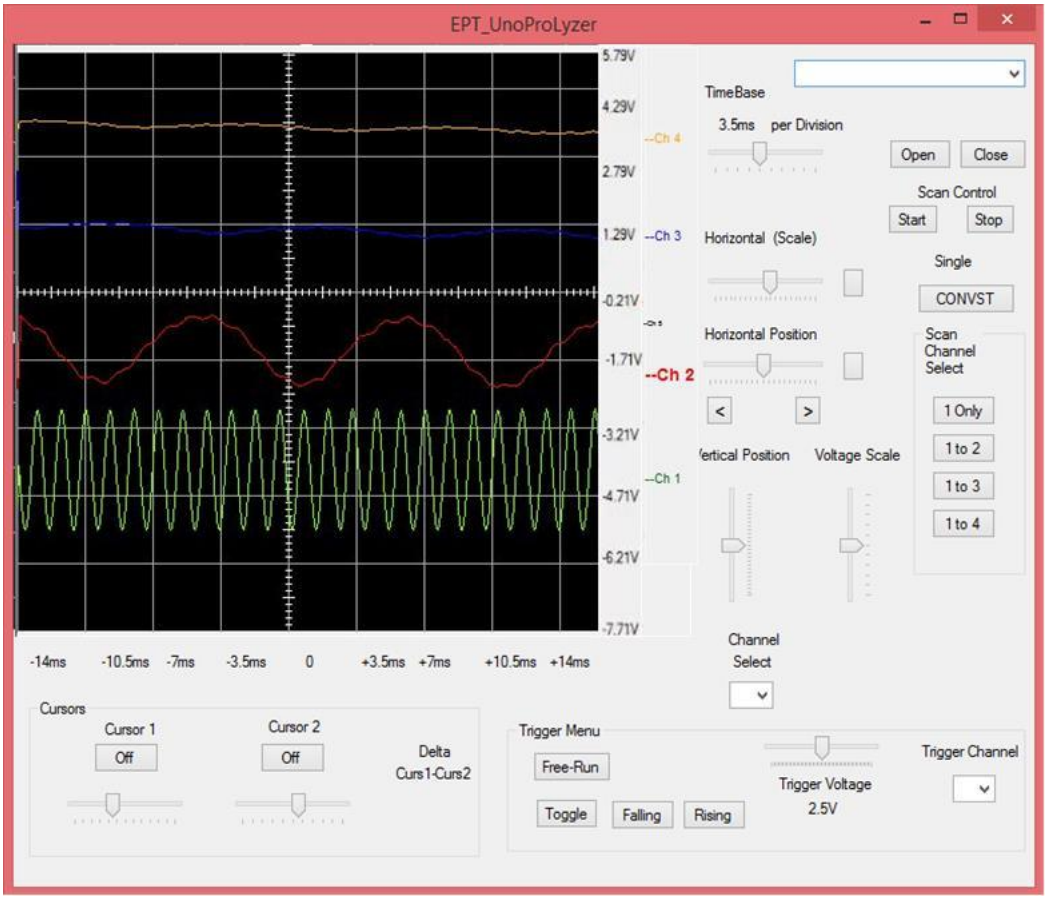
EARTH PEOPLE TECHNOLOGY

UNOPROLYZER

USER MANUAL



The UnoProLyzer is an Open Source Oscilloscope Application created by Earth People Technology. This application runs on a Windows 7/8 PC. It sends commands to and receives the data from the UnoProLogic2 and stores each channel data in its own separate buffer in memory. The UnoProLyzer collects all samples from each channel by streaming across up to four dedicated communication “pipes”. Each channel is plotted in the graph window.

Contents

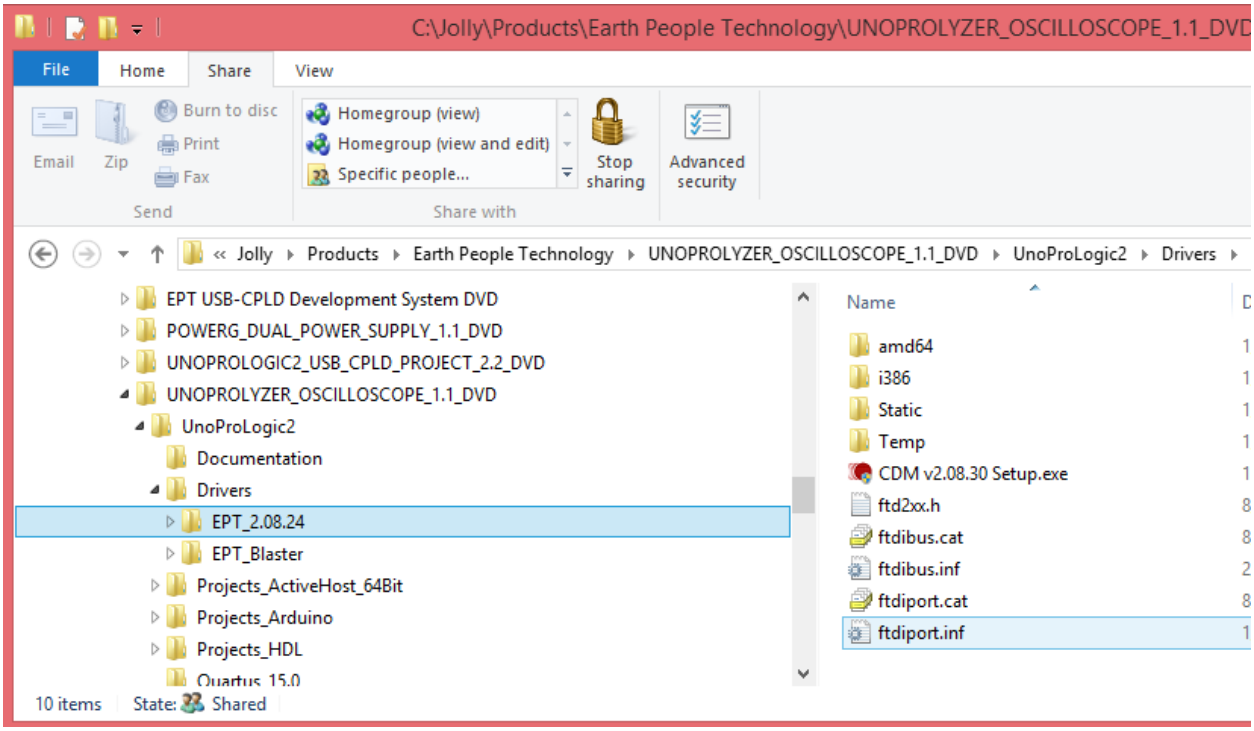
UnoProLyzer Getting Started

Below is a list of the steps to take to get started using the UnoProLyzer.

1. Install the UnoProLogic2 Driver
2. Install the UnoProLyzer Application
3. Connect the EPT -5M57-AP-U2 board to the USB Port on the PC
4. Click on the UnoProLyzer Icon under “All Programs”
5. When the application opens up, click on the drop down box in the upper right corner.
6. Select the “EPT USB<->Serial&JTAG Cable B”.
7. Click on the “Open” button
8. Click on one of the “Select Channels” buttons.
9. Then click on the “Start” button.
10. All selected analog channels should appear on the display.

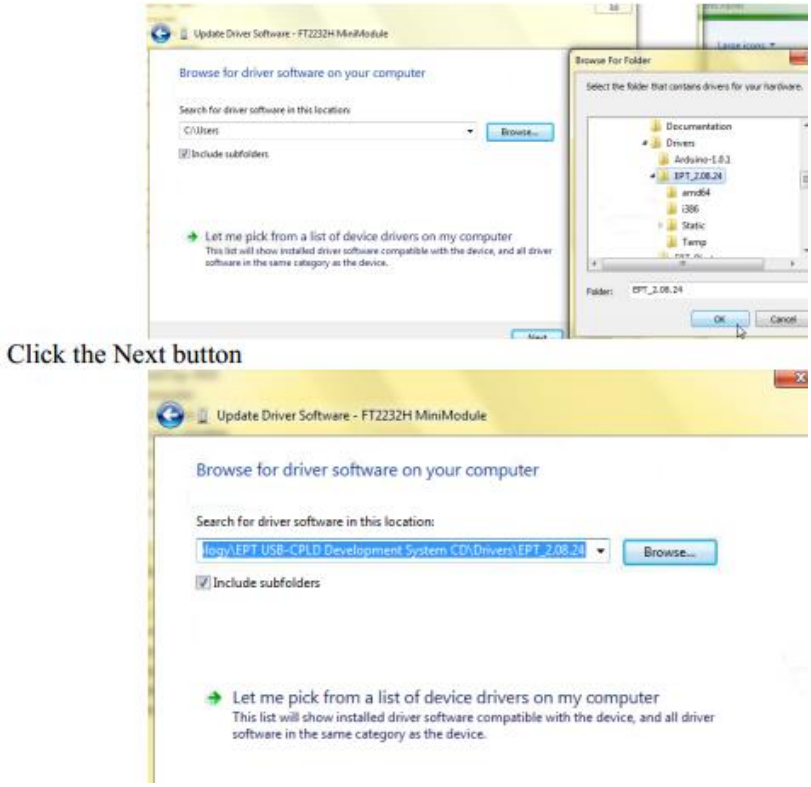
UnoProLyzer Driver

Connect the EPT -5M57-AP-U2 board to a USB port on the PC. Load the driver located on the UNOPROLYZER_OSCILLOSCOPE_1.1_DVD at /UnoProLogic2/Drivers/EPT_2.08.24



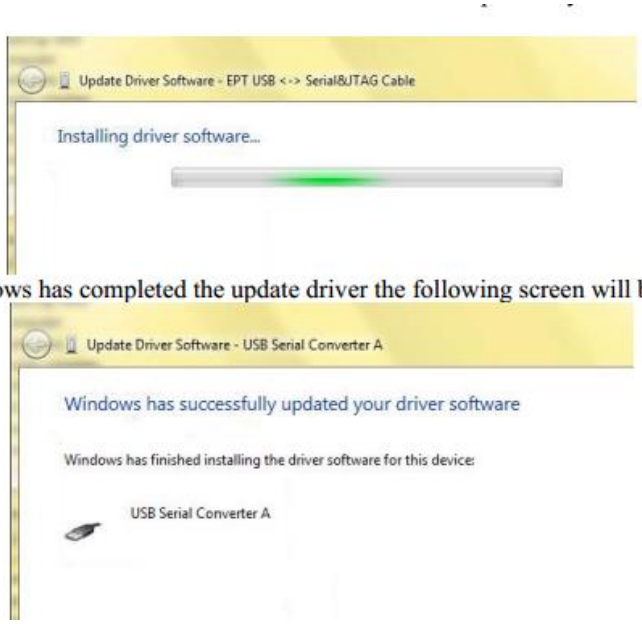
Double click on the CDM v2.08.30 Setup.exe to install the USB drivers. The EPT-5M57-AP-U2 uses the ftdibus.sys driver. This driver is loaded upon connection of the USB to Serial Cable to the PC by the ftdibus.inf file. To install these two files onto your PC, follow the instructions from the "Update Driver Software" utility. This utility will automatically load when the board is connected to the PC.

Click on the “Browse my computer for driver Software” icon. Next, click the “Browse” button and browse over to the cd and locate the above folder.



The next window is the Windows Security notice. The EPT driver is not signed by Windows. Click on the “Install this driver software anyway”.

Windows will add the EPT_2.08.24 driver to the System Registry.



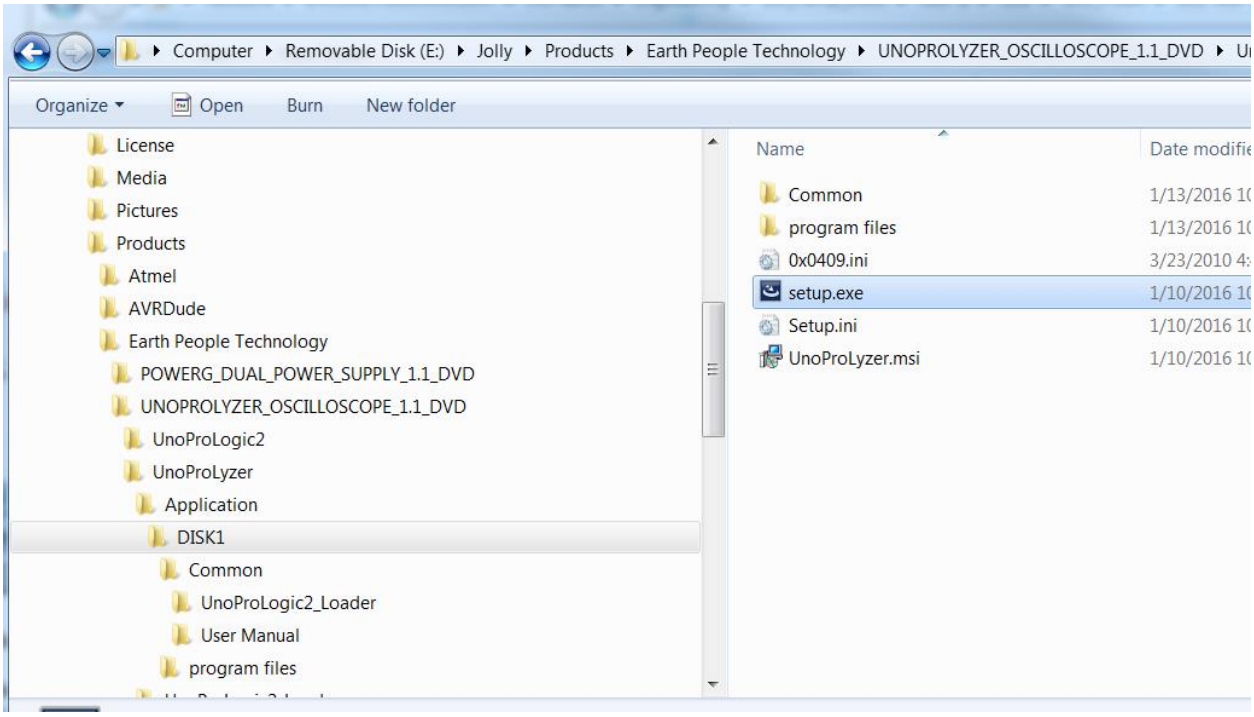
When Windows has completed the update driver the following screen will be displayed.

When this is complete, the drivers are installed and the EPT-5M57-AP-U2 is ready for use.

