HVPFC GUI Overview

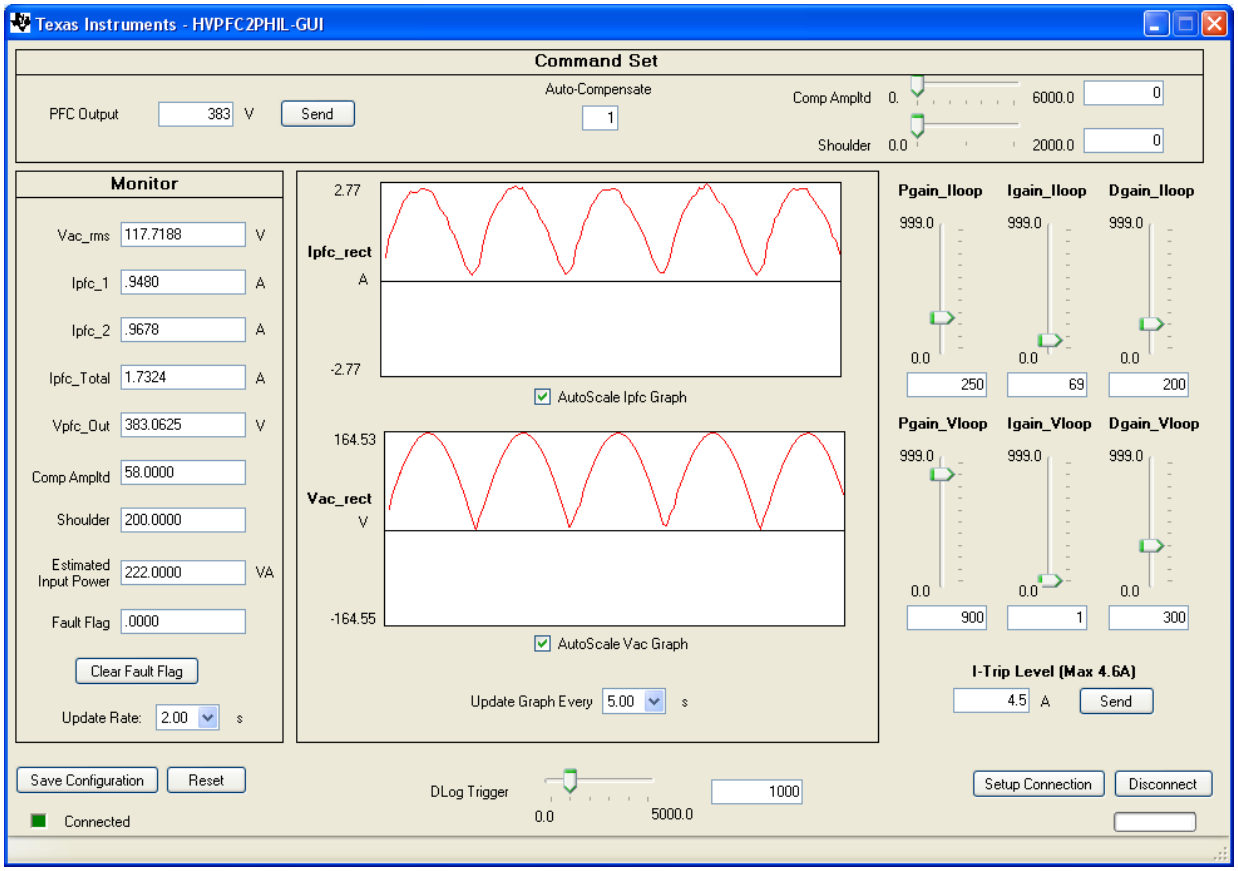
June 2010

The HVPFC GUI provides a convenient way to evaluate the functionality of the HVPFC development Kit and the TMS320F28027 device without having to learn and configure the underlying project software. The GUI is written in C# using Microsoft Visual Studio .NET with the source code located at:

`..\controlSUITE\development_kits\HVPFC2PhiL\~GUI\~Source\`

The HVPFC GUI features:

- Interactive interface using sliders, buttons, textboxes and graphs to easily control/demo the HVPFC system
- GUI variables directly tied to framework variables, allowing simplified software development
- Ability to save connection settings and startup configuration.



