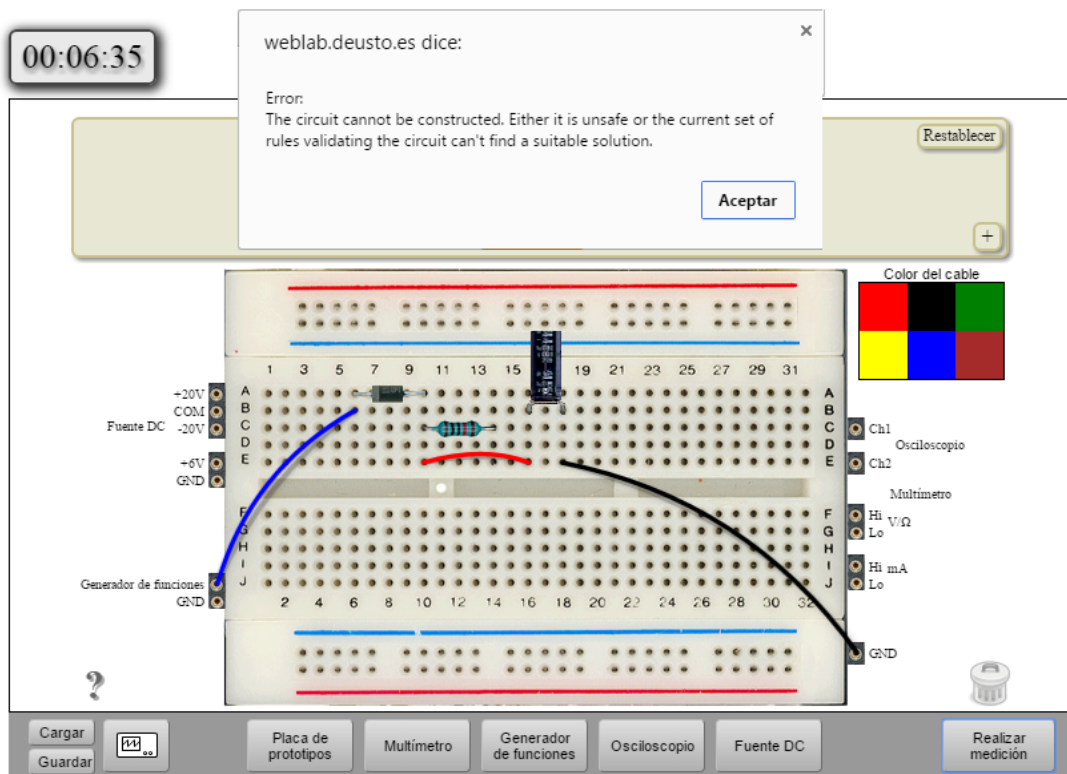


Figure 9. Error message due to a wrong circuit configuration

## 4.2 Setting up the oscilloscope

Once the circuit is correctly implemented, signals can be shown at the oscilloscope display. Click on “Scope” button at Instruments Area (Figure 2). Oscilloscope front panel as the Figure 10 is shown

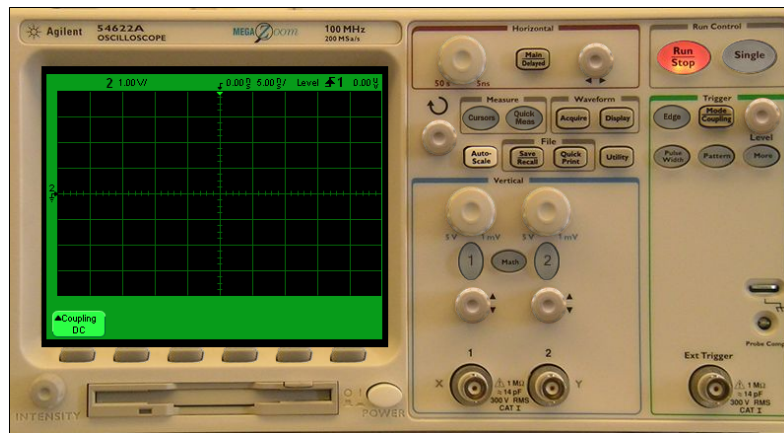


Figure 10. Oscilloscope front panel

This front panel is pretty similar to the one that can be used in a hands-on lab. Maybe it can be different but it implements all the functions that can be carried out in a real scope.

