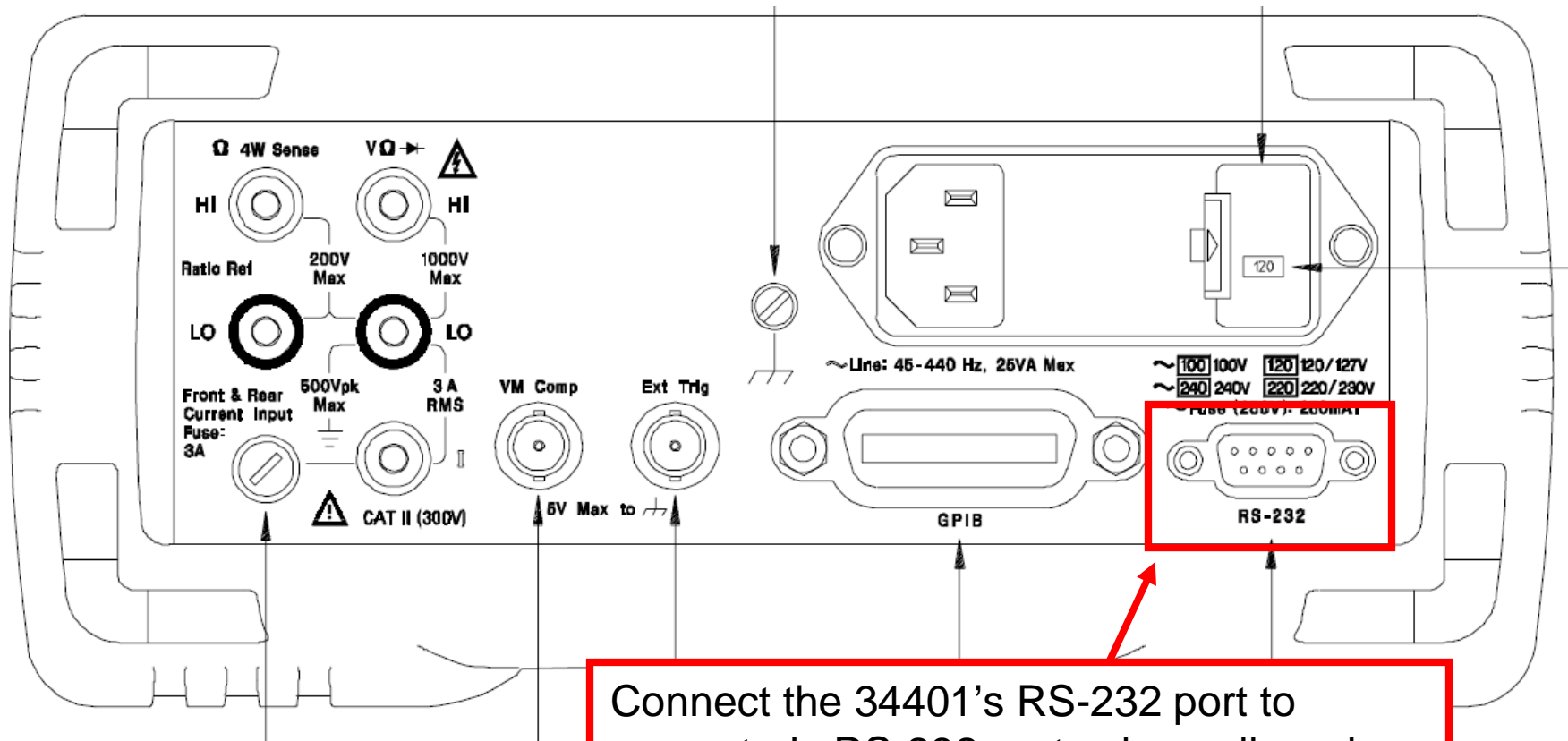


# connecting HP34401A to PGA308EVM

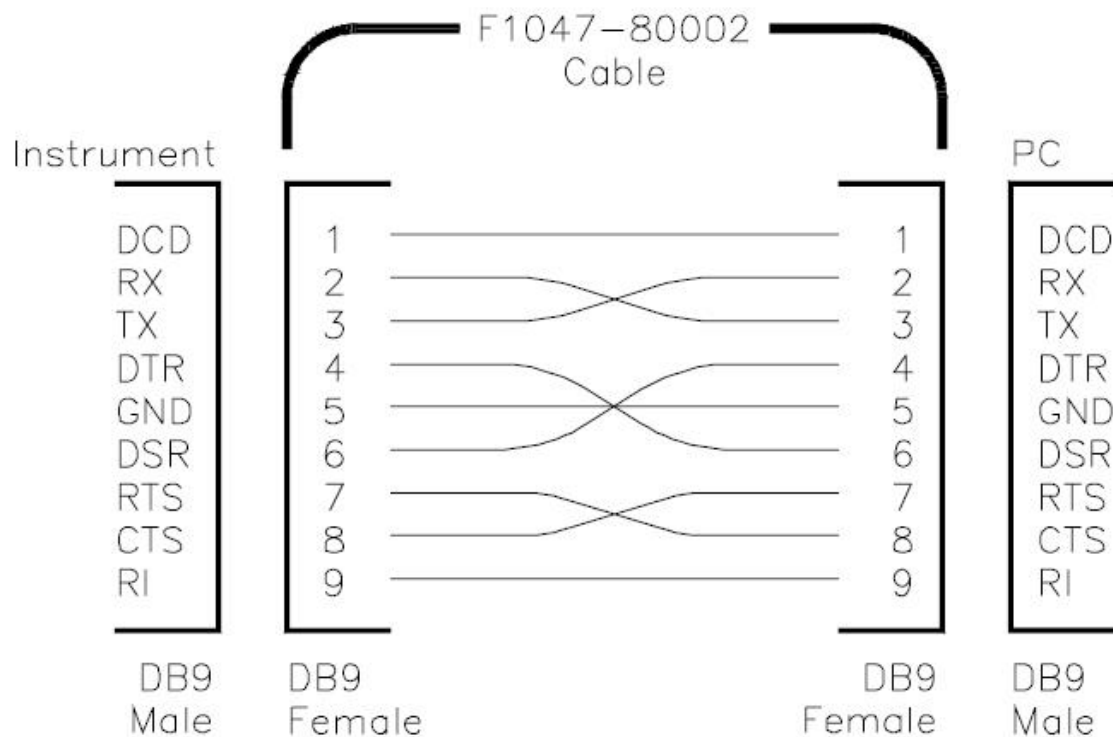
This shows the location of the RS-232 connector on the back side of the meter.