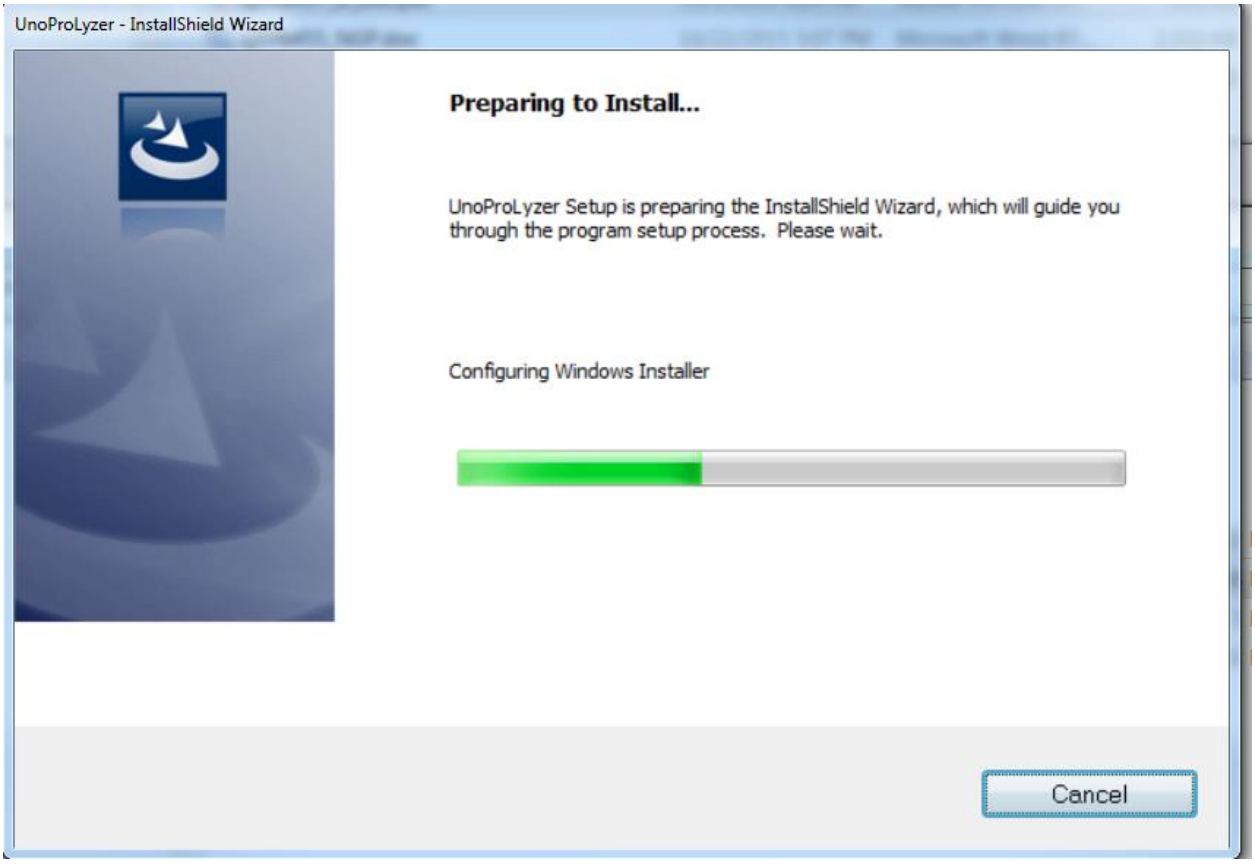
UnoProLyzer Application Install

The UnoProLyzer application software must be installed onto the users PC before using. This is

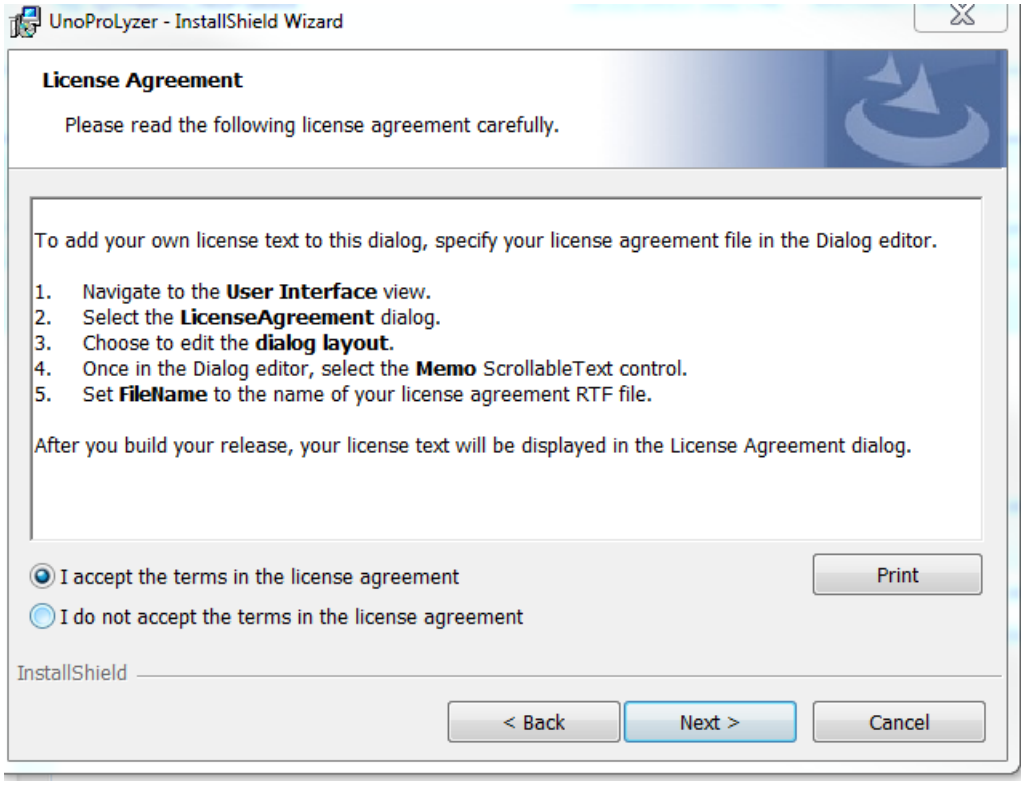
an easy process as the application and all the supporting files such as Data Sheets, UnoProLogic2 Loader and the application itself has been packed into Windows Installer files. To load the UnoProLyzer software, make you have administrator rights on you PC. Locate the \UnoProLyzer\ Application\ DISK1 folder on the UNOPROLYZER_OSCILLOSCOPE_1.1_DVD. Double click on the “setup.exe” file

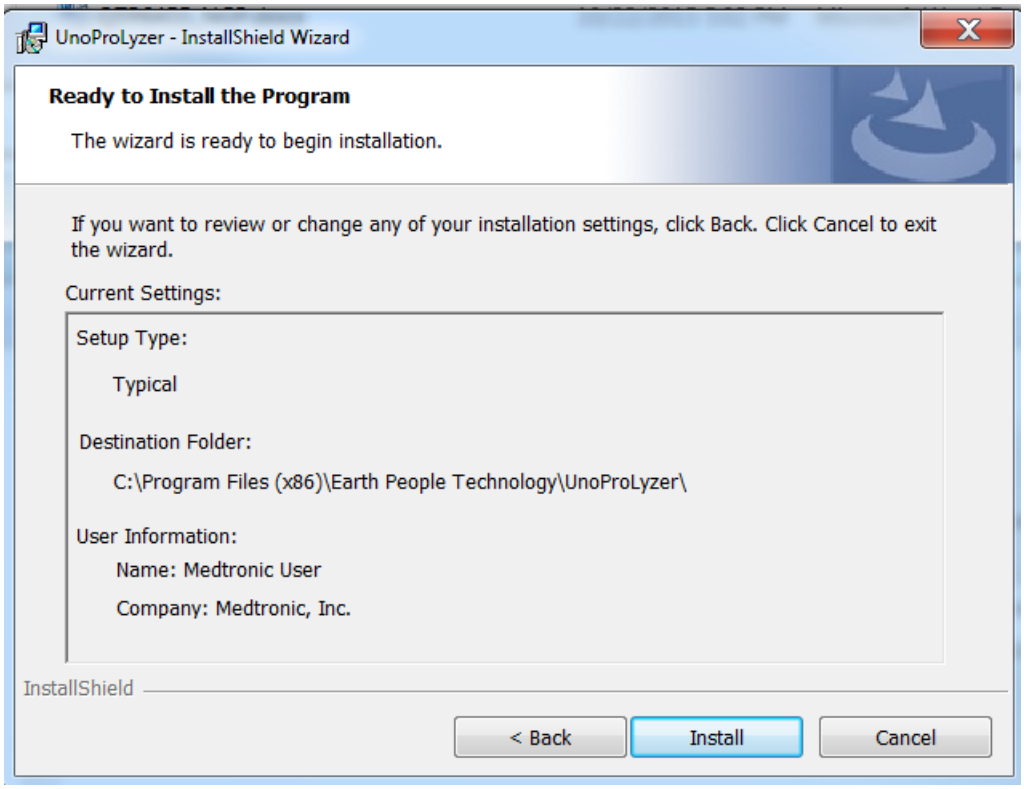


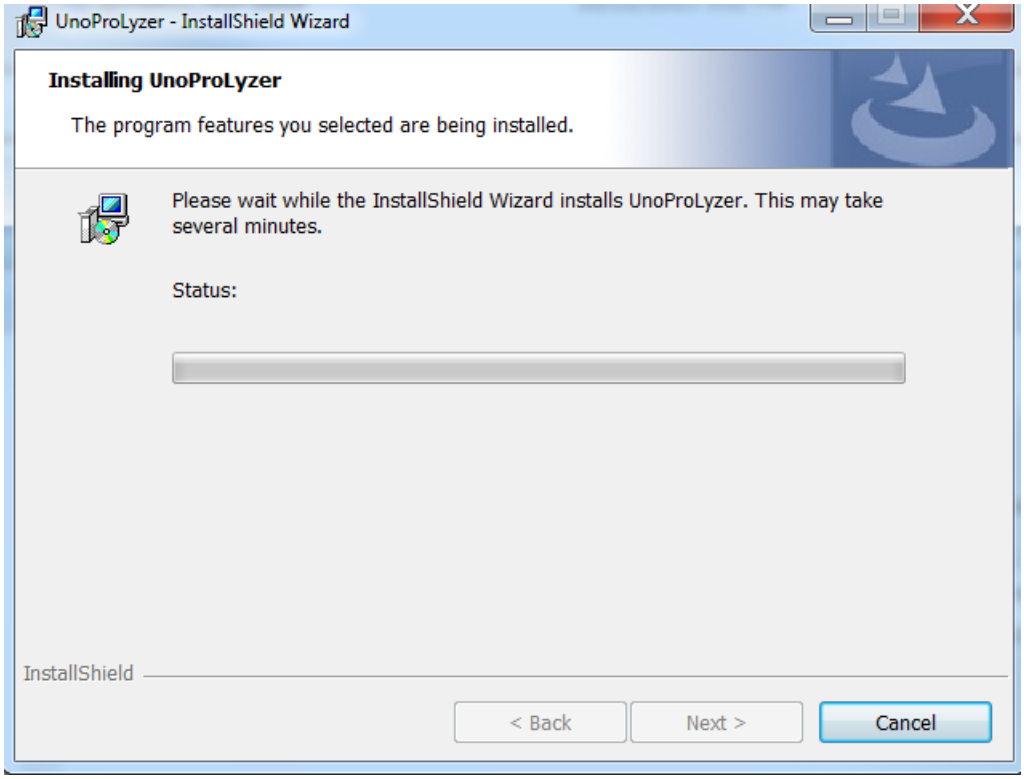
Just double click on the setup icon to launch the installer. Click through all of the install screens by clicking “Next”.

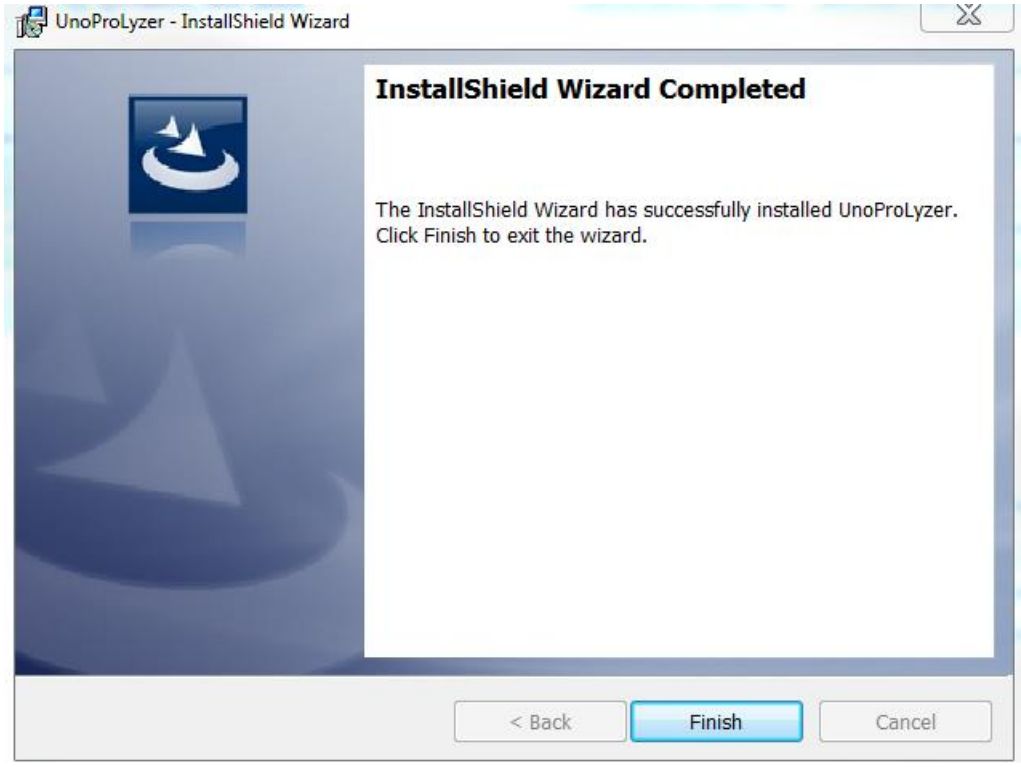

UnoProLyzer - InstallShield Wizard
Preparing to Install...
UnoProLyzer Setup is preparing the InstallShield Wizard, which will guide you through the program setup process. Please wait.
Configuring Windows Installer
Cancel


UnoProLyzer - InstallShield Wizard
Welcome to the InstallShield Wizard for UnoProLyzer
The InstallShield(R) Wizard will install UnoProLyzer on your computer. To continue, click Next.
WARNING: This program is protected by copyright law and international treaties.
< Back
Next >
Cancel

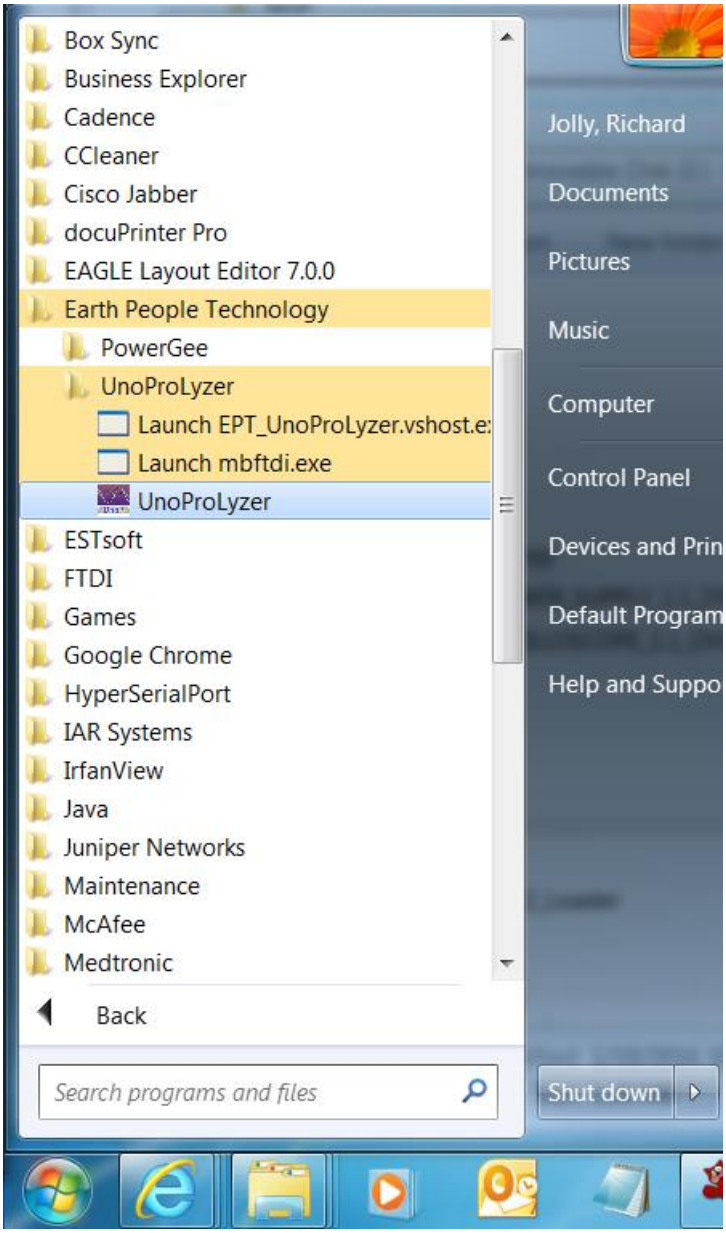

UnoProLyzer - InstallShield Wizard
License Agreement
Please read the following license agreement carefully.
To add your own license text to this dialog, specify your license agreement file in the Dialog editor.
1. Navigate to the User Interface view.
2. Select the LicenseAgreement dialog.
3. Choose to edit the dialog layout.
4. Once in the Dialog editor, select the Memo ScrollableText control.
5. Set FileName to the name of your license agreement RTF file.
After you build your release, your license text will be displayed in the License Agreement dialog.
I accept the terms in the license agreement
I do not accept the terms in the license agreement
Print
InstallShield
< Back
Next >
Cancel


UnoProLyzer - InstallShield Wizard
Ready to Install the Program
The wizard is ready to begin installation.
If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.
Current Settings:
Setup Type:
Typical
Destination Folder:
C:\Program Files (x86)\Earth People Technology\UnoProLyzer\
User Information:
Name: Medtronic User
Company: Medtronic, Inc.
InstallShield
< Back
Install
Cancel


UnoProLyzer - InstallShield Wizard
Installing UnoProLyzer
The program features you selected are being installed.
Please wait while the InstallShield Wizard installs UnoProLyzer. This may take several minutes.
Status:
InstallShield
< Back
Next >
Cancel



When the installation is complete, the application is ready for use. The installer adds a folder under the users Programs (x86) folder. Go to Start->EarthPeopleTechnology->UnoProLyzer to view the files and folders.

