BLPFC GUI Overview

April 2012

The BLPFC GUI provides a simple interface to evaluate some of the functionalities of the BLPFC EVM Kit. The GUI is written in C# using Microsoft Visual Studio .NET with the source code located at:

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

The BLPFC GUI features:

- Monitor and/or control some of the BL PFC EVM parameters such as, DC bus voltage Vbus, RMS ac input voltage Vrms and the frequency of the AC input voltage.
- Allows user to change the voltage and current loop control parameters for on-line tuning of the control loops.
- Ability to setup startup configuration.

Getting Started

Setting up the Hardware

> **Caution**
>
> There are high voltages present on the BLPFC board. It should only be handled by experienced power supply professionals in a lab environment. To safely evaluate this board **an isolated AC source should be used** to power up the unit. Before AC power is applied to the board a voltmeter and an **appropriate resistive load (only)** should be attached to the output. This will discharge the bus capacitor quickly when the AC power is turned off. The board has not been tested with electronic load and so it should not be used with such load. There is **no output overcurrent protection** implemented on the board and so the user should take appropriate measures for preventing any output short circuit condition. **The BLPFC board should always be started with 110Vac (60Hz)**. Once the board is up and running the input voltage can be changed to any other voltage within the specification.

Connect USB connector to the Piccolo (CC2803x) controller card for emulation. Use an external +12Vdc supply at JP1 to power up all the control circuit for now. By default, Piccolo controller is enabled to boot from FLASH and run the BLPFC code. The user should not use the RAM to program or run the BLPFC code. Turn on the switch SW1 by placing it towards the electrolytic caps (C5, C6 and C7). This will apply the external +12V supply to the BL PFC board.

Use an appropriate isolated AC power supply (100Vac to 250Vac, 47Hz~63Hz, 350W min) to provide input power to the BLPFC EVM. Connect the ac supply to the BLPFC EVM but **do not turn on the AC power at this time.** Connect an appropriate resistive load (only) to the BLPFC DC output terminals (PFC-Out & GND terminals). Resistive loads within the range of 10W ~ 300W are recommended. Do not use electronic load with this board.

Running the Application

By default the hardware is configured to boot from a pre-Flashed code. The GUI only works with the F2803x_FLASH configuration in the corresponding CCS project.
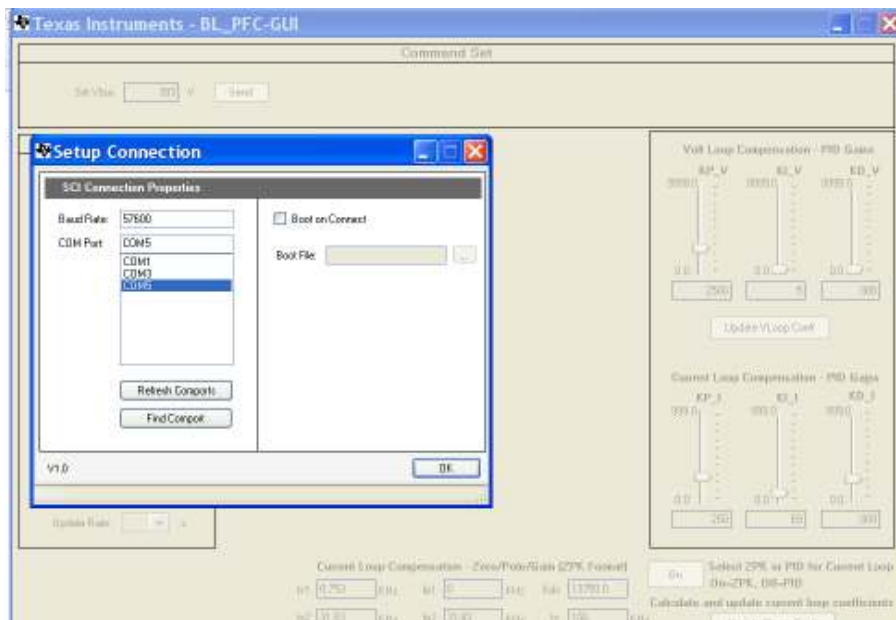
Note that the General Purpose GUI requires Microsoft .NET framework 2.0 or higher to run. Please ensure that this software is installed prior to running this program.

1) Browse to `..\controlSUITE\development_kits\BLPFC\~GUI` and double-click on BLPFC-GUI.exe. The following figure shows a screen shot for the BLPFC GUI.
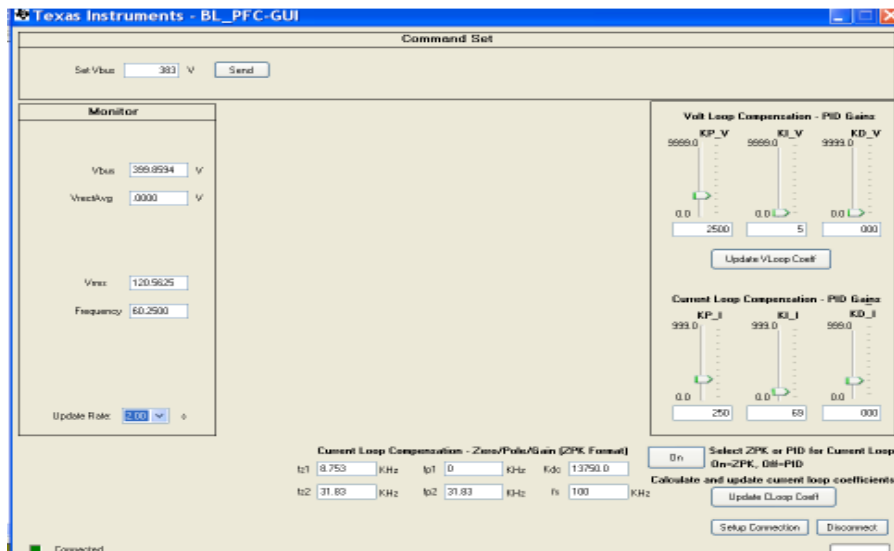

