

# PGA309EVM

Step-by-step example

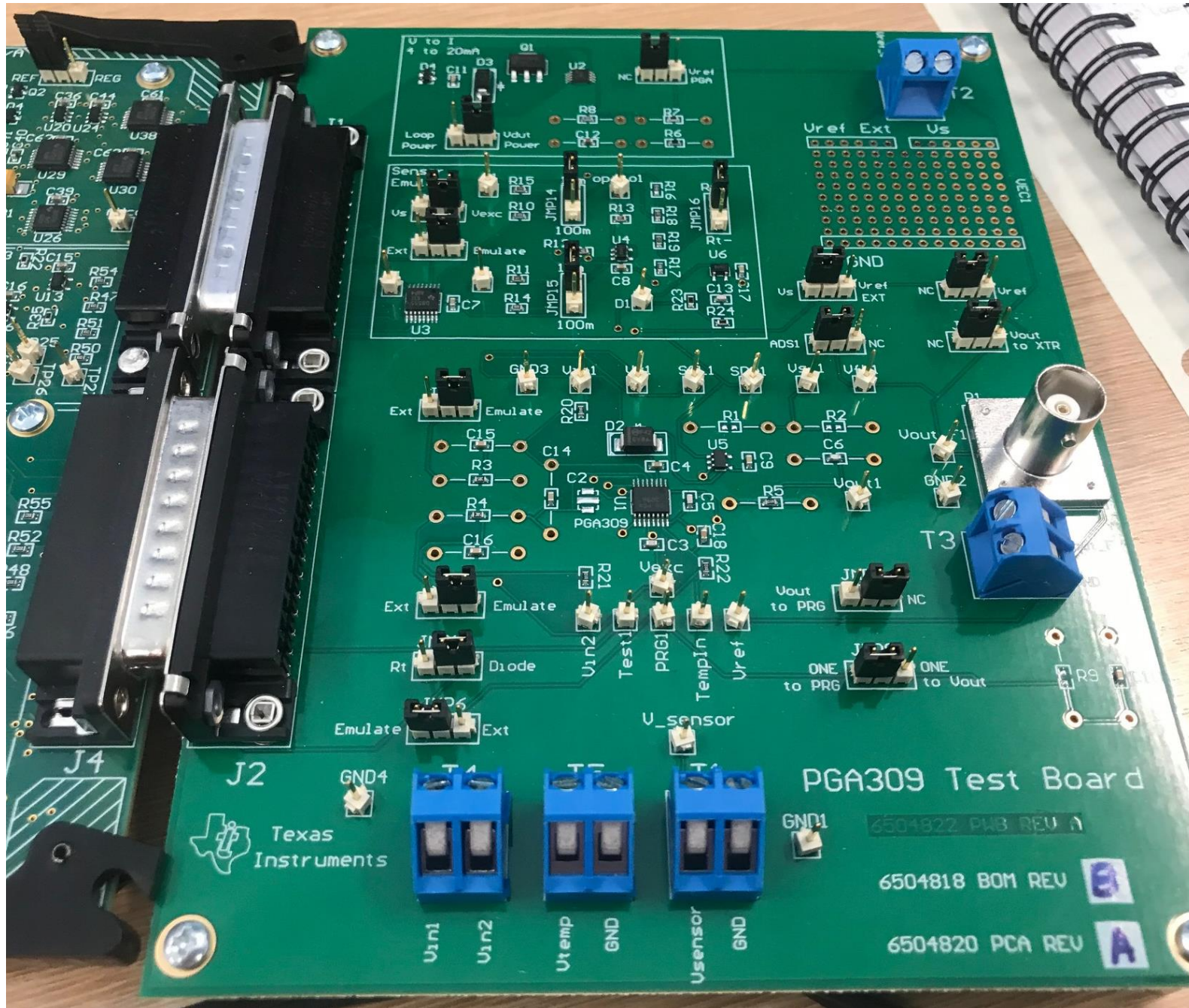
Art Kay

10-18-2023





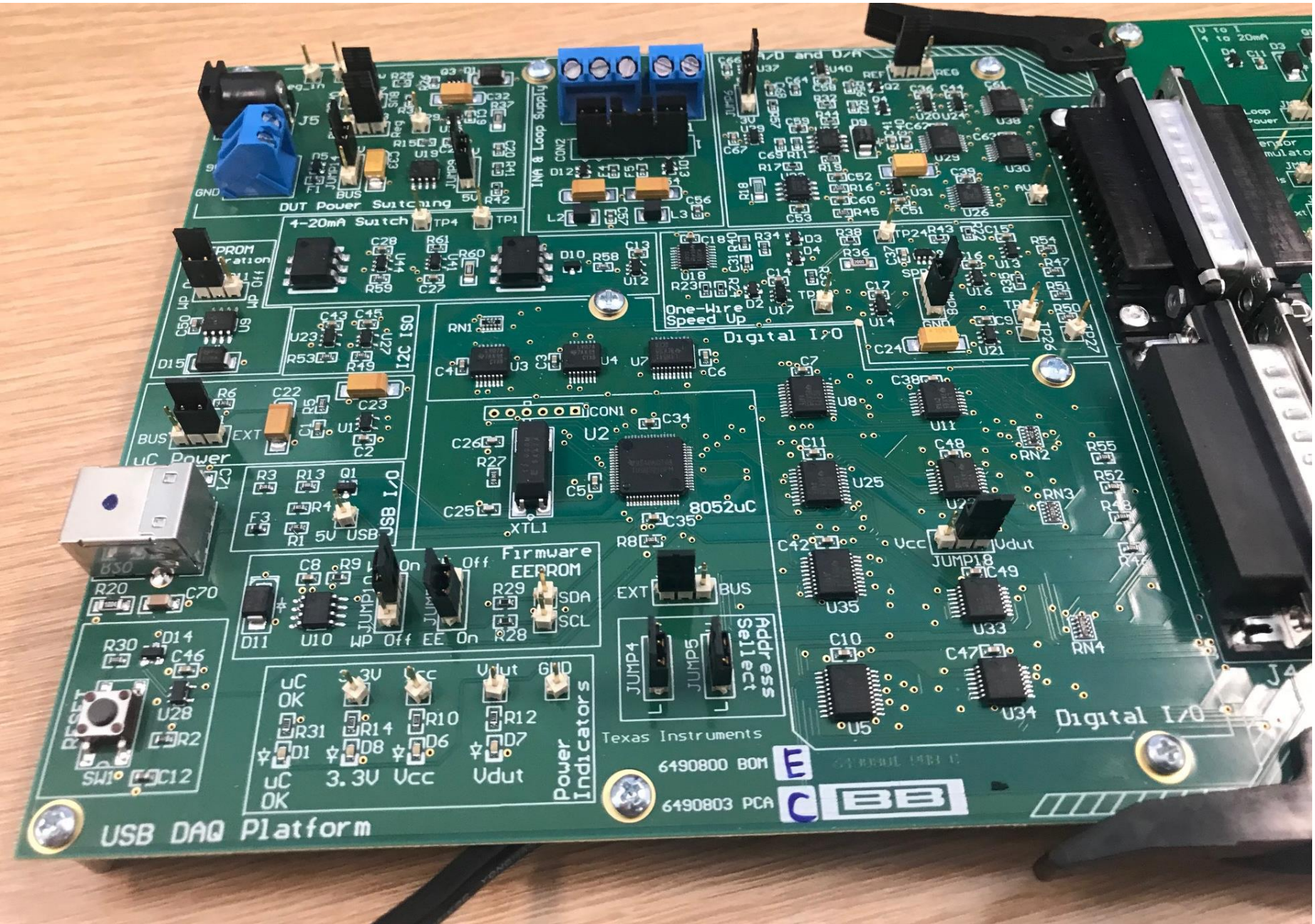
# Set the jumpers on the test board.



JMP	Position
10	NC
11	Vdut Power
12	Vexc
17	Emulate
14	10m
15	10m
16	Rt+
2	Vs
1	NC
3	ADS1
9	NC
4	Emulate
5	Emulate
13	Diode
6	Emulate
7	NC
8	ONE to PRG



# Set the jumpers on the USB-DAQ



JMP	Position
17	BUS
13	Reg
14	9V
9	5V
11	WP On
6	5V
7	REF
1	EXT
8	GND
10	WP On
3	EE On
2	EXT
4	L
5	L
18	VDUT