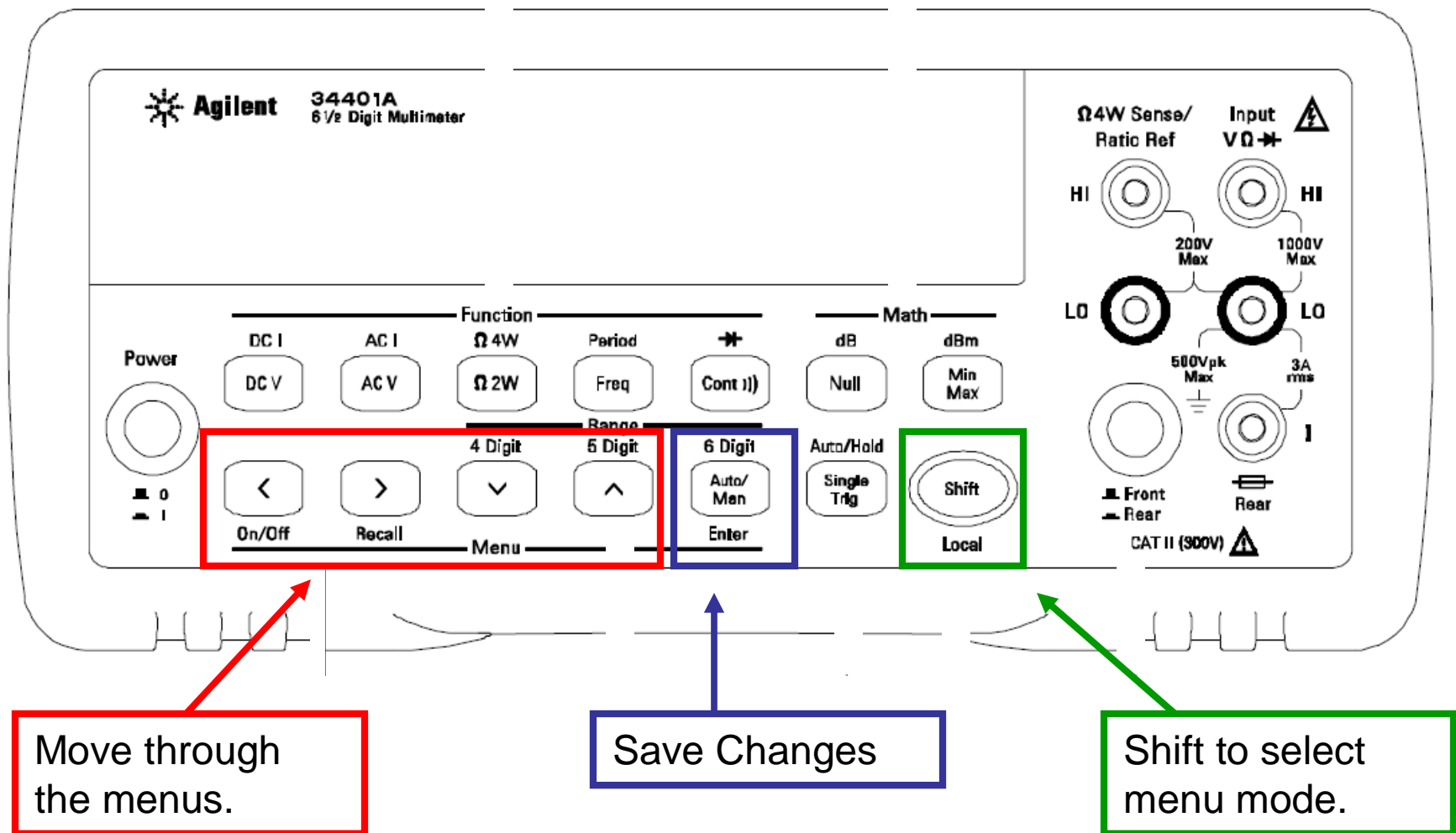
Connect the 34401's RS-232 port to computer's RS-232 port using null-modem cable. The next slide describes the "null-modem cable".

Build a cable according to the diagram below or purchase from Agilent.

