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

Iven Xu and Ian Williams Feb. 6<sup>th</sup>, 2013, updated May 20<sup>th</sup> 2016



## Agenda

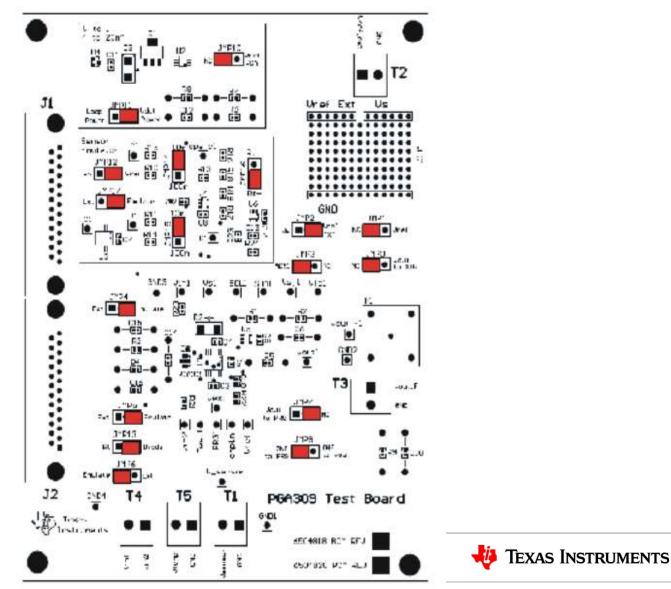
- 1. Three output modes of PGA309EVM-USB
  - a) 4-wire voltage output mode
  - b) 3-wire voltage output mode
  - c) Current output mode



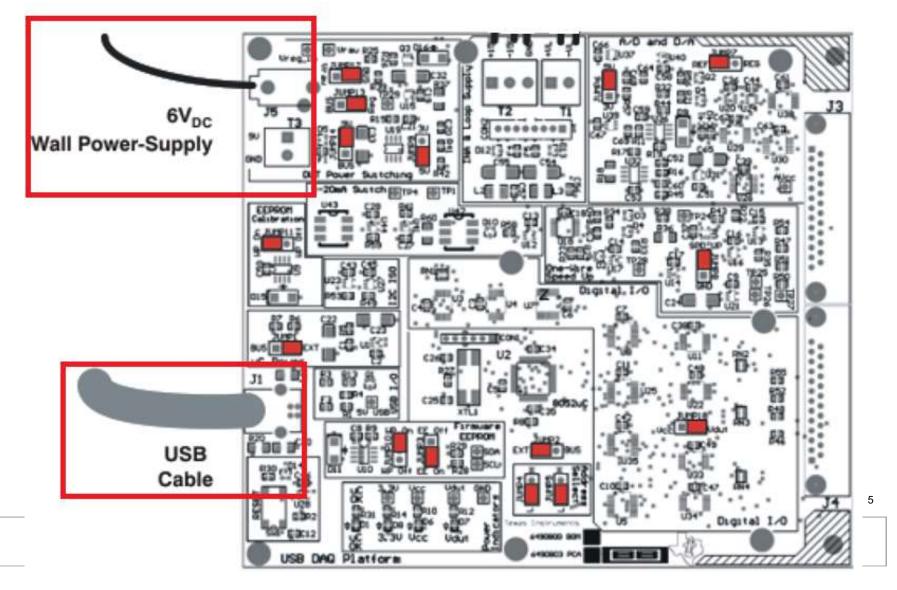


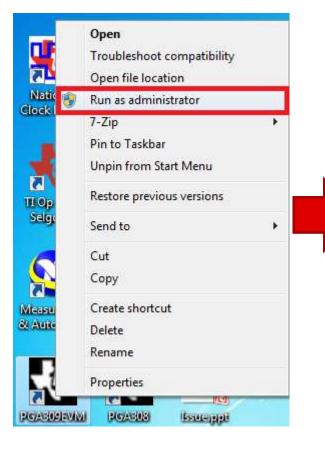


PGA309 EVM Default Configuration



• USB\_DAQ Board Default Configuration





Windows 7 Attention

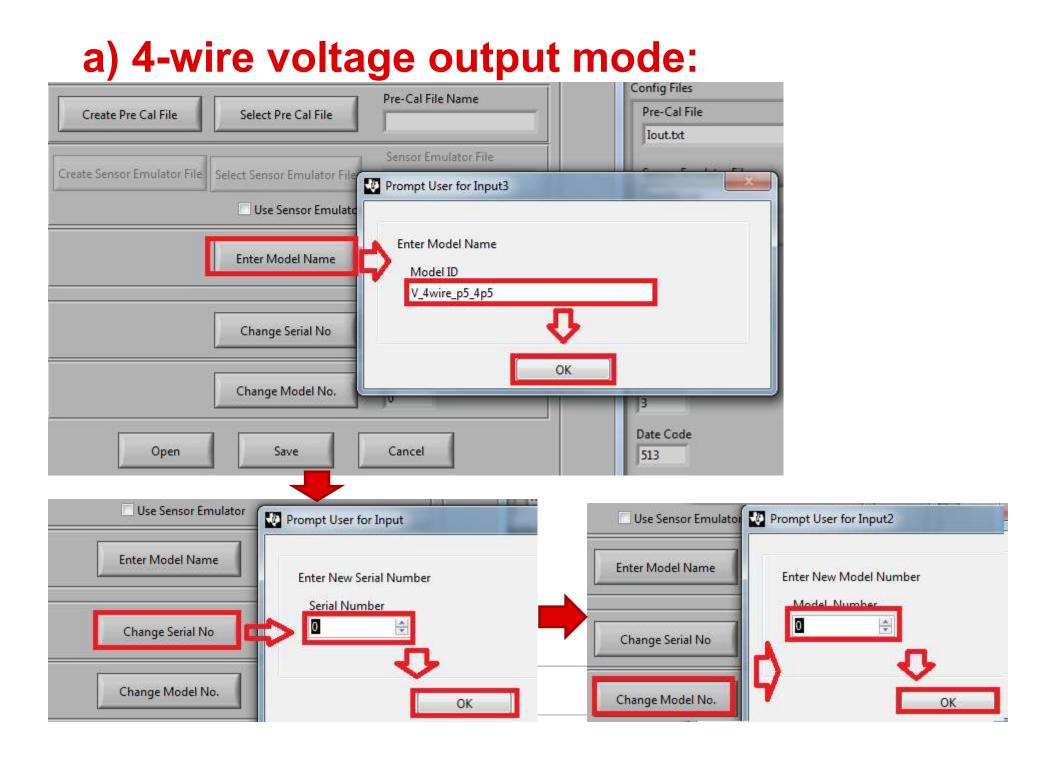
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#### **Default GUI Interface**



