

TSS200B TELEMETRY SIGNAL SIMULATOR USER'S GUIDE



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SAFETY SUMMARY

System Weight and Handling Restrictions - Depending upon the specific system and configuration, each TSS200B chassis weighs between 25 and 35 pounds. Accordingly, take care in the lifting and installation of each chassis. When lifting the chassis, always lift from the bottom of the main chassis frame.

Electrical - The TSS200B is designed to operate on 115/230 VAC 50/60 Hz and comply with all U.S. and International safety codes and regulations required for safe operation and use of commercial equipment. Use standard and accepted safety practices with respect to operating commercial electrical equipment at all times to avoid the risk of personal injury or death.

EMI/EMC - The TSS200B complies with all FCC and CE regulations regarding electromagnetic interference and compatibility. There are no personnel hazards or safety issues with respect to EMI/EMC when operating the system.

Exposure to Radio Frequency (RF) Signals - The TSS200B is designed to transmit RF signals from 70 MHz to 5250 MHz at levels of +10 dBm to -100 dBm. These signal levels are well below the minimum safe exposure levels prescribed by both U.S. and International standards.



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All	A2522-001	02/01/2011			
All	A2522-002	06/01/2011			
All	A2522-003	07/01/2012			
All	A2522-004	08/01/2020			
Sec. 4	A2522-005	01/01/2021			
All	A2522-006	01/01/2023			

Note:

The latest revision levels of all released Signal Generator Control and Monitor Software (SGCMS) program and related Touch screen software (SGCMS Client, SGCMS Remote Server and 4.3" touch screen) are available on SEMCO's website (<u>www.semco.com</u>) and can be downloaded, installed and used on all TSS200B systems, regardless of system S/N. Instructions for downloading and installing this software are on the website as well as in this User's Guide.



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1 - INTRODUCTION

1.1 Scope

This User's Guide provides the necessary information for the installation and operation of SEMCO's TSS200B Telemetry Signal Simulator, which is used to test telemetry receivers and telemetry ground stations by dynamically simulating telemetry signals normally encountered from tracking antennas during the test of aircraft, missiles and weapon systems.

1.2 Purpose and Description

This User's Guide provides detailed information to allow for installation and operation of the TSS200B Telemetry Signal Simulator (Figure 1-1). As such, this User's Guide addresses all TSS200B systems produced by SEMCO after the date of this document. This manual can also be used as reference material for earlier production systems, even though these earlier system configurations may not have all features available with the latest TSS200B configurations.

Section 2 Getting Started briefly describes and lists the standard and optional hardware features of the TSS200B system and then describes how to install and apply power to the TSS200B hardware. Section 2 also describes the initial installation and boot process for the Signal Generator Control and Monitor Software (SGCMS) Client program and related touch screen software.

Section 3 Hardware I/O and Remote Network Controls describes system hardware I/O interface. The standardized hardware I/O description facilitates installation of each TSS200B Telemetry Signal Simulator in a typical Telemetry Ground Station. Section 3 also describes the initial installation, operation and use of the SGCMS Server program, including setting up remote control of a TSS200B as a network Client.

Section 4 Telemetry Signal Simulator Operation provides instructions for TSS200B operation, including set-up and status monitoring of all simulator operating features and parameters.



Figure 1-1 TSS200B Telemetry Signal Simulator



2 – GETTING STARTED

2.1 System Description

The TSS200B Telemetry Signal Simulator is a 2U rack-mounted system designed for pre-mission checkout of a telemetry ground station, as well as telemetry receiver maintenance testing. In this regard, the simulator provides single and optional dual RF outputs, an embedded 70 MHz multi-mode modulator, dynamic Combiner test feature (Phase, Fade and Fade Rate), and two (2) embedded Bit Synchronizers, Frame Synchronizers, and Bit Error Rate Testers (BERTs) with Pseudo-Random Pattern Generators.

The RF frequency range is 200-1150 MHz, 1415-1585 MHz, 1650-1850 MHz, 2185-2485 MHz and 4400-5250 MHz. Modulation formats include PCM/FM, NTSC Composite Video (Bars), PM, BPSK, QPSK, AQPSK, UQPSK, AUQPSK, FM/FM Sub-Carrier, IRIG 106-20 Tier I SOQPSK-TG and Tier II Multi-h CPM. Forward Error Correction (FEC) encoder outputs include convolutional and Low-Density Parity Check (LDPC).

The TSS200B can be externally modulated with a user-provided signal and test pattern, and also has binary file playback capability for external modulation using pre-recorded mission data.

Dynamic combiner performance testing can be accomplished using the optional combiner fade circuitry, which provides for dual RF outputs, user-selectable phase shifts and CH1/CH2 signal level shifting (fade) at user-selectable fade rates.

The TSS200B design architecture supports a dual channel Test Signal Simulator/Fader, FPGA-based I/Q modulator, an internal 10 MHz reference, two (2) embedded Bit Synchronizers, Frame Synchronizers, BERTs that each include a pseudo-random code generator, and an optional internal power meter sensor for providing precise, calibrated RF outputs within +/- 0.1 dBm. These components are all designed into a ruggedized 2U rack-mount PC chassis.

The phase-locked RF source and modulator provides user-selectable, calibrated RF signal outputs from +10 dBm to -100 dBm in selectable 0.1, 0.5, 1- and 10-dB increments.

An optional RF multi-path simulator feature provides selectable 1, 2, 3 and 4 ray simulation, providing the user the ability to set RF signal delay, frequency offset, phase and magnitude parameters in testing a telemetry receiver's ability to correct for various RF multi-path scenarios.

An AUTO-BERT feature is also available, allowing the user to automatically plot and display E_b/N_o curves on the TSS200B Graphical User Interface (GUI), and save and store all E_b/N_o measurements.

TSS200B system local set-up, control and statusing is provided by the Signal Generator Control and Monitoring Software (SGCMS) Client program GUI. The rear panel interface is any standard SVGA display, keyboard and mouse/trackball. This local GUI interface is augmented by a 4.3" front panel touch screen that provides simultaneous setup and display in conjunction with the local GUI.

Remote operation via Ethernet is also provided using the SGCMS Server (Network) program. Both the internal TSS200B processor as well as the Remote Server use Windows 10 operating systems.

2.1.1 System Configurations and Options

The TSS200B is produced in several user-specified configurations. <u>Standard hardware features include</u>:



- A. L and S-Band RF Tuning (1415-1585 MHz, 1650-1850 MHz and 2185-2485 MHz)
- B. Multi-mode modulation (PCM/FM, NTSC Composite Video, PM, BPSK, QPSK, AQPSK, UQPSK, AUQPSK, IRIG 106-20 Tier I SOQPSK-TG and Tier II Multi-h CPM)
- C. External modulation and File Playback
- D. Dual Embedded Bit Synchronizers, Frame Synchronizers and BERTs with PN Pattern Generators
- E. AUTO-BERT feature
- F. RF multi-path simulator feature
- G. 4.3" Front Panel Touch screen controls and status displays
- H. Removable 32 GB solid state drive

Optional features include:

- A. Dual RF Outputs with a Dynamic Combiner Test feature (fade, phase and fade rate)
- B. P/CIF and C-Band RF Tuning (200-1150 MHz and 4400-5250 MHz)
- C. FM/FM Subcarrier modulation (up to 2 subcarriers)
- D. Convolutional (Viterbi), Reed-Solomon and LDPC FEC encoders
- E. Embedded power meter sensor for precision RF outputs
- F. +20 dBm and +37 dBm high power options.

2.2 System Hardware Installation and Set-up

The user should read this User's Guide and become familiar and comfortable with the overall features, options and configuration of the specific system that will be installed and operated.

Figure 2-1 illustrates the front and rear panel I/O of all system configurations with respect to AC power, software communications, touch screen, GUI display, keyboard and mouse. A jumper cable is installed where shown between the **Translator In** and **COM 1** connectors in order to operate properly.





Figure 2-1 TSS200B System Power and Boot-Up Connections



Figure 2-2 depicts the proper system set-up for initializing the system software for both local control and remote control via Ethernet. (Initializing the system via the touch screen does not require this set-up).



Figure 2-2 System Local and Remote (Network) Connections

2.3 System Software

2.3.1 Software Overview

The TSS200B uses the SGCMS Client program software, related touch screen software and the SGCMS Server software. Both the SGCMS Client software and the SGCMS Server software provides a Graphical User Interface (GUI) for all user required TSS200B operation, control, settings and status monitoring.

The SGCMS Client program runs on the TSS200B's Windows 10 Operating System and is designed for local operation using both a front panel touch screen, local GUI display and keyboard/mouse. The SGMCS Server program provides for remote (network) control via Ethernet, with a GUI display that is identical to the local GUI display. The SGCMS Server software is addressed in detail in **Section 3**, **paragraph 3.2 SGCMS Network Program Description**.

All system functions and set-up controls are by keyboard entry and/or by GUI pull-down menu screens that are selected and controlled by the mouse/touchpad, or via the touch screen. System status is via display indicators (alpha-numerical readouts) on the local GUI display, remote PC GUI display and the front panel touch screen.

2.3.2 Software Startup and Boot Procedures

Once AC power is applied to the system chassis, start the Windows 10 Operating System as well as the SGCMS Client program by depressing the **RED Power** button located on the TSS200B front panel. The SGCMS Client program is setup at the factory for automatic boot-up when the TSS200B is turned on.

Clicking on the SEMCO SGCMS Antenna icon in the **Start-Up Menu** or **Desktop** will also initiate system software. During the "auto-boot" process, **"Looking for Touch screen"** and "**Obtaining System Configuration...**" is displayed.

The software determines what the system configuration is by sending the appropriate commands to all installed cards and modules and looking for the expected response.





Once the system configuration is determined, the software then retrieves, restores and displays all system settings from the last system set-up. The SGCMS "auto-boot" process also enables the front panel touch screen (Figure 2-3). The corresponding local GUI display is shown in Figure 2-4.



Figure 2-3 Touch Screen Display



Figure 2-4 SGCMS Client GUI Control Panel



Once the applicable GUI control panels appear on the display and touch screen, the next step is to click on **Windows** in the GUI Tool Bar, which enables a pull-down menu as shown in Figure 2-5.

The user then clicks on **System Configuration**, which opens up the System Configuration display and provides important information to ascertain initial system health and communication status, as well as determine the exact system Circuit Card Assembly (CCA), module and software/firmware configuration.



Figure 2-5 System Configuration Display

2.3.3 System Shutdown

There are 3 methods to shut down a system:

A. Standard Windows 10 shutdown through the Windows Operating System

<u>Step 1</u> - Click on the Microsoft icon in the lower left corner of the desktop screen.

Step 2 - Select the Power icon.

Step 3 - Select Shutdown from the resulting Shutdown-Restart menu to shut down the system.

B. Shutdown Sequence using the TSS200B touch screen (Figure 2-6)

Step 1 - Press the touch screen Utility tab.

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<u>Step 2</u> - Press red **SHUTDOWN** button in top right corner.

Step 3 - Select the GREEN YES to commit to shutting down the simulator.

