

# Use USB\_DAQ to Complete the Calibration of PGA309 EVM

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Feb. 6<sup>th</sup>, 2013, updated May 20<sup>th</sup> 2016

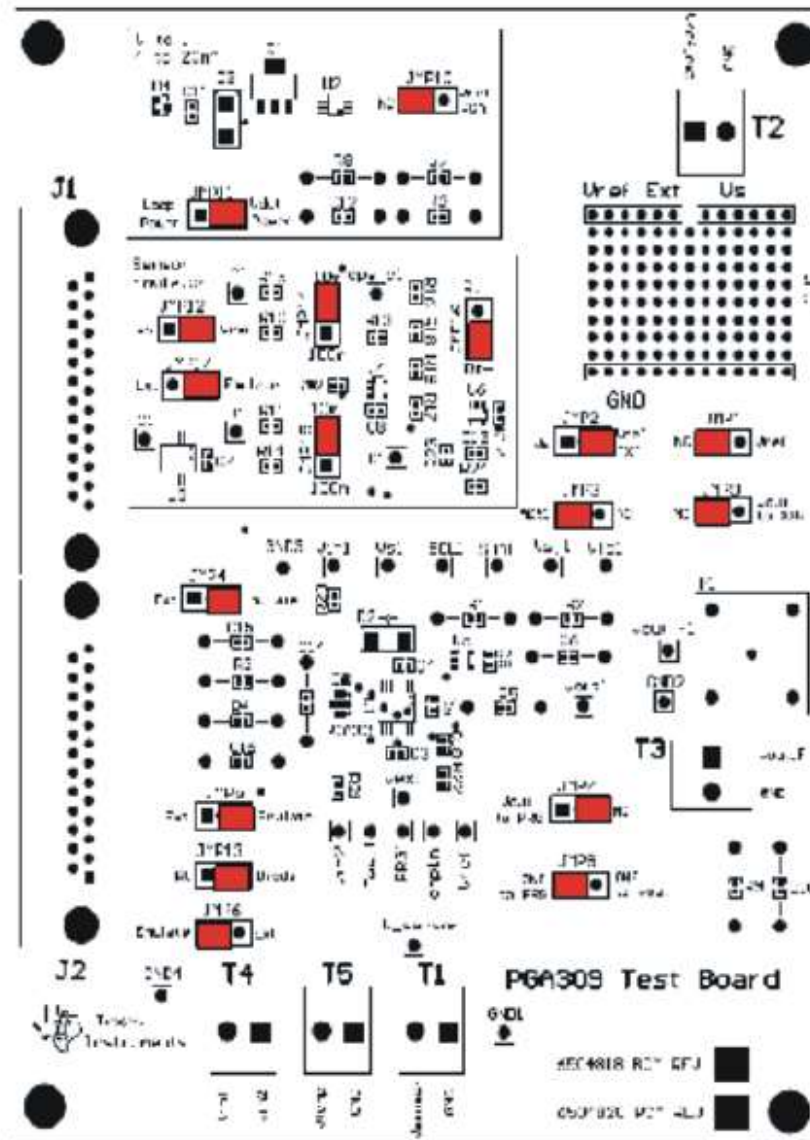
# Agenda

1. Three output modes of PGA309EVM-USB
  - a) 4-wire voltage output mode
  - b) 3-wire voltage output mode
  - c) Current output mode

# a) 4-wire voltage output mode

# a) 4-wire voltage output mode:

- PGA309 EVM Default Configuration

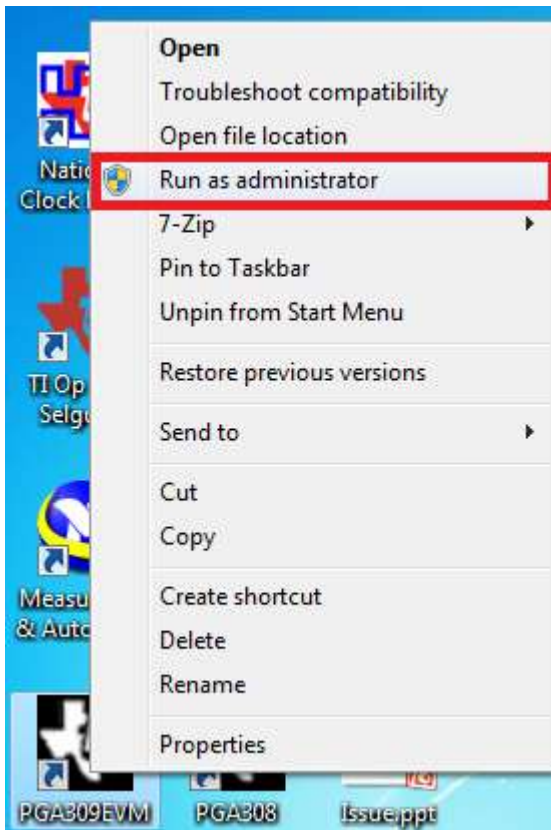


# a) 4-wire voltage output mode:

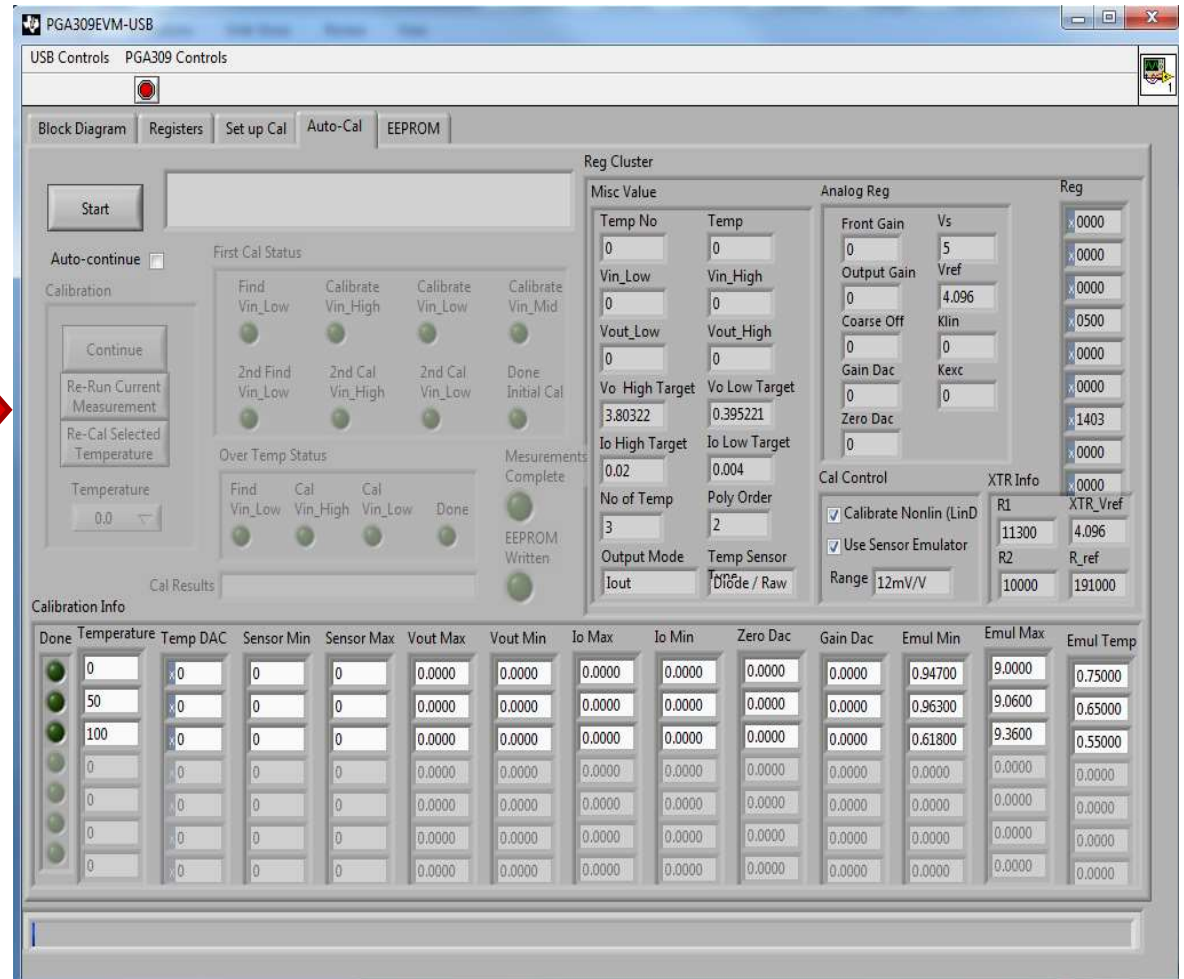
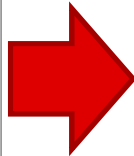
- USB\_DAQ Board Default Configuration



# a) 4-wire voltage output mode:



Windows 7 Attention



Default GUI Interface

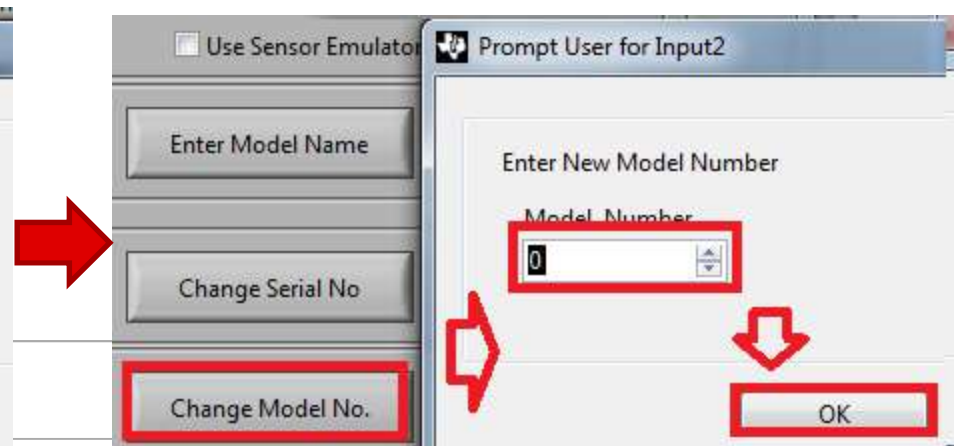
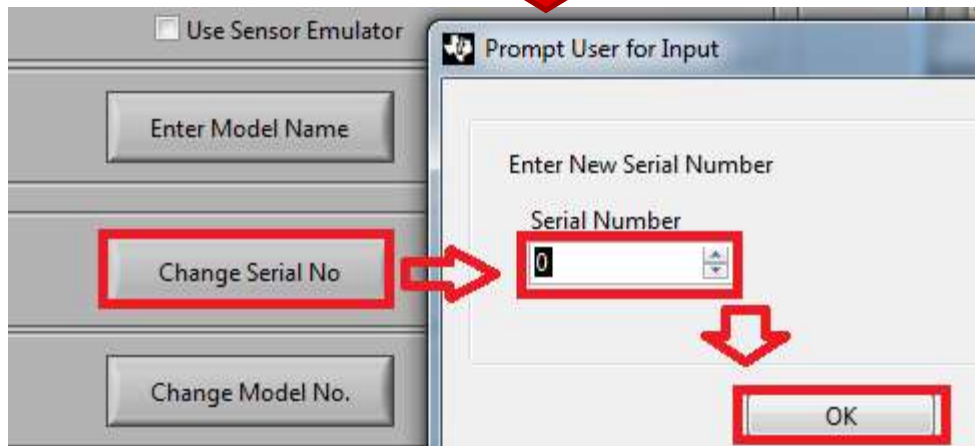
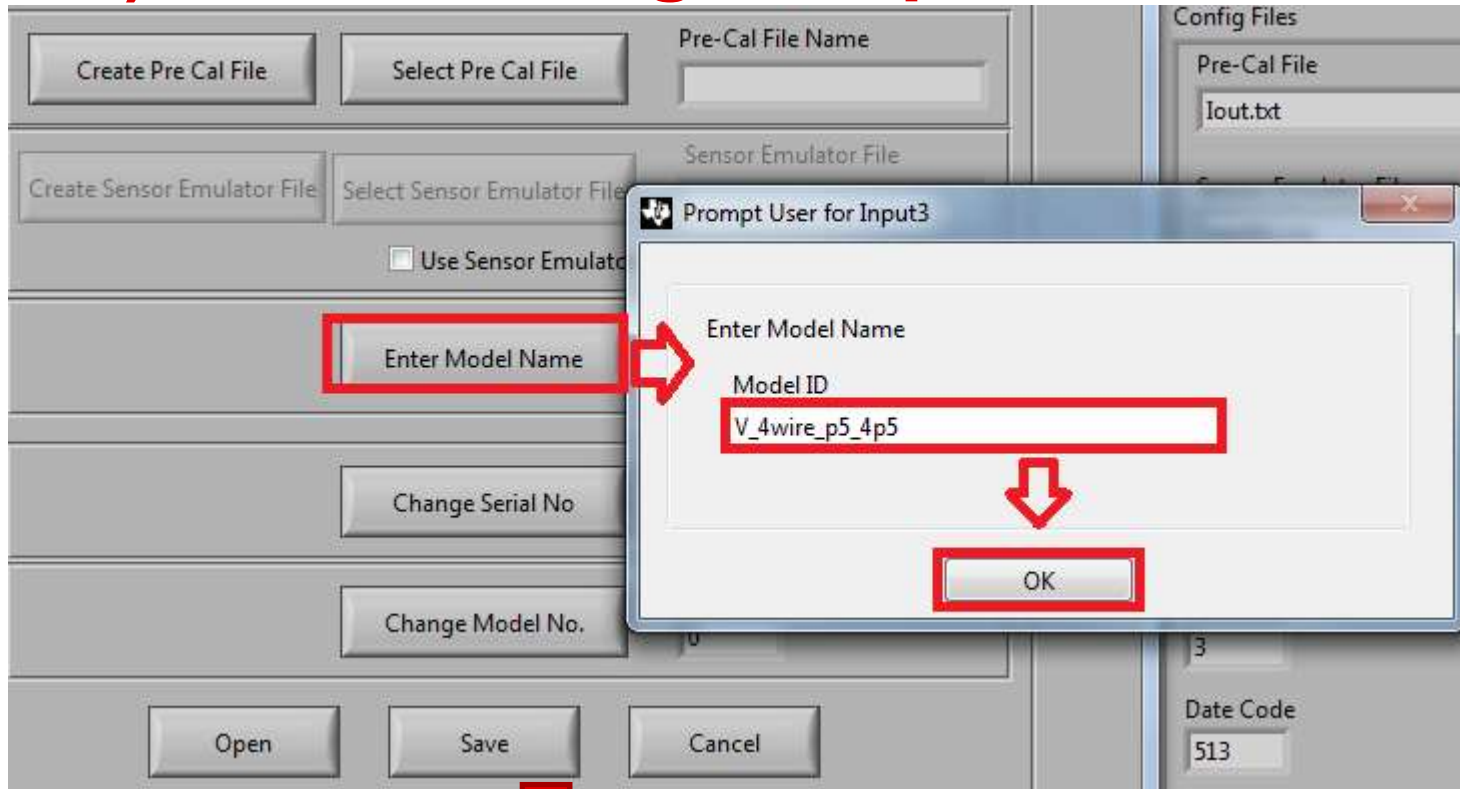
## a) 4-wire voltage output mode:

The image shows two overlapping software windows. The background window is titled 'PGA309EVM-USB' and has a menu bar with 'USB Controls' and 'PGA309 Controls'. Below the menu bar is a status bar with a red indicator light and the text 'First Step'. The main area has a tabbed interface with 'Block Diagram', 'Registers', 'Set up Cal', 'Auto-Cal', and 'EEPROM'. The 'Set up Cal' tab is active and contains a 'Model File Name' field with the text 'Iout\_4p096\_diode.txt'. A red box highlights the 'Create Model File Emulator File' button, and the text 'Second Step' is written next to it. A red arrow points from this button to the 'Create Model' dialog box in the foreground.

