PicoScope Guide for CPRE 2880

What is the PicoScope?

The PicoScope is a computer-based oscilloscope. It's used to visualize electrical signals over time to see how they change. The PicoScope, like many oscilloscopes, is able to sample an electrical signal, visualize it, take measurements, decode data packets, and much more. We will only be covering a tiny portion of what can be done with the PicoScope. If you would like to learn more: explore on your own, ask your TA, and/or Google the features you would like to learn more about.

Hardware Setup & Connections

This section will cover how to set up the hardware and how to connect the probe properly to the Cybot.

Setting up the PicoScope's Hardware

The PicoScopes in the lab come in two different flavors shown in Figure 1. This guide applies to either of them.

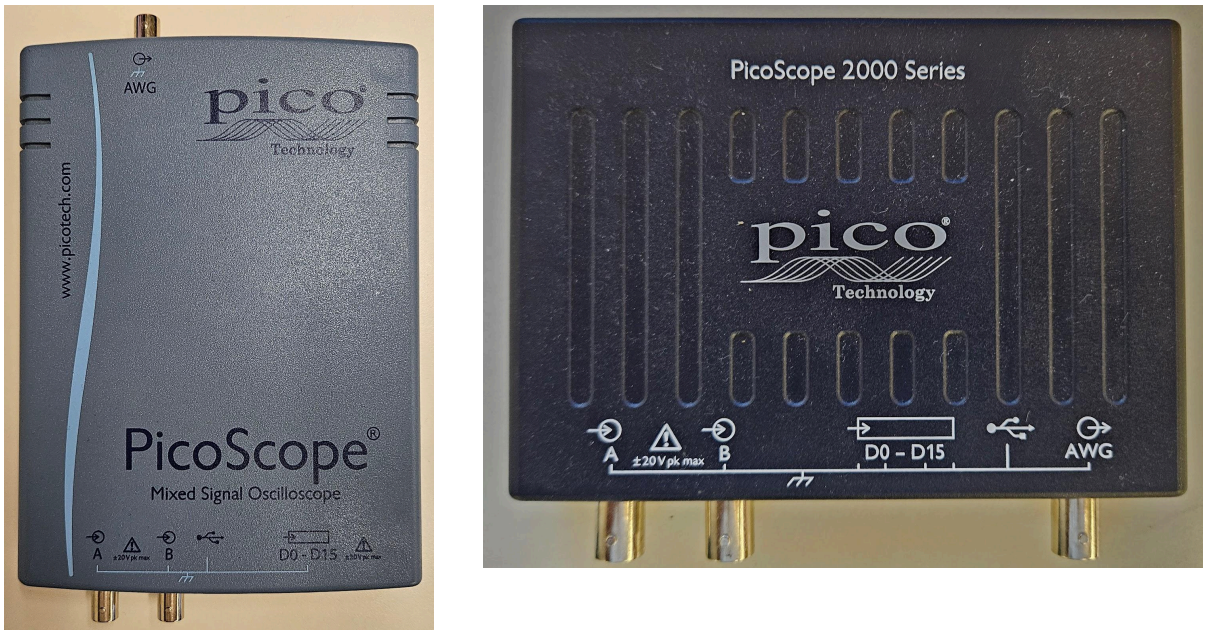


Figure 1: Two different PicoScopes in lab

The probe has four essential components, shown in Figure 2, that must be properly connected and configured:

1. Hook Tip (Witch Hat): Shown in Figure 3, this part allows the probe to securely clip onto wires, headers, or test points on your circuit.
2. Grounding Clamp: As shown in Figure 4, this connects the probe to the circuit's ground, ensuring accurate voltage readings.
3. Attenuation Switch (Multiplier): Displayed in Figure 5, this switch toggles between settings like 1x and 10x.
4. BNC Connector: Finally, Figure 6 shows the BNC end of the probe, which plugs into the input port on the PicoScope.

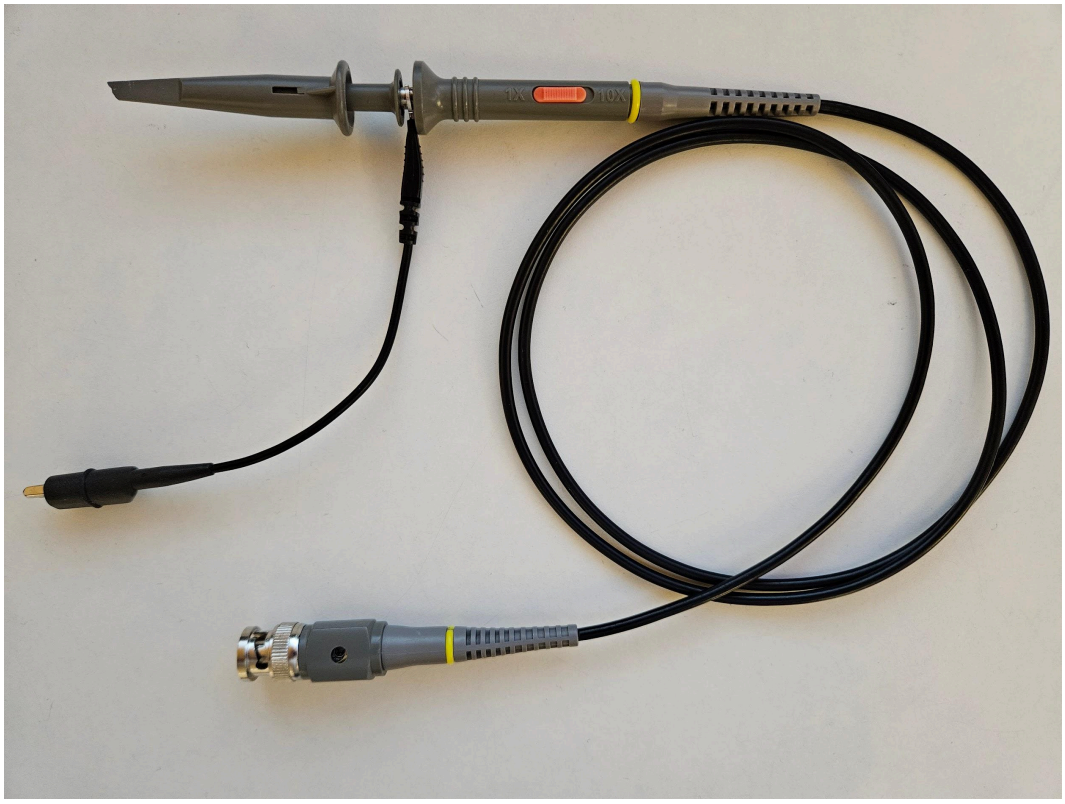


Figure 2: Oscilloscope probe

The hook tip or witch hat, as it is more commonly called, is used to “hook” the probe onto wires, test points, and headers to test the signals at those locations. As shown in Figure 3, to expose the hook, pull back on the tip. **DO NOT USE: Probes that do not have a hook tip on them.**

