

RIGOL DS4024 OSCILLOSCOPE

STUDENT INNOVATION CENTER
ROOM 2222

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VERSION 1.0

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OVERVIEW

The purpose of this document is to provide standard operating procedures for the use of the Rigol DS4024 Oscilloscope in room 2222 of the Student Innovation Center.

Prior to engaging in hands-on training and operation, these required training modules MUST be completed:

- Shop Safety Fundamentals
- Fire Safety and Fire Extinguisher Training
- Hazard Communication Training (aka Worker Right to Know)
- Portable Power Tool Safety

HEALTH & SAFETY INFO

Chemical Vapors: Heating of solder can generate toxic vapors and vapors with high volatile organic compounds (VOCs).

Hot Surfaces: Circuits and soldering equipment generate heat. Such surfaces must be guarded and labeling must warn users of the hazards.

Mechanical Hazards: Moving parts must be guarded to prevent accidental contact. Guards must never be bypassed.

Electrical: Contact with energized parts can lead to injury or even death. Before each use, inspect for any damaged wiring and safeguards. Do not use if problems are found. Ensure the oscilloscope is properly grounded and plugged directly into an outlet.

HAZARD CONTROL MEASURES AND REQUIRED PPE

REQUIRED PPE:

- Safety glasses
- Closed toed shoes

Hazard Control Measures:

- Always use the grounding strap when operating equipment
- No food/drink
- Electric shock can be dangerous and possibly deadly! If you are unfamiliar with the electricity requirements of your project, ask a shop staff for assistance

FIRST AID PROCEDURES

BURNS: Minor burns are typically small, red, have swelling, and can blister. Cool burns with cold water and continue until the pain lessens. After cooling, cover with a dry, sterile bandage or clean dressing. Consult a physician as needed.

CUTS/SCRAPES: Minor cuts and scrapes usually stop bleeding on their own. If needed, apply gentle pressure with a clean bandage or cloth and elevate the wound until bleeding stops. Clean the wound and apply bandages. Consult a physician as needed.

PINCH/CRUSH: Consult a physician as needed.

INHALATION: Ensure there is proper ventilation prior to use. If needed, stop the procedure and move to a well ventilated area. Consult a physician as needed.

EYES: Immediately irrigate the eyes at an eyewash station for at least 15 minutes. Hold the eyelids away from the eyeball, moving eye in all directions to wash thoroughly behind the eyelids. Consult a physician as needed.

All accidents and injuries occurring at work or in the course of employment must be reported to the employee's supervisor as soon as possible (even if no medical attention is required).

<http://www.ehs.iastate.edu/occupational/accidents-injuries>

WASTE DISPOSAL

If you have left over parts/materials that are still useable, you may donate them to the shop for other users.

Dispose of any un-useable left over wires, components, solder drips, etc. into the waste bin.

SPILL/CLEAN UP PROCEDURES

If using solder, do not touch solder drips for 30 seconds to allow solder to cool. After 30 seconds, wipe off surface(s) and dispose of in the waste bins.

OPERATIONS GUIDE

PLEASE NOTE: This guide is meant to cover the basic operations of creating measurements using the oscilloscope.

For a more detailed description of the front panel features, please refer to the Appendix.

Additionally, there are many features and functions available that are beyond the scope of this guide and it is recommended to read the manufacturers manual for a full detailed description of all features, functions, and operations.

If you need help, please ask the shop staff!

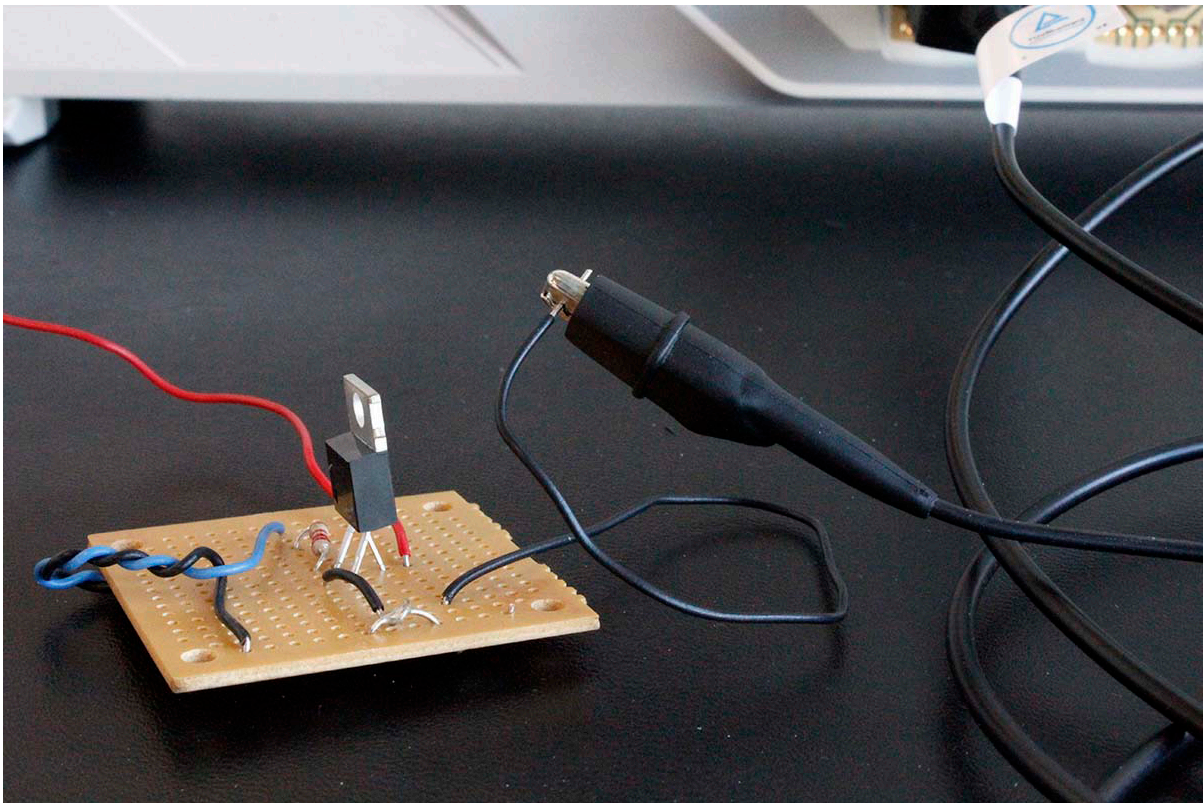
1. Turn on the power to the oscilloscope and wait for it to initialize



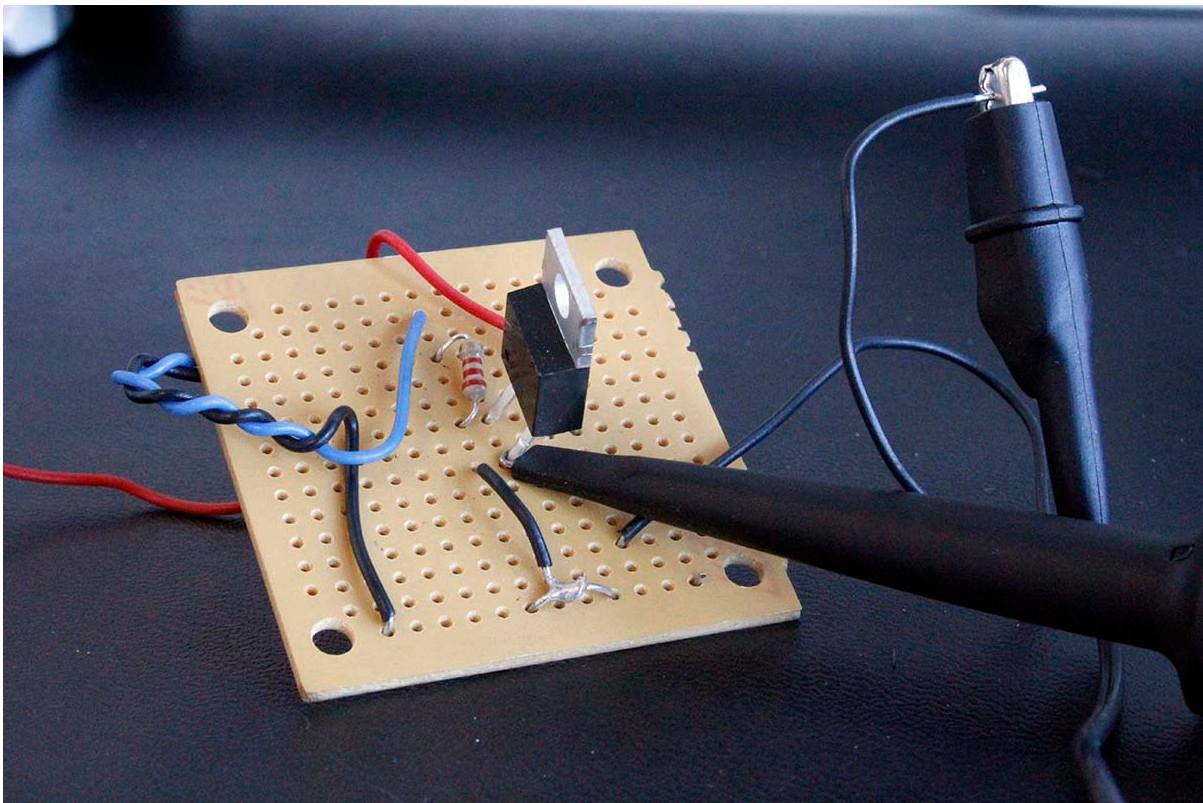
2. Attach the probe to the BNC terminal of the oscilloscope



