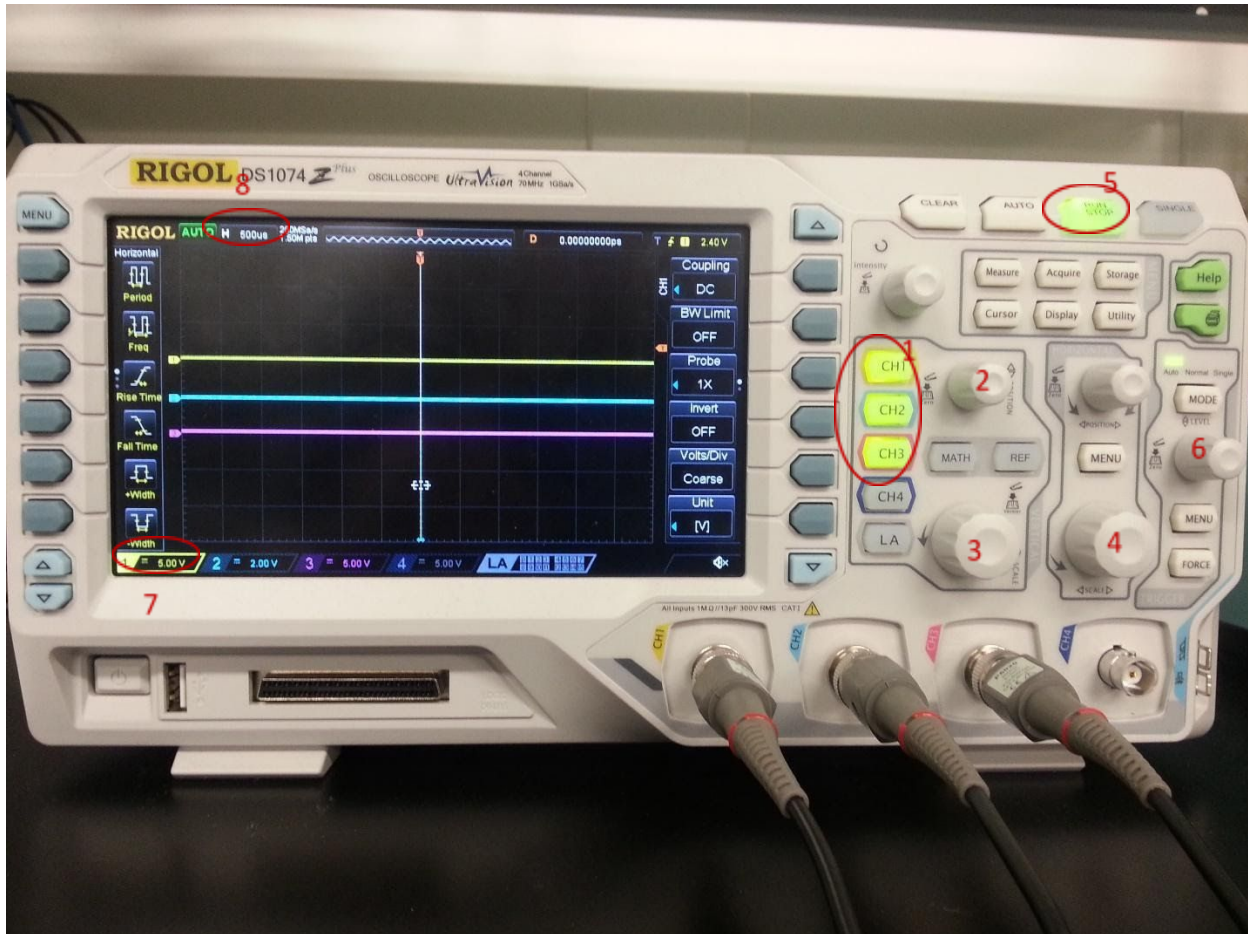# Oscilloscope

This is an oscilloscope. It is used when more detail is needed for a signal than a multimeter can supply. It is a very useful tool.

