Engineering Institute of Technology.

RS485 PicoScope

Remote Lab Instructions

V3

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Remote Lab Instructions

RS485 PicoScope

Getting Started

- Logon to Electromeet
- The software is installed on the remote labs – search for “picoscope” or “RS485” using ctrl+f

Hardware:

As you will be doing this exercise by way of a remote lab please note that all the hardware is already set up and connected to the relevant remote labs**. Other remote labs will not have the correct hardware setup.**

Software & Hardware used:

The lab was set up with the following hardware:

- Laptop with at two USB ports
- 1x MOXA UPort 1150 USB-to-serial (RS-485) adapter
- 1x PicoScope 2204 USB oscilloscope with probes

The following software has been installed:

- RealTerm: Serial Capture Program (for sending characters via the COM port)
- PicoScope 6 software

RS485

This exercise will build upon the previous (RS-232) exercise, and will introduce the use of RS-485.

1.0 Implementation

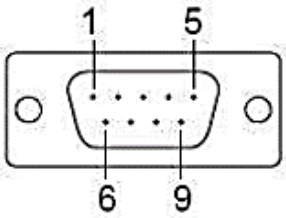
1.1 Basic port setup

As you will be doing this exercise by way of a remote lab, all of the equipment will already be set up, but please read the instructions below to familiarize yourself with the procedure.

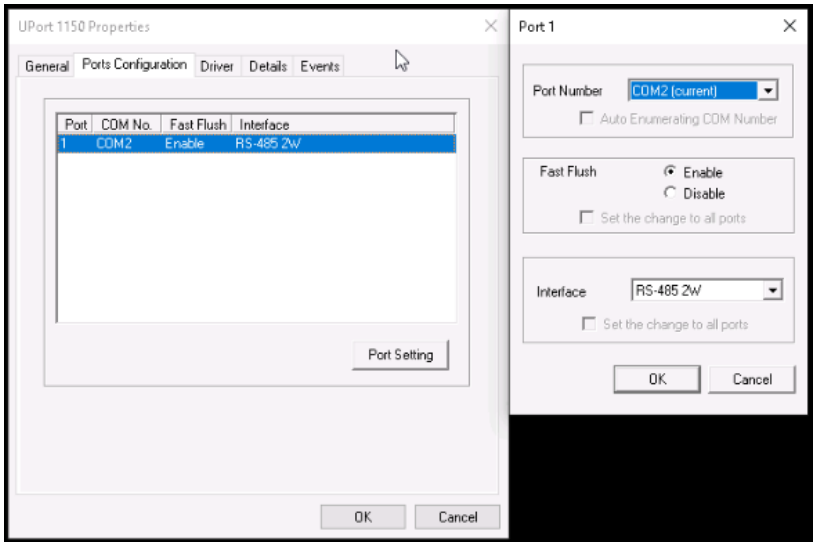
The Port setup is exactly the same as the RS232 lab, except the comm port may vary – ensure that you select the appropriate port, found in Device Manager.

And instead of using a Moxa1110 as in the last exercise we are using a **Moxa1150** this time.

The UPort 1150 is identical in appearance to the 1110, though the outputs are different.
The outputs are accessed through a screw terminal with the following configuration.

		UPort 1110	UPort 1130	
DB9 (male)	Pin	RS-232	RS-422 4-wire RS-485	2-wire RS-485
	1	DCD (in)	TxD-(A)	-
	2	RxD (in)	TxD+(B)	-
	3	TxD (out)	RxD+(B)	Data+(B)
	4	DTR (out)	RxD-(A)	Data-(A)
	5	GND	GND	GND
	6	DSR (in)	-	-
	7	RTS (out)	-	-
	8	CTS (in)	-	-

The UPort 1150 has been set up (via Device manager) to operate in RS-485 'two wire' (2W) mode. The PicoScope probes have been attached to pins 3 and 4 on the screw connector: oscilloscope Channel A to RS-485 line 'A' (Data-) and oscilloscope Channel B to RS-485 line'B' (Data+).