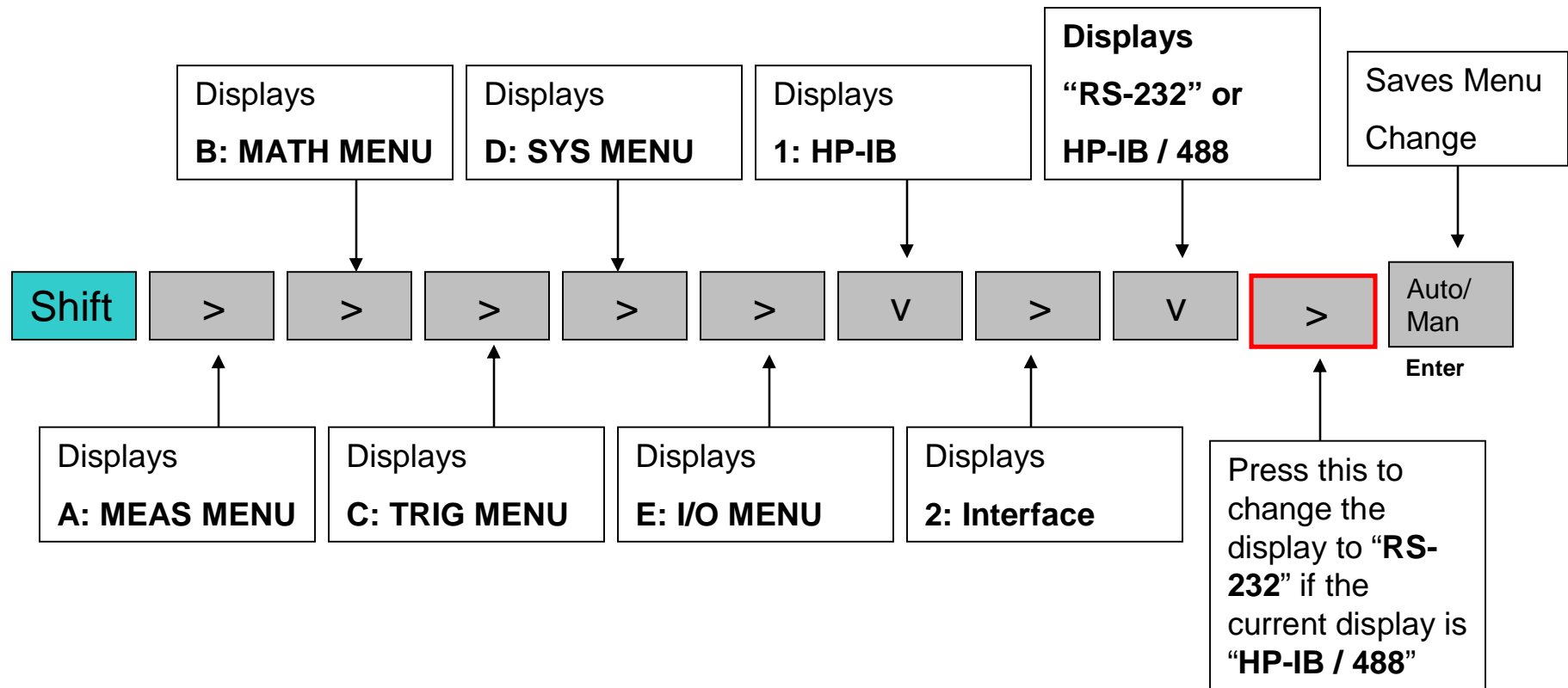
***DB-9 Serial Connection*** If your computer or terminal has a 9-pin serial port with a male connector, use the null-modem cable included with the *Agilent 34398A Cable Kit*. This cable has a 9-pin female connector on each end. The cable pin diagram is shown below.



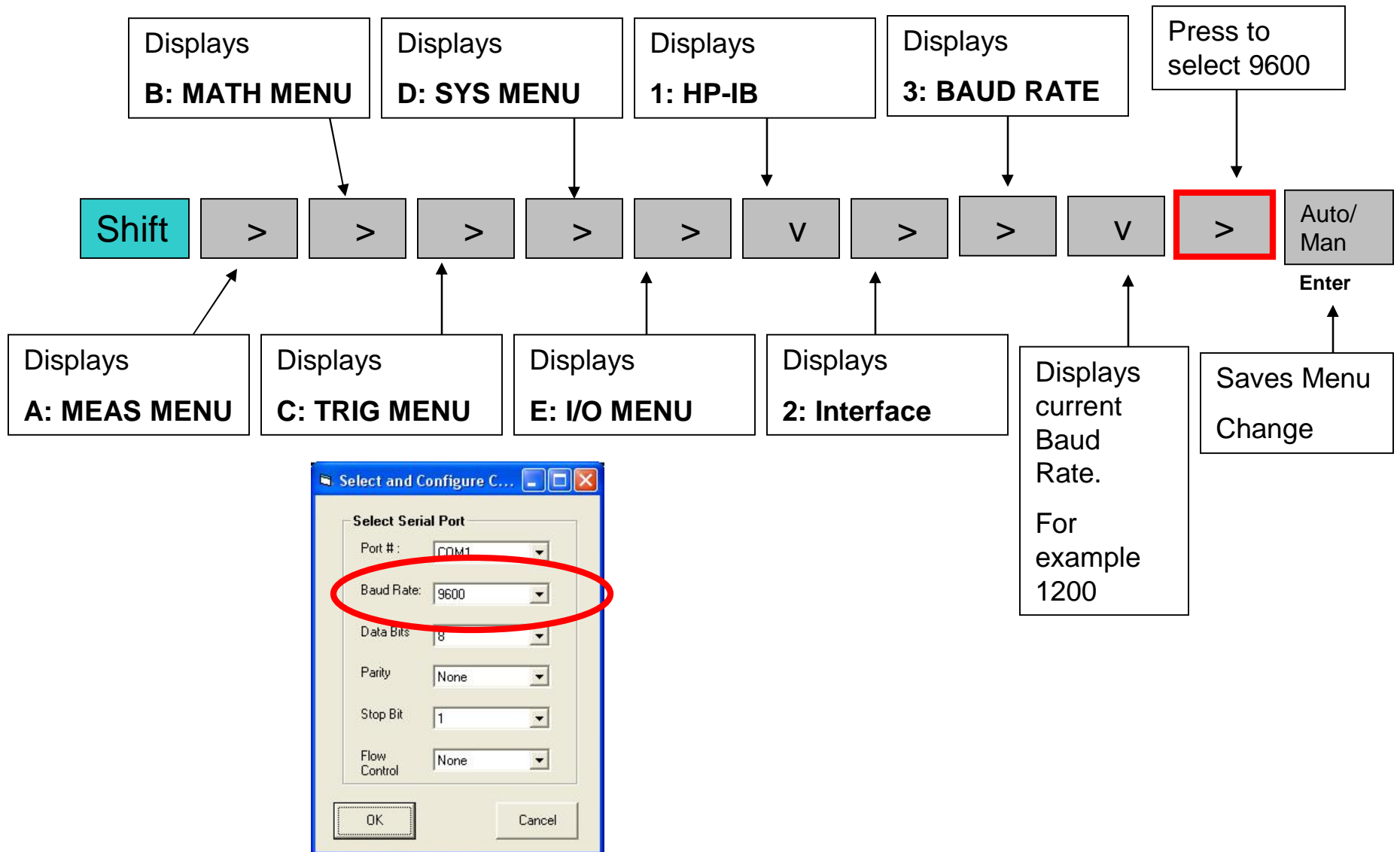
Set up the HP34401 for RS-232 communications. The picture below shows the buttons that will be used to enter the menus and edit the settings. The following slides show the specific sequence of buttons to change the settings.