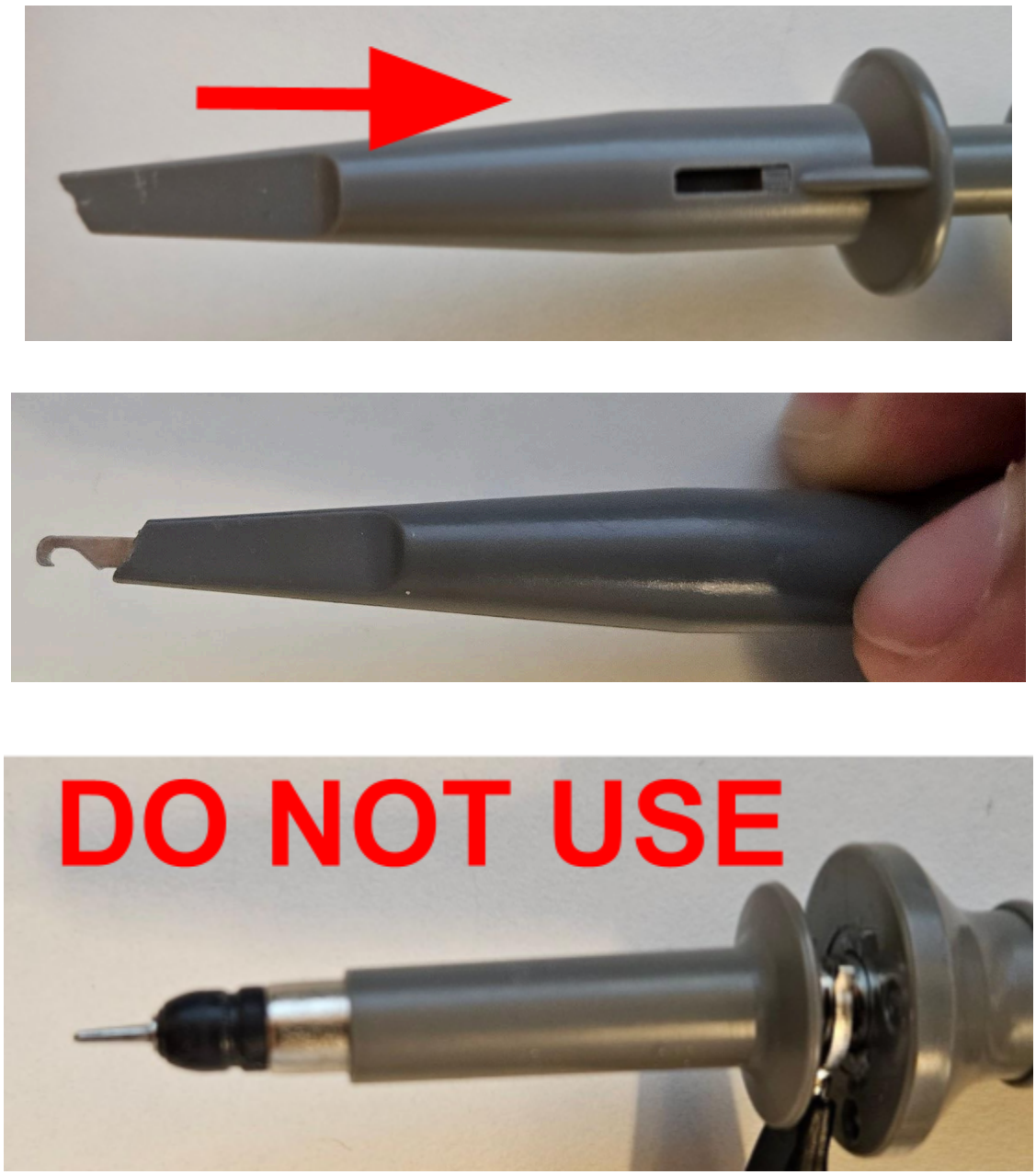


Figure 3: Probe hook tip (Witch Hat)

As stated before, a grounding clamp shown in Figure 4 is used to connect the scope's ground to the circuit ground. This connection ensures an accurate voltage reading. **DO NOT USE: Probes that do not have a grounding clamp.**

Figure 4: Grounding clamp

The attenuation switch (multiplier) shown in Figure 5 is used to scale the signal in order to read smaller signals with the scope. This is very useful for low-voltage signals. **For our purposes keep the probe on 1x mode.**

Figure 5: Attenuation switch

To connect the probe to the PicoScope:

1. First, push the BNC connector over the port A or port B input. **If your probe is on port B, you will have to turn on port B in the software and turn off port A.**
2. Then twist the connector clockwise until it clicks into place, as shown in Figure 6.

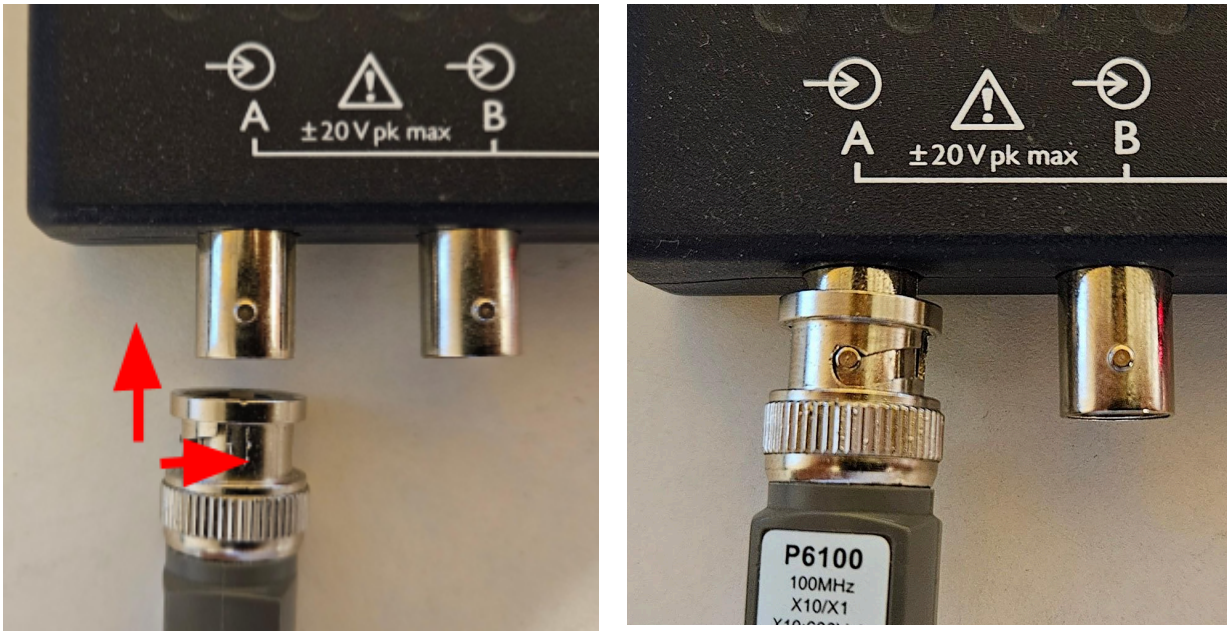


Figure 6: BNC connector connected to the PicoScope

Connecting to the Cybot

To connect to the Cybot, you will need a male-to-male jumper cable, as shown in Figure 7. **DO NOT USE: A male to female or a female to female jumper cable.**

