HV Solar MPPT DC-DC GUI Overview

Getting Started Guide

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HV Solar MPPT DC-DC GUI Overview

The High Voltage (HV) Solar Maximum Power Point Tracking (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 MPPT DC-DC GUI:

- Allows the user to start the DC-DC stage without the DC-AC Inverter connected to it.
- Monitors these EVM parameters: boost stage DC BUS voltage, panel voltage, panel current, and panel power.
- Allows the user to monitor the operating mode or status of the DC-DC stage.
- Can restart the DC-DC once the fault condition has been cleared.

CAUTION

The HV Solar DC-DC EVM produces high voltages. The system should only be handled by experienced power supply professionals in a lab environment. Prior to applying an emulator output for the solar panel to this board, connect a voltmeter and an appropriate resistive load across the EVM output only if the output is not used to power a downstream DC-AC inverter. If the DC-AC Inverter is connected to the DC-DC EVM output, then connect an appropriate resistive load across the inverter output (see the Solar Inverter System QSG for detail). This connection prevents an overvoltage condition at the DC-DC and DC-AC EVM outputs and also discharges the DC-DC BUS capacitor quickly when the panel emulator power is turned off.

Also, the DC-DC board has no output overcurrent protection, so take appropriate measures to prevent any output short circuits across the DC-DC EVM output.

1 Getting Started

Table 1 lists the jumper and switch configuration needed to power on C2000™ HV Solar MPPT 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 OR SWITCH NUMBER	JUMPER OR SWITCH CONNECTION	COMMENTS
J1, J2, J3, J4, J5, and 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 the USB connector to the Piccolo™ controller card (CC2803x) for emulation. Use an external 12-V DC supply at JP1 to power up all the control circuit for now. By default, the Piccolo controller is enabled to boot from Flash and run the HV Solar DC-DC code. The user should not use 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 switch applies the external 12-V DC supply to the EVM.

Use a solar panel emulator (200 to 300-V, 500-W maximum) to provide input power to the EVM. Configure the panel emulator to emulate the following solar panel characteristics, and connect the emulator to the EVM input. Do not power on the panel at this time.

Table 2. Example Panel Emulator Parameters

VALUE	PURPOSE	MEASUREMENT
Voc	Open circuit panel voltage	260 V
Vmpp	Panel voltage for MPPT	220 V
Impp	Panel current for MPPT	0.75 A
Isc	Short circuit panel current	1 A

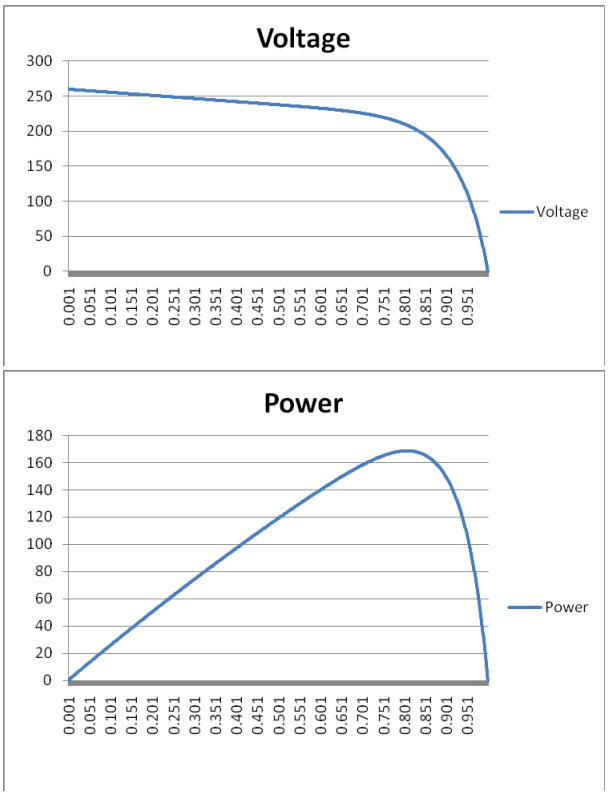

Figure 1. Example Panel Emulator Characteristics

Connect an appropriate resistive load to the EVM output terminals (Vo-R and GND terminals). As shown in Figure 1, if the panel emulator is configured to supply 165 W of power at the MPPT point, then select a load resistor value of 970 Ω so the EVM output voltage is limited to about 400 V (P = 400 × 400 / 970, approximately 165 W). A smaller resistor also works as long as the output voltage does not fall below 350 V. This limit means that the smallest resistor that can be chosen for this load setup (165 W) is about 742 Ω (R = 350 × 350 / 165 = 742 Ω). A resistor value larger than 970 Ω causes an output overvoltage higher than 400 V for this load setup. Choose a maximum resistor value of 970 Ω for this load setup of 165 W to prevent this output overvoltage, and use a resistor with a power rating of >200 W for this load setting.