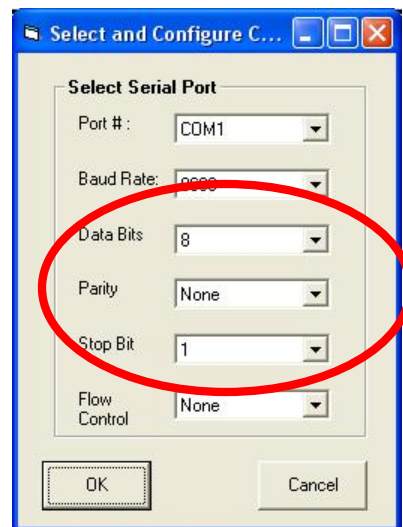
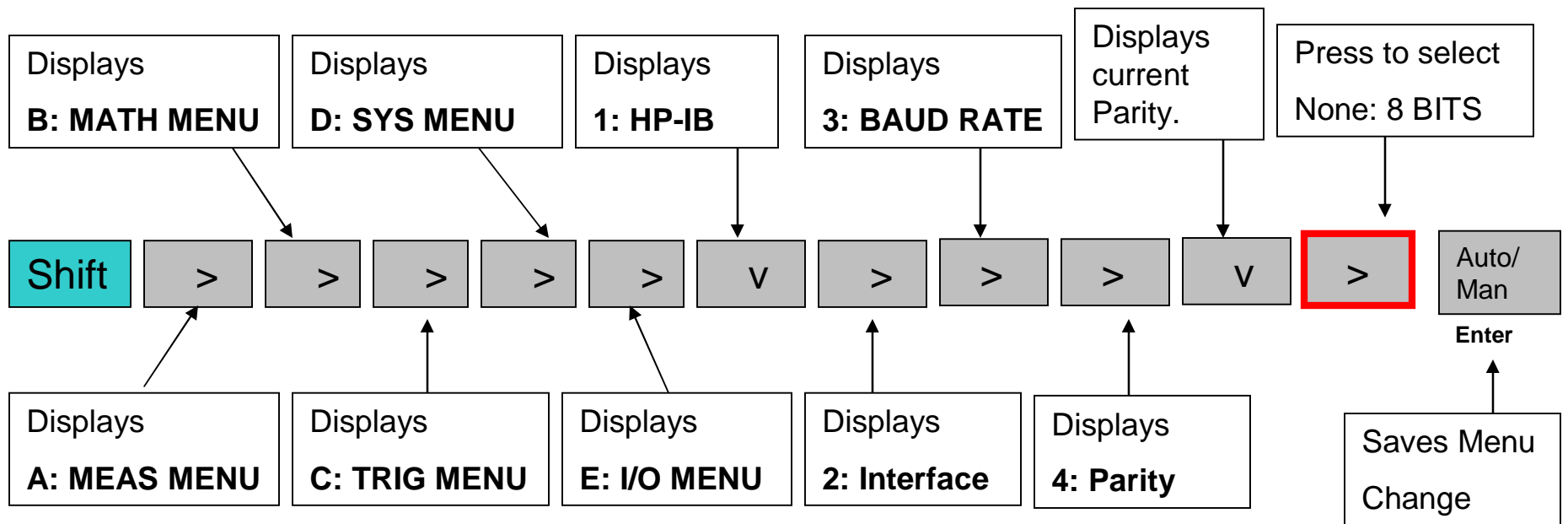
Press the keys on the HP34401 to set "interface" to **RS-232**.