The foreground window is titled 'Create Model' and has a menu bar with 'File', 'Edit', 'Operate', 'Tools', 'Window', and 'Help'. It contains the following fields and buttons:

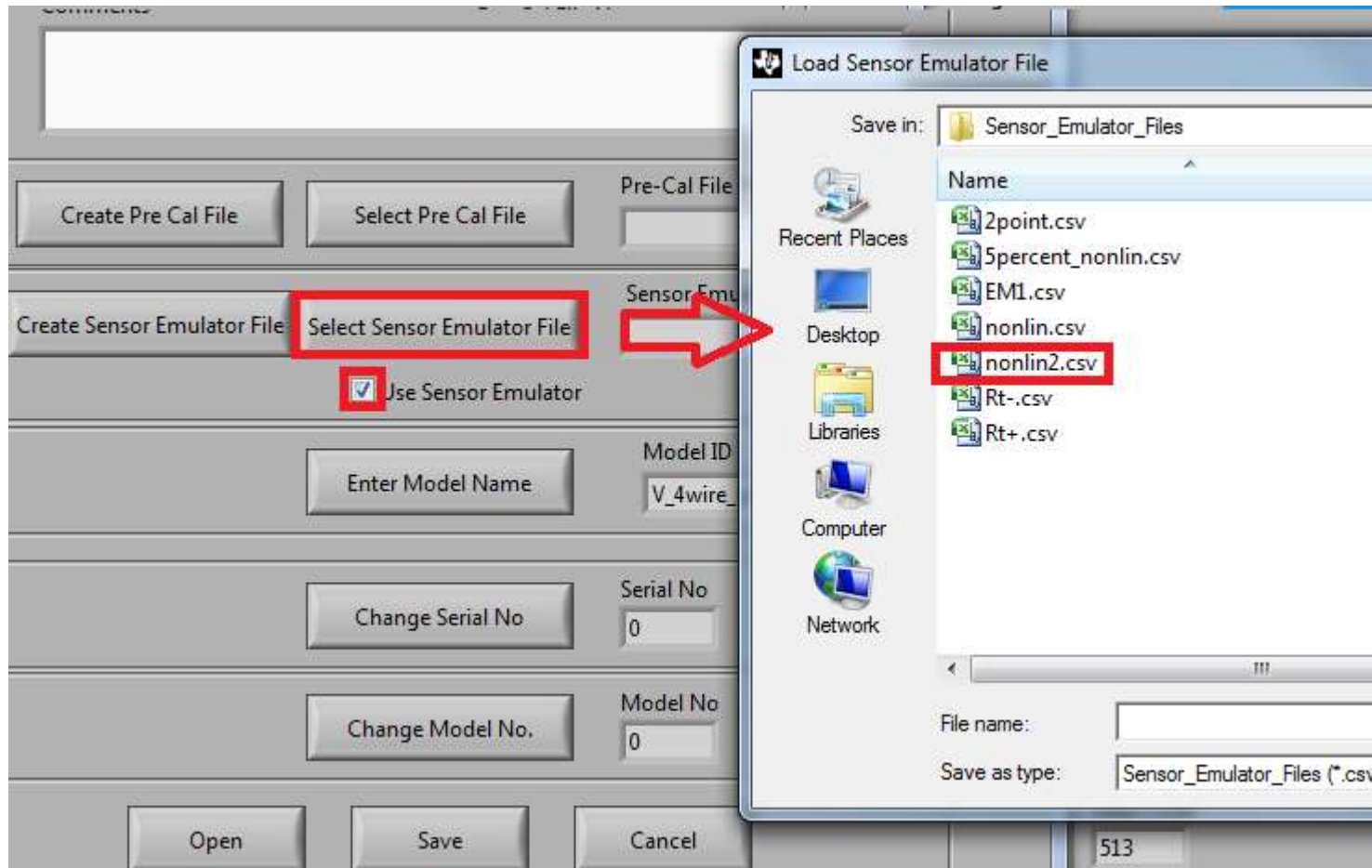
- Comments: A large text area.
- Buttons: 'Create Pre Cal File', 'Select Pre Cal File', 'Create Sensor Emulator File', 'Select Sensor Emulator File', 'Enter Model Name', 'Change Serial No', 'Change Model No.', 'Open', 'Save', 'Cancel'.
- Fields: 'Pre-Cal File Name', 'Sensor Emulator File', 'Model ID', 'Serial No' (with value '0'), 'Model No' (with value '0').
- Checkbox: 'Use Sensor Emulator' (unchecked).

# a) 4-wire voltage output mode:

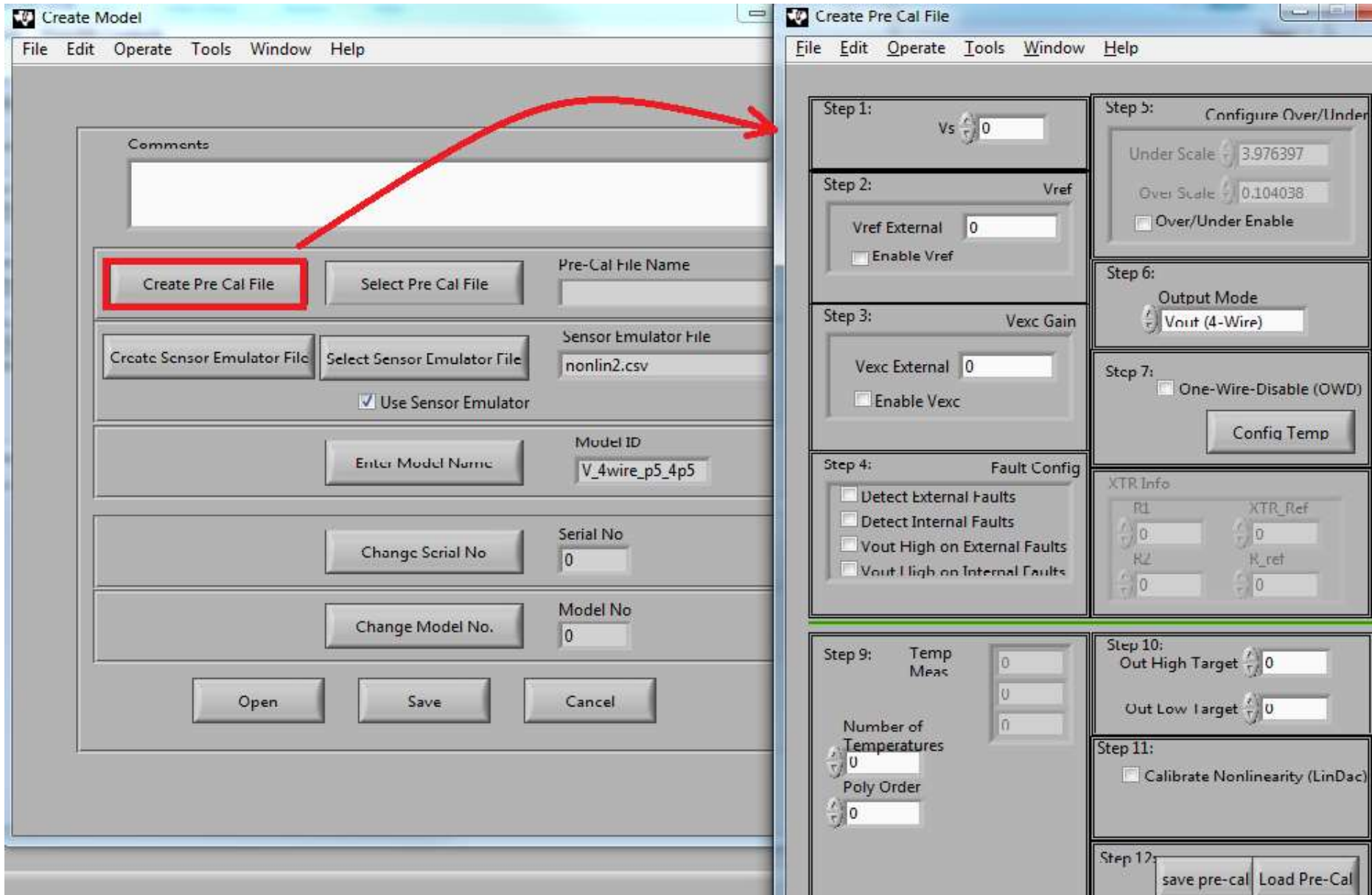




## a) 4-wire voltage output mode:



# a) 4-wire voltage output mode:



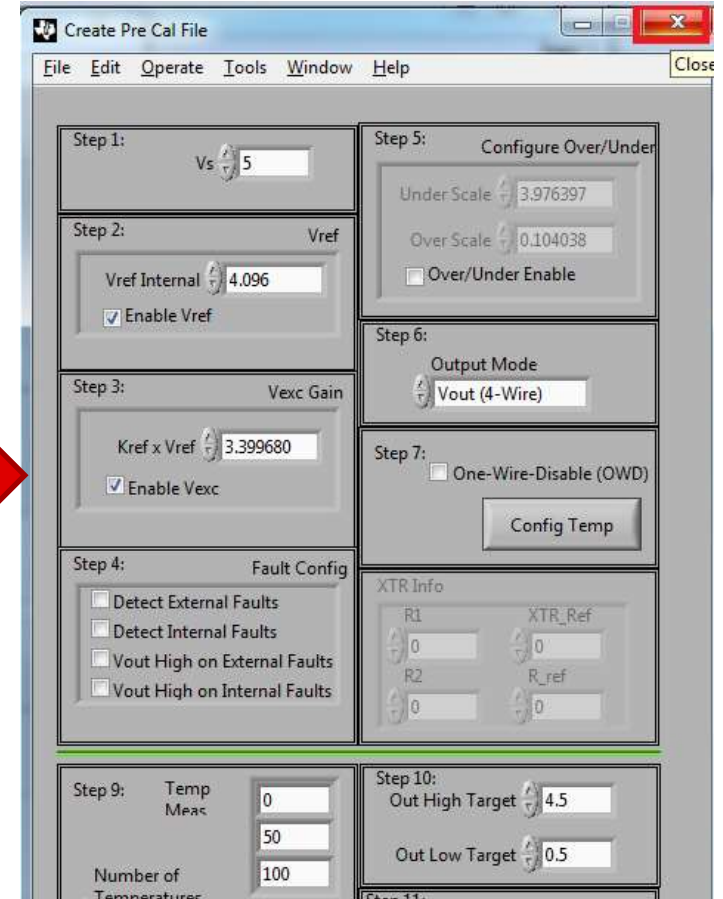
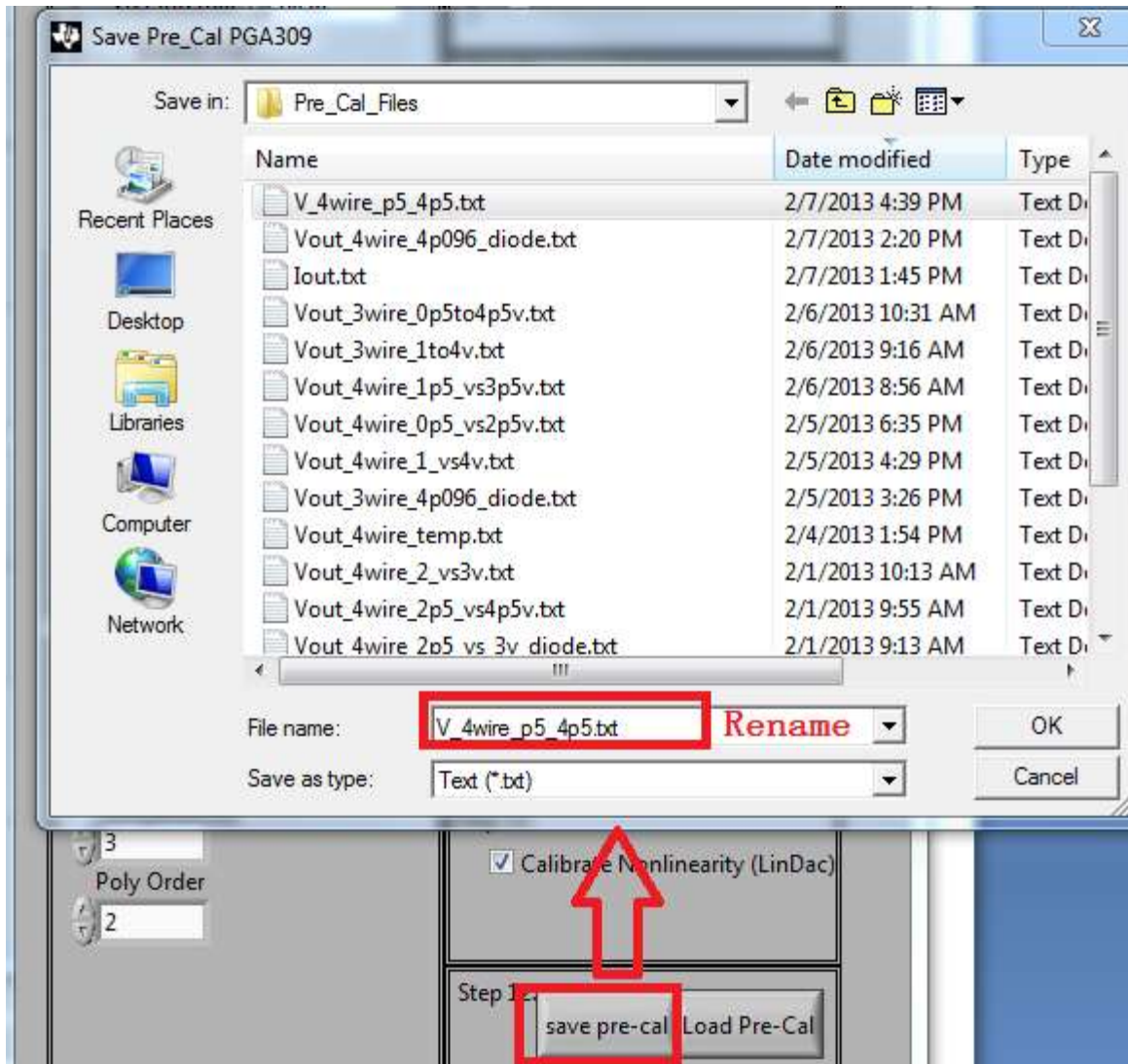
# a) 4-wire voltage output mode:

The screenshot shows the 'Create Pre Cal File' software interface. The left pane displays a file selection dialog for 'Pre\_Cal\_Files'. The file 'Vout\_4wire\_4p096\_diode.txt' is selected and highlighted with a red box. The right pane shows the configuration wizard with the following steps:

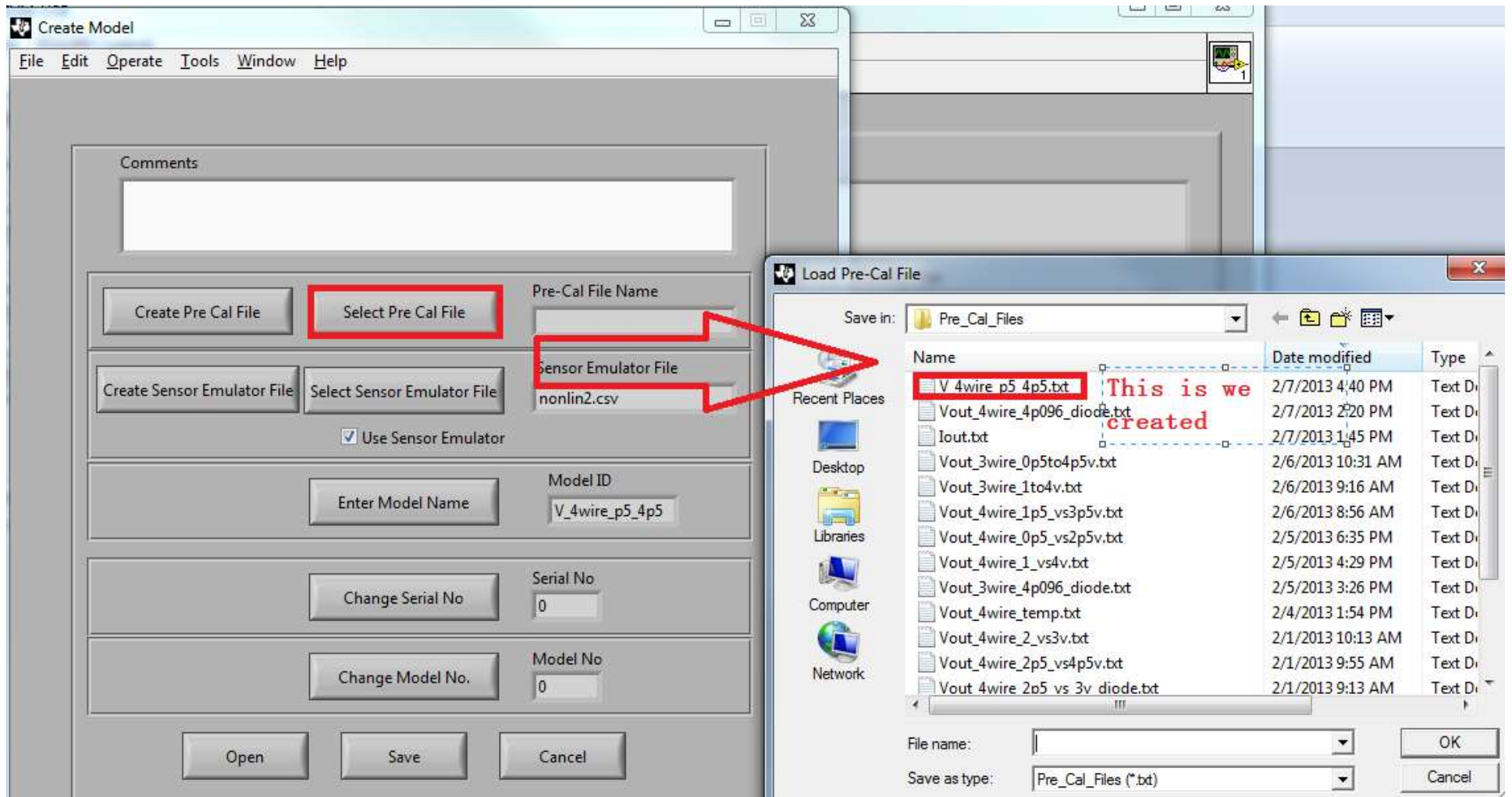
- Step 1: Vs = 0
- Step 2: Vref Internal = 4.096,  Enable Vref
- Step 3: Vexc Gain: Kref x Vref = 3.399680,  Enable Vexc
- Step 4: Fault Config:  Detect External Faults,  Detect Internal Faults,  Vout High on External Faults,  Vout High on Internal Faults
- Step 5: Configure Over/Under: Under Scale = 3.976397, Over Scale = 0.104038,  Over/Under Enable
- Step 6: Output Mode: Vout (4-Wire)
- Step 7:  One Wire Disable (OWD), Config Temp button
- Step 9: Temp Meas: 0, 50, 100 (all values are in red boxes)
- Step 10: Out High Target = 4.5, Out Low Target = 0.5 (both values are in red boxes)
- Step 11:  Calibrate Nonlinearity (LinDac)
- Step 12: save pre-cal, Load Pre-Cal (both buttons are in red boxes)

A red arrow points from the file selection dialog to the configuration wizard. A red box highlights the 'Load Pre-Cal' button in Step 12.