3. Connect the probe's ground clip to ground in the circuit



4. Connect the probe's measuring clip to the point within your circuit you wish to measure

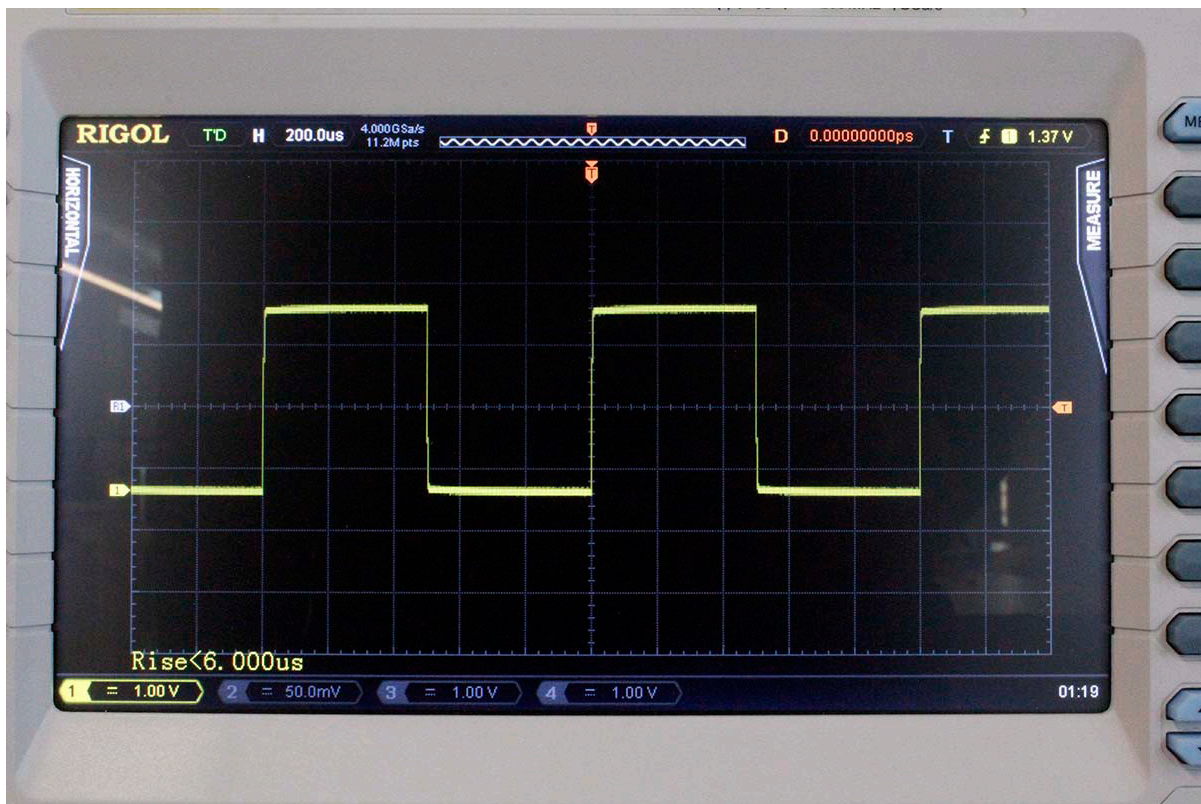


5. Press the “Auto” button on the front panel.

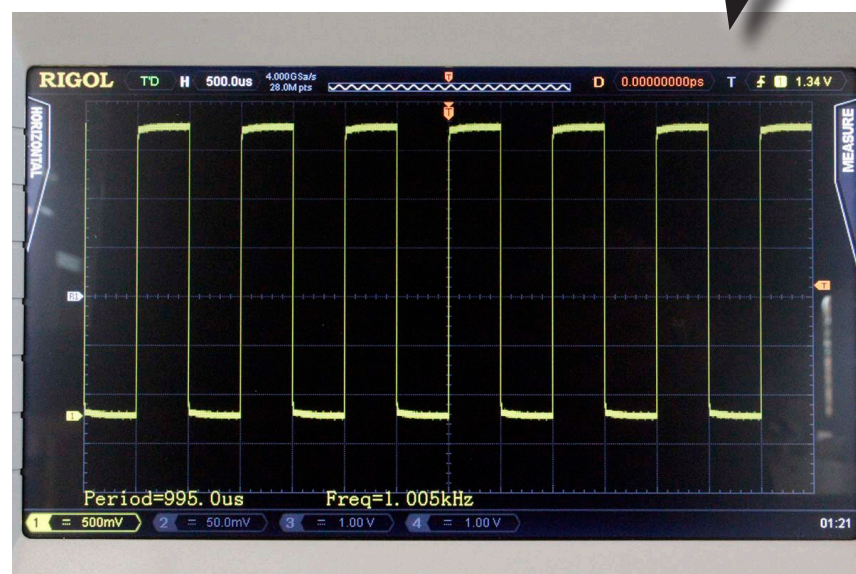
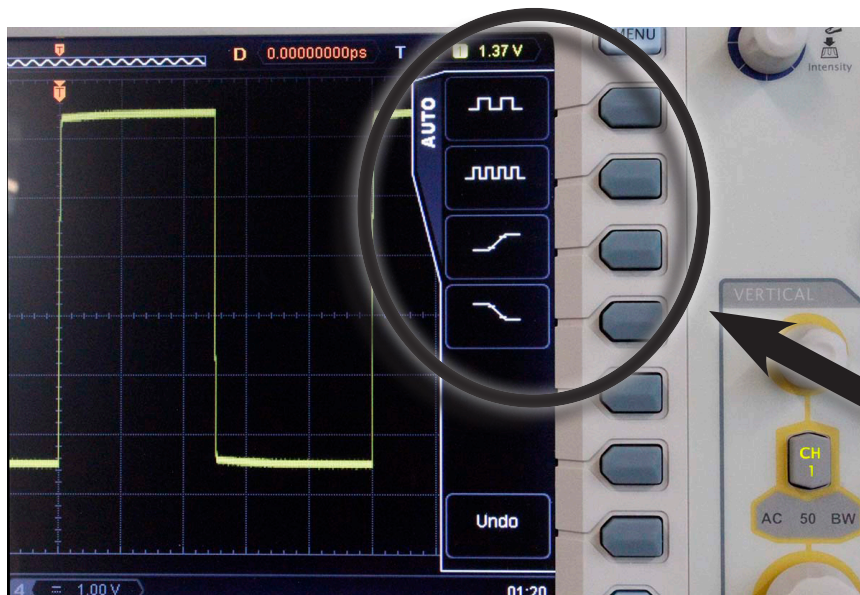
NOTE: The waveform auto setting function requires that the frequency of sine should be no lower than 20 Hz. If the parameter exceeds this limit, the waveform auto setting function might be invalid.



6. You should see your waveform on the screen



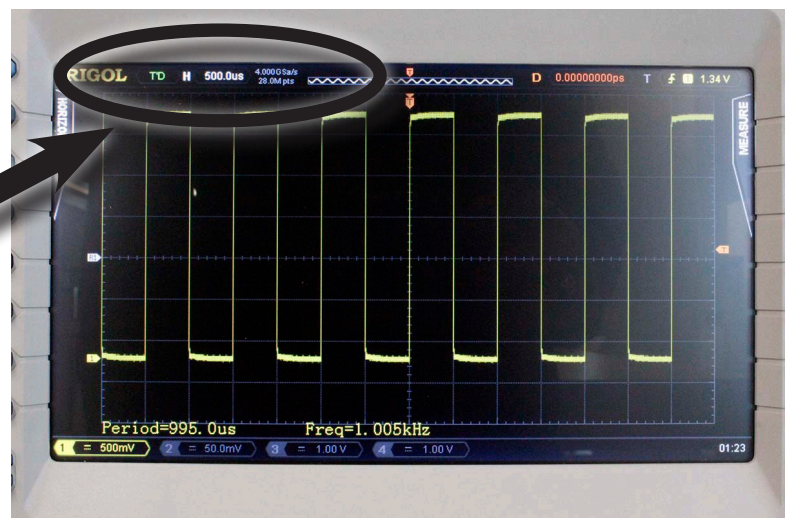
7. On the right side of the screen you will see 4 options: period, frequency, leading edge, and trailing edge. These are common parameters used to analyze your signal. Pressing one of the corresponding soft keys allows you to take a closer look at that element of your waveform.