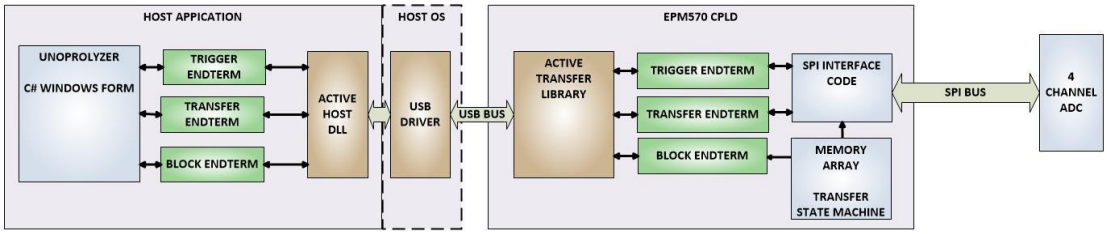


Just click on the UnoProLyzer icon to launch the application.

UnoProLyzer Functionality

The Open Source Software of the UnoProLoyzer uses the Active Host API in the PC and the Active Transfer Library on the CPLD. The Active Host API and the Active Transfer Library

provide the “pipe” mechanism that allows commands to be sent and ADC data received from the UnoProLogic2. The pipe mechanism is provided by “EndTerms”.



The user code connects to “Endterms” in the Active Host dll. These Host “Endterms” have complementary HDL “Endterms” in the Active Transfer Library which reside in the CPLD code. Users have seamless bi-directional communications at their disposal in the form of:

- Trigger Endterm
- Transfer Endterm
- Block Endterm

User code writes to the Endterms as function calls. Just include the address of the individual module (there are eight individually addressable modules of each Endterm). Immediately after writing to the selected Endterm, the value is received at the HDL Endterm in the CPLD. The Trigger Endterms send single bits to the CPLD. The Transfer Endterm sends a single byte. And, the Block Endterm sends a block of bytes. By using one of the Active Host Endterms, the user can create a dynamic, bi-directional, and configurable data transfer design.

The Active Host API is designed to seamlessly transfer data from the CPLD when it becomes available. It is a transparent receive transfer path made possible by using a callback mechanism. The data seamlessly appears in Host PC memory from the ADC.

C# Window Functionality

The C# data flow on the PC starts with the initialization of variables, controls, events, and read callback functions. The Windows Form is displayed on the PC and the system registry is scanned for any Earth People Technology devices. Any devices that are found are added to the drop down

box. The user must then select the available EPT device and click the Open control. This will select the device and allocate all memory needed for the Active Host EndTerms. Next, the user must click on the Start button. Clicking this button will set the start/stop bit of the control register and send it to the UnoProLogic. The CPLD will decode this message and assert the Start_Stop_Control signal. Once this signal is asserted, the user must click on the On/Off button to send a serial command to the ADC. This is the "Start ADC" command. This causes the Girino code to fill up the ADC Buffer. When the Girino code has detected a trigger and filled the ADC Count has reached its max "waitDuration", it transmits all bytes in the ADC Buffer up to 500 bytes. Each byte is transmitted through the Active Block Endterm of the CPLD code. When the blocks are received by the C# Window, the read callback function is called. The read callback will call the EPTParseReceive() function which calls the TransferOutReceive() function. In this function, each byte is stored in the byte array: "ScopeBuffer". This process of filling the ScopeBuffer array continues until the Girino code signals completion of the ADC Buffer transmission. When the Girino code has completed the transmission of the entire ADC Buffer, it asserts the "End Of Buffer" signal. This signal is connected to pin 3 of J9 of the UnoProLogic. The CPLD uses this signal to send a Trigger 2 using the Active Trigger EndTerm. At this point the ScopeBuffer has a complete cycle of the analog signal to display in its window. The Trigger 2 Active Trigger Endterm causes the "invalidate()" function to be called. This function will automatically cause the functions with a "Graphics" variable to be refreshed. During the Refresh of the display data, the vertical and horizontal scaling is performed. Nexti, Redrawing the graphics will cause the new values in the ScopeBuffer to be displayed in the Oscilloscope window Finally, all data is displayed on screen. The cycle repeats until the Stop button is pressed.

The button events will cause code to be executed when a button is pressed. The Visual .NET framework takes care of the background code which monitors the button events and any interrupts associated with executing this code.

Data Storage Array

The Data Storage Array is the place in the Windows memory where the data to be sent to the UnoProLyzer is stored. It interfaces to the ActiveHost.dll. This is declared as an integer array with a maximum size of 50,000 integers by four channels. Each ten bit integer is stored into this array will become a pixel in the display. The value of each integer will become the signal

amplitude. The position of each integer in the Data Storage Array is the point in time in which the data sample was collected. Each integer added to the Data Storage Array is ten bits.

Channel selection

The UnoProLyzer can display up to four individual channels of analog data. When the U sends a block of data to the EPT-5M57-AP-U2, they send it to a channel. And the data that is collected at the PC will be displayed in that channel only.

Length of display pixels

There are 450 pixels from left to right on the display. Each division has 50 pixels in it. Each pixel is a data point that is derived from the data elements in the circular buffers.

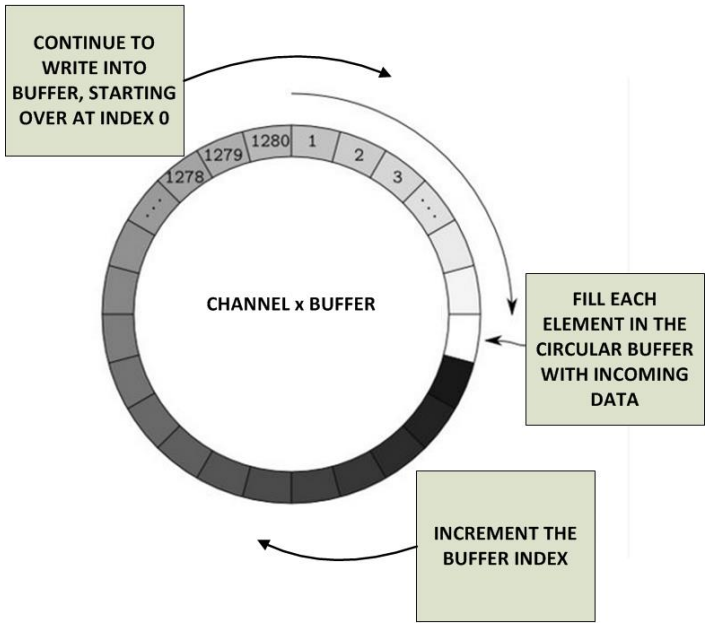
When the UnoProLyzer receives a FrameEnd command it reads the previous 450 data elements starting from the most recent data element from the selected channel in the circular buffer. It graphs each data element in one pixel. The value of the data element determines the amplitude of the signal.

Circular buffer description

The UnoProLyzer stores the incoming channel data into separate buffers. There is one buffer for each channel. All of these channel buffers are organized as Circular Buffers. The concept of using a Circular Buffer is pretty straight forward:

- Continuously store incoming data into the same buffer.
- When reaching the end of the circular buffer, start overwriting data at index 0.

It starts filling at index zero and increments the index whenever new data arrives. When the index reaches the maximum point, it starts filling the buffer at zero.



This approach allows you to save data forever without having to use the hard drive of the PC. If we imagine the array arranged in a circular way it is easy to see from the diagram.
Just keep saving data and start over when the buffer rolls over. So we end up with a buffer filled with the channel data. When a FrameEnd command comes in from the EPT-5M57-AP-U2 , the UnoProLyzer reads the 450 buffer elements from the selected channel and graphs them in the appropriate channel color. It will then store the index value that it read up to into a local register. The next time the FrameEnd command is received by UnoProLyzer, it reads 450 buffer elements starting at the end point of the previous read graph. This way, data will be graphed in an orderly manner in which it was received by UnoProLyzer.

This process can repeat forever, the incoming data will never overflow the local memory or slow down the computer by using the hard drive.

When to update the display

The display can be updated at any time. Just call the Invalidate() function and the graph will update with the latest 450 data elements. When the UnoProLyzer receives this command, it reads the previous 450 data elements from the first channel and graphs them in the display in the appropriate channel color. It continues to do this with all of the active channels and they have all been displayed.

Each of these types of data will be graphed using a different strategy of when the frame end should occur. For real time data, the circular buffers in UnoProLyzer are constantly written to as fast as possible. Every time the buffer index reaches 450, the frame end should be called. For long duration data, the frame end should be called after each data element is added to the buffer. For mathematical data, the frame end only needs to be called after the equation is complete and you want to graph the results.

Scaling and Scrolling

There are menu items on the UnoProLyzer that allow you to view the contents of the buffer using different methods.

i. Zoom in the buffer
ii. Zoom out of the buffer
iii. Shift left in the buffer
iv. Shift right in the buffer

These four menu items will change the method of reading 450 buffer elements starting at the previous end point, and graphing these elements in the selected channel. The Zoom in feature will read each element from the channel buffer and add a selected amount of "dead time" between each element. It then graphs this data in the selected channel. The effect of this "dead time" between each graph point is zooming into to the data. The amount of "dead time" between each data point is selectable by the Horizontal Scale slider. The Zoom out feature will decimate the data and graph the selected channel. This means that the data is read from the channel buffer at intervals of n+1. So, data is skipped. When the data is graphed, the effect is that we are zooming out of the data. The amount of "skipped data" between each data point is selectable by the Horizontal Scale slider.

The Shift Left and Shift Right feature will add some user selectable amount to the previous end point of the graphed data. UnoProLyzer then reads 450 elements from the buffer and plots them. The effect is that the data is shifting right or left on the screen. The amount of shifted data t is selectable by the Horizontal Scale slider.

UnoProLogic2 Functionality

The CPLD does not need any initialization as the device is ready to operate soon after the power is applied. The data flow in the UnoProLogic2 starts with a wait loop for the Start_Stop_Control signal to be asserted from the Control Register. Once this happens, the data flow will fall into the main state machine and wait for the adc_start_conversion signal to assert. When the

adc_start_conversion asserts, that state machine moves to the “WAIT_FOR_EOC” state. The external signal ADC_CNVST asserts. This signal informs the ADC to start a conversion. When the conversion is complete, the ADC asserts the ADC_EOC (end of conversion) signal. This signal will cause the state machine in the CPLD to move to the ‘START_DATA_RECEIVE” state. In this state, the CPLD engages the internal SPI bus unit and causes the SPI bus to read two bytes from the ADC per channel selected. Upon the read of each byte, the state machine causes the block of code that writes bytes into the memory to read the data byte from the SPI bus. Then clock the byte into the 2-D memory_array. This process continues until the internal memory count reaches the maximum number of bytes per channels selected (a total of eight if the max four channels are selected).

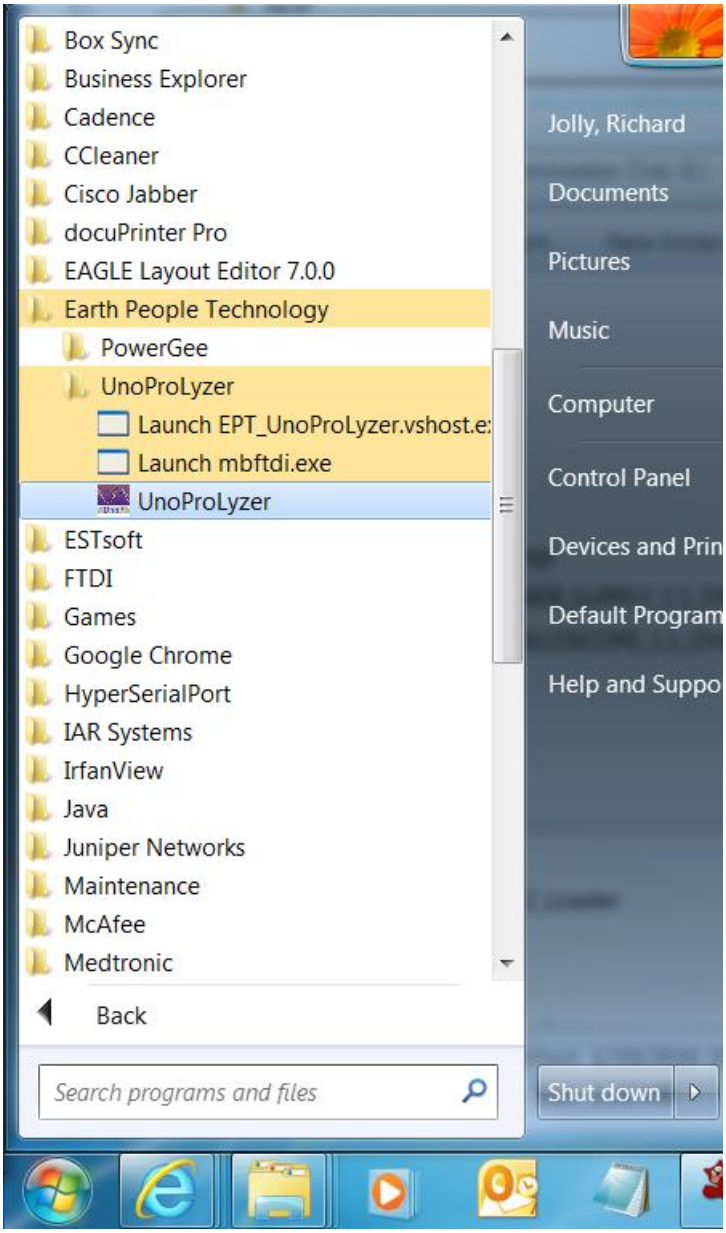
When the maximum number of bytes have been read from the ADC, the state machine will immediately enter the TRANSFER_TO_HOST state and asserts the block_out_send signal which informs the Active Block Endterm that a block transfer has started. This state will wait for the block_busy signal to assert which is an acknowledgement that the block transfer has been accepted by the Active Transfer Library. Active Block Endterm toggles the block_byte_ready signal to inform the user code to put a new byte from the memory_array on the block_out_byte register. The user code will toggle the memory read enable signal to push the first byte in the memory onto the block_out_byte. The user code will wait for the Active Transfer Library to complete the transfer across the USB. When the transfer is complete, the block_byte_ready signal goes low and causes the internal counter to increment and select the next byte from the memory_array. This process will continue to wait for block_byte_ready to signal that the Active Block Endterm is ready for the next byte from the memory_array. The block_out_counter is checked to determine if the count has surpassed the memory_array_count. If this statement is true, state machine goes to the TRANSFER_COMPLETE state. When the block_busy signal de-asserts, the state machine goes back into the IDLE state.