Advisedly, this oscilloscope does not implement the *AutoScale* function in order the user has to define by him/herself the correct configuration of the instrument.

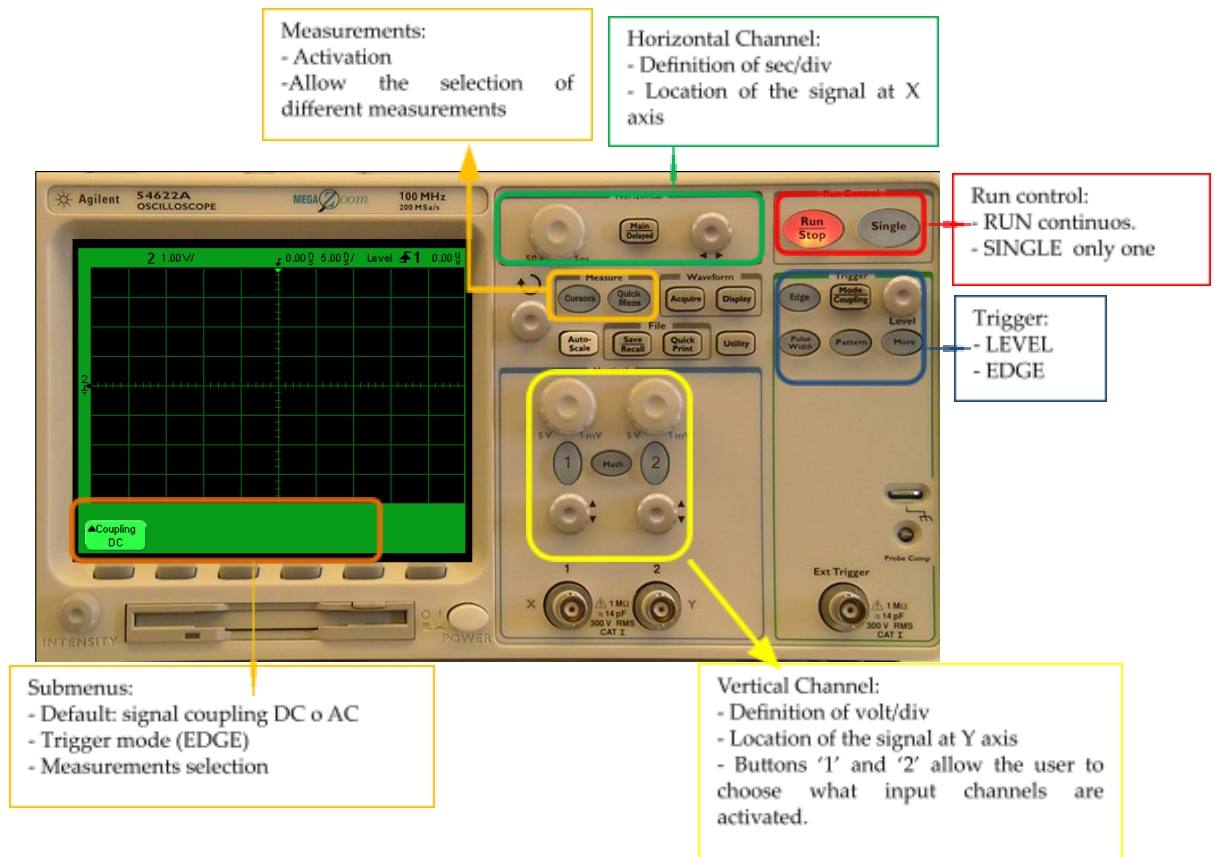


Figure 11. Main functionalities of the oscilloscope

Following the example, to display the signals on channels 1 and 2 (input and output respectively), push buttons 1 and 2. Then these buttons will be switched on and the signals will be displayed on the screen.