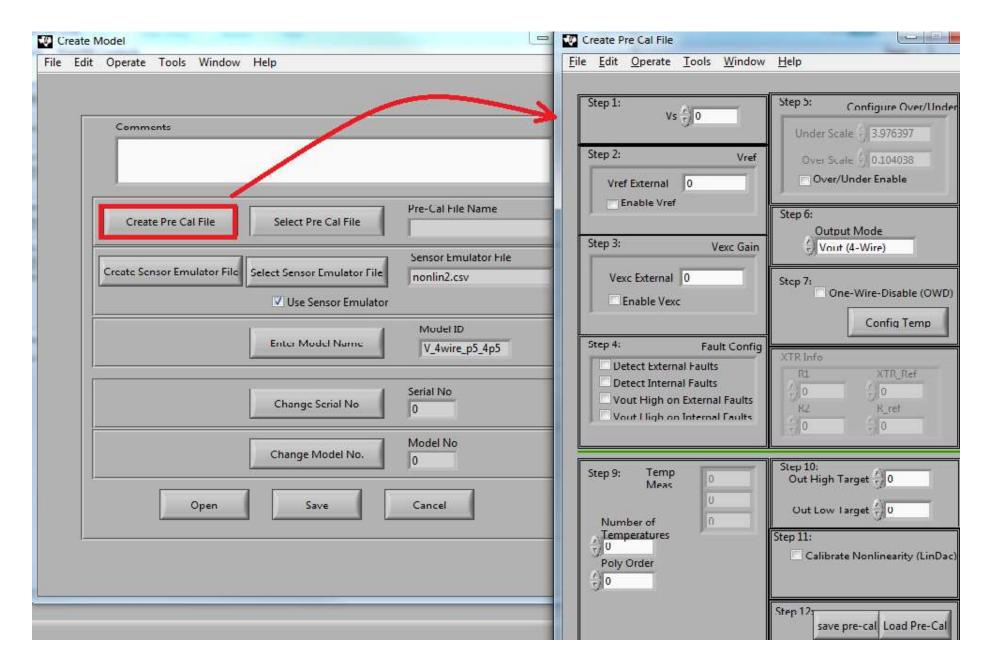
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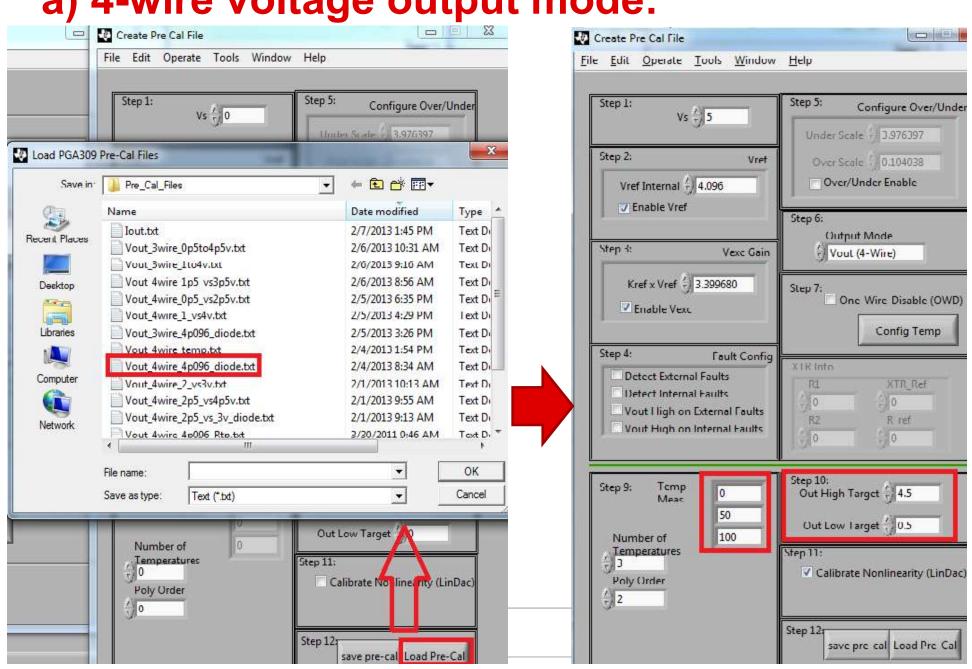


