



ASNTu2s PCB v5.0 with Tiger Board USB to 5-Channel 3-Wire Interface Bridge *Application Notes*

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Tiger Board Description

1. The Tiger Board shown in Fig. 1 is a universal USB-controlled Master/Slave SPI/I2C/JPIO interface. For the current application, it is configured as a 5-channel SPI interface. It includes a SPARTAN-6 FPGA with support components, a micro-USB connector, as well as a 40-pin and 34-pin male connectors. The board measures approximately 3.2x2.4 inches. More details can be found on the Nano River Technology web site at <http://www.nanoriverteChom/tigerboard-software.html> , specifically in the http://www.nanoriverteChom/files/doc/TigerBoardUserGuide_ver_Nov12.pdf document.

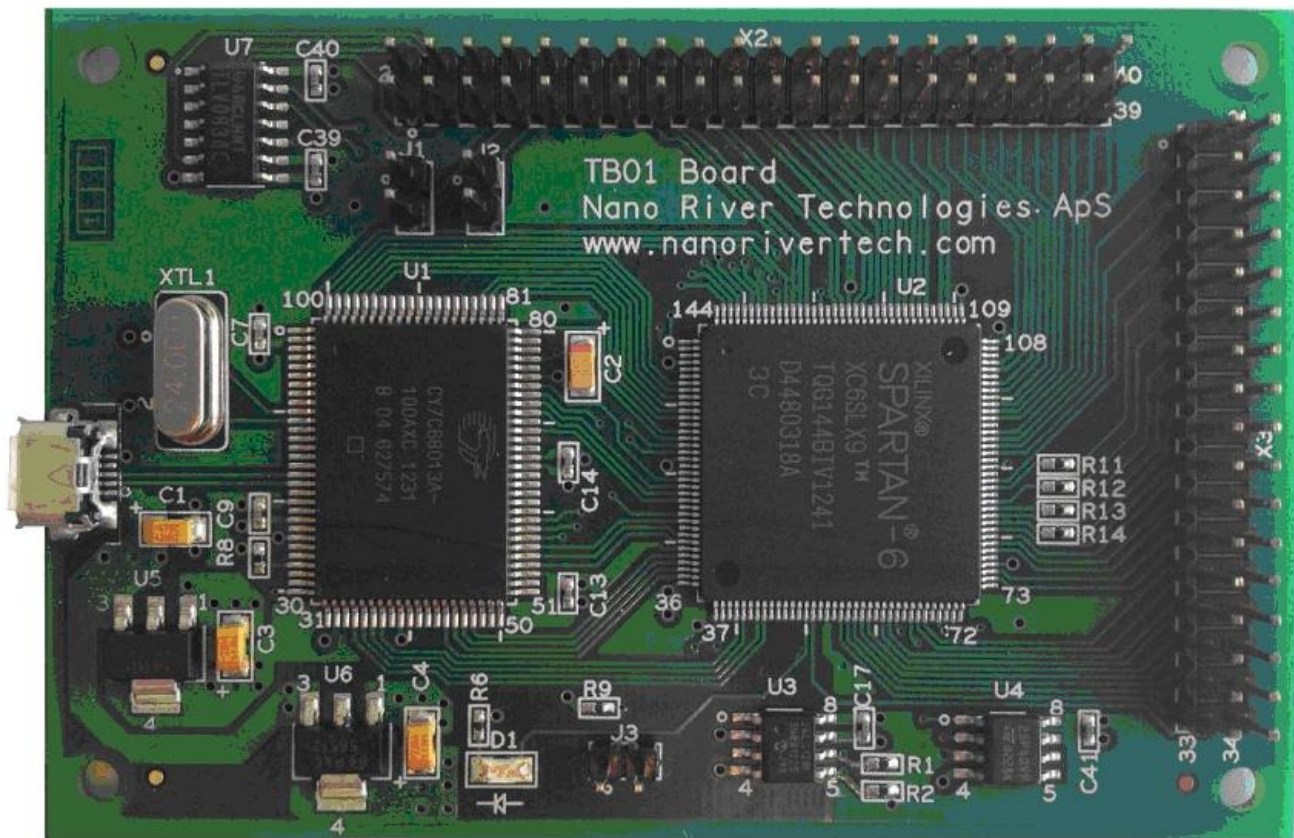


Fig. 1. Tiger Board

2. In the current configuration, the 34-pin male connector is used to deliver signals to the ASNTu2s PCB v5.0 that serves as an adapter.