Getting Started

Setting up the Hardware

Warning

There are high voltages present on the board. It should only be handled by experienced power supply professionals in a lab environment. To safely evaluate this board an isolation transformer should be connected between the AC source and the unit. Before AC power is applied to the board a voltmeter and an appropriate resistive or electronic load must be attached to the output. The unit should never be handled when the power is applied to it or when the output voltage is greater than 50V. There is no overvoltage protection implemented on the board and therefore zero load or very low load operation is highly discouraged.

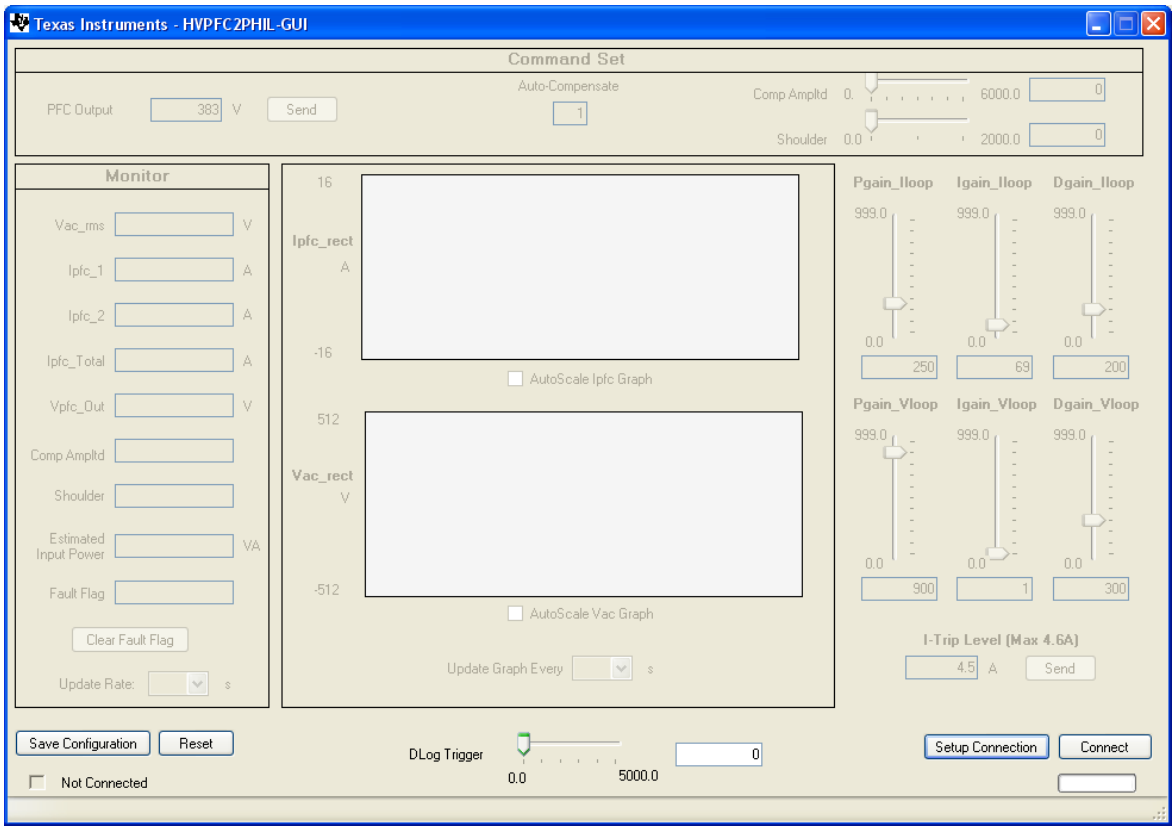
Connect USB connector to the Piccolo controller card for emulation. Power up the 14 V bias supply at J2. By default, resistors R6 and R7 on the Piccolo Macro of the control card are removed to enable – boot from FLASH. Re-populate these resistors if running and programming RAM or programming FLASH. It is recommended to use an appropriate isolated AC power supply set to output between 110Vac to 230Vac to power the AC input. Apply an appropriate resistive load to the PFC system at the DC output. Resistive loads above 80W and below 300W are recommended. Do not turn on the AC power at this time.

