TIDA-00149

Automotive Capacitive Pressure Sensor Interface - Test Data

This document shares the tests results of the PGA400-Q1 EVM using varying capacitors as inputs. The output will be very linear since the test procedure utilizes varying capacitors (and not a true sense element). Therefore, linearization firmware is not necessary and the data is extracted after the ADC.

The data is structured into two main categories:

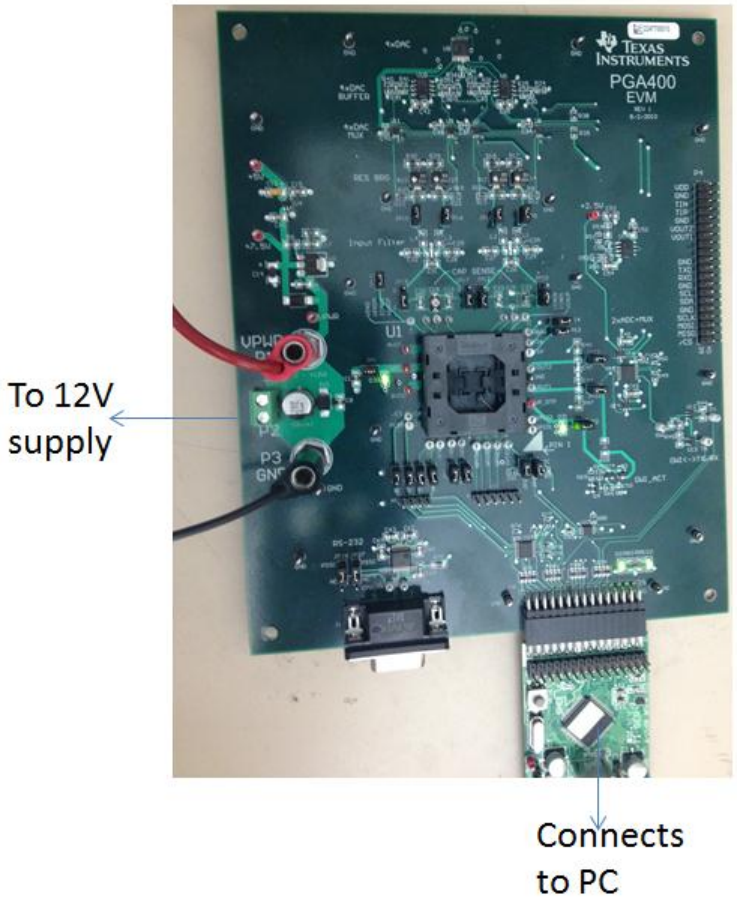
1. Test set up
2.
    a. PGA400-Q1 EVM GUI Settings
    b. PGA400-Q1 EVM GUI Procedure
3. PGA400-Q1 EVM ADC results

Equipment used to create this data:

1. 12V power supply
2. PGA400-Q1 EVM GUI installed on PC
3. PGA400-Q1 EVM + board that interfaces with PC (TI-ger board)
4. Varying capacitors (4.7pF – 50pF)