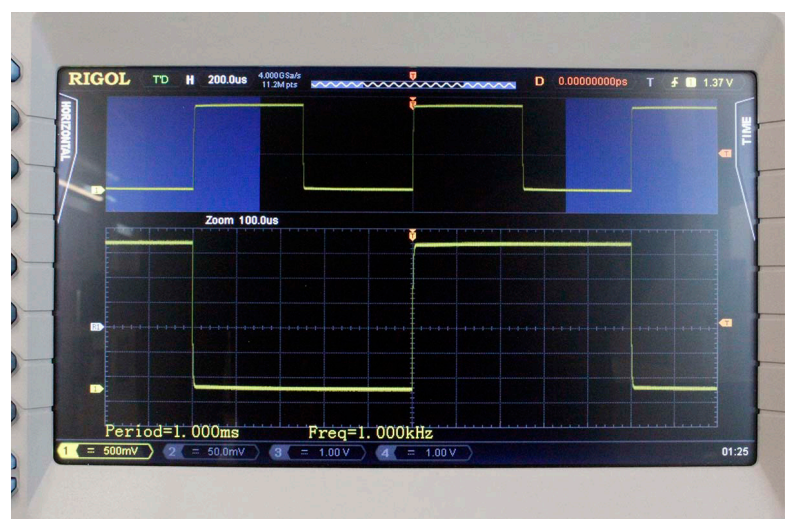
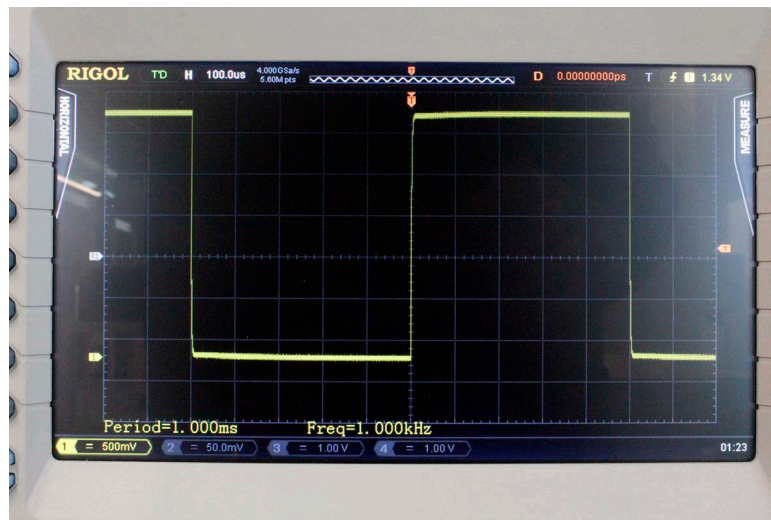
8. If you press one of the 4 softkeys and want to return back to the original screen/menu, press the “Auto” button once again



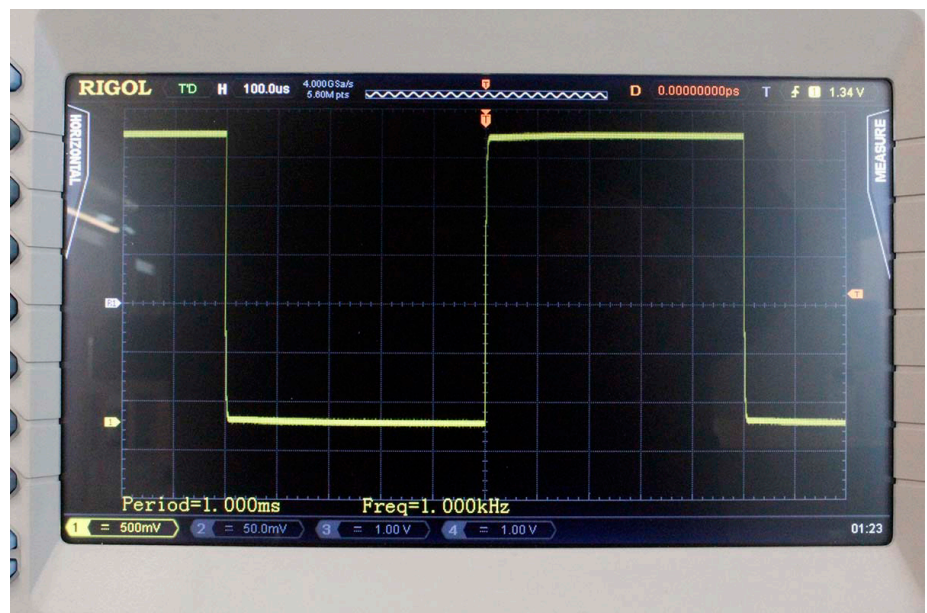
9. You can adjust the Horizontal scale by turning the horizontal scale dial. (The grid units are displayed in the upper left of the screen)



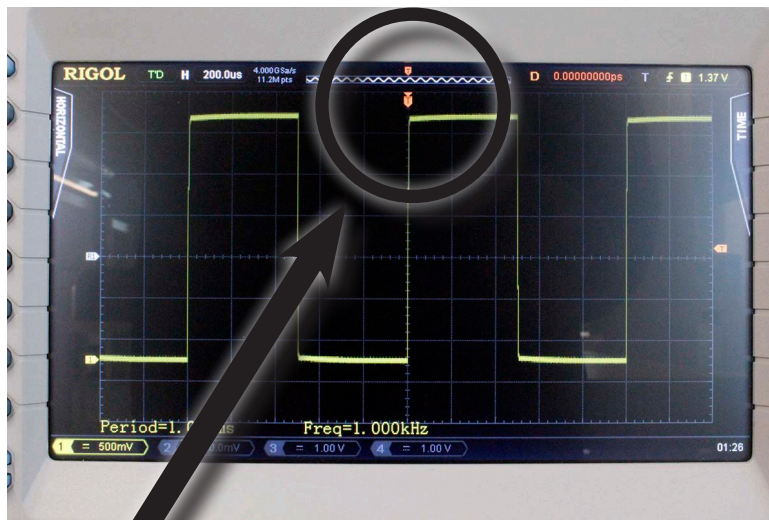
10. You can zoom into the horizontal view by pressing the dial.



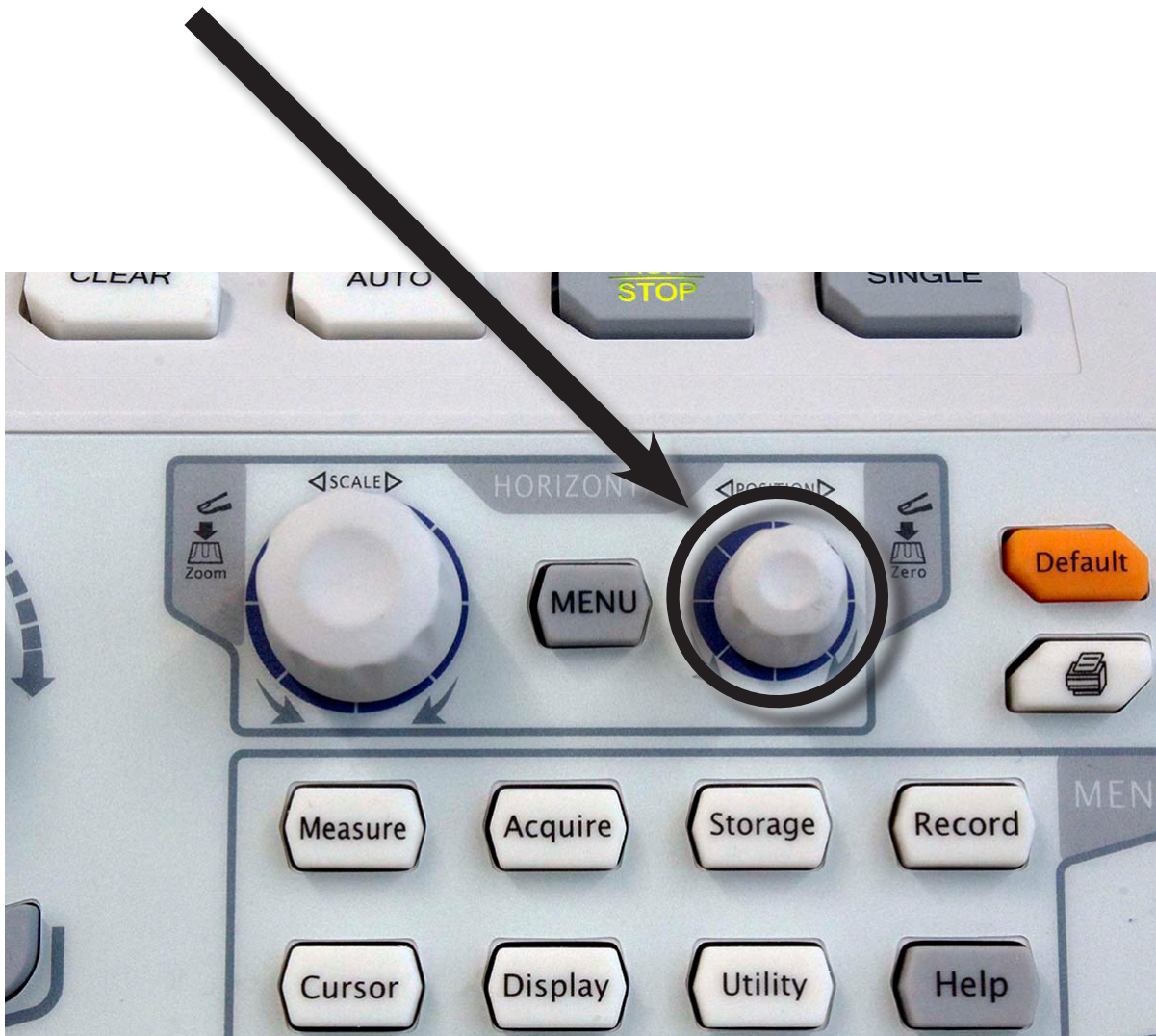
11. To return to the default view, press the scale button again