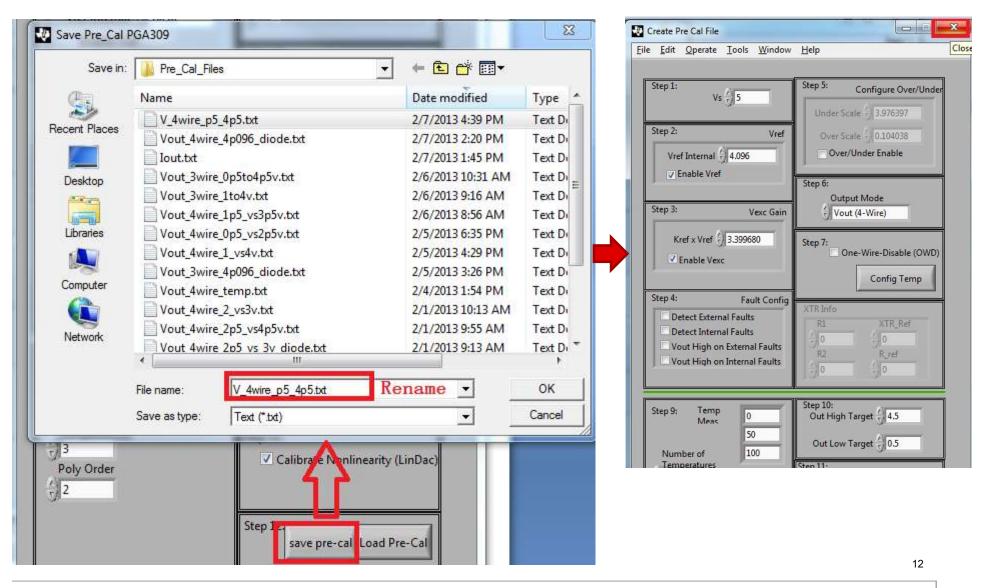


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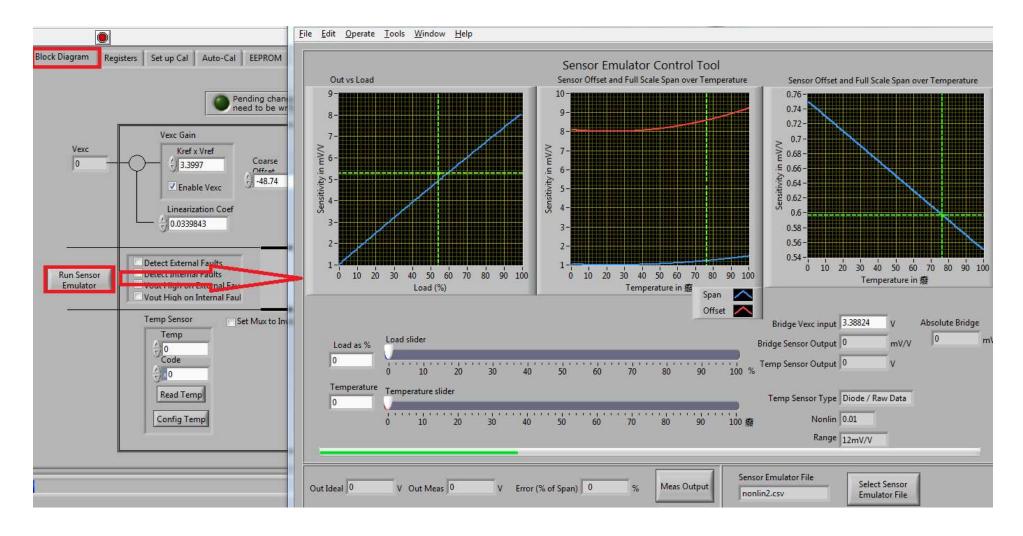
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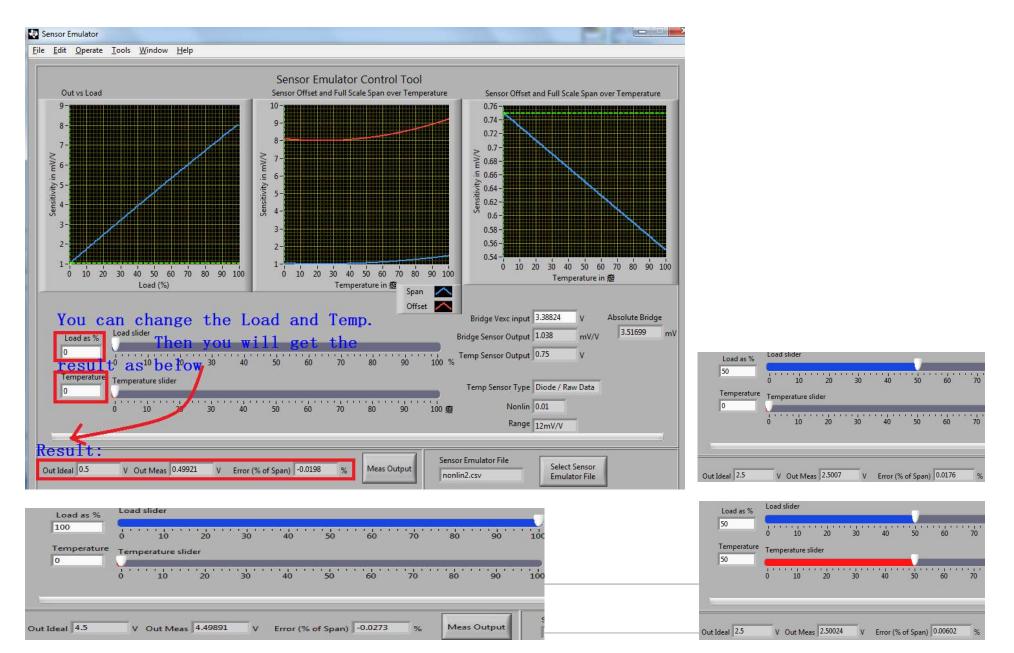
🔱 Texas Instruments

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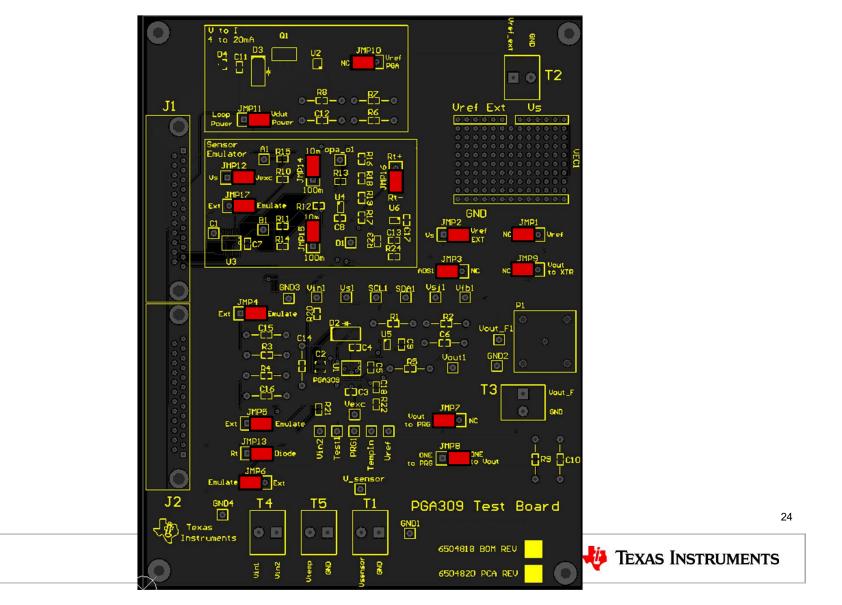