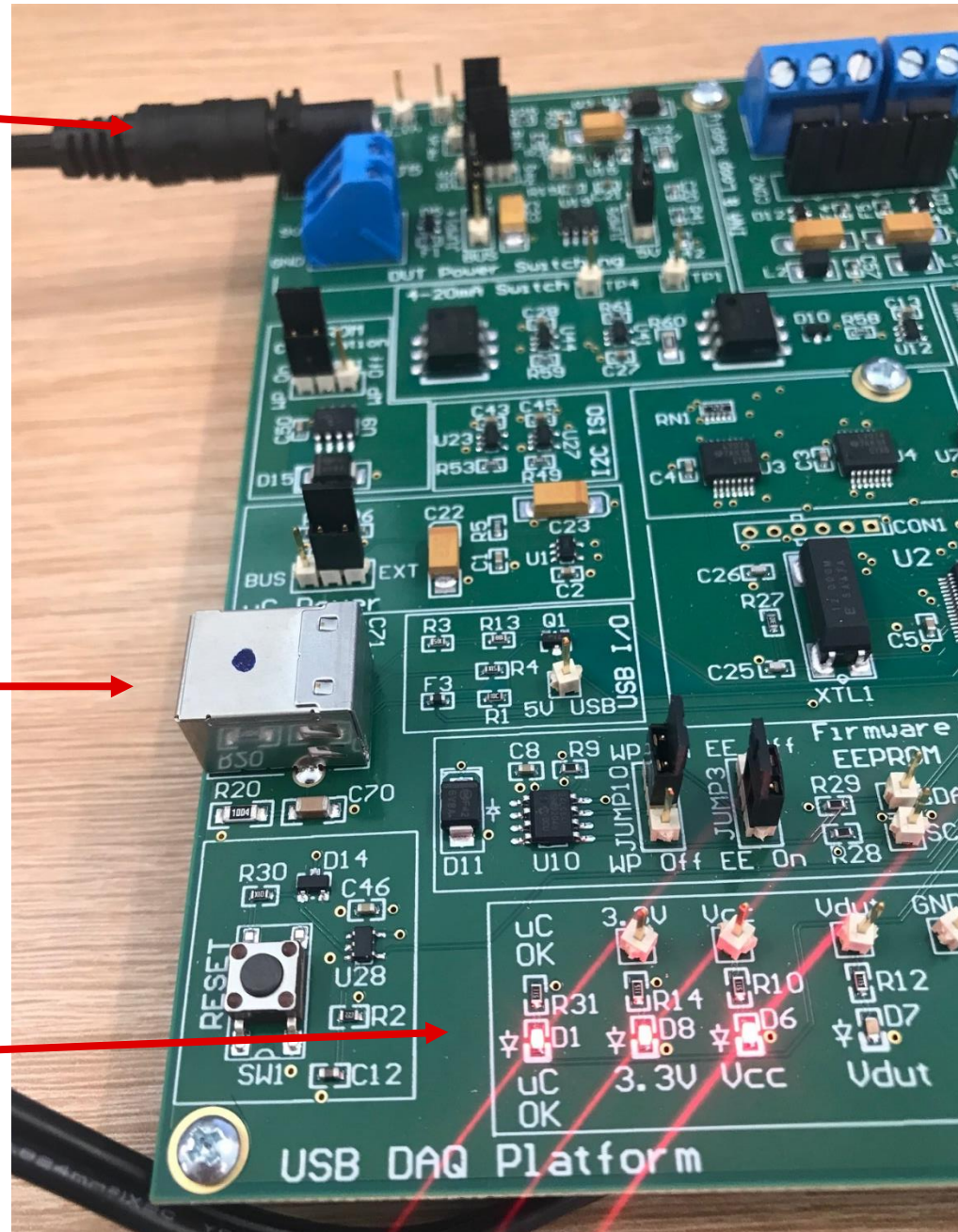


# Connect Power (6V to 9V) then USB

1. Connect 6V to 9V DC power here

3. Connect USB here