This is a scope probe. One end is a BNC connector. This connector twists to lock. The other end is a test lead, you pull back a spring loaded cover to expose a hook which can be connected to a wire. When the cover is released it will hold the wire against the hook. This test lead can generally be pulled off to reveal a bare metal contact which can be pressed against contacts. There is an alligator clip attached to the probe, this is the reference for the probe. Many probes have a 1X – 10X switch and the scope has a 1X – 10X setting. You should make sure these match otherwise your readings may be off by an order of magnitude.

A few pages of the 281 page Rigol DS1000 Series user manual are appended to this document to give you a quick overview of where the buttons are. The full user manual is available on Canvas in the Resources section.

O1 Time and Voltage Scale
Generate a signal using the ESP32 PICO OscilloSorta function generator and attach the scope probe to view the signal. Set it to generate a 3.3V sine wave signal at approximately 4000Hz.

Using a probe that is plugged into Ch1 of the scope, attach the black clip to ground and the probe tip to the signal output.   Note that the OscilloSorta cannot display this frequency, but the real oscilloscope has no troubles.   Hit the "auto" button on the upper row of buttons to automatically set the time and voltage scale for the input waveform (some description of the autosetting feature is appended to this doc). You can manually adjust scales as well.

See if the probe has a x10 switch in the handle. Move the switch and see what the signal looks like on the scope. See if you can find the option on the oscilloscope (press the CH1 button in the vertical panel and look on the onscreen menu) to indicate that your probe is in the 10X or 1X mode and see the effect of the displayed voltage.

The Oscillosorta function generator can generate much higher frequency square waves. See if the oscilloscope can view the highest frequency that the oscillosorta function generate squarewave can generate. Find the AC coupling menu option (press CH1 button in vertical panel and look on the onscreen menu) and set it so that the square wave is centered about ground. Adjust the time scale so there are between 4 and 8 cycles on the screen. Adjust the voltage scale so that the wave takes up at least half of the screen. **Take a photo of the real scope face showing the triggered signal and submit this.**

02 Single Mode
Attach a switch and pull up resistor to a +5V and ground circuit such that you can generate a rising and falling edge transition by depressing or releasing the switch. The <Single> trigger mode is one where the scope can be used to capture a single transition instead of a continuous wave form.   Put the scope into <single> mode by pressing the large <SINGLE> button in the top right corner. Capture a frame of a transition from 5V to ground that you get by pressing (or releasing) the switch circuit you just made. **Take a picture of that scope face and submit that.**

03 OscilloSorta feedback (ungraded)

Briefly describe what you feel is the most valuable thing on the oscilloscope that is missing or not as well implemented on the oscillosorta.
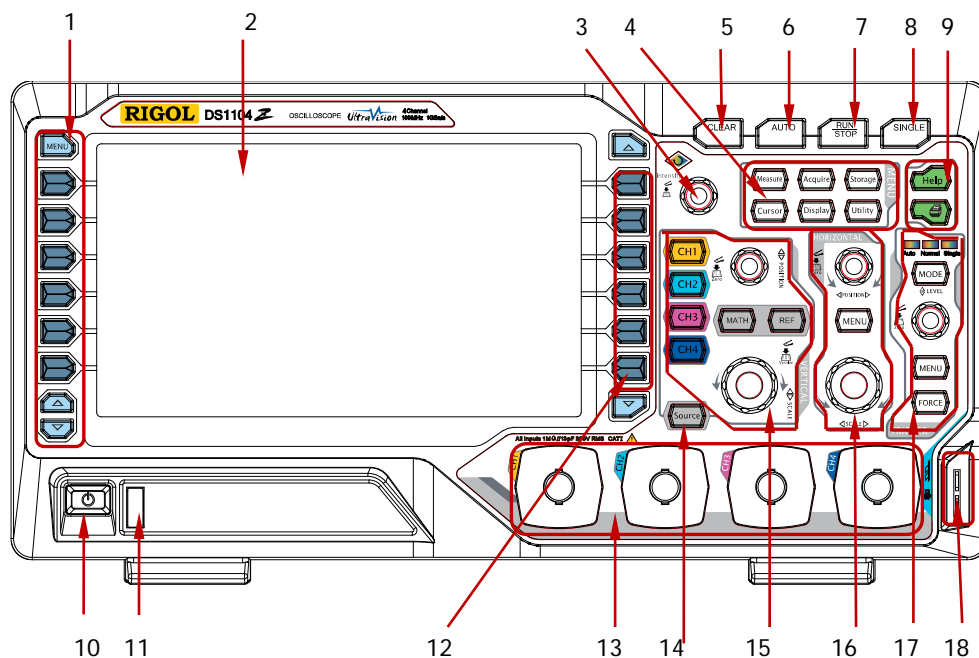
Front Panel Overview

