## Acquiring source data for calibration

Initial measurements need to be executed prior determining and writing calibration values. The capacitance of each individual beam in actuated state, Cmin (0,0) and Cmax (7F,7F). The data has to be saved in csv-file. The first row has column names, and the rest of the rows are measurement values. The tool looks for the following column names:

- "Package Number"
- "Beam reg2"
- "Beam reg3"
- "Frequency MHz" for LCR-measurement or "Frequency (MHz)" for VNA measurement
- "Capacitance fF" for LCR-measurement or "Capacitance (pF)" for VNA measurement

Frequency value is not applicable for LCR measured data. An example of beam data measured with an LCR-meter:

*Package_Number,Beam_reg2,Beam_reg3,Frequency_MHz,Capacitance_fF*

*3,0,0,1,265.238*

*3,7F,7F,1,2754.35*

*3,40,0,1,348.479*

*3,20,0,1,486.477*

*3,10,0,1,482.384*

*3,8,0,1,464.758*

*3,4,0,1,464.719*

*3,2,0,1,466.232*

*3,1,0,1,460.809*

*3,0,40,1,314.784*

*3,0,20,1,373.59*

*3,0,10,1,495.017*

*3,0,8,1,462.705*

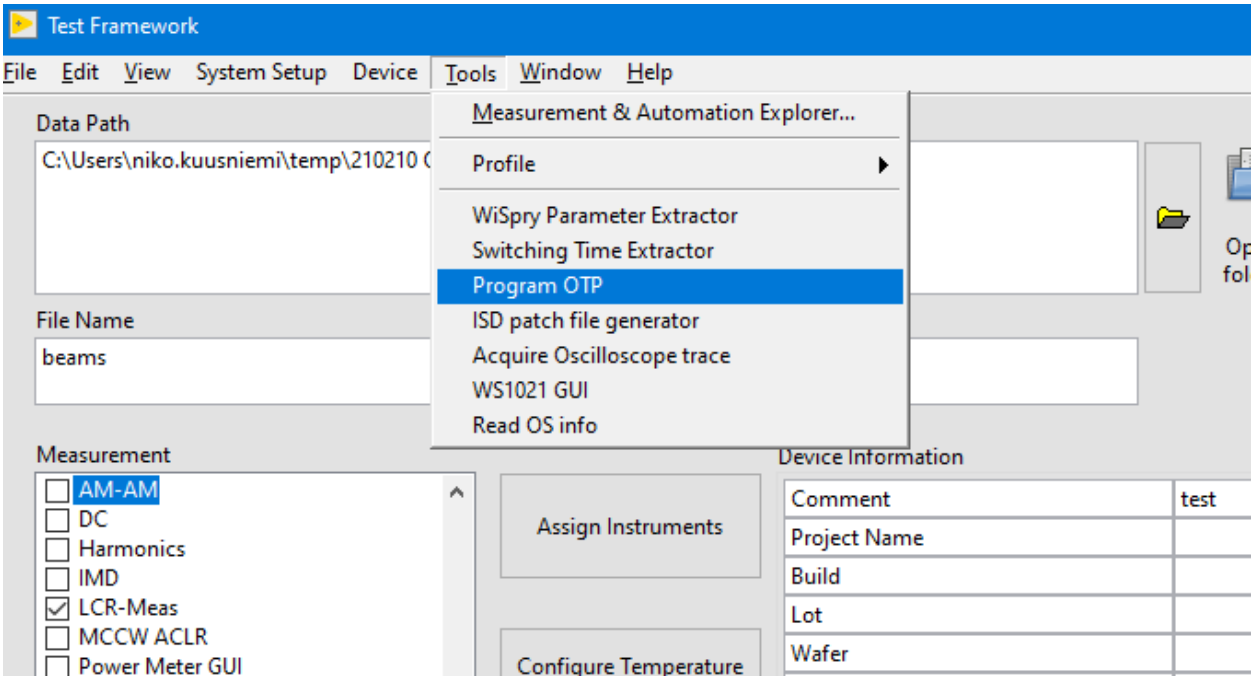
*3,0,4,1,463.483*

*3,0,2,1,461.214*

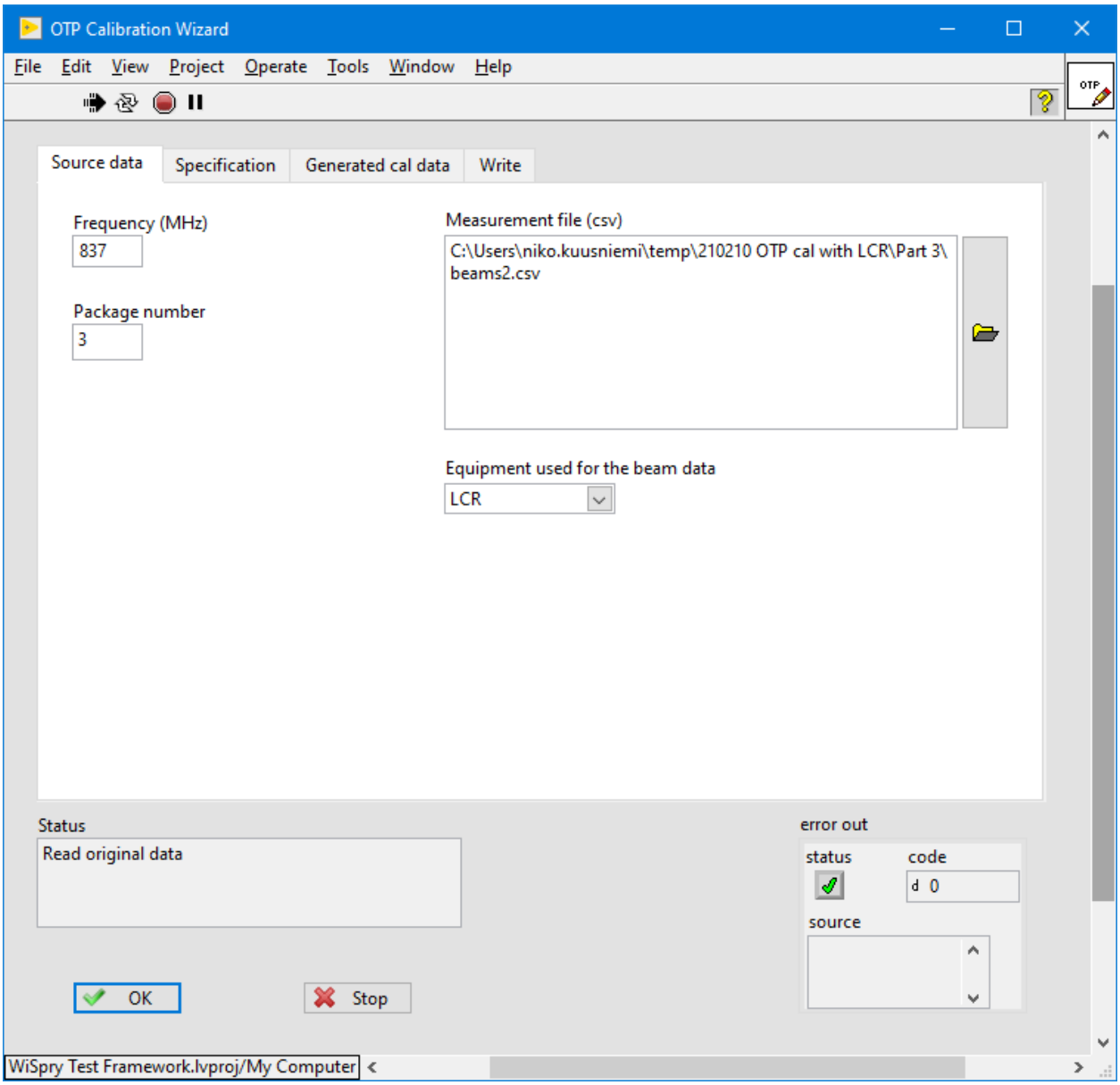
*3,0,1,1,460.171*

# Writing OTP data

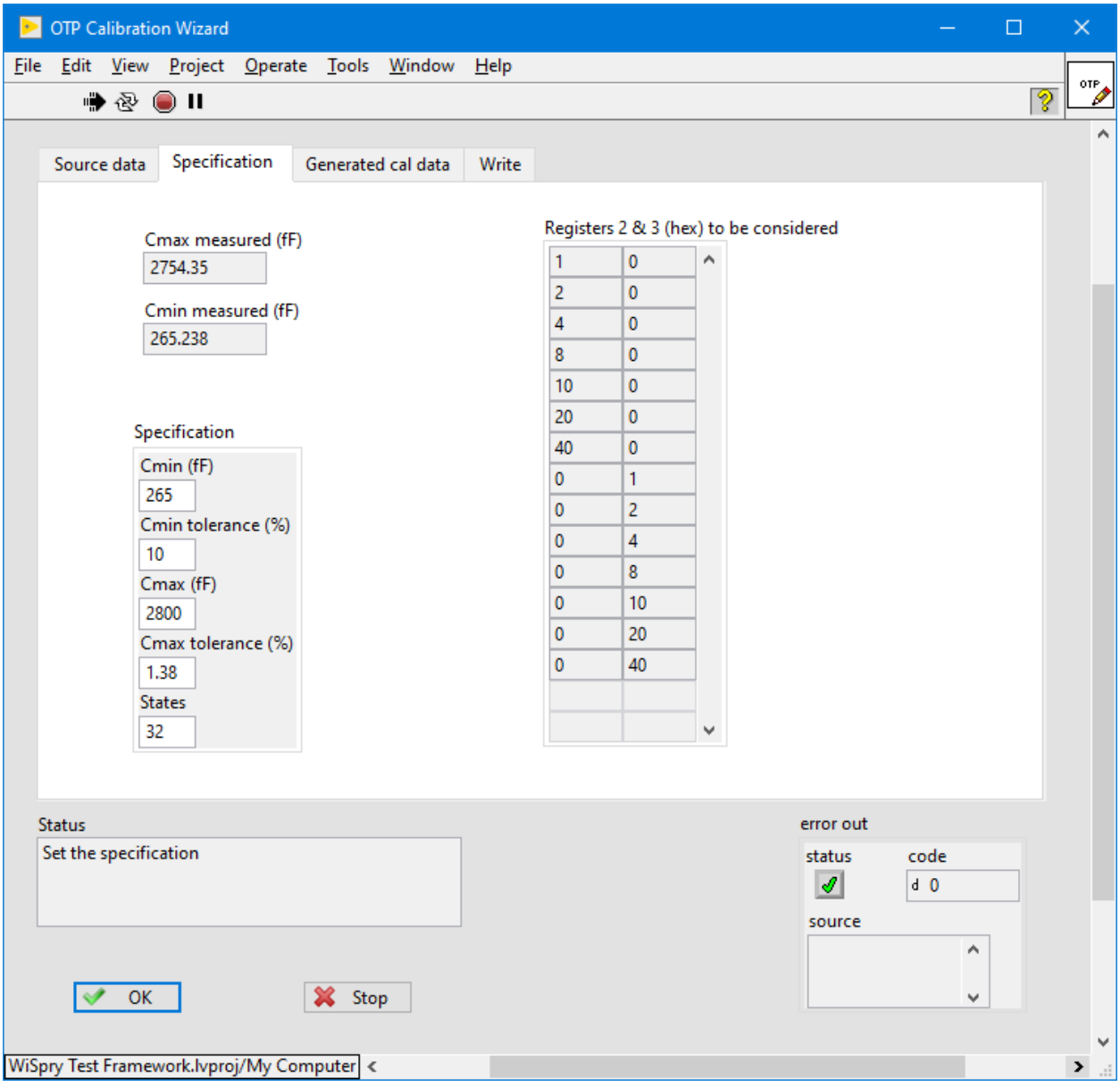
Launch WiSpry Test Framework -software and click “Program OTP” in Tools menu.