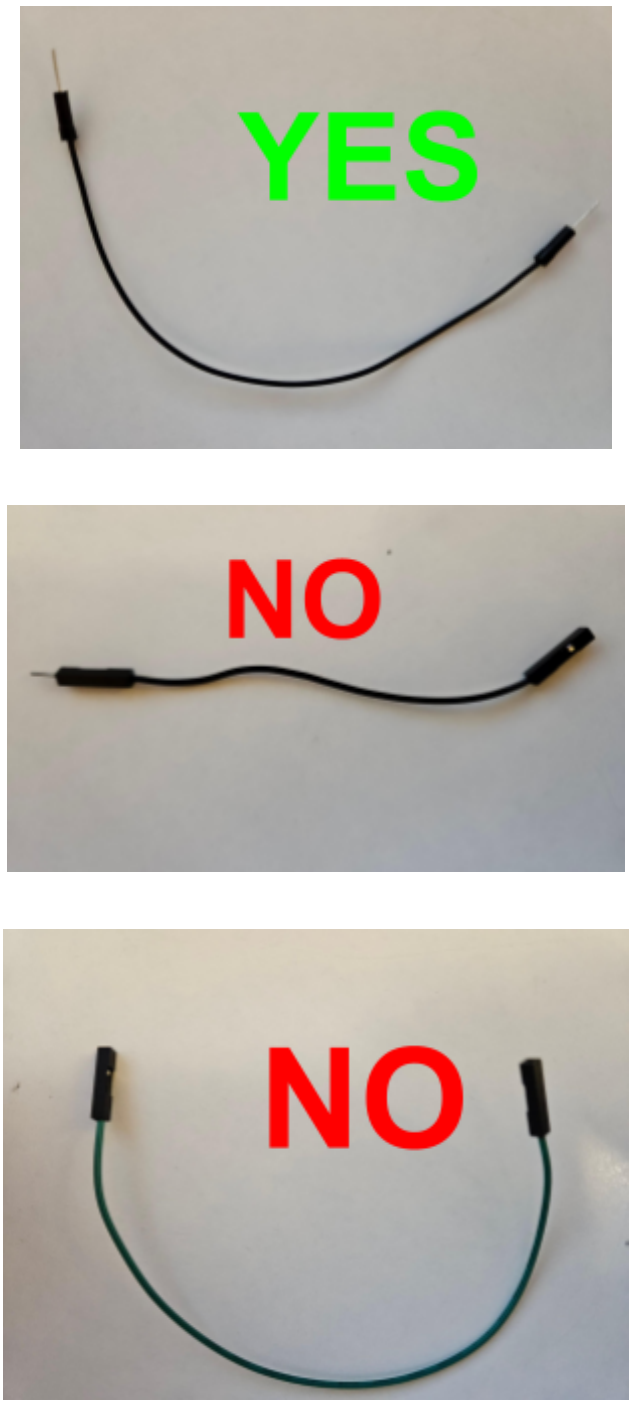


Figure 7: Jumper cables

To sample the PING sensor in lab, connect a jumper cable to the test point at the bottom of the baseboard. Then, clip the ground clamp to the provided grounding pins labeled GND. This example is shown in Figure 8.

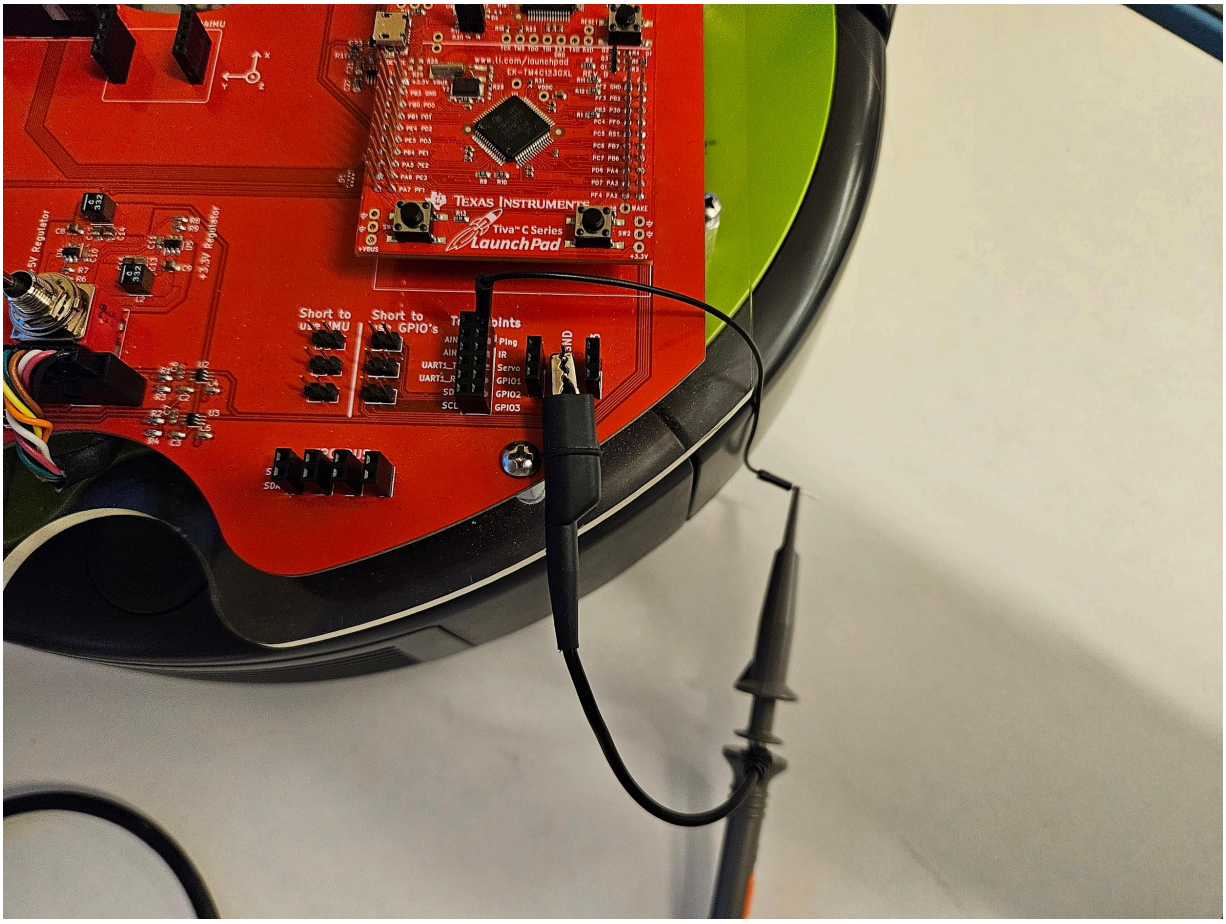


Figure 8: Example of a correct setup to probe a signal on the Cybot

Figures 9 through 11 are examples of **what not to do**. **DO NOT USE: Any of the methods displayed in Figures 9 through 11.**

Figure 9 shows an example of back probing the PING sensor connector. This can damage the cable and connector, leading to a bad connection which will result in an unreliable signal. **DO NOT DO THIS!**

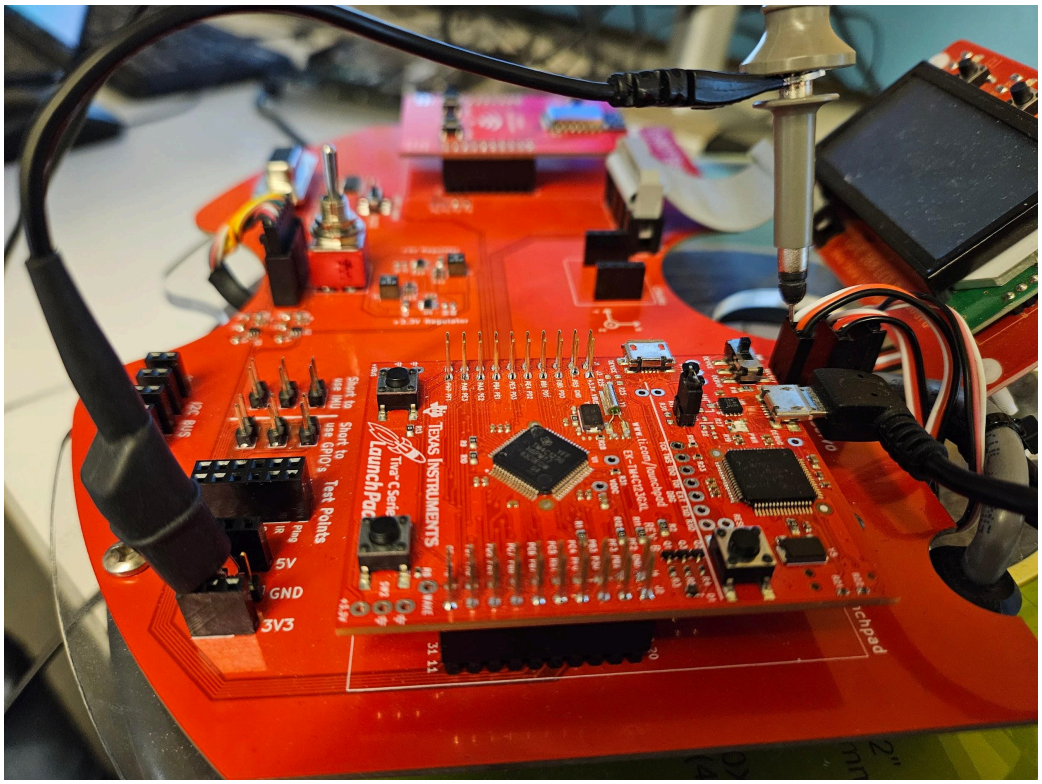


Figure 9: An example of back probing (do not do this)

