Falcon Neuro EDU (Engineering Design Unit)
February 7, 2023
United States Air Force Academy

This document is written to give a procedure for operating the Falcon Neuro EDU instrument. Please operate the instrument with care and respect as it is the only one of its kind and damage to the instrument could adversely affect the success of the overall mission.

1.) First Priority : This instrument is a working scientific instrument with static discharge sensitive components. Any physical contact with the instrument must be conducted while wearing a static discharge strap connected to a electric ground. Operating the instrument without static electric protection may result in damage to the instrument.

2.) Before connecting anything to the instrument, turn on the power supply. Ensure that it is set to 28 Volts. After setting the voltage to 28 V. turn off the power supply.

3.) The instrument communicates to a computer and gets power to operate through two separate harnesses(sets of wires). The harnesses are unique and the description here will enable the operator to correctly set up the instrument.

   a. Power harness. The power harness is a red and black set of wires and connectors. It connects to the instrument base through a barrel connector. There are only two barrel connectors on the instrument and the power harness can only connect to one of them. The other end of the harness connects to a power supply, with the red line of the harness connecting to the red recepticle on the power supply and the black line of the harness connecting to the black recepticle on the power supply. The power supply will be run at 28 Volts. The power will be turned on after the other harness is connected.

   b. Communication harness. The communication harness is a black cable with a USB connector at one end and a barrel connector at the other end. The barrel connector attaches to the instrument at the remaining open barrel connector. The USB connector is inserted into the computer that will run the software. The computer should respond with the standard tone to indicate that it has recognized that a new peripheral has been connected.

4.) The computer that is used with the instrument is named ”Falcon Neuro EDU”. It runs the windows 10 operating system. The username and password are located on the keyboard. The python script that needs to be run in order to collect data has a fixed size on the screen and that size is actually smaller than the laptop screen. To enable this to work one must use a monitor that attaches to the laptop. In emergencies, one can operate the program using the laptop screen but it is very cumbersome.

5.) The program is located on the desktop and is named : ”STP-H7 Falcon Neuro Control NO TREK - SAFE9152021_ADDEDBIAS.py”. Just double click on the icon and the program will start. It will first ask you to choose a directory in which to save the data. Choose one that you will be able to find at the end of the experiment. It defaults to choosing the Documents folder.

6.) Turn on the power supply. It should be set to 28 Volts and the current should be approximately 0.15 Amps(You will not need to set this, the instrument will draw the current it needs - which should be 0.15 Amps). Do not change the voltage setting throughout the instrument operation.

7.) The GUI is quite complicated. We will not explain every button and feedback. Just enough to get the data collected. The first button to click is in the first column, first row below the image. "Select RS422 Comms". This will result in a list of communication ports being shown below the button. If no other peripherals are connected the program will choose the correct Com port. If multiple peripherals are connected you will have to choose the one that is connected to the instrument through the communication harness.

8.) Click on the "H & S 1 Hz"(Hardware and Software) button. This will set the camera to operate at 1 Hz. This button is located in the first column, 7th row. If you are not requesting H&S and LRT, telem data will not update and they won't see that commands have worked/not worked.

On the third main column, about half way down the rows, 4 panels should turn green. They are : "normal boot", "cam uart ok", "sd good" and "hrt go". If these buttons are not green, it would be best to stop right now and contact either John Williams (john.williams@afacademy.af.edu) or Richard Balthazor (Richard.balthazor.ctr@afacademy.af.edu).

9.) Click on the "LRT 0.5 Hz" button. This will set the LRT to 0.5 Hz. This button is located directly underneat the H&S button.

10.) Choose one of the cameras. Either the Nadir Camera or the Ram camera. These buttons are located in the second major column toward the top(row 3). Only one will be operable at a given time.

13.) Now you can start to take data. In the second main column, 4th row there is a button "Camera ON". Click this button and check the FPGA. The information panel in the 3 main column should repsond with "IDLE".

11.) Choose the bias settings. These are located in the second main column below the camera choice settings. The camera in space is being operated on the "Set biases to Paras 20210911". These should be how the camera is operated if you are trying to understand the space camera response. However, Geoff McHarg will likely have some plan as to what values these should have. Check with him for direction on this point.

12.) Any time a new change is sent to the instrument it is a good idea to check the FPGA(Field Programmable Gate Arrays) Status button. This button is located on the second main column on the 6th row.

This button gives an output on the third main column(4th row for the Nadir state or 5th row for the Ram state).

The output from hitting this button will show how the camera is set. This is a way to check to see that the camera is doing what you want it to do. Any time you make a change you should hit the FPGA button to make sure that the camera is correctly set.

14.) In the second main column there are buttons to take the data. ”Req Data 1s” takes data for 1 second. ”Req Data 2s” takes data for 2 second. ”Req Data 90s” takes data for 90 second. ”Req Data 180s” takes data for 180 second. Choose one depending on what you are trying to see. The longer the camera operates the larger the corresponding data files.

After clicking one of the buttons, wait until the acquisition has completed before clicking the FPGA button. The information on the 3rd column should respond with ”Acq Complete”. We want to wait because you may lose some of the data being transferred if the instrument tries to do two things at once.

15.) The data from the just completed run is held in a buffer. It has to be transferred to the computer. In order to do this you need to click on the button ”DL Data”(download data). This will then write the file to the computer disk.

Before you download, estimate the download time. Look at the “Nadir/Ram Buffer Fill (number of packets)” telemetry value. Call it N. Estimated download time is N/72 seconds. Decide if you want to wait that long. Also note that the rest of the telemetry will not update during that download.

16.) You should check to see that the write process completed correctly. It can take some time as there may be a lot of data to write. The file name will be in the directory you chose at the start of the program operation. It will have a name with the following format : NeuroData-yyyymmdd-hhMMss.bin, where yyyy is the 4 digit year, mm is the two digit month, hh is the two digit hour the data were written, MM is the two digit minute that the data were written and ss is the two digit second the data were written. The actual time the data were taken is written into the file itself.

After the download, click the “Open New Data Log File (.bin)” button to close out the first binary file and open a new one.

17.) While the instrument is writing data to the computer you should not make changes to the instrument as it is likely that the instrument will not be able to do multiple operations at a single time.

18.) Before switching to the other camera, turn off the first camera. This is accomplished by hitting the button labeled : ”Camera OFF”. It is located next to the ”Camera ON” button. Check using the FPGA Status button to ensure that you have turned off the original camera. Then turn on the new camera using the ”Camera ON” button.

18.) After data aquisition has been accomplished, turn off both of the cameras. You can check to see that these commands were successful by clicking the ”FPGA Status” button. The message should be ”Power OFF”, if successful.

You can actually have both cameras powered simultaneously, that’s perfectly fine. I’ve also had them both taking data simultaneously, but note that any commands to the FPGA may glitch data acquisition if it’s in progress.

19.) Turn off the power supply. Make sure to be properly grounded if touching the instrument. Remove the barrel connectors only if necessary as these connectors can fail if used too often.