When the maximum number of bytes have been transferred from the memory_array to the host, the state machine returns to the IDLE The block of code: ADC conversion start command then executes and determines if another adc_start_conversion signal should be asserted. If adc_sample_counter is less than 1000, it asserts the adc_start_conversion signal and the process of reading the ADC and sending the results to the hosts starts over. This block of code sends a total of 1000 samples to the host. Then stops asserting the adc_start_conversion signal. The host must then send a restart command via the control_register to reset the adc_sample_counter. When this counter is reset, the block of code will start the process of asserting the

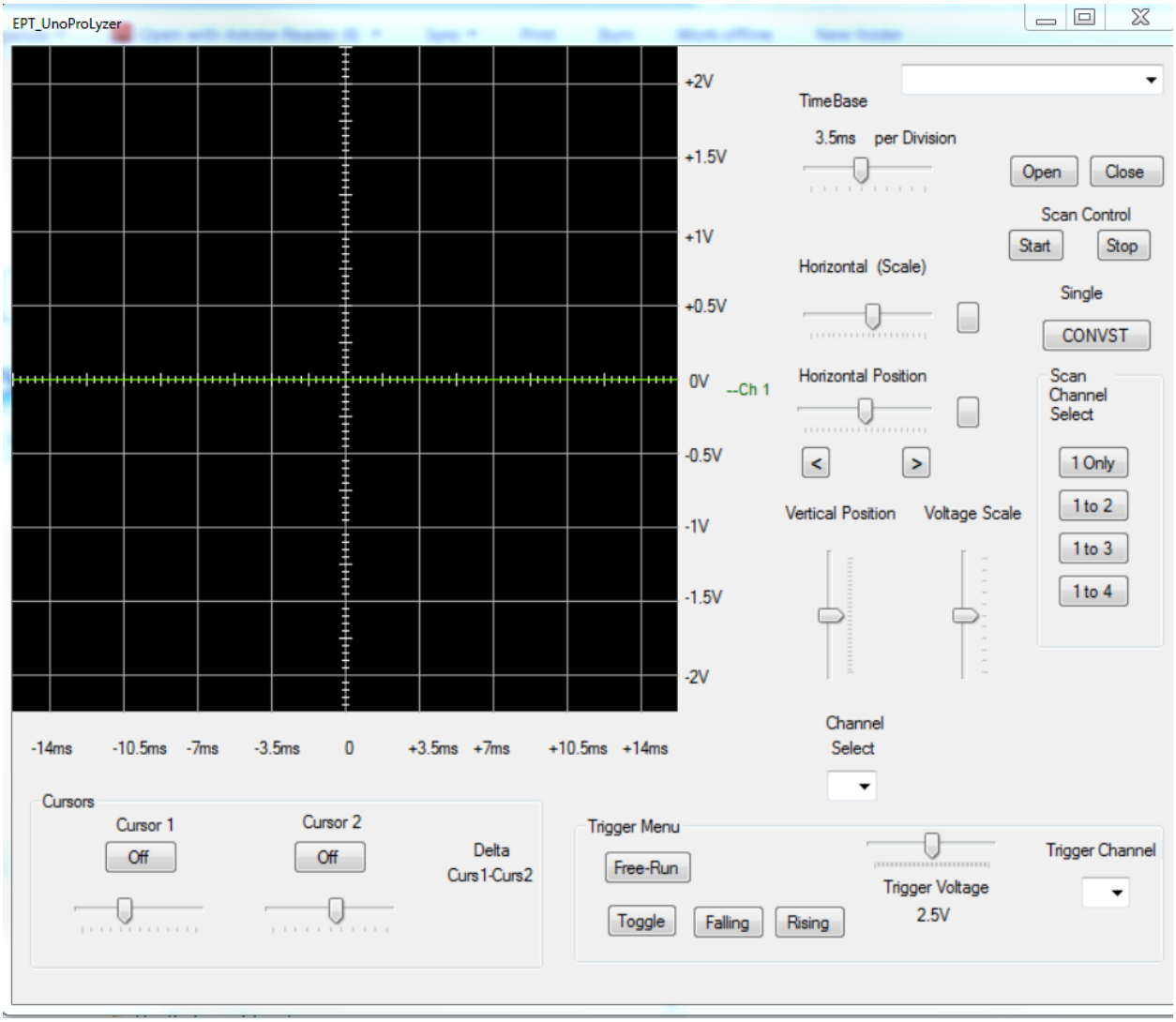
adc_start_conversion signal.

Using the GUI

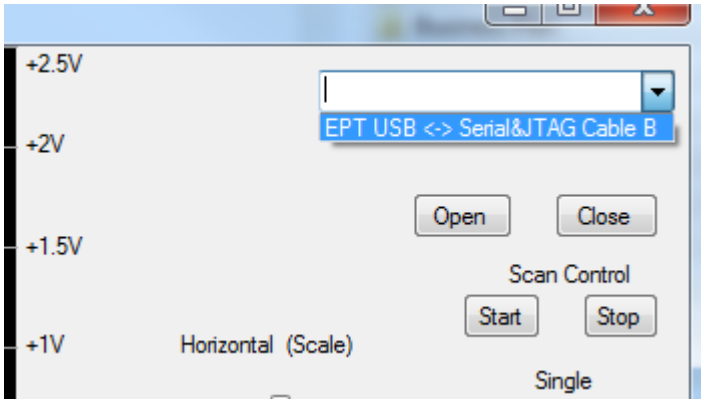
Connect the EPT-5M57-AP-U2 to the ADC Uno. Connect each board to an open serial port on the PC using both USB cables. Make sure that an example sketch is loaded into your ADC. Go to Start->UnoProLyzer to view the files and folders.



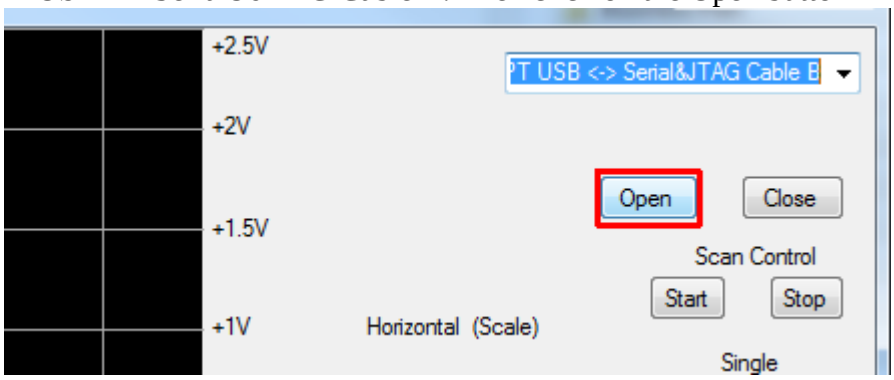
Just click on the UnoProLyzer icon to launch the application. When the application loads, click on the drop down box at the upper right of the window. Select the EPT USB<->Serial&JTAG Cable B in the list. Next, Click “Open”, select number of channels and click “Start”. The analog data will display on the graph.



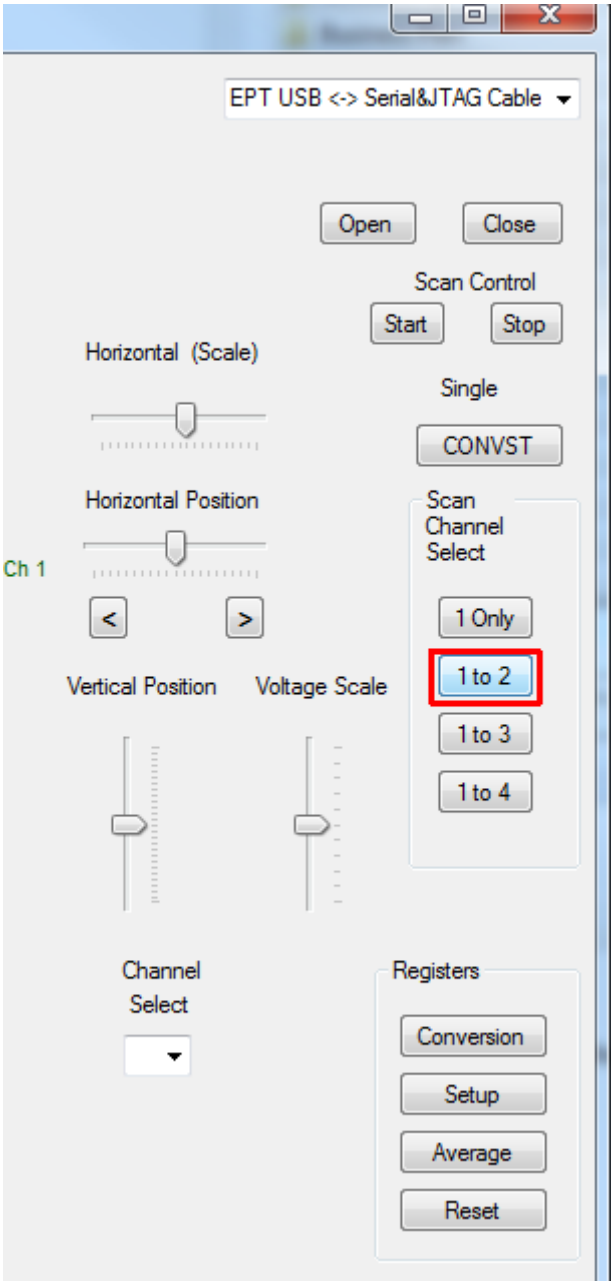
Go to the upper right of the window and click on the drop down box.



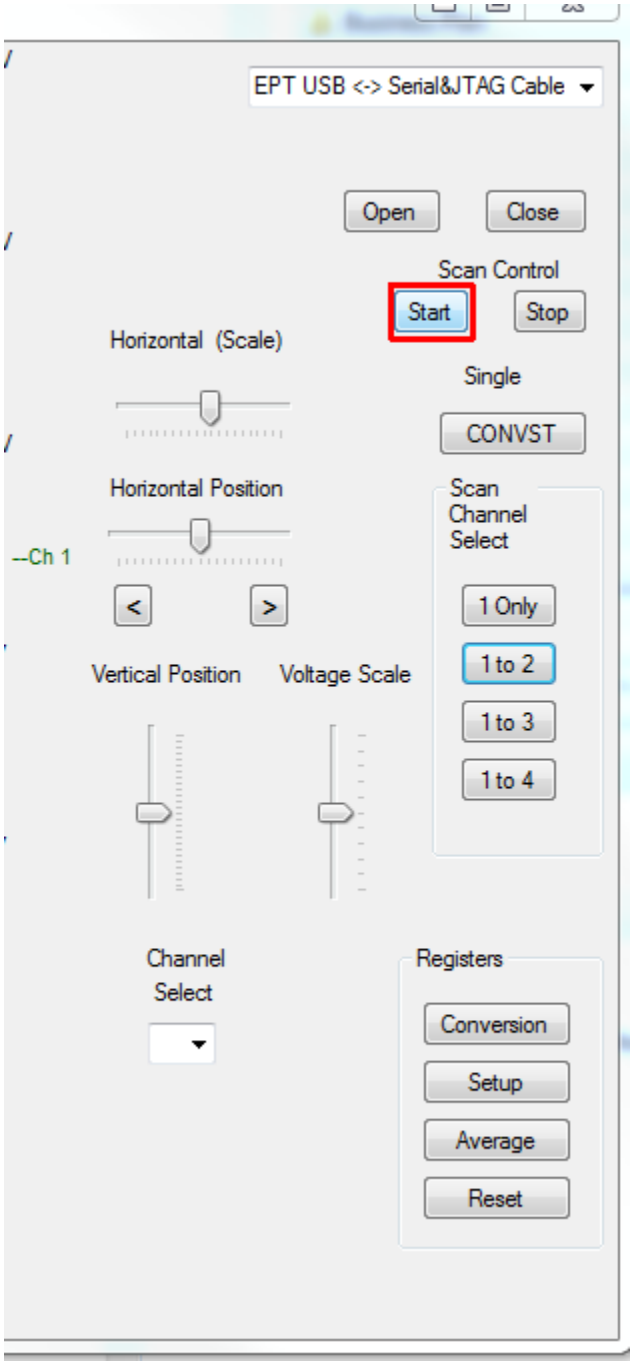
Select the "EPT USB<-> Serial&JTAG Cable B. Then click on the Open button



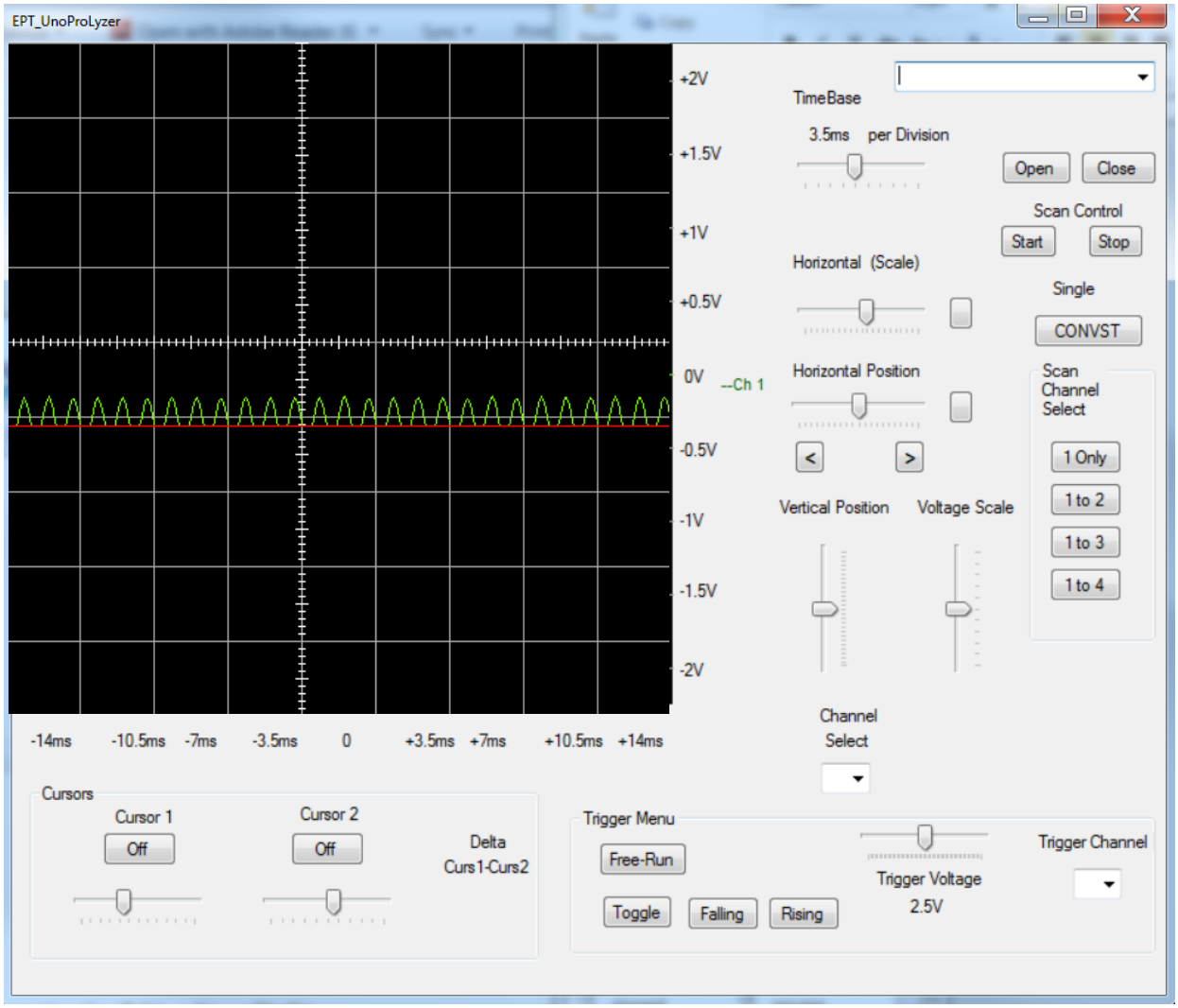
Next, select the number of channels to display. The channels have to be selected in sequential order, you cannot pick out single channel (except for channel 1). So for two channels, click on the "1 to 2" button. This will display the data from both channel 1 and 2.