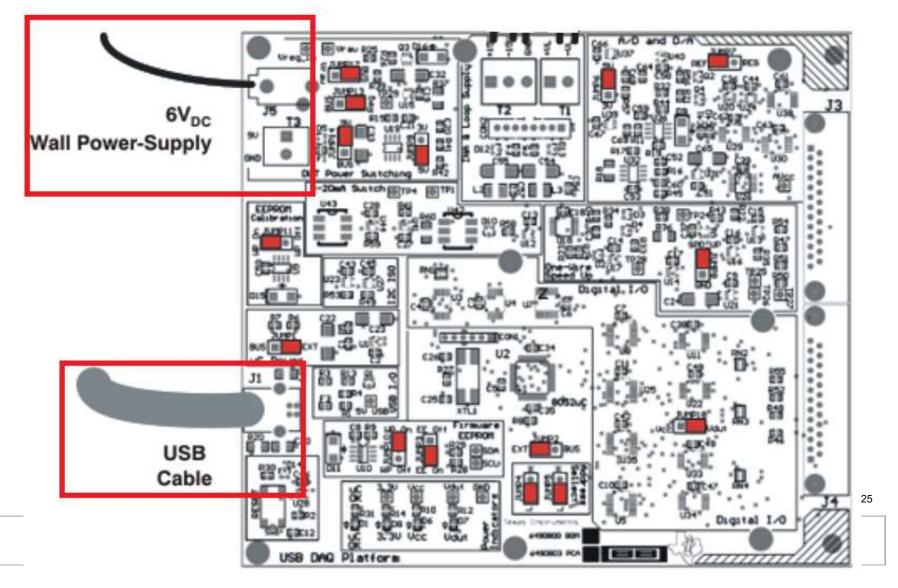


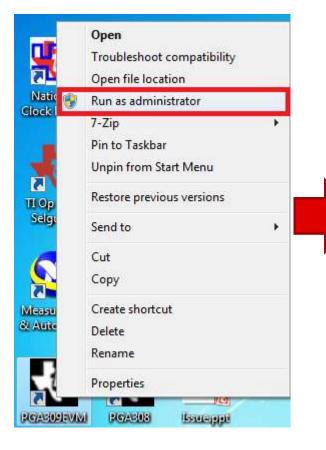


• PGA309 EVM Jumper Configuration – change JMP7, JMP8



• USB\_DAQ Board Default Configuration





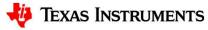
Windows 7 Attention

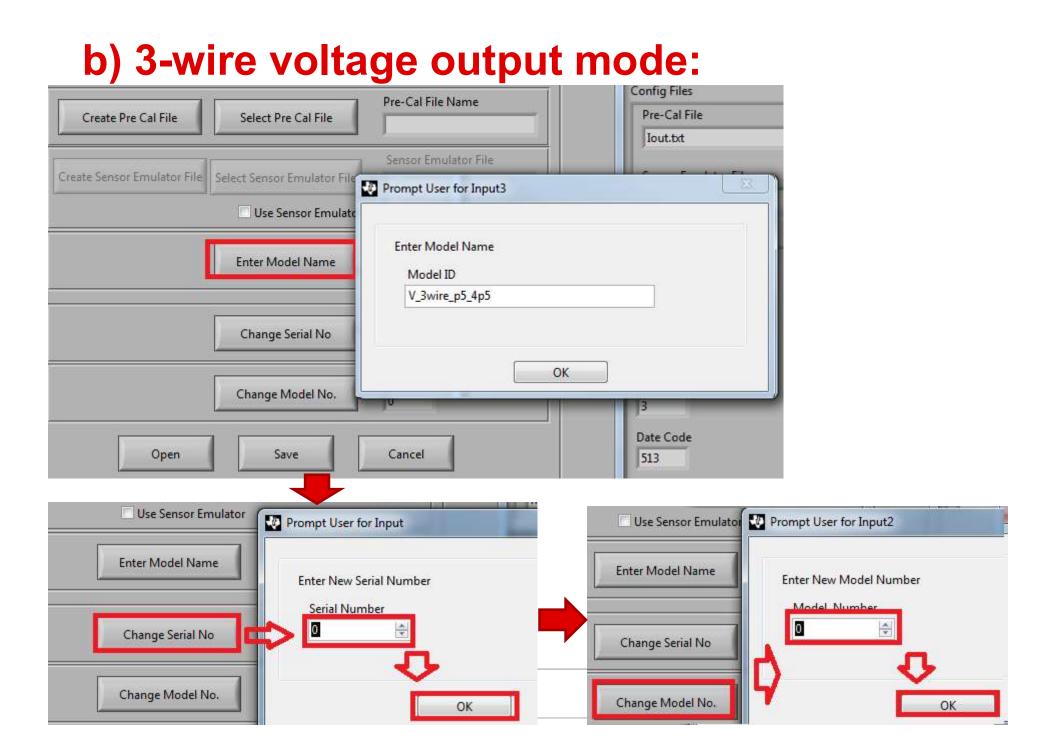
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√ 0.0	al Results		_High Vin_L			3	2		or Emulator	11300	XTR_Vref 4.096
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#### **Default GUI Interface**



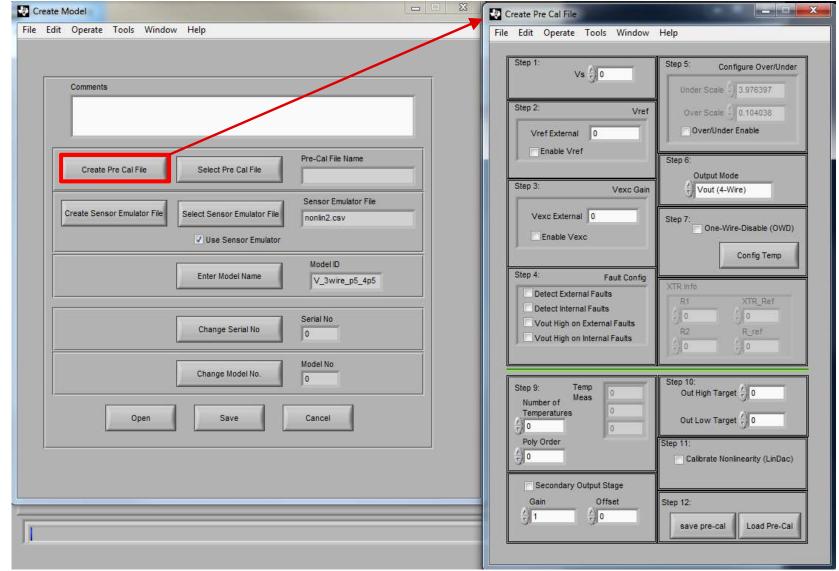
PGA309EVM-USB	USB Contr	Cre	eate Model	
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First Step	Block Dia			
Block Diagram Registers Set up Cal Auto-Cal EEPROM			Comments	
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	Secondary Ou Gain 1	Offset Step 12:	ve pre-cal Load Pre-C	Cal

Edit Operate Tools Window	Help
Step 1: Vs 1/5	Step 5: Configure Over/Under Under Scale 3.976397
Step 2: Vref Vref Internal () 4.096	Over Scale 0.104038
Step 3: Vexc Gain	Step 6: Output Mode
Krefx Vref () 3.399680 ✓ Enable Vexc	Step 7: One-Wire-Disable (OWD) Config Temp
Step 4: Fault Config Detect External Faults Detect Internal Faults Vout High on External Faults Vout High on Internal Faults	XTR info           R1         XTR_Ref           2         0           R2         R_ref           2         0
Step 9: Number of Temperature 3 Poly Order 2	Ster 10. Dut High Target Dut Low Target 0.5 Step 11: Calibrate Nonlinearity (LinDac)
Gain Offset	Step 12: save pre-cal Load Pre-Cal