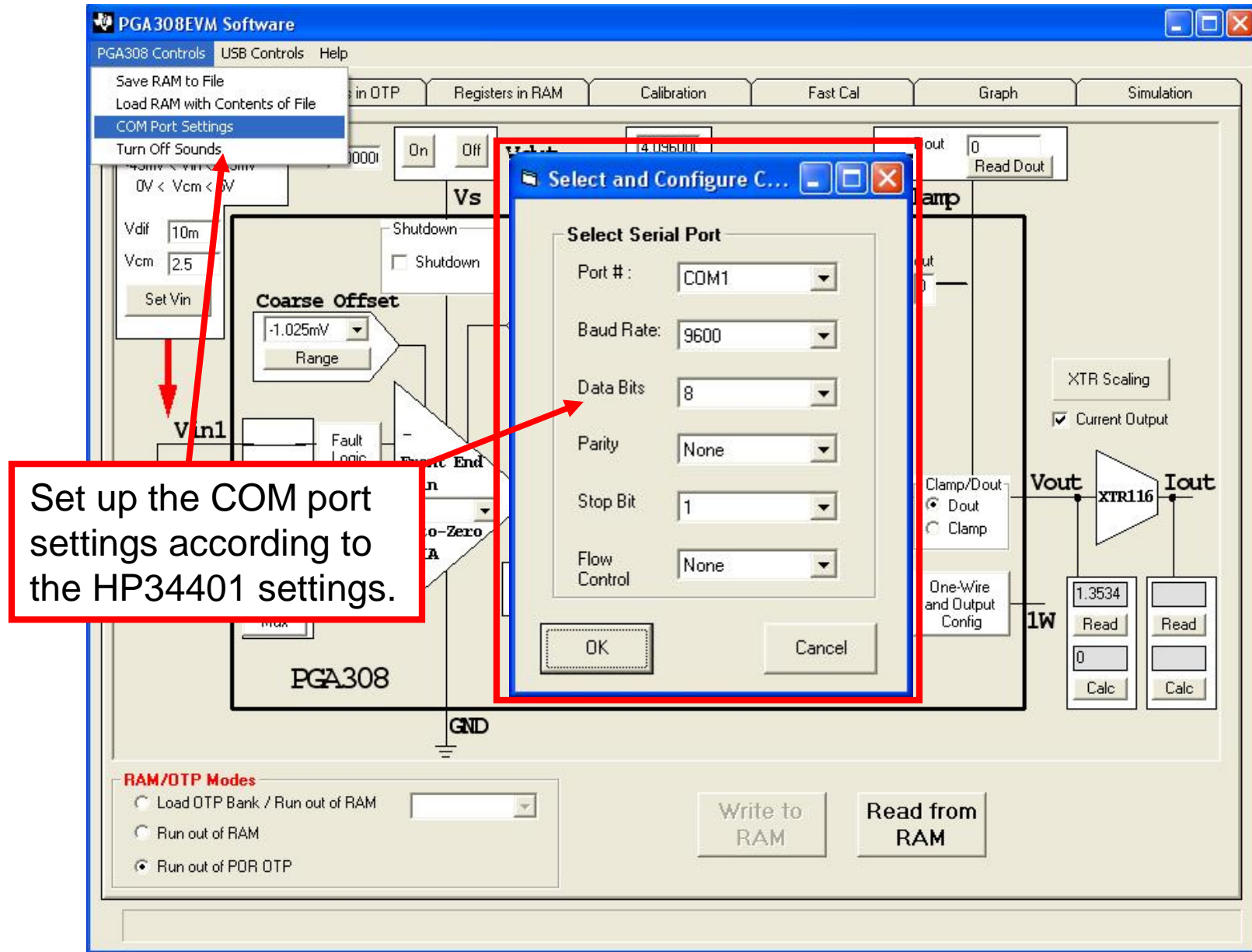
Press the keys on the HP34401 to set "Baud Rate" to **9600**.



Press the keys on the HP34401 to set "Parity" to "**None: 8 BITS**".



Start the software and select the settings to match the HP34401A.





Select HP34401A to use the HP34401A during calibration.

PGA308EVM Software

PGA308 Controls USB Controls Help

Block Diagram Registers in OTP Registers in RAM **Calibration** Fast Cal Graph Simulation

Calibration

Effect of Load on Output Swing **Step 1**

Riso  ☐ Omit Riso

RL  ☐ Omit RL

Source **Step 2**

Signal

Measurement Tool **Step 3**

☐ Use USB DAQ A/D

☐ Use External Meter

☒ HP34401A

Load Cal Preset **Step 4**

Select Cal Preset

Pre Cal File

Auto Load

Output Mode

Desired PGA Output Swing

XTR Zero Scale Output  A

XTR Full Scale Output  A

Sensor Emulator Output **Step 5a**

☐ Normalized Sensor Data

Offset (V/V)

Span (V/V)

☒ Measured Sensor Data **Step 5b**

Offset (V)

Full Scale (V)