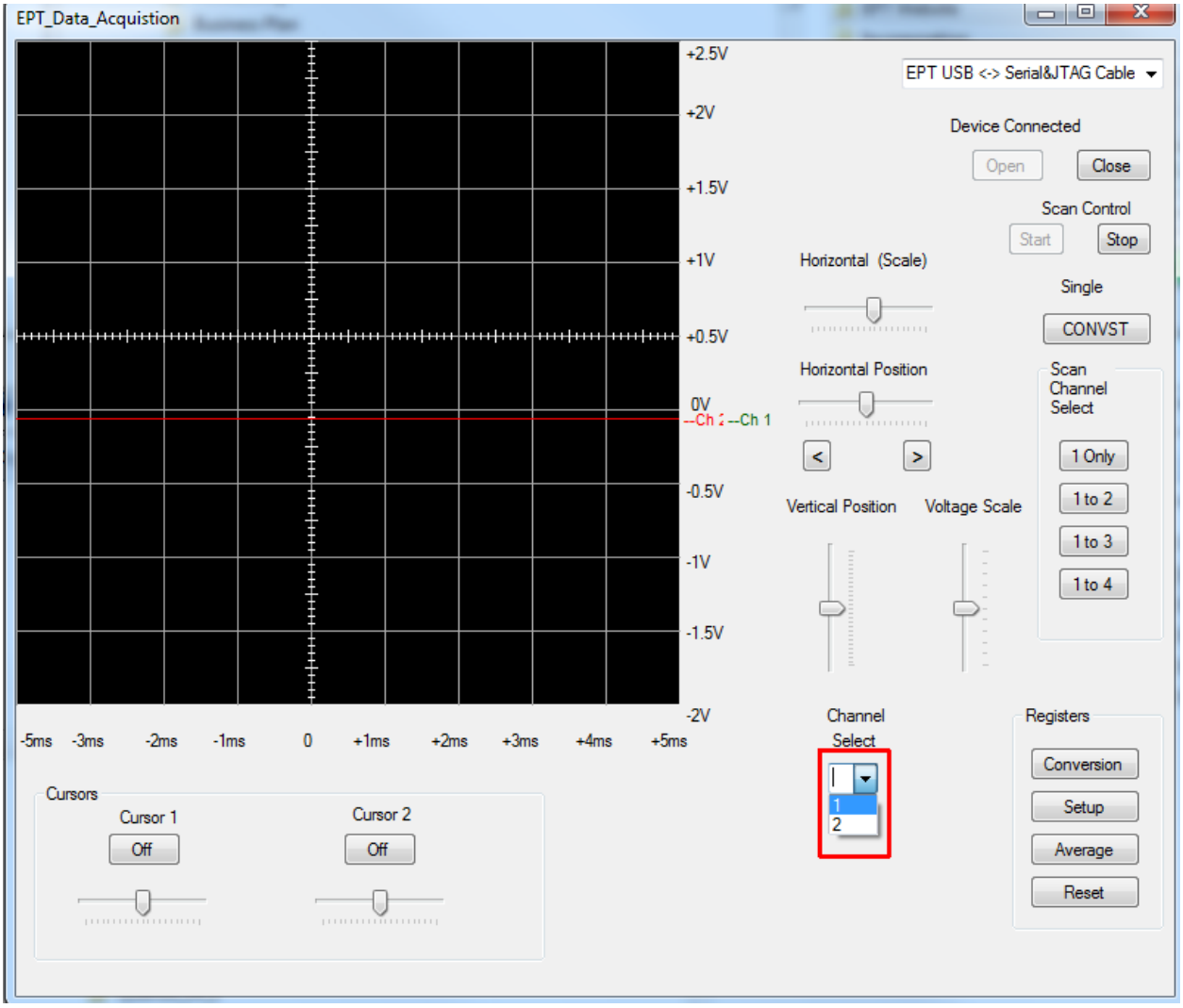
Next, click on the Start button.



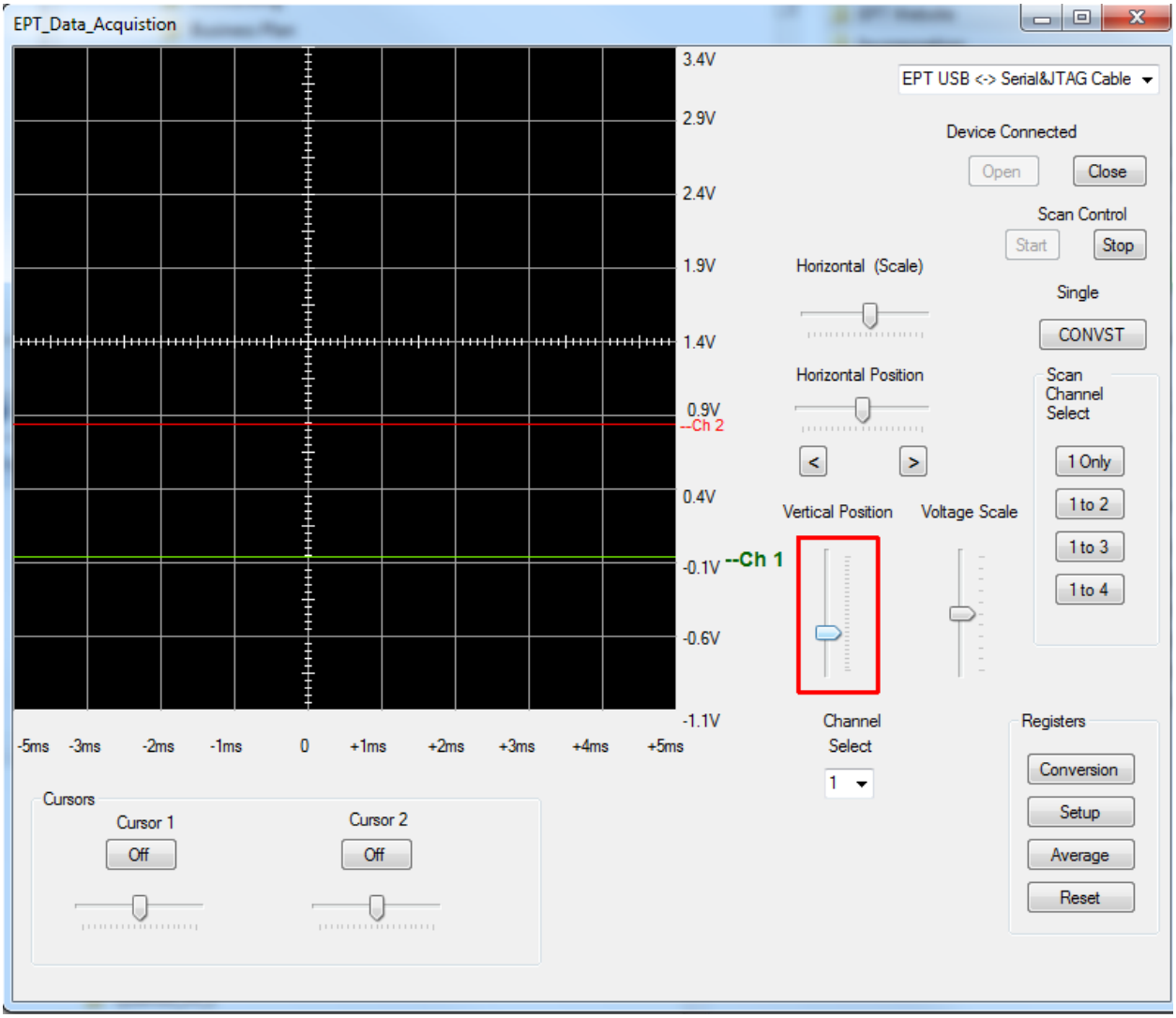
The data from the two channels will appear at the same latitude on the graph.



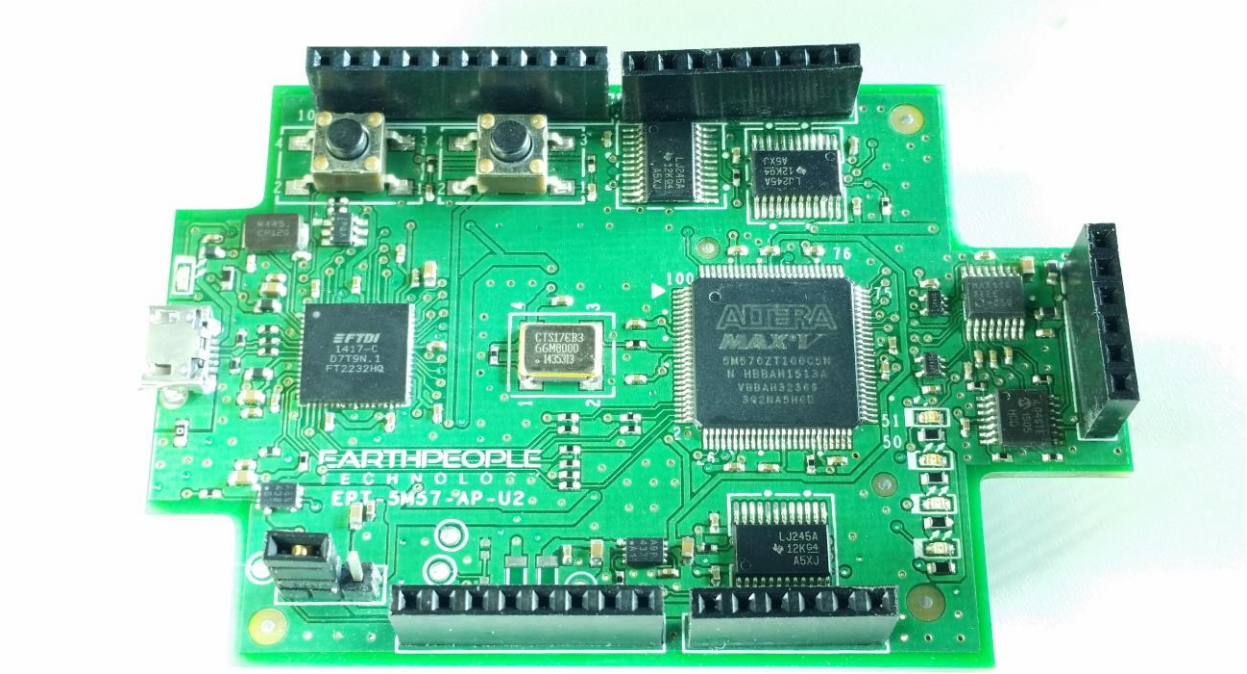
Next, locate the Channel Select drop down box and click on channel 1.



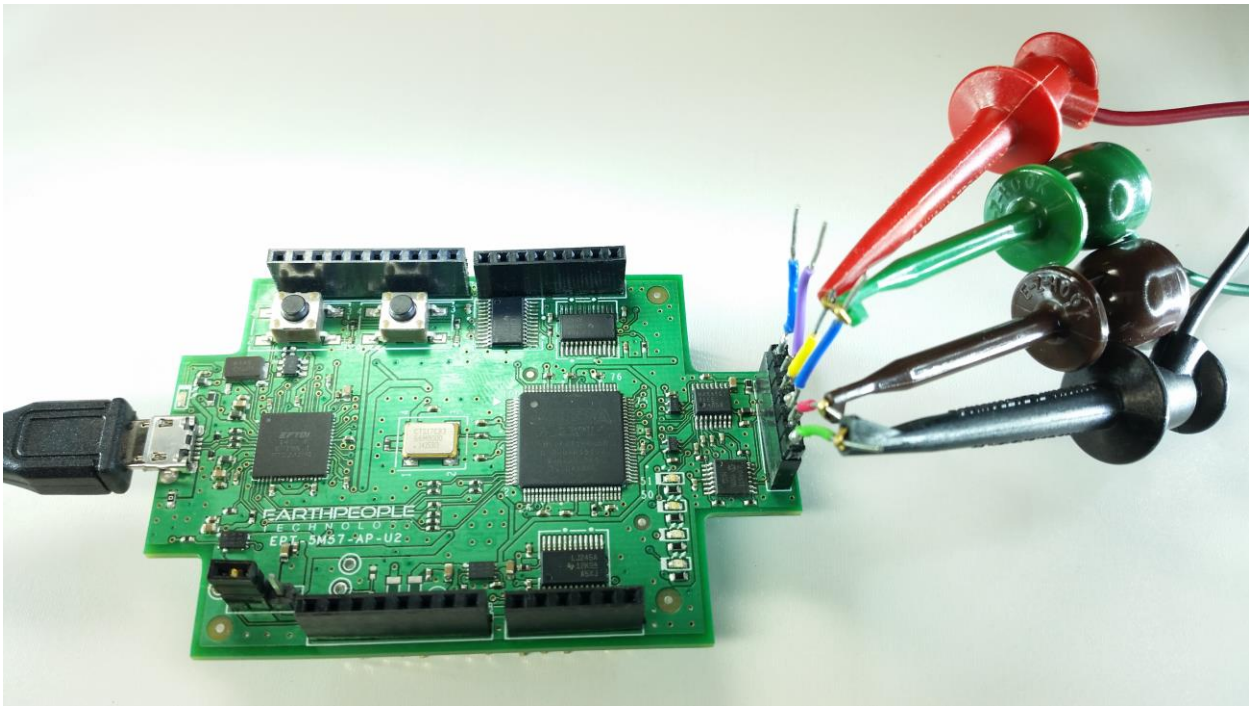
Locate the Vertical Position slider and pull it down. The channel 1 data will change position in the graph depending on where you move the slider. The voltage magnitude data also adjusts to indicate the magnitude of the data relative to the position of channel 1 data.



The selected channel will show up as a large icon. Its position indicates the zero position of the data. The magnitude information along the y-axis is only for the selected channel.
Then connect a signal to the channel 1 input on the
UnoProLogic2.