Create Pre Cal File	Create Pre Cal File
File Edit Operate Tools Window Help	File Edit Operate Tools Window Help
Step 1:       Step 5:       Configure Over/Under         Save Pre_Cal PGA309       X         Save Pre_Cal PGA309EVM-USB > Pre_Cal_Files       Y         Search Pre_Cal_Files       Y         Organize        New folder	Step 1:         Vs (1) 5         Step 5:         Configure Over/Under           Step 2:         Vref         Under Scale (1) 3.976397         Over Scale (1) 0.104038           Vref Internal (1) 4.096         Over/Under Enable         Over/Under Enable
NSCUtils       4wire_0-10V.txt         Packages       Iout.txt         PADS Projec       Iout_6to22mA.txt         PADS_ES_Ev       vout_3w:2p5.txt         PerlLogs       Vout_3wire_4p096_diode_internal.txt         Perl.bak       Vout_3wire_4p096_diode_internal.txt         Program Filk       Vout_4wire_2p5_vs_3v_diode.txt         Program Filk       Vout_4wire_4p096_diode_internal.txt         Vout_4wire_4p096_diode_internal.txt       Vout_4wire_4p096_diode_txt         Vout_4wire_4p096_diode_internal.txt       Vout_4wire_4p096_diode_txt         Vout_4wire_4p096_diode_internal.txt       Vout_4wire_4p096_Rtm.txt         Vout_4wire_4p096_Rtp.txt       Vout_4wire_4p096_Rtp.txt         Vout_4wire_4p096_Rtp.txt       Vout_4wire_4p096_Rtp.txt         Wodel_f       Model_f	Vier Internal () 4.098         Image: Construction chains         Image: Construction chains         Image: Construction chains         Step 3:       Vexc Gain         Kref x Vref () 3.399680         Image: Construction chains         Kref x Vref () 3.399680         Image: Construction chains         Image: Construction chains         Kref x Vref () 3.399680         Image: Construction chains         Image: C
Image: model   Pre_Cal   Sensor_F   File name: V 3wire_p5_4p5.txd Text (*.txt) OK Cancel    Gain Offset   Image: Offset	Step 9:       Temp Meas       0         Number of Temperatures       50       Out High Target 4.5         100       50       Out Low Target 0.5         Poly Order       100       Step 11:         12       Calibrate Nonlinearity (LinDac)         Secondary Output Stage       Step 12:         0       10       Step 12:         10       10       Load Pre-Cal

PGA309EVM-USB	
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Open Save Cancel	File name: V_3wire_p5_4p5.txt
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File Edit Operate Tools Window Help         File Edit Operate Tools Window Help         Comments         Comments         Create Pre Cal File         V_3wire_p5_4p5.txt         Designed File         Select Pre Cal File         V_3wire_p5_4p5         National Ins         Avire_4p096_diode.txt         12/21/2010 1:21 PM         Teste         Select Pre Cal File         V_3wire_p5_4p5.txt         Packages         Avire_4p096_diode.txt         4vire_4p096_diode.txt         0/23/21/2010 1:30 PM         Teste         Model D         V_3wire_p5_4p5	PGA309EVM-USB		×		
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	0.0 7		0	0	0	0	EEPROM		No of Temp 3	Poly Order	1	Range 12mV	20100000000	R2	R_ref
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0	0	0	0	0	0.0000	0.0000	0.0000	0.000	0 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
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K	0	0	0	0	0.0000	0.0000	0.0000	0.000	and the second second	0.0000	0.0000	The second second	0.0000	0.0000	0:0000
	0	0	0	0	0.0000	0.0000	0.0000	0.000	0 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

8

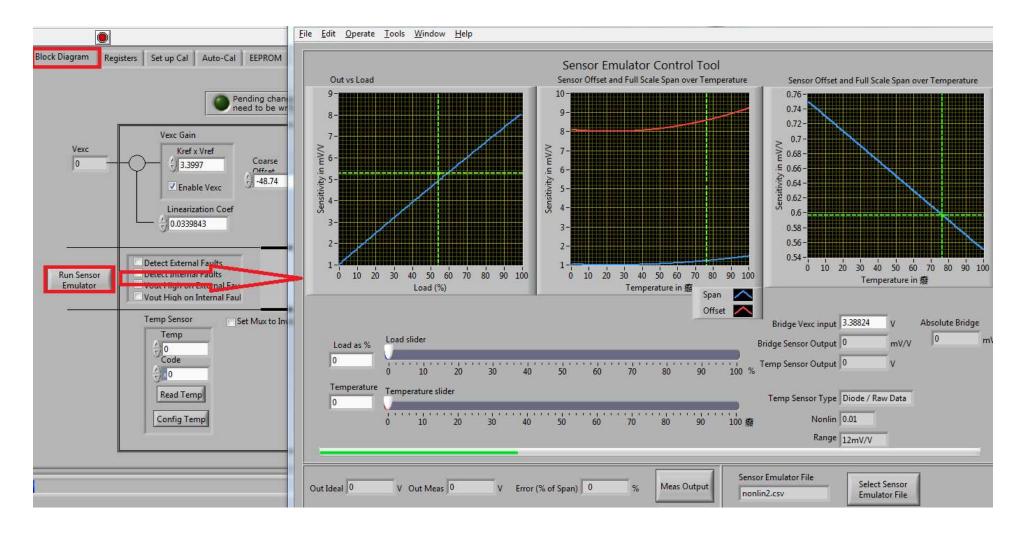
B Controls PGA309 Co	ntrols									
ock Diagram Registe	rs Set up Cal	Auto-Cal EE	PROM							
					Reg Cluster					
A CORD	ing at Low Pressure				Misc Value		Analog Reg			Reg
Start					Temp No	Temp	Front Gain	Vs		×1476
Auto-continue 🔽	First Cal Status				1	50	42.67	5		×8030
alibration	Find	Calibrate	Calibrate	Calibrate	Vin_Low	Vin_High	Output Gain	Vref	8	×7121
unoration	Vin_Low	Vin_High	Vin_Low	Vin_Mid	979.9u	8.067m	6 Coarse Off	4.096 Klin		051A
Continue		0	0	0	Vout_Low	Vout_High	-48.74m	0.034273		551F
	2nd Find	2nd Cal	2nd Cal	Done	499.16m	4.5008	Gain Dac	Kexc		
Re-Run Current Measurement	Vin_Low	Vin_High	Vin_Low	Initial Cal	Vo High Target	Vo Low Target	0.62794	0.83	1	0000
Re-Cal Selected		0	0	0	4.5	0.5	Zero Dac			1403
Temperature	Over Temp Sta	tus		Mesurements	Io High Target	Io Low Target	2.05103			x 0000
Temperature	Find Ca	al Cal	-	Complete	No of Temp	Poly Order	Cal Control	>	(TR Info	×0000
100.0 -	Vin_Low Vi	n_High Vin_Lo	w Done		3	2	🗸 Calibrate Nonlin (Lind		R1	XTR_Vref
				EEPROM Dutput Mode Temp Sensor			Use Sensor Emulator R2			4.096 R_ref
Cal Rec	ults V_4wire_p5_4	5 MNI 0 SNI 0	DC 513 tv+	C	Vout (4-Wire)	Tonede / Raw	Range 12mV/\	/	10000	191000
ibration Info	and a twite ho tab	0_1vi14_0_514_0	0C_010.000		1		J. Areada		1.000	101000
one Temperature Temp	DAC Sensor Mir	Sensor Max	Vout Max	Vout Min Io	Max Io Min	Zero Dac	Gain Dac Em	ul Min E	mul Max	Emul Temp
0 17	and the second second	8.01m	4.5006	0.49911	0.0000 0.0000	2.0677	0.62365 1.	0380	8.0980	0.75000
50 14	succession in the local division of the loca	8.067m	4.5008	procession in the	0.0000		processing and		8.1555	0.65000
100 0		and the second second	PERSONAL PROPERTY AND	PERSONAL PROPERTY AND INCOME.	0.0000 0.0000		personal person	CODO CONTRACT	9.2290	Concession of the
	0	0	0.0000	0.0000	0.0000	0.0000	0.0000 1.	4620		0.55000



