APPLICATION NOTE

Ver 2.0.1

7/7/2021

UT36/05PFD103 Smart Power Switch Controller

Software User's Guide
SPSC-EVB-R0-GUI Graphical Users Interface

PRODUCT NAME	MANUFACTURER PART NUMBER	SMD #
8V-36V Smart Power Switch Controller	UT36PFD103	5962-20206
8V-36V Smart Power Switch Controller Evaluation Board	UT36PFD103R0-EVB (aka SPSC-EVB-R0)	N/A
4.5V-5.5V Smart power Switch Controller	UT05PFD103	TBS
4.5V-5.5V Smart Power Switch Controller Evaluation Board	UT05PFD103R0-EVB (aka SPSC-EVB-R0)	N/A
32-Bit ARM™ M0+ Microcontroller	UT32M0R500	5962-17212
32-Bit ARM™ M0+ Microcontroller Evaluation Board	UT32M0R500-EVB (aka ARDUINO Host)	N/A

Table 1: Cross Reference of Applicable Products

1 Overview

This document details the functionality and operation of the Smart Power Switch Controller Evaluation Environment software, and how the software interacts with both the UT36PFD103 Smart Power Switch Controller and the UT32M0R500 M0+ Microcontroller.

2 Evaluation Setup

The three components to this evaluation include the Smart Power Switch Controller Evaluation Board (hereafter the SPSC-EVB), the M0+ Microcontroller Evaluation Board (hereafter the µC-EVB), and the Smart Power Switch Controller Evaluation Environment software (hereafter the GUI). The GUI acts as the primary user interface, allowing the user to send various commands to the µC-EVB, and receive both telemetry and device information back from the µC-EVB. In addition to processing commands for the GUI, the µC-EVB also handles plug-and-lay SPSC-EVB address resolution, periodic telemetry sampling, and supplies the SPSC-EVB with digital power through the Arduino™ pin headers. Finally, one or more SPSC-EVBs can be connected to the µC-EVB, with each SPSC-EVB capable of being operated and configured as an independent device, with up to 90 devices capable of being on one bus.

Connect the GUI to the µC-EVB using a USB-USBMini cable, from any PC USB port to the UART0 port on the µC-EVB. Power needs to be supplied separately to the µC-EVB using the provided adapter. To connect the µC-EVB to the SPSC-EVB, plug the SPSC-EVB Arduino™ pins directly into the µC-EVB's Arduino™ header. See Appendix B for SPSC-EVB switch details.

3 Evaluation Setup

There are two communication protocols used in this setup: a serial UART connection between the GUI (PC) and the µC-EVB, and an I2C bus between the µC-EVB and the SPSC-EVB(s). The UART connection is a 230400 Baud serial connection and follows normal UART protocols. The I2C connection is a conventional 100 kHz or 400 kHz I2C bus that follows additional protocols: System Management Bus (SMBus) 3.0, and Power Management Bus (PMBus™). The SPSC-EVB is already capable of communicating using SMBus and PMBus™ protocols, and the µC-EVB can be programmed with a Cobham provided API to run its I2C peripheral in accordance with the SMBus and PMBus™ specifications.

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4 Evaluation GUI Functionality

The Smart Power Switch Controller Evaluation Environment is spit up into six sections:

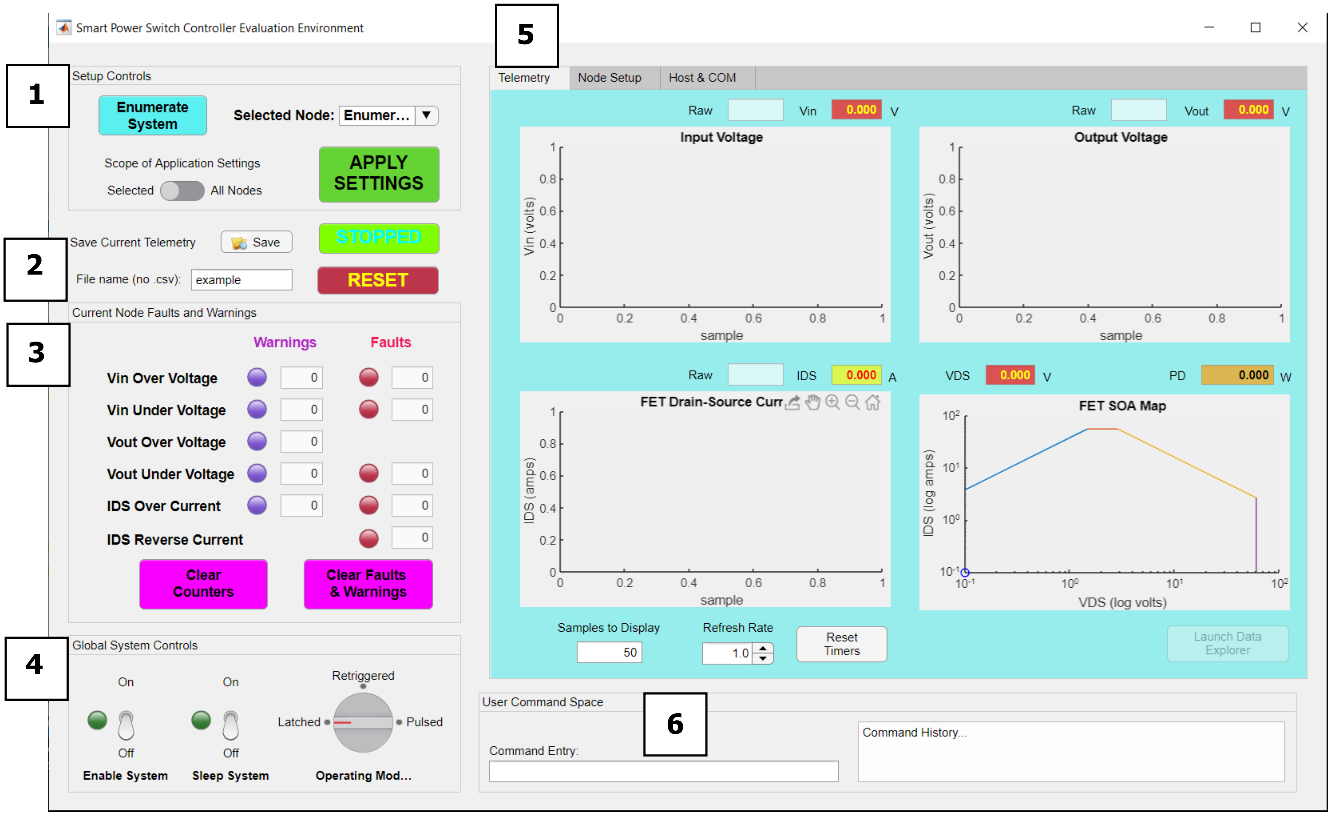

Figure 1

1. *Setup Controls*
2. *Telemetry Logging and Operation Controls*
3. *Faults and Warnings Counters*
4. *Global System Controls*
5. *Three tabs:*
    a. *Telemetry Display*
    b. *Node Setup*
        i. *SPSC Setup*
        ii. *SOA Setup*
    c. *Host & COM*
6. *User Command Space*

4.1 Setup Controls

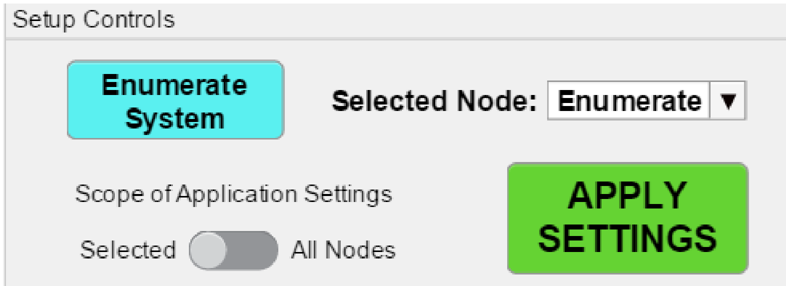

Figure 2

This section sends commands from the GUI to the µC-EVB to identify nodes, control which node is selected by the GUI, and apply setting to either the selected node, or all nodes.