2) Click "Setup Connection" on the GUI

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. Otherwise use the "Find Comport" tool to find the serial port connection that is connected to the EVM board.
      1. Ensure that the target F2803x MCU is setup to boot from a pre-Flashed code (see related control card documentation for setting up boot up configuration)
      2. 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.
      3. Following the test 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 retry this process 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.
5) Ensure "Boot on Connect" is unchecked.
7)6) Click "OK"
9)7) On the Main Window click "Connect". The GUI should now connect to the target and be ready for use.
8) Select the parameter update rate as shown below:

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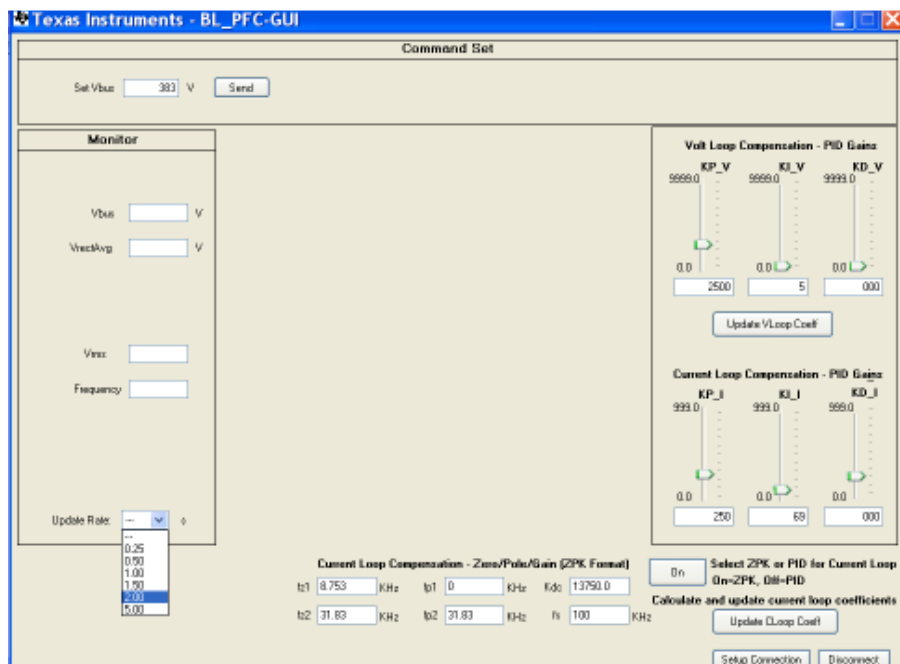
GUI Structure

- *Command Set* – section allows the user to set the PFC output voltage via a text box **Set Vbus**.
- *Monitor* – section displays various system parameter values. These include, the input AC RMS voltage, the average value of the input AC rectified voltage, the input AC line frequency and the PFC output voltage.
- *Update Rate* – changes the rate at which the GUI updates the parameters in the Monitor section.
- *Loop Tuning* – The PID gains for the current and voltage loop can be adjusted from the GUI environment while the PFC is running. However, the user needs to be careful in changing the controller gains appropriately. Incorrect gain values may result in unstable PFC operation. Acceptable range for the PID gain parameters are 0 ~ 9999 for the voltage loop, and 0 ~ 999 for the current loop. The current loop compensation can also be adjusted by using the controller in Pole/Zero/Gain format (ZPK format). To use this feature click on the button labeled as "Select ZPK or PID for Current Loop". If this button is ON then ZPK format can be used. If this button is OFF then PID format will be activated.

- *Setup Connection* – opens a new window which contains the serial port and boot settings.

- *Connect/Disconnect* – begins serial port communication with the target board.

Using the GUI

- Once the hardware is set-up correctly and the application program (pre-flashed code) is tested to run with the GUI, then close the GUI, turn OFF the switch SW1 and disconnect the external +12Vdc supply.

- Verify that the jumper at J8 is connected so that isolated bias supply (small bias supply board mounted at location M2 close to the PFC output capacitors C5, C6 and C16) can now provide the +12Vdc output when the AC power is turned on.
- Now turn on the AC power with voltage set around 110Vac.
- The PFC output should ramp according to the slew rate to the desired set value (~400Vdc).
- Verify the effect on the dc bus voltage and on the input power factor when the input voltage (100Vrms ~ 240Vrms) or the load power (0~300W) is varied. The dc bus should be regulated at 400V under all conditions. Depending on the load and line conditions, the power factor for the input current will vary from 0.94 to 0.999.
- Bring up the BLPFC GUI (as described before) and monitor the PFC parameters. Change the DC bus voltage from the GUI (400V ~ 350V). The DC bus voltage should be set close to 400V when high line input voltage (220Vrms ~ 240Vrms) is applied.
- When turning off ac power, ensure that the AC power is turned off first. Then wait for a few minutes before disconnecting the GUI.

References

For more information please refer to the following guides:

- **BLPFC User Guide –** provides detailed information on the BLPFC project within an easy to use lab-style format.

  ..\controlSUITE\development_kits\BLPFC\~Docs\BLPFC.pdf

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

  ..\controlSUITE\development_kits\BLPFC\BLPFC_HWDevPkg

- **F28xxx User's Guides**

  http://www.ti.com/f28xuserguides