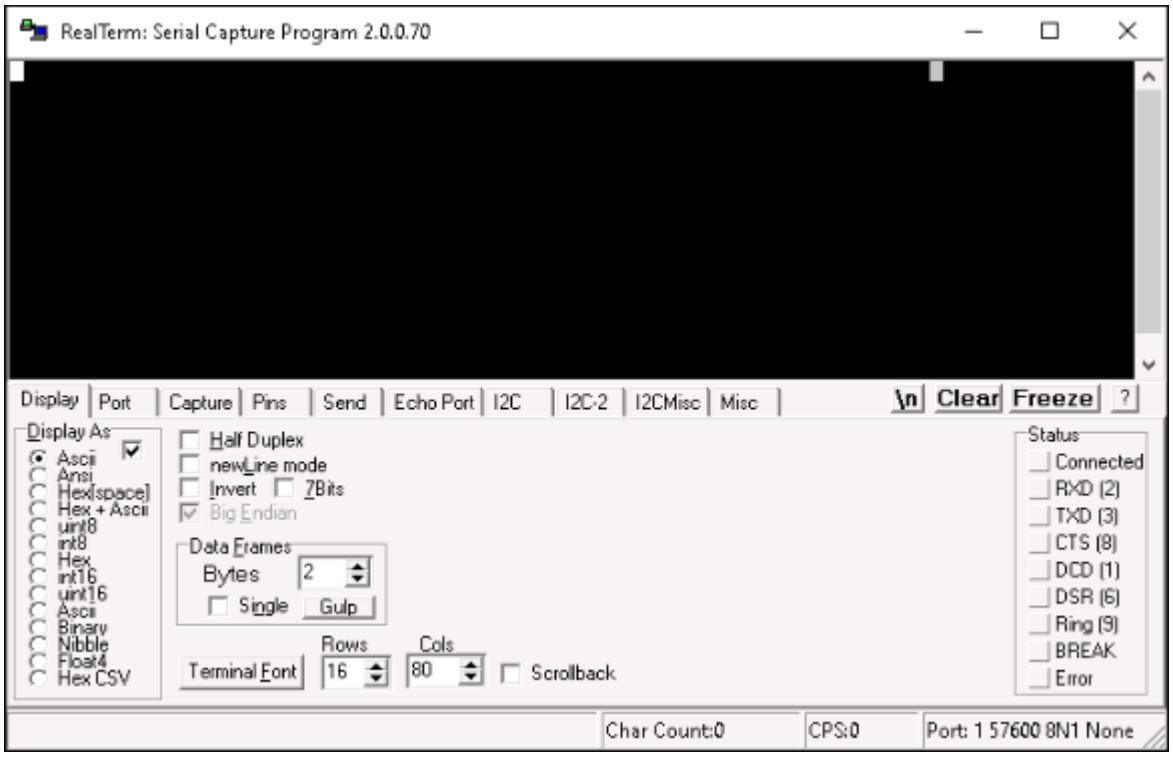
The oscilloscope ground clips have not been attached, as grounding in this case takes place via the USB cable.

Note: *Never attach a ground clip to either line A or line B, as this will short the line to ground and render it inoperative.*

1.2 Prepare to send characters

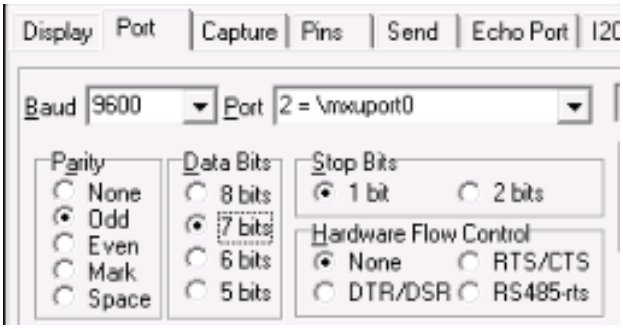
1. Run RealTerm: Serial Capture Program by clicking on the desktop icon or on the taskbar at the bottom of the screen.

The software will open up:



2. Click the “Port” tab.

3. Then set the UART parameters for the appropriate COM port (2 in this case). Set the parameters exactly as per the following figure: Baud = 9600, Parity = Odd, Data Bits = 7, Stop Bits = 1, Hardware Flow Control = None.



4. Next, start the port monitoring process by clicking “Open” and “Change”:

RealTerm is now running and the UART on the Moxa device is configured correctly. Now you must confirm the idle voltage.

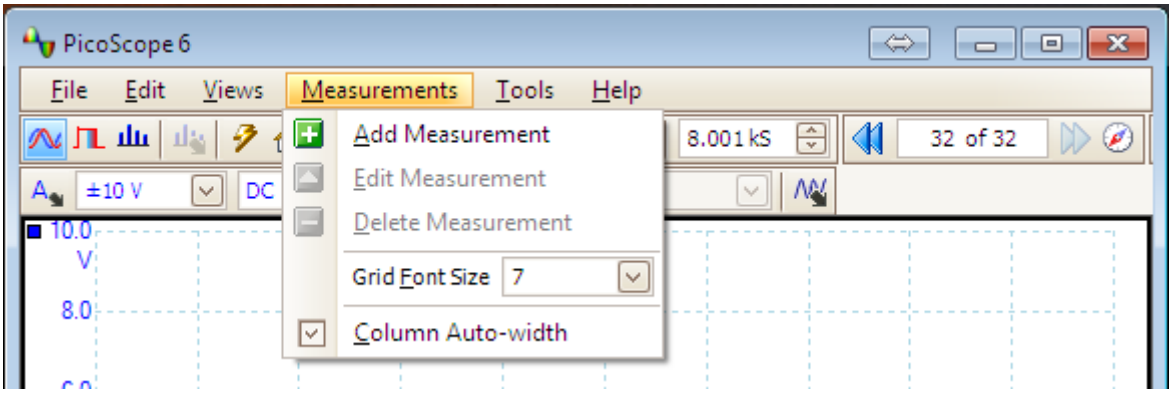
1.3 Confirmation of idle voltages

We are doing this remotely thus we can measure the TxD line idle voltage with the PicoScope.