Hitting the 'Enumerate System' button will tell the µC-EVB to run the plug-and-play Address Resolution Protocol (ARP) on all plugged in SPSC devices. The ARP will automatically search for any SPSC-EVBs on the bus, and if it finds any, will verify that its current I2C slave address does not conflict with any other nodes. When address conflicts occur, the µC-EVB will assign new available node addresses to the conflicted SPSC-EVBs. The µC-EVB will then report back all discovered nodes by sending both their Unique Device ID (UDID) and current I2C slave address. The SPSC automatically registers this information and will display a node by its current base 10 address (ex. '22' is a device located at I2C address 22).

The Selected Node dropdown allows users to choose which node will have its telemetry displayed in the Telemetry tab, and which node is being written to/read from when the Scope slider is set to 'Selected'. Only one node's data is displayed at a time, but multiple nodes can have their data read and recorded at once, and changing the selected node will display any recorded data for that node.

The Scope of Application Settings slider allows the user to choose if only the node displayed in the selected Node dropdown is being controlled/configured or all nodes are being controlled/configured. Both settings allow for data to be read and recorded from multiple nodes.

The Apply Settings button sets the Telemetry tab plots based on the current values in the Node Setup tab such as the Input Voltage Fault Level. Additionally, if the current mode is Retriggered or Pulsed, the GUI will apply the current respective settings found in the Node Setup (SPSC Setup) tab to the current selected node.

4.2 Telemetry Logging and Operation Controls

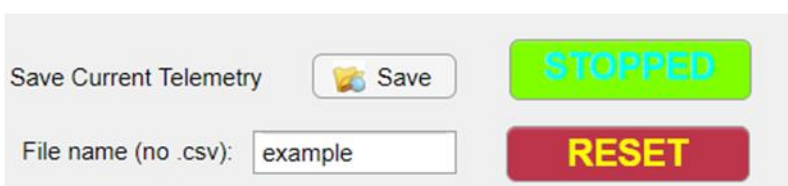

Figure 3

This section controls if telemetry is logged for the active nodes. This version of the software does not contain telemetry logging functionality.

The 'Stopped/Running' button displays the current status of the selected node (if any), and allows the user to toggle the status for the selected node or all nodes, depending on the position of the Scope slider.

The Reset button tells the µC-EVB to hold the RESET_B pin low for 0.5 seconds before bringing the pin high again, resetting all connected nodes. If two nodes have conflicting ternary addresses, whenever a power cycle or reset occurs another Enumerate needs to be performed before either node is sent any other commands.

4.3 Fault and Warning Counters

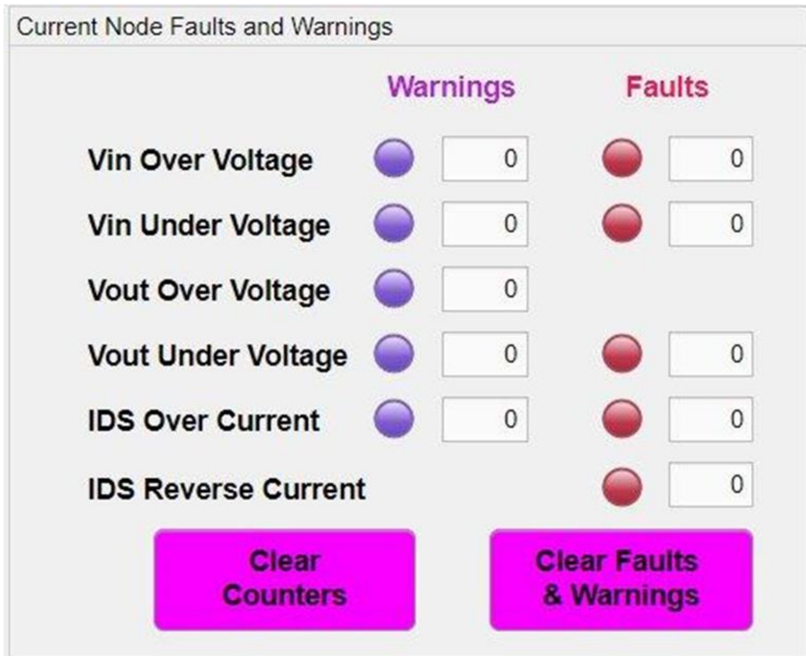

Figure 4

This section displays the number of samples for all nodes that have contained a fault or warning. Warnings are arbitrary limits established and incremented by the GUI depending on the user parameters in the Node Setup tab and the most recent data value from the running SPSC-EVB. Faults are limits established via hardware on the SPSC-EVB. Faults are read from the SPSC-EVB fault status registers when an enabled node is running.

The Clear Counters button resets the value of all counters to 0 within the GUI, and does not affect the SPSC-EVB in any way.

The Clear Faults & Warnings button sends a PMBus™ ‘Clear Faults’ command to all nodes. Fault states that have not been changed by the user will re-assert on the SPSC-EVB’s next clock cycle, and incremented by the subsequent µC-EVB’s read of the SPSC-EVB fault registers.

4.4 Global System Controls

Figure 5

This section displays three different global controls that are applied to all SPSC devices.

The Enable System switch controls the state of the ENABLE_B signal on all SPSC devices. When 'On', all nodes are enabled, and vice versa. When enabled, all SPSC-EVBs are capable of switching input power to their respective outputs by actively driving their Power-FETs. When not enabled the SPSC-EVBs will keep their Power-FETs disabled.

The Sleep System switch controls the state of the SLEEP_B signal on all SPSC devices. When 'On', all nodes are sleeping, and vice versa. When nodes are asleep, the SPSC-EVB is put in the lowest power sleep mode, disabling some of the internal circuits, and both external FETs are disabled. While asleep, GUI commands to the SPSC-EVBs will be ignored.

The Operating Modes rotary knob selects which mode all the nodes will operate in:

- *'Latched' will close the gate for the SPSC upon the first fault detection and stays that way until stopped and re-run (toggling the STOPPED/RUNNING button). If the fault condition remains after re-starting the terminal, it will latch into the OFF state again.*
- *'Retriggered' mode will close the Power-FET upon fault detection and then check if the gate can be opened again autonomously depending on a selectable number of attempts and delay time (see the Node Setup section). The initial number of retries is infinite, and initial delay time is 8 time units (~10 seconds).*
- *'Pulsed' mode will toggle delivering/removing voltage to the output based on the GATE_OFF_DELAY and GATE_ON_DELAY registers' settings regardless of if there is a fault.*