ASNTu2s PCB v5.0 Description

1. The ASNTu2s PCB v5.0 shown in Fig. 2 is a 5-channel splitter, and 3.3V SPI to applicable VDD SPI level converter for the SPI interface. It includes two optocouplers ICs, MOLEX connectors (J6, J7, J8) for configurable power supplies, a 34-pin female connector (P1) interfacing ASNTu2s PCB v5.0 with Tiger Board, five 7-pin SATA connectors (J1-J5), and two 3-pin jumpers for supply configuration. The board measures approximately 3.2x2.4 inches.

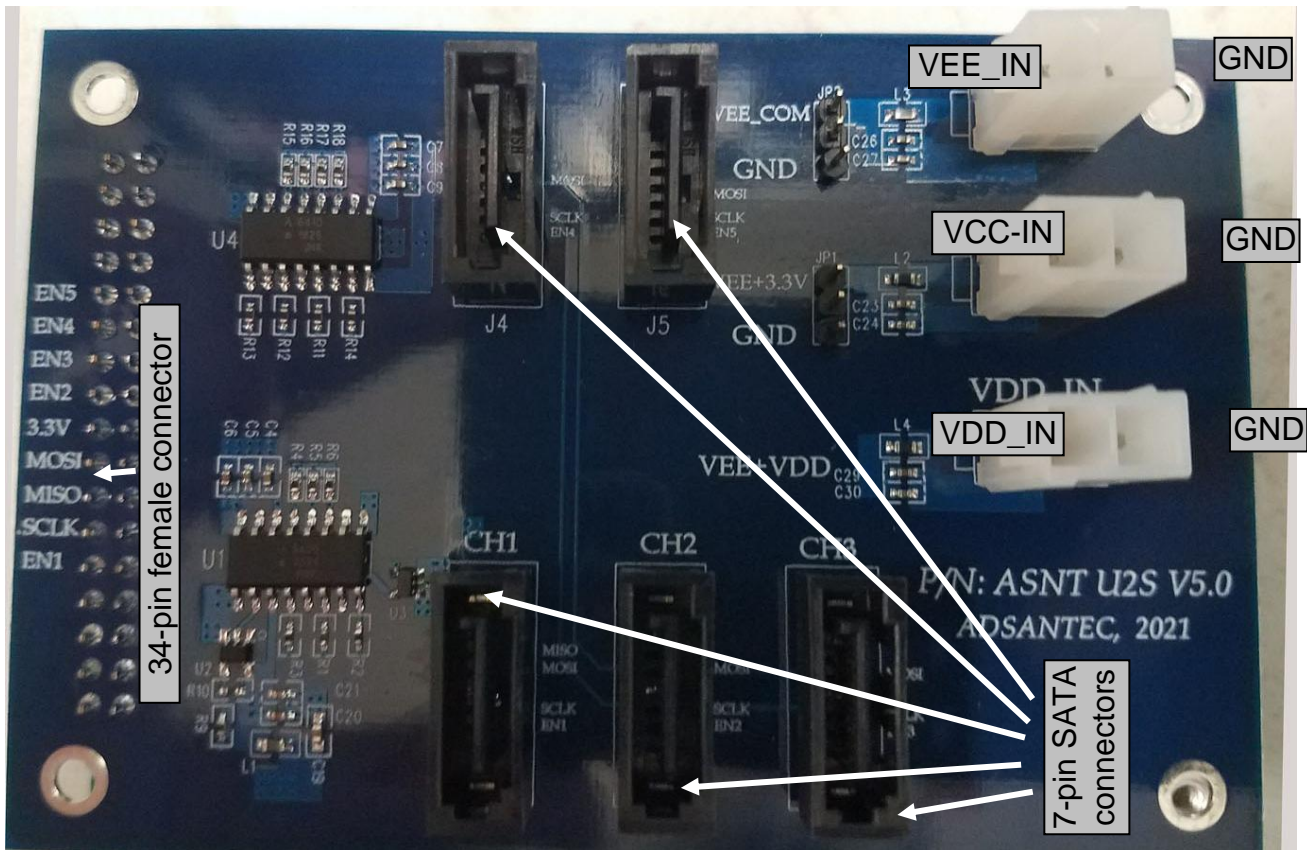


Fig. 2. ASNTu2s v5.0

- The ASNTu2s PCB v5.0 allows for control of up to five DC-coupled 3-wire SPI channels with a user-selectable VDD power supply through a USB port. The board delivers the same clock (clk) and data (di or d) signals to all five SATA connectors. Five enable signals (en1-en5) are delivered to connectors J1-J5 respectively. They correspond to Tiger board enable signals as shown in Table 1.