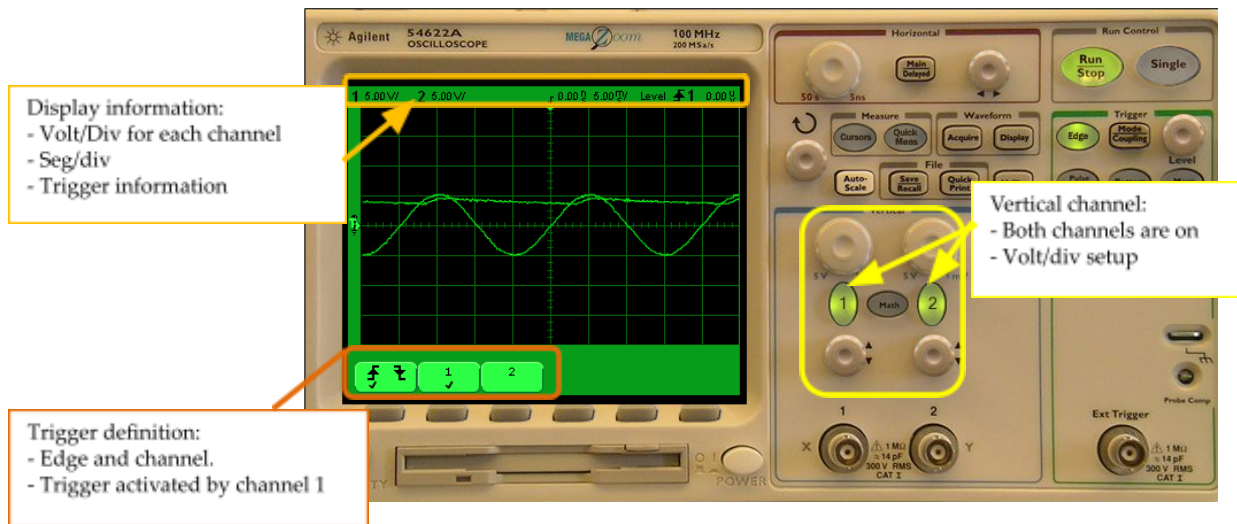


Figure 12. Signal visualization

If user only can analyse one signal, for example the input, push the button '2' and the "Quick Meas".