4.5 Three Tabs

4.5.1 Telemetry Display

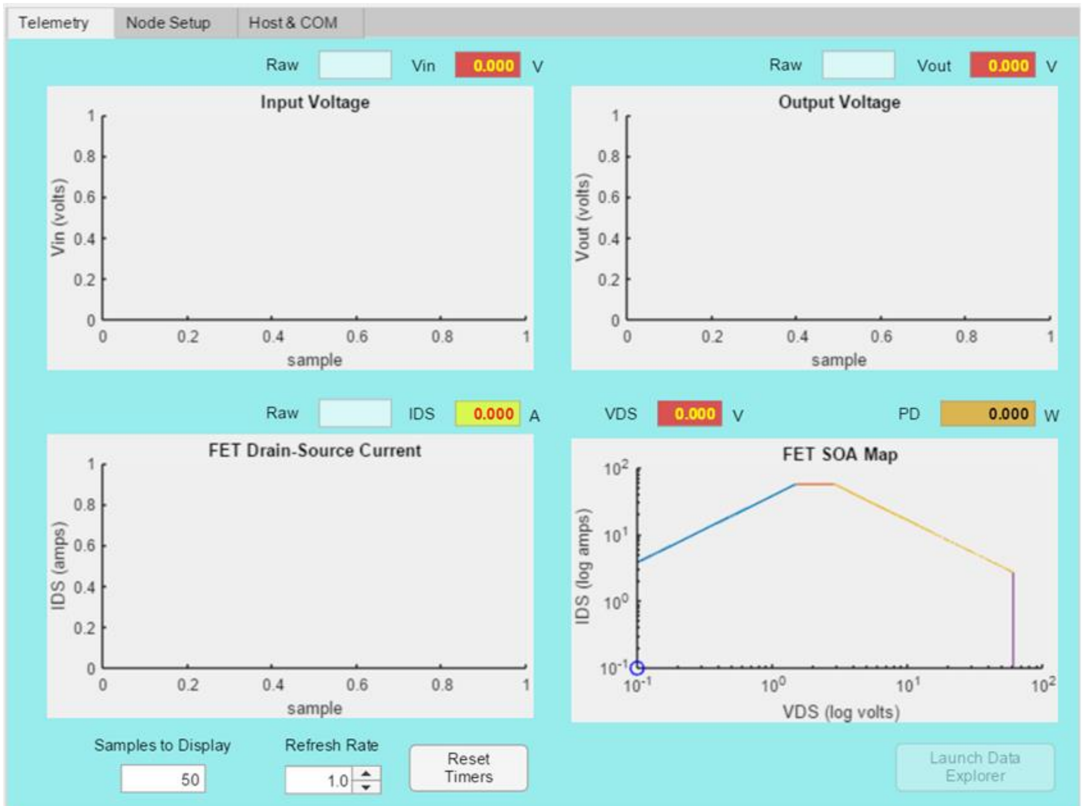

Figure 6

This tab displays the incoming telemetry from the µC-EVB for the selected node (see 1)). This section contains graphs for the Input Voltage, Output Voltage, FET Drain-Source Current, and FET SOA Map. Additionally, this section shows the most recent sample's 'Raw' (hexadecimal) data and it's converted value (decimal), along with an adjustable number of samples, refresh rate, and a timer reset button.

The Samples to Display box allows the user to choose to display 10 to 10,000 of the most recent samples for the selected node. Displaying over 5,000 samples at a given time will cause system slowdown, and is only recommended for brief amounts of time. Slower systems (e.g. processing power and memory limited) may have a lower maximum number of display-able samples.

The Refresh Rate box allows the user to change the system's refresh and sample rate to any frequency from 0.5Hz to 8Hz in 0.1Hz increments. Running the system at more than 4Hz will cause slowdown and sample data to be missed by the GUI. Slower systems (e.g. processing power and memory limited) may not be able to run at 4Hz.

The Reset Timer button will restart the GUI's internal timer and re-plot the four graphs.
NOTE Upon initial startup of the GUI and commanding the SPSC to start RUNNING, the default values may reflect maximum values until new "real" telemetry values are received from the SPSC-EVBs in question.

4.5.2 Node Setup

4.5.2.1 SPSC Setup

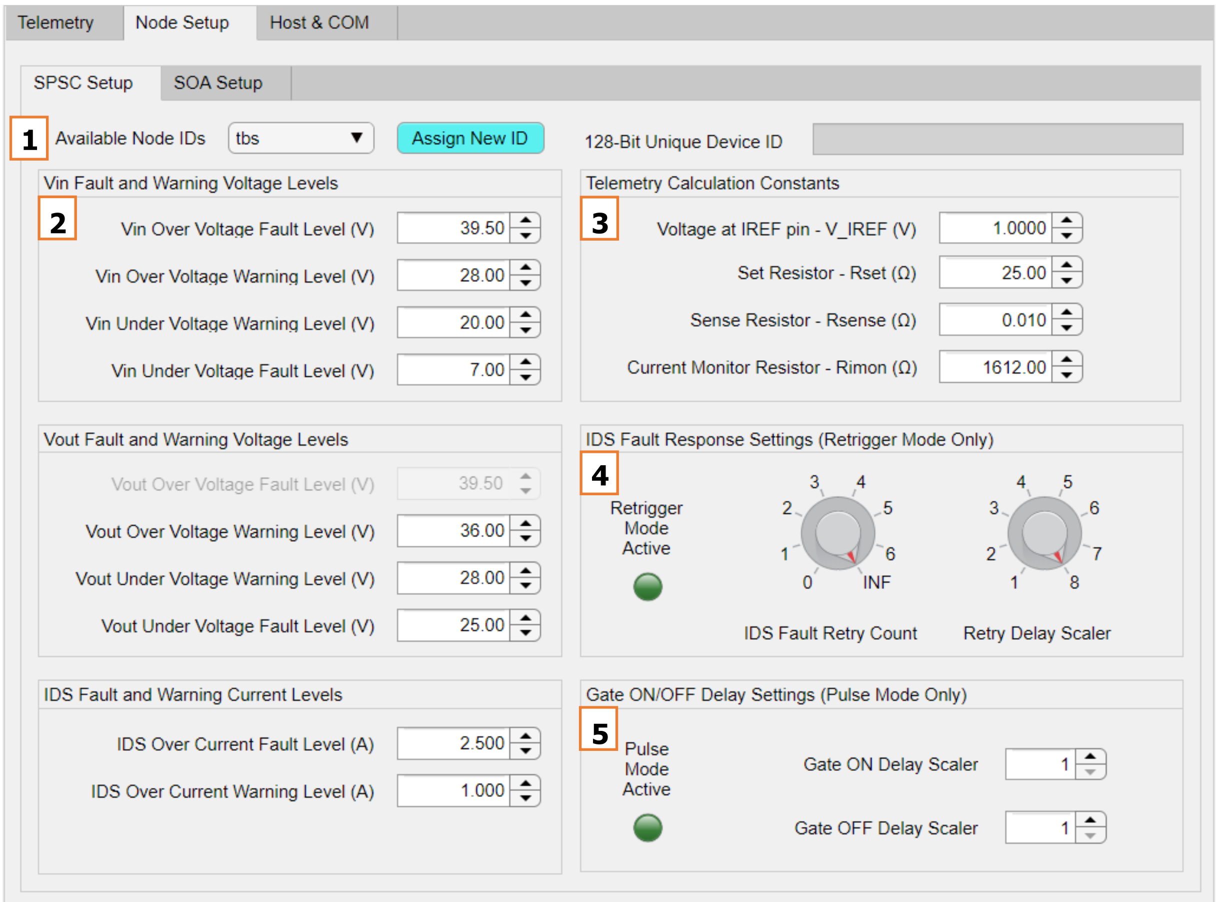

Figure 7

The Node Setup tab contains two sub-tabs: SPSC Setup and SOA Setup, both of which control the parameter settings for the selected node's graphical display and fault/warning counters. Focusing on the SPSC Setup tab, there are five (5) configurable areas.