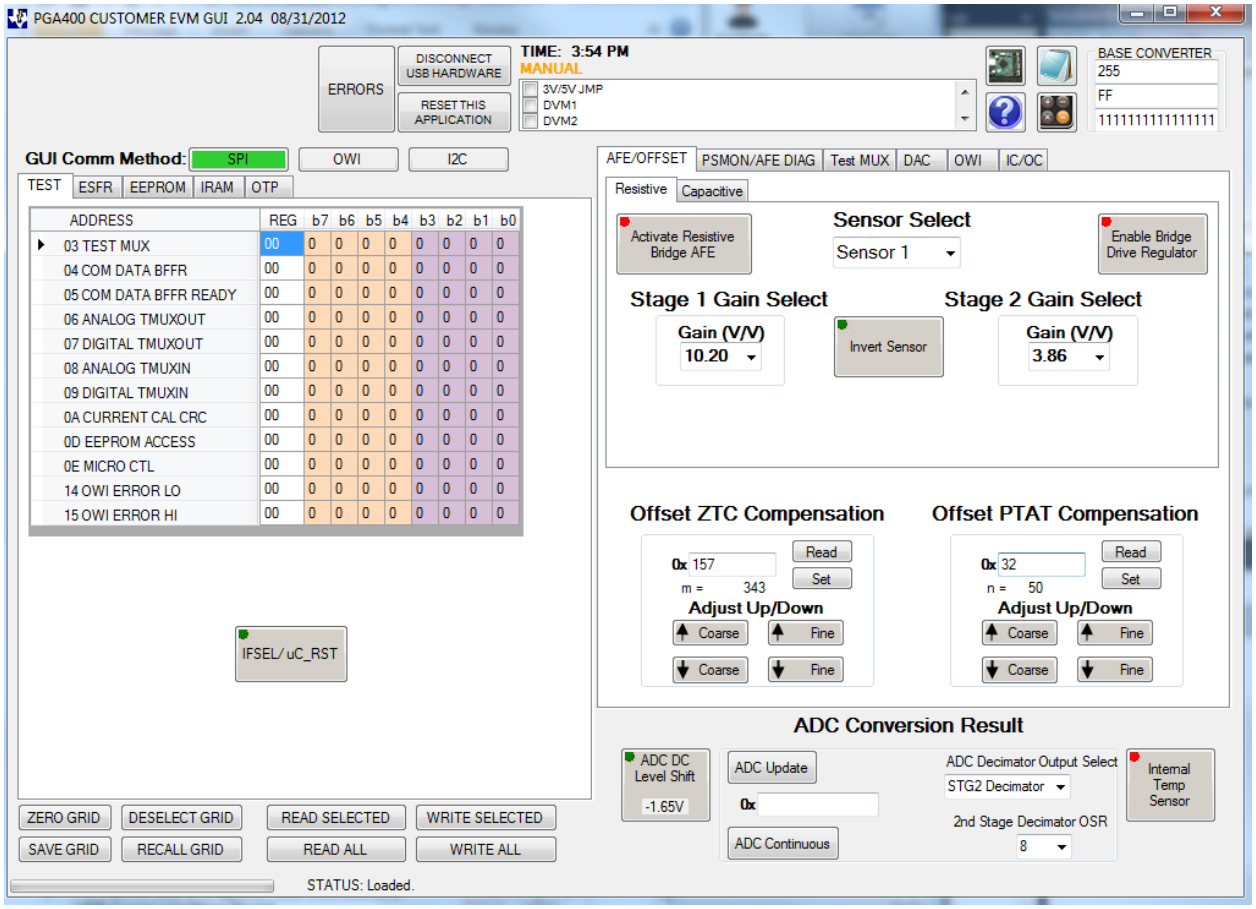
Section 1: Test set up

- Before the system is powered up, please make sure all hardware is configured properly. Check that all jumpers and headers are connected appropriately. For a detailed description of configurations, see EVM user's guide.
- To power the board:
  - The PGA400-Q1 EVM is shipped with a TI-ger USB communication board that provides a link from the PC controlled GUI to the EVM. Connect the TI-ger board to the PGA400-Q1 EVM.
  - Connect 12V from a power supply to the EVM. The 12V bucks down to 5V to power the PGA400-Q1.
  - Connect the TIger board to the PC. See figure.