Figure 10 shows an example of probing the Tiva board header pins. Because they are so close together, this can short the pins. This will fry the microcontroller, causing those pins, if not the whole board, to no longer function. **DO NOT DO THIS!**

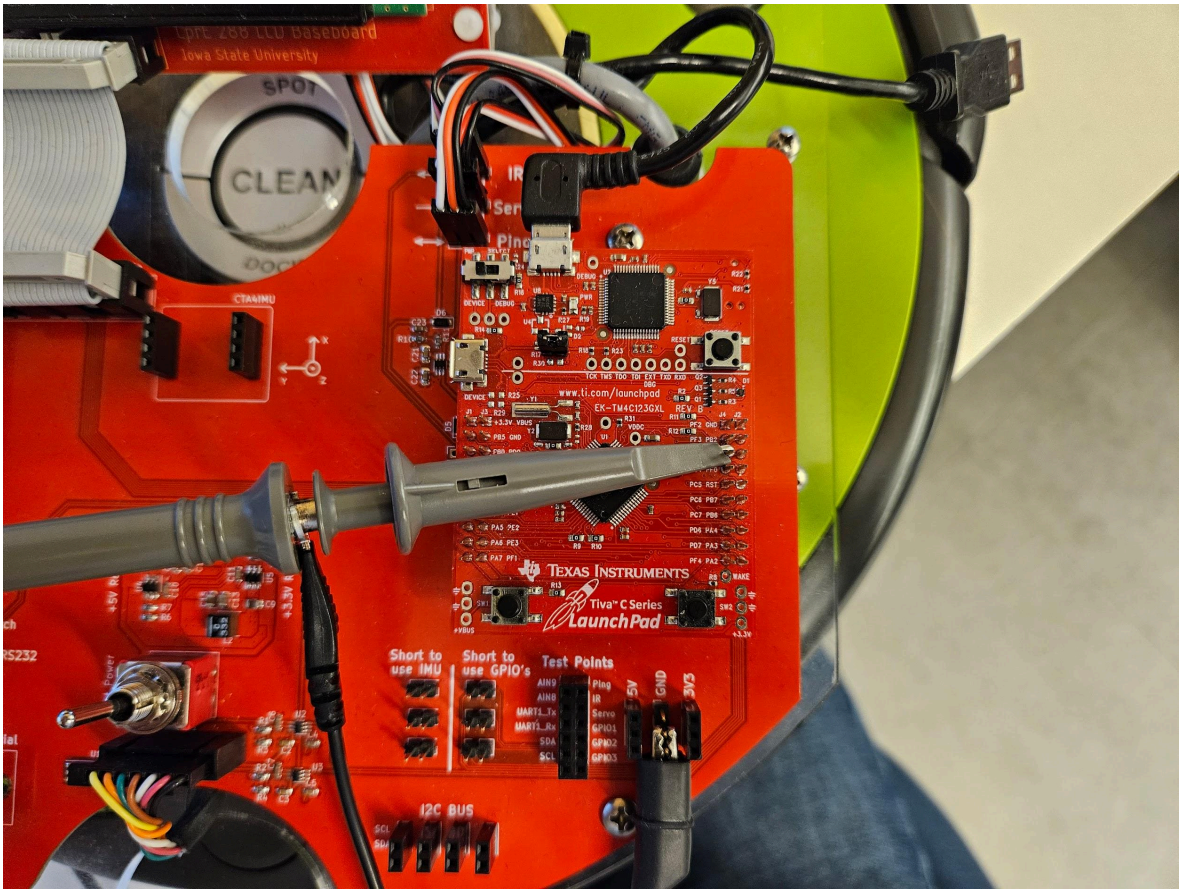


Figure 10: An example of probing the Tiva headers (do not do this)

Figure 11 shows an example of shoving a probe without a witch hat into the test point header. This can bend the probe and widen the hole in the header. The bent probe will cause it to no longer make a proper connection with a hook tip and will need to be replaced. The wider header hole will cause jumper wires to be loose, making a bad connection to the signal. **DO NOT DO THIS!**

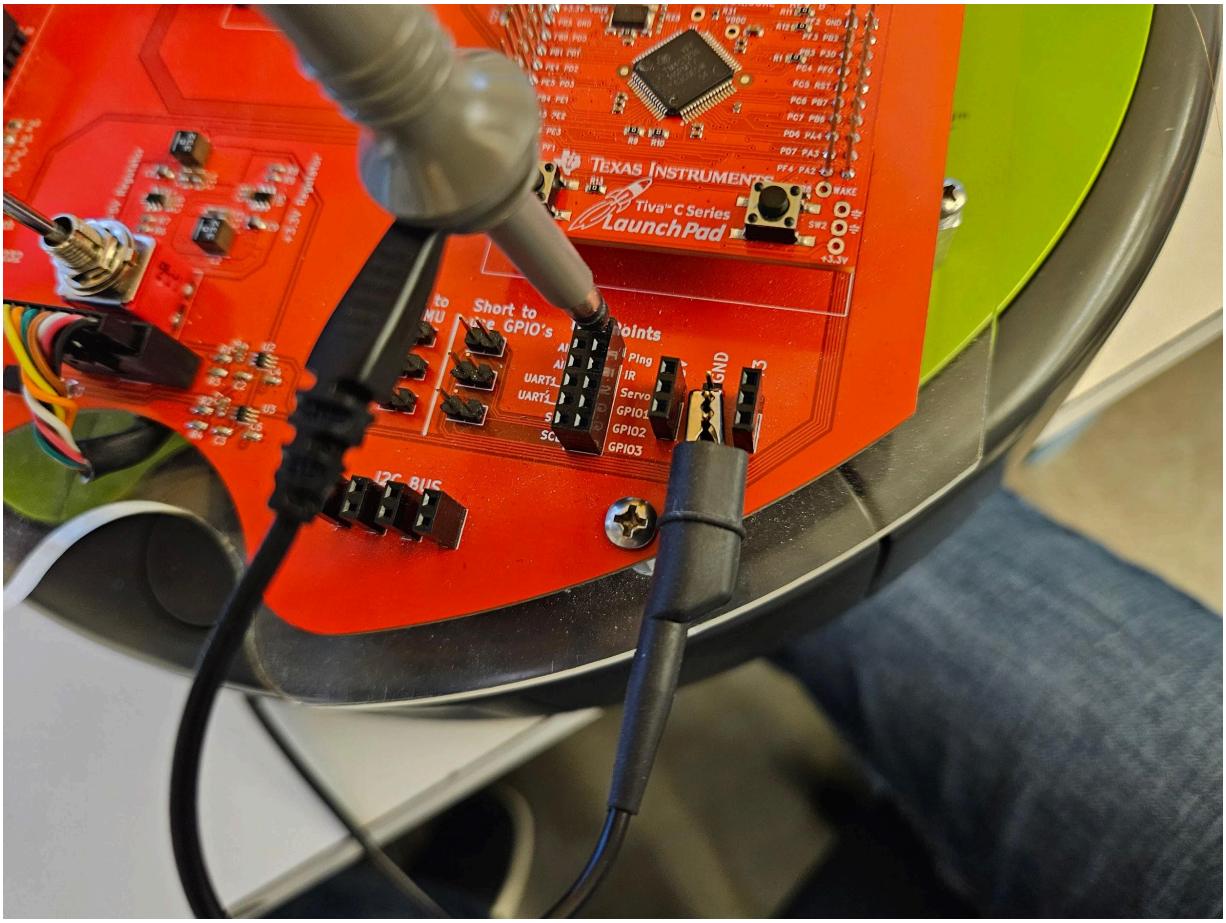


Figure 11: An example of probing the test point header with the tip of an oscilloscope probe (do not do this)

Software for the PicoScope

This section will cover software features and how to set up a basic and more advanced trigger for the PING lab.