1. Node Address (Node ID) assignment and its Unique Device ID
    a. Relates to the Selected Node visible in the Setup Controls panel on the left side of GUI.
2. Telemetry Fault and Warning Levels
    a. Affects telemetry plotting graphics on the "Telemetry" tab and Warning Counters.
3. Telemetry Calculation Constants
    a. Used to compensate for accuracy of telemetry values returned from the SPSC ADC.
4. IDS Fault Response Settings
    a. Used to configure the SPSC timing and response to current faults when in the RETRIGGERED operating mode.
5. Gate ON/OFF Delay Settings
    a. Used to configure the SPSC ON/OFF switch timing when in the PULSED operating mode.

Each of these configuration areas are described in the following subsections.

- ***Node Address (Node ID) assignment and its Unique Device ID***

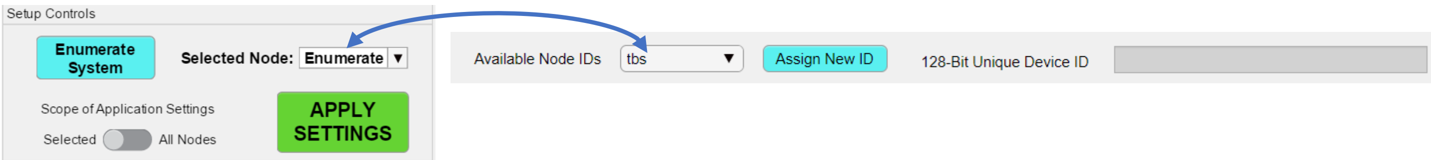

Figure 8

Using the Available Node IDs dropdown to select a free node, and then pressing the Assign New ID button will change the SMBus(I2C) slave address of the Selected Node to the new ID. If a node is occupied, no change will be made. When a node has its address re-assigned the data and settings are transferred to the address. Per the PMBus™ specification, the GUI observes the list of valid addresses, hence the first available target address is '16'.

The 128-Bit Unique Device ID bar shows the Selected Node's UDID as a hexadecimal string. The format is defined in the SMBus 3.0 specification, available online from the System Management Interface Forum (http://smiforum.org/).

- ***Telemetry Fault and Warning Levels***

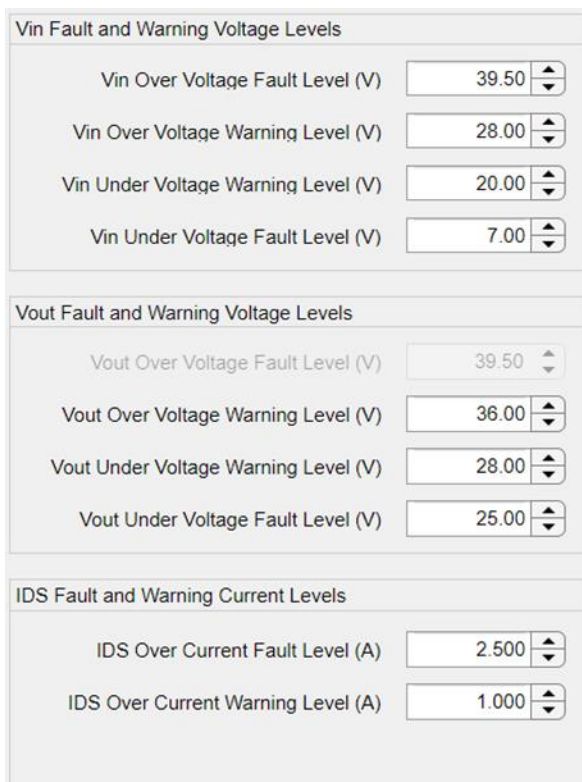

Figure 9

Changing any of the values in the Fault and Warning levels (or the SOA Setup values on the SOA Setup tab) will change the values displayed in the respective Telemetry graphs. If settings don't immediately change, press the Apply Settings button in the Setup Controls section. Changing the values of the Fault and Warning levels displayed are intended for visualization purposes only. The actual fault thresholds are set on the SPSC-EVB hardware (see Table 2).

The warning levels are arbitrarily defined by the user interacting with the GUI. Fault and Warning thresholds are reset to default values upon re-starting the GUI.

Table 2: UT36PFD103R0-EVB Hardware Defined Fault Settings

UT36PFD103R0-EVB Fault Conditions	Fault Threshold	Comment
VIN Overvoltage Fault	39.5V	Increasing VIN above its fault voltage level will trip the UT36PFD103 OVLO (Overvoltage Lockout) causing the device to disable the load switch; cutting power to the load.
VIN Undervoltage Fault	7.5V	Decreasing VIN below its fault voltage level will trip the UT36PFD103 UVLO (Undervoltage Lockout) causing the device to disable the load switch; cutting power to the load.
VOUT Undervoltage Fault	25V	Whenever the output (load) voltage is below this fault threshold, the UT36PFD103 will drive its PGOOD output low, indicating power is NOT good, and illuminating the Power Status LED. This condition does not affect the switch controller's ability to switch power to the load; it merely flags the low voltage condition of VOUT.
Overcurrent Fault	2.5A	When the load current reaches/surpasses 2.5A, a 160ms timer (set by the UT36PFD103R0-EVB hardware) begins to timeout. When the timer expires, the UT36PFD103 disables the load switch; cutting power to the load. Upon trip the overcurrent fault, the CURR_LIM# status pin is driven low illuminating the Current Fault LED. Depending on the user selected operating mode (set by the radial knob in the Global System Setting panel of the GUI), the load will be switched OFF/ON as follows: 1. Latched Mode: The load will remain OFF until the user restarts the UT36PFD103 2. Retrigger Mode: The load will switch remain OFF for the programmed duration set by the IDS Fault Response Setting Panel (described later in this document) and then will be automatically turned back ON. If the overcurrent condition persists, this OFF/ON retriggering will continue for the number of retries set in the IDS Fault Response Setting Panel
High/Short Circuit Fault	5A	If the load draws 5A or more, the UT36PFD103 immediately (<500ns) disables the load switch. Upon such a fault, the UT36PFD103 latches the load switch OFF, irrespective of the set operating mode, requiring the user to manually re-start the UT36PFD103. Similar to the Overcurrent Fault, the High/Short Circuit Fault will assert the Current Fault LED.

- ***Telemetry Calculation Constants***

The analog to digital converted telemetry displayed on the GUI Telemetry tab may have offset and gain error. These errors can be compensated by modifying the conversion constants provided in the Telemetry Calculation Constants panel (Figure 10). The default values in this panel are the nominal values for the UT36PFD103R0-EVB hardware. The tolerance of the resistors used on the UT36PFD103R0-EVB hardware is ±0.1% and represents a very small percentage of ADC telemetry error. V_IREF directly relates to the ADC reference voltage and tends to have the most significant effect on the telemetry accuracy. Cobham recommends using V_IREF to compensate for ADC telemetry readout error. Equations 1-3 are the conversion expressions for VIN, VOUT, and IDS telemetry measurements.