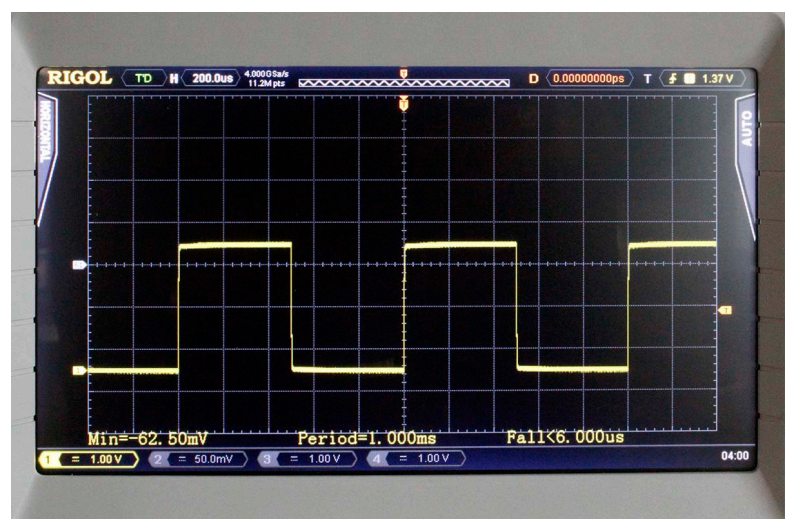
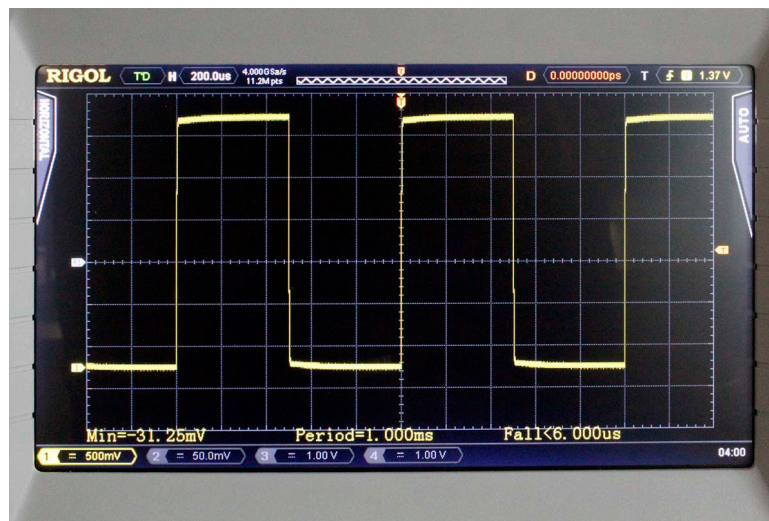
12. You can change the horizontal position by rotating the horizontal position dial. (Note the green arrow move as you rotate)



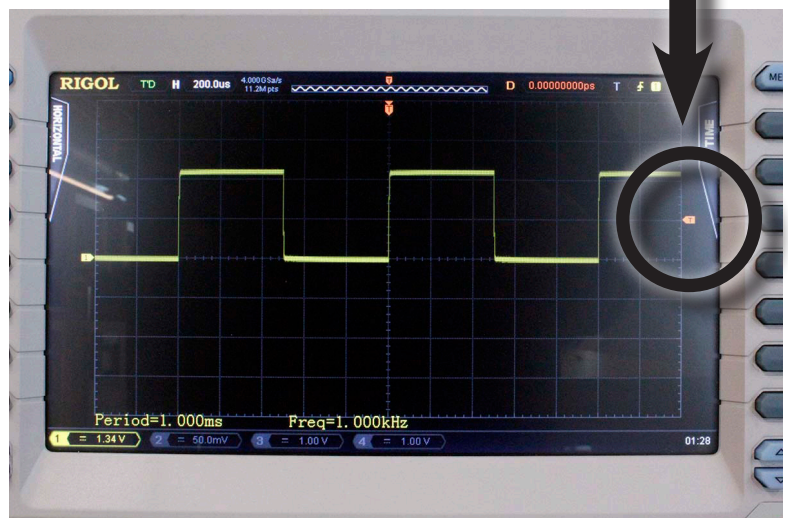
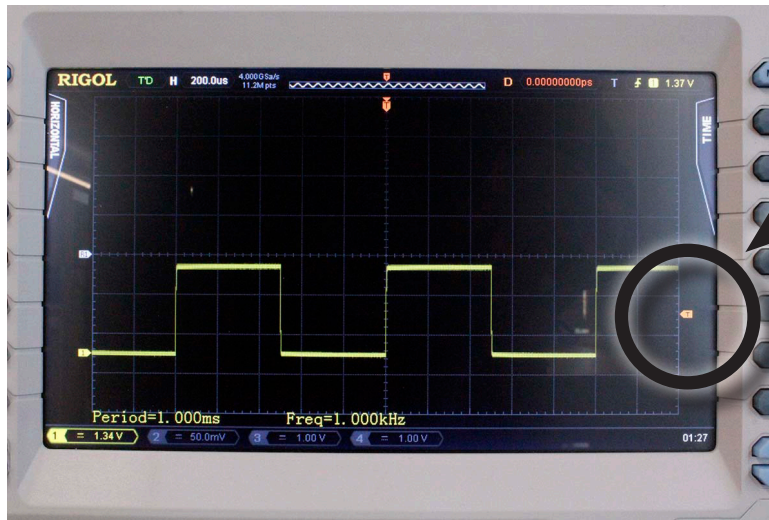
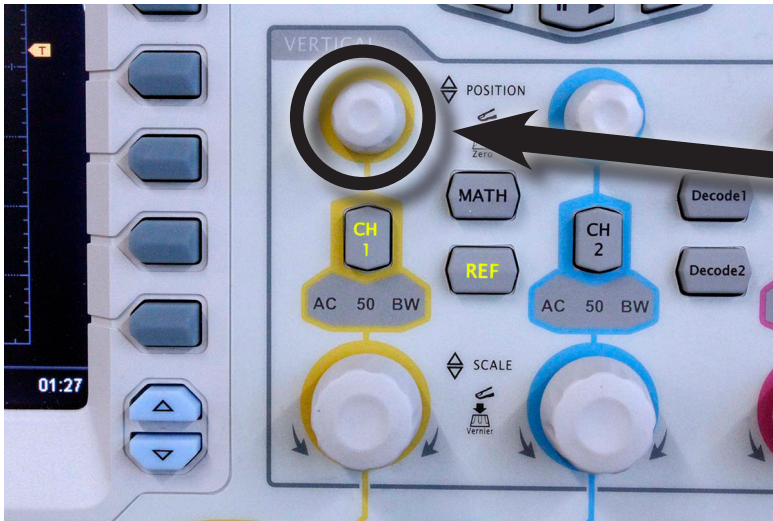
13. To return to the original position, press the horizontal position button