Connecting the PicoScope

After opening the PicoScope software, you should be greeted with the box shown in Figure 12. Wait a moment, and if it does not turn into Figure 13, click the refresh button at the bottom of the box. If it still has not found the PicoScope, check the USB connection between the scope and the computer. If the issue persists, ask your TA for assistance.

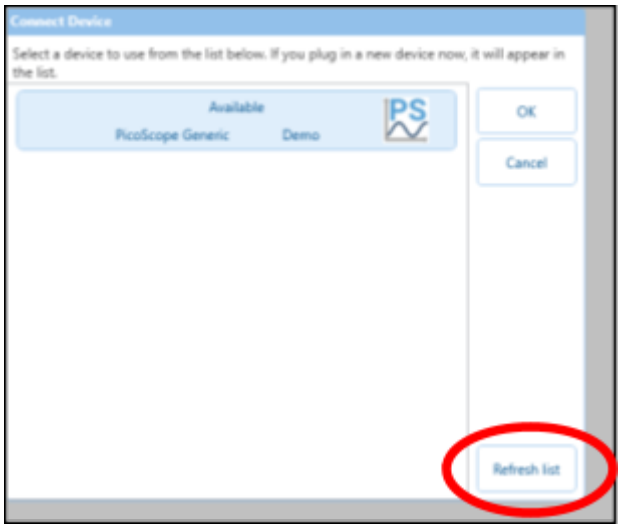


Figure 12: The PicoScope has not been found by the software yet

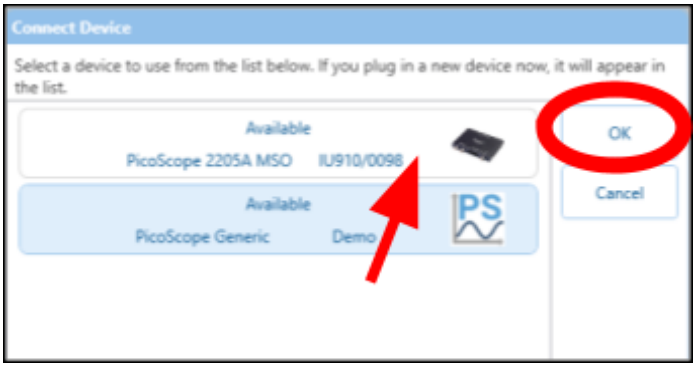


Figure 13: The PicoScope was found

After the PicoScope is found, as shown in Figure 13, click the PicoScope and then click OK. You should then see Figure 14 on your screen.

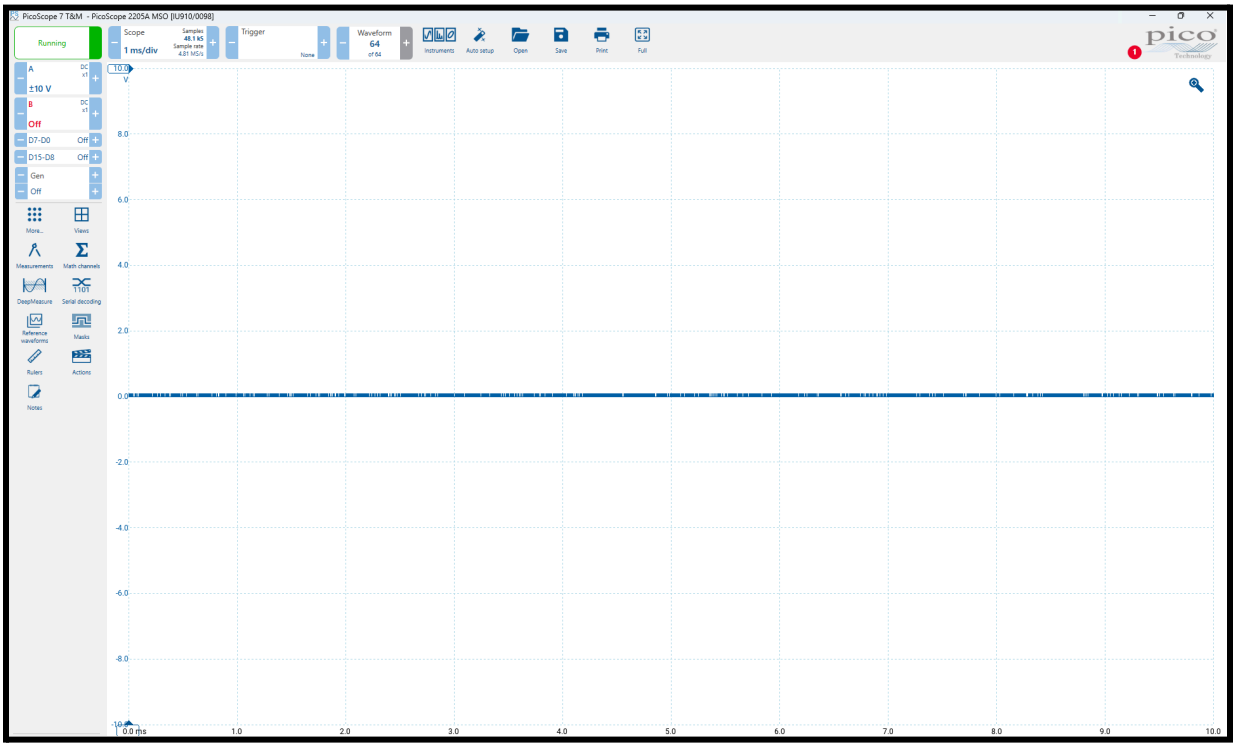
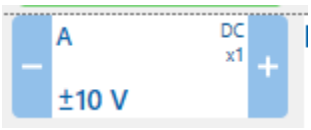
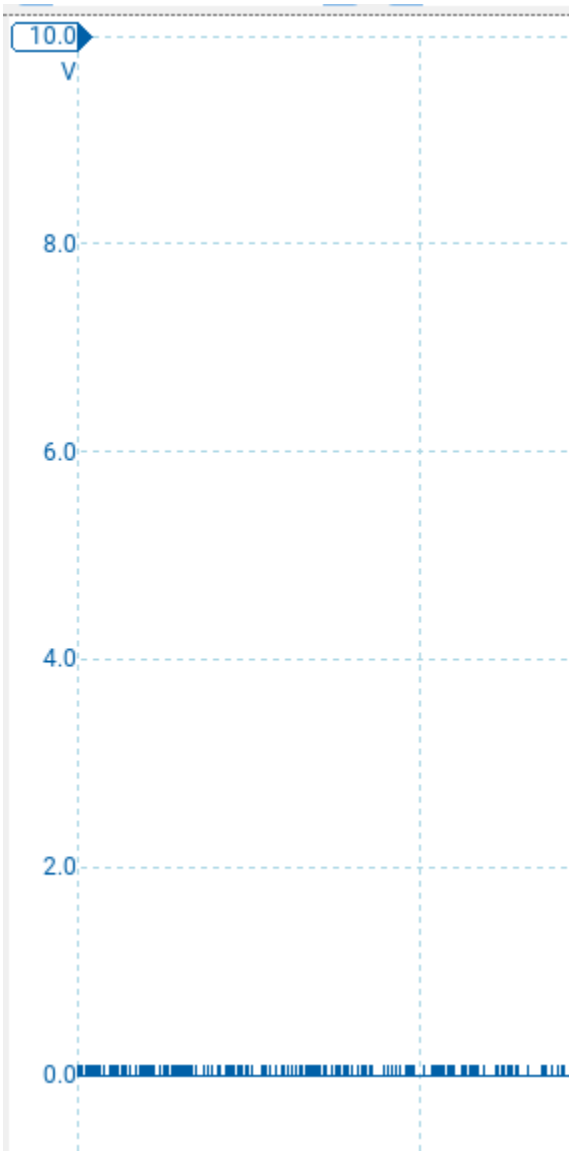