🔱 Texas Instruments

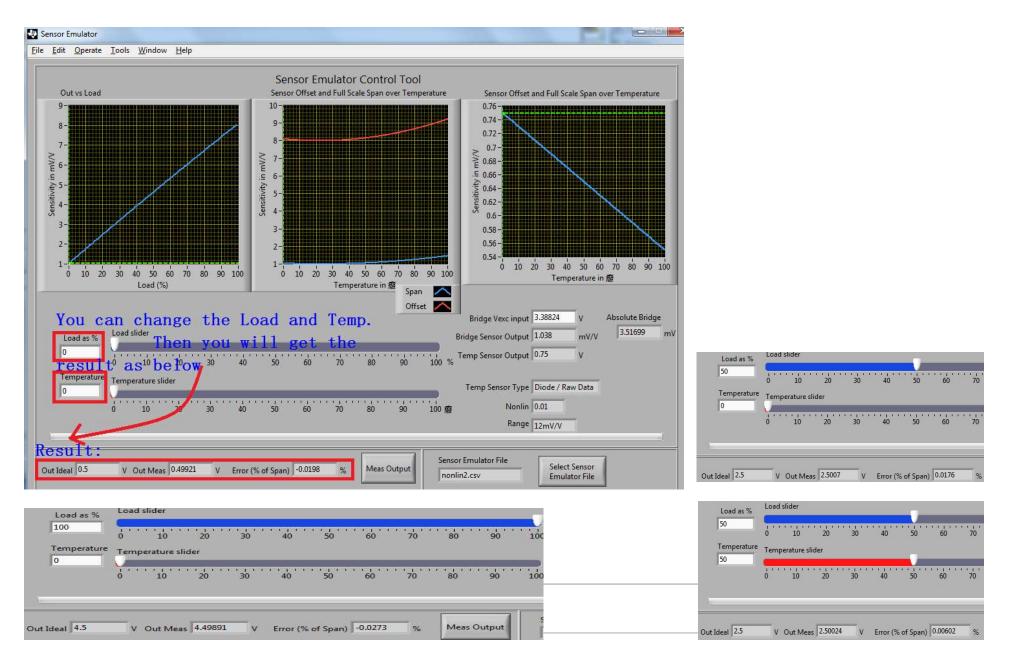
B Controls PGA30	9 Control	s										
ock Diagram Re	gisters	Set up Cal A	uto-Cal EE									
	-		-			Reg Clus	ter					
	Calibrati	on Completel				Misc Va	lue		Analog Reg			Reg
Start	I					Temp	No	Temp	Front Gair	Vs Vs		1151
Auto-continue	E F	irst Cal Status				2		100	42.67	5		7D8A
Calibration		Find	Calibrate	Calibrate	Calibrate	Vin_Lo	w	Vin_High	Output Ga		_	5817
- among a cont		Vin_Low	Vin_High	Vin_Low	Vin_Mid	1.381		9.137m	6 Coarse Of	4.096		051A
Continue	7	9	0	0	0	Vout_	and the second se	Vout_High	-48.74m	0.0342	7:	
	4	2nd Find	2nd Cal	2nd Cal	Done	500.2		4.4996	Gain Dac	Kexc		551F
Re-Run Current Measurement		Vin_Low	Vin_High	Vin_Low	Initial Cal	and the second se	gh Target	Vo Low Target	0.57054€	0.83		0000
Re-Cal Selected		0	Q.	0	0	4.5	1	0.5	Zero Dac			1403
Temperature		Over Temp Stat	us		Mesuremen	nts provide	h Target	Io Low Target	2.00866			80000
Temperature		Find Cal	Cal		Complete	0	•	0 Data Order	Cal Control		XTR Info	0000
100.0 -		Vin_Low Vin	_High Vin_Lo	w Done		No of	Temp	Poly Order	Calibrate	Nonlin (LinD	R1	XTR_Vref
		0 0		<b>O</b> .	EEPROM	3		17	Use Senso	or Emulator	11300	4.096
					Written	(COLORIDA	it Mode	Temp Sensor	Range 12m	VAL	R2	R_ref
Ca libration Info	I Results	V_4wire_p5_4p	5_MN_0_SN_0_	DC_513.txt	0	Vout	(4-Wire)	Diode / Kaw	I nunge  12m	10/0	10000	191000
one Temperature	Temp DA	C Sensor Min	Sensor Max	Vout Max	Vout Min	Io Max	Io Min	Zero Dac	Gain Dac	Emul Min	Emul Max	Emul Tem
	1798	999.9u	8.01m	4.5006	0.49911	0.0000	0.0000	2.0677	0.62365	1.0380	8.0980	0.75000
50	1476	1.02m	8.067m	4.5008	0.49916	0.0000	0.0000	2.0655	0.62029	1.0580	8.1555	0.65000
100	1151	1.425m	9.137m	4.4996	0.50024	0.0000	0.0000	2.0194	0.56595	1.4620	9.2290	0.55000