To do this you must:

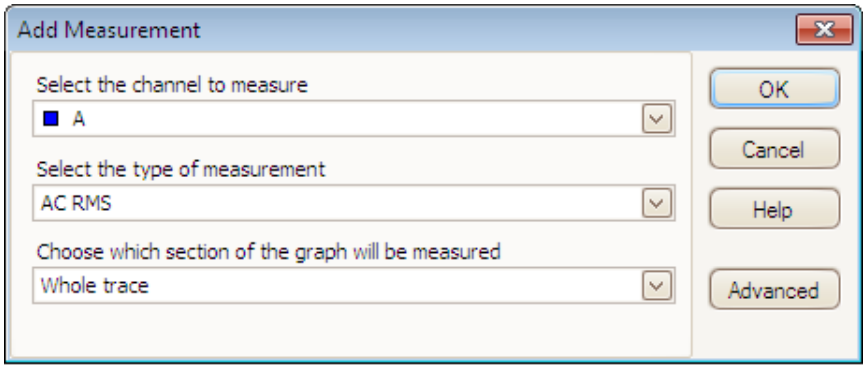
5. Run the Picosope6 software. Double-click the PicoScope6 icon on the desktop of the remote computer.

6. We can add a measurement function to the PicoScope, which will allow us to obtain a DC voltage reading. Firstly click “Measurements” at the top of the PicoScope window.