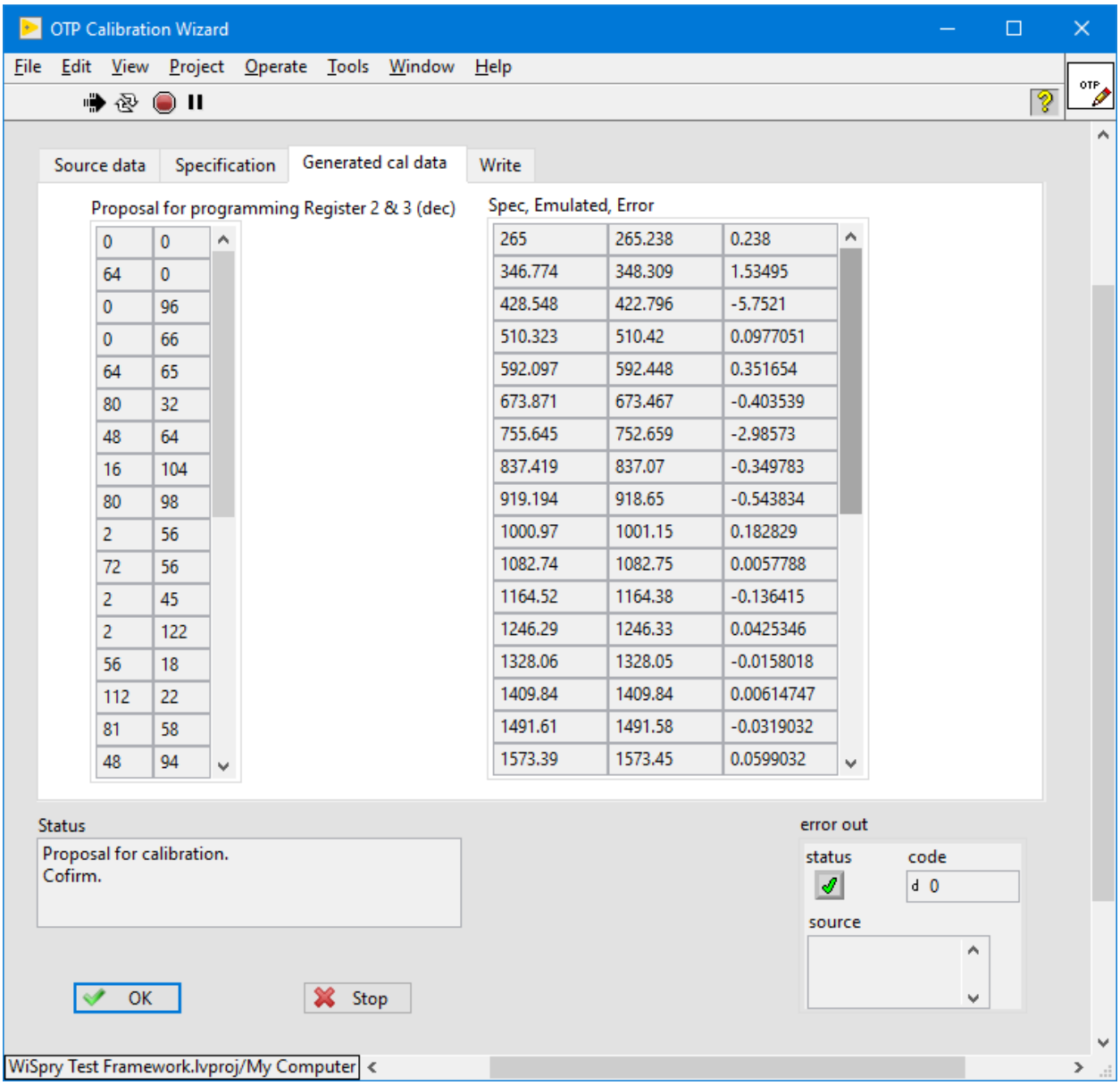
Select measurement file and data format, LCR or VNA. Make sure package number is in the same format as in the csv-file. Choose desired frequency point if VNA-data is used. Click ok to proceed.