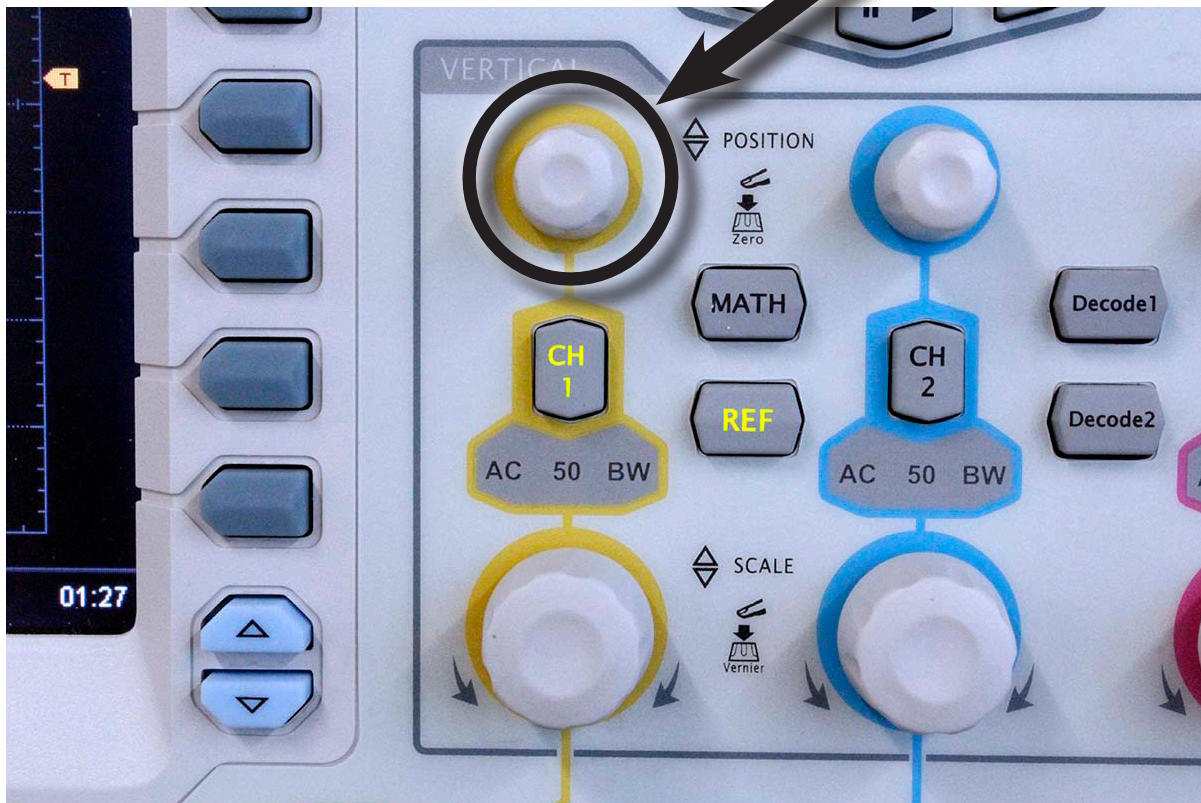
14. To change the vertical scale, rotate the vertical scale dial. (The grid units are displayed in the lower right part of the screen). To toggle between Coarse and Fine, press the Scale button



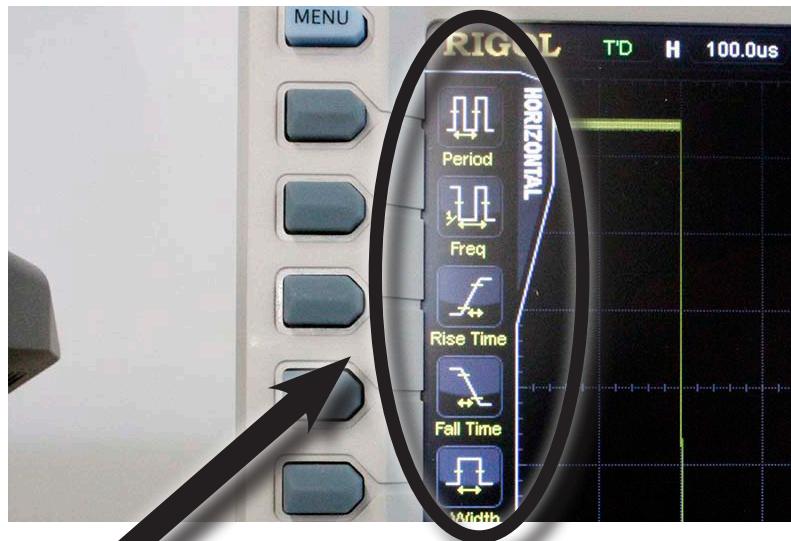
15. To change the vertical position, rotate the vertical position dial. (Note the green arrow move as you rotate)



16. To return to the default vertical position, press the vertical position button



17. To display specific information about key waveform aspects, press the "Menu" button on the top left of the front panel. (Press the "Menu" button to toggle between vertical and horizontal.)



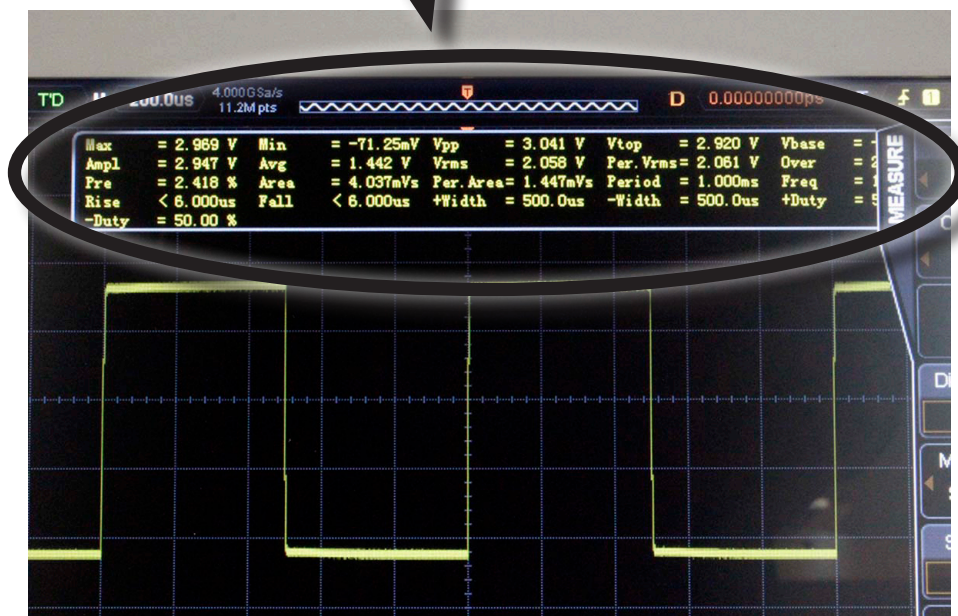
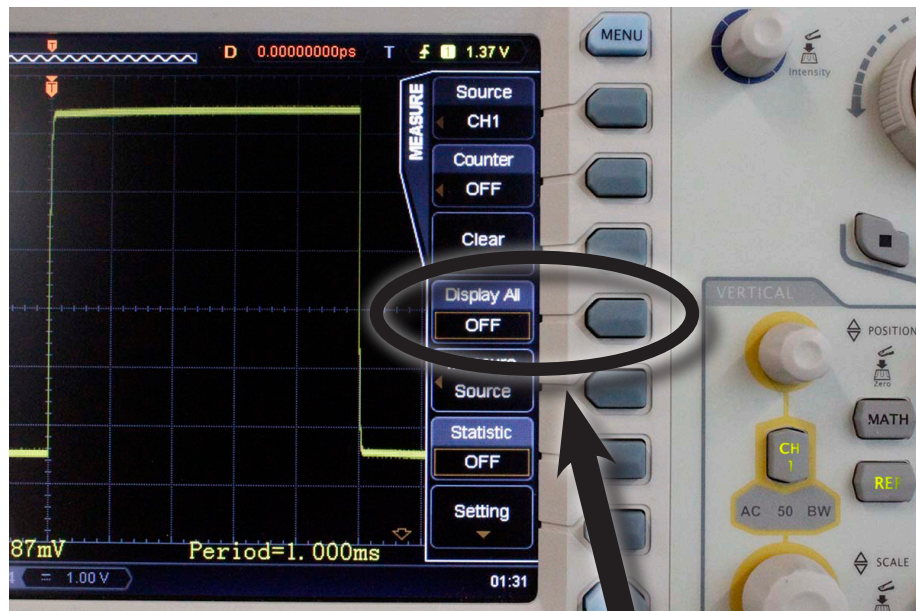
18. To select a specific feature, press the associated soft key. These features will appear in the lower part of the screen and show the 3 most recent selections