If you don’t have a 0-5 Volt signal to connect to the UnoProLogic2, you can use your finger and touch it to the bottom of the Analog Input Connector. The ambient electricity from your body has just enough current to give the Analog inputs a deflection from zero.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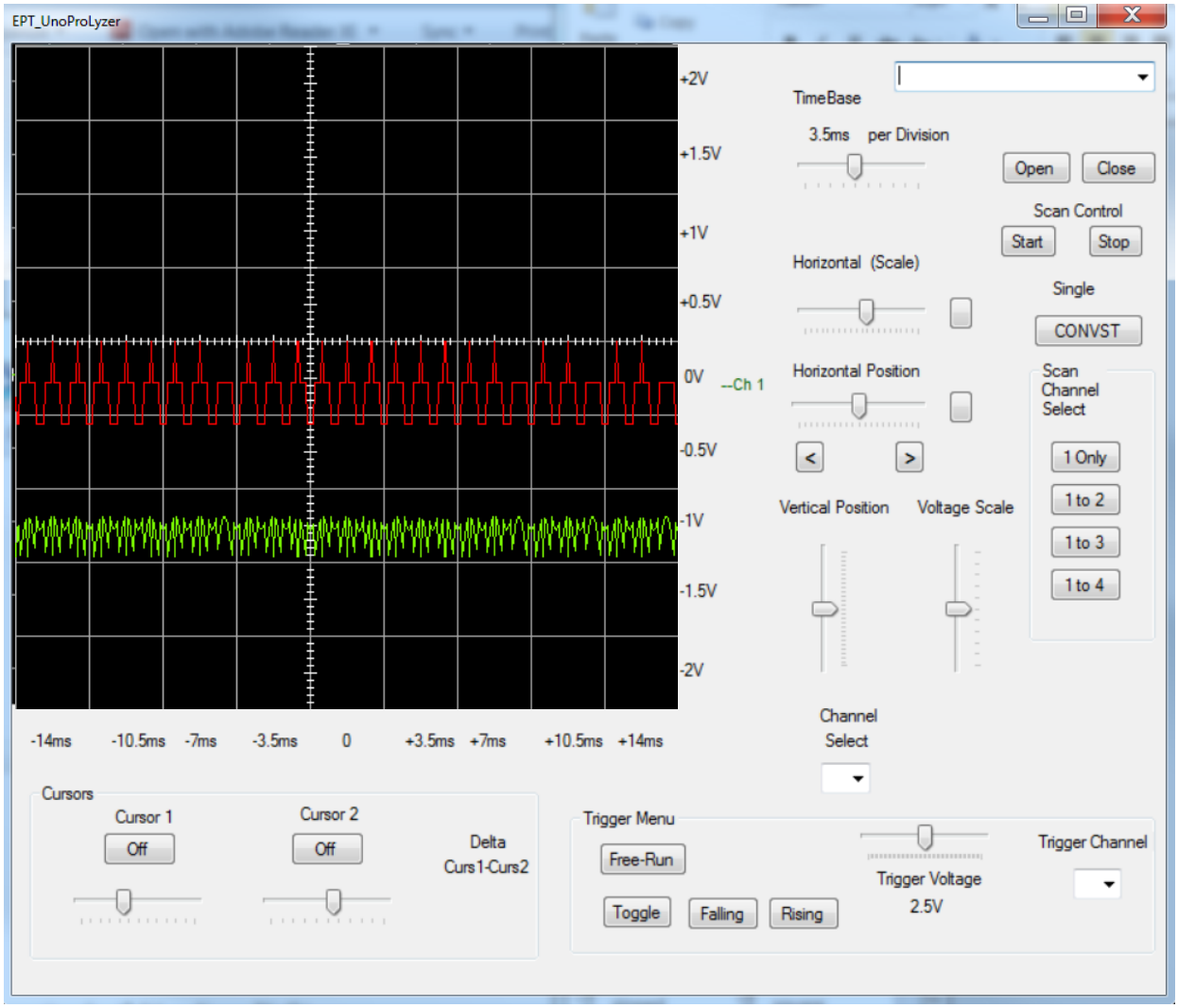
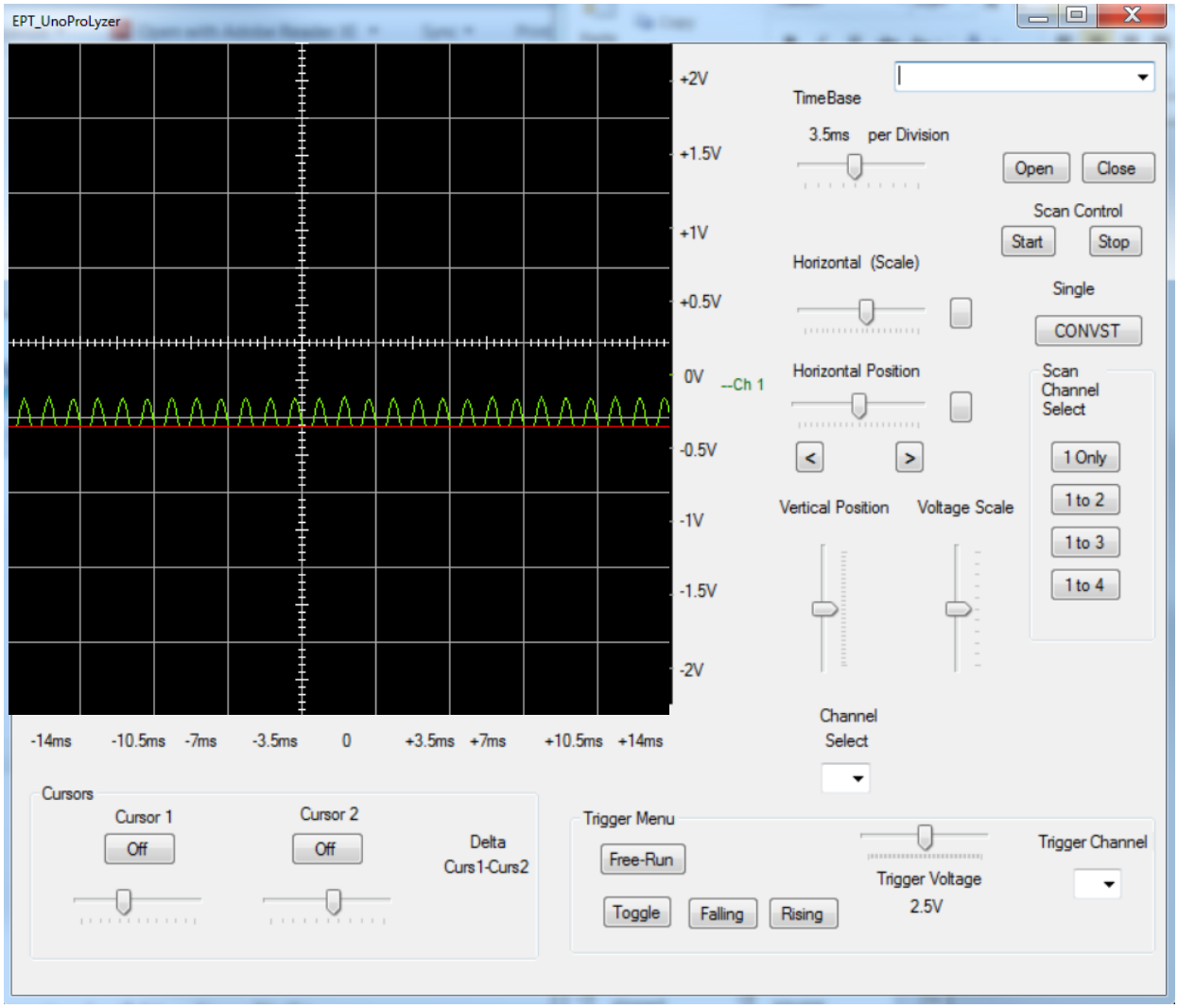
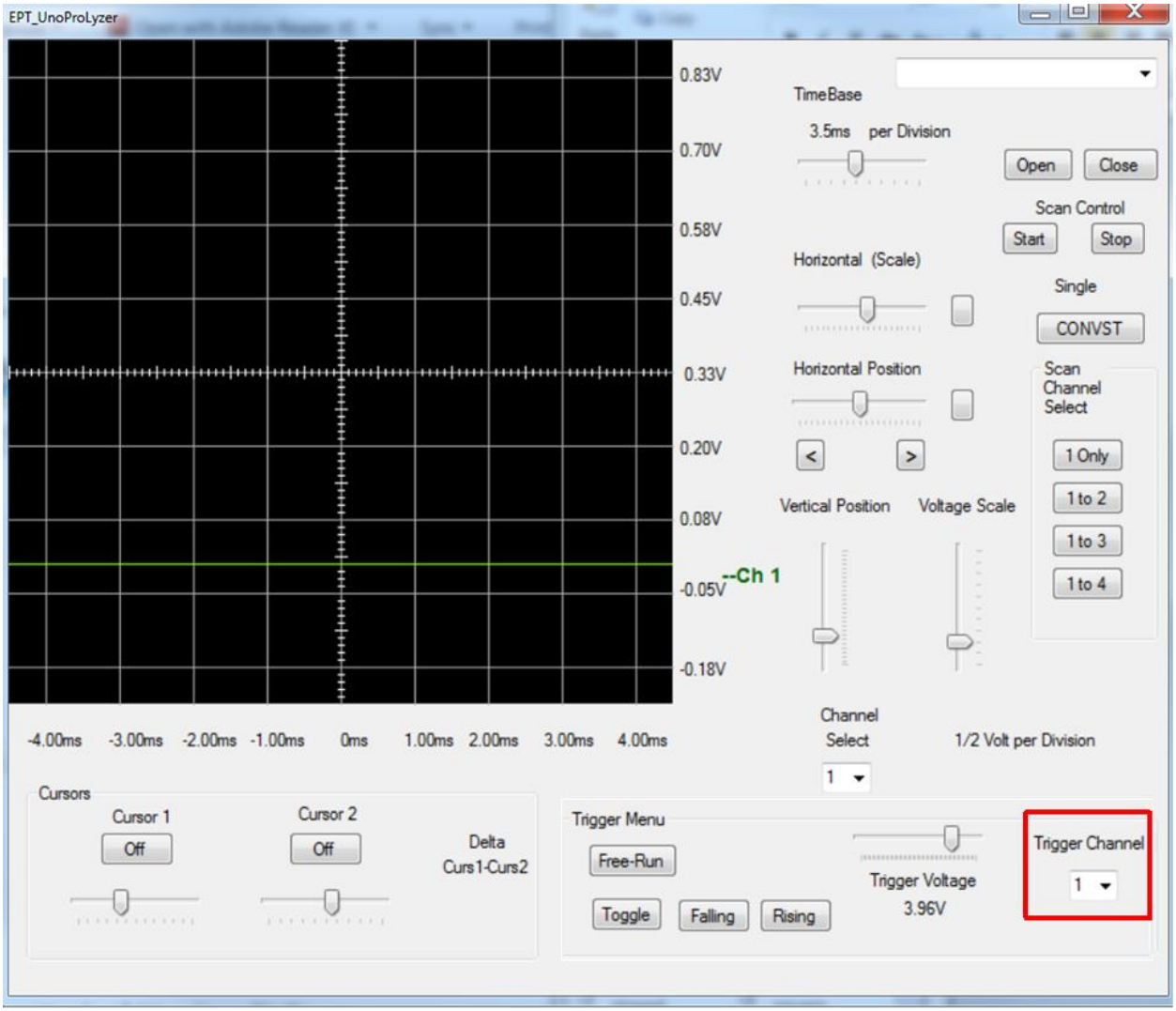
EPT-5M57-AP-U2



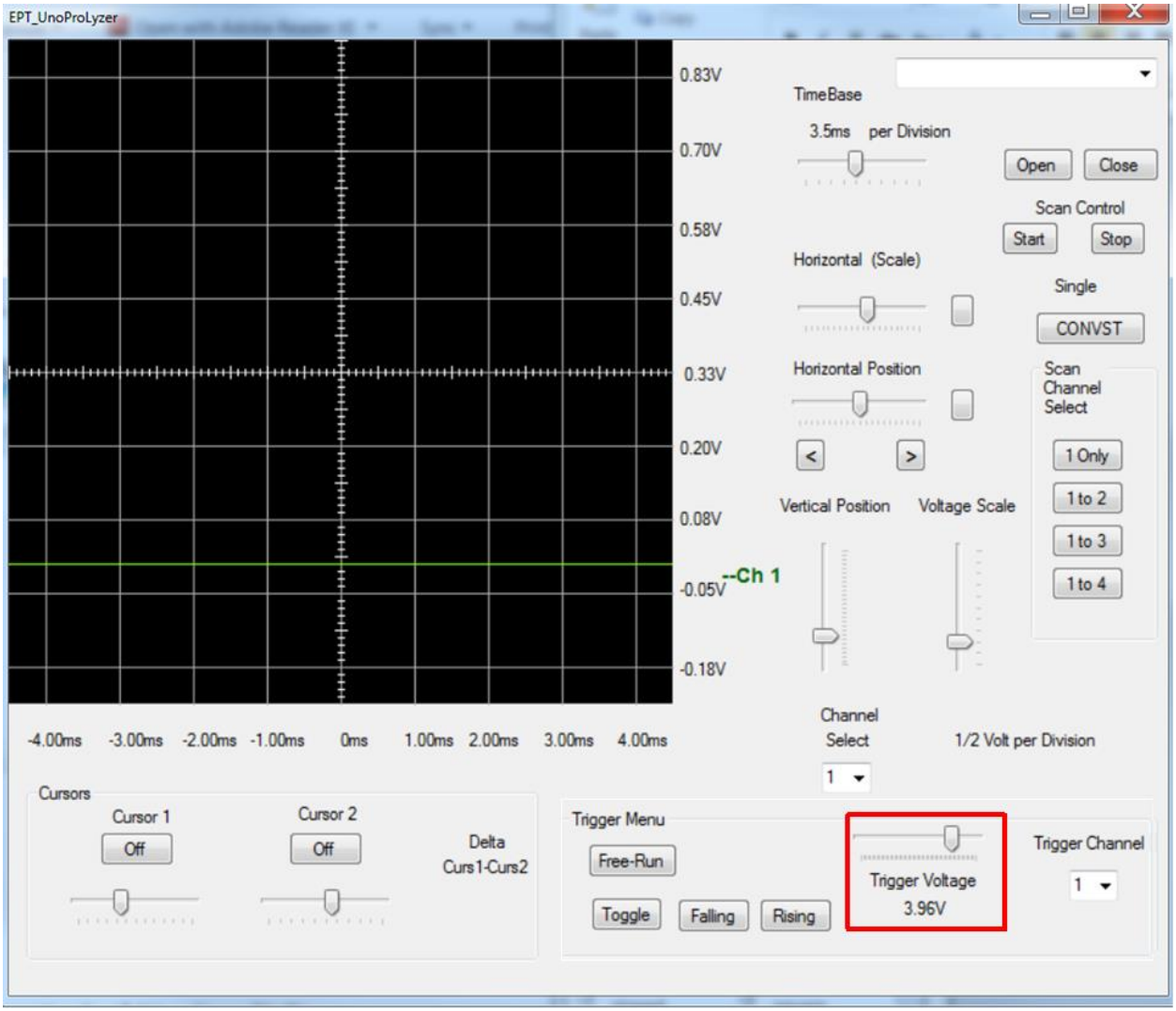
Now the UnoProLogic2 and UnoProLyzer are ready to measure an 0-5VDC signals.



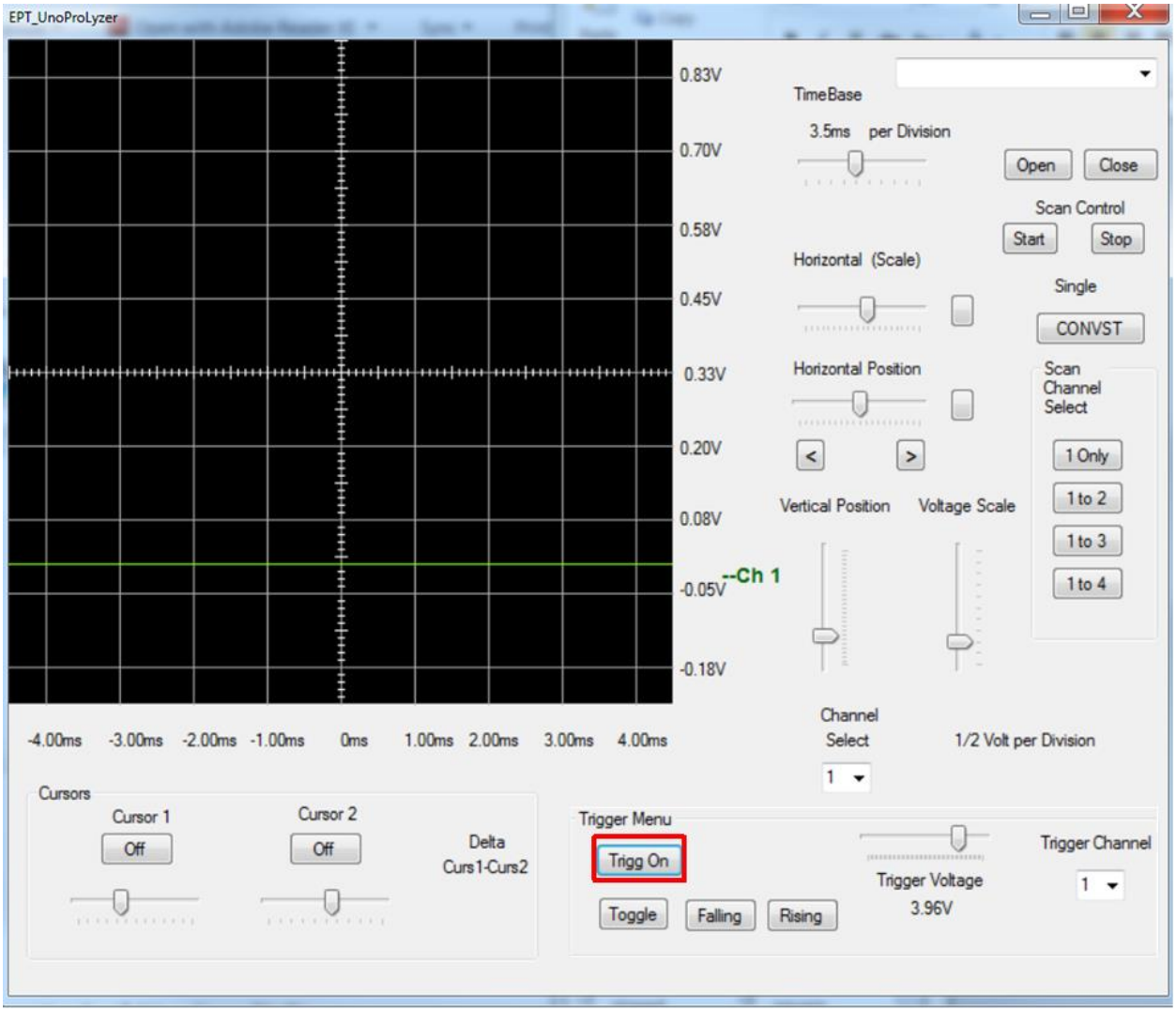
To set up triggering, locate the “Trigger Menu”. In this menu, locate the “Trigger Channel” drop down box.