Table 1. Channel to Enable Signal Correspondence

u2s channel #	CH1	CH2	CH3	CH4	CH5
Tiger board enable signal #	0	2	4	6	8

- The connector J1 also provides access to the channel 1 output data signal (do1). The SATA connector mapping is shown in Table 2.

Table 2. SATA Connector Mapping

Pin #	1	2	3	4	5	6	7
Signal	GND	enX	clk	GND	di	do1 for J1 or n/c for J2 to J5	GND

- The board can control 3-wire interfaces (SPI) on PCBs with either positive or negative power supplies.
- The board requires either two, or three external power supplies as shown in Fig. 3, depending on the SPI supply polarity on the controllable PCB.

5.1. A selectable negative supply VEE_IN from 0 to -5.0V in relation to the external GND (PSU1) defines the low voltage level of the output 3-wire interface signals. For all negative SPI

configurations, the required negative voltage should be applied to the corresponding connector while the central pin of the jumper JP2 should be shorted to VEE_COM.

- 5.2. It is possible to use the same setup for positive SPI configurations with VEE_IN=0V.
- 5.3. Alternatively, for positive SPI configurations PSU1 can be eliminated and the central pin of the jumper JP2 is shorted to GND.
- 5.4. The constant positive supply VCC_IN=+3.3V (PSU2) is powering the output interface drivers and should be referenced to GND if PSU1 is not used (for positive SPI configurations), or to VEE_IN (floating supply) if PSU1 is used (for both negative and positive SPI configurations with VEE_IN=0 for positive configuration).
- 5.5. The selectable positive supply VDD_IN=+3.3V (PSU3) defines the high voltage level of the output 3-wire interface signals, and should be referenced to GND if PSU1 is not used (for positive SPI configurations), or to VEE_IN (floating supply) if PSU1 is used (for negative or positive SPI configurations with VEE_IN=0 for positive configuration).

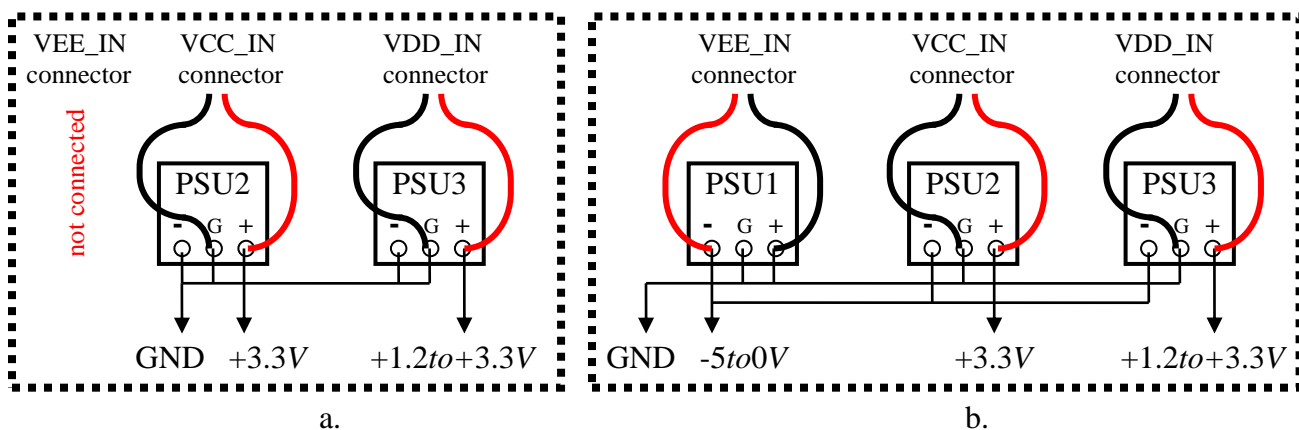


Fig. 3. Grounded Supply Configuration (a) and Floating Supply Configuration (b)