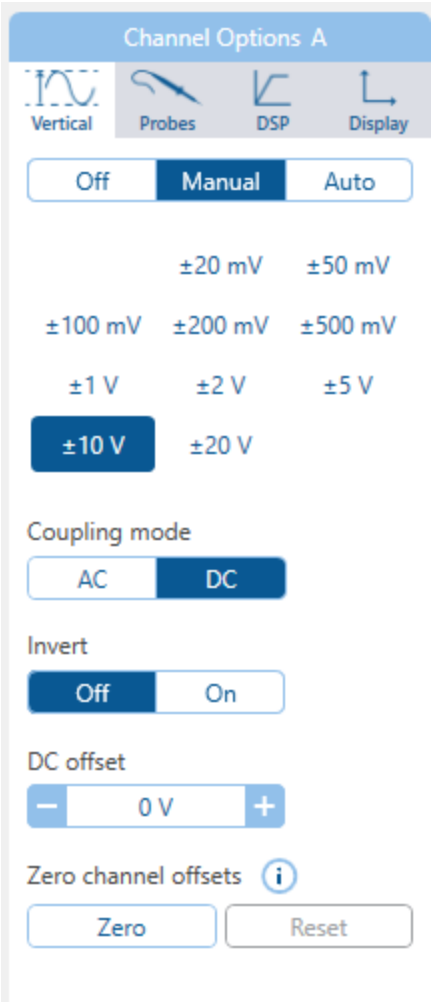
Figure 14: Successful connection

Configurations

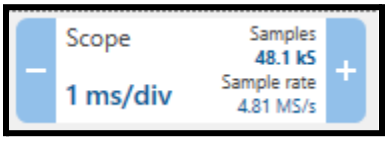
Voltage Range (Y-Axis)

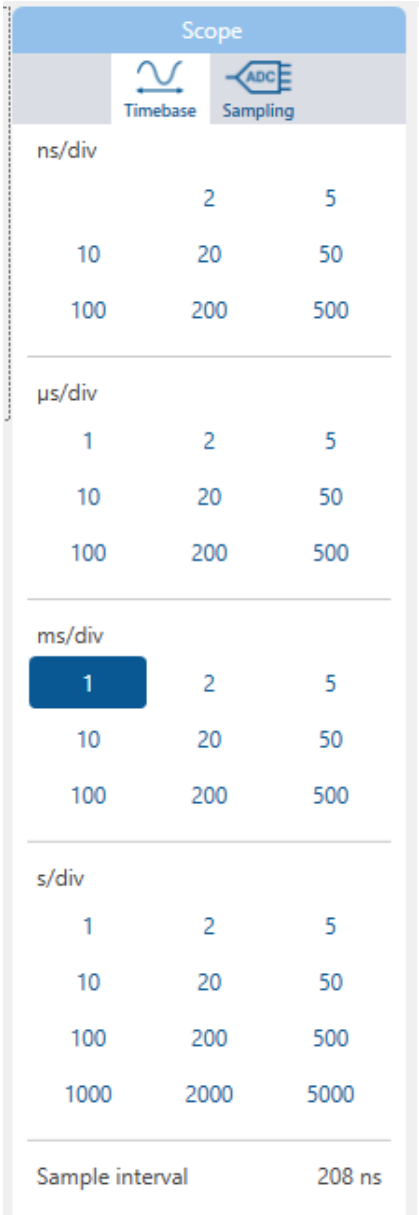




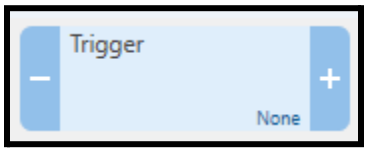

Channel Options A
Vertical
Probes
DSP
Display
Off
Manual
Auto
±20 mV
±50 mV
±100 mV
±200 mV
±500 mV
±1 V
±2 V
±5 V
±10 V
±20 V
Coupling mode
AC
DC
Invert
Off
On
DC offset
0 V
Zero channel offsets
Zero
Reset