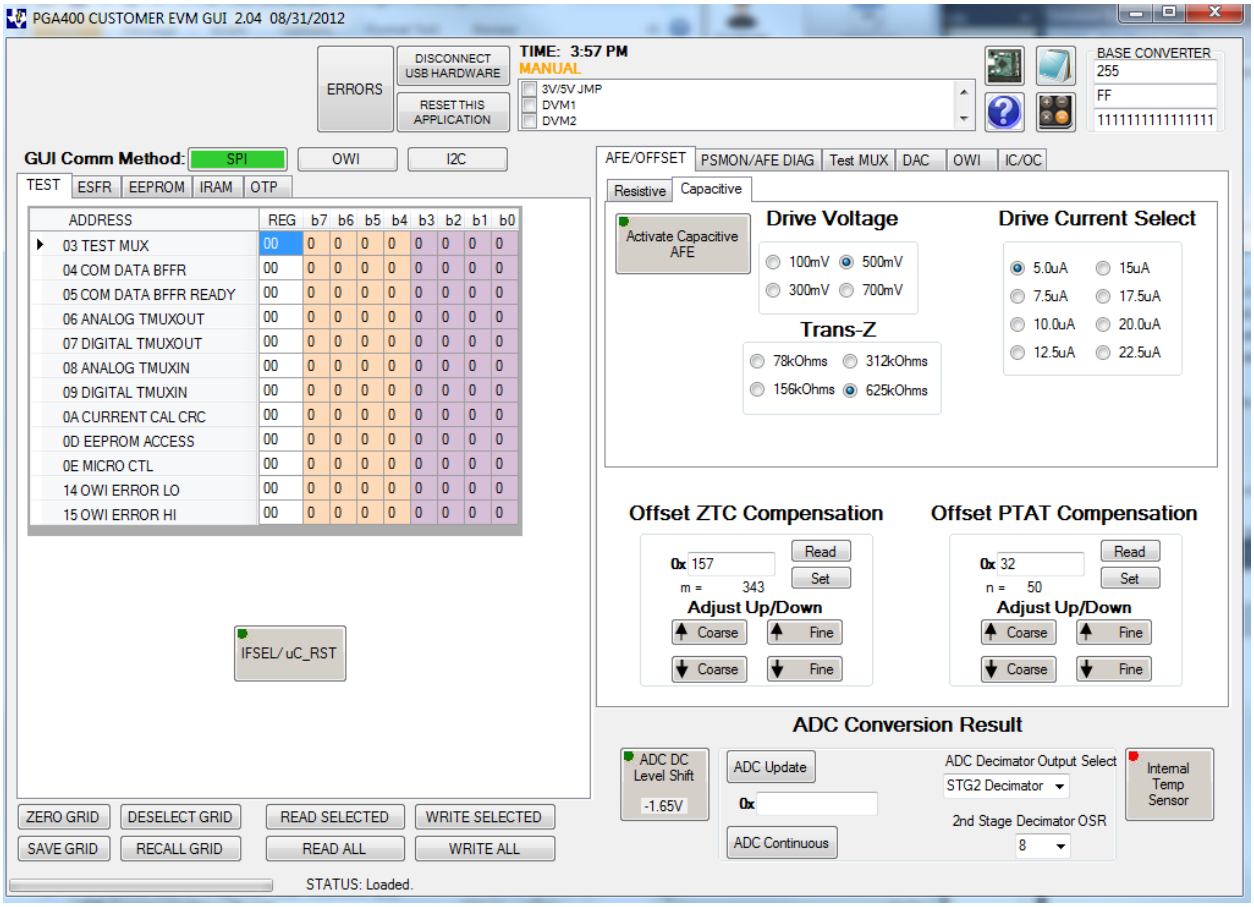


Section 2a: PGA400-Q1 EVM GUI settings

- To re-create the data, open up the EVM GUI and enter the following settings. Notice this is under the “Resistive” tab. :



- To re-create the data, open up the EVM GUI and enter the following settings. Notice this is under the “Capacitive” tab. :