6. The jumper JP1 should be shorted to VCC for all working supply configurations.

Software Installation

1. Use the USB stick provided, or Download the Tiger Board software for the required operation system (supported operation systems are Microsoft Windows XP with Service Pack 3 and newer) from Nano River Technology web site: <http://www.nanoriverteChcom/tigerboard-software.html>
2. Install the Tiger Board software following instructions:
 - 2.1. For Windows XP use the provided file WinXP_Installation_of_TigerBoard.pdf or the link http://www.nanoriverteChcom/files/winxp/WinXP_Installation_of_TigerBoard.pdf.
 - 2.2. For Windows 7 or newer use the provided file Win7_Installation_of_TigerBoard.pdf or the link http://www.nanoriverteChcom/files/win7/Win7_Installation_of_TigerBoard.pdf.
3. Double-click the file TBshell_setup.exe and follow the instructions on the screen.



Bridge Operation

1. The part is static sensitive. Please observe anti-static protection procedures!
2. Connect the Tiger Board to a computer using a USB cable.
3. Attach the ASNTu2s PCB v5.0 to the Tiger Board as shown in Fig. 4.

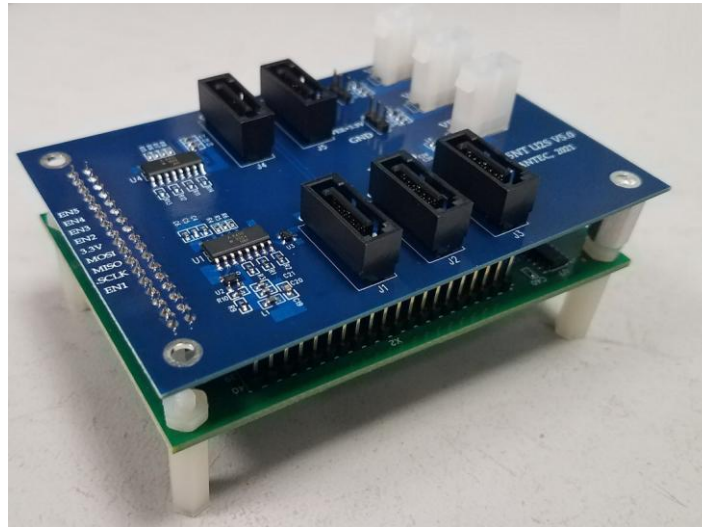


Fig. 4. ASNTu2s PCB v5.0 and Tiger Board Assembly

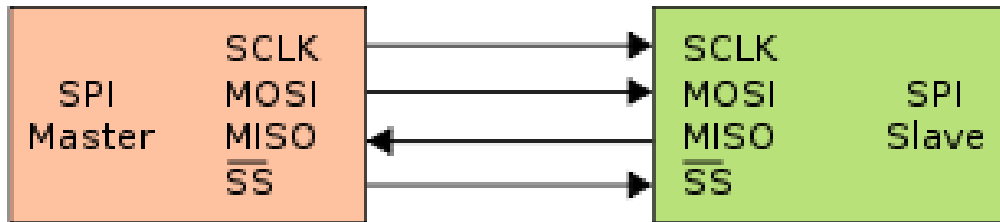
4. Switch on three external power supply units, and set their voltage values to 0.0V.
5. Connect the supply unit's output pins to the PCB's white 2-pin Molex connectors as shown in Fig. 3.
6. Connect the ASNTu2s PCB v5.0 J1-J5 SPI channels to the controlled PCBs following the GUI descriptions below (Connect to J1 if SPI readback feature is required).

Note 1: The GUI will function correctly even if some channels are not connected.

7. Gradually increase the VEE_IN negative supply voltage to the desired value.
8. Gradually increase the floating VCC_IN positive supply voltage to +3.3V.
9. Gradually increase the floating VDD_IN positive supply voltage to the desired value.
10. VEE_IN voltage can now be adjusted as required without changing the VCC_IN, and VDD_IN voltages.

SPI Operation

The Serial Peripheral Interface Bus (SPI) is a synchronous serial data link that operates in full duplex mode. SPI devices communicate in master/slave mode where the master device initiates the data frame. The simplest SPI configuration is shown in Fig. 5.