**Step 6**

Calibrate

Input

Measured Offset

Measured Full Scale

Output

Measured Zero Scale Output

Measured Full Scale Output

Linear Output Range - After Step 6

Min Linear Output  A

Max Linear Output  A

Load Post Cal **Step 7**

Select Post Cal Preset

☐ Auto Load Post Cal

Post Cal File

Auto Load

Linear Output Range - After Step 7

Min Linear Output  A

Max Linear Output  A

**Step 8**

Program into OTP power on reset

**Step 9**

Measure Post Cal Results

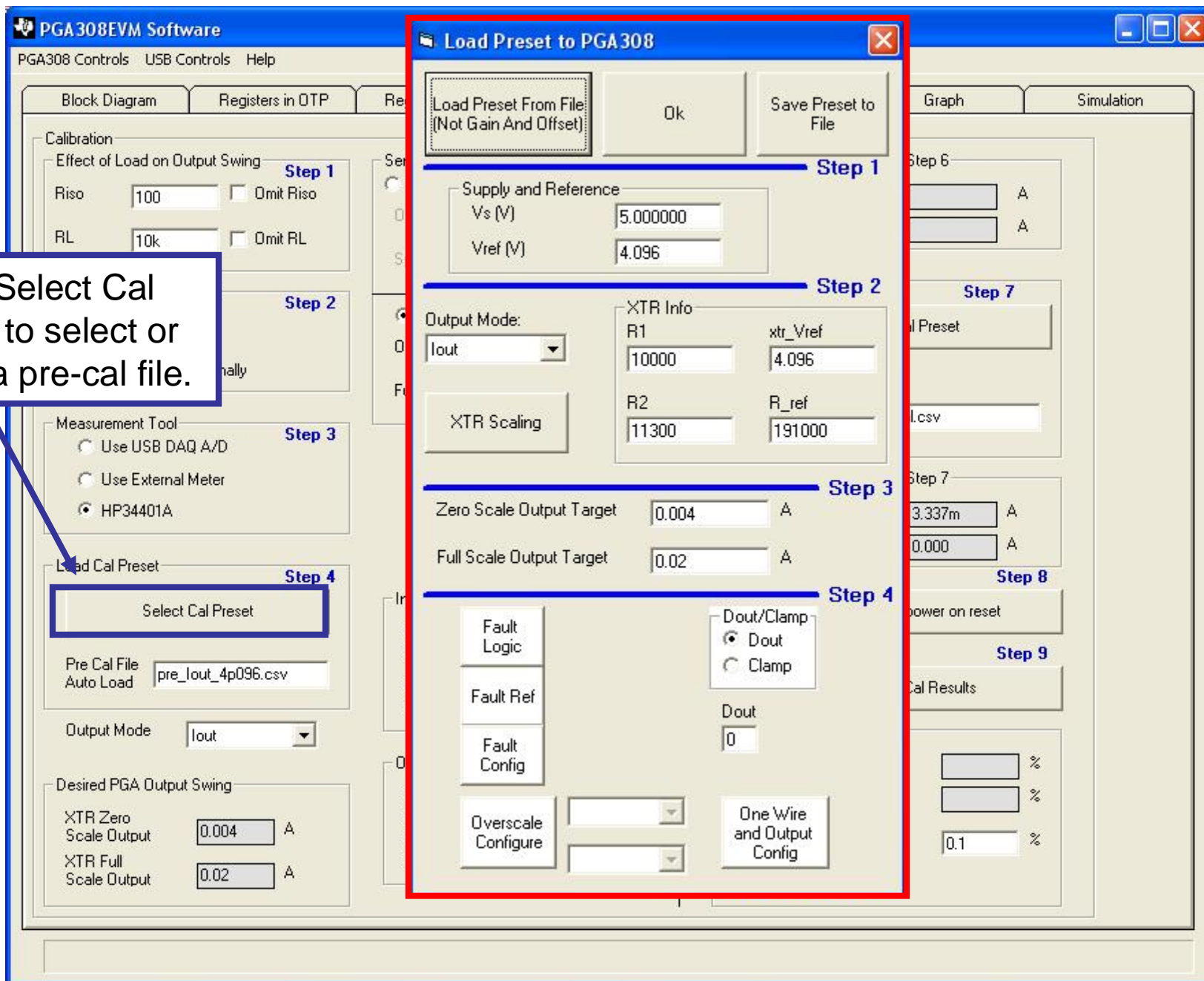
Post Calibration Results

A  %

A  %

Test Limit  %

**Test Result =**



Press "Select Cal Preset" to select or create a pre-cal file.

Pressing “Load Preset from File” will display the settings stored in the file. It will also select this file so that it is used in calibration.

Pressing “Ok” will close the “Load Preset to PGA308 form.

The screenshot shows the 'Load Preset to PGA308' dialog box, which is divided into four steps. Step 1 contains the 'Load Preset From File: (Not Set And Offset)' button, which is highlighted by a blue box and an arrow pointing to it from the first text box. Step 2 contains the 'Supply and Reference' section with 'Vs (V)' set to 5.000000 and 'Vref (V)' set to 4.096, and the 'XTR Info' section with 'R1' set to 10000, 'R2' set to 11300, 'xtr\_Vref' set to 4.096, and 'R\_ref' set to 191000. Step 3 contains the 'Zero Scale Output Target' set to 0.004 A and the 'Full Scale Output Target' set to 0.02 A. Step 4 contains the 'Fault Logic', 'Fault Ref', 'Fault Config', 'Overscale Configure', 'Dout/Clamp' (with 'Dout' selected), 'Dout' set to 0, and 'One Wire and Output Config'. The 'Ok' button is highlighted by a blue box and an arrow pointing to it from the second text box.

Load Preset to PGA308

Load Preset From File: (Not Set And Offset) Ok Save Preset to File

Step 1

Supply and Reference

Vs (V) 5.000000

Vref (V) 4.096

Step 2

Output Mode: Iout

XTR Scaling

XTR Info

R1 10000 xtr\_Vref 4.096

R2 11300 R\_ref 191000

Step 3

Zero Scale Output Target 0.004 A

Full Scale Output Target 0.02 A

Step 4

Fault Logic

Fault Ref

Fault Config

Overscale Configure

Dout/Clamp

☒ Dout

☐ Clamp

Dout 0

One Wire and Output Config

To create a new file edit the settings and press “Save Preset to File”. This will save the results to a file and select the file so that it is used during calibration.