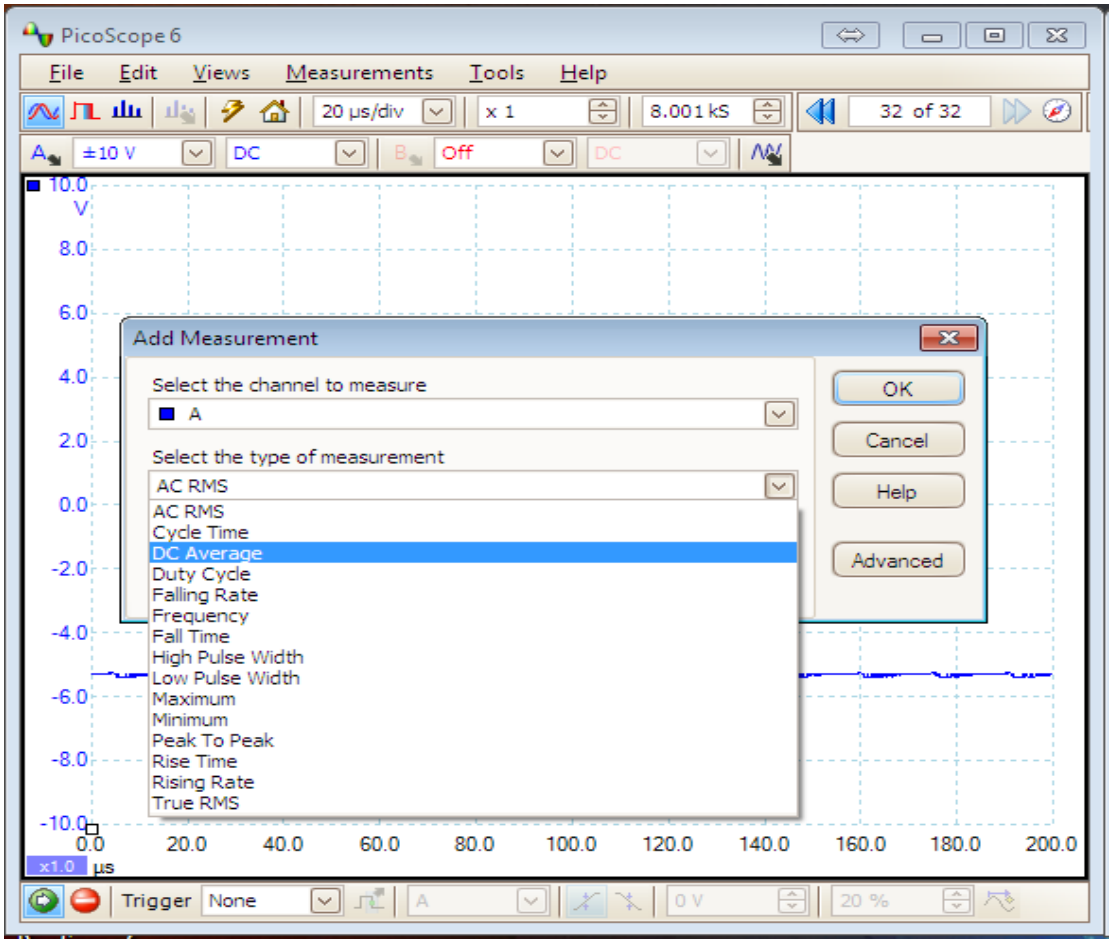


7. Click “Add Measurement”

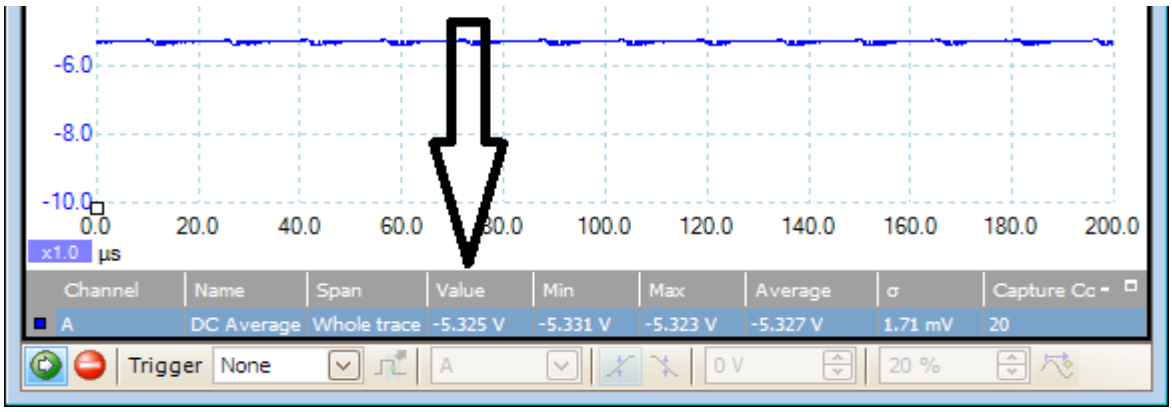
8. This will bring up the “Add Measure Window”



9. From the Type of measurement selection field select “DC Average”



10. Then Click OK. This will add the measuring function to the bottom of the PicoScope

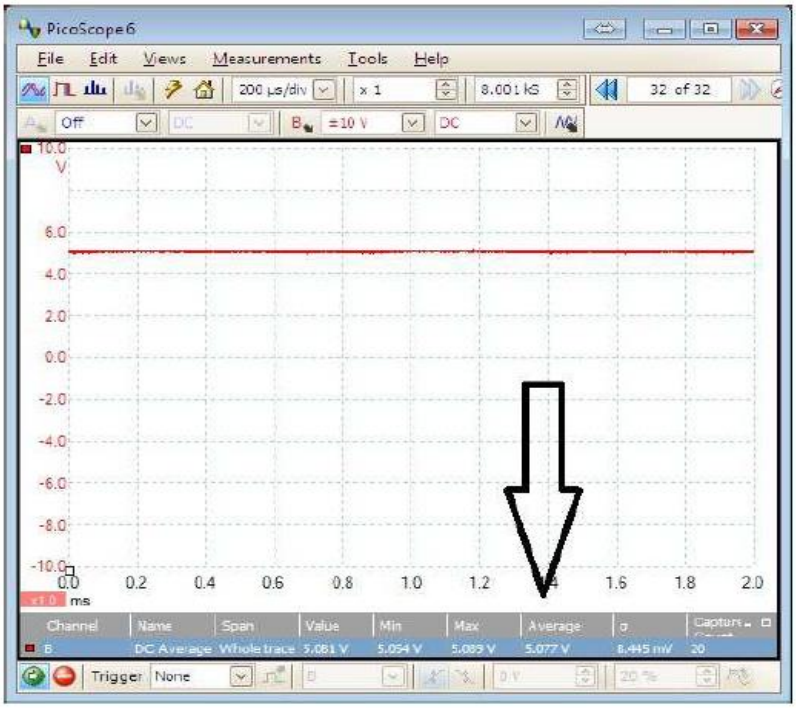


11. You can then read the average DC voltage level.

Question: What is the average DC voltage on the A wire when it is idling? State the answer in your assignment (rounded to 2 decimal places).

Instruction: Take a screenshot of this and paste it into your assignment.

12. Temporarily enable Channel B on the PicoScope and repeat the DC measurement, but this time for the B wire:



Question: What is the average DC voltage on the B wire when it is idling? State the answer in your assignment (rounded to 2 decimal places).

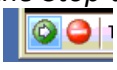
Instruction: Take a screenshot of this and paste it into your assignment.

Note:

- *Due to a bug in the Picoscope software, it may prove difficult to capture the waveform on ChB.*
- ***The software may not trigger properly on ChB** so it is not necessary to provide a screen shot of just ChB on its own.*
- *ChA is triggering normally, so you must still submit screen shots of ChA waveform, as well as ChA + ChB waveform.*
- *To capture the ChA + ChB waveform together, the trigger must be set for ChA.*

1.4 Transmitting a single character and then capturing it on the PicoScope

The PicoScope must be configured as before, but this time we are using both Channel A and Channel B. We will first check the waveform on the A wire, then on the B wire, and finally combine the two traces.