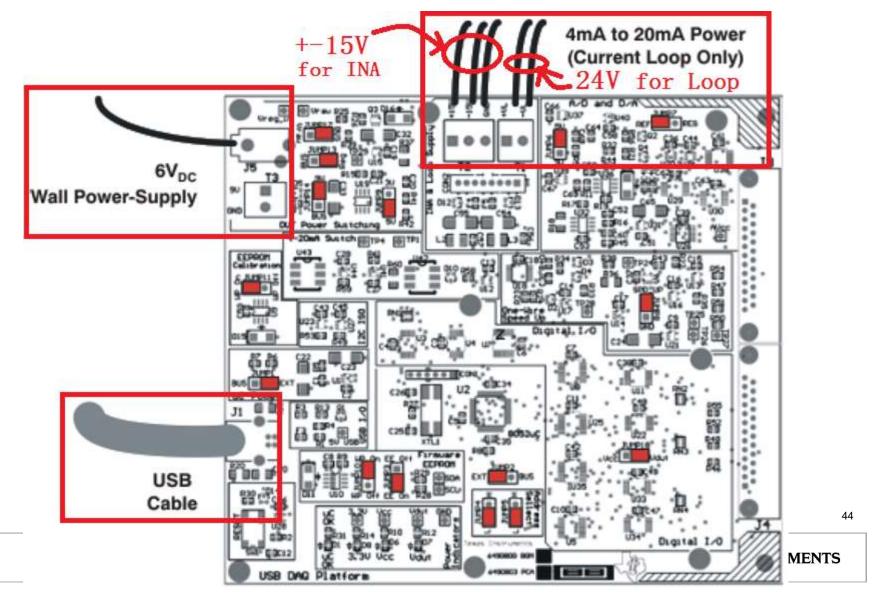
41



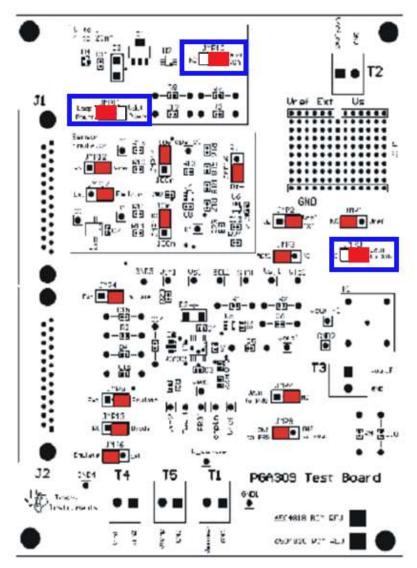




• USB DAQ Configuration



• PGA309 EVM Configuration



- \* When we want to use current output mode of XTR117:
- \* we should make sure the configuration of PGA309 is in 4-wire voltage output mode;
- \* Because in 3-wire voltage output mode of PGA309, we should turn on/off the Vs of PGA309. But in 3-wire mode, the one-wire and Vout is connect in one junction, so we cannot use one-wire to control the Vs (turn on/off).

\* conclusion:

is we should use 4-wire voltage output for current output.