C. Physical shut down by a <u>SINGLE ONE (1) SECOND PRESS</u> of the <u>RED</u> Power button on the TSS200B front panel.



Figure 2-6 Touch Screen System Power Down Sequence

2.3.4 SGCMS Client Program Software Installation

The SGCMS Client program is installed on each individual TSS200B system. As previously described, this program allows for local monitoring and control of the TSS200B via a display and keyboard/mouse. In addition, each Local TSS200B (Client system) will attempt to connect to the SGCMS Remote PC (Server application) at a specified Server IP address that has been set in the SGCMS Client application.

The SGCMS Server program resides on a remote PC (i.e., Server) and once activated, listens for any Client systems requesting connection to it. A connection is established when a Client's request is detected, and a graphical status panel is displayed in the Server system's main window. Installation and detailed description of the SGCMS Server program is addressed in **Section 3**, **paragraph 3.2 SGCMS Network Program Description.**

The SGCMS Client program is factory installed and setup for automatic boot-up when the simulator is turned on. There may be an occasion to install a new or upgraded SGCMS Client program in the field. This requirement will normally be associated with a simulator software upgrade, and standard software installation procedures pertaining to the addition or deletion of a program in a Windows 10 OS environment are used as described in subsequent paragraphs.



The following steps address SGCMS Client program software installation on the TSS200B:

<u>Step 1</u> - If the SGCMS program has been previously installed, Uninstall the software before continuing as shown in Figure 2-7. Right-Click on **Start > Apps and Features**, find and click on the program and then select **Uninstall**.

<u>Step 2</u> - To Install the new SGCMS program, navigate to the installation folder (CD, USB, etc.), right-click on the **setup** file and choose **Run as Administrator** as shown in Figure 2-8. Acknowledge the prompts, click on **Next** (3 times) and finally **Close**. The SGCMS software is now installed.



Figure 2-7 Uninstalling an Existing SGCMS Client Program

Name	^	Date modified	Туре	Size
🛃 SEMCO SGCMS		8/8/2020 12:49 PM	Windows Installer	1,170 KB
😵 setup	-	8/8/2020 12:49 PM	Application	593 KB
	Open			
	💡 Run as administ	rator		

Figure 2-8 Installing a New SGCMS Client Program

<u>Step 3</u> - After installing the SGCMS program, a shortcut needs to be placed in the **Startup** folder so that the software automatically launches when the simulator boots up.

First, copy the shortcut to the new software installation and then navigate to **SEMCO SGCMS** in the programs menu by clicking on **Start > SEMCO >.** <u>Right-click</u> on **SEMCO SGCMS > More >** and **Open file location** as shown in Figure 2-9.



This will open the location of the shortcut to the SGCMS program as shown. <u>Right-Click</u> on the **SEMCO SGCMS** program and select **Copy**.





<u>Step 4</u> - Open the **Startup** folder to paste this copied shortcut. Press the **Windows Key + R** as shown in Figure 2-10 to launch the **Run Window**. Type **shell:startup** and then press **Enter** (or OK) as shown.

If the SGCMS program was previously installed and there is a shortcut in the folder, delete the SGCMS shortcut.

<u>**Right-Click**</u> in the **Startup** folder and select **Paste**. This will paste the previously copied shortcut to the SGCMS program in this folder. Now when the computer is booted up, the SGCMS will be automatically launched without user intervention.

ĩ lị	© # 2 3	5	5	🖅 Run		×
Tab +	Q W	E F	F G		Type the name of a program, folder, document, or Ir resource, and Windows will open it for you.	ternet
shift T	Z	× Uc	U, ×́I	Open:	shell:startup	~
Ctrl	Alt	U_			OK Cancel Brow	wse

Figure 2-10 Step 4 - Installing SGCMS Client Program in Startup Folder



2.3.5 Touch Screen Software Installation

<u>Step 1</u> – Download the latest 4.3" touch screen software from the <u>www.semco.com</u> website (see paragraph 2.3.4 B.). Extract the LCD folder from the downloaded "zip" file and replace the "C:\LCD" folder located on the hard drive of the simulator.

Step 2 - First make sure the SEMCO SGCMS GUI is completely closed.

<u>Step 3</u> - The program that is used for installation of new or updated touch screen firmware and software is available on the hard drive of each simulator system in C:\LCD\BMPloadxxxx.exe. Execute the BMPload program. The program will open with the window shown in Figure 2-11. Please make sure the text "BMPload Vx.x.x Supports SLCD43" is displayed in the blue bar of the program as shown. Contact the factory if the text is different.

<u>Step 4</u> - Ensure that the latest firmware is installed in the touch screen. Contact the factory for a CD with the latest 4.3" touch screen firmware, or go to <u>www.semco.com</u> home page to check and, if necessary download the latest firmware version.

Step 3 —	BMPload V1.10.0 - Supports SLCD/+, SLCD6, SLCD43			
	BMP List	Selected BMP Information		
		File Name		
		Size Colors		
		Bits per Pixel Bytes per Line		
		Total bytes Compressed		
		Notes		
		Macro File		
	Step 5 Step 6	Add Macro File		
		Font List File		
		Add Font List		
	Add BMP Remove BMP Load BMP List Save BMP			
	Sort BMP Files when added / loaded	Add Firmware C:\LCD\lb043_2_8_3c.upg	tep 4	
	Pert Setting: Binary Image Load / Save	SLED Statur		
	Port COM3	o File Status Disconnected		
	Baud Bate 460800 V CRC Value	Bytes Available 3145728 Step 7		
	Screen Snaphot			
	Autobaud Connect GetScn	een		
	Extra Settings	tom Palette High Color Store into SLCD ABORT Aux Escape C Drientation ASCII Hex Value Quit Touch Switch Debounce Delay (ms)		

Figure 2-11 Touch Screen Firmware/Software Installation Screen

<u>Step 5</u> - Set the **Port Settings** as shown in Figure 2-11. Select the **COM3** Port and a **460800** Baud Rate. Select **USB Autobaud** and press **Connect**. If an error appears, try **115,200** Baud Rate.



Note:

Touch screen firmware is embedded and supported by the touch screen manufacturer and will rarely ever need to be updated. If touch screen firmware does not need to be updated, skip to Step 9.

<u>Step 6</u> – (If Required) Click on the "**Add Firmware**" button. A window will pop up for navigating to the location of the firmware upgrade file (i.e. Hard Drive, Flash Drive or CD).

<u>Step 7</u> - (If Required) If the connection in Step 5 is successful, click on the button "**Store into SLCD**". When programming is complete, the SLCD Status screen will appear as shown in Figure 2-12.

ESLCD Statu:	8
Status	Programmed 589824 bytes in 45.0 seconds (13.1KB/s)
Bytes Availa	ble 3145728

Figure 2-12 Touch Screen Firmware Installation Status Screen

<u>Step 8</u> - (If Required) After new firmware is loaded into the touch screen, all parameters including the Baud rate are reset. The baud rate should now be 115,200. If the baud rate has not automatically changed to 115,200, change it to that rate as shown in Figure 2-13.

	🛤 BMPload V1.10.0 - Supports SLCD/+ , SLCD6, SLCD43	
	BMP List Selected BMP Information File Name Size Size Colors Bits per Pixel Bytes per Line Total bytes Compressed Notes Notes Macro File Add BMP Add BMP Remove BMP Load BMP List Save BMP List Firmware Dygade	
Step 8	Port Settings Binary Image Load / Gave SLCD Status Port CDM3 Load from File Save to File Baud Rate 115200 CRC Value 0xFDB4 Screen Snaphot Screen GetScreen	— Step 10
Step 11	Extra Settings V Set Power On Macro Power On Macro 1 Set Splash Screen Set Aux Escape Orientation Set Typematic Parameters Bitmap Number ASUI Hex Value Delay Set Control Port Repeat (x10ms) Port Number Delay (ms)	— Step 12

Figure 2-13 Touch Screen Software Installation Sequence



<u>Step 9</u> – The latest 4.3" touch screen software file, which was downloaded in Step 1, is shown in Figure 2-14. Alternatively, contact the factory to obtain a copy of the latest software version. This software program name will always end in **.BIN**.



Figure 2-14 Touch Screen Software Location

<u>Step 10</u> – Referring again to Figure 2-13, click on "Load from File" and a pop-up window will appear. Navigate to the location of the **.BIN** file, select the file and press Open.

<u>Step 11</u> - Make sure the following boxes are selected (checked); Set Power On Macro, Enable Bitmap Compression, Power On Macro = 1 and High Color.

<u>Step 12</u> - Click on "Store into SLCD" and wait until the "SLCD Status" completes (see Figure 2-13).

<u>Step 13</u> – Power down the simulator system. This action allows the Touch Screen to reset itself with the new programming. Restart the system. As soon as the computer starts booting, the Touch Screen display will appear as shown in Figure 2-15.



Figure 2-15 Touch Screen Boot-up Display



At this point, verify that the latest SGCMS Local Software has been installed, and refer to paragraph 2.3.4 if the SGCMS Software needs to be installed. When the GUI completes its startup, the Touch Screen will be functional, and the Touch Screen Main Menu screen appears as shown in Figure 2-16.



Figure 2-16 Touch Screen Main Menu Display



3 - HARDWARE I/O AND REMOTE NETWORK CONTROLS

3.1 Simulator Hardware I/O and Operation

Figure 3-1 depicts the TSS200B front and rear panel I/O. The front panel consists of a **RED Power** and **Reset** indicator, a 4.3" touch screen and a lockable door assembly housing a removable Solid-State Drive (SSD). The USB ports, which were originally per an earlier TSS200 configuration have been relocated to the rear panel. Table 3-1 lists and describes the TSS200B rear panel I/O interface.





Figure 3-1 TSS200B System I/O Interface

Table 3-1 TSS200B Rear Panel Signal I/O

Ref. Des.	Input/Output	Description
J1	CH 1 RF Out	"N" Connector RF Output (Channel 1)
J2	CH 2 RF Out	"N" Connector RF Output (Channel 2)
J3	PCM Out	Not Used
J4	70 MHz Out	BNC 70 MHz Output Signal (Modulated)
J5	Data In 2	BNC CH2 Data Input (Analog/TTL Baseband Video from external source)
J6	Data In 1	BNC CH1 Data Input (Analog/TTL Baseband Video from external source)
J7	Sync	Not Used
J8	I Data In	BNC External TTL Modulation Data Input
J9	Data Out	BNC Bit Synchronizer 1 Data Output
J10	Q Data In	BNC External TTL Modulation Data Input
J11	Clock Out	BNC Bit Synchronizer 1 Clock Output
J12	70 MHz In	BNC Input for external 70 MHz Modulation Source
J13	AUX 1	BNC Auxiliary I/O reserved for future requirements
J14	CAL In	"N" Connector input used for optional precision RF output calibration
J15	Data Out 2	BNC Bit Synchronizer 2 Data Output
J16	Clock Out 2	BNC Bit Synchronizer 2 Clock Output



3.2 SGCMS Network Program Description

SEMCO's SGCMS Network Program provides for remote control of one or several TSS200B systems. The Network Software comes in two separate applications. The Remote PC ("Server") side uses the **SGCMS Server Program**, and the Local TSS200B ("Client") side uses the **SGCMS Client Program**.

The SGCMS Client program is installed on each individual TSS200B system. This program allows for local monitoring and control of the TSS200B via a display and keyboard/mouse. In addition, each Local TSS200B (Client system) will attempt to connect to the SGCMS Remote PC (Server application) at a specified Server IP address that has been set in the SGCMS Client application.