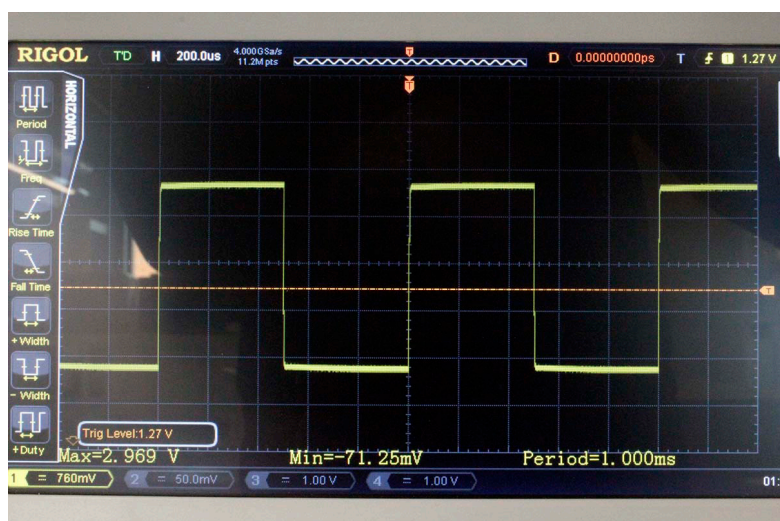
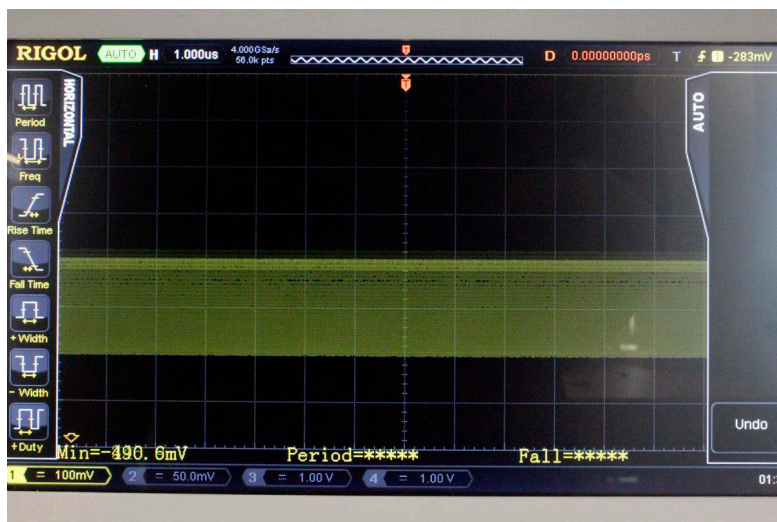
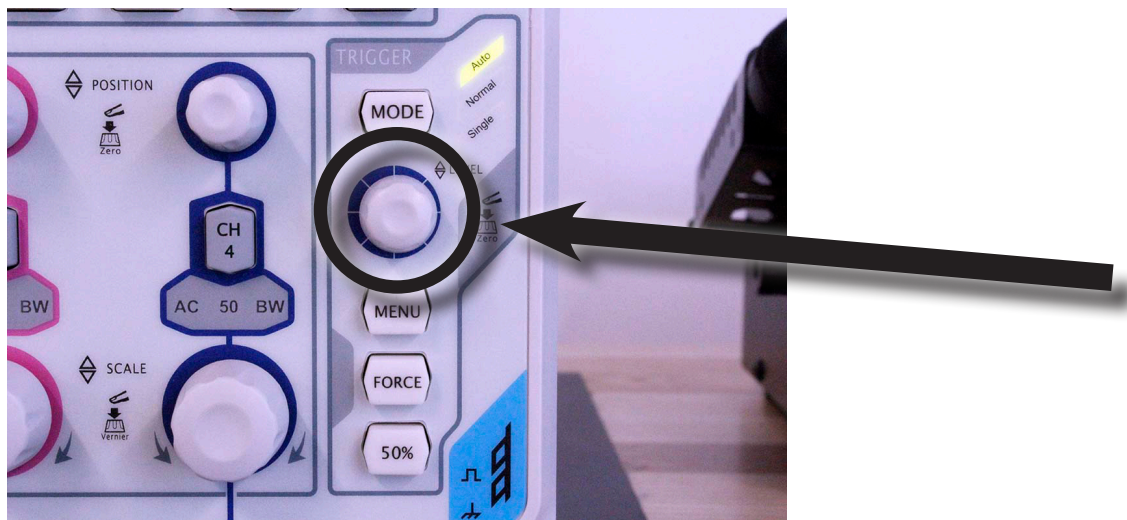
19. To display all information about your waveform, press the “Measure” button on the front panel



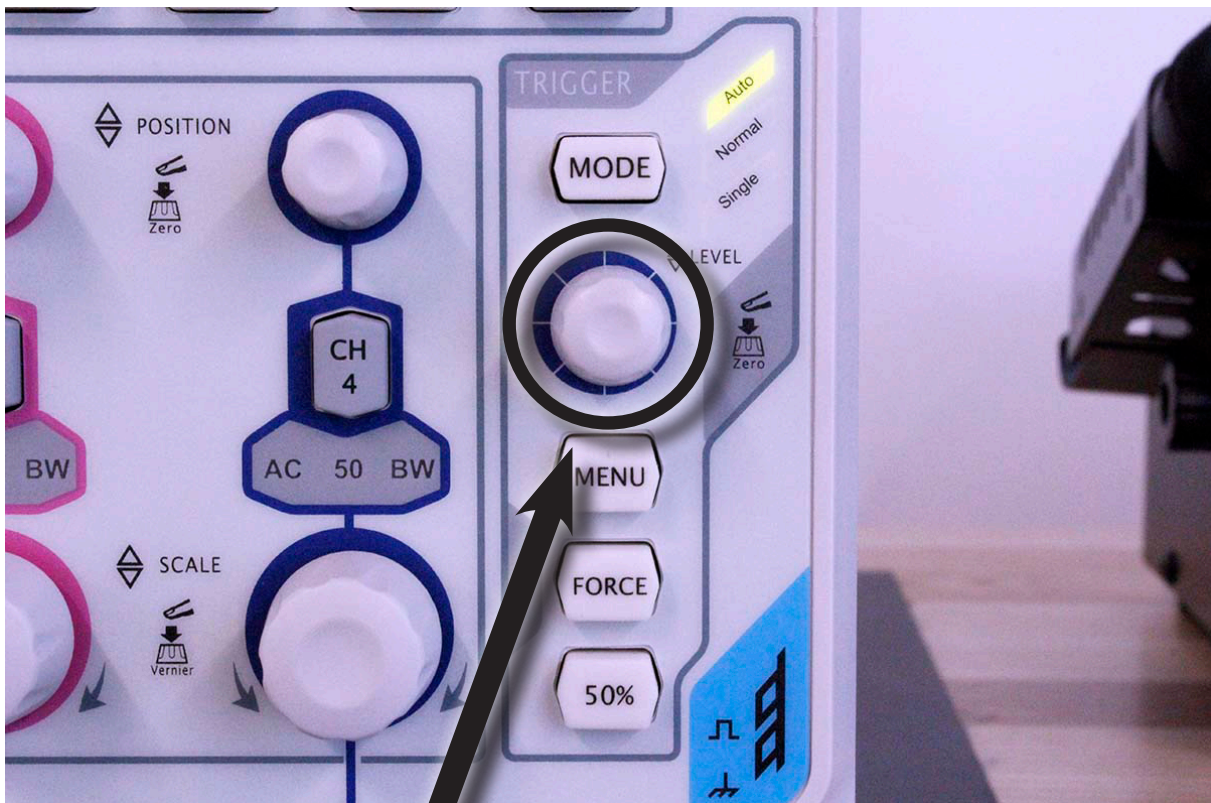
20. Press the "Display All" soft key



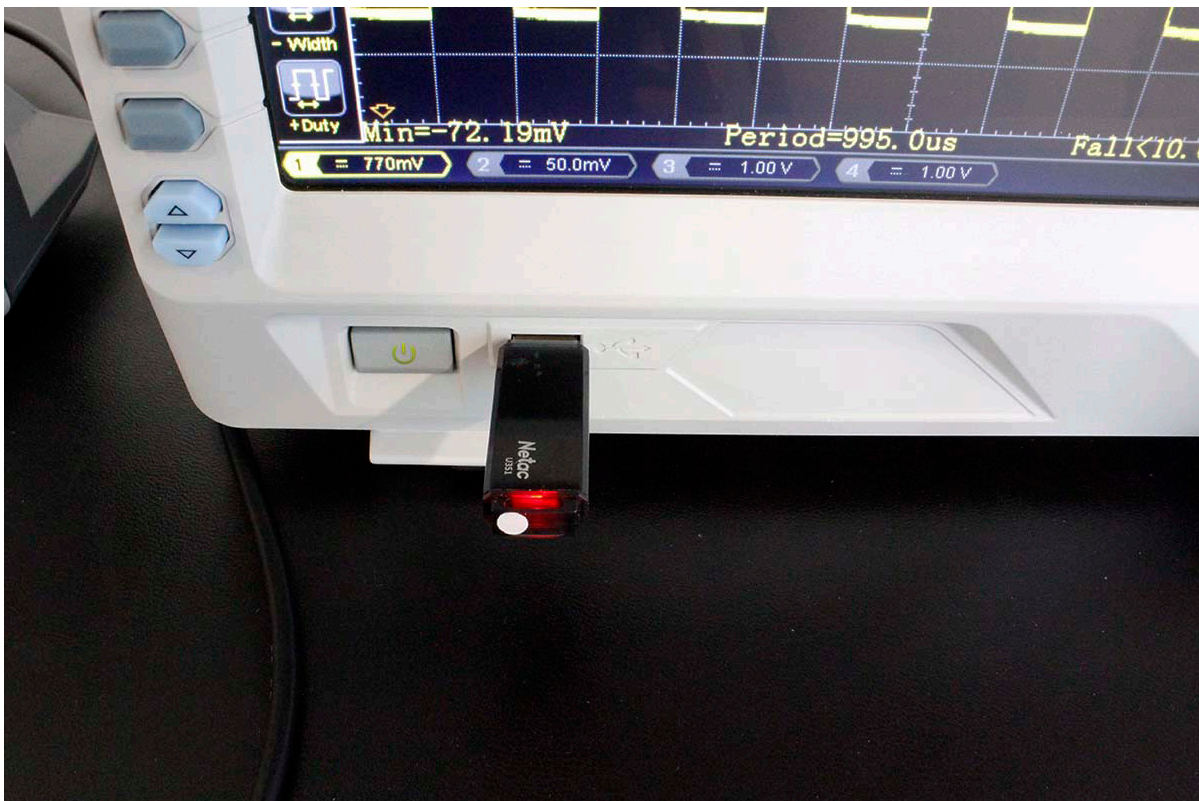
21. The trigger is set to "auto" by default. You can adjust the trigger level by rotating the trigger dial