2 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: The General Purpose GUI requires Microsoft .NET framework 2.0 or higher to run. Ensure that this software is installed prior to running this program.

1. Browse to ..\controlSUITE\development_kits\HV_SOLAR_DCDC\~GUI and doubleclick on *HV SOLAR DC-DC-GUI.exe*. Figure 2 shows a screenshot for the GUI.

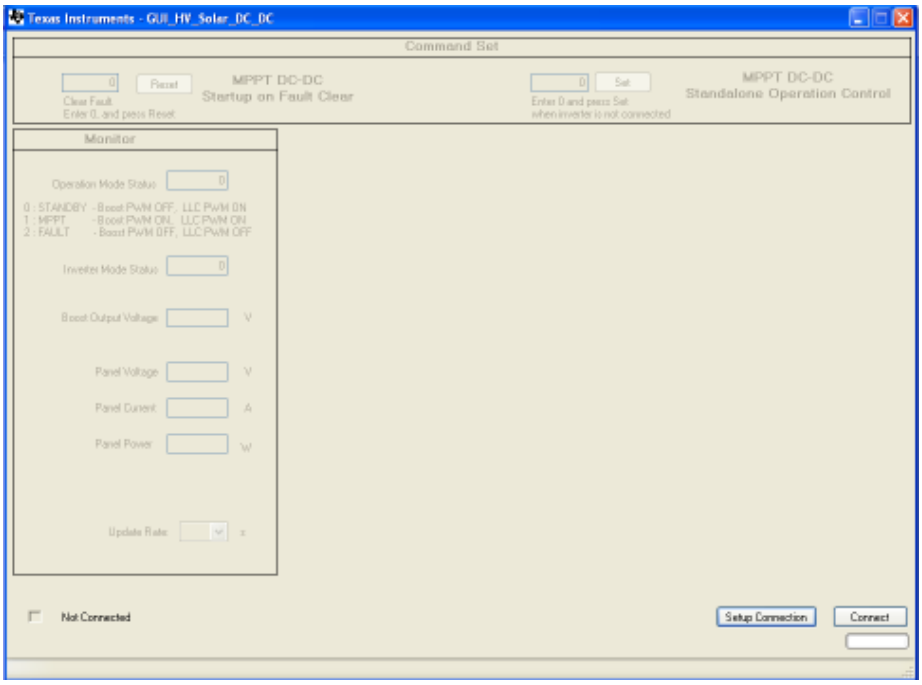

Figure 2. Something

2. Click *Setup Connection* on the GUI.

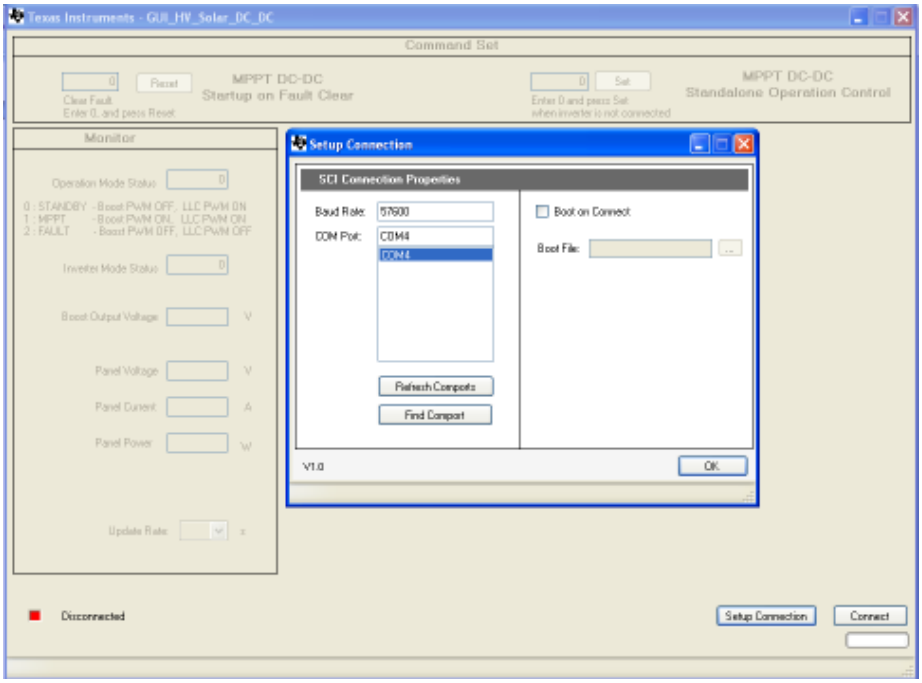

Figure 3. Something Else

3. Ensure the *Baud Rate* is set to 57600.

4. 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.
      (i) 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)
      (ii) Click *Find Comport*, then follow the instructions shown at the bottom of the window. This function will run through a short automated test to find the COM port that is connected to the EVM board.
      (iii) Following the test, *Comport Found: COMXX* should appear near the bottom of the window. If the GUI is unable to find a valid comport after fixing and checking all of the 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 and LPT)*. If the board is 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 the board is using a USB-to-Serial adapter, look for the COM port, which shows up as *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 in Figure 4:

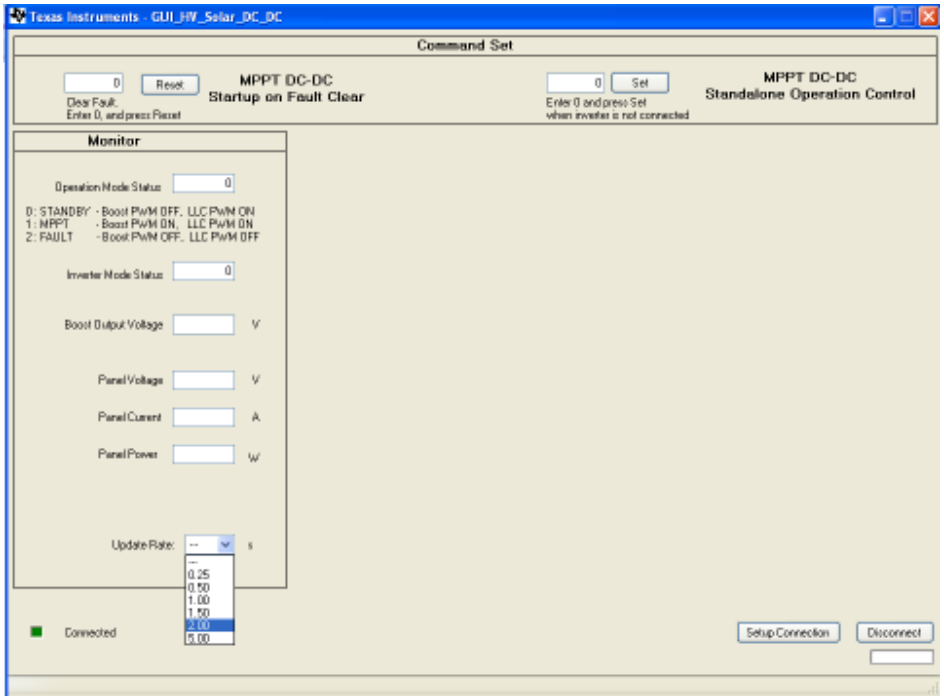

Figure 4. Something Again

2.1 GUI Structure

- *Command Set*: This section allows the user to perform two functions:
  - Start the DC-DC EVM only when the DC-AC Inverter is not connected to its output. To use this function, connect an appropriate load to the DC-DC EVM output, enter *0* on the entry field next to the *Set* button, and then press the *Set* button.
  - Reset the DC-DC EVM output via a text box reset. To use this function, first clear the fault, enter *0* on the entry field next to the *Reset* button, and press *Reset*.
- *Monitor*: This section displays various system parameter values. These values 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*: This section changes the rate the GUI updates the parameters in the Monitor section.
- *Setup Connection*: This section opens a new window that contains the serial port and boot settings.
- *Connect/Disconnect*: This section begins serial port communication with the target board.

2.2 Using the GUI

1. Once the hardware is set up correctly and the application program (pre-flashed code) is tested to run with the GUI, close the GUI, turn off the switch SW1, and disconnect the external 12-V DC supply.
2. Verify that the jumper at J1 is connected so the isolated bias supply (a small bias supply board mounted at location M2) can now provide the 12-V DC output when the panel power is turned on.
3. Turn on the power for the panel emulator with the configuration (for the panel emulator and the load resistor) described above.
4. Bring up the GUI and monitor the parameters.
5. If the DC-AC Inverter is not connected to the DC-DC EVM, then enter *0* on the entry field next to the *Set* button on the GUI. Press the *Set* button to increase the EVM output to approximately 400-V DC.
6. On the GUI, verify the panel emulator output is approximately 220 V and the panel power is about 165 W.
7. To create a fault condition for the input undervoltage, reduce the panel emulator output to 170 V. This reduction will cause the EVM to shut off and its output to reduce to almost 0 V. The status indicator on the GUI should show this fault status. The threshold for the input undervoltage in the code is set to 180 V.
8. Restore the initial setting of the panel emulator (MPPT point 220 V, 165 W) 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 value restores the EVM status and increases the output to approximately 400 V.
9. When turning off the panel power, ensure that the power is turned off first. Then wait for a few minutes before disconnecting the GUI.

3 References

1. *HV Solar MPPT DC-DC User Guide* (TIDU404)
   - Provides detailed information on the HV Solar DC-DC project within an easy-to-use lab-style format
2. *HV Solar DC-DC_Rel-1.0-HWdevPkg* (link)
   - 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
   –
3. F28xxx User's Guides (link) http://www.ti.com/lsds/ti/microcontrollers_16-bit_32-bit/c2000_performance/real-time_control/f2802x_f2803x_f2806x/overview.page

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