Installation and description of the SGCMS Client program was previously addressed in Section 2, paragraph 2.3.4 SGCMS Client Program Installation

The SGCMS Server application resides on a remote PC (the "Server") and, once activated, listens for any TSS200B Client systems requesting connection to it. A connection is established when a Client's request is detected, and a graphical status panel is displayed in the Server system's main window.

3.2.1 Installing the SGCMS Server Program

The following steps address SGCMS Server program software installation on a remote PC:

<u>Step 1</u> - If the SGCMS Server program has been previously installed, Uninstall the software before continuing as shown in Figure 3.2. Right-Click on **Start > Apps and Features**, find and click on the program and then select **Uninstall**.

<u>Step 2</u> - To Install the new SGCMS Server program, navigate to the installation folder (CD, USB, etc.), rightclick on the **setup** file and choose **Run as Administrator** as shown in Figure 3.3. Acknowledge the prompts, click on **Next** (3 times) and finally **Close**. The SGCMS Server program software is now installed.



Figure 3-2 Uninstalling an Existing SGCMS Server Program

					S	-MC
Name	^		Date modified	Туре	Size	
🔀 SEMCO SGCMS			8/8/2020 12:49 PM	Windows Installer	1,170 KB	
😵 setup			8/8/2020 12:49 PM	Application	593 KB	
		Open				
		Run as administ	rator			

Figure 3-3 Installing a New SGCMS Server Program

3.2.2 Connecting SGCMS Server Program with a TSS200B Client

Figure 3-4 depicts a TSS200B GUI control panel with the SGCMS Client Program installed. To set up the TSS200B in a network, the user selects **Network Settings** on the Toolbar as shown and then proceeds with the following steps:

<u>Step 1</u> - The user then verifies that the IP address that is displayed in the **Server Address** window is the correct IP address for the Remote PC (Server). If so, and with the SGCMS Server program open and running, the user simply clicks on **Reset Connection**, and the Client simulator is activated for network operation.

<u>Step 2</u> - If the Remote PC (Server) Address is different, then the user clicks on the **IP Address** window and the **Server Address Setup** window appears as shown.

<u>Step 3</u> - The user then types in the correct Remote PC (Server) IP address in the **New Address** window, clicks **OK** and then **Reset Connection** to activate the Client simulator for network operation.

SEMCO SGCMS System Name	-	• X
Server Address > 192.168.1.31	1	
SigGen 1 Name Reset Connection		
RF Synth	Bit Synol Rate France and Annual Instit Cole ND7 I and Annual Date	01.7
Frequency (MHz) Level (dBm)	Status viterbi 1,000,000 Data Pol. NORM v Input Code NRZ-L v Viterbi R=1/2	Z;K=/ ∨
2335.050.5 -	Loop BW 1.5 % v Descram. RNRZ11 v Clk Phase O v Output Code NRZ	H V
70 MHz Source Outputs		
Internal V CH 1 V	BER 1 Server Address Setup	
	Status	Start/Stop
Modulation	OFF	
Made Deviation (He)	Current 102 168 1 31	Restart
PCM/FM ~ 350,000 -	Frame Sync 1 Status FS	
Data Source	OFF EB	Start/Stop
Internal 🗸	New Address: 192.168.1.31	
Internal Data	Bit Sync 2 Status R Viterbi OFF	~
Rate (bps) Data Code Pattern (2^n)		
1,000,000 + NRZ-L V PN11 F (2(V Error Error		- I ~
	BER 2	0-1/0-2
	Status OFF Seconds 10^3 Bits v	Start/Stop
	000000 Avg. BER Accum. Errors Pattern (2^n)	
	PN11 F v	Restart
Fader	Frame Sync 2	
Depth (dB) Phase (Degrees) Rate (Hz)	Status FSYNC PAT Sync Length Bits/Word Words/Frame FSYNC Thresh	
0	OFF EB90 ~ 16 8 ~ 1024 ~ 15 ~	Start/Stop

Figure 3-4 Local (Client) Network Settings and Server Address Set-up



5EMCO RCMS

3.2.3 Remote SGCMS Server Program Description

This icon appears on the remote PC desktop when the SGCMS Server program is installed. Clicking on this icon opens the program and displays status panels of all system clients (TSS200B systems) that are on the network. Figure 3-5 is an example of a networked TSS200B system.

To control a Local (Client) system remotely, the user **right clicks** anywhere on the status panel of the desired system and then clicks on the **Control** window as shown in Figure 3-5. This opens up the control panel of the TSS200B selected, and the TSS200B settings can now be changed as desired.



Figure 3-5 Selecting a TSS200B GUI Control Panel from the Control Window

This control panel is identical to the local control panel of the selected Local (Client) TSS200B. Any changes made at either the Local (Client) control panel or Remote PC (Server) control panel is activated on both panels.



An alternative method for selecting a system control panel is shown in Figure 3-6. By clicking on **Clients** in the Toolbar, the user can click on any client TSS200B listed and open its respective control panel.