22. Return to the original trigger level by pressing the trigger dial button



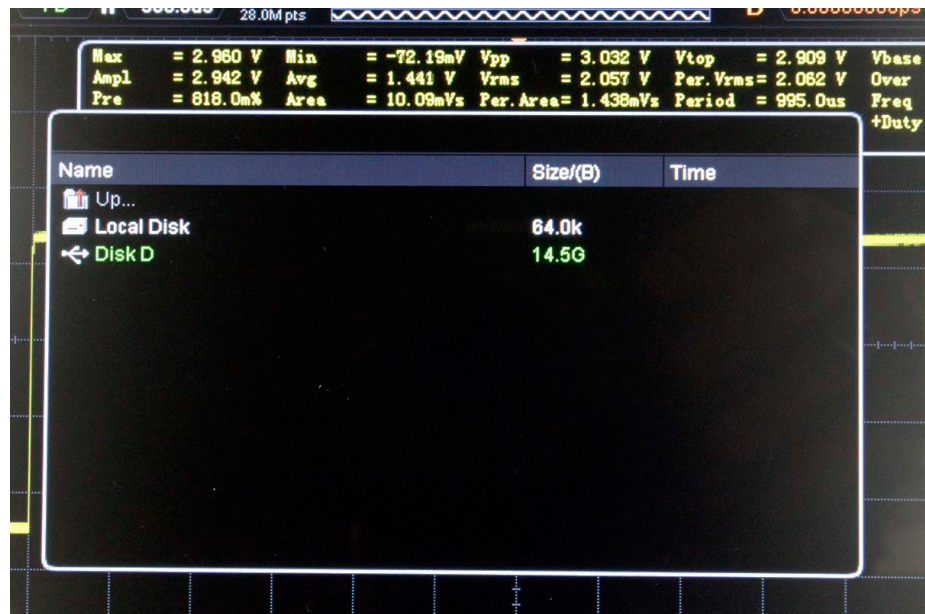
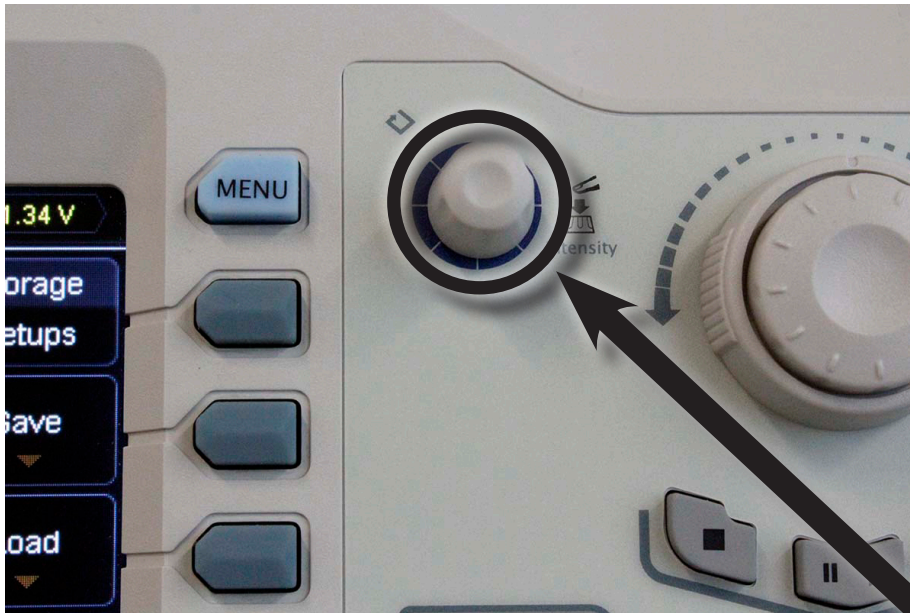
253. To store a screen shot, insert a USB drive into the port on the front panel



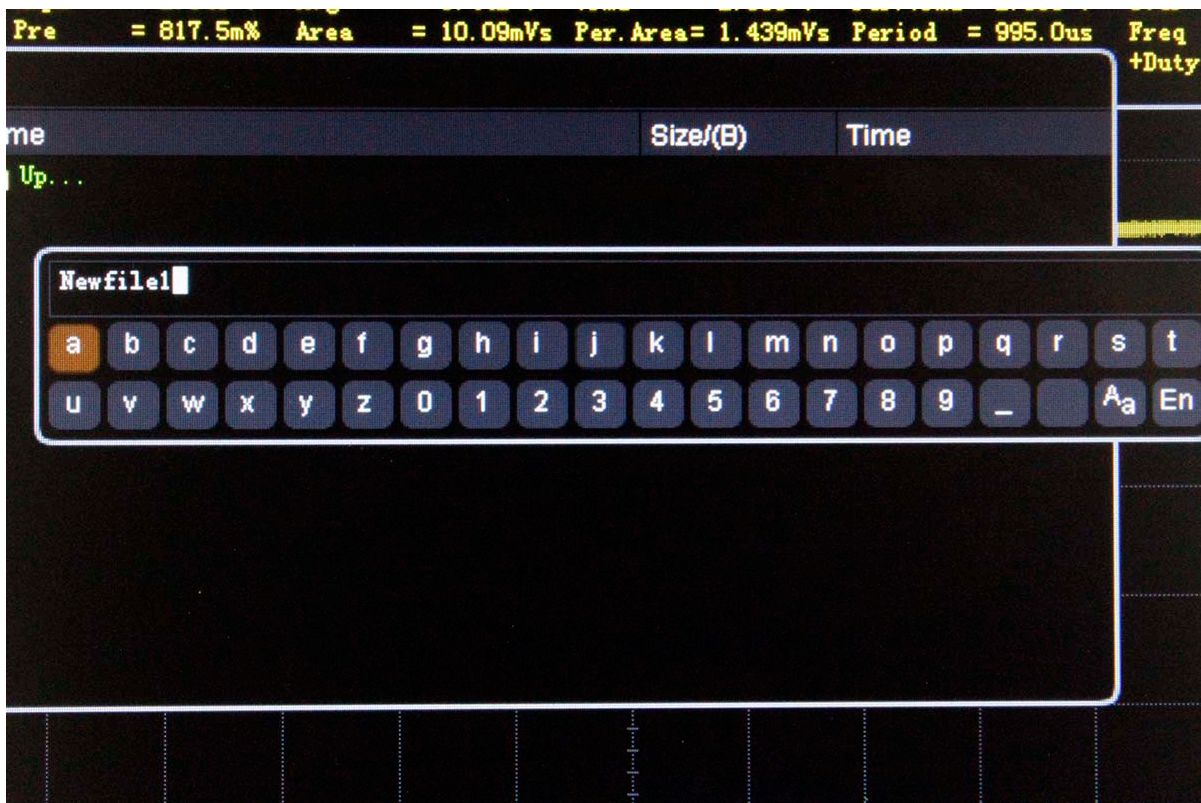
24. Press the "Storage" button on the front panel