Running the Application

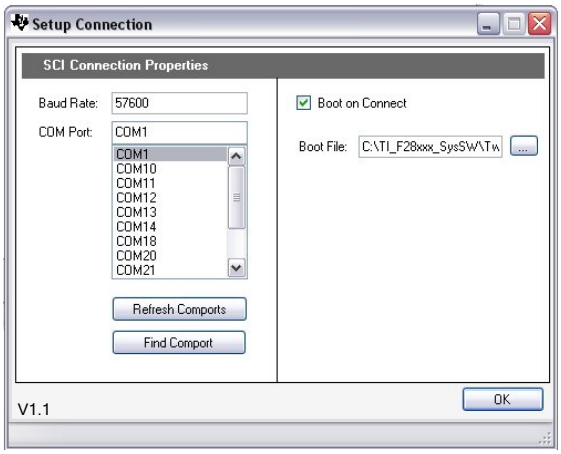
By default the hardware is configured to boot from a pre-Flashed code. The GUI only works with the F2802x_FLASH configuration in the corresponding CCS project.

Note that the General Purpose GUI requires Microsoft .NET framework 2.0 or higher to run. Please ensure that this software is installed prior to running this program.

1) Browse to `..\controlSUITE\development_kits\HVPFC2PhiL\~GUI` and double-click on HVPFC2PHIL-GUI.exe.



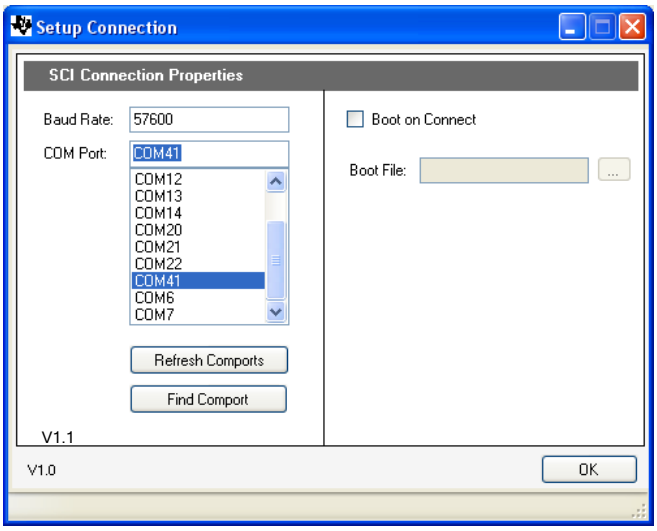
2) Click “Setup Connection” on the GUI



3) Ensure the Baud Rate is set to 57600.
4) Next you will need to select your serial comport.
   a. If the comport that the target is connected to is known please select it.
   b. Use the “Find Comport” tool to find the serial port connection that is connected to the EVM board.
      1. Disconnect the emulator from the target board.
      2. Ensure that the target F2802x MCU is pre-flashed.
      3. Click “Find Comport” then follow the instructions shown at the bottom of the window. This will run through a short automated test to find the COM port that is connected to the EVM board.

4. Once complete you should see “Comport Found: COMXX” appear near the bottom of the window. If the GUI is unable to find a valid comport after fixing/checking all errors received then retrying this process try to find the proper comport using option c.

c. Manually find the comport by going to:
Control Panel->System->Hardware tab->Device Manager->Ports(COM & LPT).
If using a serial port directly connected to a PC, look for a comport which shows up as “Communications Port” and select this comport in the Setup Connection window. If using a USB to Serial adapter look for the com port which shows “USB-to-Serial Bridge”, then select this comport in the Setup Connection window.



5) Ensure “Boot on Connect” is unchecked.
6) Click “OK”
7) On the Main Window click “Connect”. The GUI should now connect to the target and be ready for use.