KEMCO SGCMS Server			– 🗆 X	-	
Clients Windows Group	Preset Help				
System Name //192.10	68.1.30		^		
	SigGen 1 Na	me			
RF Synth: LOCK	Mode: RCM/EM B	nal Data	Bit Sync		
	Dev (Hz) 3.5E+5		Status.		
Freq (MHz): 2480.0	Source: INT	Status: OFF	Rate (bps): 1000000		
Level (dBm): -50.5	-Fader Acc	m Errors: 4.89E-04	Code In: NRZ-L		
Outputs: CH 1	Depth (dB): 0	est BER: 4.89E-04			
70 MHz Src: INT	Phase (Dgrs): 360	Avg BER: 4.89E-04	Data Pol: NOR		
	OFF Bate (Hz): 100000	Seconds: 000000	Pattern (2^n): PN11 F		
<			>		
Presets System Config Windows	Network Settings Help				
SinGen 1 Name		•			
DE		Pit Suns 1			
Frequency (MHz) Level	(dBm) Synth LOCK	Status Rate	10,000,000 Data Pol. NO	ORM V Input Code NRZ-L	<u>Viterbi</u> OFF ~
2335.0 -46	6.5 🗧	LOSS (DDS) LOOD B	W 1.5 % ~ Descram. Dis	sabled v Clk Phase 0	<u>Output</u> NRZ-L V
				Out	C 1 1 1 1 1 1 1 1 1 1
70 MHz Source Out		Enable	a AGC □ HI-Z Input ☑ DC Offset [Fitering	Code
70 MHz Source Outp	<u>outs</u> B →	Enable	e AGC 🗌 HI-Z Input 🗹 DC Offset [Filtering	Code
70 MHz Source Outp Internal ✓ COMB	buts B v	Enable BER 1 Status	e AGC HI-Z Input DC Offset	Filtering Test Errors Test Perio	d Start/Stop
70 MHz Source Outp Internal COMH	suts 3 ~	BER 1 <u>Status</u> OFF	e AGC ☐ HI-Z Input ☑ DC Offset [<u>Test BER</u> <u>Seconds</u> 00000 Ave BER	Test Errors Test Perio 10°6 Bits Accum Errors	d Start/Stop
70 MHz Source Outp Internal COMH Modulation Mode	eviation (Rads)	BER 1 Status OFF S 0	e AGC ☐ HI-Z Input ☑ DC Offset [<u>Test BER</u> <u>Seconds</u> 000000 <u>Avg. BER</u>	Fikering Test Errors Test Perio 10^6 Bits Accum. Errors PN11 F	d Start/Stop
70 MHz Source Outp Internal COMB Modulation Mode Mode D AQPSK V	eviation (Rads)	BER 1 Status OFF 5 0	e AGC ☐ HI-Z Input ☑ DC Offset [<u>Test BER</u> <u>Seconds</u> <u>Avg. BER</u> 	Test Errors Test Perio 10^6 Bits Accum. Errors Pattern (2^ PN11 F	d Start/Stop
70 MHz Source Outp Internal COMH Modulation Mode Mode D AQPSK V	eviation (Rads)	Enable	e AGC ☐ HI-Z Input ☑ DC Offset [<u>Test BER</u> <u>Seconds</u> 00000 <u>Avg. BER</u> <u></u> <u>: PAT</u> <u>Sync Length Bits/Wor</u>	Itering Test Errors Test Errors 10°6 Bits Accum. Errors PN11 F Words/Frame ESYNC Thresh	d Start/Stop m) Code Restart
70 MHz Source Outp Internal COMH Modulation Mode Mode D AQPSK Data Source Internal Internal	eviation (Rads)	BER 1 Status OFF S OFF S O Frame Sync 1 Status FSYNC OFF B8	e AGC HI-Z Input DC Offset [<u>Test BER</u> <u>Seconds</u> <u>Avg. BER</u> <u></u>	Test Errors Test Perio Image: Construction of the second	d Start/Stop m) Start/Stop Start/Stop
70 MHz Source Outp Internal COMH Modulation D Mode D AQPSK Data Source Internal D	eviation (Rads)	Enable BER 1 Status OFF S OFF B B Bit Sync 2 Bate	a AGC ☐ HI-Z Input ☑ DC Offset [<u>Test BER</u> 000000 <u>Avg. BER</u> 	Out Test Errors Test Perio 10^6 Bits 10^6 Bits Accum. Errors Pattern (2^ PN11 F PN11 F rd Words/Frame FSYNC Thresh 1024 15 >	d Start/Stop
70 MHz Source Outp Internal COMH Modulation Mode Mode D AQPSK V Data Source Internal Internal Data I Rate (bps) Da	eviation (Rads) 0.785 ÷	BER 1 Status OFF 5 OFF 6 OFF 8 Bit Sync 2 Bit Sync 2 Status Rate (bps)	AGC HI-Z Input DC Offset [Test BER Seconds 00000 Avg. BER 	Test Errors Test Perio 10^6 Bits 10^6 Bits Accum. Errors Pattern (2^6 PN11 F rd Words/Frame FSYNC Thresh 1024 15 0 DRM Code In NRZ-L	d Start/Stop
70 MHz Source Internal Outp COMH Modulation Mode D Mode D AQPSK Data Source Internal Internal Internal Internal Data I Rate (bps) Data 10,000,000 ÷ NF	eviation (Rads) 0.785 ÷ Rta Code Pattern (2^n) RZ-L PN11 F (2C From From From From From From From From	BER 1 Status OFF S OFF S OFF B8 Bit Sync 2 Status LOSS <u>Loop B</u>	e AGC ☐ HI-Z Input ☑ DC Offset [<u>Test BER</u> <u>Seconds</u> 00000 <u>Avg. BER</u> 	Test Errors Test Perio 10°6 Bits Accum. Errors Pattern (2^ PN11 F v 1024 15 ORM Code In NRZ-L sabled Out Out	d Start/Stop → n) → Restart Start/Stop ✓ Vitterbi OFF ✓ Other ✓ OFF ✓ OF OF
70 MHz Source Internal Output COMH Modulation Mode D Mode D AQPSK Data Source Internal Internal Internal Internal Data I Rate (bps) Data NF	teviation (Rads) 0.785 ÷ ta Code Pattern (2^n) ta Code Pattern (2^n)	BER 1 Status OFF S OFF S OFF BB Bit Sync 2 Status Rate (UpS) LOSS Loop B' — Enable	e AGC ☐ HI-Z Input ☑ DC Offset [<u>Test BER</u> <u>Seconds</u> 000000 <u>Avg. BER</u> <u>PAT</u> <u>Sync Length Bits/Wor</u> <u>000000</u> <u>Data Pol.</u> N(<u>10,000,000</u> <u>Data Pol.</u> N(<u>W</u> <u>1.5 % ○ Descram.</u> Dis e AGC ☐ HI-Z Input ☑ DC Offset ☐	Stering Test Errors Test Perio 10^6 Bits Accum. Errors Pattern (2^A PN11 F Mords/Frame FSYNC Thresh 1024 15 ORM Code In NRZ-L sabled Clk Phase Out	<u>d</u> Start/Stop → m) → Prestart Start/Stop Start/Stop Start/Stop Start/Stop
70 MHz Source Internal Output COMH Modulation Mode Mode D AQPSK Data Source Internal Internal Internal Data I Rate (bps) Data 10,000,000 T Internal Data Q Data	eviation (Rads) 0.785 ÷ ta Code Pattern (2^n) RZ-L ~ PN11 F (2C ~ Error Fr	BER 1 Status OFF S OFF S OFF B Bit Sync 2 Status <u>Rate</u> LOSS <u>Loop B</u> — Enable BER 2	a AGC ☐ HI-Z Input ☑ DC Offset [Test BER Seconds 000000 Avg. BER 	Test Errors Test Perio 10°6 Bits 10°6 Bits Accum. Errors Pattern (2^ PN11 F PN11 F Io24 15 ORM Code In NRZ-L Or sabled Out Itest Errors Test Perio	d Start/Stop a) b) code Start/Stop viterbi OFF v Output NRZ-L v d Start/Stop
70 MHz Source Outp Internal COMH Modulation Mode Mode D AQPSK Data Source Internal Internal Internal Data I Rate (bps) Internal Data Q Rate (bps) Z62,000 Data	eviation (Rads) 0.785 ta Code Pattern (2^n) RZ-L ~ PN11 F (2(~ Error Fr ata Code Pattern (2^n) RZ L PN12 F Potent 11	BER 1 Status OFF 9 OFF 9 OFF 8 Bit Sync 1 Status FSYNC OFF 8 Bit Sync 2 Status Cop Bit Cop Bi	AGC HI-Z Input DC Offset [Test BER Seconds 00000 Avg. BER PAT Sync Length Bits/Wor 2 16 8 10,000,000 Data Pol. NC W 1.5 % Descram. Dis AGC HI-Z Input DC Offset Test BER Seconds	Test Errors Test Perio 10°6 Bits 10°6 Bits Accum. Errors Pattern (2^ PN11 F PN11 F v 1024 1024 15 ORM Code In NRZ-L sabled Clk Phase Out Fittering Test Errors Test Perio 10°6 Bits	d Start/Stop a) Nestart Start/Stop Viterbi OFF Output NRZ-L d Start/Stop
70 MHz Source Internal Outp COMH Modulation Mode D Mode D D AQPSK V D Data Source Internal V Internal Data I Rate (bps) Da 10,000,000 NF Internal Data Q Rate (bps) D 768,000 NF	eviation (Rads) 0.785 ↓ ta Code Pattern (2^n) RZ-L ∨ PN11 F (2C ∨ Error Error ata Code Pattern (2^n) RZ-L ∨ PN23 F ∨ Error Error	BER 1 Status OFF 5 OFF 6 OFF 6 Bit Sync 2 Status COFF 6 COFF 6 Bit Sync 2 Status COFF 6 COFF 6 Bit Sync 2 Status COFF 6 COFF	AGC HI-Z Input DC Offset [Test BER Seconds 00000 Avg. BER PAT Sync Length Bits/Wor V 16 8 10,000,000 Data Pol. NC W 1.5 % V Descram. Dis AGC HI-Z Input DC Offset Test BER Seconds 00000 Avg. BER	Test Errors Test Perio 10°6 Bits 10°6 Bits Accum. Errors Pattern (2^ PN11 F PN11 F 1024 15 ORM Code In NRZ-L Or Sabled Citk Phase Ott 0 Fittering 10°6 Bits Accum. Errors Test Perio 10°6 Bits Accum. Errors Accum. Errors Test Perio 10°6 Bits Accum. Errors	d Start/Stop n) Viterbi OFF Viterbi NRZ-L d Start/Stop
70 MHz Source Internal Outp COMH Modulation Mode D Modulation Mode D AQPSK V D Data Source Internal V Internal Data I NF NF Internal Data Q Rate (bps) Data 10,000,000 V NF Internal Data Q A NF Internal Data Q NF NF Eader Fader NF	eviation (Rads) 0.785 ÷ Rta Code Pattern (2^n) RZ-L ∨ PN11 F (2C ∨ Pn23 F ∨ Error Error From From From From From From From	BER 1 Status OFF 9 OFF 9 OFF 88 Bit Sync 2 Status ESYNC OFF 88 Bit Sync 2 Status Cop B LOSS Loop B Denable BER 2 Status OFF 9 OFF 9 OF	AGC HH-Z Input ☑ DC Offset [Test BER Seconds 00000 Avg. BER 10,000,000 Data Pol. NC W 1.5 % ✓ Descram. Direct AGC HH-Z Input ☑ DC Offset] Test BER Seconds 00000 Avg. BER	Test Errors Test Perio 10°6 Bits PN11 F Accum. Errors PN11 F v 1024 1024 15 ORM Code In NRZ-L Sabled Ott Filtering 10°6 Bits Accum. Errors Test Perio ORM Code In NRZ-L Sabled Ord Ott Filtering 10°6 Bits Accum. Errors Test Perio 10°6 Bits PN11 F	d Start/Stop
70 MHz Source Internal Outp COMH Modulation Mode D Modulation Mode D AQPSK Image: Comparison of the second sec	eviation (Rads) 0.785 ÷ RZ-L ∨ PN11 F (2(∨ Fror If RZ-L ∨ PN23 F ↓ hereft II RZ-L ∨ PN23 F ↓ hereft II RZ-L ∨ PN23 F ↓ hereft II Prove Fror If Prove Fror If PN23 F ↓ hereft II Prove Fror If Prove Fror If Prove Fror If PN23 F ↓ hereft II Prove Fror If PN23 F ↓ hereft II Prove Fror If Prove Fror If	BER 1 Status OFF S OFF S OFF B8 Bit Sync 2 Status <u>Rate</u> (OPS) LOSS <u>Loop B</u> Enable BER 2 Status OFF 9 OFF 9 Correction of the sync 2 Status Correction of the sync 2 Status OFF 9 Correction of the sync 3 Correction of the sync 3 C	AGC HH-Z Input ☑ DC Offset [Test BER Seconds 00000 Avg. BER PAT Sync Length Bits/Wor ○ 16 8 10,000,000 Data Pol. N(W 1.5 % ○ Descram. Dis AGC HH-Z Input ☑ DC Offset □ Test BER Seconds 00000 Avg. BER NC PAT Sync Length Bits/W	Test Errors Test Perio 10°6 Bits Accum. Errors Pattern (2^ PN11 F PN11 F v 1024 15 ORM Code In NRZ-L Sabled Out 0 Fiteing 10°6 Bits Pattern (2^ 15 PN11 F 15 ORM Code In NRZ-L Out Sabled Out Fiteing 10°6 Bits Accum. Errors Test Perio 10°6 Bits Pattern (2^ PN11 F PN11 F	d Start/Stop n) Viterbi OFF Output Code NRZ-L d Start/Stop Restart
70 MHz Source Internal Output COMH Modulation Mode D Mode D AQPSK D Jata Source Internal Internal Internal Data I Rate (bps) Data 10,000,000 * NF Internal Data Q Rate (bps) Data 768,000 * NF Fader Depth (dB) Phase (De 0 * 360	eviation (Rads) 0.785 ↓ ta Code Pattern (2^n) RZ-L ∨ PN11 F (2C ∨ Error fr ata Code Pattern (2^n) RZ-L ∨ PN23 F ∨ Error fr sgrees) Rate (Hz) ↑ Fader OFF	BER 1 Status OFF S OFF S OFF BB Bit Sync 2 Status Rate (UpS) LOSS Loop B' Enable BER 2 Status OFF S OFF S OF	a AGC ☐ HI-Z Input ☑ DC Offset [<u>Test BER</u> <u>Seconds</u> 000000 <u>Avg. BER</u> 2 PAT <u>Sync Length Bits/Wor</u> 3 16 8 10,000,000 <u>Data Pol.</u> N(W 1.5 % ☑ <u>Descram.</u> Dis aGC ☐ HI-Z Input ☑ DC Offset ☐ <u>Test BER</u> <u>Seconds</u> 1000000 <u>Avg. BER</u> <u>NC PAT</u> <u>Sync Length Bits/Wir</u> 20 ☑ 16 8	Test Errors Test Perio 10°6 Bits Accum. Errors Pattern (2^ PN11 F PN11 F v 1024 15 ORM Code In NRZ-L Sabled Cik Phase Out 0 Fitering Test Errors Test Perio 10°6 Bits Accum. Errors Pattern (2^ Fitering Test Perio 0 Fitering Test Perio 10°6 Bits Accum. Errors Test Perio 10°6 Bits Accum. Errors Pattern (2^ PN11 F Ord Words/Frame FSYNC Thresh V 1024 15	d Start/Stop n) Niterbi OFF Output Code NRZ-L NRZ-L Restart Restart Start/Stop NRZ-L Restart Start/Stop NRZ-L Start/Stop S

Figure 3-6 Selecting a TSS200B GUI Control Panel from the Clients List



4 – TELEMETRY SIGNAL SIMULATOR OPERATION

4.1 Overview

This section describes all features, functions and steps required for Telemetry Signal Simulator operation. The Graphical User Interface (GUI) and front panel touch screen described in subsequent paragraphs is applicable to all delivered TSS200B systems.

As previously described in Sections 2 and 3, the TSS200B is designed for local operation using its internal Windows 10 Processor, or remote operation via Ethernet. The TSS200B SGCMS Client program is hosted on the simulator's embedded processor using the Windows 10 Operating System. This embedded processor communicates with and controls all simulator cards and modules, including the front panel touch screen.

The TSS200B user's local interface is the local SGCMS Client GUI running on an SVGA display, keyboard and mouse that are connected to the rear panel. Using this local SGCMS GUI, all system functions and set-up are controlled by keyboard entry and/or by GUI pull-down menus that are selected and controlled by the mouse. System status is provided via display indications (numerical readouts and bar graphs).

All of these local GUI functions and controls are also simultaneously available via the 4.3" touch screen on the TSS200B front panel. SGCMS program GUI control panels, sub-panels and correlating touch screen controls are described in subsequent paragraphs.

TSS200B remote (network) control is provided by the SGMS Remote PC (Server) software program, which is installed on a remote PC (Server) running Windows 10 and connected to the TSS200B via Ethernet. The remote GUI functionality and layout is identical to the local GUI for both continuity and simultaneous local and remote operation.

4.2 GUI and Touch Screen Functions and Controls

Figure 4-1 depicts the Test Simulator GUI Control Panel and correlating front panel touch screen display. The TSS200B GUI control panel and touch screen are each divided into functions and controls as listed in Table 4-1.