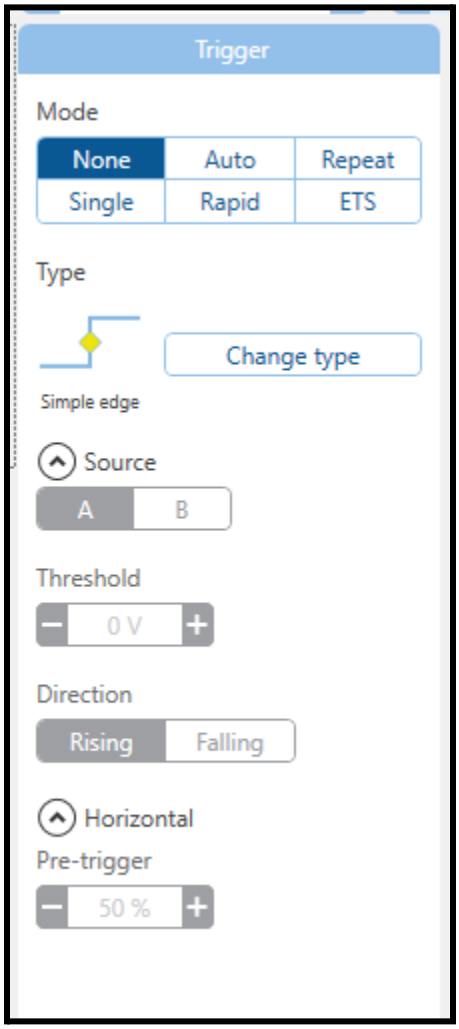
Sample Frequency & Time Intervals

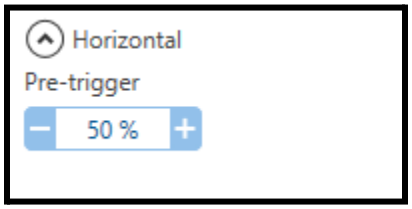


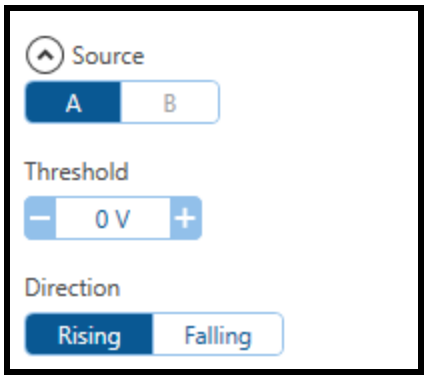


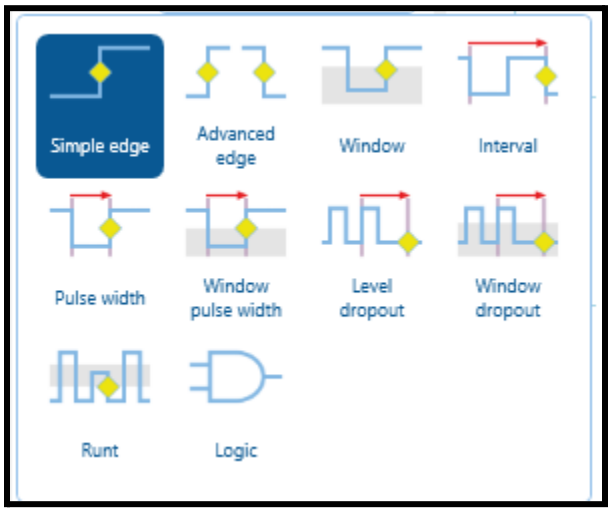
Trigger

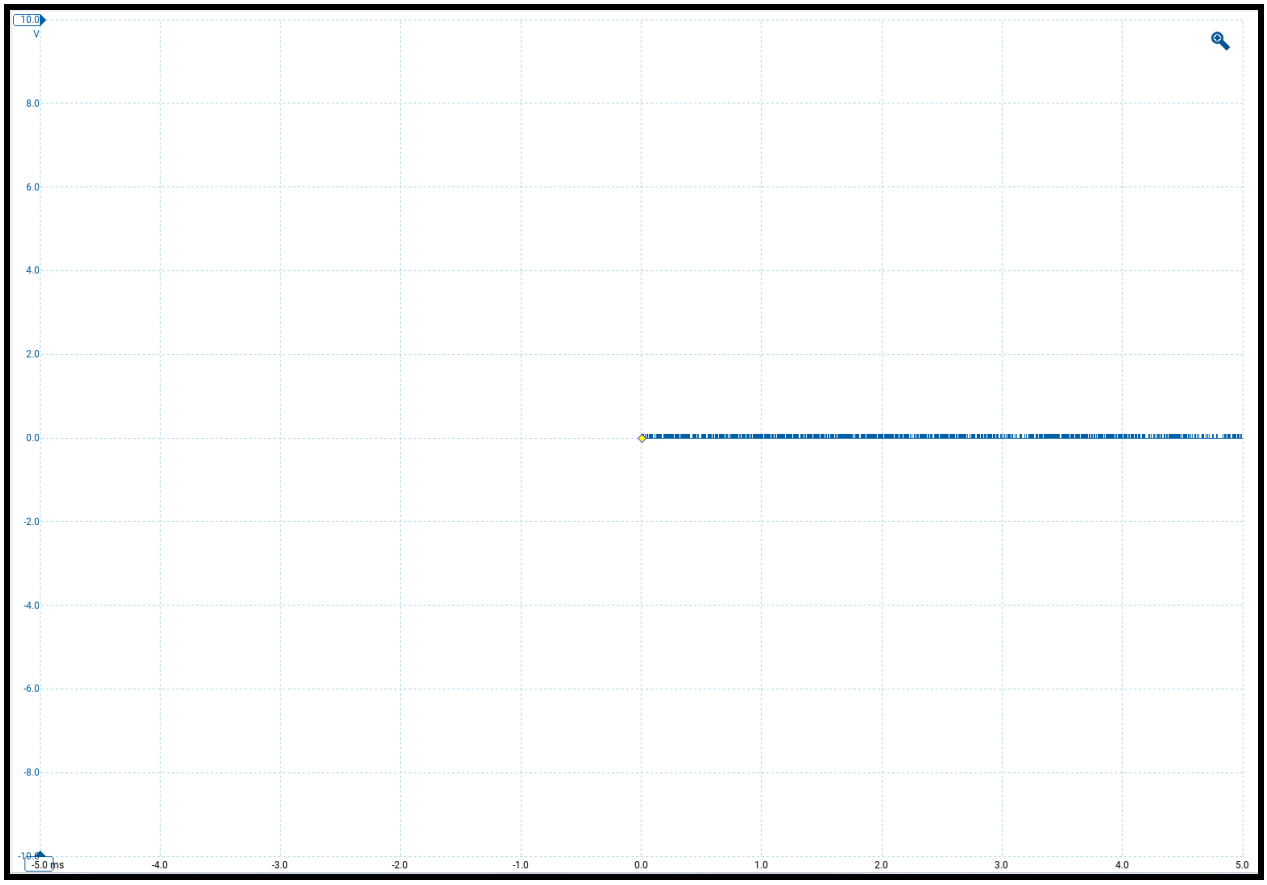

Trigger
None


Trigger
Mode
None
Auto
Repeat
Single
Rapid
ETS
Type
Change type
Simple edge
Source
A
B
Threshold
0 V
Direction
Rising
Falling
Horizontal
Pre-trigger
50 %

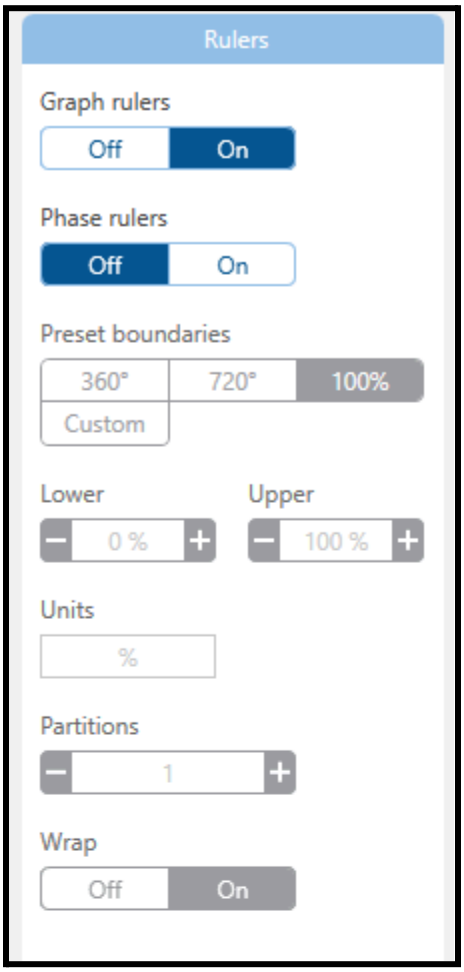

Horizontal
Pre-trigger
50 %

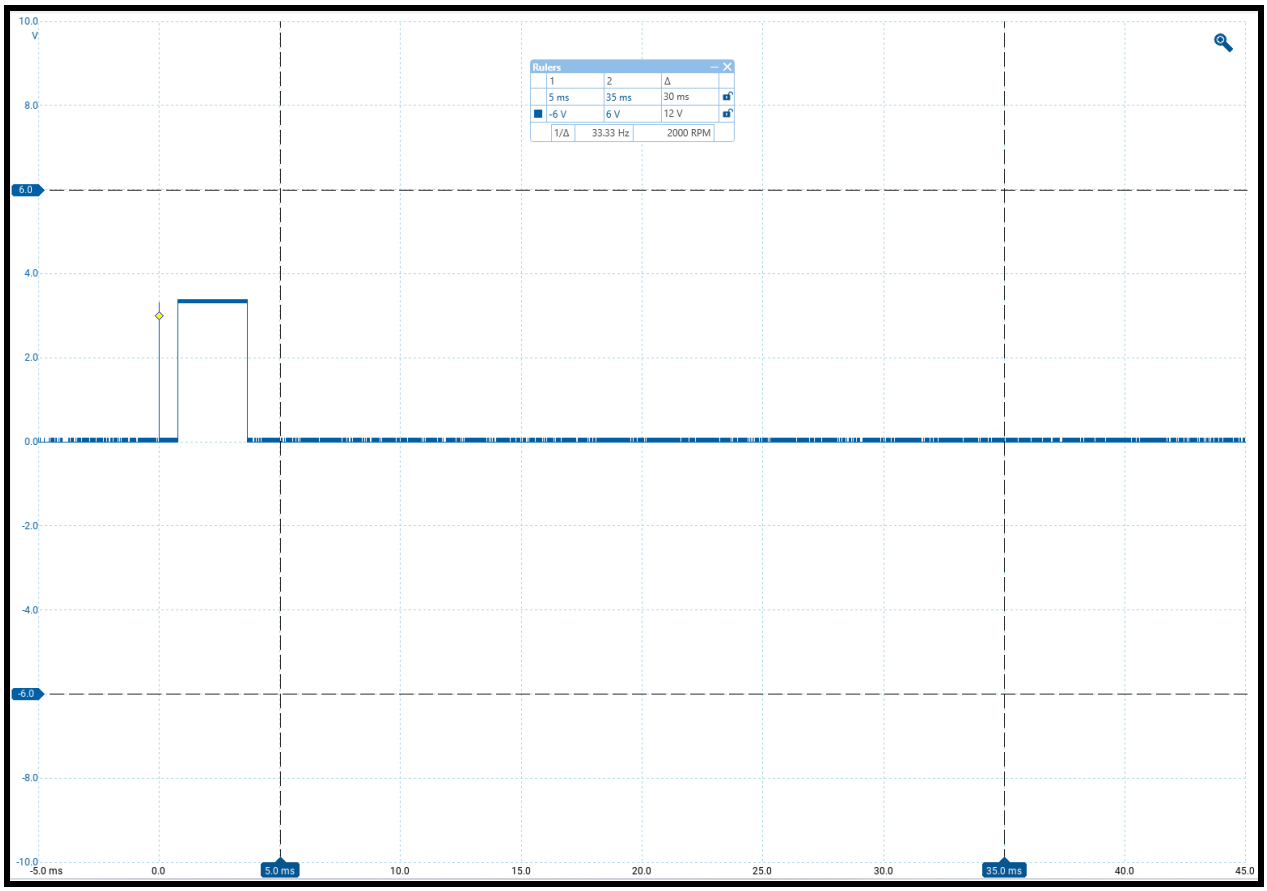

Source
A
B
Threshold
0 V
Direction
Rising
Falling


Simple edge
Advanced edge
Window
Interval
Pulse width
Window pulse width
Level dropout
Window dropout
Runt
Logic

