HV Solar MPPT DC-DC GUI Overview

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

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

The HV SOLAR DC-DC GUI features:

- Allows user to start the DC-DC stage without the DC-AC Inverter connected to it.
- Monitor some of the EVM parameters such as, boost stage DC bus voltage, panel voltage, panel current and panel power.
- Allows user to monitor the operating mode or status of the DC-DC stage.
- Ability to restart DC-DC once the fault condition has been cleared.

Getting Started

Setting up the Hardware

Caution

There are high voltages present on the HV SOLAR DC-DC EVM. It should only be handled by experienced power supply professionals in a lab environment. Prior to applying a solar panel emulator output to this board (DC-DC EVM), a voltmeter and an appropriate resistive load should be connected across the EVM output only if it is not used to power a downstream DC-AC Inverter. If the DC-AC Inverter is connected to the DC-DC EVM output then an appropriate resistive load must be connected across the Inverter output (see the Solar System QSG for detail). This will prevent overvoltage condition at the DC-DC and DC-AC EVM outputs and also discharge the DC-DC bus capacitor quickly when the panel emulator power is turned off. Also, there is no output overcurrent protection implemented on this board(DC-DC EVM) and so the user should take appropriate measures for preventing any output short circuit condition.

Table 1 lists the jumper and switch configuration needed to power on C2000 HV SOLAR DC-DC EVM. Before applying any DC power, make sure these jumpers and switches are installed properly.

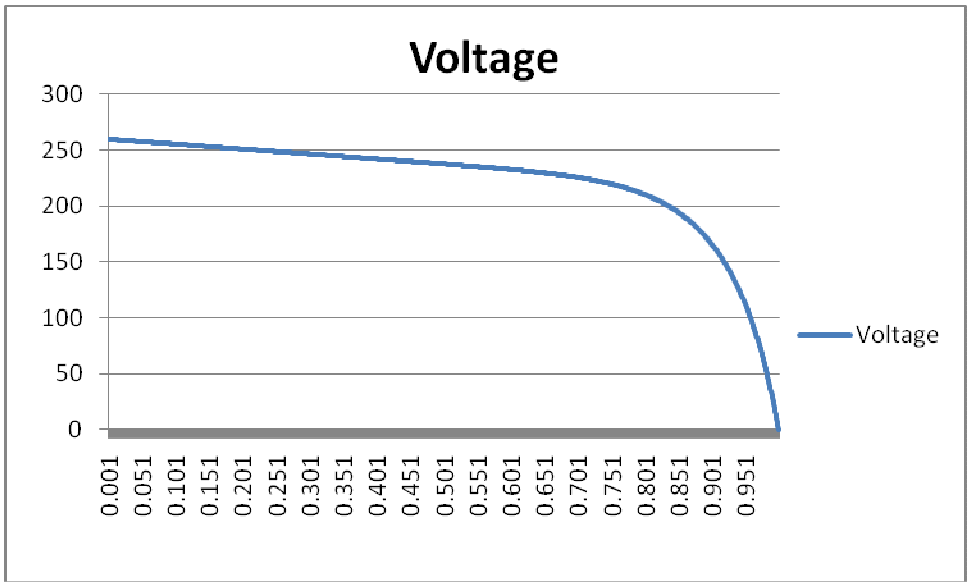
Table 1. List of installed jumpers and switches on C2000 HV SOLAR DC-DC EVM