***Note: This Is A Trap For The Unwary**. The Start/Stop buttons on the PicoScope complement every time you click on them. So, if the PicoScope has stopped capturing, and you click twice on the Start button, you are still in 'stop' mode. However, if you observe the backgrounds of the Stop and Start buttons you will notice that they change to a blue selection highlight when active.* 

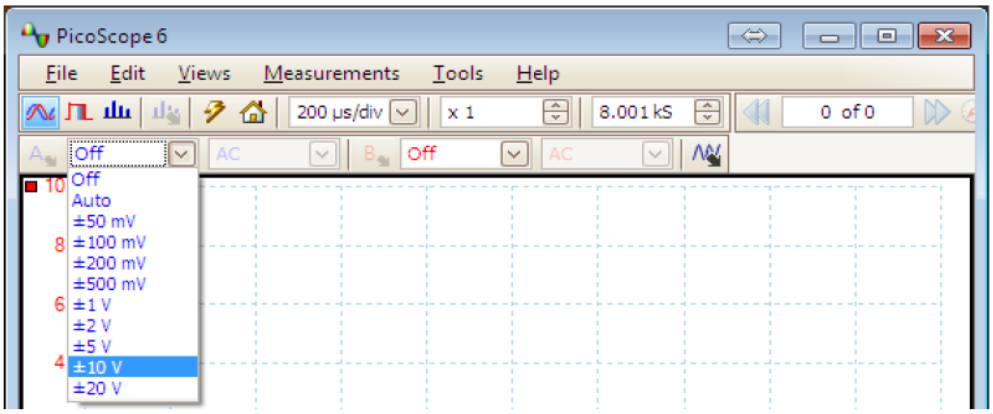
1.4.1 Capturing the signal on the 'A' wire

We will set up **Channel A** first. The PicoScope settings should be as follows:

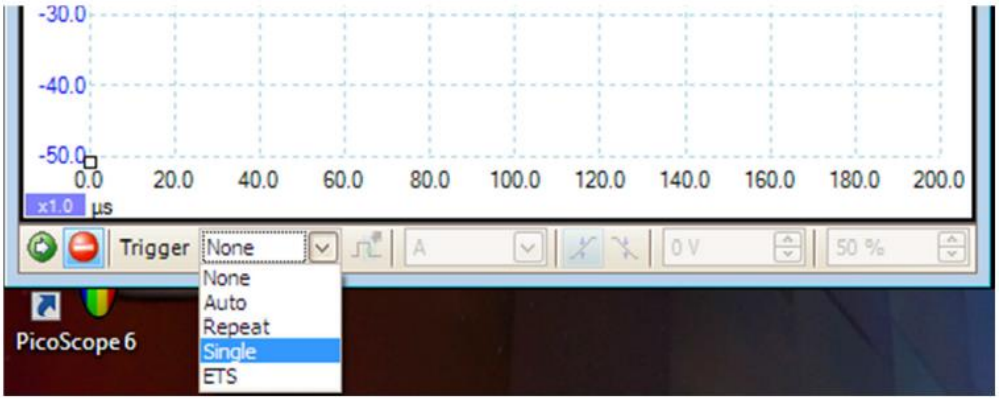
- Trigger: Single trigger, Channel A , rising edge
- Trigger level 2V. This is necessary because, unlike with RS-232, we are operating with positive voltages only. In theory the 'A' wire will be at '0' when no data is being sent. However, you have already ascertained that it is not. So, should the trigger level be set to 0V, the oscilloscope will not detect the low-to-high transition. If you cannot push the trigger level up high enough, check that the X-axis scale is on +/- 10V, and not on 'auto'.
- X-axis: 200 microseconds per division
- Magnification: X1
- Y-axis full scale: +/-10V
- Coupling: DC

Here is how we change to settings

13. First we will set the Y axis. At the top of the PicoScope under the "Input Range" field for ChA select +/-10V:



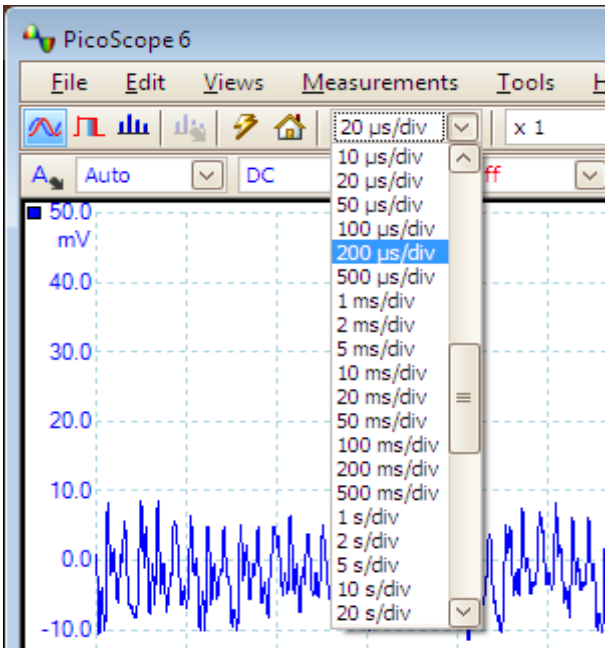
14. On the PicoScope under the trigger Field (at the bottom of the screen) select "Single":