# a) 4-wire voltage output mode:



# a) 4-wire voltage output mode:



# a) 4-wire voltage output mode:

Comments

Create Pre Cal File Select Pre Cal File Pre-Cal File Name  
V\_4wire\_p5\_4p5.txt

Create Sensor Emulator File Select Sensor Emulator File Sensor Emulator File  
nonlin2.csv

Use Sensor Emulator

Enter Model Name Model ID  
V\_4wire\_p5\_4p5

Change Serial No Serial No  
0

Change Model No. Model No  
0

Open Save Cancel

Load Model File

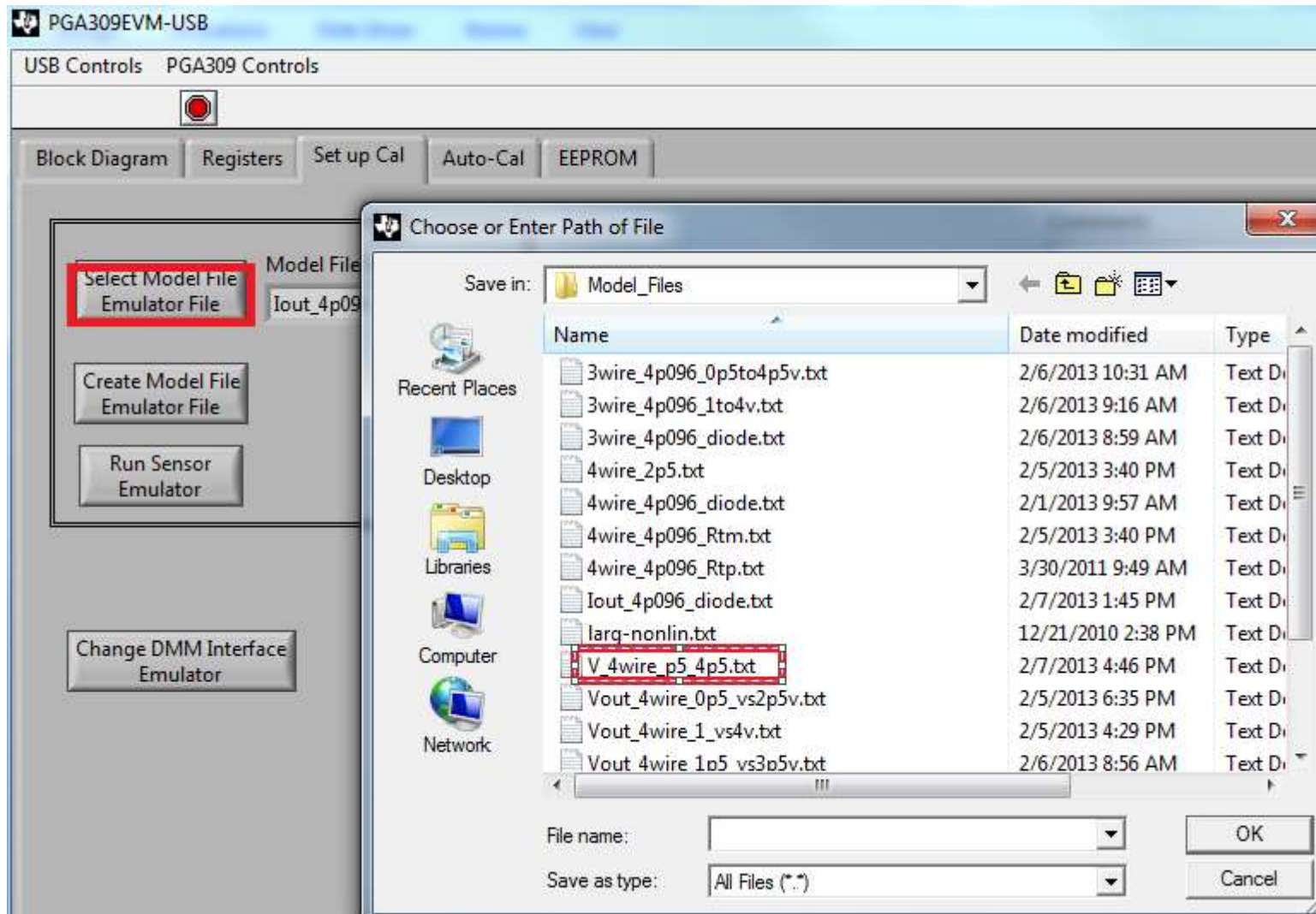
Save in: Model\_Files

Name	Date modified	Type
3wire_4p096_0p5to4p5v.txt	2/6/2013 10:31 AM	Text Document
3wire_4p096_1to4v.txt	2/6/2013 9:16 AM	Text Document
3wire_4p096_diode.txt	2/6/2013 9:57 AM	Text Document
4wire_2p5.txt	2/6/2013 10:31 AM	Text Document
4wire_4p096_diode.txt	2/5/2013 3:40 PM	Text Document
4wire_4p096_Rtm.txt	2/7/2013 1:45 PM	Text Document
4wire_4p096_Rtp.txt	3/30/2011 9:49 AM	Text Document
Iout_4p096_diode.txt	12/21/2010 2:38 PM	Text Document
larg-nonlin.txt	2/5/2013 6:35 PM	Text Document
Vout_4wire_0p5_vs2p5v.txt	2/5/2013 4:29 PM	Text Document
Vout_4wire_1_vs4v.txt	2/6/2013 8:56 AM	Text Document
Vout_4wire_1p5_vs3p5v.txt	2/1/2013 10:15 AM	Text Document
Vout_4wire_2_vs3v.txt		Text Document

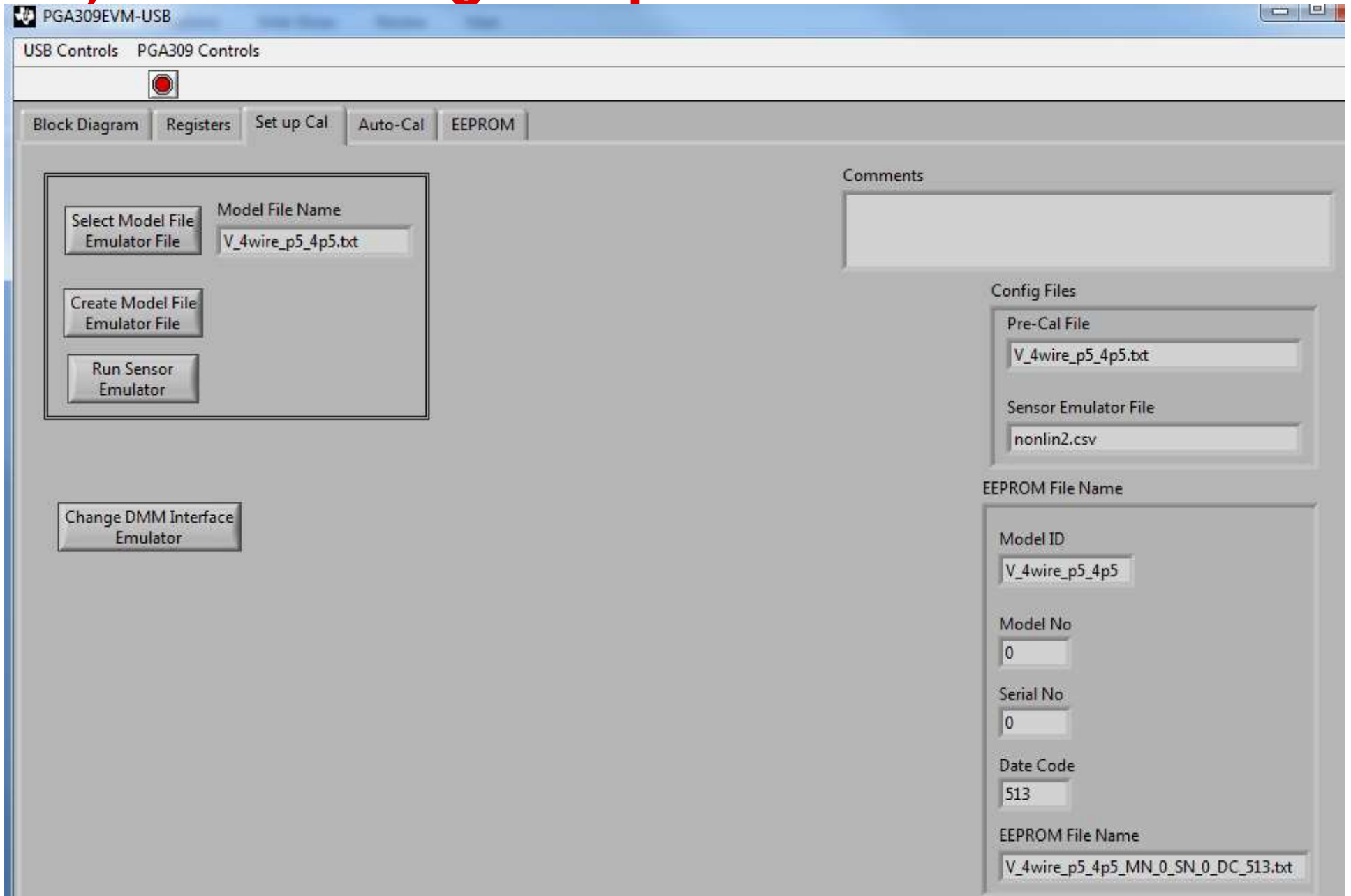
File name: V\_4wire\_p5\_4p5.txt

Save as type: Model Files (\*.txt)

## a) 4-wire voltage output mode:



# a) 4-wire voltage output mode:





# a) 4-wire voltage output mode:

PGA309EVM-USB

USB Controls PGA309 Controls

Block Diagram Registers Set up Cal **Auto-Cal** EEPROM

**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
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2nd Find Vin_Low	2nd Cal Vin_High	2nd Cal Vin_Low	Done Initial Cal
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Over Temp Status

Find Vin_Low	Cal Vin_High	Cal Vin_Low	Done
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Mesurement Complete

EEPROM Written

Reg Cluster

Misc Value	Analog Reg	Reg
Temp No: 0	Front Gain: 0	0000
Temp: 0	Vs: 5	0000
Vin_Low: 0	Output Gain: 0	0000
Vin_High: 0	Vref: 4.096	0500
Vout_Low: 0	Coarse Off: 0	0000
Vout_High: 0	Gain Dac: 0	0000
Vo High Target: 4.5	Kexc: 0	0000
Vo Low Target: 0.5	Zero Dac: 0	1403
Io High Target: 0	Cal Control	0000
Io Low Target: 0	<input checked="" type="checkbox"/> Calibrate Nonlin (LinD)	0000
No of Temp: 3	<input checked="" type="checkbox"/> Use Sensor Emulator	XTR Info
Poly Order: 2	Range: 12mV/V	R1: 11300
Output Mode: Vout (4-Wire)		XTR_Vref: 4.096
Temp Sensor: Diode / Raw		R2: 10000
		R_ref: 191000

Cal Results

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	0	0	0.0000	0.0000	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 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

# a) 4-wire voltage output mode:

The screenshot displays the PGA309EVM-USB software interface. The 'Calibration' section on the left includes a 'Continue' button highlighted with a red box and the text 'Press again'. The 'Reg Cluster' section on the right shows various registers and their values, including 'Output Mode' set to 'Vout (4-Wire)'. The 'Cal Results' section at the bottom shows a table of calibration data.

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	0	0	0.0000	0.0000	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 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

# a) 4-wire voltage output mode:

PGA309EVM-USB

USB Controls PGA309 Controls

Block Diagram Registers Set up Cal Auto-Cal EEPROM

Start testing at Low Pressure...

Auto-continue

Calibration

Continue

Re-Run Current Measurement

Re-Cal Selected Temperature

Temperature 100.0

First Cal Status

Find Vin_Low	Calibrate Vin_High	Calibrate Vin_Low	Calibrate Vin_Mid
<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
2nd Find Vin_Low	2nd Cal Vin_High	2nd Cal Vin_Low	Done Initial Cal
<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>

Over Temp Status

Find Vin_Low	Cal Vin_High	Cal Vin_Low	Done
<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>

Mesurements Complete

EEPROM Written

Cal Results V\_4wire\_p5\_4p5\_MN\_0\_SN\_0\_DC\_513.txt

Reg Cluster

Misc Value		Analog Reg		Reg
Temp No	Temp	Front Gain	Vs	1476
1	50	42.67	5	8030
Vin_Low	Vin_High	Output Gain	Vref	7121
979.9u	8.067m	6	4.096	051A
Vout_Low	Vout_High	Coarse Off	Klin	551F
499.16m	4.5008	-48.74m	0.03427:	0000
Vo High Target	Vo Low Target	Gain Dac	Kexc	1403
4.5	0.5	0.62794	0.83	0000
Io High Target	Io Low Target	Zero Dac		0000
0	0	2.05103		0000
No of Temp	Poly Order	Cal Control	XTR Info	0000
3	2	<input checked="" type="checkbox"/> Calibrate Nonlin (LinD)	R1	XTR_Vref
Output Mode	Temp Sensor	<input checked="" type="checkbox"/> Use Sensor Emulator	11300	4.096
Vout (4-Wire)	Diode / Raw	Range 12mV/V	R2	R_ref
			10000	191000

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="radio"/>	0	1798	999.9u	8.01m	4.5006	0.49911	0.0000	0.0000	2.0677	0.62365	1.0380	8.0980	0.75000
<input checked="" type="radio"/>	50	1476	1.02m	8.067m	4.5008	0.49916	0.0000	0.0000	2.0655	0.62029	1.0580	8.1555	0.65000
<input checked="" type="radio"/>	100	0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.4620	9.2290	0.55000

# a) 4-wire voltage output mode:

The screenshot shows the PGA309EVM-USB software interface. A red box highlights the "Calibration Complete!" message. The interface includes several sections:

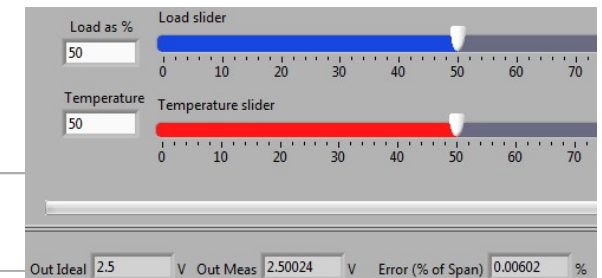
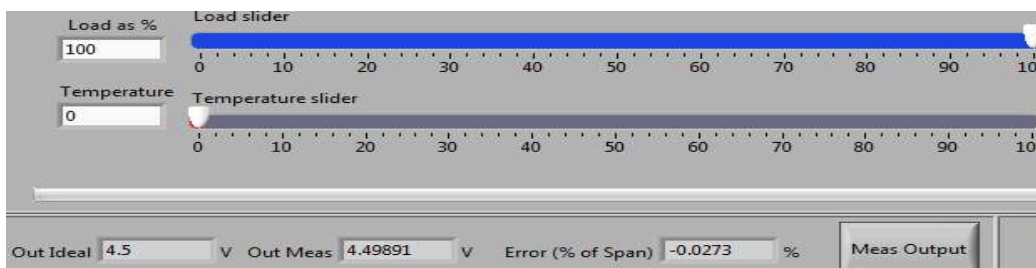
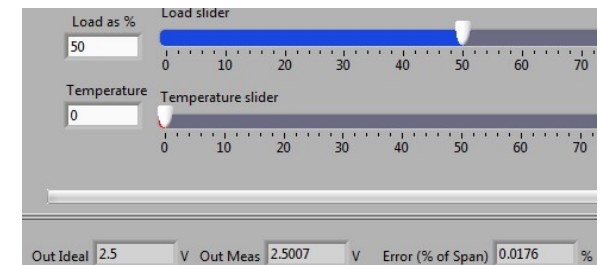
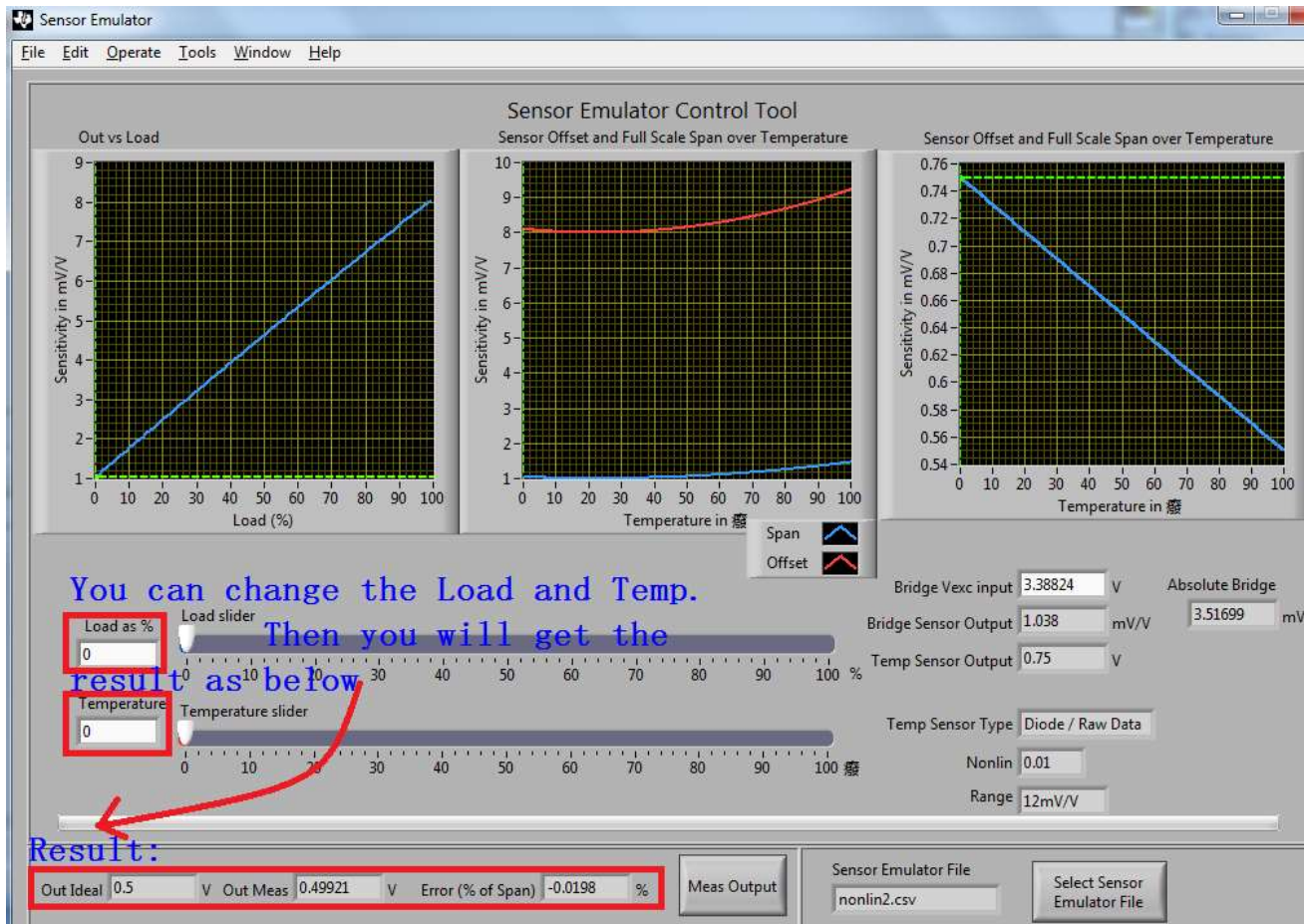
- Buttons:** Start, Continue, Re-Run Current Measurement, Re-Cal Selected Temperature.
- Calibration Status:**
  - Auto-continue:
  - First Cal Status: Find Vin\_Low, Calibrate Vin\_High, Calibrate Vin\_Low, Calibrate Vin\_Mid (all green).
  - 2nd Find Vin\_Low, 2nd Cal Vin\_High, 2nd Cal Vin\_Low, Done Initial Cal (all green).
  - Over Temp Status: Find Vin\_Low, Cal Vin\_High, Cal Vin\_Low, Done (all green).
  - Mesurements Complete:
  - EEPROM Written:
- Reg Cluster:**
  - Misc Value: Temp No (2), Vin\_Low (1.381m), Vout\_Low (500.24m), Vo High Target (4.5), Io High Target (0), No of Temp (3), Output Mode (Vout (4-Wire)).
  - Temp: 100, Vin\_High (9.137m), Vout\_High (4.4996), Vo Low Target (0.5), Io Low Target (0), Poly Order (2), Temp Sensor (Diode / Raw).
  - Analog Reg: Front Gain (42.67), Output Gain (6), Coarse Off (-48.74m), Gain Dac (0.57054), Zero Dac (2.00866).
  - Reg: 1151, 7D8A, 5B17, 051A, 551F, 0000, 1403, 0000, 0000.
  - Cal Control:  Calibrate Nonlin (LinD),  Use Sensor Emulator, Range (12mV/V).
  - XTR Info: R1 (11300), R2 (10000), XTR\_Vref (4.096), R\_ref (191000).
- Cal Results:** V\_4wire\_p5\_4p5\_MN\_0\_5N\_0\_DC\_513.txt
- Calibration Info Table:**