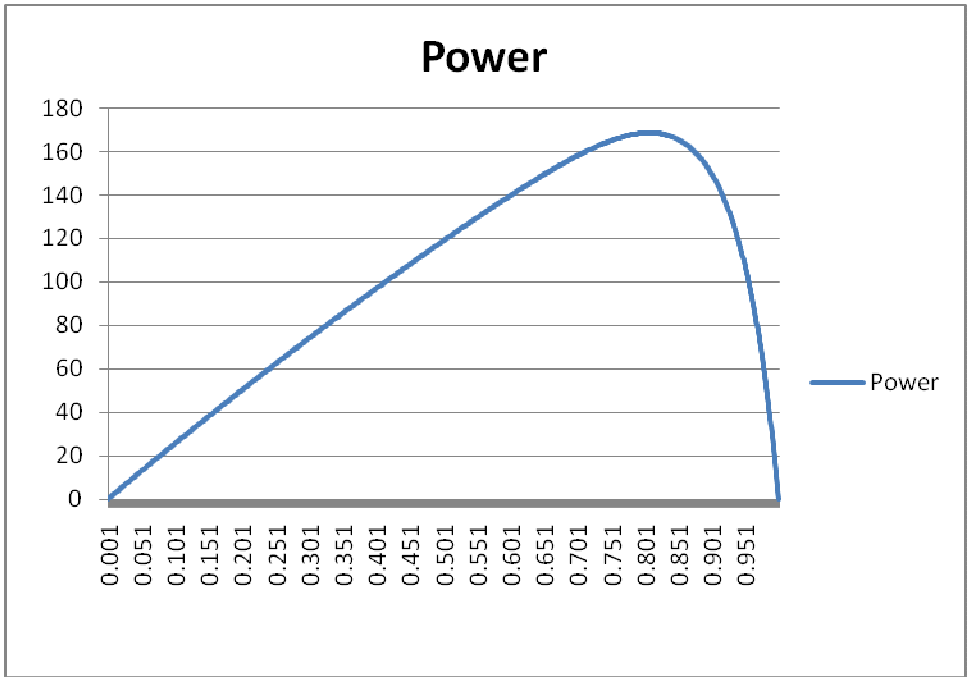
Jumper/Switch No.	Jumper/Switch Connection	Comments
J1, J2, J3, J4, J5 & J7	Pin 1-2	Jumpers located on Main board of HV Solar DC-DC EVM
SW1	Switch position away from the side labeled ***Ext***.	Switch SW1 located on M3 macro (DC-PwrEntry1Sw)

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 HV SOLAR DC-DC code. The user should not use the RAM to program or run the HV SOLAR DC-DC code. Turn on the switch SW1(in section or macro M3) by placing it towards the electrolytic caps (C5, C6 and C7 located in M3). This will apply the external +12Vdc supply to the EVM.

Use a solar panel emulator (200V to 300V, 500W max) to provide input power to the EVM. Configure the panel emulator to emulate the following solar panel characteristics, connect it to the EVM input but **do not turn on panel power at this time.**

Example Panel Emulator Parameters		
Voc	Open circuit panel voltage	**260V**
Vmpp	Panel voltage for max power point tracking (MPPT)	**220V**
Impp	Panel current for max power point tracking (MPPT)	**0.75A**
Isc	Short circuit panel current	**1A**