2. LED should eliminate as shown.



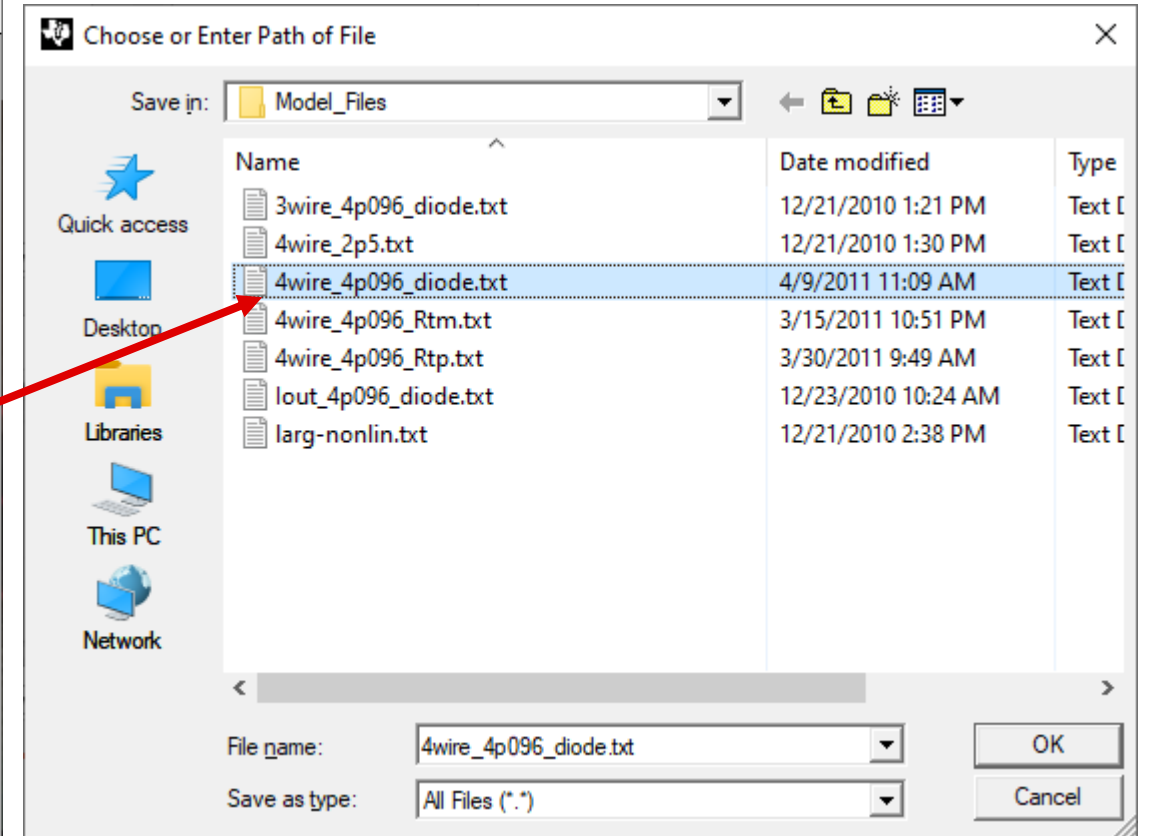
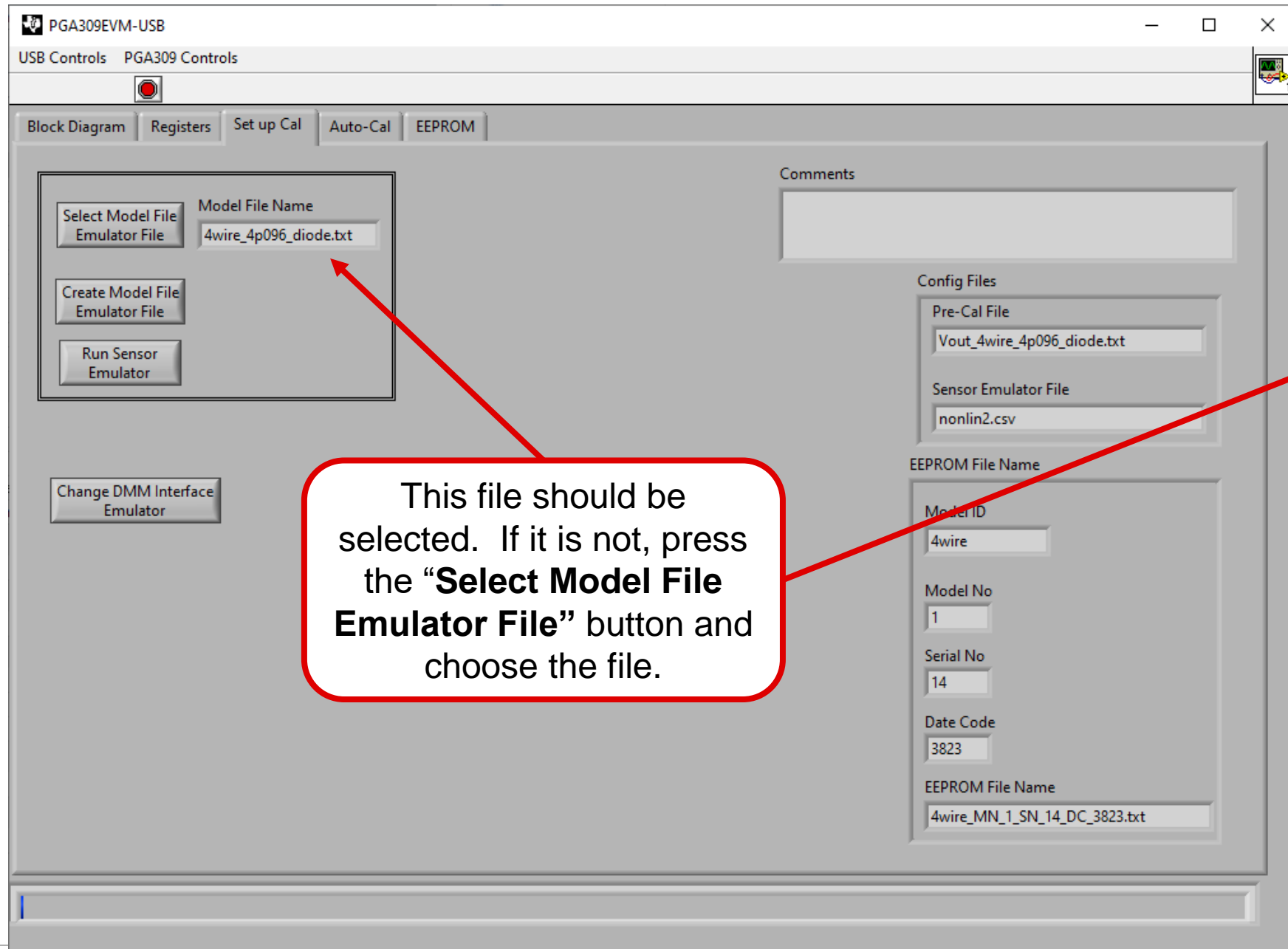
# Start Software