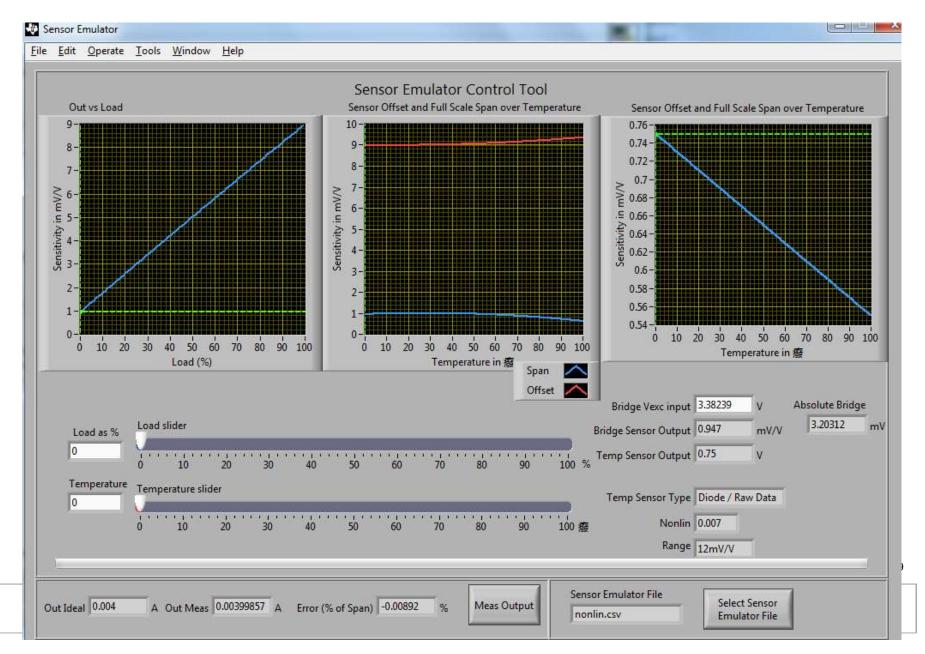


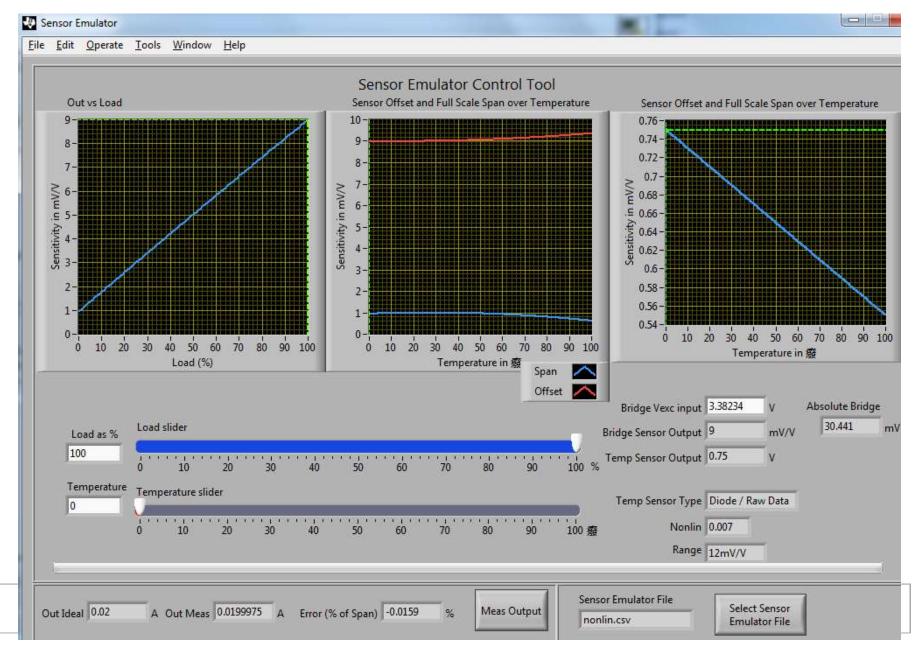


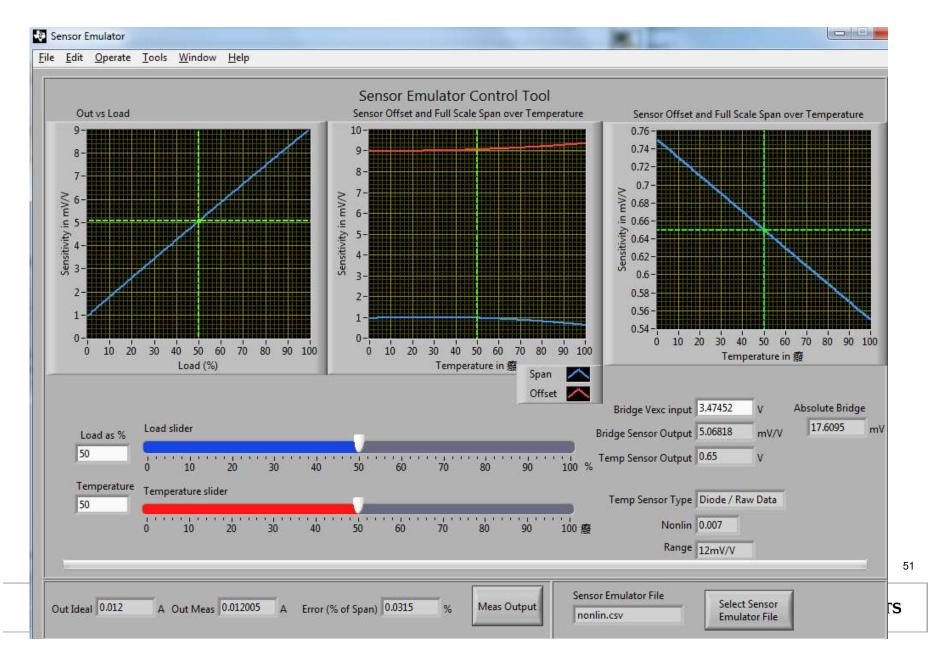
Enter Model Name	Model ID I_4mA_20mA_1			
Change Serial No	Serial No			
Change Model No.	Model No			
	PGA309EVM-USB		ate Model	
	USB Controls PGA309 Controls	File	<u>E</u> dit <u>O</u> perate <u>T</u> ools <u>W</u> indow <u>H</u> elp	
	Block Diagram Registers Set up Cal Auto-Cal	E		Load Sensor Emulator File
			Comments	Save in: Save in: Save in:
	Select Model File Model File Name Emulator File Iout_4p096_diode.txt		Create Pre Cal File Select Pre Cal File	me Name
	Emulator File Run Sensor Emulator		Create Sensor Emulator File Select Sensor Emulator File	Rt+.csv
			Use Sensor Emulator	Computer
	Change DMM Interface Emulator		Enter Model Name I_4mA_20m/	
			Change Serial No 1	File name:
			Change Model No. Model No.	Save as type: Sensor_
			Open Save Cancel	

Create Pre Cal File		25		
<u>File E</u> dit <u>O</u> perate <u>T</u> ools <u>W</u> indow	Help		Model	
			<u>O</u> perate <u>T</u> ools <u>W</u> indow <u>H</u> elp	
Step 1:         Vs 'j         5           Step 2:         Vref	Step 5: Configure Over/Under		Comments	
Vref Internal () 4.096	Over/Under Enable			
Step 3: Vexc Gain Kref x Vref 🗧 3.399680	Output Mode	L	Create Pre Cal File Select Pre Cal File	Pre-Cal File Name Sensor Emulator File
Enable Vexc	Config Temp	4	Create Sensor Emulator File Select Sensor Emulator File	nonlin.csv
Step 4: Fault Config Detect External Faults Detect Internal Faults Vout High on External Faults	XTR Info R1 XTR_Ref 11300 44.096	cori	Enter Model Name	Model ID I_4mA_20mA_1
Vout High on Internal Faults	R2 R_ref		Change Serial No	Serial No 1 Model No
Step 9: Temp Meas 50 50 100	Step 10: Out High Target (0.02) Out Low Target (0.004) Step 11:		Change Model No.	Cancel
Poly Order	<b>Ration range</b>			

lock Diagram Registe	3		1							
	ers Set up Cal	Auto-Cal EE	PROM		Reg Cluster					
	libration Complete!				Misc Value		Analog Reg			Reg
Start					Temp No	Temp	Front Gain	Vs 5		1151
Auto-continue 🔽	First Cal Status				2 Vin Low	Vin_High	42.67 5 Output Gain Vref			8628
Calibration	Find Vin_Low	Calibrate Vin_High	Calibrate Vin_Low	Calibrate Vin Mid	523.8u	9.27m	4.5	4.096		× SFSF
1	0	0	0	0	Vout_Low	Vout_High	Coarse Off	Klin		×0515
Continue	2nd Find	2nd Cal	2nd Cal	Done	395.28m	3.8037	-48.74m Gain Dac	0.0276 Kexc	R	x 451F
Re-Run Current Measurement	Vin_Low	Vin_High	Vin_Low	Initial Cal	Vo High Targe	100 million (100 m	0.581696	0.83		× 0000
Re-Cal Selected		0	0	0	3.80322	0.395221	Zero Dac			×1403
Temperature		Mesurement	5 Io High Target Io Low Targ 0.02 0.004		2.14653					
Temperature	Find Ca			Complete	No of Temp Poly Order		Cal Control		XTR Info	XTR_Vref
100.0 🤝	Vin_Low Vi	n_High Vin_Lo	ow Done	-	3	2	Calibrate No	nlin (LinD	R1 11300	4.096
			9.	EEPROM Written	Output Mode	Temp Sensor	Use Sensor E	mulator	R2	R_ref
Cal Re libration Info	sults I_4mA_20mA	1_MN_1_SN_2_	DC_513.txt	0	Iout	Diode / Raw	Range 12mV/	V	10000	191000
one Temperature Tem	p DAC Sensor Mir	n Sensor Max	Vout Max	Vout Min Io	Max Io Mir	n Zero Dac	Gain Dac Em	nul Min	Emul Max	Emul Te
0	798 900.5u	8.913m	3.8036	0.39484	20.002m 3.99	82m 2.0882	0.63005 0	.94700	9.0000	0.75000
50 14	175 916.1u	8.973m	3.8036	0.39528	20.002m 4.00	03m 2.0867	0.62657 0	.96300	9.0600	0.65000
100	151 570.2u	9.27m	3.8037	0.39528	20.002m 4.00	03m 2.1480	0.58103 0	.61800	9.3600	0.55000
0 0	0	0	0.0000	0.0000	0.00 0000.0	0000.0	0.0000 0	0000.	0.0000	0.0000
Carl Street Stre	and the second s	0	0.0000	0.0000	0.000 0.00	0000.000	0.0000 0	0000	0.0000	- income







# Thanks!