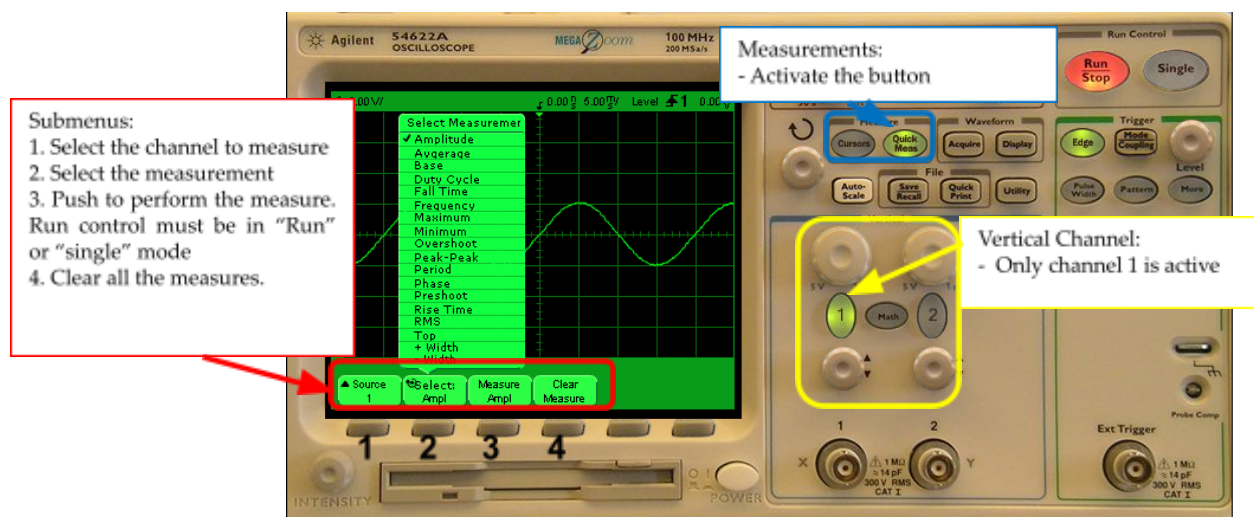


Figure 13. Performing measurements on the scope

Like in the real oscilloscopes, horizontal and vertical cursors also can be used to carry out measures over the signals. Figure 14 shows how cursors can be used means “Cursors” button.

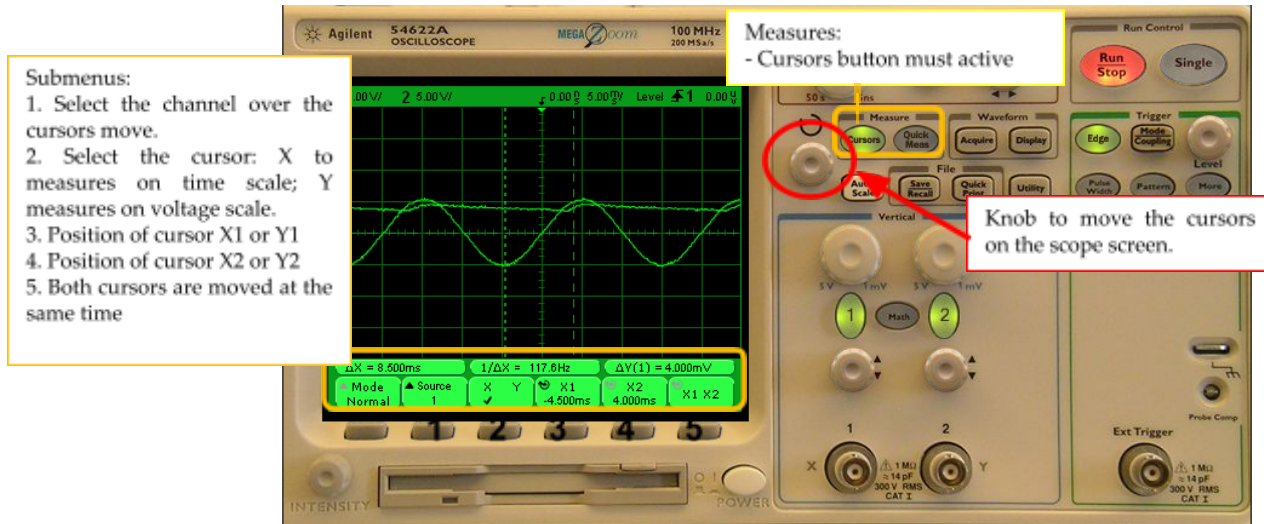


Figure 14. Using cursors on the oscilloscope

## 5. Resistors, voltages and currents measurements

### 5.1 Setting up the digital multimeter

The digital multimeter available on the remote lab is the same that is commonly used in a hands-on lab. Thanks to it, user can measure resistances, voltages and currents.

Depending on the measure to perform on the circuit, the terminals of the DMM to connect are different. Hi & Lo (V/ $\Omega$ ) terminals are used to measure voltages and resistances while Hi & Lo (mA) terminal are used to measure currents. Figure 16 shows how the DMM is connected to measure the value of a resistor.