FUNCTION	DESCRIPTION
RF	Frequency, RF Output Level, Number of Outputs and Modulation Source
Modulation	Modulation Format, Deviation and Data Source
Internal Data	Data Rate, Output Code, PN Pattern and FEC Encoders
Internal Data I	AQPSK and AUQPSK I Data Rate, Output Code, PN Pattern and FEC Encoders
Internal Data Q	AQPSK and AUQPSK Q Data Rate, Output Code, PN Pattern and FEC Encoders
Fader	CH1/CH2 Phase Difference, Fade Depth and Fade Rate for Combiner Testing
Bit Sync 1	All Bit Sync 1 Functions for processing external baseband input signal
BER 1	Bit Error Rate (BER) tests on Bit Sync 1 TTL outputs
Frame Sync 1	Major Frame settings to verify lock on Bit Sync 1 external baseband input signal
Bit Sync 2	A second Bit Sync for processing AQPSK and AUQPSK (I/Q) baseband input signals
BER 2	A second Bit Error Rate tester on Bit Sync 2 (I/Q) outputs
Frame Sync 2	Major Frame settings to verify lock on Bit Sync 2 external baseband input signal

Table 4-1 Test Simulator Functions and Controls

Each of these functions is described in further detail in subsequent paragraphs.







Figure 4-1 GUI and Touch Screen Display

4.2.1 RF Control Panel

The RF Control panel (Figure 4-2) is used to turn the Simulator RF Output OFF/ON, select RF Output Frequency, RF Output Level, 70 MHz Modulator Source and the number of RF Outputs. The RF Control Panel also provides status (**Synth**) indicating whether or not the Simulator output channel is tuned to the frequency of interest. Both the GUI and touch screen provide these controls.

A <u>Synth</u> GREEN LOCK indication means that the RF outputs are tuned to the frequency entered in the **Frequency (MHz)** box. The <u>Synth</u> indicator is also used to determine health and status monitoring of the Simulator channel. A constant <u>Synth</u> RED NO COMM (never GREEN) indication means user control and status monitoring is not available or working and indicates a malfunction in the internal TSS200B PC/Simulator communication link. A <u>Synth</u> RED UNLOCKED after a valid frequency has been entered (i.e., was GREEN LOCK before frequency entry) indicates a TSS200B hardware malfunction.

A. <u>Frequency (MHz)</u> - The RF Output Frequency can be either typed in or selected by scrolling in 100 kHz increments using the up-down arrow (▲▼) icons located on the right of the frequency indicator box. The system will only accept valid frequencies of the particular frequency bands installed in the Simulator. The entire frequency (for example: 2335.0) must be typed in.



Once the user has typed in the frequency of interest, the user then hits **Enter** on the keyboard and the **Frequency (MHz)** window turns gray, indicating that the frequency has been accepted and tuned.

Right-clicking on the **<u>Frequency (MHz)</u>** label provides a display of all frequency bands installed in a given TSS200B. Right-clicking on the actual frequency displayed in the <u>**Frequency (MHz)**</u> window enables a pull-down menu that provides user-selectable RF frequency tuning increments of 0.1, 1.0, 10.0 and 100.0 MHz steps. Figure 4-3 illustrates these features.



Figure 4-2 RF Control Panel



Figure 4-3 Frequency Band Display and Incremental Tuning Feature



B. <u>RF Output Level</u> - Referring again to Figure 4-2, The RF output level can be either typed in from +10 dBm to -100 dBm in 0.1 dB increments, or selected by scrolling in 0.1 dB increments using the up-down arrow (▲ ▼) icons located on the right of the <u>Level (dBm)</u> window.

Right clicking on the <u>Level (dBm)</u> window enables a pull-down menu that allows the user to change the increments to either 0.1 dB, 0.5 dB, 1 dB or 10 dB as shown in Figure 4-4.





The touch screen **FREQ (MHz)** and **Synth** indicator is shown in Figure 4-5. Touching the **FREQ** (**MHz**) window enables a keyboard for frequency entry as shown.

Figure 4-5 also shows how to set the RF output level by touching the **LEVEL (dB)** window or the **Up/Dn** arrows as shown. Level increments can be changed to 0.1 dB, 0.5 dB, 1.0 dB or 10.0 dB by touching the **Units** window as shown.



Figure 4-5 Touch Screen RF Control Panel



C. <u>**RF Outputs</u>** - Figure 4-6 shows how to select the desired number of RF Outputs on the GUI. The user clicks on the arrow icon to the right of the <u>**Outputs**</u> window to enable a pull-down window as shown. The user then selects **CH 1**, **CH 2**, both (**COMB**) RF Outputs or (**OFF**).</u>

On the touch screen the user touches the **Output** box, which then toggles between **CH 1**, **CH 2**, **COMB** or **OFF** as shown.





Figure 4-6 RF Output Modes

D. <u>**70 MHz Source</u>** - Figure 4-7 shows how to select either the simulator's internal 70 MHz reference source or provide an external 70 MHz reference source.</u>

On the GUI, the user clicks on the arrow icon to the right of the **70 MHz Source** window to enable a pull-down menu as shown. The user then selects either **Internal** or **External**.

On the touch screen the user touches the white box to the right of **70 MHz Ref** to select either **Internal** or **External** as shown. An **X** will appear in the box for **Internal** and the box will remain white for **External**.





Figure 4-7 70 MHz Reference Source

4.2.2 Modulation Control Panel

The Modulation Control panel (Figure 4-8) is used to select modulation format (<u>Mode</u>), and the modulation data source (<u>Data Source</u>). <u>Deviation (Rads)</u> is also enabled as well as other settings for different modulation modes as described in subsequent paragraphs.

		-
SEMCO SGCMS System Name	- 🗆 🗙	
Presets System Config Windows Network Settings Help		-
SigGen 1 Name		
RF Frequency (AHz) Level (dBm) 2335.0 - 46.5 - 70 MHz Source Outputs	Bit Sync 1 Status Rate 10,000,000 Data Pol. NORM Japut Code NRZ-L Viterbi OFF LOSS Loop BW 1.5 % Descram. Disabled Chc Phase 0 Output Code NRZ-L Viterbi NRZ-L Viterbi NRZ-L Viterbi NRZ-L Viterbi NRZ-L Viterbi Viterbi NRZ-L Viterbi Viterbi Viterbi Viterbi NRZ-L Viterbi Viterbi Viterbi Viterbi Viterbi NRZ-L Viterbi V	
Internal ~ COMB ~	BER 1 Test RER Test Errors Test Period	
	Status Status	
Modulation	OFF Seconds	
	Ava RER Accum, Errors Pattern (2 ⁿ n)	
Mode Deviation (Rads)	Modulation	
AQPSK ~ 0.785 :	Frame Sync 1	
Data Source Internal	OFF B Mode Deviation (Rads)	
Internal Data I Rate (bps) Data Code Pattern (2*n) 10,000,000 * NRZ-L PN11 F (2C v) Inset 10'3 Env		
Internal Data Q	BER 2 Data Source	
Rate (bps) Data Code Pattern (2^n)	Status	
768,000 • NRZ-L ~ PN23 F ~ Error Error	OFF Internal V	
Fader		
Depth (dB) Phase (Degrees) Rate (Hz) 0 2 360 3 Fader OFF	Frame Sync 2 FSYNC PAI Sync Length Bits/Word Words/Frame FSYNC Thresh OFF FAF320 16 8 1024 15 Sart/Stop	

Figure 4-8 GUI Modulation Control Panel



4.2.2.1 Modulation Mode

Figure 4-9 shows how to select the desired modulation mode. The user clicks on the arrow icon to the right of the <u>Mode</u> window to enable a pull-down menu of all available modulation modes, and then selects the modulation mode desired.

Figure 4-9 also shows how to select a modulation mode using the touch screen. The user touches the **Mode** box to toggle between all available modulation modes.



Figure 4-9 Modulation Mode

A. <u>UQPSK and AUQPSK</u> - Additional settings are available to set up a desired I/Q power level ratio. Figure 4-10 shows the <u>Balance</u> feature that appears on the GUI when either UQPSK or AUQPSK modulation is selected. Clicking on the up-down arrow (▲▼) icons located on the right of the I (dB) and Q (dB) windows allows the user to select the desired power level ratio (balance) between the I and Q signals.

Modulation		Balance	
Mode	Deviation (Rads)		
AUQPSK ~	0.785	I (dB)	0.0
Data Source Internal ~		Q (dB)	0.0 🔹

Figure 4-10 AUQPSK and UQPSK I/Q Power Ratio Feature on GUI

Figure 4-11 shows how to enable the Balance feature on the touch screens in **AUQPSK** and **UQPSK** modulation modes. The user touches the **Mod/Deviation** tab on the bottom of the touch screen and then **Advance** to enable the I and Q Balance feature as shown. Touching the I and Q <u>BALANCE</u> buttons allows the user to set the desired power level ratio (balance) between the I and Q signals.



FREQ (MHz) SYNTH Mode Source 1 2335.0 AUQPSK Internal Internal EVEL (db) Up DATA 1,000,000 I (bps) -50.5 Dn BIT SYNC1 F SYNC OUTPUT FADER BIT ER KOR RATE START 70 MH2 Internal BER Elapsed: 000000 (s) BS/BER Fader Mod/Dev Friavback Friesets Utility	MODULATION MODE AUQPSK RATE: 1,000,000 (bps) SOURCE Internal RATE 1,000,000 DEVIATION 0.785 (Rad) MODULATION MENU Advance Return
ADVANCE MENU	Mod/Dev Return

Figure 4-11 AUQPSK and UQPSK I/Q Power Ratio Feature on Touch Screen

B. <u>FM/FM Subcarrier</u> - The FM/FM Subcarrier modulation mode provides the ability to set up either one or two FM subcarriers. Figure 4-12 shows the Subcarrier settings that are accessed on the GUI when FM/FM modulation is selected. The user clicks on the Sub Carrier box to enable the Signal Generator Sub Carrier settings. One or Two FM subcarrier modulation signals can be set up and generated by clicking on the <u>Enable</u> box for each subcarrier as shown.

Each FM subcarrier's parameters can be set by clicking on the up-down arrow ($\blacktriangle \lor$) icons located on the right of <u>Center Frequency (Hz)</u>, <u>Rate (Hz)</u> and <u>Deviation (Hz)</u> windows.

The Main Carrier is enabled by clicking on the **Enable** box under the Main Carrier label.



Figure 4-12 FM/FM Subcarrier Settings on GUI



Figure 4-13 shows the touch screen subcarrier settings using when **FM/FM** modulation is selected. The user touches the **Mod/Deviation** tab on the bottom of the touch screen and then **Advance** as shown to enable the **MODULATION MENU** screen. The user then touches the **Advance** tab which enables the **SUBCARRIER** screen as shown.

The user then can enable FM Subcarrier 1, FM Subcarrier 2 and the Main Carrier by touching the boxes next to **SC1**, **SC2** and **Main** as shown. FM Subcarrier 1 and Subcarrier 2 settings (Frequency, Data Rate and Deviation) are then set by touching the boxes next to **Freq 1**, **Rate 1**, **Dev 1** and **Freq 2**, **Rate 2** and **Dev 2**.