Be careful to edit all the settings to match your hardware setup. Edit them in the order shown; because changes in step 1 affect step 2 and 3.

The screenshot shows the 'Load Preset to PGA308' window with four steps of configuration. Step 1 is 'Load Preset From File: (Not Gain And Offset)' with 'Ok' and 'Save Preset to File' buttons. Step 2 is 'Supply and Reference' with 'Vs (V)' set to 5.000000 and 'Vref (V)' set to 4.096. Step 3 is 'XTR Info' with 'Output Mode' set to 'Iout', 'R1' set to 10000, 'R2' set to 11300, 'xtr\_Vref' set to 4.096, and 'R\_ref' set to 191000. Step 4 is 'Zero Scale Output Target' set to 0.004 A and 'Full Scale Output Target' set to 0.02 A. The bottom section contains 'Fault Logic', 'Fault Ref', 'Fault Config', 'Overscale Configure', 'Dout/Clamp' (radio buttons for 'Dout' and 'Clamp'), 'Dout' (set to 0), and 'One Wire and Output Config'.

**Step 1**

Load Preset From File: (Not Gain And Offset)

Ok Save Preset to File

**Step 2**

Supply and Reference

Vs (V) 5.000000

Vref (V) 4.096

**Step 3**

Output Mode: Iout

XTR Info

R1 10000 xtr\_Vref 4.096

R2 11300 R\_ref 191000

**Step 4**

Zero Scale Output Target 0.004 A

Full Scale Output Target 0.02 A

Fault Logic

Fault Ref

Fault Config

Overscale Configure

Dout/Clamp

☒ Dout

☐ Clamp

Dout 0

One Wire and Output Config

**PGA308EVM Software**

PGA308 Controls USB Controls Help

Block Diagram Registers in OTP Registers in RAM **Calibration** Fast Cal Graph Simulation

**Calibration**

Effect of Load on Output Swing **Step 1**

Riso  ☐ Omit Riso

RL  ☐ Omit RL

Calibration Signal Source **Step 2**

☒ Use DAC Signal

**Step 3**

Sensor Emulator Output **Step 5a**

☐ Normalized Sensor Data

Offset (V/V)

Span (V/V)

☒ Measured Sensor Data **Step 5b**

Offset (V)

Full Scale (V)

**Step 6**

Linear Output Range - After Step 6

Min Linear Output  A

Max Linear Output  A

Load Post Cal **Step 7**

☒ Auto Load Post Cal

Post Cal File

Auto Load

Linear Output Range - After Step 7

Min Linear Output  A

Max Linear Output  A

**Step 8**

**Step 9**

Post Calibration Results

A  %

A  %

Test Limit  %

**Test Result =**

**Load Cal Preset Step 4**

Pre Cal File

Auto Load

Output Mode

Desired PGA Output Swing

XTR Zero Scale Output  A

XTR Full Scale Output  A

Input

Measured Offset

Measured Full Scale

Output

Measured Zero Scale Output

Measured Full Scale Output

This shows the file that will be used during calibration for PGA308 setup.



PGA308EVM Software

PGA308 Controls USB Controls Help

Block Diagram Registers in OTP Registers in RAM **Calibration** Fast Cal Graph Simulation

A "Post Cal" file can be selected also. The post cal file is typically very similar to the "Pre Cal" file. The main difference is over-scale and under scale limits. These should be turned off during calibration and can be turned on after calibration. If you do not need over/under scale limits do not use a post cal file.

Use External Meter  
HP34401A

Calibrate

Load Cal Preset **Step 4**

Select Cal Preset

Pre Cal File Auto Load pre\_lout\_4p096.csv

Output Mode lout

Desired PGA Output Swing

XTR Zero Scale Output 0.004 A

XTR Full Scale Output 0.02 A

Input

Measured Offset

Measured Full Scale

Output

Measured Zero Scale Output

Measured Full Scale Output

Linear Output Range - After Step 6

Min Linear Output

Max Linear Output

Load Post Cal **Step 7**

Select Post Cal Preset

☒ Auto Load Post Cal

Post Cal File Auto Load lout\_post\_cal.csv

Linear Output Range - After Step 7

Min Linear Output 3.337m A

Max Linear Output 0.000 A

**Step 8**

Program into OTP power on reset

**Step 9**

Measure Post Cal Results

Post Calibration Results

Test Limit 0.1 %

**Test Result =**

During engineering development the built in “sensor emulator” can be used instead of a real world sensor.

The screenshot shows a software calibration interface with the following sections and steps highlighted:

- Step 1:** Effect of Load on Output Swing. Includes fields for Riso (100) and RL (10k), with checkboxes for Omit Riso and Omit RL.
- Step 2:** Calibration Signal Source. Includes radio buttons for Use DAC Signal (selected) and Apply Signal Externally.
- Step 3:** Measurement Tool. Includes radio buttons for Use USB DAQ A/D, Use External Meter, and HP34401A (selected).
- Step 4:** Load Cal Preset. Includes a Select Cal Preset button, Pre Cal File (pre\_vout\_pre\_2p5.csv), Auto Load checkbox, and Output Mode (Vout).
- Step 5a:** Sensor Emulator Output. Includes radio buttons for Normalized Sensor Data and Measured Sensor Data (selected). Fields for Offset (V/V) and Span (V/V) are present.
- Step 5b:** Measured Sensor Data. Includes fields for Offset (V) (2m) and Full Scale (V) (-33m).
- Step 6:** A Calibrate button.
- Step 7:** Load Post Cal. Includes a Select Post Cal Preset button, Auto Load Post Cal checkbox, and Post Cal File (No Post Cal File).
- Step 8:** Linear Output Range - After Step 7. Includes fields for Min Linear Output and Max Linear Output.
- Step 9:** Measure Post Cal Results. Includes a button to measure post-cal results.
- Post Calibration Results:** A table showing results for 0.5 V and 4.5 V outputs, with a Test Limit of 0.1%.
- Pass Test:** A green message indicating the calibration was successful.