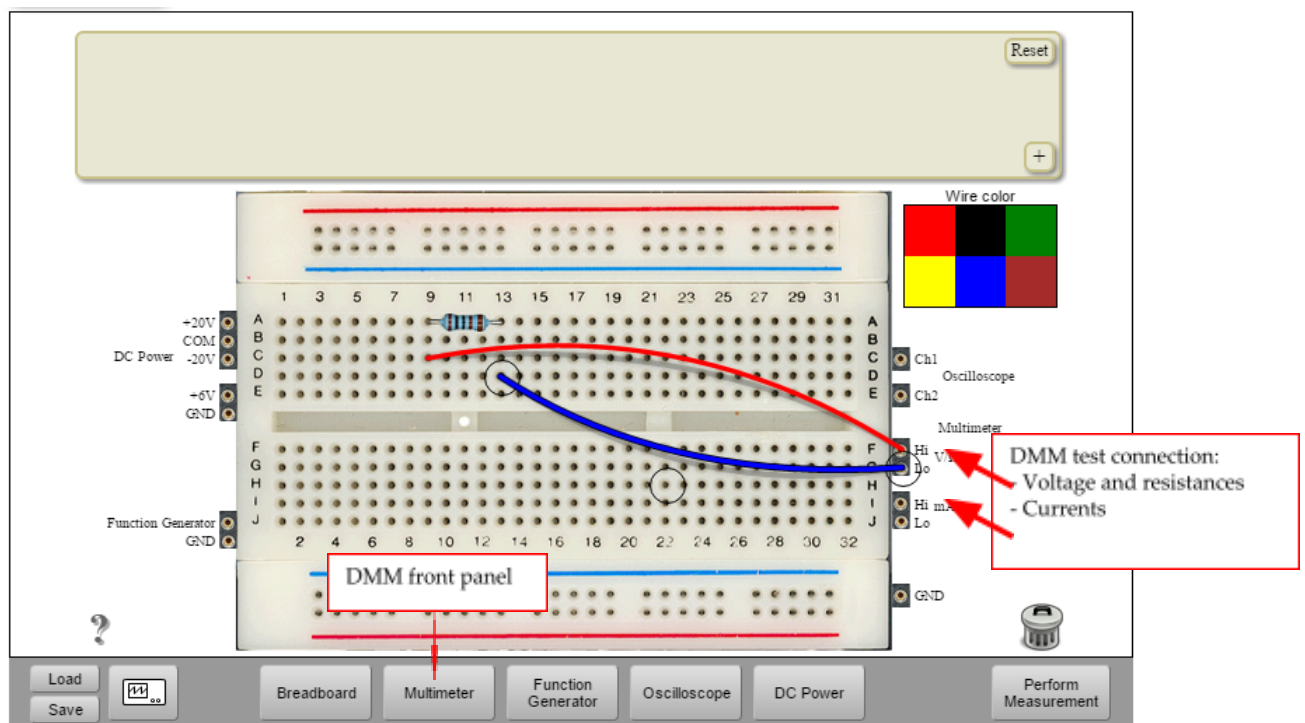


Figure 15. Digital multimeter (DMM) connection

The DMM front panel is accessed through the “*Multimeter*” button at the *Instruments Area*.

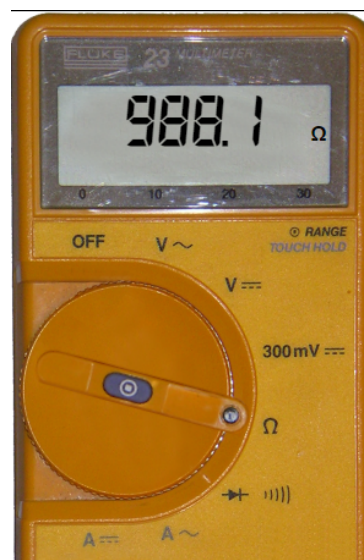


Figure 16. Digital multimeter front panel

To obtain the value of the carried out measurement, turn the central knob of the DMM and push the “*perform experiment*” button.

Current measurement is a little special because in this case the DMM must be placed on the branch where the current flows. That is, the user has to open the branch and connect there the DMM. Figure 18 shows the three branched where the DMM can be placed to measure currents.

**IMPORTANT:** due to this remote lab is implemented over real components and then, circuits are real, current measurements only can be possible before the first component in each branch.