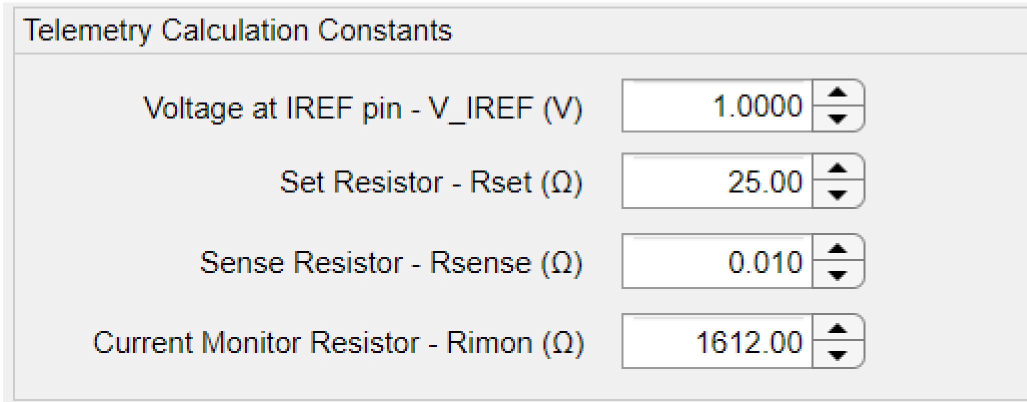

Figure 10

$$VIN = READ_{VIN} * \frac{V_{IREF}*2}{1024} * 20$$ Equation 1.

$$VOUT = READ_{VOUT} * \frac{V_{IREF}*2}{1024} * 20$$ Equation 2.

$$IDS = READ_{IDS} * \frac{R_{SET}}{R_{SENSE}} * \frac{V_{IREF}*2}{R_{IMON}} * \frac{1}{1024}$$ Equation 3.

- ***IDS Fault Response Settings***

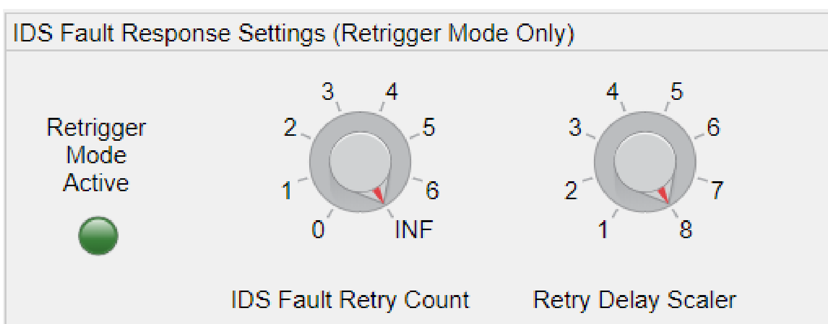

Figure 11

The IDS Fault Response Settings section allows the user to change the amount of retries and the delay scaler for any devices running the Retriggered mode. Once both knobs have been set to the desired settings, the user should ensure they are in Retriggered mode, and then hit the "Apply Settings" button to send the new Fault Response Settings to the currently selected node.

The IDS Fault Retry Count rotary allows the user to select the number of retries the SPSC-EVB attempts when a fault occurs. If set to zero, the fault will put the SPSC-EVB into latched mode, with no retries attempted. If set to one through six the SPSC-EVB will attempt to charge the output after a delay (see IDS Retry Delay Scaler below), and then latch if the fault is still present after all programmed retries are exhausted. If set to INF (infinite) the SPSC-EVB will retry indefinitely with the correct delay in between.

The IDS Retry Delay Scaler controls the amount of time units the SPSC-EVB waits between retries while in retrigger mode. The retry time is calculated by combining the Retry Delay Scaler value and the respective delay offset to get the total number of clock periods. The clock period is configured by the value between the C_TIMER pin and ground.

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The current version of the SPSC-EVB has a clock period of approximately 1.28 seconds. To calculate the number of periods for a given Retry Delay Scaler value, see the equation and table below.

$$Delay\ Time = 1.28\ seconds * Final\ Retry\ Periods$$
$$Final\ Retry\ Periods = Retry\ Delay\ Scaler + Delay\ Offset$$

Table 3

Retry Delay Scaler (IOUT_OC_FAULT_RESPONSE[2:0])	Delay Offset (# CLK_ADJ periods)	Final Retry Periods (# of CLK_ADJ periods)
0	+2.5 to +3.5	2.5 to 3.5
1	+1.5 to +2.5	2.5 to 3.5
2	+0.5 to +1.5	2.5 to 3.5
3	+0.5 to +1.5	3.5 to 4.5
4	+0.5 to +1.5	4.5 to 5.5
5	+0.5 to +1.5	5.5 to 6.5
6	+0.5 to +1.5	6.5 to 7.5
7	+0.5 to +1.5	7.5 to 8.5

- ***Gate ON/OFF Delay Settings***

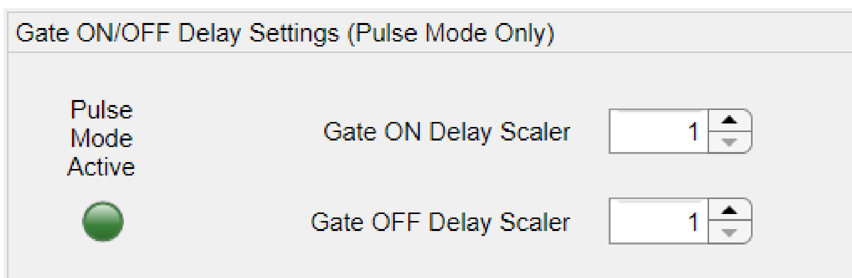

Figure 12

The Gate ON/OFF Delay Settings section allows users to modify the ON/OFF delay time while in Pulsed mode. The values selectable represent the amount of time units (respective to the same adjustable clock period of 1.28 seconds (nominal) as the Retrigger delay) that the SPSC-EVB stays in the Gate ON or Gate OFF condition. These values can range from 1 to 256. Once the values have been set to the desired values, the user should ensure they are loaded into the UT36PFD103 by hitting the "Apply Settings" button.

4.5.2.2 Power FET Safe Operating Area (SOA) Setup

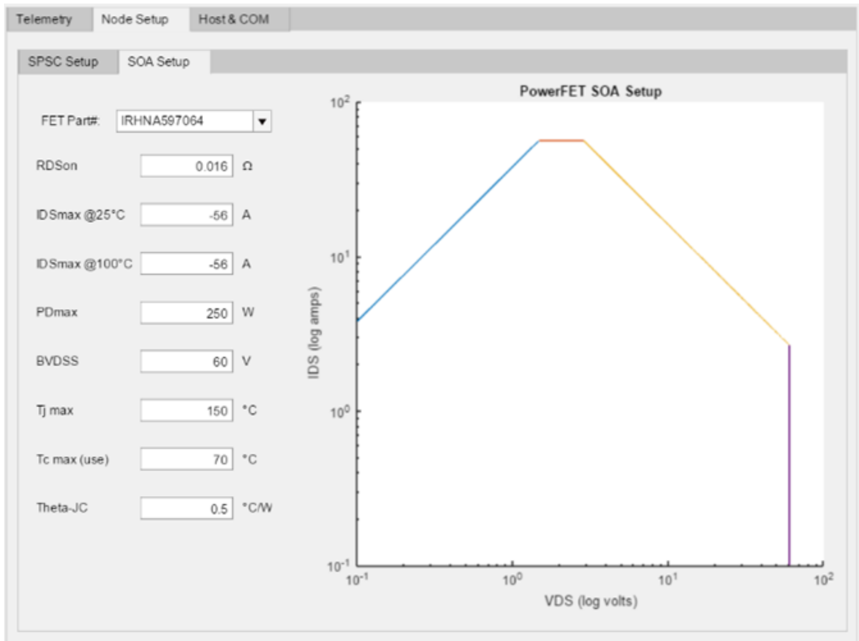

Figure 13

The SOA Setup tab on the GUI provides the user with the ability to change parameters associated with the PowerFETs installed on the SPSC-EVB. The default values populated by the GUI reflect the PowerFET’s installed on the SPSC-EVB by the factory. If the user decided to replace the PowerFETs with a version of his choice, the specific parameters taken from the PowerFET datasheet could be entered on this tab, and the SOA plot will be re-drawn accordingly.