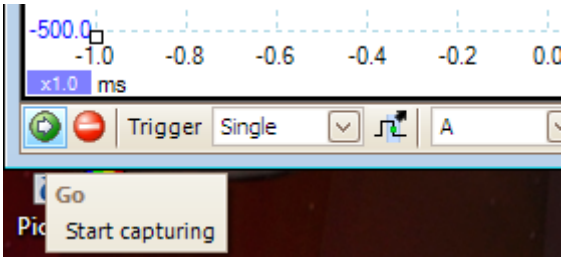
15. Set the pre-trigger to 20%:

16. The other trigger settings (slope and level) are shown below:

17. At the top of the PicoScope interface under the Time/div field select 200µS/div:



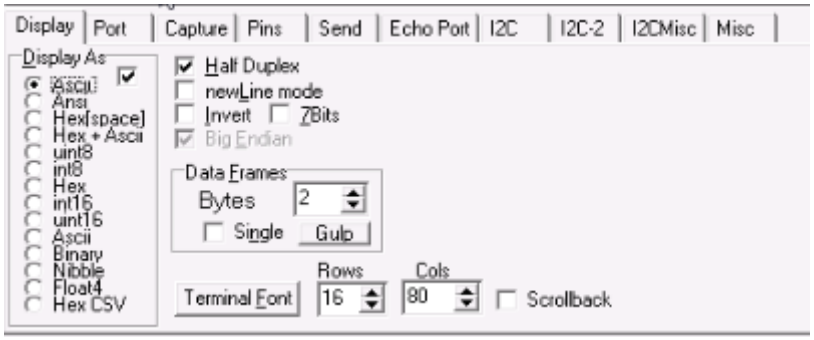
18. Now click the green “Start Capturing” icon (green Icon at the bottom left of the PicoScope window)



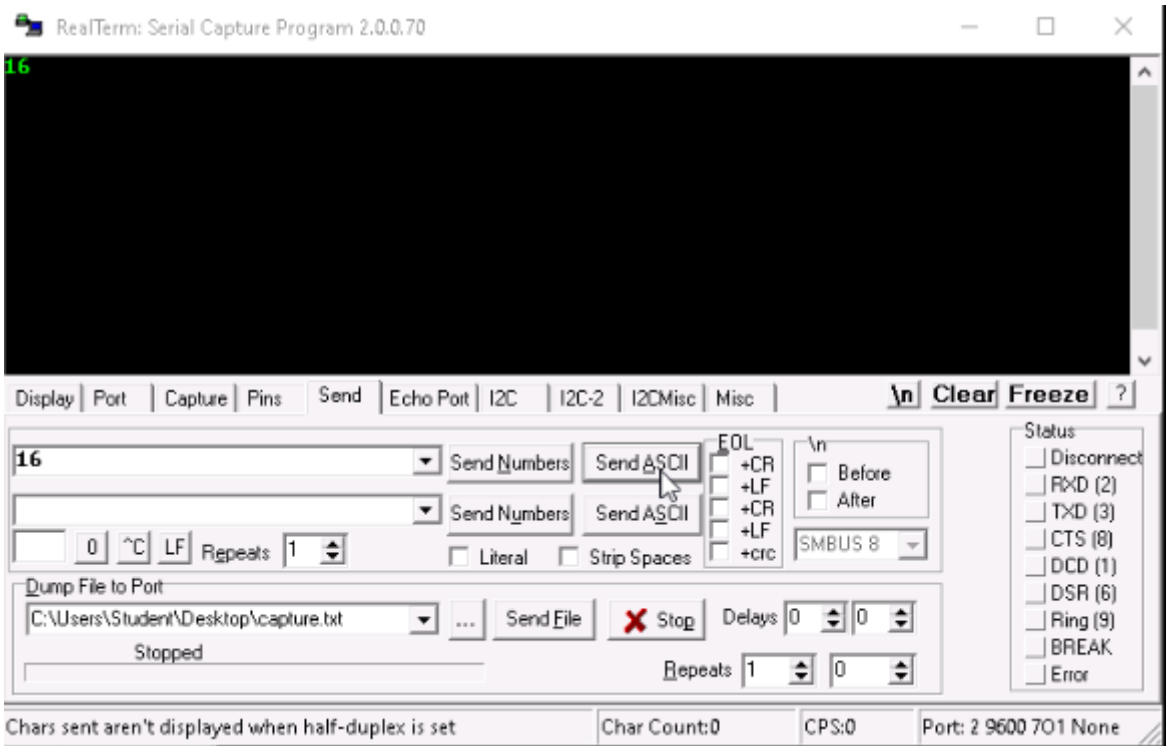
The Picoscope is now ready to capture the character we are about to transmit on Channel A, which is the A line or Data- of the RS-485.