Example Panel Emulator Characteristics

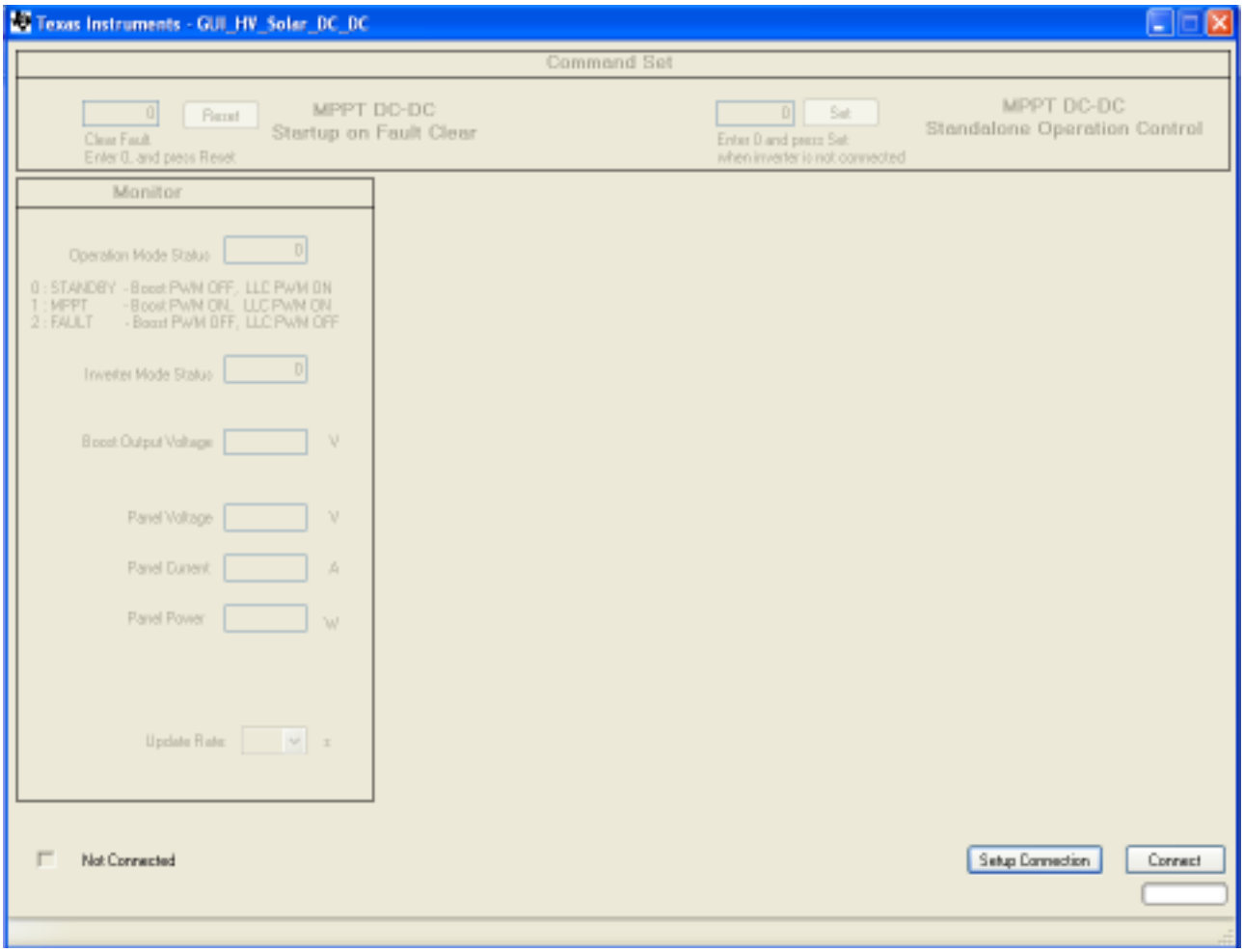
Connect an appropriate resistive load to the EVM output terminals (Vo-R & GND terminals). As in the example above, if the panel emulator is configured to supply 165W of power at MPPT point, then select a load resistor value of 970 ohm so that the EVM output voltage is limited to about 400V (P = 400*400/970 ≈ 165W). A smaller resistor will also work as long as the output voltage does not fall below 350V. This means that the smallest resistor that can be chosen for this load set up (165W) is about 742 ohm (R = 350*350/165 = 742 ohm). A resistor value larger than 970 ohm will cause output voltage higher than 400V for this load set up. **This output overvoltage condition must be prevented by choosing the maximum resistor value of 970 ohm for this load set up of 165W.** It is recommended that the resistor with a power rating > 200W is used for this load setting.