4.5.3 Host & COM

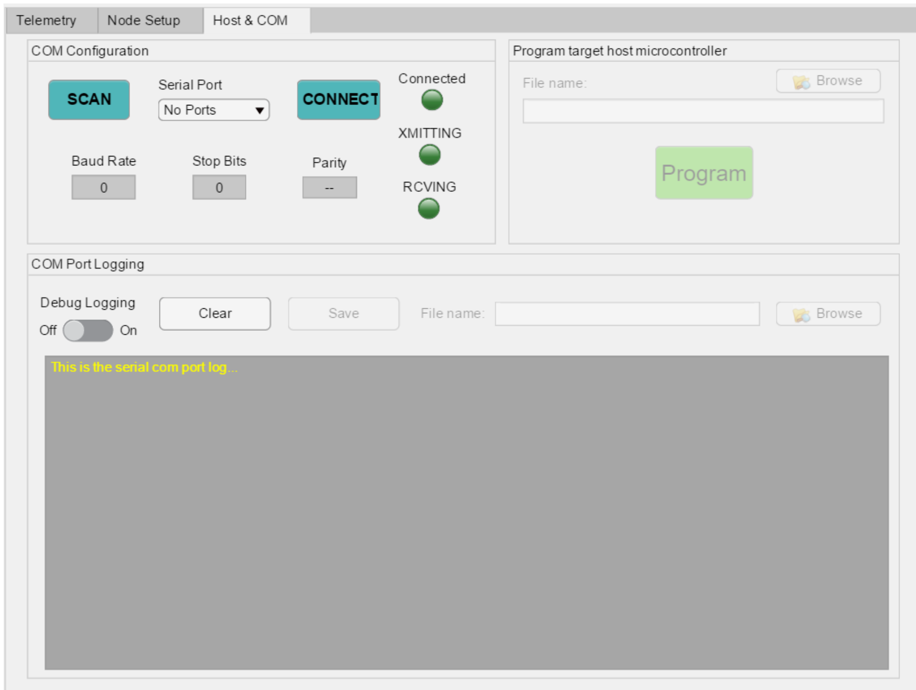

Figure 14

This tab controls the serial UART connection between the GUI and the µC-EVB, and allows for communication monitoring between the two devices.

The Scan button will search for available COM connections and list them in the Serial Port dropdown.

The Serial Port dropdown allows the user to select the COM port they want to connect to.

The Connect button will attempt to connect to the selected COM port with a 230400 baud rate. This is the baud rate used by the µC-EVB when it is running the UT32MIC-SPSC host software. Once connected, the Connected Lamp will become bright green.

COM Port Logging section allows the user to monitor the COM port connection whenever the Debug Logging slider is set to 'On'.

The Clear button allows users to clear all data in the COM port section. Note: leaving this section on can cause slowdown at higher sample rates or after a long continuous operating duration. If you are experiencing slowdown after long runtimes, hitting the 'clear' button or turning off the Debug Logging can help speed up the GUI again.

The debug log SAVE feature is not supported in this version of the GUI.

4.6 The User Command Space

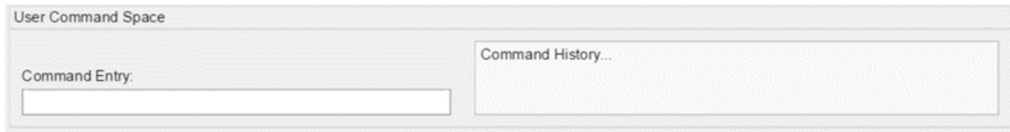

Figure 15

To simplify and accelerate the user's ability to interact with the target SPSC-EVBs, a User Command Space line entry space is supported. Sending commands in this way has the potential to bypass some parts of the GUI. Cobham recommends that users have a good understanding of GUI functionality before using the command line entry feature. A list of valid commands can be found in Appendix A.

Commands are entered into the Command Entry box with past commands displayed in the Command History box. Commands sent while using the GUI, for example by hitting the 'Enumerate' button will also be displayed in the Command History box. This feature can be useful for troubleshooting.

Additionally, the Command Entry box can read a user scripted text file containing a sequence of desired commands. The script command must be contained in the same directory as the GUI executable application. Syntax to run a script is to precede the filename with the '@' character (e.g. @filename.txt).

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5 Startup Guide

When you first turn on the SPSC Evaluation GUI you will see the below screen:

Figure 16

To connect to the GUI to the µC-EVB, do the following steps:

Click on the "Host & COM" tab. Click SCAN. You should see the adjacent dropdown fill with all COM#s. Select the COM# associated with the USB port connected to the µC-EVB, then click on the CONNECT button. You should see the baud rate change to '230400', and the connected LED light up. If this does not happen, check the connections & power to the µC-EVB.

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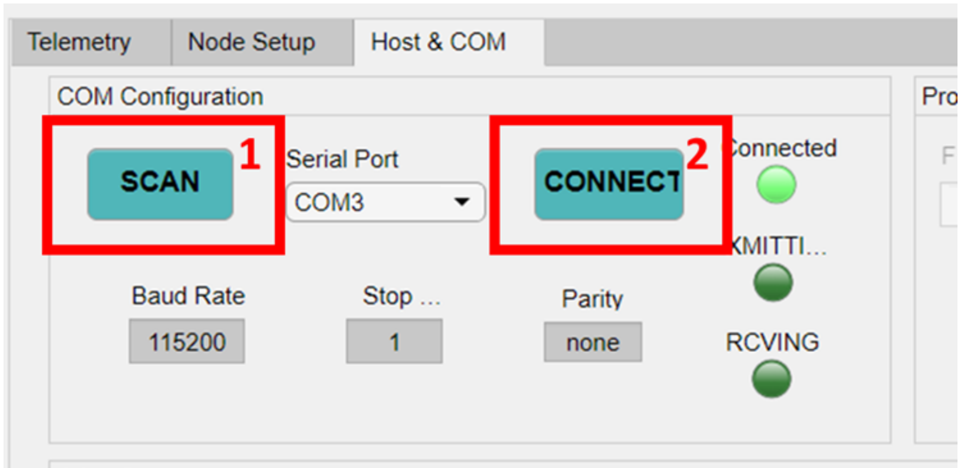

Figure 17

Once you are connected, turn on the Host & COM's Debug Logging slider. Hit the Enumerate System button, and wait for the µC-EVB to send back node data. You should see something similar to the debug output below, and a number appear in the Selected Node section from the list of valid PMBus™ nodes based on the SPSC-EVB's ternary pins.