Output (V)	Measured Zero Scale Output	Measured Full Scale Output	Test Limit (%)
0.5	-1.969m	32.71m	-0.002
4.5	.5	4.5001	0.003

When testing a real sensor module use the “apply signal externally option. Note that step 5 is disabled because this step is only used with the “sensor emulator”.

The screenshot shows a calibration software interface with several sections and steps. Annotations include a callout box with instructions and blue arrows pointing to specific controls.

**Annotations:**

- A callout box states: "When testing a real sensor module use the “apply signal externally option. Note that step 5 is disabled because this step is only used with the “sensor emulator”."
- An arrow points from the callout box to the "Apply Signal Externally" radio button in the "Calibration Signal Source" section.
- Another arrow points from the callout box to the "Measured Sensor Data" section, which is labeled "Step 5b".

**Interface Sections:**

- RL:** 10k, Omit RL
- Calibration Signal Source:** ☐ Use DAC Signal, ☒ Apply Signal Externally
- Measurement Tool:** ☐ Use USB DAQ A/D, ☐ Use External Meter, ☒ HP34401A
- Load Cal Preset:** Select Cal Preset, Pre Cal File Auto Load: pre\_vout\_pre\_2p5.csv
- Output Mode:** Vout
- Desired PGA Output Swing:** PGA Zero Scale Output: 0.5 V, PGA Full Scale Output: 4.5 V
- Offset (V/V):** [Empty], **Span (V/V):** [Empty]
- Measured Sensor Data (Step 5b):** ☒ Measured Sensor Data, Offset (V): 2m, Full Scale (V): -33m
- Calibrate:** [Button]
- Input:** Measured Offset: -1.969m, Measured Full Scale: 32.71m
- Output:** Measured Zero Scale Output: .5, Measured Full Scale Output: 4.5001
- Fast Cal:** Linear Output Range - After Step 6: Min Linear Output: 90.12m V, Max Linear Output: 4.851 V
- Graph:** [Empty]
- Simulation:** Load Post Cal: Select Post Cal Preset, ☐ Auto Load Post Cal, Post Cal File Auto Load: No Post Cal File
- Linear Output Range - After Step 7:** Min Linear Output: [Empty] V, Max Linear Output: [Empty] V
- Program into OTP power on reset:** [Button]
- Measure Post Cal Results:** [Button]
- Post Calibration Results:** 0.5 V: -0.002 %, 4.5 V: 0.003 %, Test Limit: 0.1 %
- Pass Test:** [Green Text]



PGA308EVM Software

PGA308 Controls USB Controls Help

Block Diagram Registers in OTP Registers in RAM **Calibration** Fast Cal Graph Simulation

Once all the options have been set up in the “Calibration” tab, only three buttons need to be used to run the calibration. All the settings will be saved when the software is closed. Also, these three buttons are copied on the “Fast Cal” tab. The “Fast Cal” tab is a convenient way of running calibrations without having to view all of the other calibration controls. “Fast Cal” simplifies calibration to the essential elements.

Measurement Tool **Step 3**

- ☐ Use USB DAQ A/D
- ☐ Use External Meter
- ☒ HP34401A

Load Cal Preset **Step 4**

Select Cal Preset

Pre Cal File Auto Load pre\_vout\_pre\_2p5.csv

Output Mode Vout

Desired PGA Output Swing

PGA Zero Scale Output 0.5 V

PGA Full Scale Output 4.5 V

**Step 6**

Calibrate

Input

Measured Offset -1.969m

Measured Full Scale 32.71m

Output

Measured Zero Scale Output .5

Measured Full Scale Output 4.5001

Post Cal File Auto Load No Post Cal File

Linear Output Range - After Step 7

Min Linear Output V

Max Linear Output V

**Step 8**

Program into OTP power on reset

**Step 9**

Measure Post Cal Results

Post Calibration Results

0.5 V	-0.002 %
4.5 V	0.003 %
Test Limit	0.1 %

**Pass Test**

This shows the “Fast Cal” tab. The “Calibrate”, “Program OTP” and “Test” buttons were simply copies of step 6, step 8, and step 9 from the calibrate tab.

**Calibrate:** This does the full calibration. After it is pressed the software will prompt the user to change pressure. The software will take readings and adjust the gain to achieve the “Desired PGA Output Swing”

**Prog OTP:** This will store the calibration results into POR (Power On Reset) OTP (One Time Programmable) memory. This step can be repeated four times.

**Test:** This will measure the post calibration output calculate the error and compare to the user selected “test limit”. The test limit is entered at the bottom of the “Calibration” tab.

Below is a picture that shows the results for a good sensor module; all three steps passed.

PGA30

Block Diagram   Registers in OTP   Registers in RAM   Calibration   Simulation   Graph   **Fast Cal**

Calibrate

Calibrate **Pass Cal**

Sensor Output

Measure Offset 776.2u

Measured Full Scale 32.63m

Output

Measured Zero Scale 4.000m

Measured Full Scale 20.00m

Program OTP

Program OTP **Pass OTP**

Test Post Cal Error

Test Post Cal Error **Pass Test**

Test Results

Zero Scale Output 4.000m 0.001

Full Scale Output 20.00m -0.003