The screenshot shows the PGA309EVM-USB software interface. The window title is "PGA309EVM-USB" and the menu bar includes "USB Controls" and "PGA309 Controls". The main interface has several tabs: "Block Diagram", "Registers", "Set up Cal", "Auto-Cal", and "EEPROM". The "Auto-Cal" tab is active, showing a "Start" button and an "Auto-continue" checkbox. Below this are "Calibration" controls including "Continue", "Re-Run Current Measurement", and "Re-Cal Selected Temperature". A "Temperature" dropdown is set to "0.0". The "First Cal Status" section shows four progress indicators for "Find Vin\_Low", "Calibrate Vin\_High", "Calibrate Vin\_Low", and "Calibrate Vin\_Mid", all of which are green, indicating completion. The "Over Temp Status" section shows four progress indicators for "Find Vin\_Low", "Cal Vin\_High", "Cal Vin\_Low", and "Done", also all green. A "Measurements Complete" indicator is also green. The "Cal Results" section shows "EEPROM Written" as green. The "Reg Cluster" section contains various registers: "Misc Value" (Temp No, Vin\_Low, Vout\_Low, Vo High Target, Io High Target, No of Temp, Output Mode), "Analog Reg" (Front Gain, Output Gain, Coarse Off, Gain Dac, Zero Dac), and "Reg" (Vs, Vref, Klin, Kexc, XTR\_Vref, R1, R2, R\_ref). The "Cal Control" section has checkboxes for "Calibrate Nonlin (LinD)" and "Use Sensor Emulator", and a "Range" dropdown set to "12mV/V". The "XTR Info" section shows "R1" and "R2" as 0. The "Cal Results" table is as follows:

Done	Temperature	Temp DAC	Sensor Min	Sensor Max	Vout Max	Vout Min	Io Max	Io Min	Zero Dac	Gain Dac	Emul Min	Emul Max	Emul Temp
●	0	x0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0380	8.0980	0.75000
●	50	x0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0580	8.1555	0.65000
●	100	x0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.4620	9.2290	0.55000
●	0	x0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
●	0	x0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
●	0	x0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
●	0	x0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Should see a quick update on status bar and no error messages.

# Select the “4wire\_4p096\_diode.txt” if needed



# Run Auto-Cal

2. Press start.

1. Check "auto-continue" to speed up calibration.

3. Continue should start to blink. Press this to initiate calibration.

The screenshot shows the 'PGA309 Controls' software interface. The 'Auto-Cal' tab is selected. The 'Start' button is highlighted with a red arrow. The 'Auto-continue' checkbox is checked. The 'Continue' button is highlighted with a red arrow. The 'Calibration Info' table is visible at the bottom.

Done	Temperature	Temp DAC	Sensor Min	Sensor Max	Vout Max	Vout Min	Io Max	Io Min	Zero Dac	Gain Dac	Emul Min	Emul Max	Emul Temp
<input type="checkbox"/>	0	x0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0380	8.0980	0.75000
<input type="checkbox"/>	50	x0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0580	8.1555	0.65000
<input type="checkbox"/>	100	x0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.4620	9.2290	0.55000
<input type="checkbox"/>	0	x0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<input type="checkbox"/>	0	x0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<input type="checkbox"/>	0	x0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<input type="checkbox"/>	0	x0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000



# Calibration progress

1. Text describing the current step is shown here

2. Measured results will update here. The sensor emulator will automatically adjust the "sensor" output according to the current emulated temperature and pressure.

PGA309EVM-USB

USB Controls PGA309 Controls

Block Diagram Registers Set up Cal Auto-Cal EEPROM

testing at High Pressure...

Start

Auto-continue

Calibration

Continue

Re-Run Current Measurement

Re-Cal Selected Temperature

Temperature 0.0

First Cal Status

Find Vin\_Low Calibrate Vin\_High Calibrate Vin\_Low Calibrate Vin\_Mid

2nd Find Vin\_Low 2nd Cal Vin\_High 2nd Cal Vin\_Low Done Initial Cal

Over Temp Status

Find Vin\_Low Cal Vin\_High Cal Vin\_Low Done

Measurements Complete

EEPROM Written

Cal Results 4wire\_MN\_1\_SN\_14\_DC\_3823.txt

Calibration Info

Done	Temperature	Temp DAC	Sensor Min	Sensor Max	Vout Max	Vout Min	Io Max	Io Min	Zero Dac	Gain Dac	Emul Min	Emul Max	Emul Temp
<input checked="" type="checkbox"/>	0	0	1.033m	7.943m	2.9321	2.9495	0.0000	0.0000	0.0000	0.0000	1.0380	8.0980	0.75000
<input checked="" type="checkbox"/>	50	0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0580	8.1555	0.65000
<input checked="" type="checkbox"/>	100	0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.4620	9.2290	0.55000
<input checked="" type="checkbox"/>	0	0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<input checked="" type="checkbox"/>	0	0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<input checked="" type="checkbox"/>	0	0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<input checked="" type="checkbox"/>	0	0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000