Reference Guide

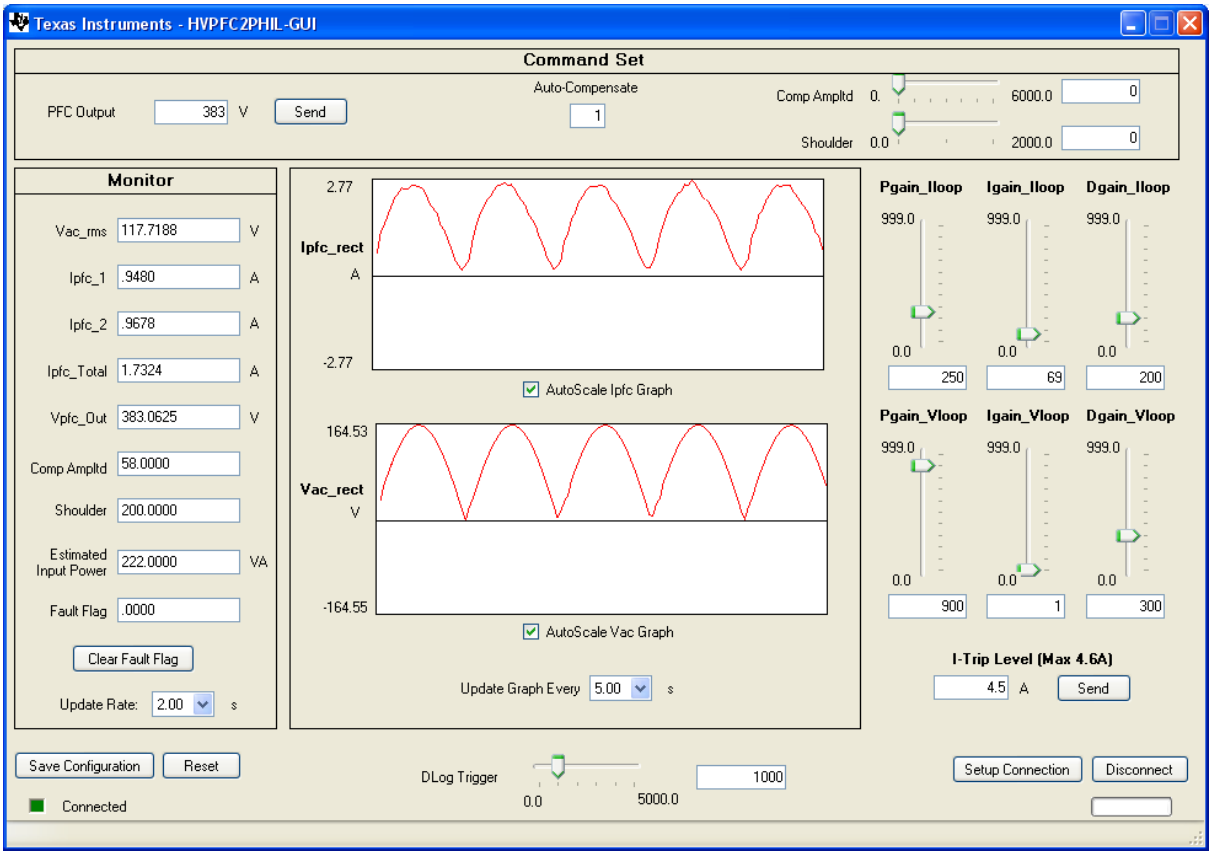
- *Save Configuration* – saves the current values of all settable attributes. The next time the application runs these settings will be used as the default settings.
- *Reset* – reloads the application with the last saved configuration.
- *Setup Connection* – opens a new window which contains the serial port and boot settings.
- *Connect/Disconnect* – begins serial port communication with the target board.