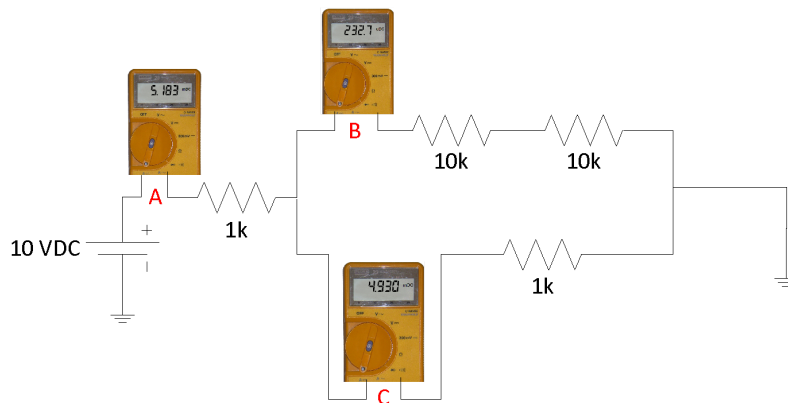


Figure 17. Example of current measurements.

Figure 18 shows an example where it is measured the current that flows over the branch where two 10k resistors are connected in serial, that is, B point at Figure 17.

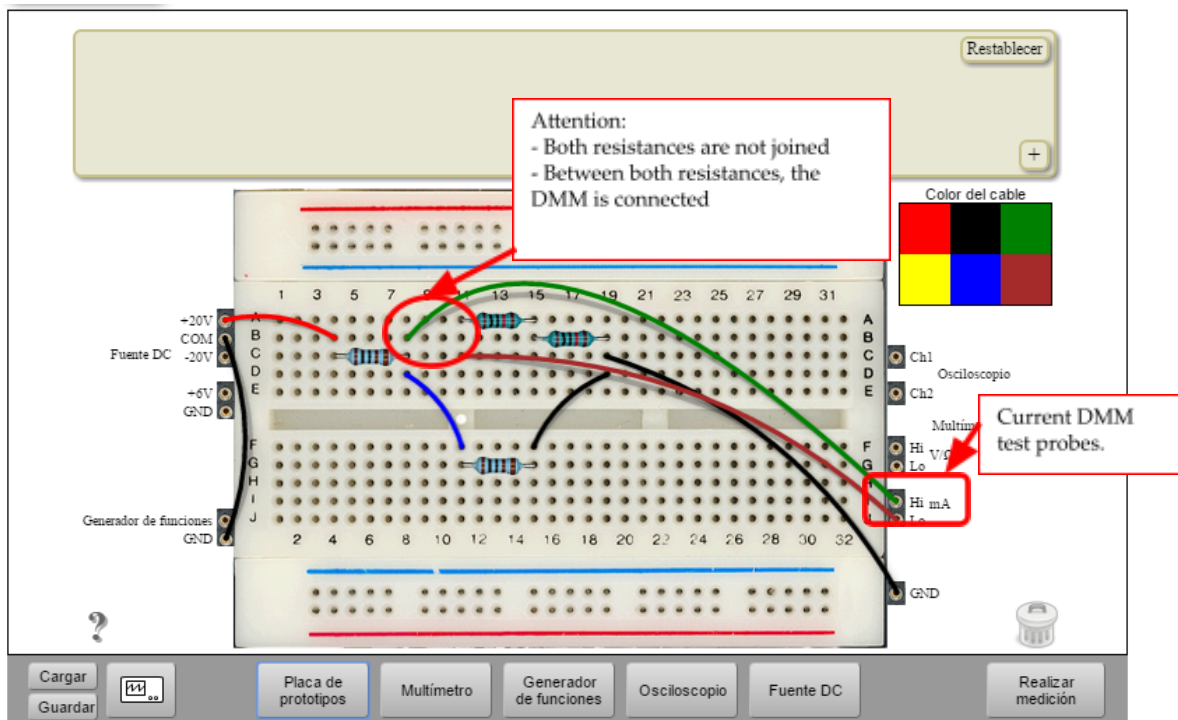


Figure 18. Current measure

## 5.2 Power Supply

Power supply front panel appears after pushing “DC Power” button at Instruments Area (Figure 1. Analogue remote lab user interface). Voltage (+6V, +25V and -25V) and current values (up to 500mA) can be setting up in this front panel (Figure 20. DC power supply front panel) following the same steps as in the Function Generator.