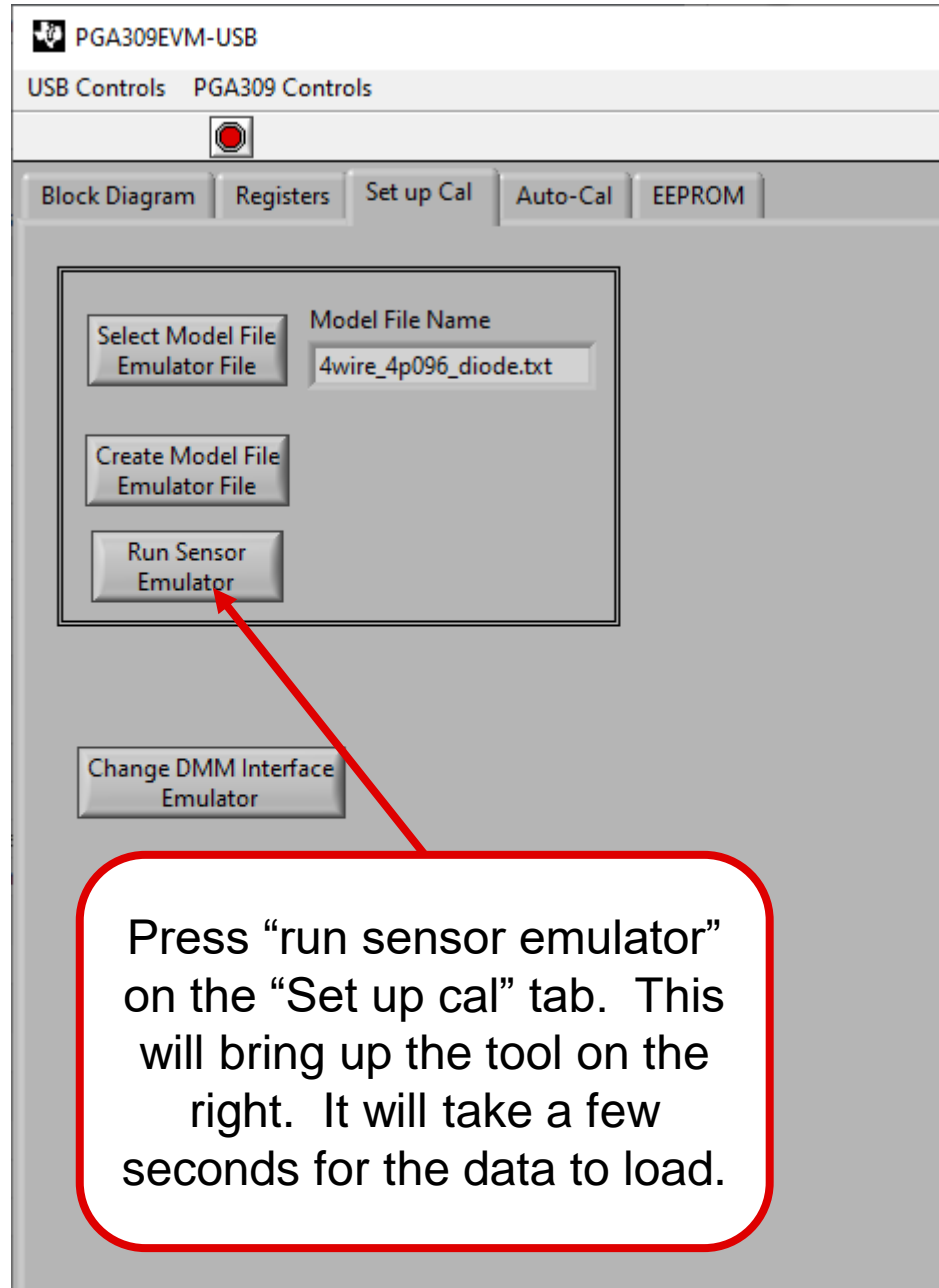
# Calibration complete

1. Notice that the calibrated min and max output are approximately at the target of 0.5V to 4.5V. This indicates that the calibration worked and the hardware is functioning correctly

The screenshot shows the PGA309EVM-USB software interface. The 'Calibration Complete!' message is displayed at the top. The 'Calibration Info' table at the bottom shows the calibrated output values for different temperatures. A yellow box highlights the 'Vout Max' and 'Vout Min' columns for the 100°C row, which are 4.4998 and 0.49951 respectively. A red arrow points from the text in the callout box to these values.

Done	Temperature	Temp DAC	Sensor Min	Sensor Max	Vout Max	Vout Min	Io Max	Io Min	Zero Dac	Gain Dac	Emul Min	Emul Max	Emul Temp
<input checked="" type="checkbox"/>	0	17A2	1.065m	8.095m	4.4998	0.49951	0.0000	0.0000	2.1639	0.62250	1.0380	8.0980	0.75000
<input checked="" type="checkbox"/>	50	1480	1.086m	8.153m	4.5001	0.49941	0.0000	0.0000	2.1573	0.61911	1.0580	8.1555	0.65000
<input checked="" type="checkbox"/>	100	115E	1.492m	9.225m	4.5001	0.49951	0.0000	0.0000	2.0184	0.56497	1.4620	9.2290	0.55000
<input type="checkbox"/>	0	0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<input type="checkbox"/>	0	0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<input type="checkbox"/>	0	0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
<input type="checkbox"/>	0	0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