19. We already have RealTerm running (it will be in the tool bar at the bottom of the screen if the

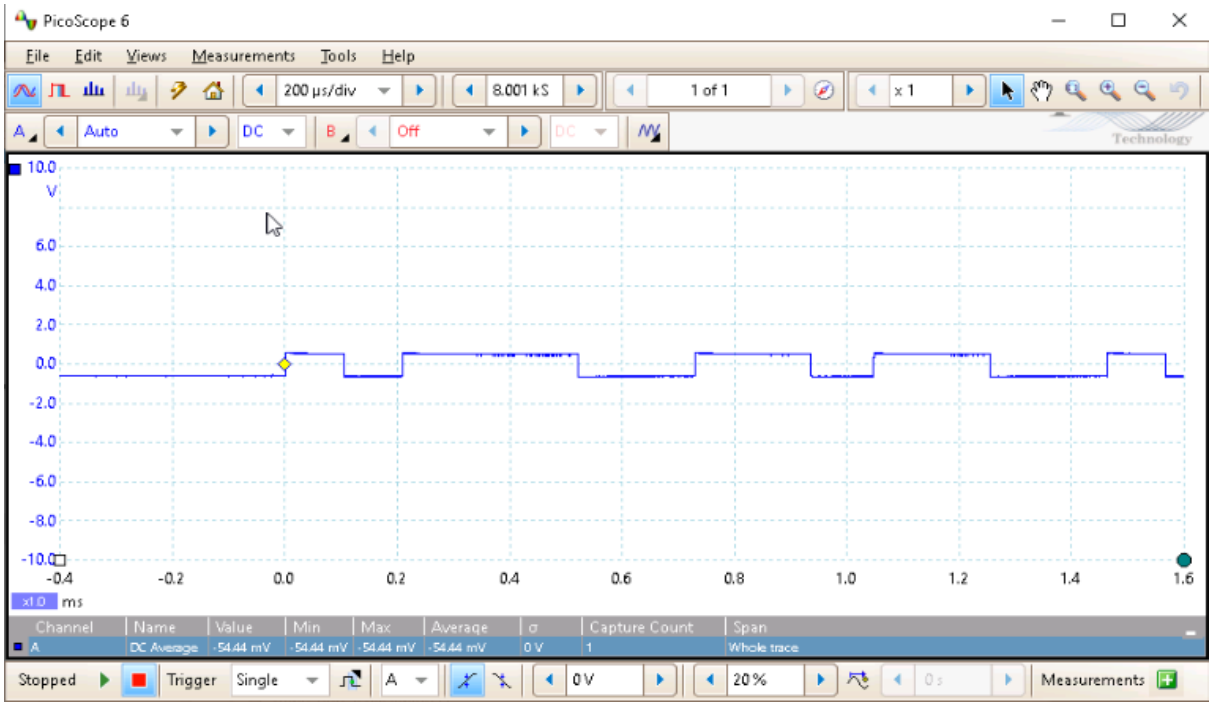
window is not already on screen). Open the RealTerm window and click the “Display” tab, and select “Half Duplex” – this will output sent values to the black terminal window:



20. On the RealTerm window click on the “Send” tab, enter a value in the field (i.e. “F”) and click “Send ASCII” – note, the value appears in the black terminal above:



21. The transmission should be captured on the PicoScope now (and the PicoScope capture changed from Running to Stopped), select the PicoScope and observe the waveform (similar to the one below):



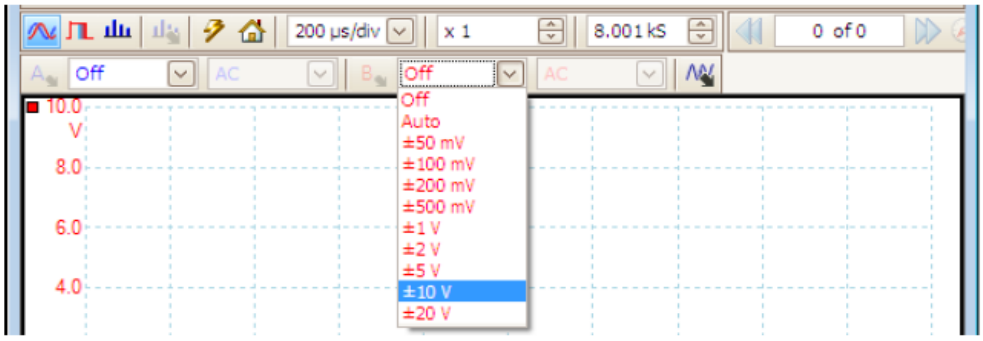
Note that the shape of the waveform is identical to that of RS-232, but instead of alternating between -5V and +5V it now only alternates between 0V and +5V.

Instruction: Take a screenshot of this waveform (trace A), and paste it into your assignment.