Section 2b: PGA400-Q1 EVM GUI Procedure

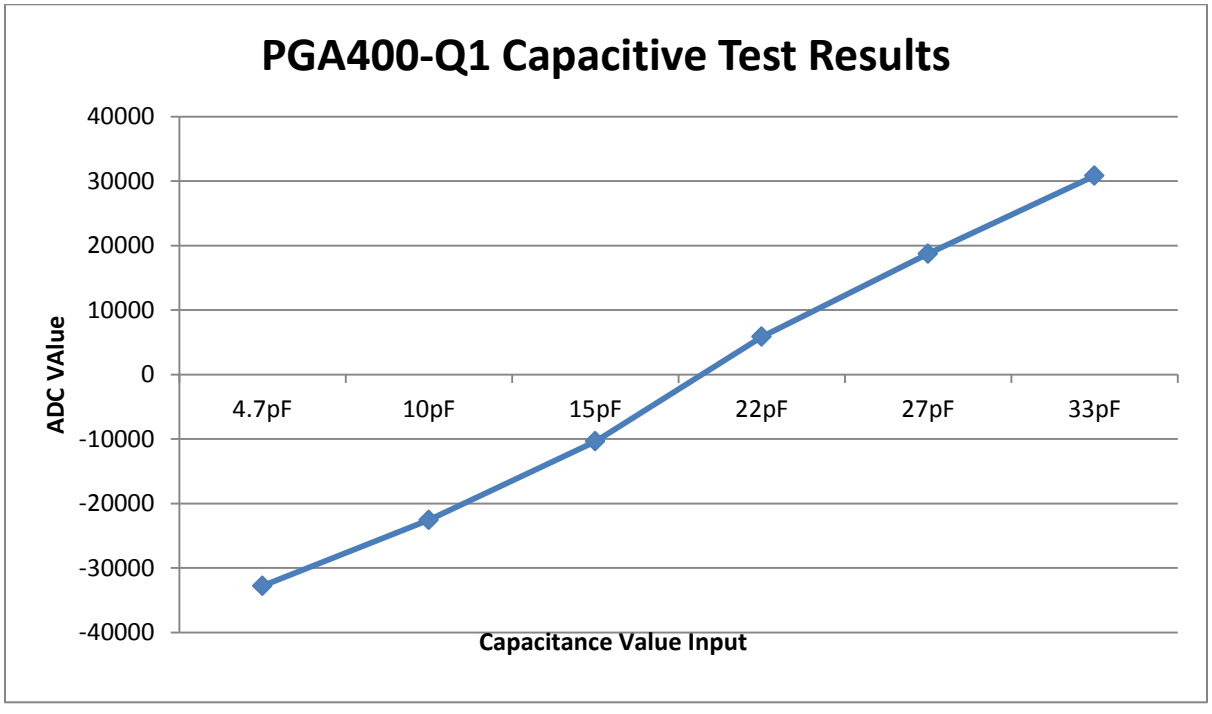
- Put in reset to do SPI communication. That is found under the “Test” tab, then click “If Select/UC_RST”. When the PGA400's MCU is in reset, SPI can be used to write to the registers that control the MUXes, gains, and offsets of the AFE.
- Put in settings as shown in the figures in section 2a under the “AFE/OFFSET” tab.
    - Note: Fields under the “resistive” and “capacitive” tabs are not exclusive to just resistive or just capacitive measurements. The information under both tabs are relevant in both cases.)
    - Note: Many buttons need to be toggled to be enabled. The input does not re-enable itself each time the input is changed and must be re-enabled again each time.
    - Under Sensor Select, select “Sensor 1”
    - Stage 1 gain: 10.20
    - Stage 2 gain: 3.86
    - Toggle “Invert Sensor” (to disable, then enable)
    - Toggle “Enable Bridge Drive Regulator” (to disable, then enable)
    - Under Sensor Select, select “Sensor 2”. Repeat steps for “Sensor 2”.
    - ZTC: 157 (hit “set” to program value, then “read” to verify and read back value)
    - PTAT: 32 (hit “set” to program value, then “read” to verify and read back value)
    - Drive voltage: 500mV
    - Drive current: 5uA
    - Trans-Z (transimpedance amp): 625kohms
    - Toggle “Active Capacitance AFE” to activate capacitance AFE
    - Toggle “ADC DC Level Shift” (to disable, then enable)
    - Note: These values are reflected in the grid to the left. The values can be saved by saving the grid.
    - Press “ADC Update” to read back the ADC value. Theoretically, as the input capacitance changes, so should the ADC value.

Section 3: PGA400-Q1 EVM ADC results

Below are the test results. As expected, the ADC value increases as the capacitance increases. The output is very linear. If the input were a true capacitive sense element, the pressure vs. capacitance would not be linear.

With these particular GUI settings, the 4.7pF saturates the ADC. If the GUI settings are tweaked, the saturation can be prevented.

Var cap	ADC value
4.7pF	-32768
10pF	-22542
15pF	-10371
22pF	5844
27pF	18725
33pF	30811



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