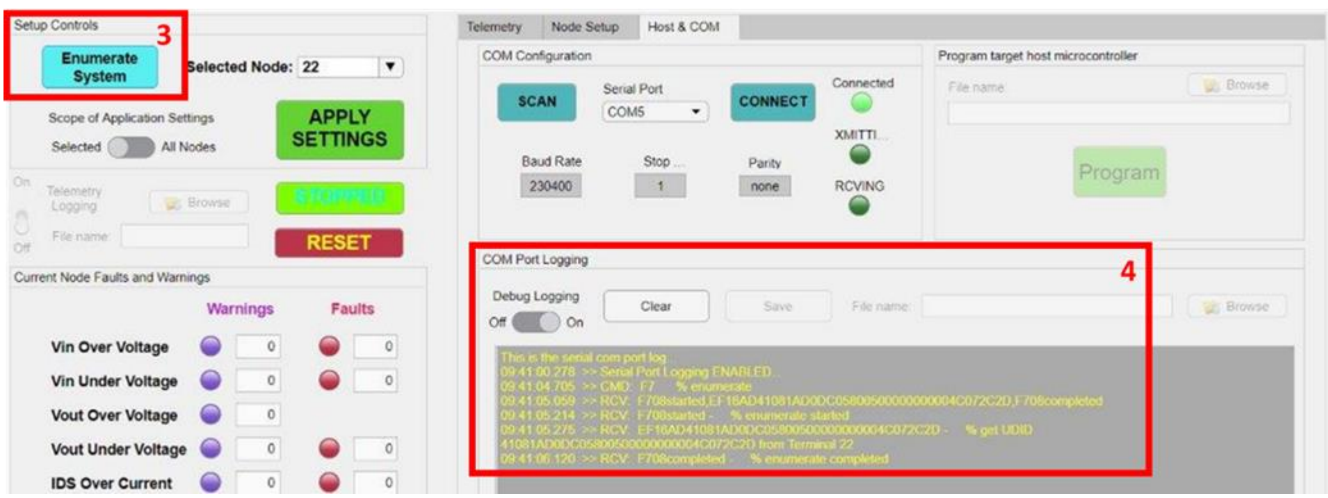

Figure 18

If you do not see this, check connections to the µC-EVB and reset the board. The µC-EVB RESET button is on the diagonally opposite corner of the PCB from the USB-0 connector. Re-connect the COM and then press the Enumerate System button again. After successfully enumerating turn off the debug logging slider to reduce the amount of memory used. If left on the large amount of data kept in this section will lead to slowdown, as the display does not auto-clear. The section can be left on if cleared periodically.

Finally, return to the Telemetry Tab. To get the SPSC into a running state, change the Enable System switch into the 'On' position and press the STOPPED/RUNNING button. On boot-up it should say STOPPED, and change to RUNNING once the button is pressed.

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Figure 19

The node is now connected and running. To put the node in retriggered or pulsed mode, simply move the operating mode spinner to the retriggered selection (see 4).

6 Troubleshooting

This GUI is not a finished product, and is still prone to have the occasional bug. When such a bug arises, here are a few troubleshooting recommendations.

1. If the GUI was previously reading data and suddenly stopped (typically by a command being sent, button being pressed, etc.), toggle the Enable switch and check if the problem was resolved. If that did not fix the issue, try the Reset Time button in the Telemetry tab. If that did not fix the issue, restart the GUI and/or µC-EVB.

2. If the GUI is behaving slowly, ensure that the samples being displayed is set to a reasonable amount (5,000 or lower), and that the refresh rate isn't over 4Hz. If the Debug Logging is on, clear the window or turn off the Debug Logging if it is not being looked at.

3. To reset the µC-EVB, set both switches (bottom right of the µC-EVB) in the down position (yellow LED) and hit the reset button (bottom left). You will then need to re-connect and enumerate again.

4. If you need to reprogram the wolverine code, consult the online appnote (https://www.cobhamaes.com/pagesproduct/appnotes/AppNote_UT32M0R500_UART_Flash_Download.pdf) and attached hex file included in your software download zip file.

5. For issues not listed in this section, check connections between all devices are correct, and perform power resets where needed. If the problem persists, contact Cobham for troubleshooting support.

Appendix A – Valid Commands for the User Command Space

The below table includes valid commands that can be used in the User Command Space.

Command Name	Input	Example Input	Output to µC	Example Output	Brief
Enable	Enable	Enable	FF	FF	Sets the EN_B pin low (enabled)
Disable	Disable	Disable	FE	FE	Sets the EN_B pin high (disabled)
Sleep	Sleep	Sleep	FD	FD	Sets the SLEEP_B pin low (sleeping)
Wake	Wake	Wake	FC	FC	Sets the SLEEP_B pin high (awake)
Run	Run <target>	Run id 22 Run all	FB<target>	FB22 FB00	Runs the selected ID (ex 22), or all nodes
Stop	Stop <target>	Stop id 22 Stop all	FA<target>	FA22 FA00	Stops the selected ID (ex 22), or all nodes
Clear Faults	Clear <target>	Clear id 22 Clear all	F9<target>	F922 F900	Clears the selected ID's faults (ex 22), or all nodes
Set Mode	Mode <option>	Mode Latched	F8<mode>	F800	Sets all nodes to operate under the selected node
Enumerate	Enumerate	Enumerate	F7	F7	Tells the µController to perform an ARP protocol and return the addresses and UDIDs
Assign ID	Assign <currID> <newID>	Assign 22 16	F6<currID> <newID>	F62216	Assigns an existing node to a new valid and available node. New Node must observe the SMBus valid addresses, or the GUI will reject the command
Change Sample Rate	Rate <newRate>	Rate 2.1 Rate 4	F5 <newRate>	F52.1 F54.0	Sets the new telemetry sample rate and data plot rate
Reset	Reset	Reset	F0	F0	Tells the µController to toggle Reset_B low for 0.5 seconds
Get Register	Get <target> <register>	Get 22 Op	EF<target> <register>	EF2201	Gets the contents of a register from the selected SPSC node. Reigsters: Op - Operation Fr - Fault Response Svo - Status Vout Si - Status Ids Svi - Status Vin Rvi - Read Vin Rvo - Read Vout Ri - Read Ids Goff - Gate Off Delay Gon - Gate On Delay Udid - UDID

Command Name	Input	Example Input	Output to µC	Example Output	Brief
Set Register	Set <target> <register> <newVal>	Set 22 Op 82	E0<target> <register> <newVal>	E0220182	Sets the contents of a register from the selected SPSC node. Registers: Op - Operation Fr - Fault Response Svo - Status Vout Si - Status Ids Svi - Status Vin Goff - Gate Off Delay Gon - Gate On Delay