Figure 4-13 FM/FM Subcarrier Settings on Touch Screen

4.2.2.2 Randomizer

Figure 4-14 shows how to enable the modulator's randomizer using the GUI. The user clicks on <u>Scramble</u> to enable a pulldown menu and then selects the **RN15** randomizer as shown. Randomizer selection is not accessible via the touch screen.

Modulation	
Mode	Deviation (Rads)
SOQPSK	~ 0.785 *
Data Source	Scramble
Internal ~	Off ~
	Off
	RN15
	Figure 4-14
	Selecting Randomizer on GUI



4.2.2.3 Modulation Data Source

Figure 4-15 shows how to select the modulation data source on the GUI. The user clicks on the arrow icon to the right of the <u>Data Source</u> window to enable a pull-down menu that allows the user to select no modulation data source (None), the simulator's internal modulation data source (Internal), an external modulation data source (External) or a recorded binary file as a data source (File Plybck).

Touching the **Source** box on the touch screen toggles between the aforementioned modulation data source selections as shown

When **External** is selected, the user provides an external TTL modulation inputs to the rear panel BNC connectors as defined in Tables 4-1 and 4-2.



Figure 4-15 Modulation Data Source Selection

Table 4-1External Modulation Source Requirements

Mode	Back Panel J8 EXT. DATA IN / I DATA IN	Back Panel J10 EXT. CLOCK IN / Q DATA IN
FM, PM, BPSK	Digital (TTL) Data	Not Used
QPSK	Digital (TTL) Data I	Digital (TTL) Data Q
SOQPSK, CPM	*Digital (TTL) Data	Digital (TTL)Clock

*Data is latched on falling edge of Digital Clock.

Table 4-2External Modulation TTL Signal Level and Impedance

Input Logic	Minimum Signal Level	Maximum Signal Level	Impedance
VIH	1.7 V		75 ohms
Voн		0.7 V	75 ohms


A. <u>File Playback</u> - Figure 4-16 illustrates the File Playback (File Plybck) mode on both the GUI and Touch screen. The File Playback mode allows the user to load a binary file (usually recorded mission data) on the TSS200B Solid State Drive (SSD), and then be able to select and run this file as the data source for modulating the TSS200B RF output. This feature is available for all modulation formats except AQPSK and AUQPSK.

Note:

As this feature requires a binary file for playback, the user must convert recorded data files to binary format in order to use this feature. Please contact the factory for an available software conversion program, which is provided at no cost. Assistance in this regard is also available to provide step-bystep instructions for successful conversion of recorded files to a binary format.

The user can load the binary file of interest either via the TSS200B USB port(s) or access the SSD with a remote PC via Ethernet when running SCGMS Network software. Figure 4-16 depicts the GUI and Touch screen File Playback controls.





Figure 4-16 File Playback Feature



Figure 4-17 shows how to load and select a binary file for playback using the GUI. The user clicks on **Select File** to enable the simulator's SSD file directory. The user can either run the file directly from an external device or (CD, USB, etc.) or copying and pasting the file into the file directory.



Figure 4-17 File Selection for Playback Using GUI

Once the playback file has been selected and opened, the file is loaded (**Loading...**) as shown in Figure 4-18 (**pn15.out** is the example shown as a playback file that has been copied from an external device and pasted into the simulator's SSD directory). The % readout in the lower left corner of the **File Playback** control panel progresses the load process.

Figure 4-18 also shows how to start and stop the playback file as well as to set up the file to run in a continuous loop. Clicking on the box next to **Loop File** enables the file to run in a continuous loop. The user then clicks on **GREEN Start** and **RED Stop** as shown.



Figure 4-18 File Playback Using GUI

The touch screen does not have File Playback select and load capability. However, once a playback file has been selected/loaded using the GUI, then this file is also accessible using the touch screen.

Figure 4-19 shows how to start, stop and loop the selected playback file using the touch screen. The user touches the **Source** box, toggles to **File PlyBck** and then touches the **Playback** tab located along the bottom of the touch screen.

Touching the box next to **Loop File Off** enables the file to run in a continuous loop. The user then touches **Start** and **Stop** as shown.



FREQ (MHz)	SYNTH	MODULATION Mode Source		PLAYBACK	BITSYNC 1	
2335.0		SOQPSK File Plybck		FILE pn15	LOSS	
LEVEL (d8)	A its				RATE: 1,000,000 (0ps)	
-50.5		RATE 1,000,000 • (bps		Loop File Off	BIT ERROR RATE	
Units 0.5		BITSYNC1	FSYNC		OFF	
OUTPUT	FADER	LOSS RATE: 1,000,000	OFF	STARI		
COMB	OFF	OFF START			ELAPSED: 000000 (s)	
70 MHz 🗙 Ref	Internal	BER: Elapsed: AVG BER: O00000 (S	START		START	
BS/BER	Fader	Mod/Dev Playback Pres	sets otility	FILE PLAYBACK ME	NU	Return
PLAN	(BAC	K BITSYNC 1		PLAYBACK	BITSYNC 1	
FILE pn	15			FILE pn15		
			_		RATE: 1,000,000 (0ps)	
X	Loop File	On BIT ERROR RATE		X Loop File On	BIT ERROR RATE	
ста	DT	OFF		STOR	OFF	
317	NIT I	AVG BER:		STOP	AVG BER:	
		ELAPSED: 000000 (s)			ELAPSED: 000000 (s)	
		START			START	
	VRACI		Return		NUT	Poturo

Figure 4-19 File Playback Using the Touchscreen

4.2.2.4 Deviation Indicator

Figure 4-20 depicts the GUI <u>Deviation</u> indicator which provides the modulation index relative to data rate for all phase modulation modes in radians (<u>Rads</u>), and in Hz (<u>Hz</u>) for the PCM/FM modulation format. **PCM/FM**, **PCM/PM**, **FM/FM**, and **NTSC** deviation can be changed using the up-down arrow ($\blacktriangle \lor$) icons located on the right of the <u>Deviation</u> window. All other modulation formats are relative to data rate and are grayed out.

Modulation	
Mode	Deviation (Hz)
PCM/FM ~	350,000 🗧
Data Source Internal ~	
Modulation	
Mode	Deviation (Rads)
PCM/PM ~	0.785
Data Source Internal ∨	

Figure 4-20 GUI Deviation Settings

Figure 4-21 shows how to change deviation settings using the touch screen. The user touches the **Mod/Deviation** tab on the bottom of the touch screen and then the **DEVIATION** window, which enables a keypad for entering the desired **PCM/FM**, **PCM/PM**, **FM/FM**, and **NTSC** deviation as shown.



FINE Q (PINZ)	SYNTH	MODULATION 1	MODULATION BITSYNC 1	
2335.0		PCM/FM Internal		1 2 3
LEVEL (dB)	A 115		RATE. 1,000,000 (ups)	
-50.5	The op	DATA RATE 1,000,000 I (bps)	SOURCE Internal BIT ERROR RATE	
Units 0.5	🦇 Un	BITSYNC1 FS	YNC OFF OFF	7 8 9
	FADER	LOSS RATE: 1,000,000	DFF BER:	· 0 <
СОМВ	OFF	BIT ERROR RATE	DEVIATION ELAPSED: 000000 (s)	— MHz
70 MHz 🗙 Ref	Internal	BER: Elapsed: AVG BER 000000 (s)	350000.00 (Hz) START	ENTER
BS/BER	Fader	Mod/Dev Playback Presets	Utility MODULATION MENU	Return
FREQ (MHz)	SYNTH	MODULATION 1	MODULATION BITSYNC 1	
2335.0		PCM/PM Internal		1 2 3
LEVEL (dB)	A lin	PCM/PM Internal	MODE PCM/PM RATE: 1,000,000 (bps)	1 2 3
2335.0 LEVEL (dB) -50.5	🛧 Up	Mode Source PCM/PM Internal DATA RATE 1,000,000 I (bps)	MODE PCM/PM RATE: 1,000,000 (bps) SOURCE Internal BIT ERROR RATE	1 2 3 4 5 6
2335.0 LEVEL (dB) -50.5 Units 0.5	∱ Up ∳ Dn	Mode Source PCM/PM Internal DATA 1,000,000 I (bps) BITS / N C 1 FS	MODE PCM/PM RATE: 1,000,000 (bps) SOURCE Internal BIT ERROR RATE	1 2 3 4 5 6 7 8 9
2335.0 LEVEL (d8) -50.5 Units 0.5 OUTPUT	t A Dn A Dr A A A A A A A A A A A A A A A A A	Mode Source Internal	MODE PCM/PM RATE: 1,000,000 (bps) SOURCE Internal BIT ERROR RATE Y N C RATE 1,000,000 BER:	1 2 3 4 5 6 7 8 9 · 0 <
2335.0 LEVEL (dB) -50.5 Units 0.5 OUTPUT COMB	FADER	Mode Source Internal DATA 1,000,000 I (bps) B I T S / N C 1 F S LOSS RATE 1,000,000 BIT ERF OR RATE START	MODE PCM/PM RATE: 1,000,000 (bps) SOURCE Internal Y N C RATE 1,000,000 BIT ERROR RATE OFF BER: AVG BER: AVG BER: ELAPSED: 000000 (s)	1 2 3 4 5 6 7 8 9 • 0 <
2335.0 LEVEL (dB) -50.5 Units 0.5 OUTPUT COMB 70 MH2 X	A Up → Dn FADER OFF Internal	Mode Source PCM/PM Internal DATA RATE 1,000,000 I (bps) BITS / N C 1 F S LOSS RATE: 1,000,000 BIT S / N C 1 F S LOSS RATE: 1,000,000 BIT ERI OR RATE START OFF START BER: Elapsed: AVG BER: 0000000 (s)	MODE PCM/PM LOSS RATE 1,000,000 (bps) SOURCE Internal BIT ERROR RATE Y N C RATE 1,000,000 DFF DE VIATION BER: AVG BER: ELAPSED: 000000 (s) 0.785 (Rad)	1 2 3 4 5 6 7 8 9 · 0 < ■ MHz ENTER

Figure 4-21 Touch Screen Deviation Settings

4.2.3 Internal Data Control Panel

The Internal Data Control Panel (Figure 4-22) is used to select the embedded modulator's Data Rate, Data Code PN Pattern and Forward Error Correction (FEC) encoder. There are two separate controls for AQPSK and AUQPSK to individually select I and Q Data Rates, Data Codes, PN Patterns and FEC encoders. There is also an Error Insertion feature that allows the user to insert a single error or 10³ errors when running Bit Error Rate (BER) tests.

Internal Data <u>Rate (bps)</u>	Data Code Pattern (2^n)	Incort	10^2
1,000,000 🗄	NRZ-L ~ PN11 F (2(~	Error	Errors
	FEC - Off		

Individual I and Q internal data controls for AQPSK and AUQPSK modulation

Internal Data I <u>Rate (bps)</u> 10,000,000 ↓ NR	a Code Pattern (2^n) Z-L PN11 F (2C ~)	10^3 Errors
Internal Data Q <u>Rate (bps)</u> Da 768,000 C	ta Code Pattern (2^n) Z-L V PN23 F Fror	10^3 Errors

Figure 4-22 GUI Internal Data Control Panel



4.2.3.1 Data Rate

Referring back to Figure 4-22, the user enters the desired data rate by typing in the desired rate in the **<u>Rate (bps)</u>** window as shown. The data rate is set by hitting the keyboard Enter key (window turns gray). The user can also use the up-down arrow ($\blacktriangle \lor$) icons located on the right of the <u>**Rate (bps)**</u> window. Valid data rate ranges for each modulation format is provided by <u>right-clicking</u> on the <u>**Rate (bps)**</u> window as shown in Figure 4-23.