Running the Application

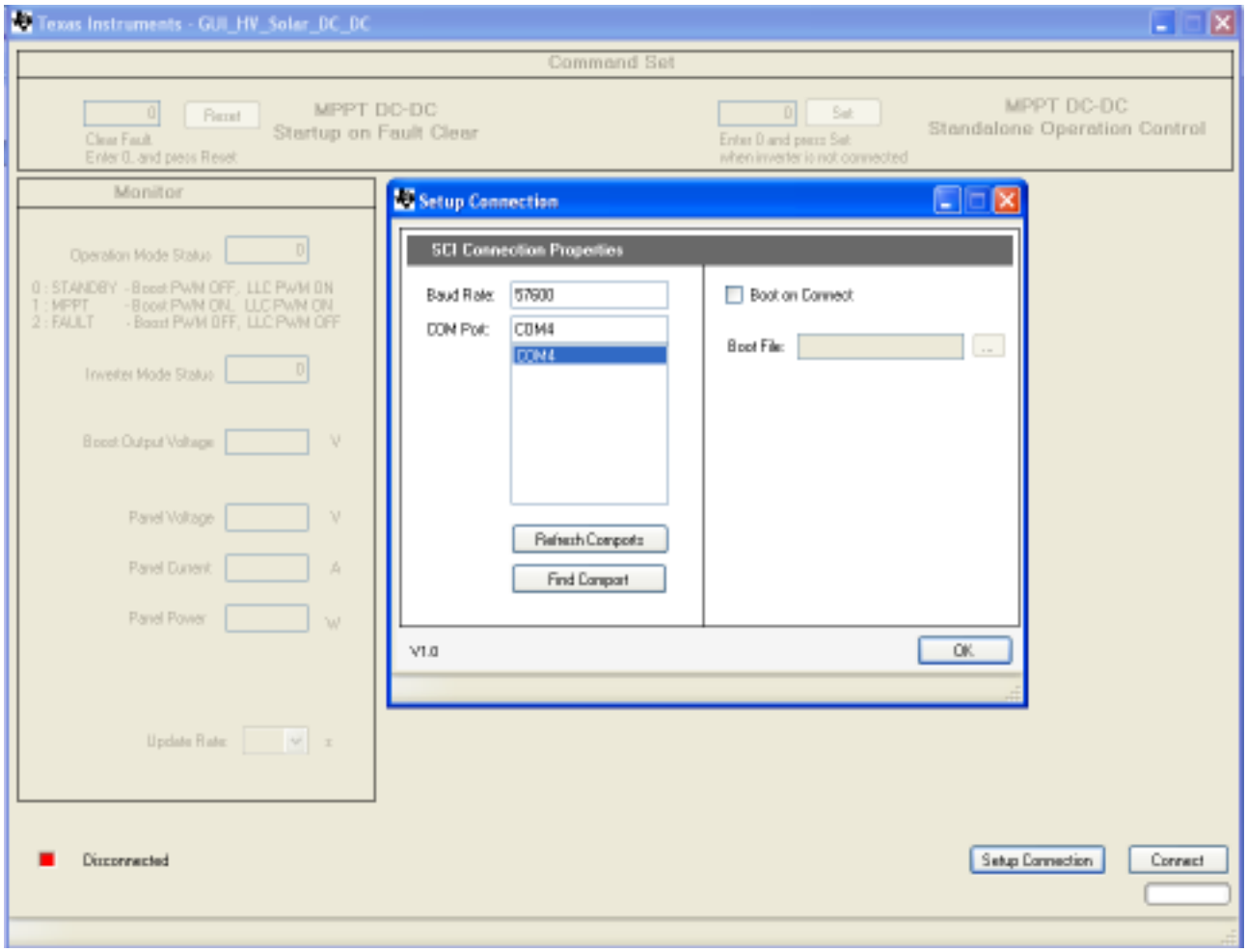
By default the hardware is configured to boot from a pre-Flashed code. The GUI only works with the F2803x_FLASH configuration in the corresponding CCS project.

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\HV_SOLAR_DCDC\~GUI` and double-click on HV SOLAR DC-DC-GUI.exe. The following figure shows a screen shot for the GUI.