# Sensor emulator for verification



PGA309EVM-USB  
USB Controls PGA309 Controls

Block Diagram Registers Set up Cal Auto-Cal EEPROM

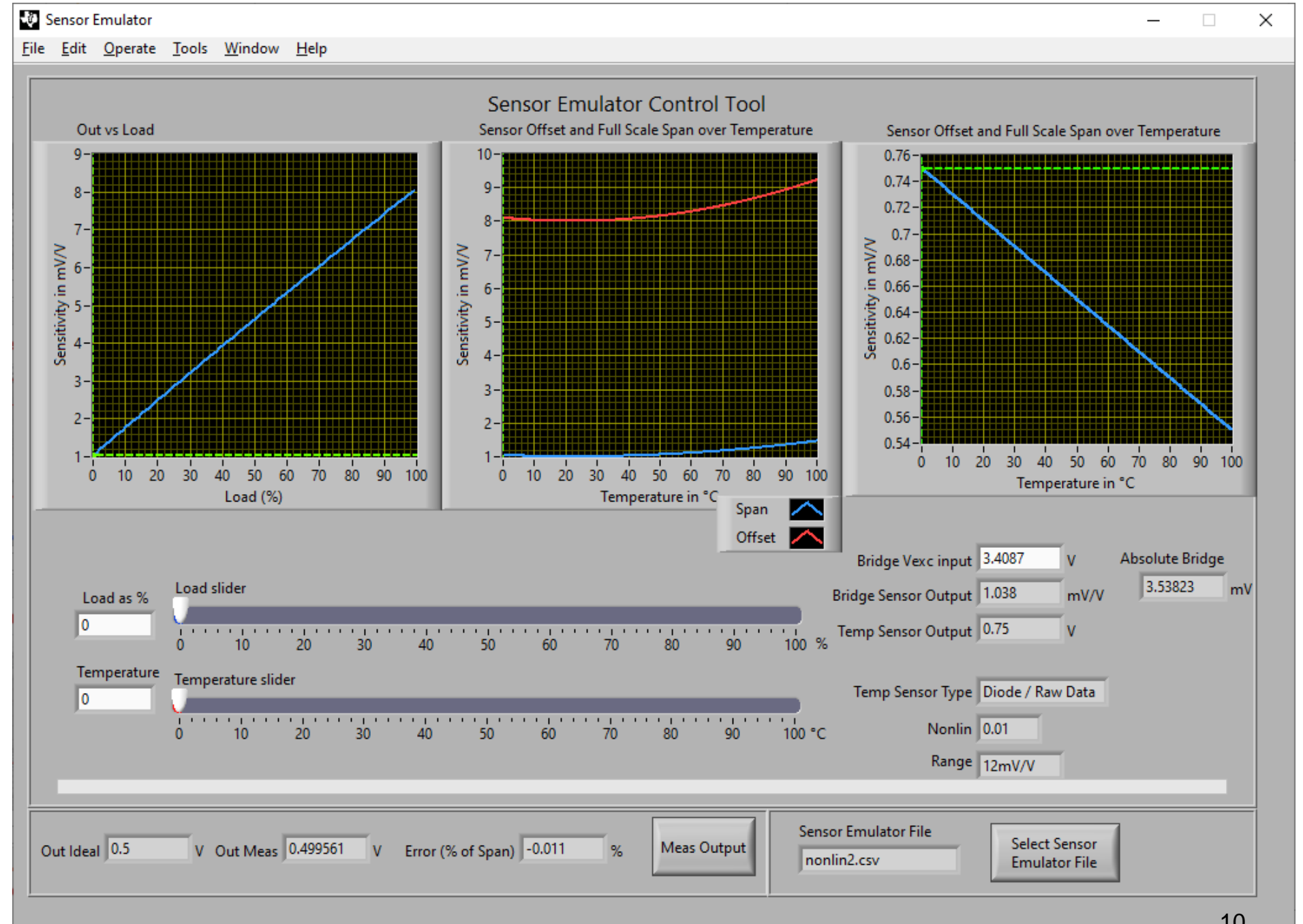
Select Model File Emulator File Model File Name  
4wire\_4p096\_diode.txt

Create Model File Emulator File

Run Sensor Emulator

Change DMM Interface Emulator

Press "run sensor emulator" on the "Set up cal" tab. This will bring up the tool on the right. It will take a few seconds for the data to load.



Sensor Emulator  
File Edit Operate Tools Window Help

Sensor Emulator Control Tool

Out vs Load  
Sensitivity in mV/V vs Load (%)

Sensor Offset and Full Scale Span over Temperature  
Sensitivity in mV/V vs Temperature in °C

Sensor Offset and Full Scale Span over Temperature  
Sensitivity in mV/V vs Temperature in °C

Span  
Offset

Load as % Load slider  
0 0 10 20 30 40 50 60 70 80 90 100 %

Temperature Temperature slider  
0 0 10 20 30 40 50 60 70 80 90 100 °C

Bridge Vexc input 3.4087 V Absolute Bridge  
Bridge Sensor Output 1.038 mV/V 3.53823 mV  
Temp Sensor Output 0.75 V  
Temp Sensor Type Diode / Raw Data  
Nonlin 0.01  
Range 12mV/V