Internal Data <u>Rate (bps)</u>	Data Code Patter	n <u>(2^n)</u>	Insert 10^3
1,000,000	Data Rate Ranges	>	PCM/FM: 100 to 22,000,000
		_	PCM/PM: 100 to 20,000,000
			BPSK: 100 to 20,000,000
			SOQPSK: 1,000,000 to 40,000,000
			QPSK: 100 to 40,000,000
			CPM: 1,000,000
			1,250,000
			2,500,000
			5,000,000
	Figuro 4-23		10,000,000

Valid Modulation Data Rate Range per Modulation Format

Data rate selection using the touch screen is shown in Figure 4-24. The user touches the **DATA RATE** box which enables a keyboard for data rate entry as shown. I and **Q Data Rate** selection is also shown.

FREQ (MHz) SYNTH	MODULATION 1 Mode Source	FREQ (MHz)	MODULATION Mode Source	
	PCM/FM Internal	LEVEL (dB)	PCM/FM Internal	1 2 3
-50.5	DATA 1,000,000 (bps)	-50.5	DATA 1,000,000 (ups)	4 5 6
Units 0.5	BITSTNC1 FSYNC LOSS RATE: 1,000,000	Units 0.5	BITSYNC1 Loss Rate: 1,000,000	
COMB OFF	BIT ERROR RATE START	COMB OFF	BIT ERROR RATE START	– MHz
70 MHz X Internal	BER: Elapsed: START AVG BER: 0000000 (s) (s)	70 MHz X Internal	BER: Elapsed: AVG BER: 000000 (s)	ENTER
BS/BER Fade	Mod/Dev Playback Presets Utility	BS/BER Fade	r Mod/Dev Playback Pres	ets Utility





Figure 4-24 Touch Screen Data Rate Selection



4.2.3.2 Data Output Code

Figure 4-25 show how the data output code is selected on the GUI. The user clicks on the arrow icon to the right of the **<u>Data Code</u>** window to enable a pull-down menu that allows the user to select the desired data output code. As previously discussed, two Internal Data Control panels are enabled for AUQPSK and AQPSK, which provide for individual selection of I and Q data output codes.

Internal Data Rate (bps)	Data Code	Pattern (2^n)		
1,000,000 🗧	NRZ-L v	PN11 F (2(~	Insert Error	10^3 Errors
	NRZ-L			
	NRZ-M			
	NRZ-S			
	NRZ-I			
	BIP-L			
	BIP-M			
	BIP-S			
	BIP-I			
	DM-M			
	DM-S			
	MDM-S			
	MDM-M	Figure 4-2	5	
	GUI Dat	a Output Cod	le Sele	ection

These data output code settings for the embedded TSS200A modulator are not available using the front panel touch screen.

4.2.3.3 PN Pattern Selection

Figure 4-26 show how the data PN Pattern is selected on the GUI. The user clicks on the arrow icon to the right of the <u>Pattern (2^n)</u> window to enable a pull-down menu that allows the user to select the desired PN pattern.

As previously discussed, two Internal Data Control panels are enabled for AUQPSK and AQPSK, which provide for individual selection of I and Q PN patterns.





Figure 4-27 shows how to select a PN Pattern on the touch screens. The user touches the **BS/BER** tab on the bottom of the touch screen as shown and then touches the **PATTERN** box to toggle between available output codes. Referring back to Figure 4-24, the user selects **1** for **I PN Patterns** and **2** for **Q PN Patterns** when **AQPSK** or **AUQPSK** is selected.





Figure 4-27 Touch Screen PN Pattern Selection

4.2.3.4 Bit Error Insertion

The Internal Data Control Panel also provides the ability to insert a single error or 10³ errors when running Bit Error Rate (BER) tests. Figure 4-28 shows this feature on both the GUI and touch screen.

On the GUI, the user clicks on **Insert Error** to provide a momentary single bit error insertion. Clicking on **10^3 errors** inserts 10³ bit errors (box turns gray).

Using the touch screen, the user touches the **BS/BER** tab on the bottom of the touch screen as shown and then touches the **ERR** box to insert a single bit error. Touching the box next to **10^3 errors** (**x** in box) inserts 10³ bit errors.





Figure 4-28 GUI and Touch Screen Bit Error Insertion



4.2.3.5 FEC Encoders

The **Internal Data** panel controls two available FEC encoders. The convolutional encoder is rate = 1/2, k=7. The second encoder is Low Density Parity Check (LDPC), which has 3 selectable rates, 2 selectable block sizes and both a CCSDS and IRIG randomizer.

Figure 4-29 shows how to select an FEC encoder using the GUI. The user clicks on the **Internal Data FEC - Off** box to enable the **Forward Error Correction** window as shown. The selected FEC encoder then populates **FEC - Off**, (**FEC - Convolution Encoder** or **FEC - LDPC**) as shown.



FEC encoder selection is not available via the front panel touch screen.

Figure 4-30 shows how to set up the Convolution Encoder on the GUI. The user clicks the **FEC** - **Convolution Encoder** box to access the **Forward Error Correction** window as shown. The convolutional encoder is a fixed Rate 1/2, k=7 with a 1024 Block Size and 2 outputs (G1 and G2). Clicking on the <u>G2</u> Inv box inverts the G2 outputs.

		Forward Error Correction
Internal Data <u>Rate (bps)</u> 10,000,000	Data Code Pattern (2^n) NRZ-L ∨ PN23 F ∨	Convolution Enc R = 2, k = Convolution Encoder Option r S <u>G2 Inv</u>
	FEC - Convolution Encoder	LDPC Options Rate Block Size Randomizer 1/2 1024 OFF Reed Solomon Options ASM Enable 223 1ACFFC1D
	E lawara 4 .00	

Figure 4-30 Convolution Encoder FEC Setup on GUI



Figure 4-31 shows how to set up the LDPC Encoder on the GUI. The user clicks the **FEC - LDPC** box to access the **Forward Error Correction** window, then clicks on the arrow to the right of the <u>Block Size</u> window to select either 1024 or 4096, on the arrow to the right of the <u>Rate</u> window to select 1/2, 2/3 or 4/5 rate and on the arrow to the right of <u>Randomizer</u> to select either CCSDS or IRIG randomization.

Forward Error Correction	-	Forward Error Correction
LDPC v	ernal Data <u>Rate (bps)</u> <u>Data Code</u> <u>Pattern (2^n)</u> Insert 10'	LDPC
LDPC Options Rate Block Size 1/2 1024 1024 0FF 1026 0FF 1026 0FF 2096 0FF 223 ASM Enable 1ACFFC1D	FEC - LDPC	LDPC Options Rate Block Size Randomizer 1/2 1024 OFF 1/2 2/3 4/5 n Options Descriptions ASM Enable
Close	LDPC Options Rate Block Size Randomizer 1/2 V OFF V OFF CCSDS Reed Solomon Options IRIG Rate ASM Enable	223 v 1ACFFC1D Close
	223 ACFFC1D Close	

Figure 4-31 LDPC FEC Setup on GUI

Figure 4-32 shows how to set up the Reed-Solomon Encoder on the GUI. The user clicks the **FEC - Reed Solomon** box to access the **Forward Error Correction** window, then clicks on the arrow to the right of the <u>Rate</u> window to select the desired rate.

Forward Error Correction	Forward Error Correction
Reed Solomon v	Reed Solomon V FEC Off
Convolution Encoder Op <u>G2 Inv</u> <u>Internal Data</u> <u>Data Code</u> <u>Pattern (2^n)</u> <u>10 000 000</u> NRZ-L ~ PN11 F (2(~ Insection of the formula to th	Convolution Enc R = 2, k = 7 LDPC Reed Solomon
LDPC Options FC - RS Enc Rate Block Si FEC - RS Enc 1/2 1024 OFF	C Options Rate Block Size 1/2 V 1024 OFF
Reed Solomon Options Rate ASM-Enable 223 1ACFFC1D 239 223	Reed Solomon Options Rate ASM Enable 223 1ACFFC1D
Close	Close

Figure 4-32 Reed-Solomon FEC Setup on GUI



4.2.4 Diversity Combiner Fade and Phase Test Feature

The Diversity Combiner test feature provides dual RF outputs (CH1 and CH2) and the ability to select dynamically changing RF signal levels (Fade) between CH1 and CH2 at selectable change rates (Fade Rate). This test feature also provides the ability to change the phase shift between CH1 and CH2 in 1 degree increments up to 180 degrees.

Figure 4-33 depicts the GUI Fader Control Panel. Clicking on the **Fader OFF/ON** window turns the **Fader OFF** to a **GREEN Fader ON** and enables the **Depth (dB)**, **Phase (degrees)** and **Rate (Hz)** controls.

The user enters the CH1/CH2 fade depth from 0 to 30 dB in 1 dB increments, phase shift between CH1 and CH2 from 0 to 180 degrees in 1 degree increments and fade rate between CH1 and CH2 from 1 Hz to 100 kHz by typing in the desired values in the **Depth (dB)**, **Phase (degrees)** and **Rate (Hz)** windows as shown. Each value entered is set by hitting the keyboard **Enter** key (window turns gray).

The user can also use the up-down arrow (▲ ▼) icons located on the right of each window.

F	ader						
	Depth (d	B)	Phase (Deg	grees)	Rate (Hz)		
	0	▲ ▼	360	•	100,00C	Fader ON	

Figure 4-33 GUI Fader Control Panel

Figure 4-34 shows how to select fader controls using the touch screen. Using the touch screen, the user touches the **Fader** tab on the bottom of the touch screen as shown to enable the **FADER MENU** screen. The user then touches the box next to **FADER**, which turns a **GREEN ON** as shown.

Touching the box next to **DEPTH (dB)**, **PHASE (Degrees)** and **RATE (Hz)** enables a keyboard as shown. The user then types in the values for each of these parameters and touches **ENTER**.



Figure 4-34 Touch Screen Fader Controls

4.2.5 Bit Synchronizer Control Panel

Figure 4-35 shows the GUI Bit Synchronizer Control Panel. There are two identical Bit Sync channels and control panels (**Bit Sync 1** and **Bit Sync 2**). Bit Sync 1 and Bit Sync 2 are both used for BER testing and can be individually selected for all modulation formats. Bit Sync 1 and Bit Sync 2 are used together for I and Q BER testing when AQPSK or AUQPSK modulation formats are selected.



Bit Sync 1 and Bit Sync 2 process analog or TTL baseband video inputs connected to the TSS200B rear panel (**Data In 1** and **Data In 2**).

Figure 4-35 also shows the touch screen Bit Synchronizer controls. The user touches the **BS/BER** tab on the bottom of the touch screen to access the **BIT SYNC-BER MENU** screen. This screen controls Bit Sync 1 when **1** is selected and Bit Sync 2 when **2** is elected as shown.



Figure 4-35 Bit Sync Functions and Controls

4.2.5.1 Bit Sync Status

Referring back to Figure 4-35, bit sync status is indicated under the GUI <u>Status</u> label as either LOSS or LOCK. Bit Sync status on the touch screen is either a **RED LOSS** or **GREEN LOCK** indication under the **BIT SYNC-BER MENU STATUS** label.