- SCLK — Serial Clock (output from master)
- MOSI — Master Output, Slave Input (output from master)
- MISO — Master Input, Slave Output (output from slave)
- SSn — Slave Select (active low; output from master)

Fig. 5. SPI Bus: Single Master and Single Slave

A typical hardware setup uses shift registers to form an inter-chip circular buffer. If the system does not require reading from the slave, the MISO output can be used for functional test purposes as shown in Fig. 6.

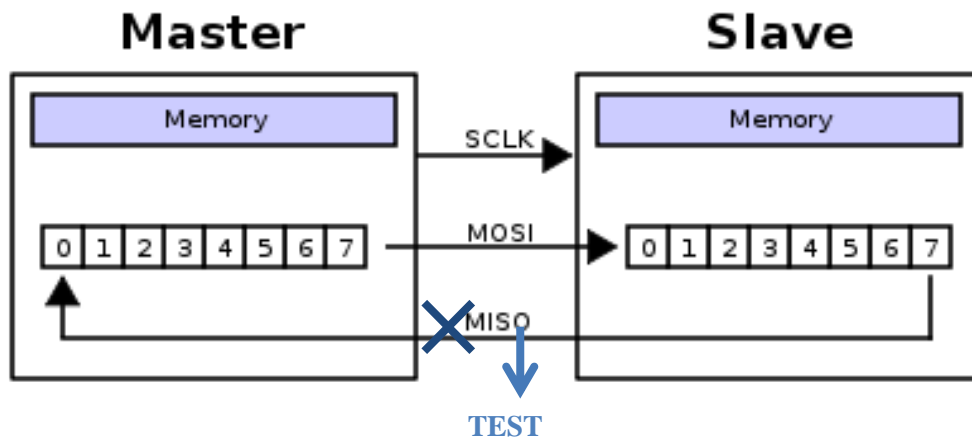


Fig. 6. SPI 8-bit circular transfer

Multiple slave devices are allowed with individual slave select lines SSn as shown in Fig. 7.

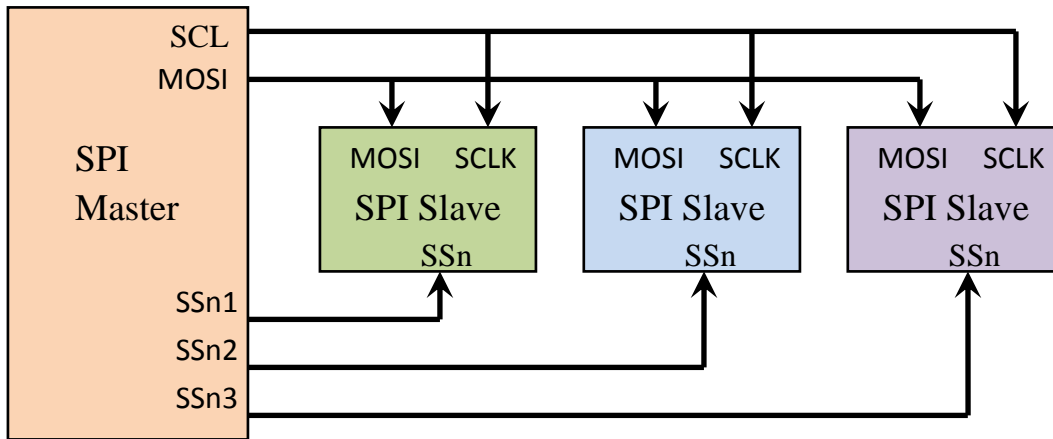


Fig. 7. SPI with Three Slaves

The SPI can operate in different modes defined by the clock polarity CPOL, and clock phase CPHA parameters as shown in Table 2.

Table 3. SPI Operational Modes

CPOL	CPHA	The first clock edge is:	Data is sampled by:
0	0	Rising	the leading (first) clock edge
0	1	Rising	the trailing (second) clock edge
1	0	Falling	the leading (first) clock edge
1	1	Falling	the trailing (second) clock edge

The on-chip SPI modules operate only in slave mode with CPOL=0 and CPHA=0, as shown in Fig. 8.