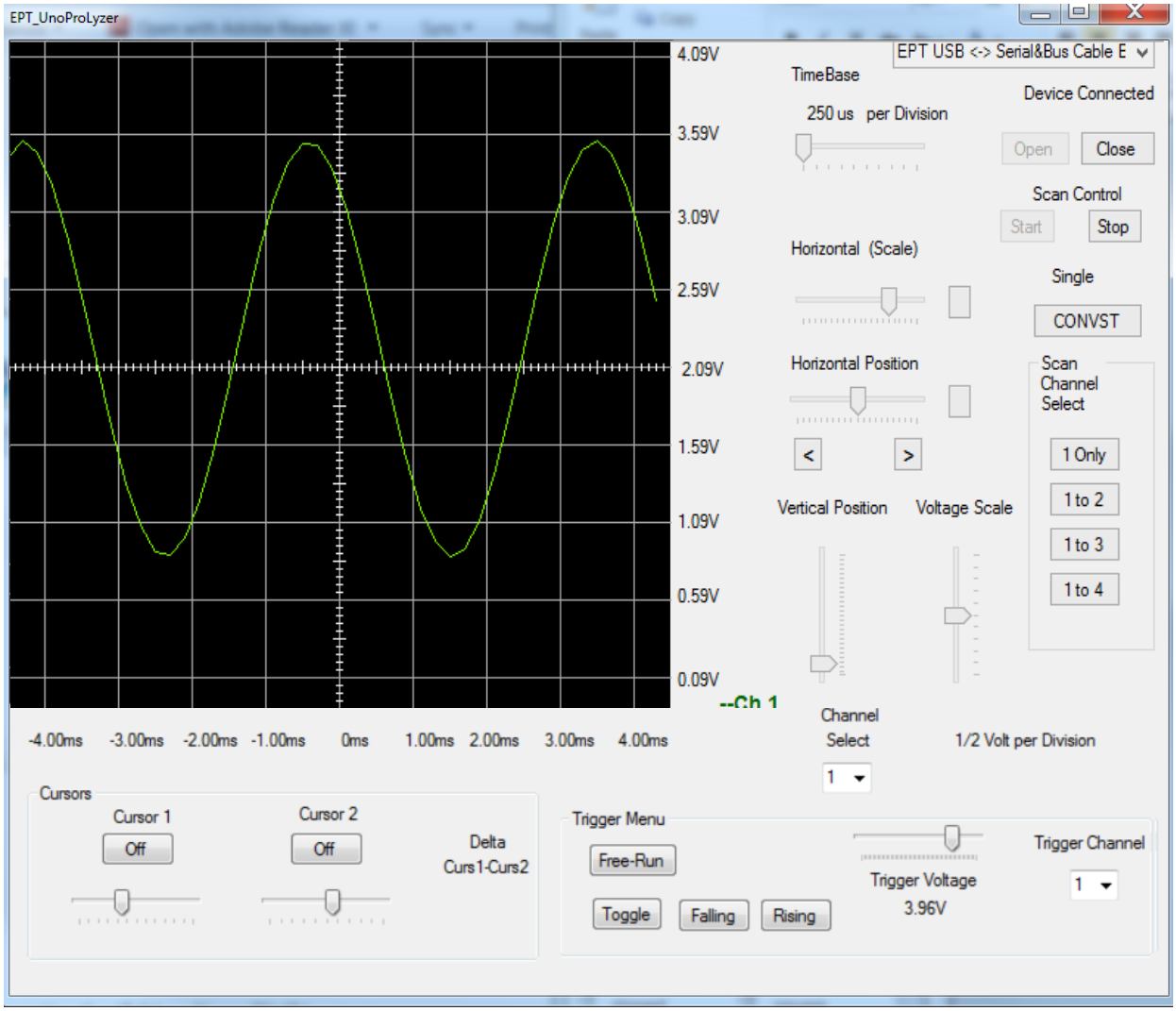
Click on the drop down box and select the channel in which to scan for the trigger value.



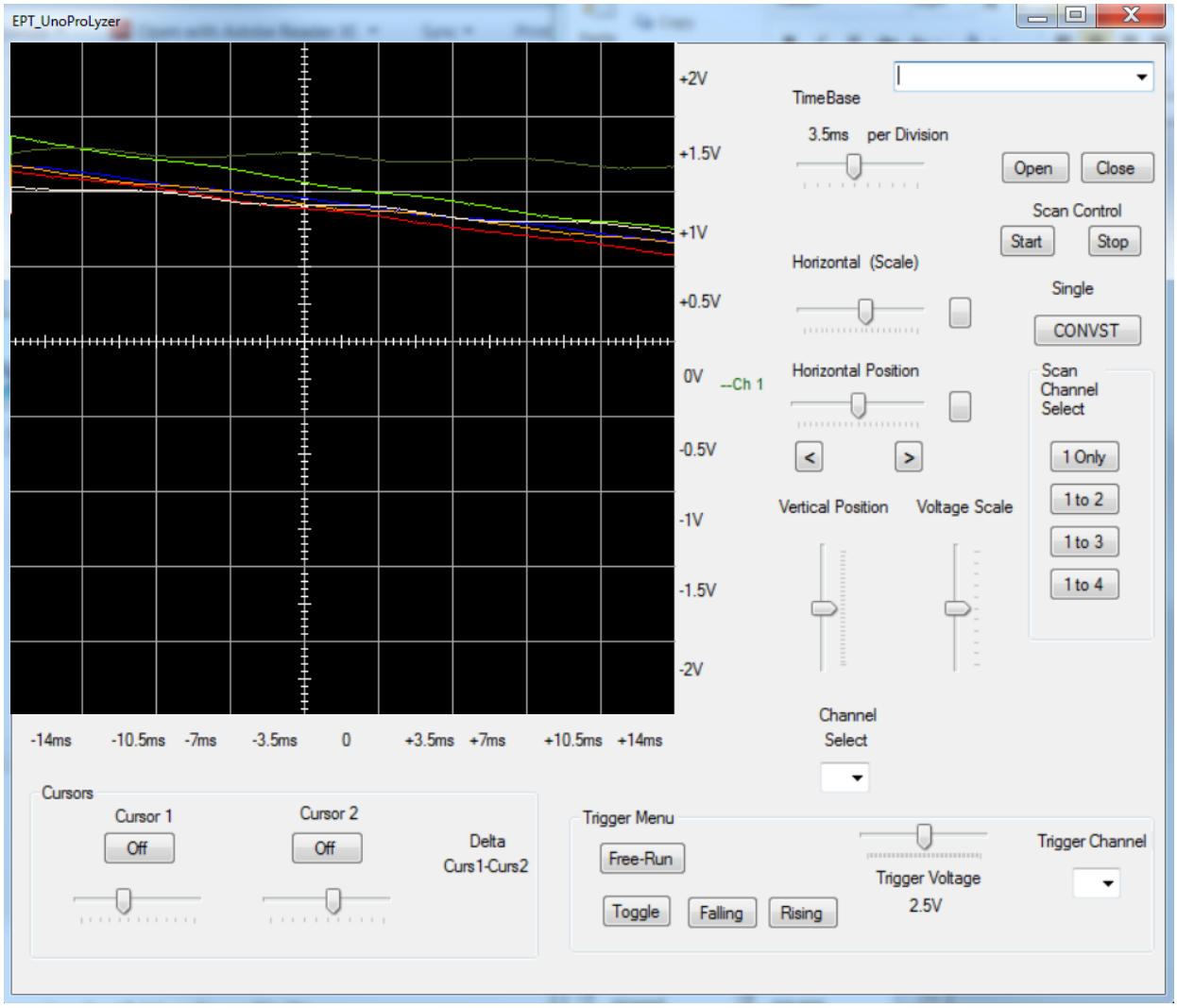
Next, adjust the “Trigger Voltage” level to the appropriate trigger threshold point.



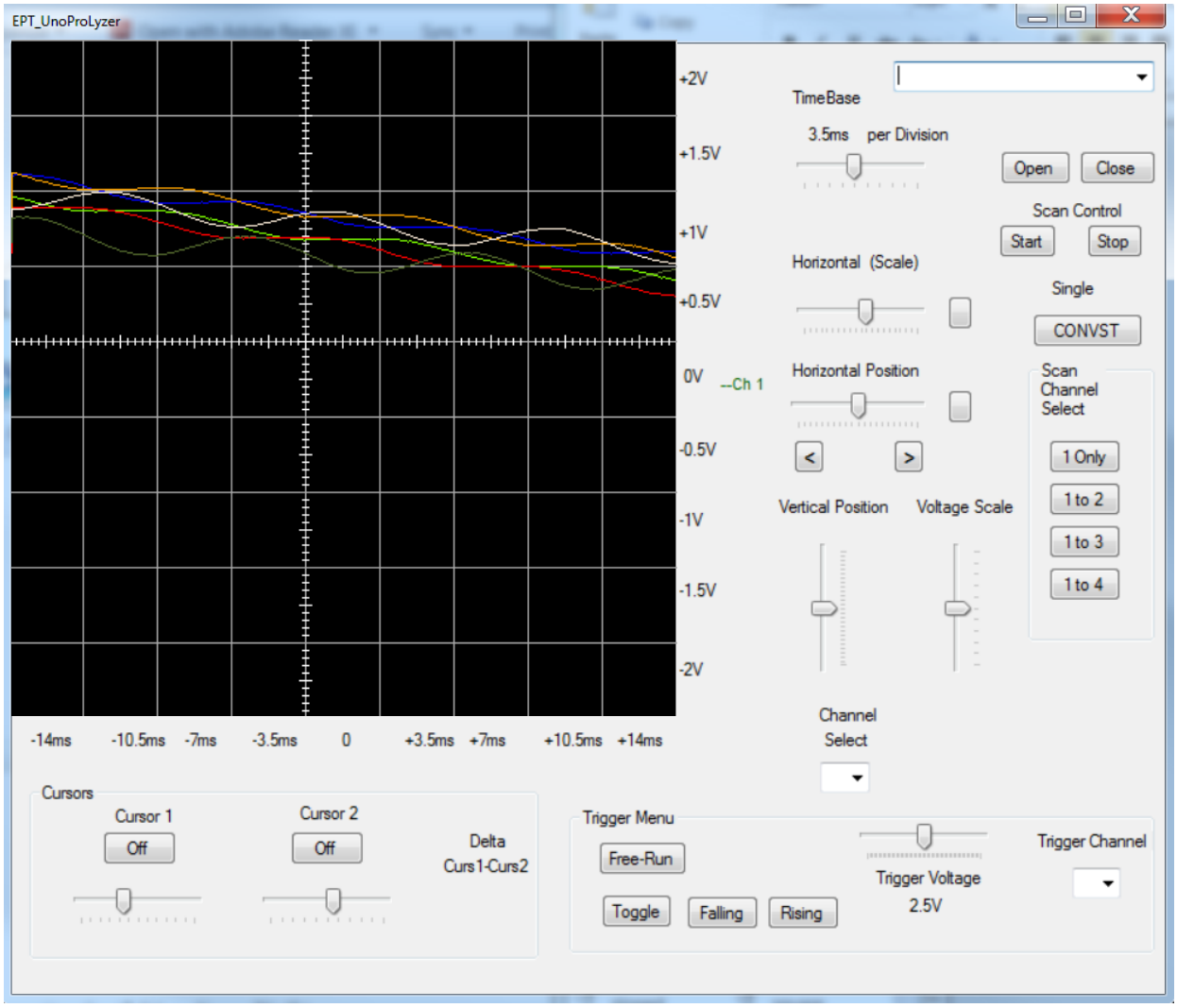
Click on the “Trigg On” button to turn on triggering.



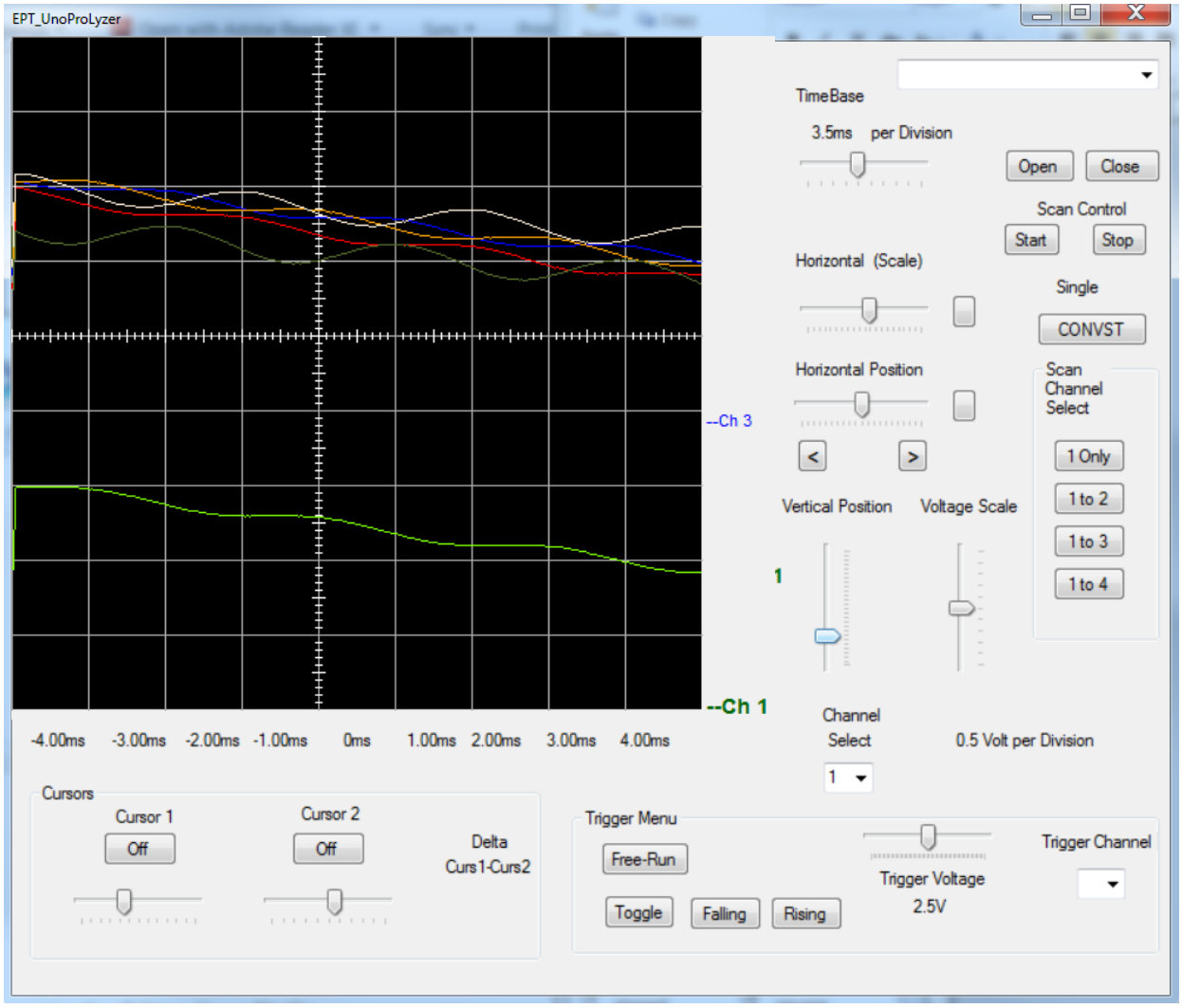
When the UnoProLyzer connects with the EPT-5M57-AP-U2 and all four channels are setup and start button has been pressed, the display will show all four analog inputs on the screen.