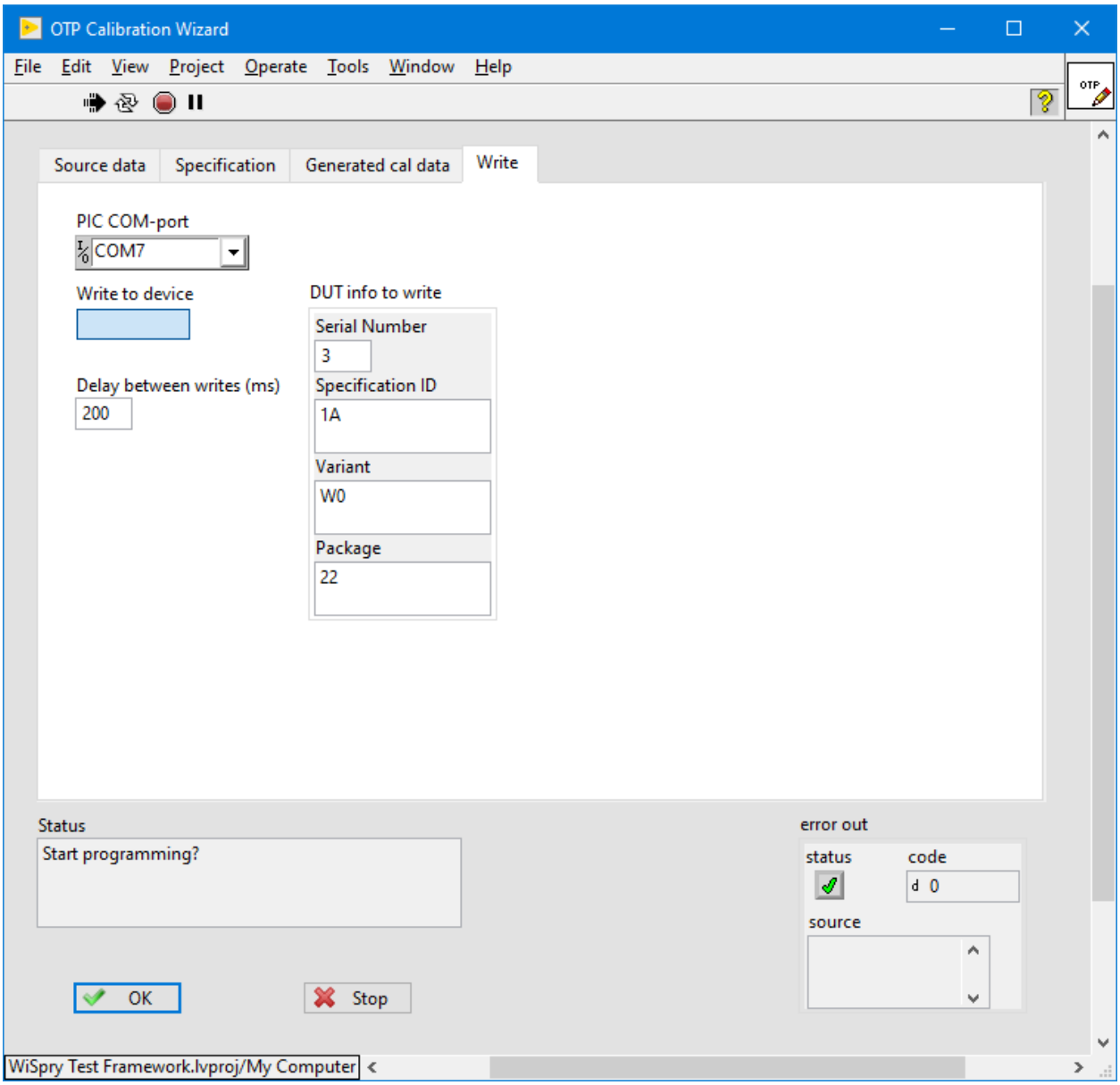
Make sure that the tool read the Cmax and Cmin values correctly. Set the specification values, Cmin, Cmax and number of states (tolerance values are ignored at this time). The list on the right shows what register values are going to be used for calibration. It should be 14 rows for 14 beams. Click ok to proceed.



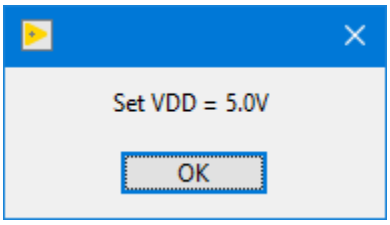
Inspect the proposed calibration registers on the left. The table on the right shows the target capacitance, emulated capacitance (calculated based on the original data in csv-file) and error. Click ok to proceed.