Out Ideal 0.5 V Out Meas 0.499561 V Error (% of Span) -0.011 % Meas Output  
Sensor Emulator File nonlin2.csv Select Sensor Emulator File

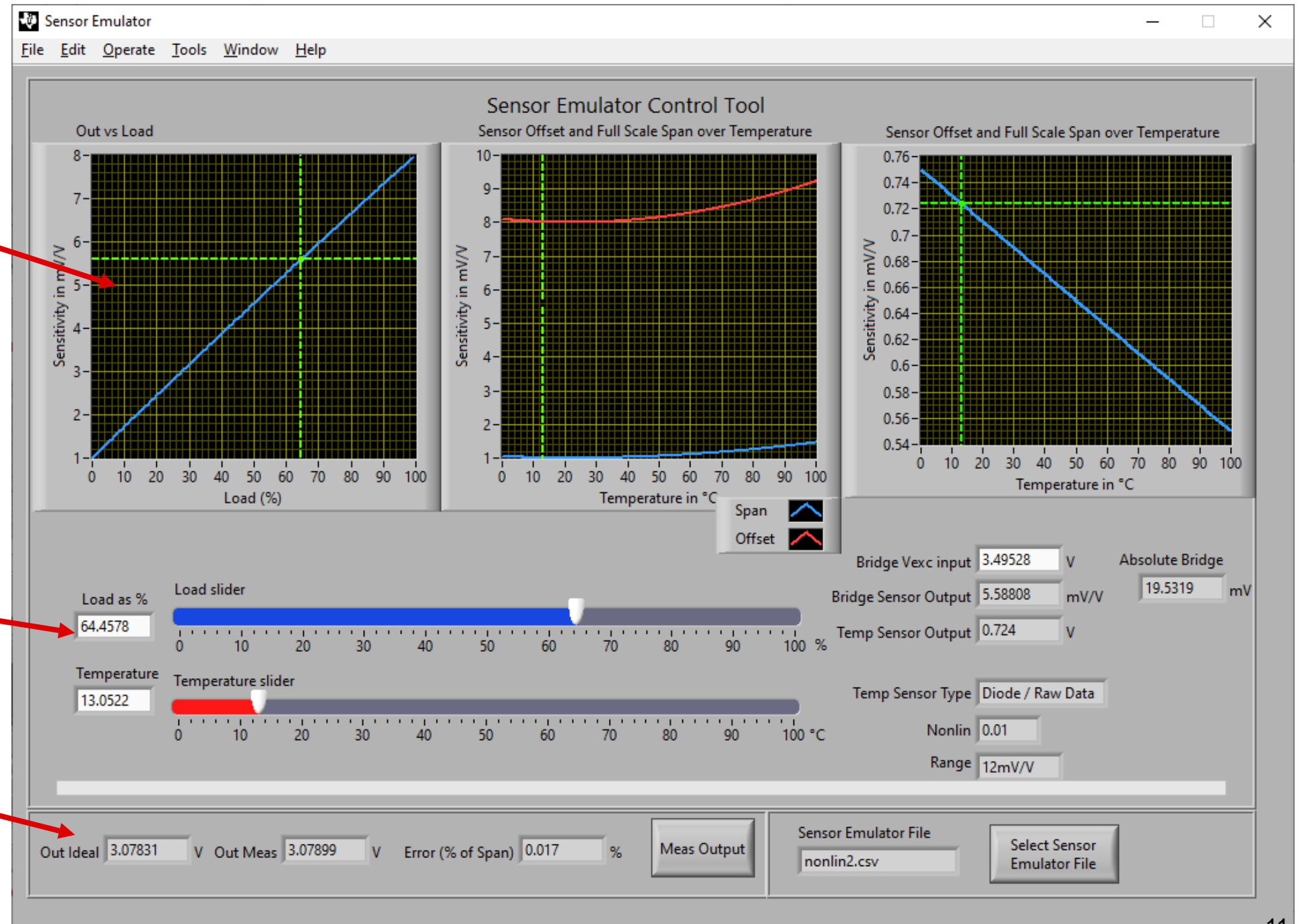


# Sensor emulator for verification

2. The cursor position will adjust to show the current temperature and pressure conditions on the sensor curves.

1. Adjust the sliders to any temperature or pressure.

3. The “ideal output” and “Out Meas” should be approximately equal. The Error should be less than 0.1%. In this case the error is 0.017% so it is working well.



# Changes for real world sensors

JMP	Position
10	NC
11	Vdut Power
12	Vexc
<b>17</b>	<b>Ext</b>
14	10m
15	10m
16	Rt+
2	Vs
1	NC
3	ADS1
9	NC
<b>4</b>	<b>Ext</b>
<b>5</b>	<b>Ext</b>
13	Diode
<b>6</b>	<b>Ext</b>
7	NC
8	ONE to PRG

1. Change jumpers 4, 5, 6 and 17 to Ext to use external sensors.