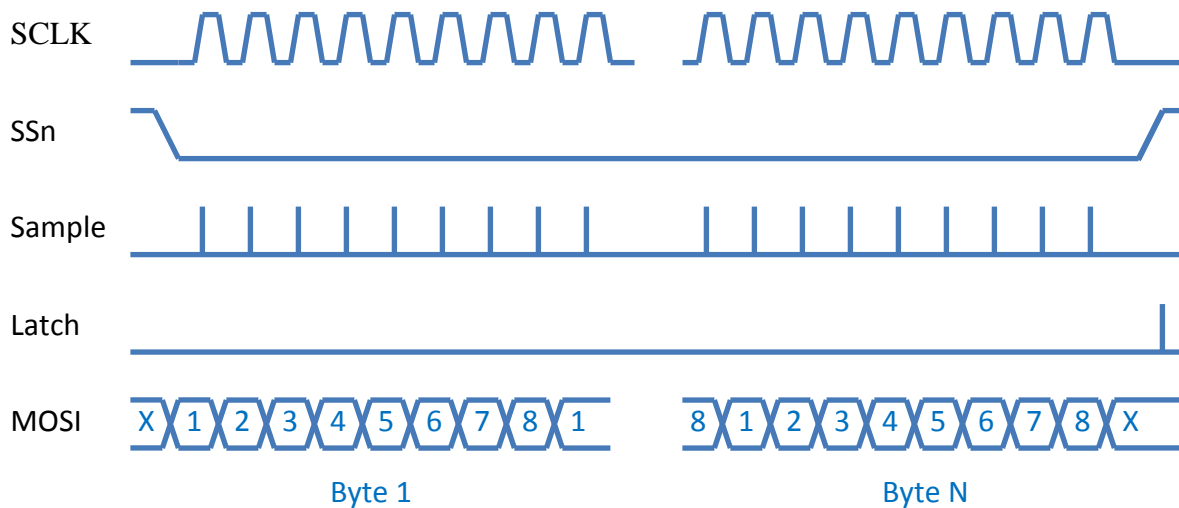


Fig. 8. SPI Transfer Mode

TBshell Dashboard Description

1. To run the dashboard, select the "ADSANTEC TigerBoard Shell" icon on the desktop, or in the "ADSANTEC TigerBoard Shell" Start menu.
2. The default TBshell dashboard window is shown in Fig. 9. It has seven drop-down lists, one for each ASNTu2s channel, buttons "Apply" and "Run", and the drop-down menu "File".

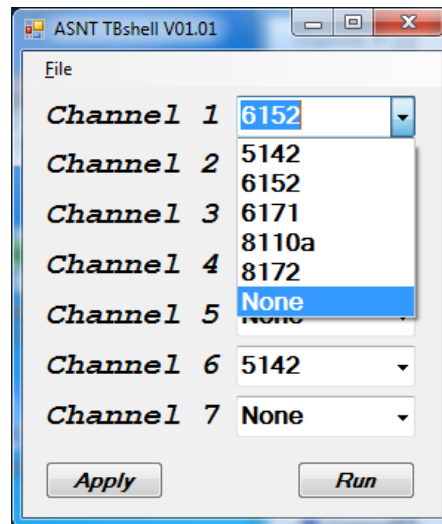


Fig. 9. TBshell dashboard Window

3. The ADSANTEC TigerBoard Shell can work on a computer with, or without a connection to a Tiger Board.
4. Up to 5 independent products can be controlled from a TigerBoard-u2sv5.0 assembly. Some products also may require more than one channel for their control.
5. To run a particular product's GUI from the TBshell, click the channel to which the product is connected, and select the product name from the menu. Select "None" for all non-used channels. Press the "Apply", or "Run" button to activate the GUI. The "Apply" button preserves the dashboard on the desktop; the "Run" button closes it.
6. The last product selection is saved automatically, and loaded with the next dashboard run. The current selection can also be saved, and then loaded back. To save the current selection to a file, click on "File" menu, then select "Save state" from the pull-down menu. Using the Windows navigator, select a directory, and enter a filename or select an existing file. To load a selection from a file, click on "File" menu, then select "Load state" from the pull-down menu. Using the Windows navigator, select a file to load.
7. Each GUI can be also activated without the dashboard. To run a particular GUI without running the dashboard, select the "ASNT####" icon in the "ADSANTEC TigerBoard Shell" Start menu, where #### is a 4-digit product number.



Common GUI Description

This section describes common properties, and controls of all ADSANTEC GUIs.