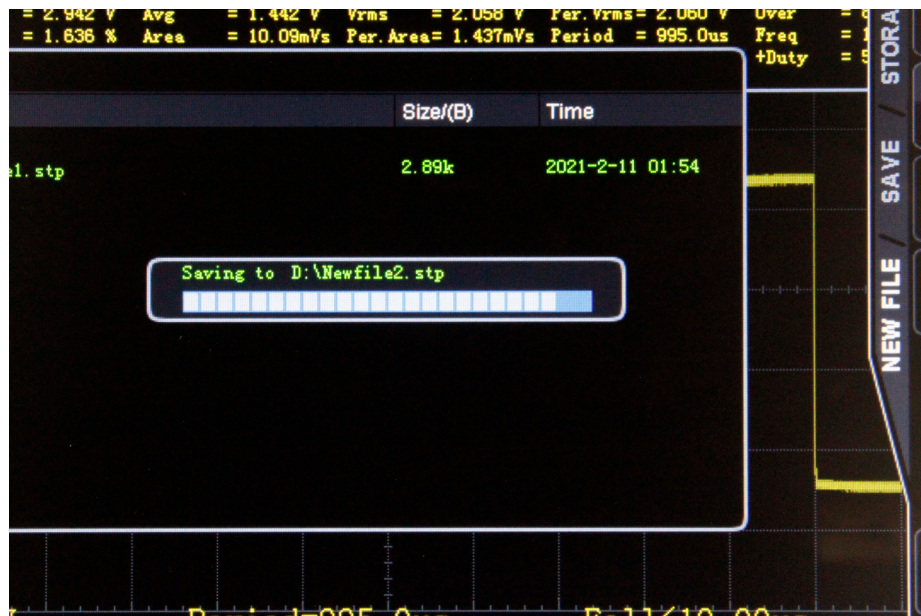
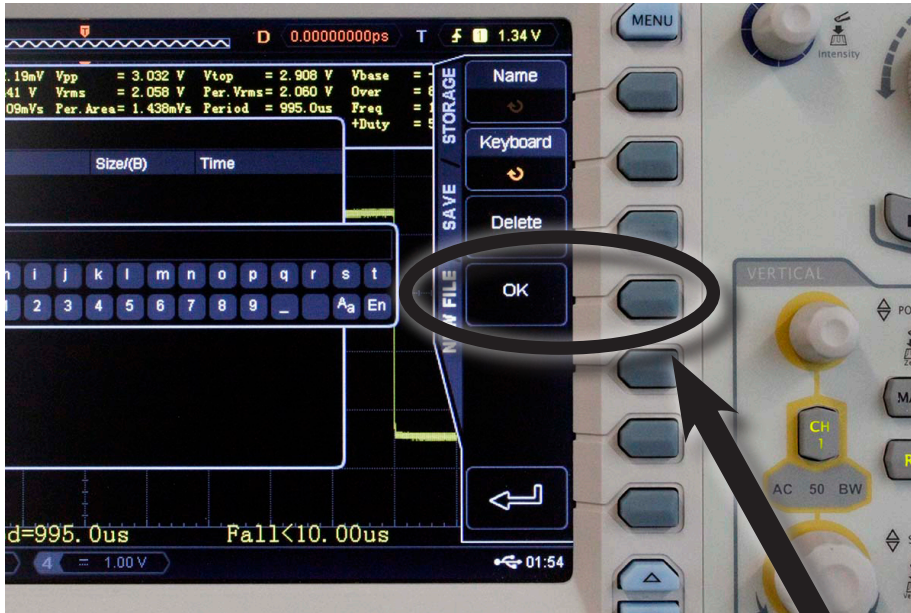
25. Rotate the Multi-Function Knob to highlight "DiskD" and press to select the USB drive



27. Name the file (if needed)



28. Press the "OK" soft key



29. Press the "Menu" button on the right of the screen to exit



APPENDIX: FRONT PANEL FUNCTION OVERVIEW

VERTICAL



- **CH1, CH2, CH3, CH4:** analog input channel switches. The four channels are marked by different colors which are also used to mark the corresponding waveforms on the screen and the channel input connectors. Press any key to turn on the corresponding channel and open the corresponding channel menu; press again to turn off the channel.
- **VERTICAL POSITION:** channel vertical position knobs. Turn the knob to modify the vertical position of the corresponding channel waveform. During the modification, the waveform of the corresponding channel moves up and down; the vertical position information pops up at the lower-left side of the screen in real-time. Pressing down the knob can quickly reset the vertical position (zero).
- **VERTICAL SCALE:** channel vertical scale knobs. Turn the knob to modify the vertical scale of the corresponding channel waveform. During the modification, the waveform of the corresponding channel is expanded or compressed vertically (the actual amplitude keeps unchanged); the vertical scale information at the bottom of the screen changes accordingly. Pressing down the knob can quickly switch the vertical scale adjustment mode between “Coarse” and “Fine”.
- **MATH:** press this key to open the math operation function menu. You can perform addition, subtraction, multiplication, division, FFT, digital filter, logic operations and advanced operations.

- **REF:** press this key to enable the reference waveform function. You can compare the waveform actually measured with the reference waveform.
- **Decode1, Decode2:** press any key to open the corresponding decoding function menu.

HORIZONTAL



- **MENU:** press this key to open the horizontal control menu. You can turn on or off the delayed sweep, switch between different horizontal time base modes, switch between “Coarse” and “Fine” adjustments of the horizontal time base as well as modify the horizontal reference setting.
- **HORIZONTAL SCALE:** horizontal scale knob. Turn the knob to modify the horizontal time base. During the modification, the waveforms displayed are expanded or compressed horizontally; the horizontal time base message at the upper-left side of the screen changes accordingly. Pressing down the knob can quickly turn on or off the delayed sweep. When delayed sweep is turned on, turning the knob can modify the delayed sweep time base. During the modification, the delayed sweep waveform is expanded or compressed horizontally; the delayed sweep time base message at the middle of the screen changes accordingly.

- **HORIZONTAL POSITION:** horizontal position knob. Turn the knob to modify the horizontal position (namely the trigger position). During the modification, the trigger point and the waveforms displayed move left or right; the horizontal position message at the upper-right side of the screen changes accordingly. Pressing down the knob can quickly reset the horizontal position (zero). When delayed sweep is turned on, turning the knob can modify the delayed sweep horizontal position. During the modification, the delayed sweep trigger point and waveform move left or right; the delayed sweep horizontal position message at the upper-right side of the screen changes accordingly.

TRIGGER



- **MODE:** press this key to switch the trigger mode to “Auto”, “Normal” or “Single” and the corresponding status backlight of the current trigger mode would be illuminated.
- **TRIGGER LEVEL:** trigger level knob. Turn the knob to modify the trigger level. During the modification, the trigger level line moves up and down; the trigger level message pops up at the lower-left side of the screen in real-time. Pressing down the knob can quickly reset the trigger level to 0.
- **MENU:** press this key to open the trigger operation menu. This oscilloscope provides various trigger types.
- **FORCE:** in Normal and Single trigger modes, press this key to generate a trigger signal forcibly.
- **50%:** press this key to set the trigger level to the vertical midpoint of the trigger signal amplitude.

MULTI-FUNCTION KNOB



This knob can be used to select parameter item, adjust the value of the parameter and etc.

- In menu operation, this knob can be used to open the submenu or select the desired parameter item. For menu item that include multiple parameter items, you can press the corresponding menu softkey and then turn the knob to select the specified parameter item (sometimes, you need to press down the knob to select the parameter item). This knob can also be used to modify the parameter, input filename and etc.
- In non-menu operation (the menu is hidden), turning the knob can adjust the waveform brightness. The adjustable range is from 0% to 100%. Turn the knob clockwise to increase the waveform brightness and counterclockwise to decrease the waveform brightness. Pressing down the knob can quickly reset the waveform brightness to 50%. You can also press Display WaveIntensity and then turn the knob to adjust the waveform brightness.

NAVIGATION KNOB



This knob provides quick adjust/locate function for numerical parameters with relatively larger settable ranges. Turn the knob clockwise to increase the value and counterclockwise to decrease the value. The inner knob is used for fine adjustment and the outer knob for coarse adjustment (the larger the rotation amplitude of the outer knob is, the faster the change speed of the value will be).

For example, this knob can be used to quickly locate the waveform frame to be played back in waveform playback. Similar parameters include trigger holdoff, pulse width setting, slope time and etc.

AUTO



Press this key to enable the waveform auto setting function. The oscilloscope will automatically adjust the vertical scale, horizontal time base, trigger mode and so on according to the input signal to realize optimum waveform display. Besides, the quick parameter measurement function is also provided.

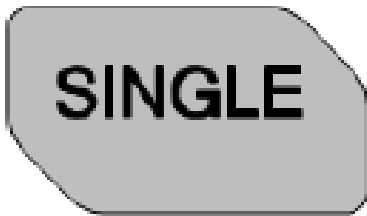
Note: The waveform auto setting function requires that the frequency of sine should be no lower than 20 Hz. If the parameter exceeds this limit, the waveform auto setting function might be invalid.

RUN/STOP



Press this key to set the state of the oscilloscope to "RUN" or "STOP". In "RUN" state, the key is illuminated in yellow and red in "STOP" state.

SINGLE



Press this key to set the trigger mode to "Single". In single trigger mode, the oscilloscope generates a trigger when the trigger conditions are met and then stops. When the oscilloscope is in wait-for-trigger state (the key is illuminated in orange), pressing FORCE will generate a trigger signal immediately.

DEFAULT



Press this key and then press OK to restore the oscilloscope to its factory setting

PRINT



Press this key to execute the print function or save the screen content in a USB storage device as a picture file.