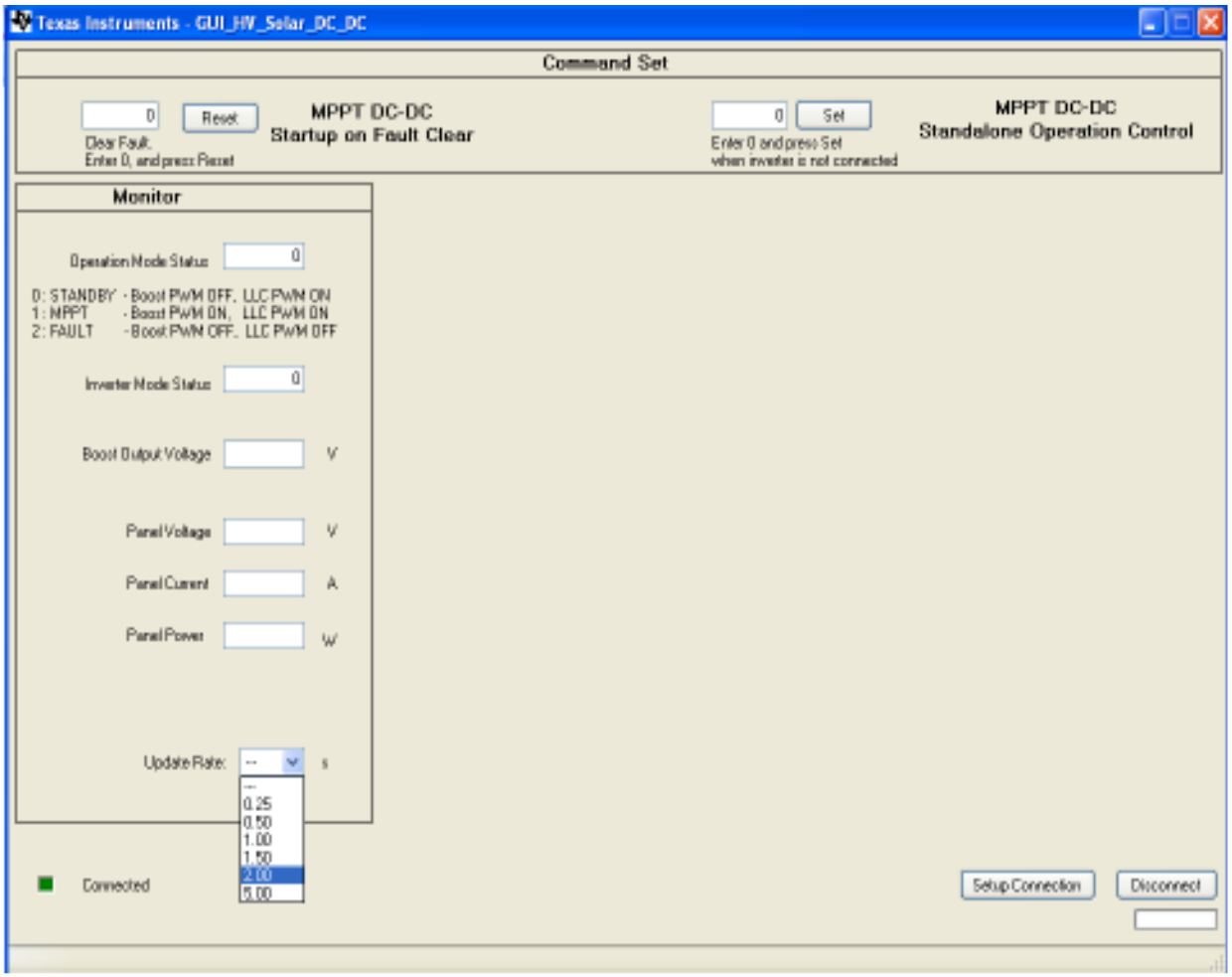
2) Click “Setup Connection” on the GUI



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 then 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 F2803x control card documentation for setting up boot 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 COM port which shows up as “Communications Port” and select this COM port 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. Then click “OK”

6) On the Main Window click “Connect”. The GUI should now connect to the target and be ready for use.
7) Select the parameter update rate as shown below:



GUI Structure

- ***Command Set*** – This section allows the user to perform two functions: (1) Start the DC-DC EVM **ONLY** when the DC-AC Inverter is not connected to its output. To use this, connect an appropriate load to DC-DC EVM output, enter 0 on the entry field next to ***Set*** button and then press the ***Set*** button, (2) Reset the DC-DC EVM output via a text box ***Reset***. To use this, first clear the fault, enter 0 on the entry field next to the ***Reset*** button and press ***Reset***.
- ***Monitor*** – section displays various system parameter values. These include EVM operation mode, Inverter mode (whether or not the Inverter is connected to DC-DC), the boost stage output voltage, the panel voltage, the panel current and the panel power.
- ***Update Rate*** – changes the rate at which the GUI updates the parameters in the Monitor section.
- ***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 J1 is connected so that isolated bias supply (small bias supply board mounted at location M2) can now provide the +12Vdc output when the panel power is turned on.
- Now turn on the panel emulator power with the configuration (for the panel emulator & the load resistor) described above.
- Bring up the GUI (as described before) and monitor the parameters.
- If the DC-AC Inverter is not connected to the DC-DC EVM then enter 0 on the entry field next to ***Set*** button on the GUI. Then press the ***Set*** button.
- The EVM output should now ramp to about 400Vdc.
- On the GUI verify the panel emulator output is about 220V and the panel power is about 165W
- To create an input under voltage fault condition, reduce the panel emulator output to 170V. This will cause the EVM to shut off and its output to reduce to almost 0V. The status indicator on the GUI should show this fault status. The input under voltage threshold in the code is set to 180V.
- Now restore the initial setting of the panel emulator (MPPT point 220V, 165W) in order to clear the fault condition. The EVM will still remain off. At this point enter 0 in the ***Reset*** entry field and then click on "***Reset***". This will restore the EVM status and the output will ramp back to about 400V.
- When turning off panel power, ensure that the 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:

- **HV SOLAR DC-DC User Guide –** provides detailed information on the HV SOLAR DC-DC project within an easy to use lab-style format.
  ..\controlSUITE\development_kits\HV SOLAR DC-DC\~Docs\HV SOLAR DC-DC.pdf
- **HV SOLAR DC-DC_Rel-1.0-HWdevPkg** – a folder containing various files related to the Piccolo-A controller card schematics.
  ..\controlSUITE\development_kits\HV SOLAR DC-DC\HV SOLAR DC-DC_HWDevPkg
- **F28xxx User's Guides**
  http://www.ti.com/f28xuserguides