1. If a Tiger Board is not connected, the GUI will operate in Demo mode, and the red warning note "Board not connected. Demonstration Mode Only" will be displayed.
2. The warning will disappear when a Tiger Board is connected.
3. After GUI activation for a particular product, a pre-defined default state is loaded.
4. The current state of the GUI can be saved and then loaded back. To save the current state in a file, click on the "File" menu, then select "Save state" from the pull-down menu. Using the Windows navigator, select a directory, and enter a filename or select an existing file.
5. To load a state from a file, click on the "File" menu, then select "Load state" from the pull-down menu. Using the Windows navigator, select a file to load. The new data will be sent automatically.
6. Modify the GUI control values as required. The controls can be manipulated as follows:
 - a. Checkboxes can be clicked ON (checked), or Off (empty).
 - b. Radio buttons can be clicked ON (checked), or Off (empty).
 - c. Sliders in the scrollbars may be shifted.
 - d. The arrows in the numeric up-downs, and scrollbars may be clicked (1-step change), or clicked-and-held (constant change).
 - e. The number in the numeric up-downs can be directly typed in. Click **Enter** to confirm.
7. The GUI sends new data after any move of the slider, arrow click, or data confirmation.
8. The GUI can also operate in Expert mode. To activate Expert mode, click on the "File" menu, and select "Enter Expert Mode" from the pull-down menu.
9. In Expert mode, the following additional options are available:
 - a. Selection of certain pre-assigned operational frequencies for the interface. To change the interface operational frequency, click the **Frequency** arrow, and select the desired value from the pull-down menu.
 - b. Assignment of the active TB-u2s channel number. To assign a different channel to a particular GUI, click the corresponding **Channel** arrow, and select the desired value from the pull-down menu.
 - c. Visual control of the clock polarity (CPOL), and phase (CPHA) parameters. For the current application, both parameters are set to 0. For more details see the EQ_3w_AN document.
 - d. Visual control of the sent, and received data packets (**Writing:** and **Reading:** lines in the additional panel at the bottom of the GUI window). The transmission information (panel name and channel number) precedes the **Writing:** and **Reading:** lines.
 - e. In some GUIs there are additional controls in expert mode for ADSANTEC internal use for testing and debugging.



- 10. **Note 1:** Data reading is delayed by one cycle compared to data writing. In case of the correct SPI operation, the previous writing (top line) should be equal to the current reading (bottom line).
- 11. **Note 2:** Full received data is displayed for channel 1 only.
- 12. To return to Standard mode, click on the "File" menu, then select "Enter Standard Mode" from the pull-down menu.
- 13. Example of a GUI running in expert mode is shown in Fig. 10.

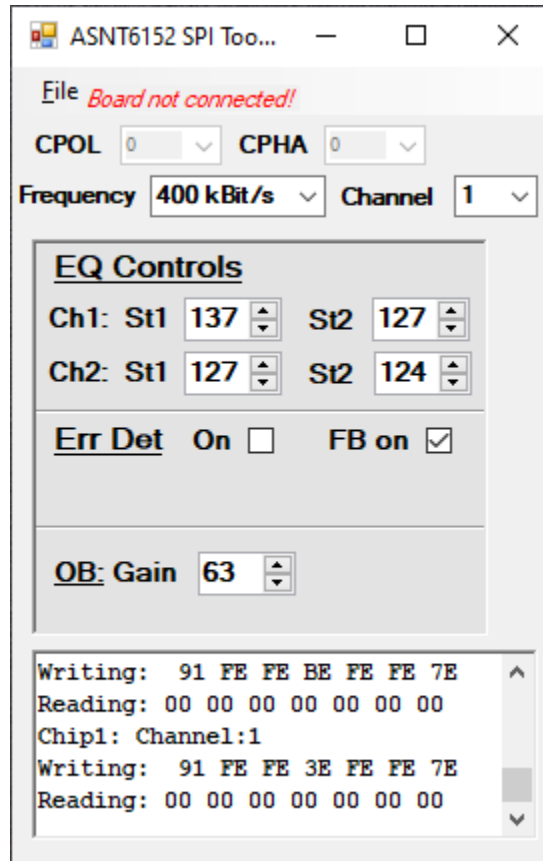


Fig. 10. GUI in the expert mode example

REVISION HISTORY

Revision	Date	Changes
1.1.2	09-2021	Added Tiger board enables to u2s channels correspondence
1.0.2	07-2021	First release