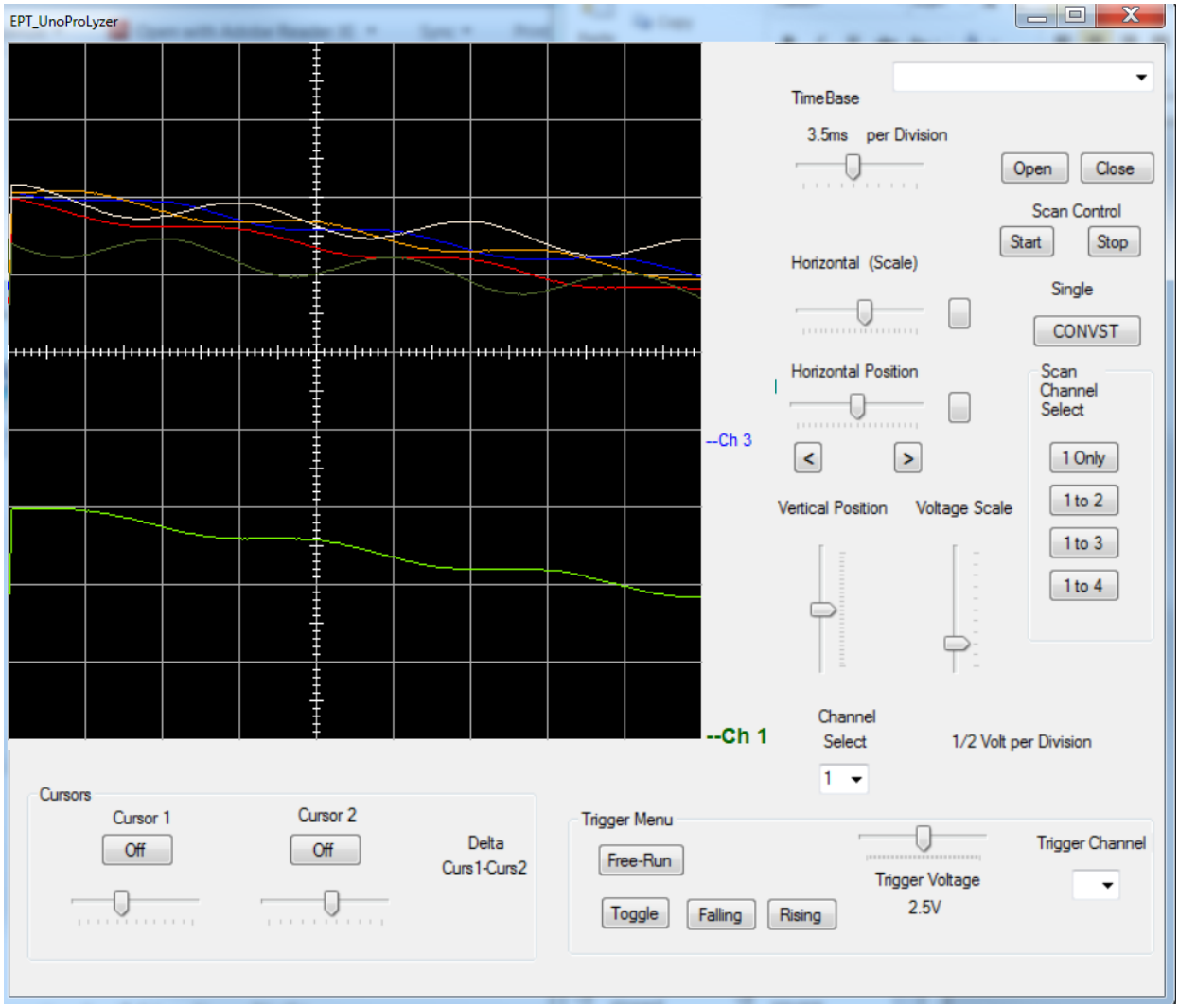
All of the channels will be grouped at the same spot on the graph by default. To separate these channels, click on the drop down box underneath the “Channel Select” lable.



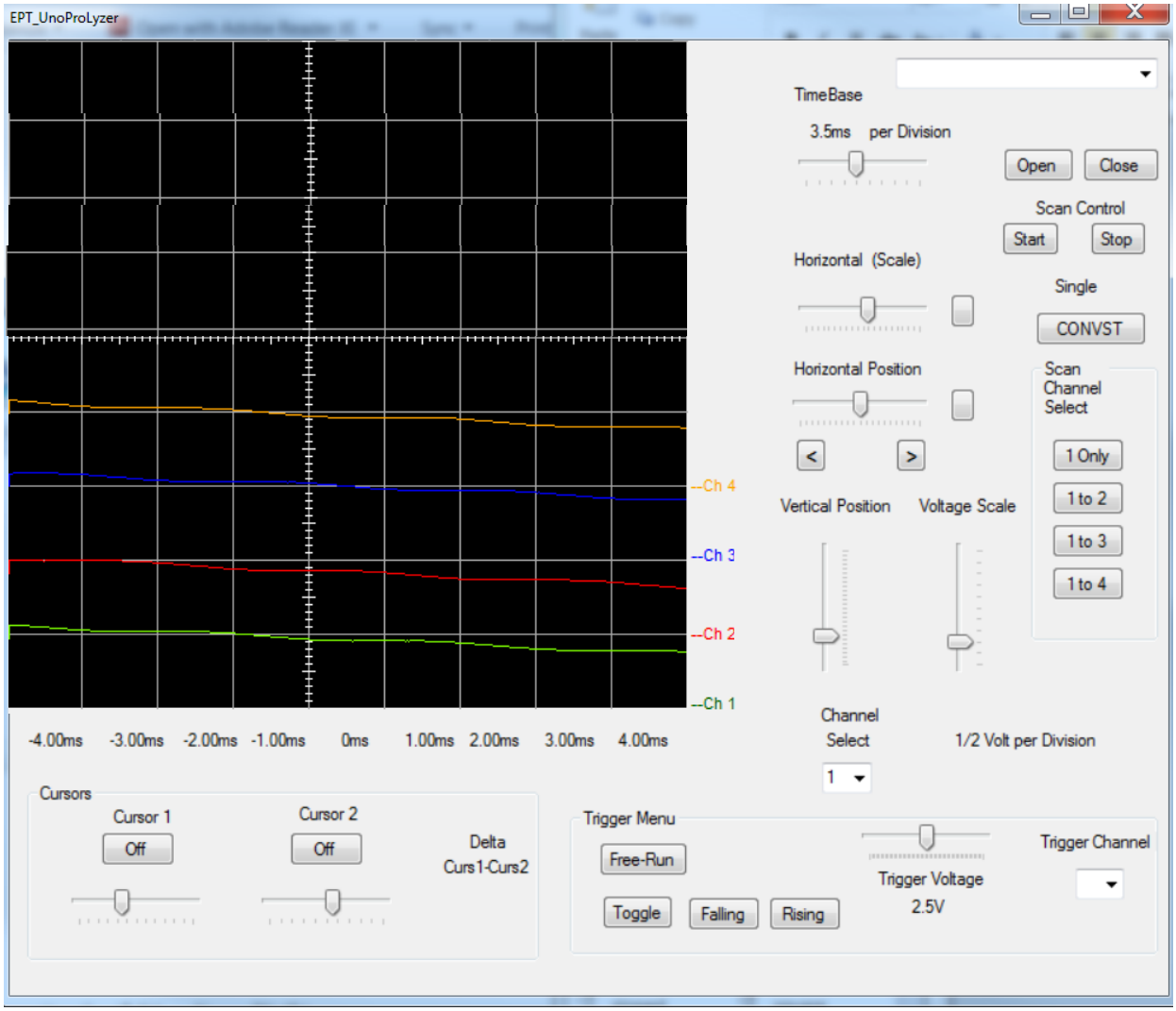
Select a channel and us the “Vertical Position” slider to adjust the position of the channel graph in the display. Notice that the channel indicator highlights in bold when the channel is selected.



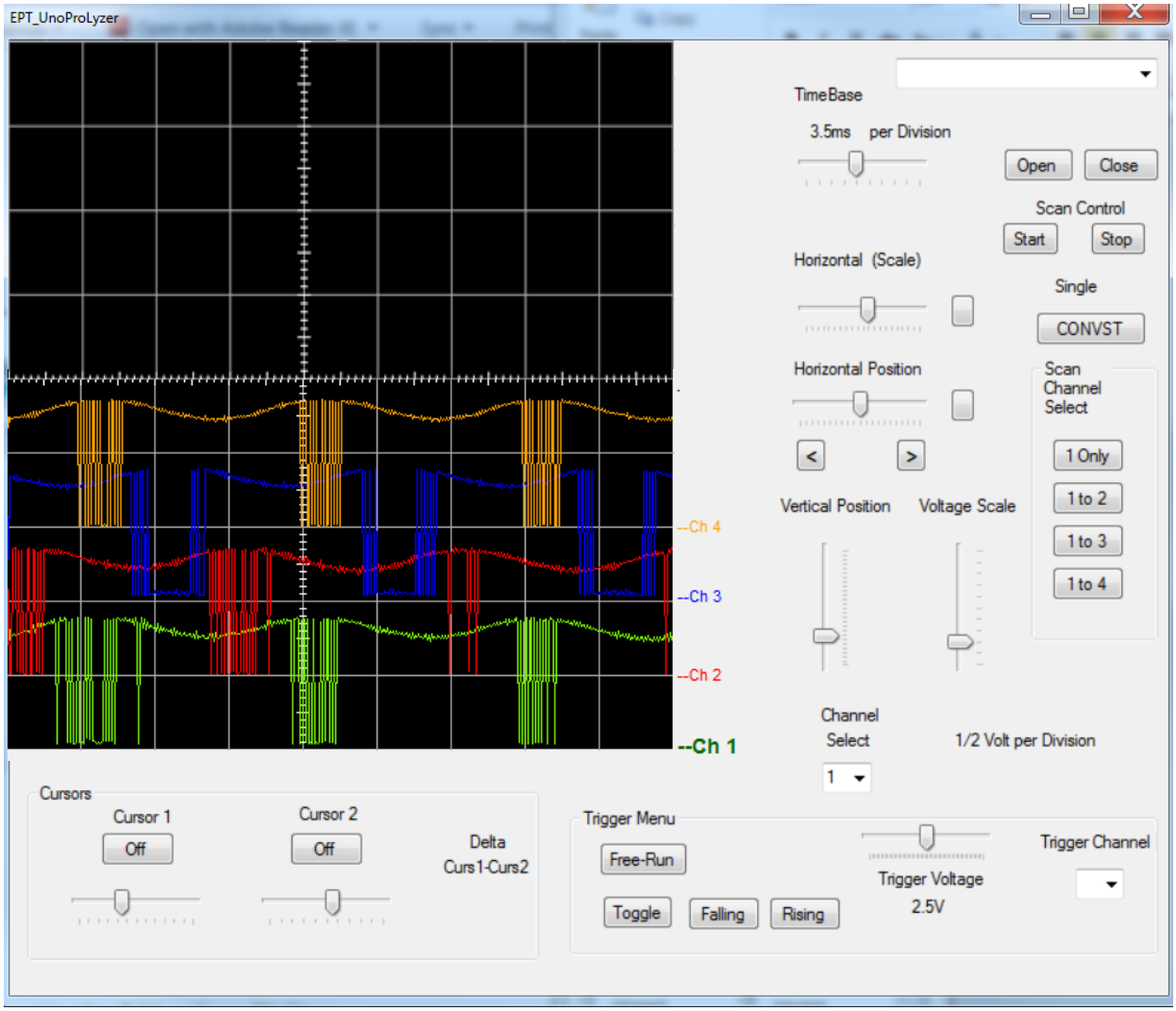
Grab the "Vertical Scale" slider and push up on it until the scale is 1/3. This divides each data element in channel 1 by 1/3.



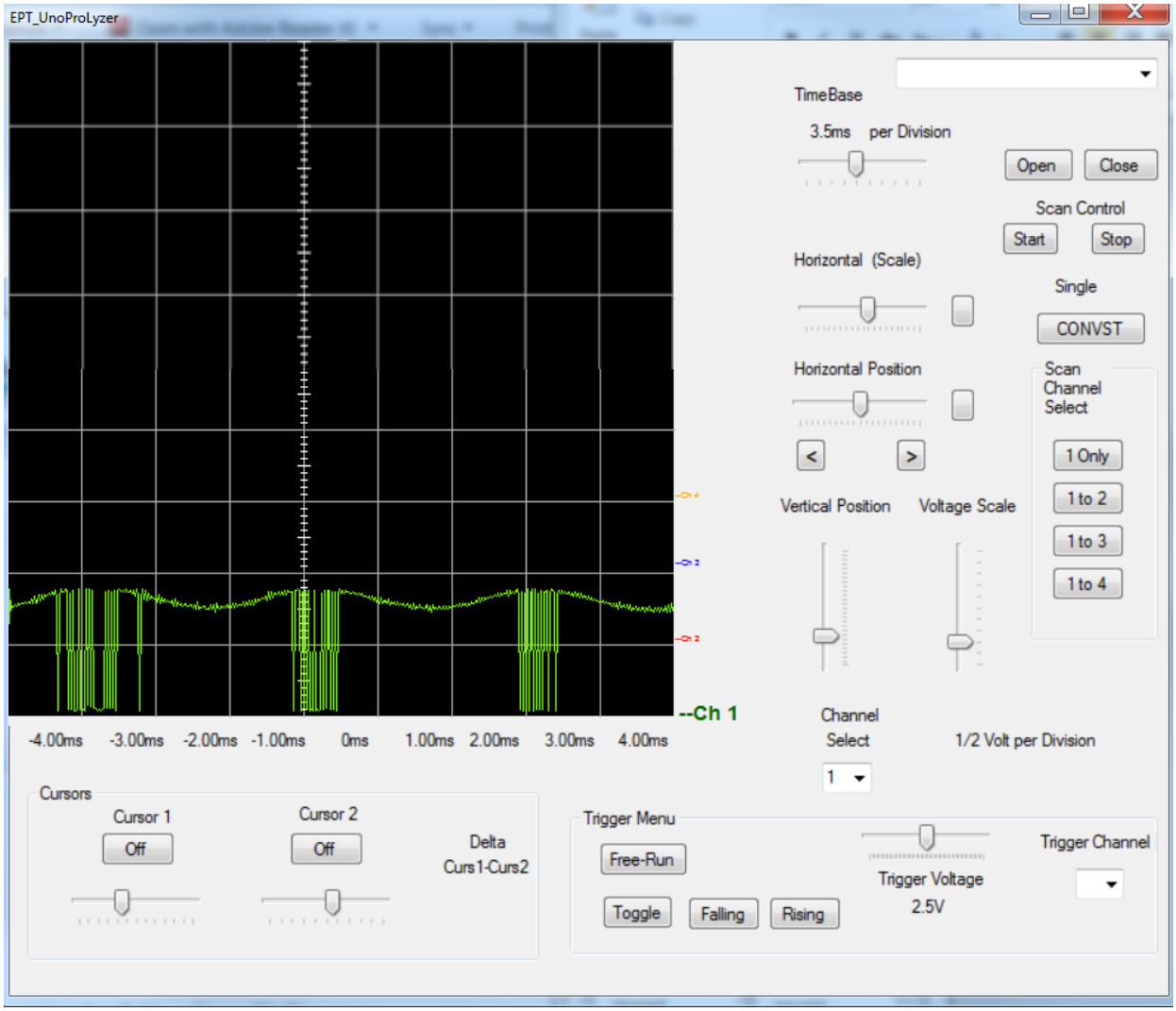
Repeat this process for all six signals. Leaving one division between each channel.



Each channel can also be scaled in the Horizontal Scale. Provide Channel 1 with a signal. A simple way to do this is to touch your finger to the analog input. Then click the “Stop” button. The “Stop” button will cause the ProLyzer to stop filling the circular buffers with new data. All of the previously stored data is preserved in the circular buffers. This allows to you to scroll through the data to view events that occurred in the past.



Turn off each channel (except for Channel 1) by first selecting the channel, then clicking on the "On/Off" button directly below the "Channel Select" drop down box.



Select Channel 1 and grab the “Time (Scale) “ slider and slide it to the left. Notice the signal is zooming out.