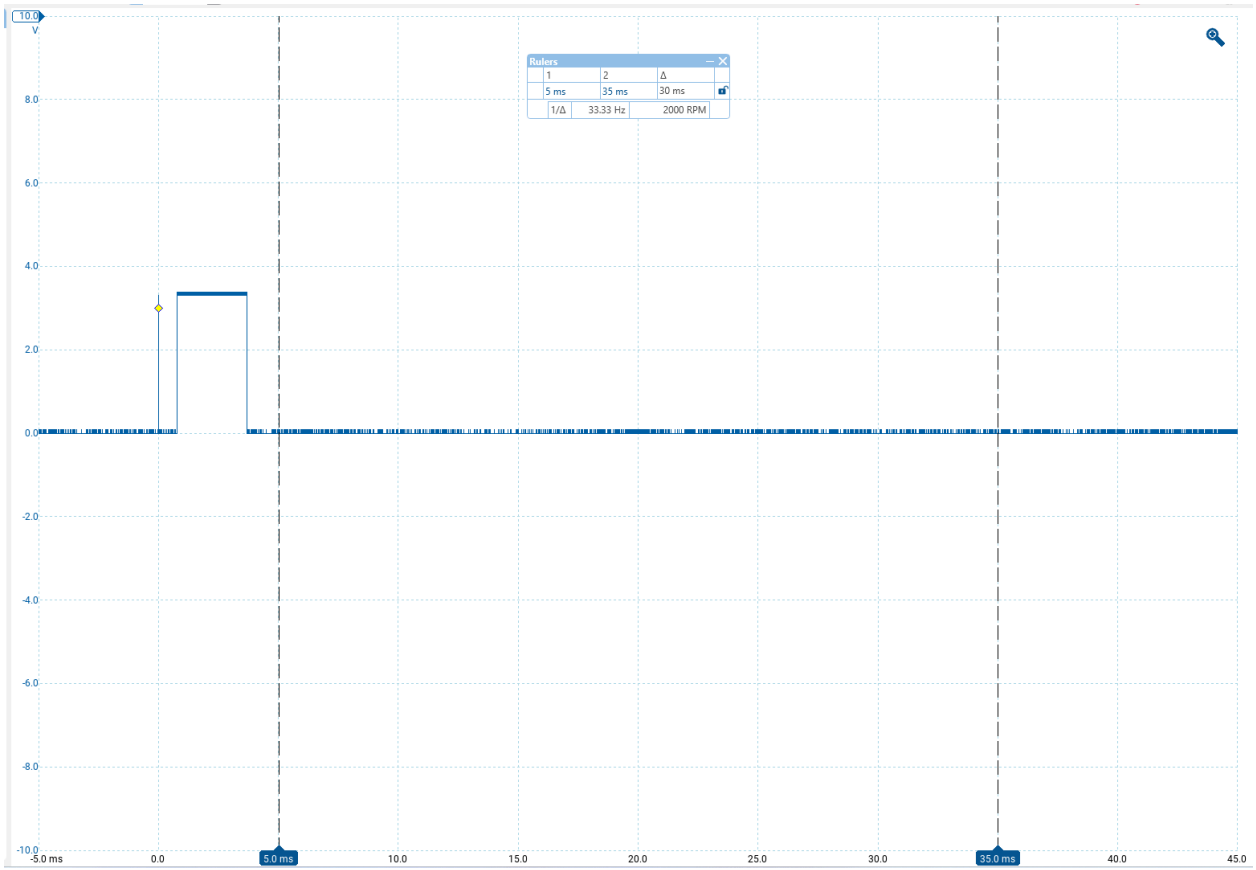

10.0
V
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
-6.0
-8.0
-10
-5.0 ms
-4.0
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0

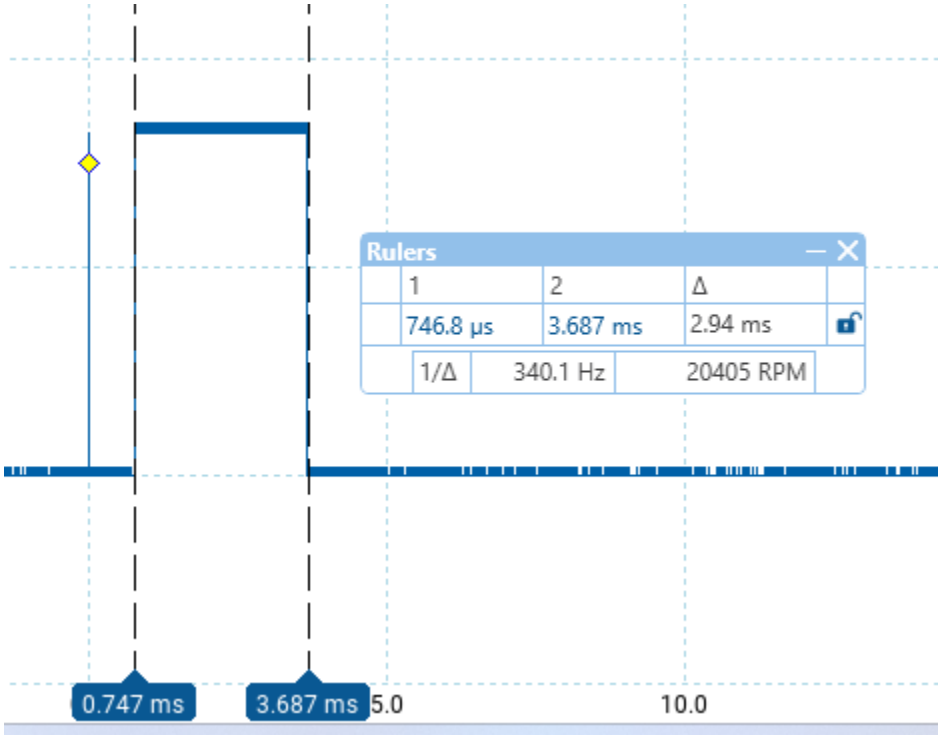
Rulers


Rulers
Graph rulers
Off
On
Phase rulers
Off
On
Preset boundaries
360°
720°
100%
Custom
Lower
0 %
Upper
100 %
Units
%
Partitions
1
Wrap
Off
On



Y-Axis Rulers by sliding them all the way to the top


Rulers
1
2
Δ
5 ms
35 ms
30 ms
1/Δ
33.33 Hz
2000 RPM
10.0
V
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-5.0 ms
0.0
5.0 ms
10.0
15.0
20.0
25.0
30.0
35.0 ms
40.0
45.0


Rulers
1
2
Δ
746.8 µs
3.687 ms
2.94 ms
1/Δ
340.1 Hz
20405 RPM
0.747 ms
3.687 ms
5.0
10.0

Advanced Trigger