GUI Structure

- *Command Set* – section allows the user to set the PFC output voltage via a text box. Notice the text box for variable *auto_compensate*. When this parameter is set to 1 (default) the algorithm calculates the *CompAmpltd* and *shoulder* values on its own depending on the line-load conditions. A value of 0 for *auto_compensate* lets the user set the *CompAmpltd* and *shoulder* values using the *CompAmpltd* and *shoulder* slider in the *Command Set* section of the GUI. This provides for an easy means to experiment with/without this compensation mechanism. Please refer to section 3.2 of the *HVPFC2PHIL.pdf* document for a detailed explanation of *CompAmpltd* and *Shoulder* parameters.
- *Monitor* – section displays various system parameter values being monitored. These include the input AC RMS voltage, the two instantaneous PFC phase currents, the instantaneous total

PFC input current, the PFC output voltage, the estimated input power, the *shoulder* and *CompAmpltd* values and the fault status flag.

- In case of a fault condition or if the *"Fault Flag"* is set, after making sure that the fault condition (Over voltage/Over current) doesn't exist anymore you may reset this flag using the "*Clear Fault Flag*" push button.
- *Update Rate* – changes the rate at which the GUI updates the parameters in the Monitor section.
- *Two graph windows* – plot the input voltage and current waveforms making it easy to visualize the PFC action.
- *Update Graph Every* – changes the rate at which the GUI updates the two graph windows.
- *AutoScale* – lets you auto-scale the two graphs individually.
- *Loop Tuning* – The Pgain_Iloop, Igain_Iloop and Dgain_Iloop allow for the P, I and D coefficients for the current loop to be adjusted from the GUI environment on-the-fly. Similarly, the Pgain_Vloop, Igain_Vloop and Dgain_Vloop allow for the P, I and D coefficients for the voltage loop to be adjusted from the GUI environment on-the-fly. Acceptable range for these parameters is 0 – 999.
- *I-Trip Level* – This value sets the two DAC references feeding the on-chip comparators. This will trip the two PFC PWMs when either of the instantaneous phase currents hits this set value.



Using the GUI

- Once the hardware is set-up correctly and the application is running with the GUI connected, turn On the AC input with the AC voltage set between 110Vac to 240Vac.
- The PFC output should ramp according to the slew rate to the desired set value (~385Vdc). The power factor correction should be maintained during this process. You may have to adjust the "*DLog Trigger*" slider on the GUI for the graphical display.
- Observe the effect of varying the input voltage on the output voltage and input current. There should be virtually no effect on the output voltage. Also the power factor correction should be maintained.
- Similarly observe the effect of varying the load. Again there should be virtually no effect on the output voltage and the power factor correction should be maintained.
- When turning off, make sure that you turn off the AC power first wait a few minutes and then disconnect the GUI and turn-off the 14V bias supply.

References

For more information please refer to the following guides:

- **HVPFC2PHIL-GUI-QSG** – gives an overview on how to quickly demo the HVPFC project using an intuitive GUI interface.

  ..\controlSUITE\development_kits\HVPFC2PhiL \~Docs\HVPFC2PHIL-GUI-QSG.pdf

- **HVPFC2PHIL –** provides detailed information on the PFC2PHIL project within an easy to use lab-style format.

  ..\controlSUITE\development_kits\HVPFC2PhiL\~Docs\HVPFC2PHIL.pdf

- **HVPFC2PHIL-Calculations** – a spreadsheet showing a few of the key calculations made within the PFC2PHIL project.

  ..\controlSUITE\development_kits\HVPFC2PhiL\HVPFC2PHIL-Calculations.xls

- **HVPFC2PHIL_Rel-1.0-HWdevPkg** – a folder containing various files related to the Piccolo-A controller card schematics.

  ..\controlSUITE\development_kits\HVPFC2PhiL\HVPFC2PhiL_HWDevPkg

- **UCC28070EVM power board** related useful files found at http://focus.ti.com/docs/toolsw/folders/print/ucc28070evm.html –
  - HPA225A - Gerber files for the EVM mother board
  - User Guide - UCC28070, 300-W Interleaved PFC Pre-Regulator (Rev. B)

- **F28xxx User's Guides**
  http://www.ti.com/f28xuserguides