1.4.2 Capturing the signal on the 'B' wire

The steps are similar to those for the A wire, but there are a few minor differences.
27. First turn off Channel A in the Input range field:

22. Now turn on Channel B in the input range field, and select +/-10V:

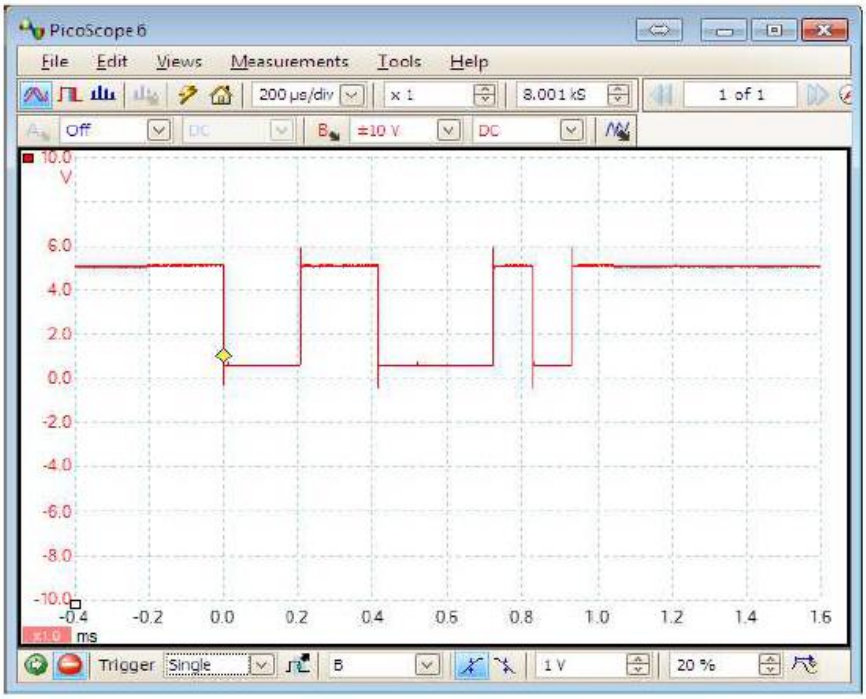


23. Set the trigger for channel B. Keep in mind that the captured signal is expected to be a mirror image of what we saw on Channel A. Setting the trigger will involves the same steps as for Channel A, **BUT:**

We have to trigger on channel **B**, and on the **falling** edge. See below:

24. Select RealTerm again send a value (Send ASCII) as we did for Channel A.

25. Bring up the PicoScope window again and you should have a waveform that looks similar to this:



Note that this signal is a mirror image of that on the Channel A wire. What is important is the difference between A and B

Instruction: Take a screenshot of this waveform (trace B), and paste it into your assignment.

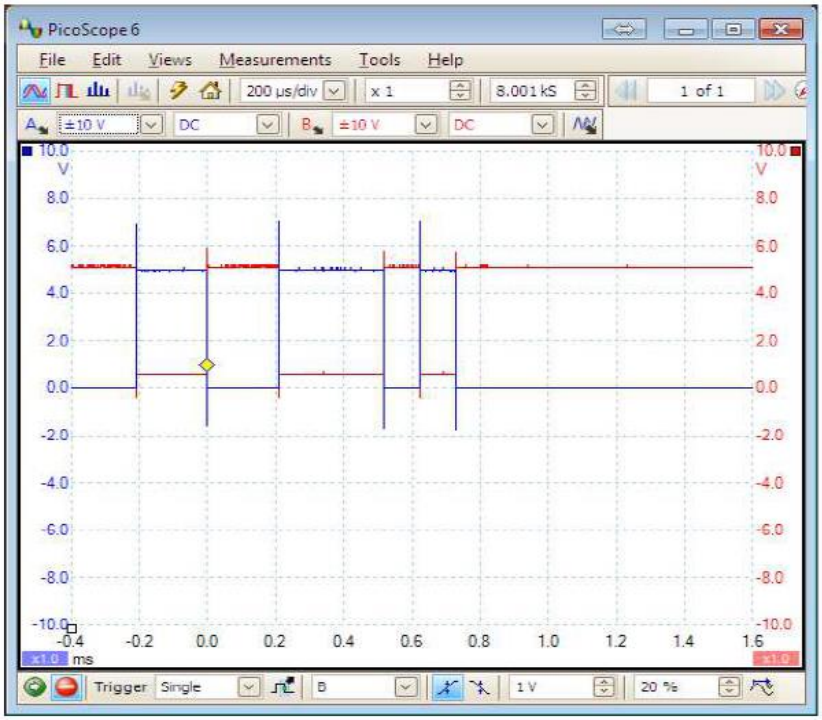
1.4.3 Capturing A and B simultaneously

26. We now must enable Channel A again in order to capture both A and B. So leave Channel B enabled and re-enable Channel A by again selecting +/-10V under the “Input Range” field.

27. Reset the trigger again as above (Single) then click the green “Go” button (Running).

28. Again, select RealTerm and send a value (Send ASCII).

29. Bring up the PicoScope window and you should have a waveform that looks similar to this:



At first glance it might seem like a string of rectangles, but this is because the low-to-high transition of the one signal coincides with the high-to-low transition of the other.

Question: Take a screenshow of this waveform (traces A and B) and paste it into your assignment.

END OF INSTRUCTIONS