Figure 1-10 Front Panel Overview

Table 1-1 Front Panel Description

No.	Description	No.	Description
1	Measurement Menu Softkeys	10	Power Key
2	LCD	11	USB HOST
3	Multi-function Knob	12	Function Menu Softkeys
4	Function Menu Keys	13	Analog Channel Input Area
5	CLEAR	14	Source[1]
6	AUTO	15	VERTICAL
7	RUN/STOP	16	HORIZONTAL
8	SINGLE	17	TRIGGER
9	Help&Print	18	Probe Compensation Signal Output Terminal/Ground Terminal

Note[1]: Only applicable to DS1104Z-S and DS1074Z-S.

Auto Options

As mentioned before, you can press **AUTO** at the front panel to enable the waveform autosetting function. The oscilloscope will adjust the vertical scale, horizontal scale and trigger mode automatically according to the input signal to acquire the optimum waveform display effect. This oscilloscope allows users to set the relative parameters of the waveform auto setting function.

Press **Utility** → **Auto Options** to enter the Auto setting menu and you can set the following parameters.

● Press **Lock** to lock **AUTO**, namely this key is disabled.
   Note: You can only unlock the key using remote command (:SYSTem:AUToscale 1). For the remote command, refer to the *DS1000Z Programming Guide*.

● Press **Pk.Pk** to turn on or off the peak-peak priority function. When it is turned on, the instrument displays the peak-peak value using the optimum scale. This function is especially useful when you are observing the varying part of the signal with offset.

● Press **CH** to select the channel for the AUTO operation. You can select "OPENed" (channels currently turned on. If no channel is currently turned on, the AUTO operation will be performed on all the channels automatically) or "ALL". The default is "ALL".

● Press **Menu Hold** to turn on or off the menu hold function. When it is turned on, the menu as shown in Figure 6-2 will not be displayed after the AUTO operation, namely the current menu remains unchanged.

● Press **Overlay** to turn on or off the overlay display function. When it is turned on and signals are connected to multiple channels, the channels will be displayed on the screen in overlay mode and each channel occupies 8 grids of vertical range. At this point, it is easier to get stable trigger as the amplitude resolution is low. When the function is turned off, the channels will be displayed on the screen separately and each channel occupies 2 grids of vertical range; at this point, the trigger might not be stable for the amplitude resolution is high.

● Press **Coupling** to turn on or off the coupling hold function. When it is turned on, the coupling setting of the channel in which signal is detected will be held. That is, if the channel is set to DC coupling, the DC coupling will be held after signal is detected in the channel; if the channel is set to AC coupling, the AC coupling will be held after signal is detected in the channel; if the channel is set to GND, DC

coupling will be used by default. When this function is turned off, DC coupling will be used by default when signal is signal is detected in the channel.

Key Lock

Press **Utility** → **KeyLock**→ **Lock** and all the softkeys and buttons (except **Unlock**) are locked. Pressing **Unlock** can unlock the keys.