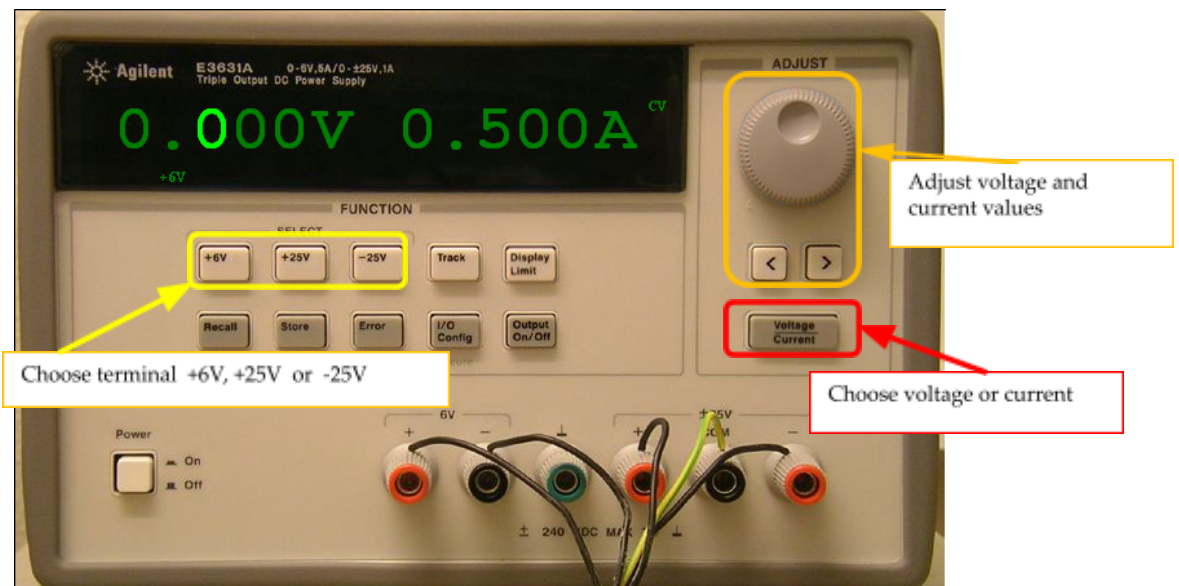


Figure 19. DC power supply front panel

## 6. FAQ

1. I place the components on the protoboard and after clicking on *"Perform Experiment"*, an error message appears.

It can appear due to different reasons: you have chosen components that are not considered in the session or they are wrong interconnected.

2. I cannot see any signal on the oscilloscope.

It can be due to: 1<sup>o</sup> you have not pushed the *"Perform experiment"* button; 2<sup>o</sup>, or you have not pushed the *"Single"* button or 3, the channel of the scope is not activated (Figure 11. Oscilloscope front panel)

3. Measuring voltages with the DMM the result is not coherent or zero.

Check that the DMM is correctly connected. Sometimes the wires are not correctly connected on holes on the protoboard. Check also that the circuit is well implemented.

4. I want to measure a current and a error message appears when I connect the DMM

Remember that to measure currents, the test probes are different and the DMM must be connected “breaking” the branch where you want to perform the measure (Figure 19. Current measure).

**5. I cannot set up the function generator with 20Vpp and an offset 5V**

Maximum amplitude of the function generator is 10Vpp. This value is related to the maximum offset allowed by the real instrument used on the lab.

**6. I want to set up 12VDC at the DC power supply and it does not allow me**

Check that you have chosen the +25VDC configuration.