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	1798	999.9u	8.01m	4.5006	0.49911	0.0000	0.0000	2.0677	0.62365	1.0380	8.0980	0.75000
<input checked="" type="checkbox"/>	50	1476	1.02m	8.067m	4.5008	0.49916	0.0000	0.0000	2.0655	0.62029	1.0580	8.1555	0.65000
<input checked="" type="checkbox"/>	100	1151	1.425m	9.137m	4.4996	0.50024	0.0000	0.0000	2.0194	0.56595	1.4620	9.2290	0.55000

# a) 4-wire voltage output mode:

The screenshot displays the 'Sensor Emulator Control Tool' software interface. On the left, the 'Block Diagram' tab is active, showing a 'Vexc' input set to 0 and a 'Vexc Gain' section with 'Kref x Vref' at 3.3997, 'Coarse Offset' at -48.74, and 'Linearization Coef' at 0.0339843. Below this, the 'Run Sensor Emulator' button is highlighted with a red box. Further down, a list of fault detection options includes 'Detect External Faults', 'Detect Internal Faults', 'Vout High on External Fault', and 'Vout High on Internal Fault'. The 'Temp Sensor' section includes 'Temp' (0), 'Code' (0), and buttons for 'Read Temp' and 'Config Temp'. The main area contains three graphs: 'Out vs Load' showing a linear relationship between Sensitivity (mV/V) and Load (%); 'Sensor Offset and Full Scale Span over Temperature' showing Sensitivity (mV/V) vs Temperature (°C) with a red curve; and another 'Sensor Offset and Full Scale Span over Temperature' graph showing Sensitivity (mV/V) vs Temperature (°C) with a blue line. Below the graphs are sliders for 'Load as %' and 'Temperature', both set to 0. The bottom right shows output fields: 'Bridge Vexc input' (3.38824 V), 'Bridge Sensor Output' (0 mV/V), 'Temp Sensor Output' (0 V), and 'Temp Sensor Type' (Diode / Raw Data). A 'Meas Output' button and a file selection area are also present.

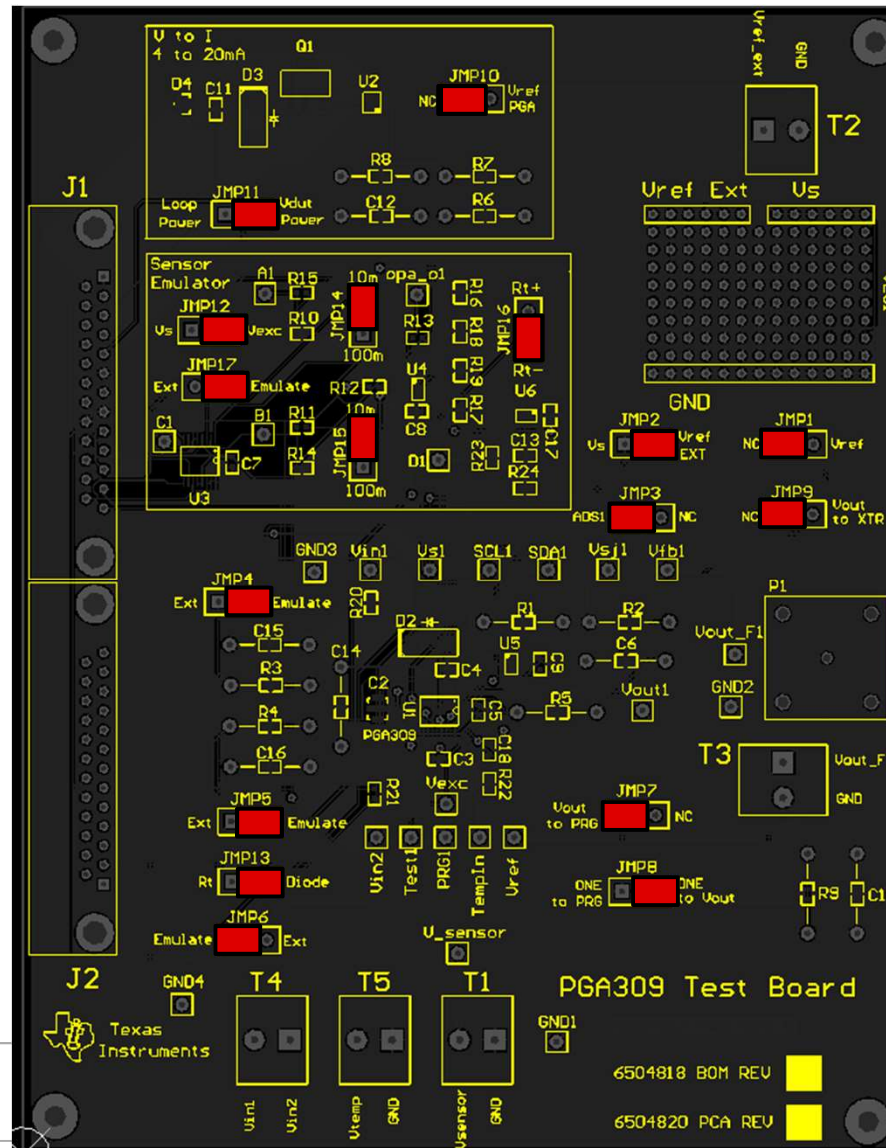
# a) 4-wire voltage output mode:



# **b) 3-wire voltage output mode**

## b) 3-wire voltage output mode:

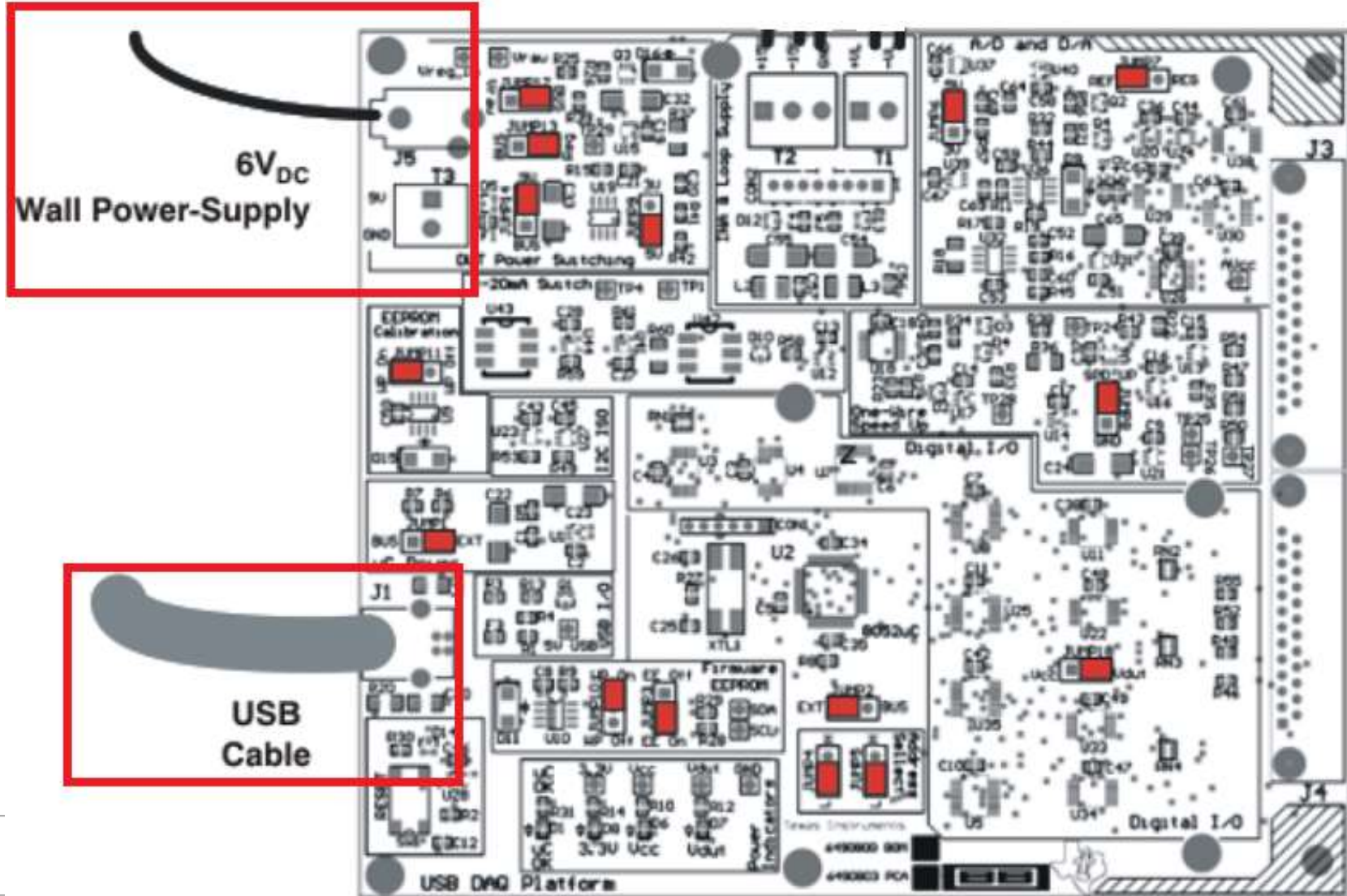
- PGA309 EVM Jumper Configuration – change JMP7, JMP8