Appendix B – Valid Address Lookup Table

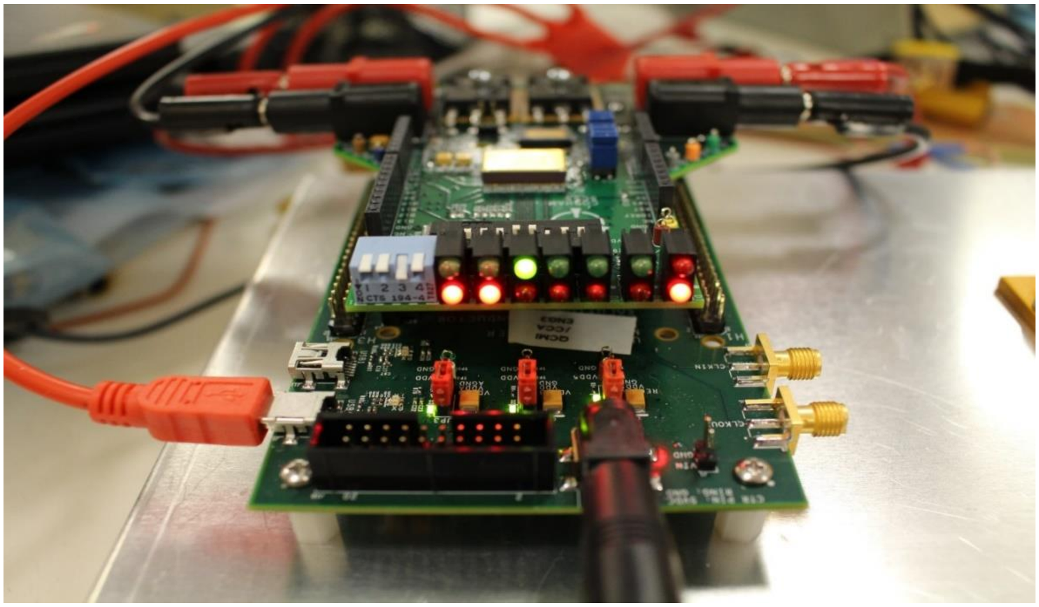

Figure 20

Piano Switches (1 to 4): EN_B_RESTART, MRST_B_RESTART, PMB_EN, PARITY
LED pairs (Left to Right): ADDR0 Low (RED), ADDR1 Low (RED), ADDR2 High (GREEN), ADDR3 Mid (OFF), ADDR4 Mid (OFF), Parity (top GREEN only, illuminated when PARITY switch is low), PGOOD (bottom RED LED only, illuminated when VOUT is under voltage) / CURR_LIM_B (top GREEN LED, illuminated when CURR_LIM_B is low due to IDS current fault)

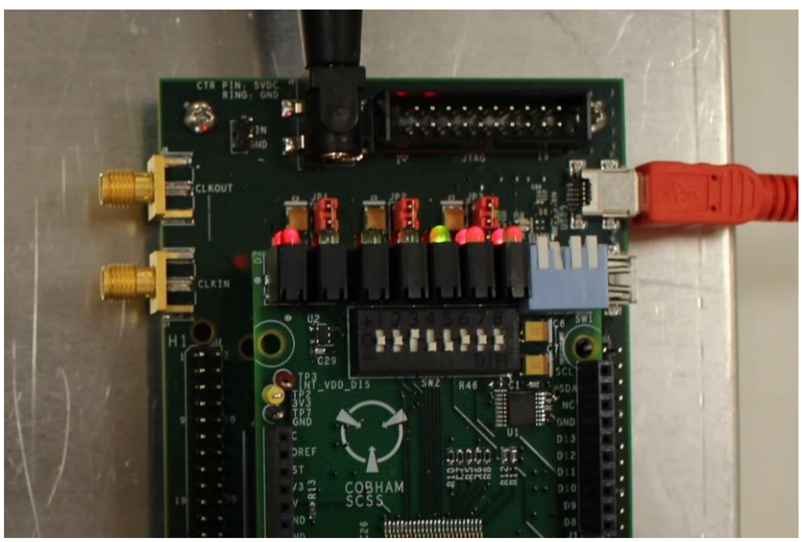

Figure 21

Ternary Switches (Black, 1 to 8): ADDR4, ADDR3, ADDR2, ADDR1, ADDR0, NC, NC, NC
Current Ternary setting shown: 22 (LLHMM), PARITY high
Note: The PMB_EN piano switch (2nd position from the LEFT of the LEDs) must be down (Enabled) for any of these pins to be sampled by the SPSC-EVB

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Ternary switches 1-5 match up with ADDR[4:0] (ADDR4 is ternary switch 1, ADDR3 = sw2, …, ADDR0 = sw5). Switches 6-8 are not connected. For example, decimal 22 needs to be LLHMM on the ADDR pins (LSB->MSB), so the switches from 1 to 8 would be: Middle, Middle, High, Low, Low, X, X, X. When a ternary switch is low, the corresponding red LED will light up, nothing will light up for a middle, and when high a green LED will light up.

The Parity Switch is the piano switch closest to the LEDs, and denotes odd parity on the ternary switches. For decimal 22, the parity switch should be in the up position, allowing a pulldown resistor to pull the PARITY pin to digital ground. For decimal 23, the parity switch should be in the down position, tying PARITY directly to 3V3.

Decimal Value	Ternary Pins (LSB->MSB)	Parity Switch	Decimal Value	Ternary Pins (LSB->MSB)	Parity Switch
16	LLMHM	Up (logic 0)	70	LHMHM	Up
17	LLMHH	Down (logic 1)	71	LHMHH	Down
18	LLHLL	Down (logic 1)	76	LHHMM	Up
19	LLHLM	Up (logic 0)	77	LHHMH	Down
20	LLHLH	Down	78	LHHHL	Down
21	LLHML	Up	79	LHHHM	Up
22	LLHMM	Up	80	LHHHH	Down
23	LLHMH	Down	81	HLLLL	Up
24	LLHHL	Down	82	HLLLM	Up
25	LLHHM	Up	83	HLLLH	Down
26	LLHHH	Up	84	HLLML	Up
27	LMLLL	Down	85	HLLMM	Down
28	LMLLM	Up	86	HLLMH	Down
29	LMLLH	Down	87	HLLHL	Up
30	LMLML	Down	88	HLLHM	Up
31	LMLMM	Up	89	HLLHH	Down
32	LMLMH	Up	90	HLMLL	Down
33	LMLHL	Down	91	HLMLM	Up
34	LMLHM	Down	92	HLMLH	Down
35	LMLHH	Up	93	HLMML	Up
36	LMMLL	Down	94	HLMMM	Up
37	LMMLM	Up	95	HLMMH	Down
38	LMMLH	Up	96	HLMHL	Down
39	LMMML	Down	98	HLMHH	Up
41	LMMMH	Up	99	HLHLL	Down
42	LMMHL	Up	100	HLHLM	Up
43	LMMHM	Down	101	HLHLH	Down
46	LMHLM	Down	102	HLHML	Down
47	LMHLH	Up	103	HLHMM	Up
48	LMHML	Down	104	HLHMH	Up
49	LMHMM	Up	105	HLHHL	Down
50	LMHMH	Up	106	HLHHM	Down
51	LMHHL	Down	107	HLHHH	Up
52	LMHHM	Up	108	HMLLL	Down
53	LMHHH	Down	109	HMLLM	Up
54	LHLLL	Down	110	HMLLH	Up
56	LHLLH	Up	111	HMLML	Down
57	LHLML	Down	112	HMLMM	Up

Decimal Value	Ternary Pins (LSB->MSB)	Parity Switch	Decimal Value	Ternary Pins (LSB->MSB)	Parity Switch
58	LHLMM	Down	113	HMLMH	Down
59	LHLMH	Up	114	HMLHL	Down
60	LHLHL	Down	115	HMLHM	Up
61	LHLHM	Up	116	HMLHH	Down
62	LHLHH	Up	117	HMMLL	Up
63	LHMLL	Down	118	HMMLM	Up
69	LHMHL	Up	119	HMMLH	Down

APPLICATION NOTE

Ver 2.0.1

7/7/2021

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REVISION HISTORY

Date	Revision	Author	Change Description
07/15/2019	1.0.0	OW	Initial Release
12/9/2019	1.1.0	TLM	• Added reference to applicable evaluation boards in reference table. • Updated some figures from the latest revision of the GUI software. • Added significant new content section 4.5.2.1 SPSC Setup. Made editorial and formatting changes throughout.
4/15/2020	2.0.0	TLM	• Changed references to UT36PFD103-EVB-R0 to correct ordering PN of UT36PFD103R0-EVB • Added references to UT05PFD103R0-EVB • Added new GUI features to include selection of either the UT36PFD103R0-EVB or UT05PFD103R0-EVB which scales the telemetry plot setting to align with the specific EVB settings • Added SOA setup functionality from the FET selection pull-down menu and the ability to use a separate text file to add FETs and their parameters in an ASCII text format
7/7/2021	2.0.1	OW	Updated Template

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