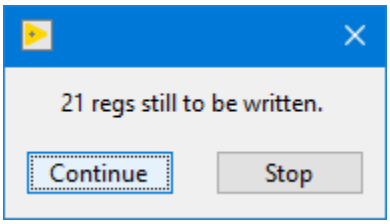
Select COM-port for the PIC and make sure that “Write to device” is selected. In case there were problems programming previously, the delay between the writes can be increased to give the device more time. Fill in additional information about the device. Click ok to proceed.



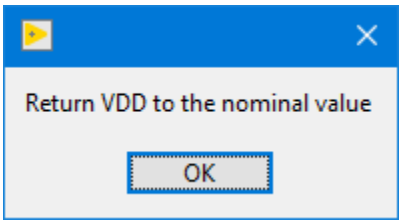
Before starting programming, the tool will ask to set Vdd to 5V.




The tool reads back the written registers and checks if they were written correctly. If not, it will pop up a window showing how many registers were not correct. The tool continues trying to write the registers until Stop is clicked.

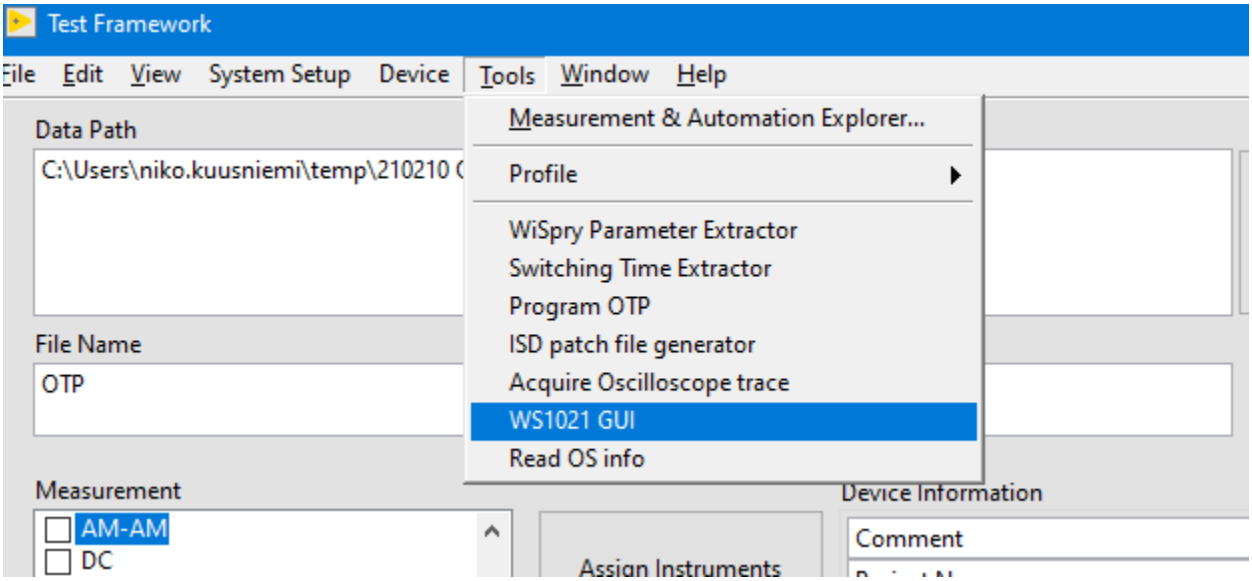



After successful write or if Stop was clicked, the tool will ask to return Vdd back to normal value.



## Checking the OTP data

In WiSpry Test Framework -software, click “WS1021 GUI” in Tools menu.



Select COM-port and correct USID (typically 0x7) and click “Init”. “Connected” LED should lit up. Click “Read info”, the newly written serial number should show up below. Clicking “Toggle Cmin/Cmax” should make the part switch between 0 and 31 state using the OTP-calibration. The whole OTP-header can be downloaded by clicking “Read OTP” button.