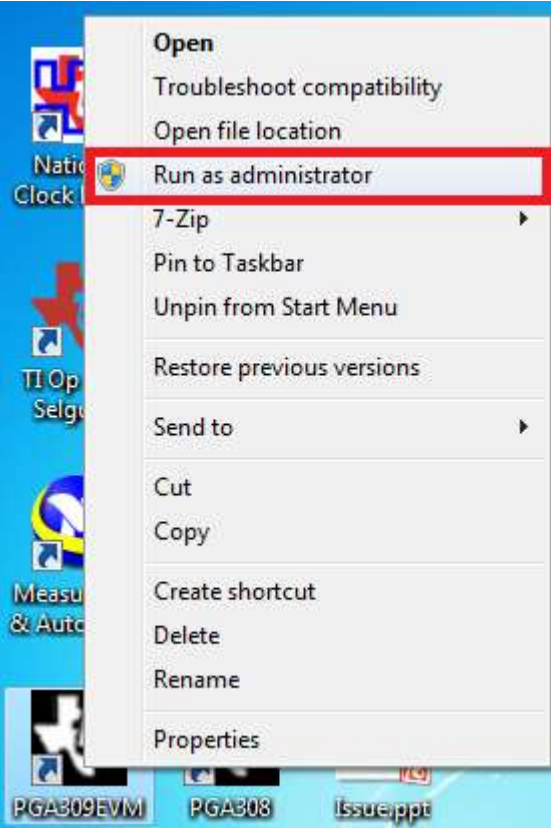


## b) 3-wire voltage output mode:

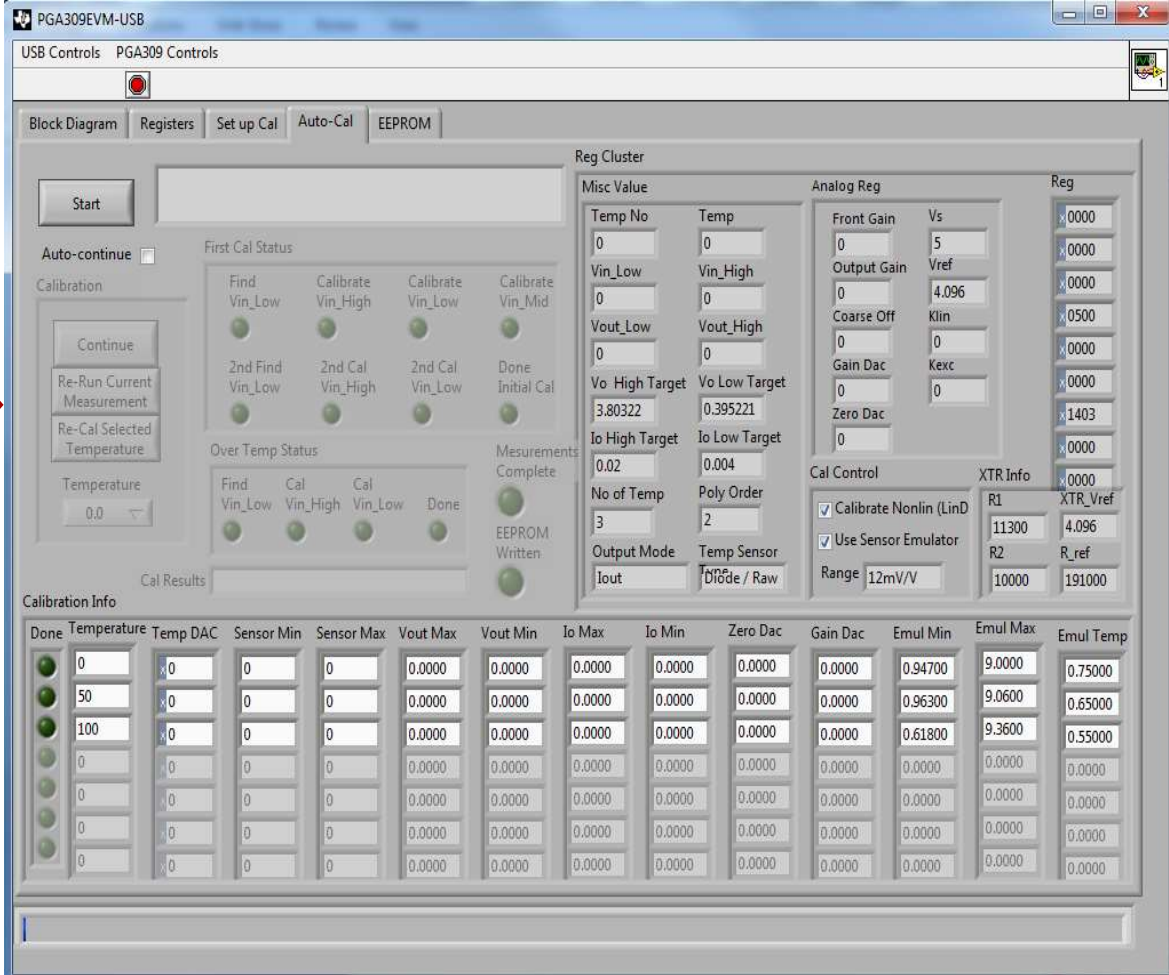
- USB\_DAQ Board Default Configuration



# b) 3-wire voltage output mode:

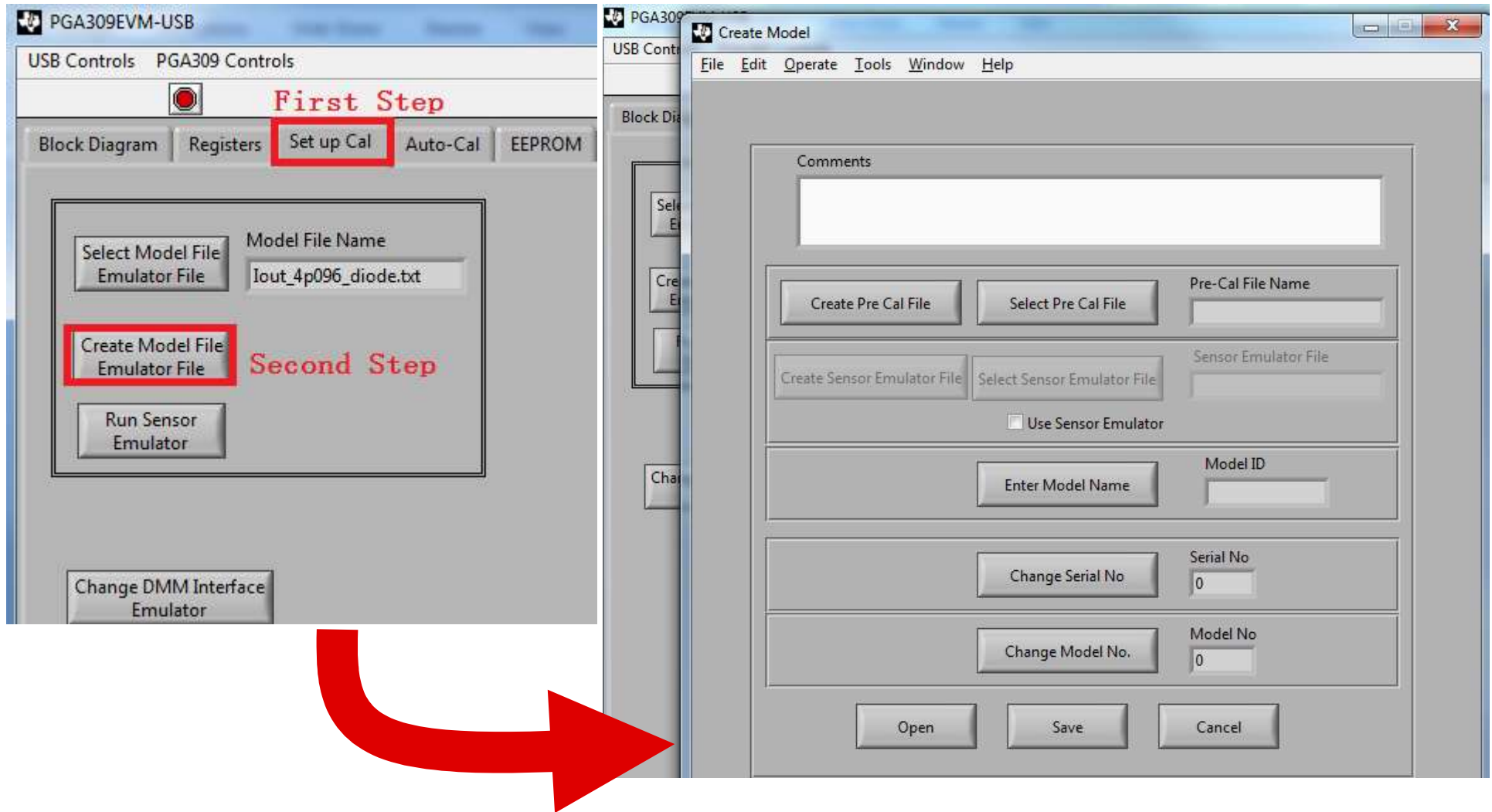


Windows 7 Attention

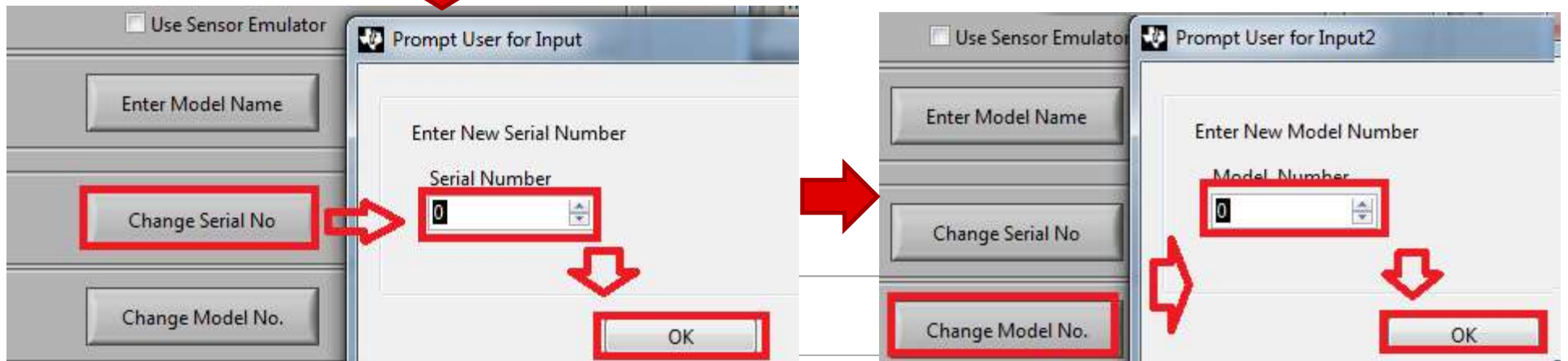
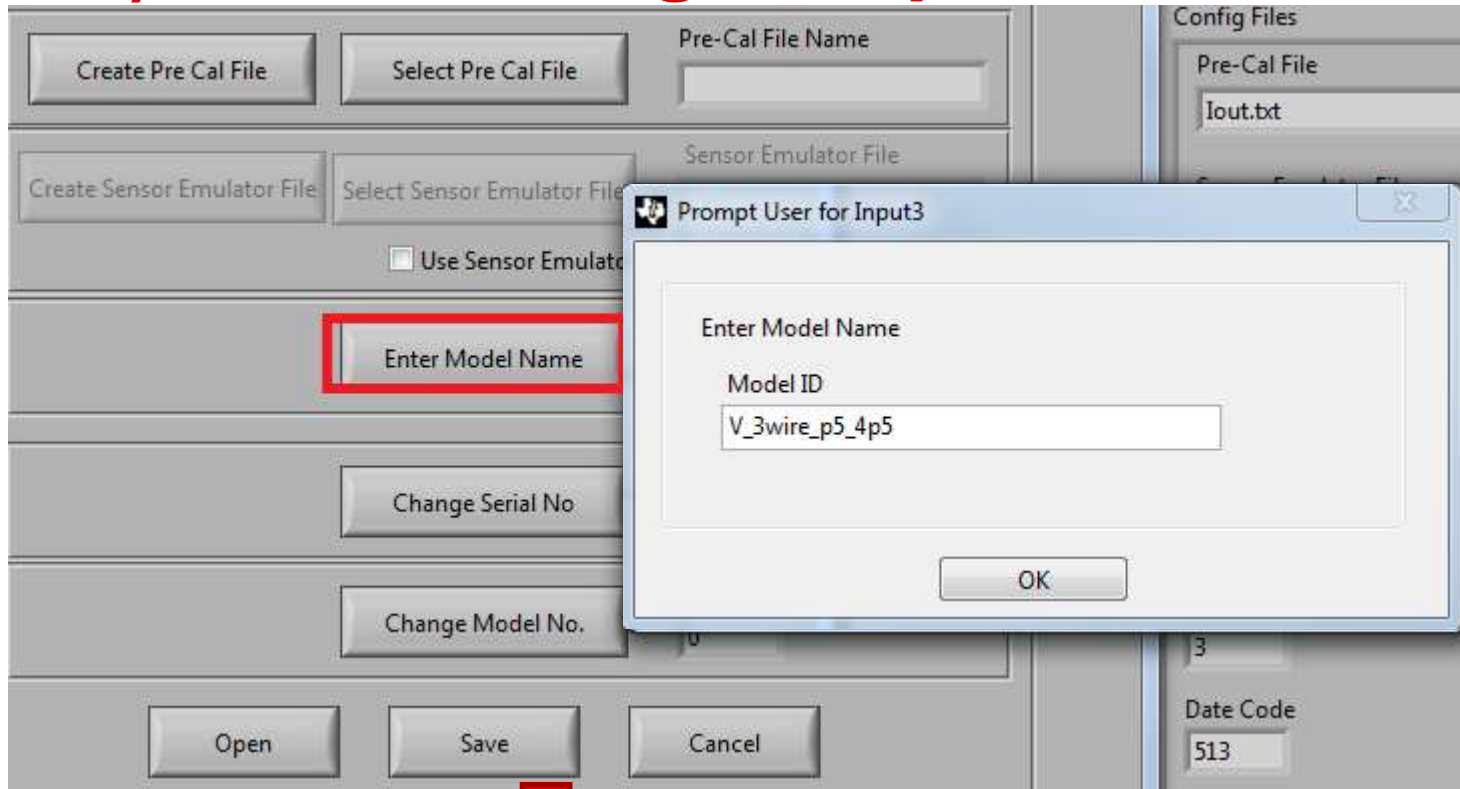


Default GUI Interface

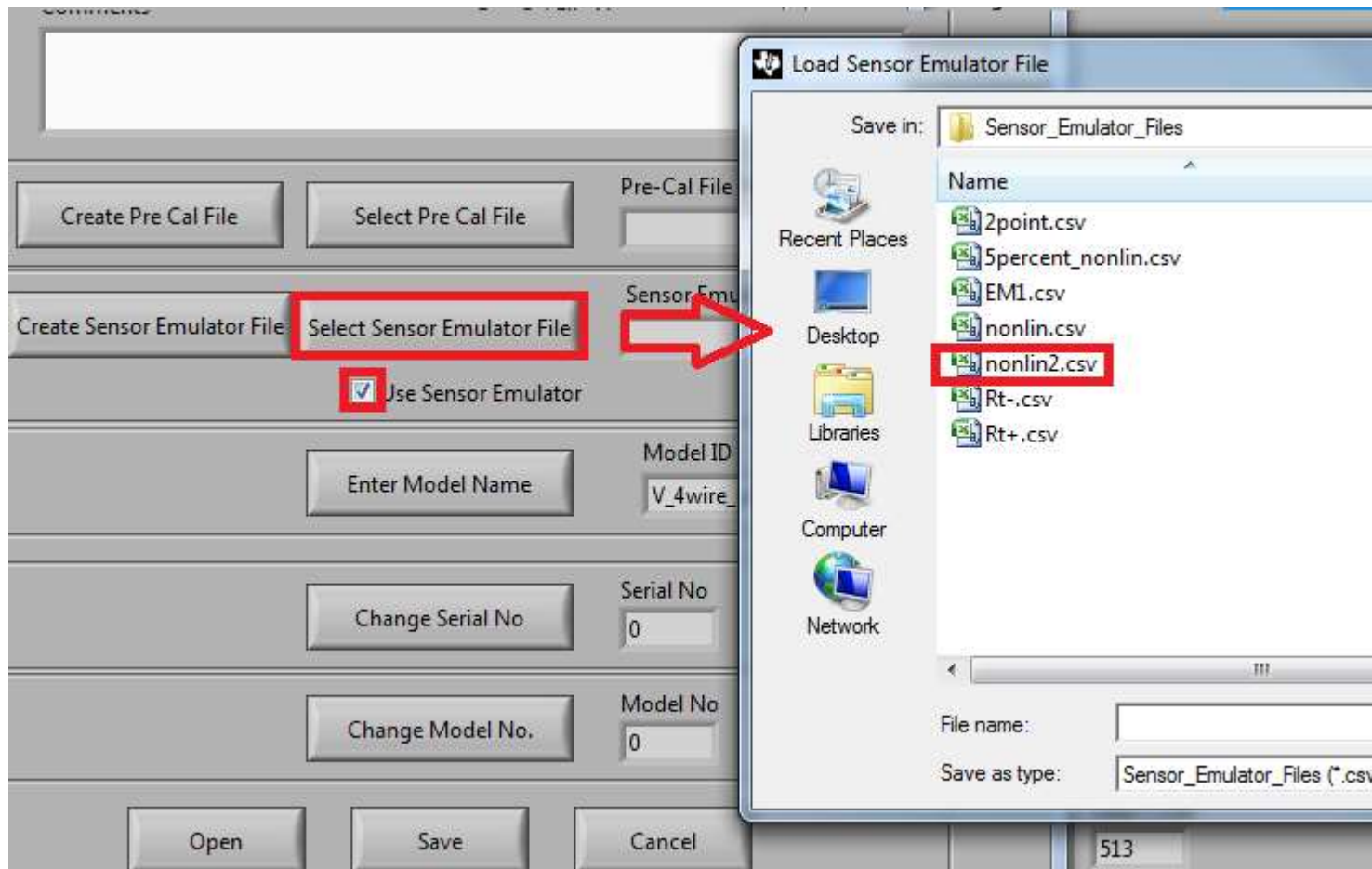
## b) 3-wire voltage output mode:



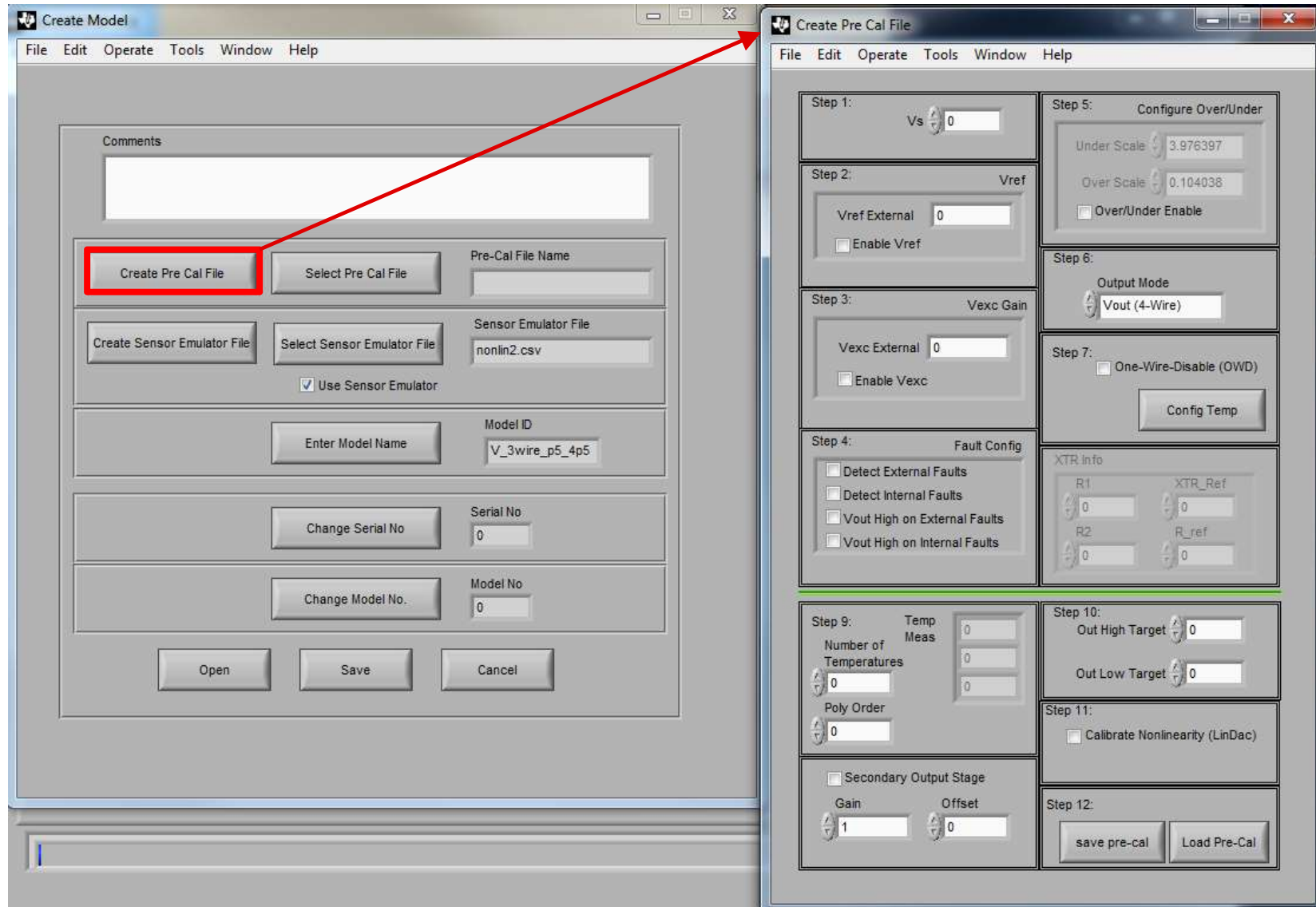
## b) 3-wire voltage output mode:



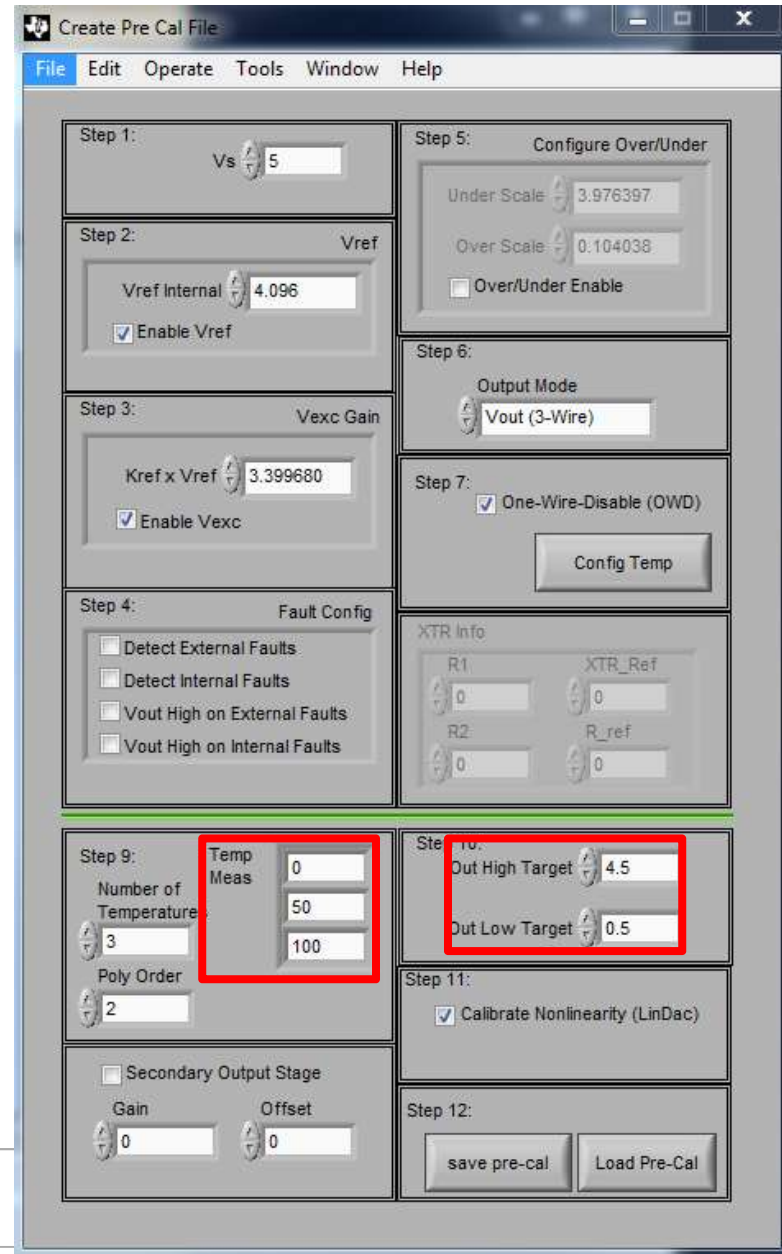
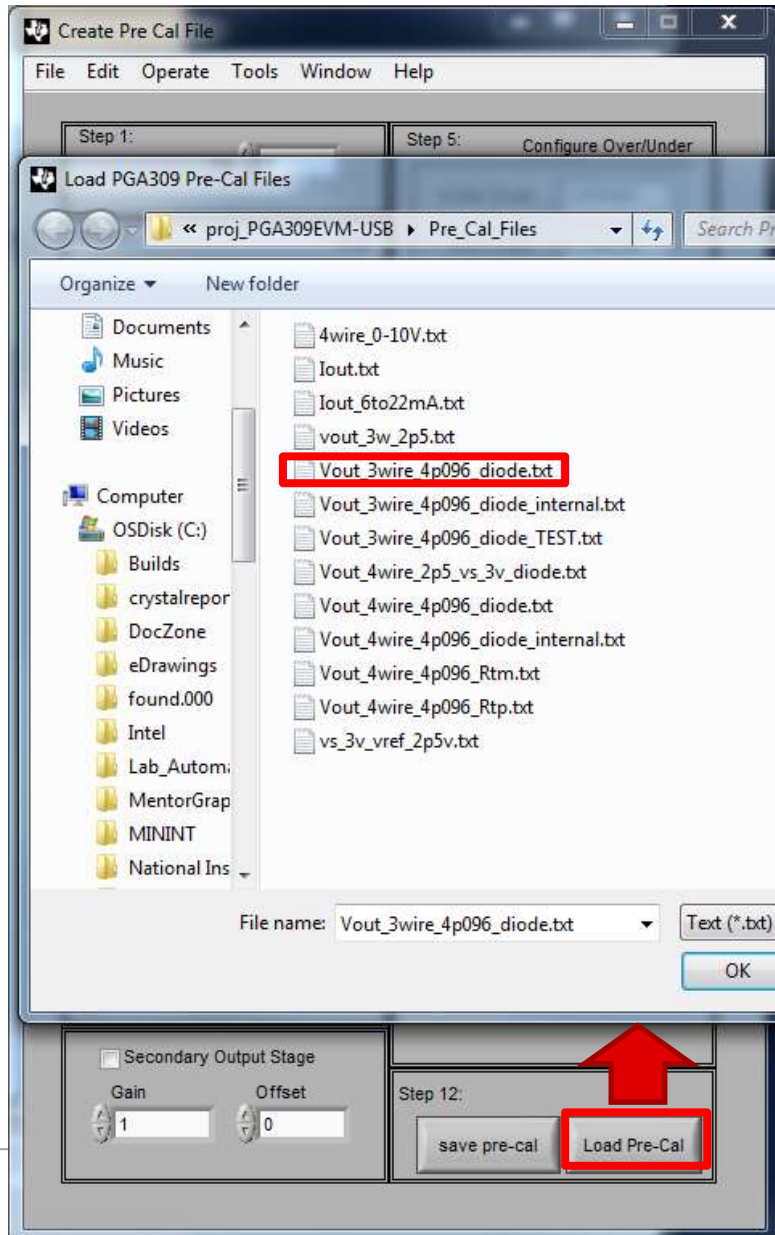
## b) 3-wire voltage output mode:



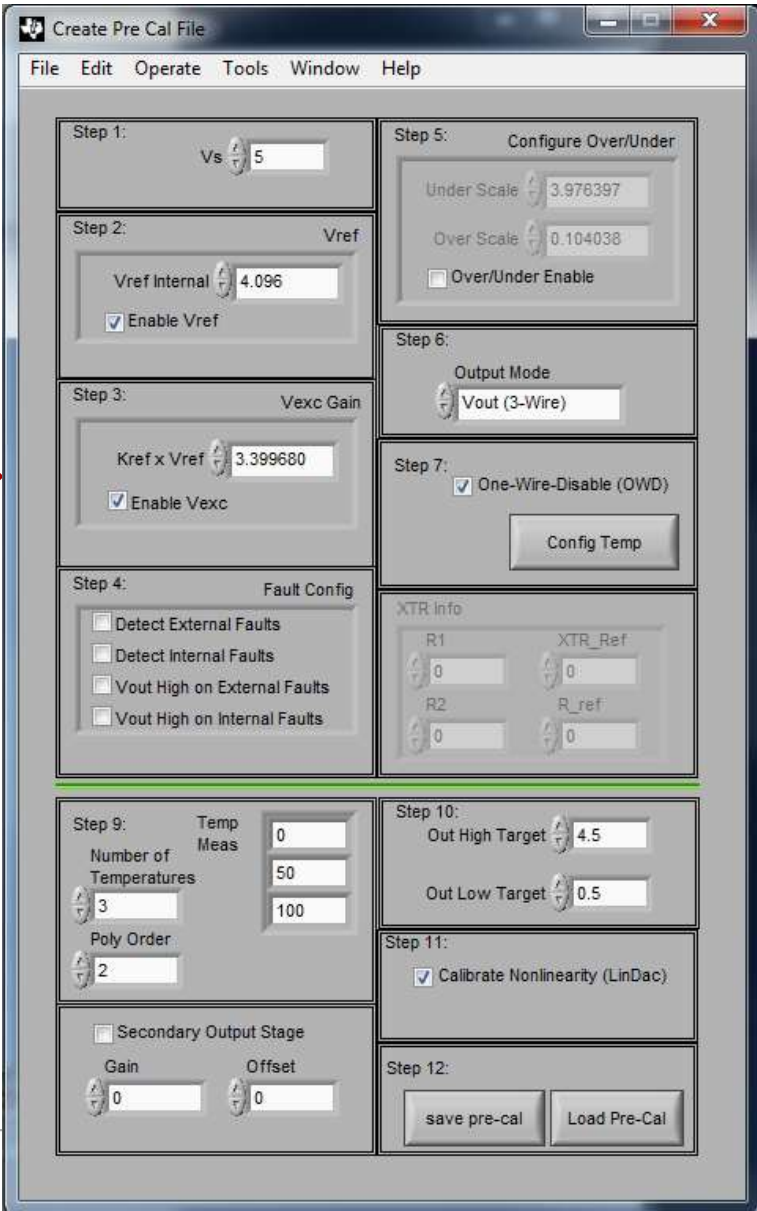
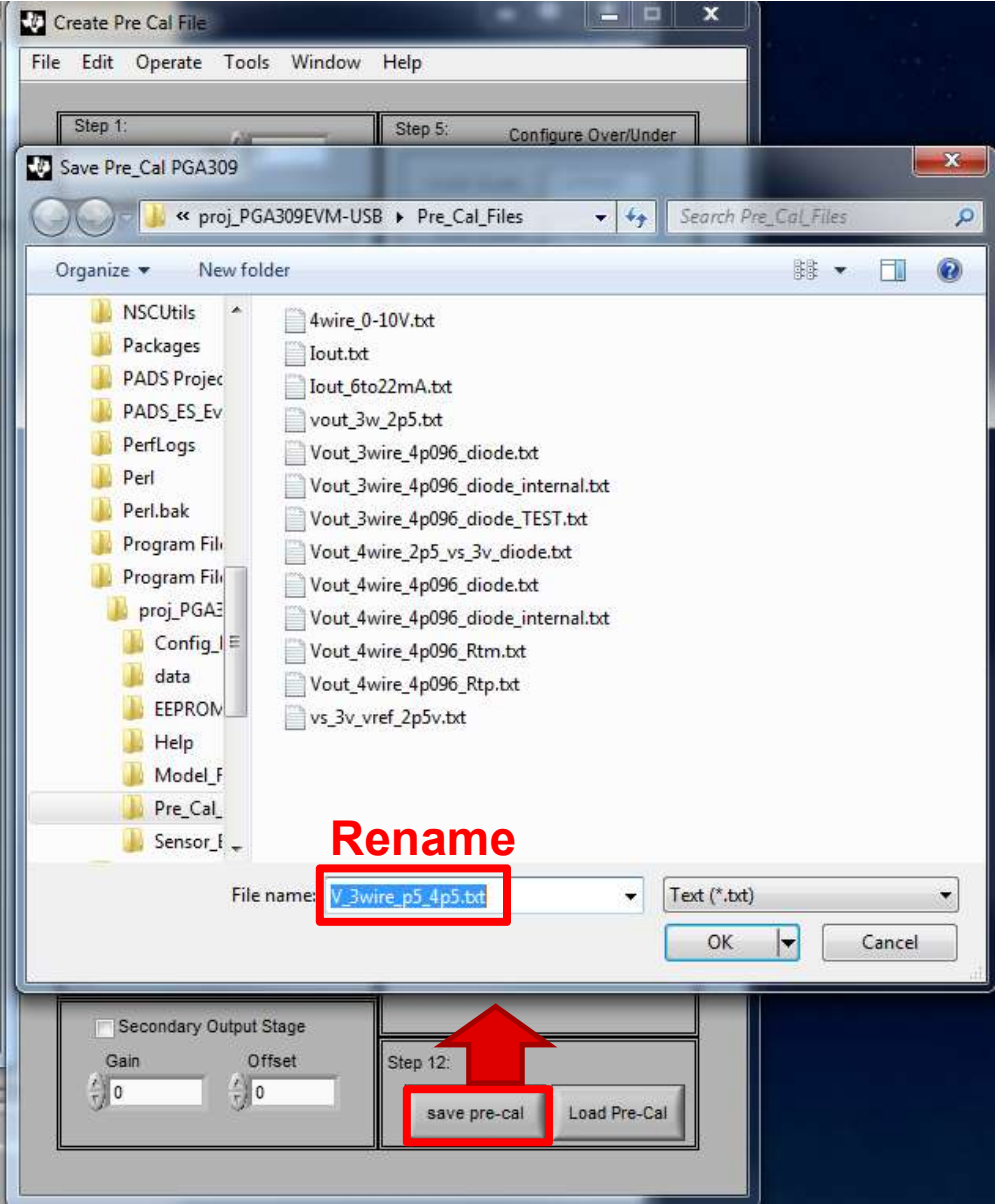
## b) 3-wire voltage output mode:



## b) 3-wire voltage output mode:

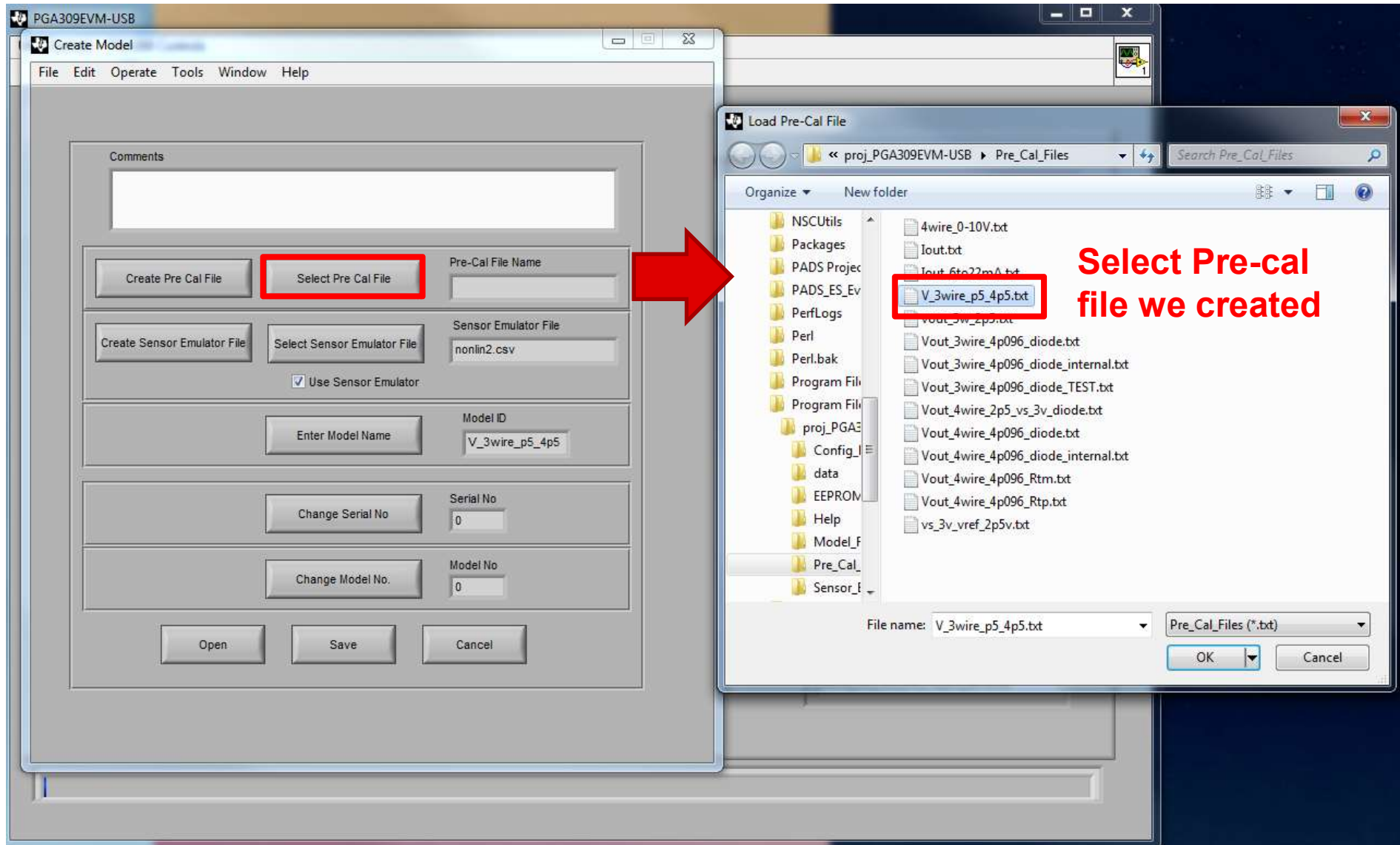


# b) 3-wire voltage output mode:

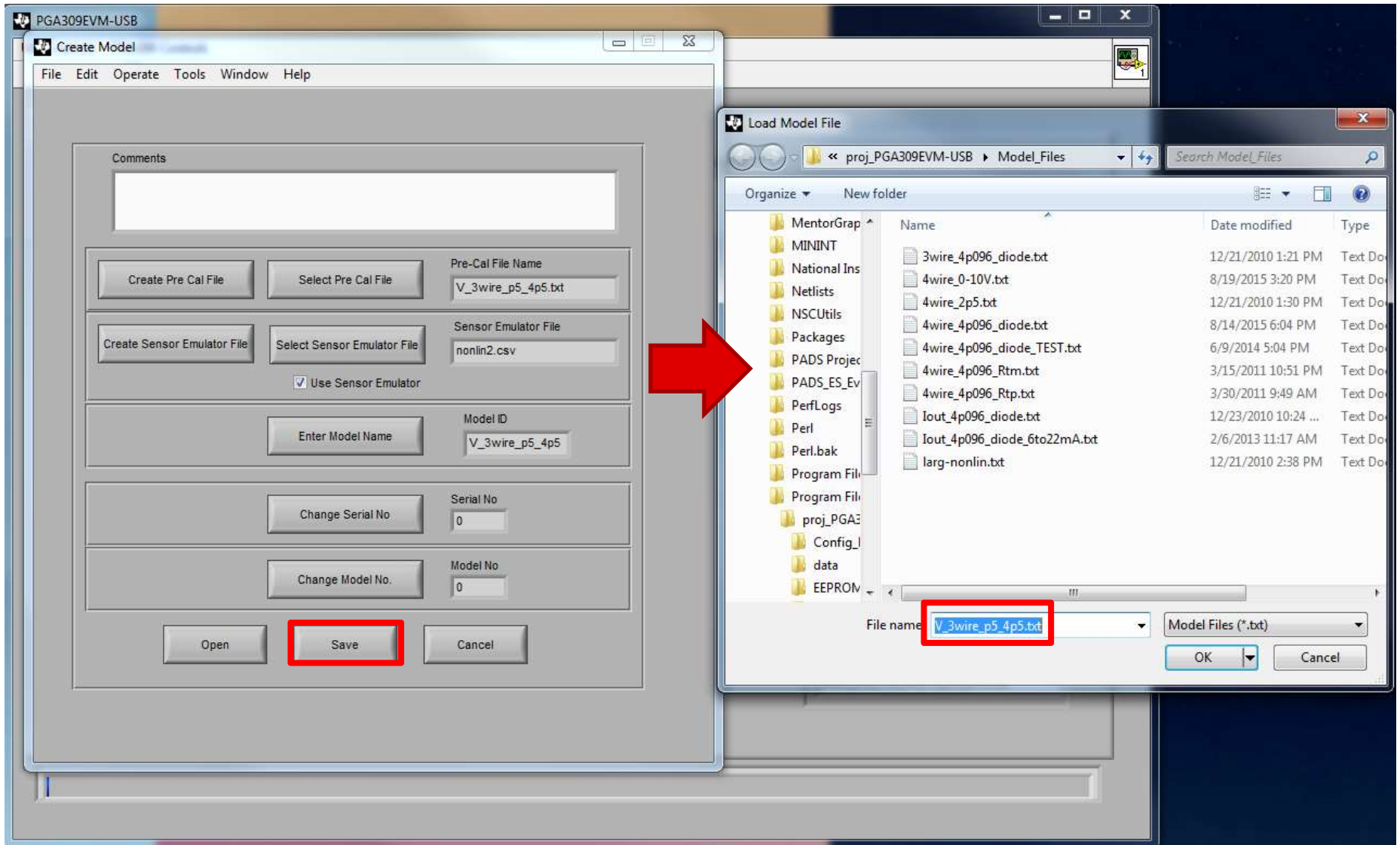




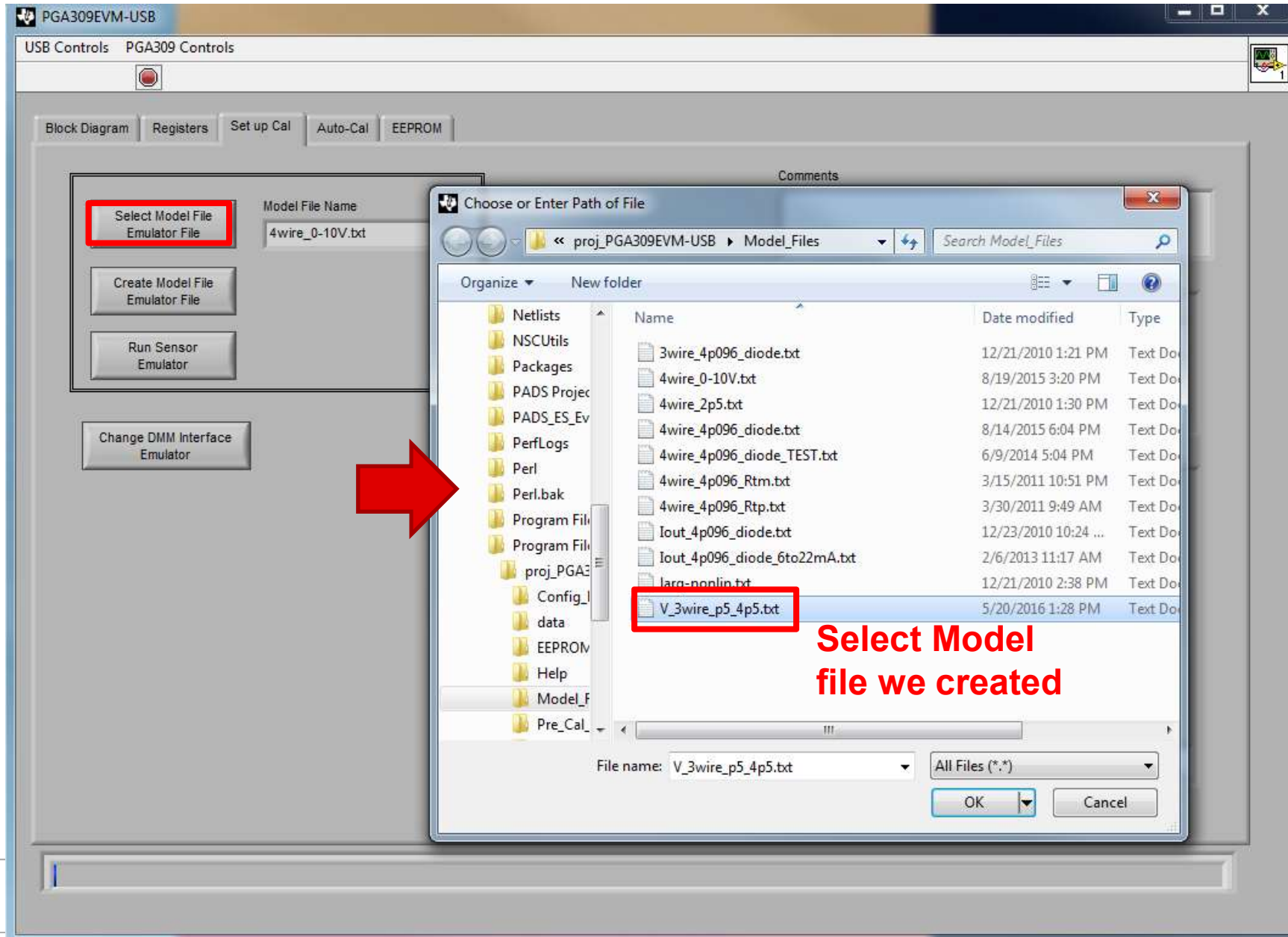
## b) 3-wire voltage output mode:



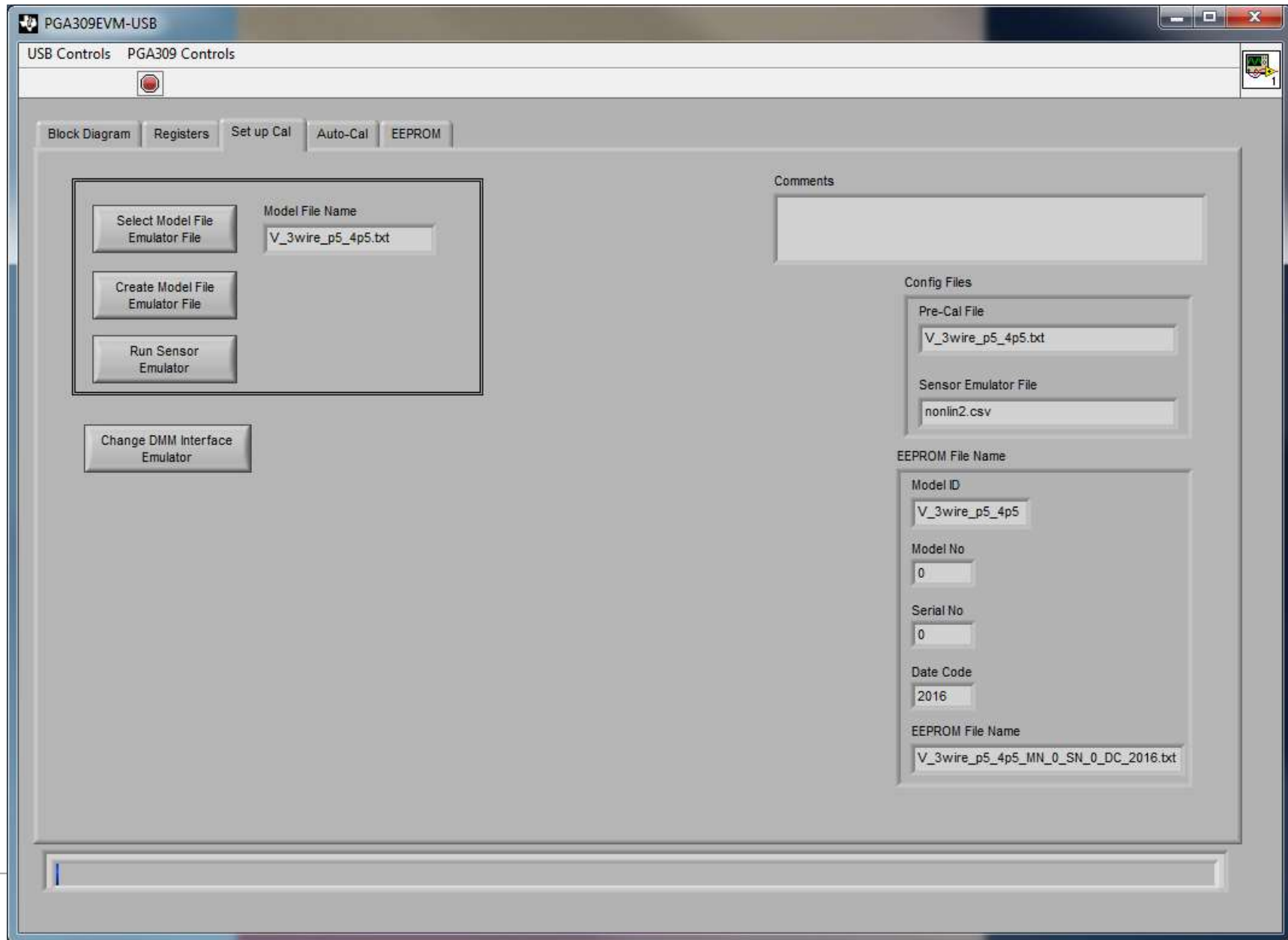
## b) 3-wire voltage output mode:



## b) 3-wire voltage output mode:



## b) 3-wire voltage output mode:



## b) 3-wire voltage output mode:

The screenshot displays the 'PGA309EVM-USB' software interface, specifically the 'Auto-Cal' tab. The interface is divided into several sections:

- Navigation:** 'Block Diagram', 'Registers', 'Set up Cal', 'Auto-Cal' (highlighted), and 'EEPROM'.
- Control Buttons:** 'Start' (highlighted), 'Auto-continue' (checked), 'Continue', 'Re-Run Current Measurement', 'Re-Cal Selected Temperature', and 'Temperature' (set to 0.0).
- Calibration Progress:** 'First Cal Status' and 'Over Temp Status' sections with progress indicators for 'Find Vin\_Low', 'Calibrate Vin\_High', 'Calibrate Vin\_Low', and 'Calibrate Vin\_Mid'. 'Measurements Complete' and 'EEPROM Written' are also indicated.
- Misc Value:** Fields for Temp No, Vin\_Low, Vin\_High, Vout\_Low, Vout\_High, Vo High Target, Vo Low Target, Vo\_mod H Targ, Vo\_mod L Targ, Io High Target, Io Low Target, No of Temp, Poly Order, and Output Mode (set to 'Vout (3-Wire)').
- Analog Reg:** Fields for Front Gain, Vs, Output Gain, Vref, Coarse Off, Klin, Gain Dac, Kexc, Zero Dac, and Cal Control (checked for 'Calibrate Nonlin (LinDac)' and 'Use Sensor Emulator').
- Reg:** A vertical column of registers with values like x0000, x0000, x0000, x0500, x8000, x0000, x1403, x0000, x0000.
- XTR Info:** Fields for R1, XTR\_Vref, R2, R\_ref, and Secondary Output Stage.
- Calibration Info Table:** A table with 15 columns: Done, Temperature, Temp DAC, Sensor Min, Sensor Max, Vout Max, Vout Min, VoMinPGA, VoMaxPGA, Io Max, Io Min, Zero Dac, Gain Dac, Emul Min, Emul Max, Emul Temp.

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

## b) 3-wire voltage output mode:

The screenshot shows the PGA309EVM-USB software interface. The 'Auto-Cal' tab is selected, and the 'Continue' button is highlighted with a red box. Red text 'Press again' is overlaid on the button. The interface displays various calibration parameters and status indicators.

**Calibration Info Table:**

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

# b) 3-wire voltage output mode:

PGA309EVM-USB

USB Controls PGA309 Controls

Block Diagram Registers Set up Cal Auto-Cal EEPROM

Start testing at Low Pressure...

Auto-continue

Calibration

Continue

Re-Run Current Measurement

Re-Cal Selected Temperature

Temperature 100.0

First Cal Status

Find Vin_Low	Calibrate Vin_High	Calibrate Vin_Low	Calibrate Vin_Mid
<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>
2nd Find Vin_Low	2nd Cal Vin_High	2nd Cal Vin_Low	Done Initial Cal
<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>

Over Temp Status

Find Vin_Low	Cal Vin_High	Cal Vin_Low	Done
<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>

Mesurements Complete

EEPROM Written

Cal Results V\_4wire\_p5\_4p5\_MN\_0\_SN\_0\_DC\_513.txt

Reg Cluster

Misc Value		Analog Reg		Reg
Temp No	Temp	Front Gain	Vs	1476
1	50	42.67	5	8030
Vin_Low	Vin_High	Output Gain	Vref	7121
979.9u	8.067m	6	4.096	051A
Vout_Low	Vout_High	Coarse Off	Klin	551F
499.16m	4.5008	-48.74m	0.03427:	0000
Vo High Target	Vo Low Target	Gain Dac	Kexc	1403
4.5	0.5	0.62794	0.83	0000
Io High Target	Io Low Target	Zero Dac		0000
0	0	2.05103		0000
No of Temp	Poly Order	Cal Control	XTR Info	
3	2	<input checked="" type="checkbox"/> Calibrate Nonlin (LinD)	R1	XTR_Vref
Output Mode	Temp Sensor	<input checked="" type="checkbox"/> Use Sensor Emulator	11300	4.096
Vout (4-Wire)	Diode / Raw	Range 12mV/V	R2	R_ref
			10000	191000

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="radio"/>	0	1798	999.9u	8.01m	4.5006	0.49911	0.0000	0.0000	2.0677	0.62365	1.0380	8.0980	0.75000
<input checked="" type="radio"/>	50	1476	1.02m	8.067m	4.5008	0.49916	0.0000	0.0000	2.0655	0.62029	1.0580	8.1555	0.65000
<input checked="" type="radio"/>	100	0	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.4620	9.2290	0.55000

## b) 3-wire voltage output mode:

The screenshot shows the PGA309EVM-USB software interface. A red box highlights the "Calibration Complete!" message. The interface includes several sections:

- Buttons:** Start, Continue, Re-Run Current Measurement, Re-Cal Selected Temperature.
- Calibration Status:** Auto-continue (checked), 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.
- Reg Cluster:** Misc Value (Temp No, Vin\_Low, Vout\_Low, Vo High Target, Io High Target, No of Temp, Output Mode), Temp (Temp, Vin\_High, Vout\_High, Vo Low Target, Io Low Target, Poly Order, Temp Sensor), Analog Reg (Front Gain, Output Gain, Coarse Off, Gain Dac, Zero Dac), Vs, Vref, Klin, Kexc, XTR Info (R1, R2, XTR\_Vref, R\_ref).
- Cal Control:** Calibrate Nonlin (LinD), Use Sensor Emulator, Range (12mV/V).
- Calibration Info Table:**

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	1798	999.9u	8.01m	4.5006	0.49911	0.0000	0.0000	2.0677	0.62365	1.0380	8.0980	0.75000
<input checked="" type="checkbox"/>	50	1476	1.02m	8.067m	4.5008	0.49916	0.0000	0.0000	2.0655	0.62029	1.0580	8.1555	0.65000
<input checked="" type="checkbox"/>	100	1151	1.425m	9.137m	4.4996	0.50024	0.0000	0.0000	2.0194	0.56595	1.4620	9.2290	0.55000



## b) 3-wire voltage output mode:

The screenshot displays the 'Sensor Emulator Control Tool' software interface. On the left, the 'Block Diagram' tab is active, showing a 'Vexc' input set to 0. The 'Vexc Gain' section includes a 'Kref x Vref' value of 3.3997, an 'Enable Vexc' checkbox, and a 'Linearization Coef' of 0.0339843. The 'Coarse Offset' is set to -48.74. Below this, the 'Run Sensor Emulator' button is highlighted with a red box. The 'Temp Sensor' section has 'Temp' and 'Code' fields set to 0, with 'Read Temp' and 'Config Temp' buttons. A 'Set Mux to Inv' checkbox is also present.

The main area contains three graphs and control elements:

- Out vs Load:** A graph showing Sensitivity in mV/V (y-axis, 1 to 9) versus Load (%) (x-axis, 0 to 100). A blue line shows a linear increase from approximately 1.2 mV/V at 0% load to 8.2 mV/V at 100% load. A vertical dashed green line is at 50% load, and a horizontal dashed green line is at 5.5 mV/V.
- Sensor Offset and Full Scale Span over Temperature (Left):** A graph showing Sensitivity in mV/V (y-axis, 1 to 10) versus Temperature in °C (x-axis, 0 to 100). A red curve shows a slight upward trend from about 8.2 mV/V at 0°C to 9.2 mV/V at 100°C. A vertical dashed green line is at 75°C.
- Sensor Offset and Full Scale Span over Temperature (Right):** A graph showing Sensitivity in mV/V (y-axis, 0.54 to 0.76) versus Temperature in °C (x-axis, 0 to 100). A blue line shows a linear decrease from about 0.75 mV/V at 0°C to 0.55 mV/V at 100°C. A vertical dashed green line is at 75°C, and a horizontal dashed green line is at 0.6 mV/V.

Below the graphs are two sliders: 'Load as %' and 'Temperature', both set to 0. At the bottom, there are output fields: 'Out Ideal' (0 V), 'Out Meas' (0 V), and 'Error (% of Span)' (0 %). A 'Meas Output' button is also present. On the right side, there are input fields for 'Bridge Vexc input' (3.38824 V), 'Bridge Sensor Output' (0 mV/V), and 'Temp Sensor Output' (0 V). A 'Temp Sensor Type' dropdown is set to 'Diode / Raw Data', with 'Nonlin' set to 0.01 and 'Range' set to 12mV/V. A 'Sensor Emulator File' field contains 'nonlin2.csv' and a 'Select Sensor Emulator File' button.

# b) 3-wire voltage output mode:

Sensor Emulator Control Tool

**You can change the Load and Temp. Then you will get the result as below**

Load as %: 0  
Temperature: 0

Bridge Vexc input: 3.38824 V  
Bridge Sensor Output: 1.038 mV/V  
Temp Sensor Output: 0.75 V

Temp Sensor Type: Diode / Raw Data  
Nonlin: 0.01  
Range: 12mV/V

**Result:**  
Out Ideal: 0.5 V  
Out Meas: 0.49921 V  
Error (% of Span): -0.0198 %

Load as %: 50  
Temperature: 0

Out Ideal: 2.5 V  
Out Meas: 2.5007 V  
Error (% of Span): 0.0176 %

Load as %: 100  
Temperature: 0

Out Ideal: 4.5 V  
Out Meas: 4.49891 V  
Error (% of Span): -0.0273 %

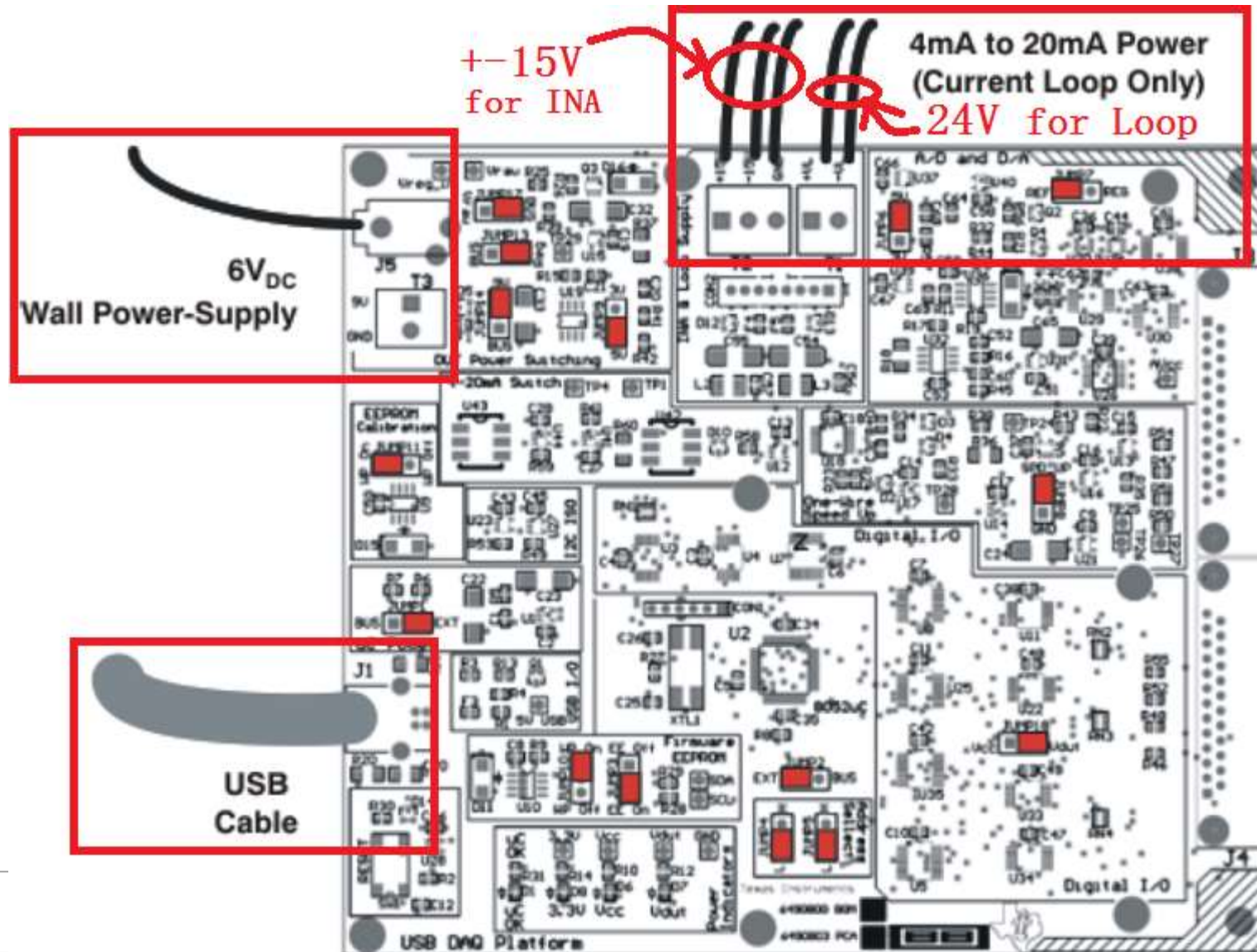
Load as %: 50  
Temperature: 50

Out Ideal: 2.5 V  
Out Meas: 2.50024 V  
Error (% of Span): 0.00602 %

# c) Current output mode

## c) Current output mode:

- USB DAQ Configuration





## c) Current output mode:

Enter Model Name	Model ID I_4mA_20mA_1
Change Serial No	Serial No 1
Change Model No.	Model No 1

The screenshot displays the software interface for the PGA309EVM-USB. The main window is titled 'Create Model' and contains several sections:

- Comments:** A text area for entering comments.
- Pre-Cal File:** Includes 'Create Pre Cal File' and 'Select Pre Cal File' buttons, and a 'Pre-Cal File Name' field.
- Sensor Emulator File:** Includes 'Create Sensor Emulator File' and 'Select Sensor Emulator File' buttons, a 'Sensor Emulator File' field, and a checked 'Use Sensor Emulator' checkbox.
- Model Information:** Includes 'Enter Model Name' (I\_4mA\_20mA\_1), 'Change Serial No' (1), and 'Change Model No.' (1) buttons and fields.
- Buttons:** 'Open', 'Save', and 'Cancel' buttons at the bottom.

A 'Load Sensor Emulator File' dialog box is open over the 'Select Sensor Emulator File' button. The dialog shows the file 'nonlin.csv' selected in the 'Sensor\_Emulator\_Files' directory. A red box highlights the 'nonlin.csv' file, and a red arrow points from the 'Select Sensor Emulator File' button to the dialog.

# c) Current output mode:

The screenshot displays the 'Create Pre Cal File' software interface, which is divided into two main windows: 'Create Pre Cal File' and 'Model'.

**Left Window: Create Pre Cal File**

- Step 1:** Vs = 5
- Step 2:** Vref = 4.096,  Enable Vref
- Step 3:** Vexc Gain = 3.399680,  Enable Vexc
- Step 4:** Fault Config
  - Detect External Faults
  - Detect Internal Faults
  - Vout High on External Faults
  - Vout High on Internal Faults
- Step 5:** Configure Over/Under
  - Under Scale = 3.976397
  - Over Scale = 0.104038
  - Over/Under Enable
- Step 6:** Output Mode = Iout
- Step 7:**  One-Wire-Disable (OWD), Config Temp
- XTR Info:** R1 = 11300, XTR\_Ref = 4.096, R2 = 10000, R\_ref = 191000
- Step 9:** Temp Meas = 0, 50, 100
- Step 10:** Out High Target = 0.02, Out Low Target = 0.004
- Step 11:**  Calibrate Nonlinearity (LinDac)

**Right Window: Model**

- Comments:** (Empty text area)
- Create Pre Cal File** (Button)
- Select Pre Cal File** (Button)
- Pre-Cal File Name:** (Text field)
- Create Sensor Emulator File** (Button)
- Select Sensor Emulator File** (Button)
- Sensor Emulator File:** nonlin.csv
- Use Sensor Emulator
- Enter Model Name** (Button)
- Model ID:** I\_4mA\_20mA\_1
- Change Serial No** (Button)
- Serial No:** 1
- Change Model No.** (Button)
- Model No:** 1
- Open** (Button)
- Save** (Button)
- Cancel** (Button)

**Annotations:**

- A red arrow points from the 'Output Mode' field in Step 6 to the 'Create Pre Cal File' button.
- Red text 'According to hardware' is written next to the 'XTR Info' section.
- Red text 'Calibration range' is written below the 'Temp Meas' section.

## c) Current output mode:

PGA309EVM-USB

USB Controls PGA309 Controls

Block Diagram Registers Set up Cal Auto-Cal EEPROM

Start Calibration Complete!

Auto-continue

Calibration

Continue

Re-Run Current Measurement

Re-Cal Selected Temperature

Temperature 100.0

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
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Measurements Complete

EEPROM Written

Cal Results I\_4mA\_20mA\_1\_MN\_1\_SN\_2\_DC\_513.txt

Calibration Info

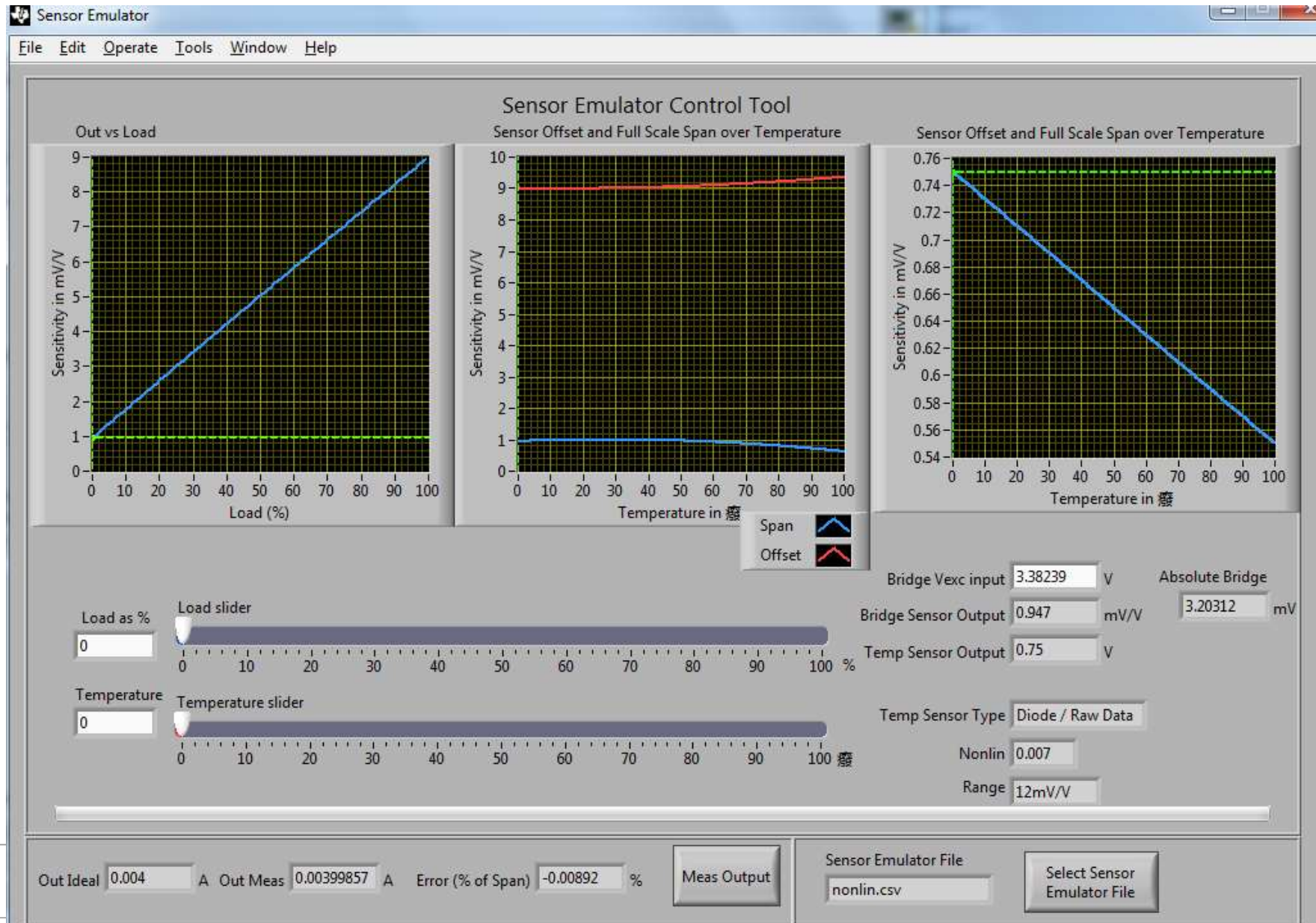
Done	Temperature	Temp DAC	Sensor Min	Sensor Max	Vout Max	Vout Min	Io Max	Io Min	Zero Dac	Gain Dac	Emul Min	Emul Max	Emul Temp
<input checked="" type="checkbox"/>	0	1798	900.5u	8.913m	3.8036	0.39484	20.002m	3.9982m	2.0882	0.63005	0.94700	9.0000	0.75000
<input checked="" type="checkbox"/>	50	1475	916.1u	8.973m	3.8036	0.39528	20.002m	4.0003m	2.0867	0.62657	0.96300	9.0600	0.65000
<input checked="" type="checkbox"/>	100	1151	570.2u	9.27m	3.8037	0.39528	20.002m	4.0003m	2.1480	0.58103	0.61800	9.3600	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

Reg Cluster

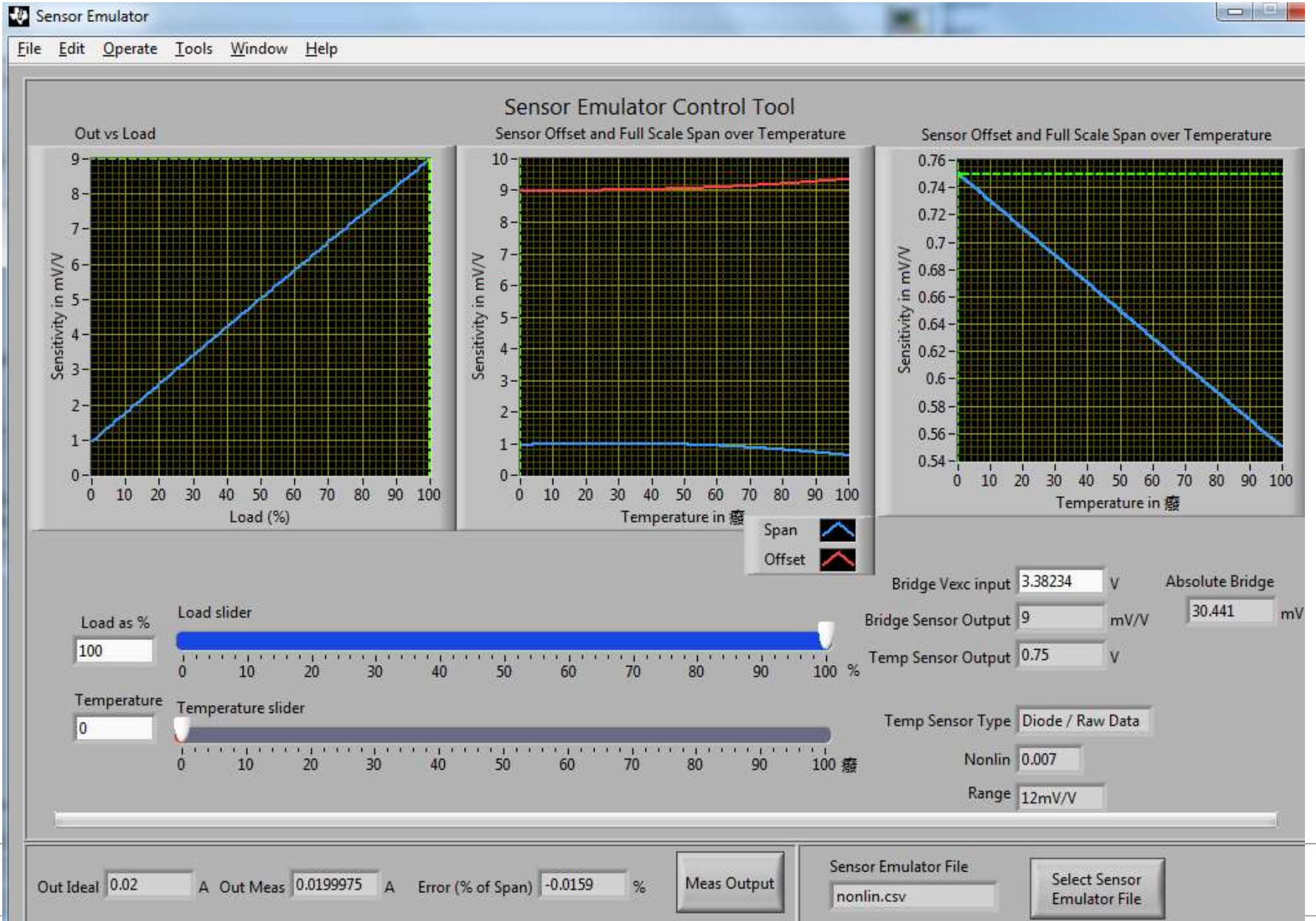
Misc Value	Analog Reg	Reg
Temp No: 2	Front Gain: 42.67	1151
Temp: 100	Vs: 5	8628
Vin_Low: 523.8u	Output Gain: 4.5	5F5F
Vin_High: 9.27m	Vref: 4.096	0515
Vout_Low: 395.28m	Coarse Off: -48.74m	451F
Vout_High: 3.8037	Klin: 0.027676	0000
Vo_High Target: 3.80322	Gain Dac: 0.581696	1403
Vo_Low Target: 0.395221	Kexc: 0.83	0000
Io_High Target: 0.02	Zero Dac: 2.14653	0000
Io_Low Target: 0.004	Cal Control	0000
No of Temp: 3	<input checked="" type="checkbox"/> Calibrate Nonlin (LinD)	R1: 11300
Poly Order: 2	<input checked="" type="checkbox"/> Use Sensor Emulator	XTR_Vref: 4.096
Output Mode: Iout	Range: 12mV/V	R2: 10000
Temp Sensor: Diode / Raw	XTR Info	R_ref: 191000



# c) Current output mode:



## c) Current output mode:



# c) Current output mode:

Sensor Emulator Control Tool

File Edit Operate Tools Window Help

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

Load (%)	Sensitivity (mV/V)
0	1.0
10	1.5
20	2.0
30	2.5
40	3.0
50	3.5
60	4.0
70	4.5
80	5.0
90	5.5
100	6.0

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

Temperature (°C)	Span (mV/V)
0	1.0
10	1.0
20	1.0
30	1.0
40	1.0
50	1.0
60	1.0
70	1.0
80	1.0
90	1.0
100	1.0

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

Temperature (°C)	Offset (mV/V)
0	0.75
10	0.72
20	0.69
30	0.66
40	0.63
50	0.60
60	0.57
70	0.54
80	0.51
90	0.48
100	0.45

Span

Offset

Load as %: 50

Load slider: 0 to 100 %

Temperature: 50

Temperature slider: 0 to 100 °C

Bridge Vexc input: 3.47452 V

Absolute Bridge: 17.6095 mV

Bridge Sensor Output: 5.06818 mV/V

Temp Sensor Output: 0.65 V

Temp Sensor Type: Diode / Raw Data

Nonlin: 0.007

Range: 12mV/V

Out Ideal: 0.012 A

Out Meas: 0.012005 A

Error (% of Span): 0.0315 %

Meas Output

Sensor Emulator File: nonlin.csv

Select Sensor Emulator File

# Thanks!