Bit sync status is also displayed on the main touch screen under the **BIT SYNC** label as shown. Bit Sync 1 status is displayed when 1 is selected, and Bit Sync 2 status displayed when 2 is selected.

4.2.5.2 Bit Sync Data Rate

Referring again to Figure 4-35, the user types in the desired bit sync data rate by typing in the desired data rate in the GUI window next to **Rate (bps)**. The data rate is set by hitting **Enter** on the Keyboard.

Using the touch screen, the desired bit sync data rate is entered by touching the **BIT SYNC 1** (or **BIT SYNC 2**) **RATE** box on the main touch screen as shown in Figure 4-36. A keyboard is enabled as shown for entering the data rate.

This data rate is also displayed on the **BITSYNC-BER MENU RATE (bps)** label as shown.



FREQ (MHz) SYNTH	MODULATION 1 Mode Source		BITSYNC	1 STATUS	DESCRAM
2335.0	PCM/FM Internal	1 2 3	CODE NRZ-L	RATE: 1,000,000 (ps)	Disabled
-50.5 -	DATA RATE 1,000,000 I (bps)	4 5 6	PHASE	BIT ERROR RATE	1.5 %
Units 0.5	BITSYNC1	7 8 9		OFF	AGC HI-Z
OUTPUT FADER	BIT ERBOR BATE	· [0]<	CODE NRZ-L	AVG BER: 0.00E-00	DC OFFST
COMB OFF	OFF START	MHz	DATA POL	ELAPSED: 000000 (s)	FILTER
70 MHz 🗙 Internal Ref	BER: Elapsed: AVG BER: 000000 (s)	ENTER	PATTERN PN11 F	START ERR 10^3 Bits	10^3 Bits
BS/BER Fade	r Mod/Dev Playback Prese	ts Utility	BITSYNC - BER ME	NU FSYNC	Return

Figure 4-36 Bit Sync Data Rate Selection and Display on Touch Screen

4.2.5.3 Bit Sync Loop Bandwidth

Figure 4-37 shows how to select bit sync loop bandwidth on the GUI. The user clicks on the arrow icon to the right of the **Loop BW** window to enable a pull-down menu that allows the user to select one of five loop bandwidth values from 0.01% to 3.0%.



Figure 4-38 shows how to select bit sync loop bandwidth using the touch screen. The user touches the **BS/BER** tab on the bottom of the main touch screen to access the **BIT SYNC-BER MENU** screen and then touches the bit sync loop bandwidth % box as shown to toggle thru the 5 loop bandwidth values available.

FREQ (MHz) 2335.0	SYNTH	MODULATION 1 Mode Source			Y <u>NC</u> 1 NRZ-L	STATUS LOSS	DESCRAM
LEVEL (dB)	🛧 Up			OUTP CLK PHASE		E: 1,000,000 (bps)	Disabled
-50.5 Units 0.5	🐺 Dn	BITSYNC1	FSYNC		DFF		AGC HI-Z
OUTPUT	FADER	LOSS RATE: 1,000,000 BIT ERROR RATE	OFF	CODE		BER: 0.00E-00	DC OFFST
	OFF	OFF START BER: Etapsed:	START	DATA POL	Normal ELA	PSED: UUUUUU (s) PERIOD RT FRR 1043 Bits	FILTER 10^3 Bits
BS/BER	Fader	AVG BED 000000 (8) Mod/Dev Playback Prese	ts Utility	BITSYNC -	BER MENU	FSYNC	Return

Figure 4-38 Bit Sync Loop Bandwidth Selection on Touch Screen



4.2.5.4 Bit Sync Data Polarity

Figure 4-39 shows how to select bit sync data polarity on the GUI. The user clicks on the arrow icon to the right of the <u>Data Pol.</u> window to enable a pull-down menu that allows the user to select normal (**NORM**) or inverted (**INV**) polarity.

Bit Sync 1 <u>Status</u> LOSS	<u>Rate</u> (bps) Loop B	1,000,000 <u>w</u> 1.5 % ~	<u>Data Pol.</u> Descram.		~	Input Code Clk Phase Out	NRZ-L	<u>Viterbi</u> <u>Output</u>	off NRZ-L	~
	Enable	e AGC 🔲 HI-Z Inpu	ıt 🔲 DC Offs	et 🗌 Filterir	ng	<u></u>		<u>coue</u>		

Figure 4-39 Bit Sync Data Polarity Selection on GUI

Figure 4-40 shows how to select bit sync data polarity using the touch screen. The user touches the **BS/BER** tab on the bottom of the main touch screen to access the **BIT SYNC-BER MENU** screen and then touches the box next to **OUTPUT DATA POL** to toggle between **Normal** or **Inverted** as shown.

FREQ (MHz)	SYNTH	MODULATION	l 1	BITS	YNC	1 S	TATUS	
2335.0		Mode Sourc			NRZ-L		LOSS	DESCRAM
LEVEL (dB)	A	PCM/FM Internal		OUTP CLK	0	RATE: 1,	, 000,000 (bps)	Disabled
-50.5	T Up	DATA RATE 1,000,000	(bps)		OFF	BIT EI	RROR RATE	1.5 %
Units 0.5		BITSYNC1	FSYNC	OUTPUT				HI-Z
ουτρυτ	FADER	RATE: 1,000,0	OFF	CODE	NRZ-L		0.00E-00	DC OFFST
COMB	OFF	OFF	TART	DATA POL	Normal	ELAPSED	: 000000 (s)	FILTER
70 MHz 🔀	Internal	BER: Elap AVG BER: 000	ood. START 000 (s)	PATTERN	PN11 F	START	ERR 10 ^{^3} Bits	10^3 Bits
BS/BER	Fader	Mod/Dev Playback	Presets Utility	BITSYNC	- BER ME	NU	FSYNC	Return

Figure 4-40 Bit Sync Data Polarity Selection on Touch Screen

4.2.5.5 Bit Sync Derandomizer

Figure 4-41 shows how to select a bit sync derandomizer format on the GUI. The user clicks on the arrow icon to the right of the **Descram.** window to enable a pull-down menu that allows the user to enable and select one of five derandomizer data formats as shown.

Bit Sync 1 Status Rate 1,000,000 Data Pol. LOSS Loop BW 1.5 % Descram. Enable AGC HI-Z Input DC Offs	NORM V Disabled V Disabled RNRZ15	NRZ-L ∨ 0 ∨	ViterbiOFF~Output CodeNRZ-L~
	RNR29 RNR211 RNR217 RNR223		





Figure 4-42 shows how to select bit sync loop bandwidth using the touch screen. The user touches the **BS/BER** tab on the bottom of the main touch screen to access the **BIT SYNC-BER MENU** screen and then touches the **DESCRAM** box as shown to enable and toggle thru the 5 available derandomizer formats.

FREQ (MHz) SYNTH			BITSYNC	1 STATUS	
2335.0			INPUT NRZ-L	LOSS	DESCRAM
	PCM/FM Internal			RATE: 1,000,000 (bps)	Disabled
-50.5	DATA RATE 1,000,000 I (bps)		PHASE	BIT ERROR RATE	1.5 %
Units 0.5	BITSYNC1	FSYNC	VITERBI OFF	OFF	AGC
OUTPUT FADER	LOSS RATE: 1,000,000	OFF	CODE NRZ-L	BER: 0.00E-00	
COMB OFF	BIT ERROR RATE OFF START	OT A DT	OUTPUT DATA POL		FILTER
70 MHz 🔀 Internal Ref	BER: Elapsed: AVG BER: O000000 (s)	START	PATTERN PN11 F	START ERR 10^3 Bits	10^3 Bits
BS/BER Fade	r Mod/Dev Playback Presets	Utility	BITSYNC - BER ME	NU FSYNC	Return

Figure 4-42 Bit Sync Derandomizer Selection on Touch Screen

4.2.5.6 Bit Sync Input Code

Figure 4-43 shows how to select the bit sync data input code on the GUI. The user clicks on the arrow icon to the right of the **Input Code** window to enable a pull-down menu that allows the user to select one of 12 available data input codes.



Figure 4-44 shows how to select bit sync data input code using the touch screen. The user touches the **BS/BER** tab on the bottom of the main touch screen to access the **BIT SYNC-BER MENU** screen and then touches the box next to **INPUT CODE** to toggle between the 12 available data input codes as shown.

FREQ (MHz)	SYNTH	MODULATION 1		BITS	YNC	1	STATUS	
2335.0			(NRZ-L		LOSS	DESCRAM
LEVEL (dB)	A	PCM/FM Internal		OUTP CLK	0	RATE:	1,000,000 (bps)	Disabled
-50.5	T Up	DATA RATE 1,000,000 I (bps)		PHASE		BIT	ERROR RATE	1.5 %
Units 0.5	🤟 Dn	BITSYNC1	FSYNC	VITERBI	UFF		OFF	
	FADER	LOSS RATE: 1,003,000	OFF	CODE	NRZ-L	BER:	0.00E-00 FR [:] 0.00E-00	
СОМВ	OFF	BIT ERROR RATE OFF START		OUTPUT	Normal		ED: 000000 (s)	FILTER
70 MHz 🗙	Internal	BER Elapsed: AVG BER: 000000 (s)	START	PATTERN	PN11 F	STAR	ERR 10^3 Bits	10^3 Bits
BS/BER	Fader	r Mod/Dev Playback Prese	ts Utility	BITSYNC	- BER ME	NU	FSYNC	Return

Figure 4-44 Bit Sync Data Input Code Selection on Touch Screen



4.2.5.7 Bit Sync Output Clock Phase

Figure 4-45 shows how to select the bit sync output clock phase on the GUI. The user clicks on the arrow icon to the right of the <u>Clk Phase Out</u> window to enable a pull-down menu that allows the user to select 0°, 90°, 180° or 270° output clock phase.



Figure 4-45 Bit Sync Output Clock Phase on GUI

Figure 4-46 shows how to select bit sync data input code using the touch screen. The user touches the **BS/BER** tab on the bottom of the main touch screen to access the **BIT SYNC-BER MENU** screen and then touches the box next to **OUTP CLK PHASE** to toggle between 0°, 90°, 180° or 270° output clock phase as shown.

FREQ (MHz)	SYNTH	MODUL	ATION 1		BITS	YNC	1	STA	TUS		
2335.0		Mode	Source		INPUT	NRZ-L		LO	SS	DE	SCRAM
		PCM/FM	Internal		OUTP CLK	0		ATE: 1,000),000 (bps)	Di	sabled
-50.5	🛧 Up	DATA RATE 1,000	,000 I (bps)		PHASE	OFF			OR RATE		1.5 % GC
Units 0.5		BITSYNC1 LOSS RATI	E: 1,000,000	FSYNC	OUTPUT	NRZ-L		ER: 0.1	00E-00		II-Z
OUTPUT	FADER	BIT ERROR RAT	E	OFF				VG BER: 0.	00E-00		IC OFFST
COMB	OFF	OFF	START	07.4.07	DATA POL	Normal	E	LAPSED: 00	10000 (s)		ILTER
70 MHz 🔀 Ir Ref	nternal	BER:	— Elapsed: — 000000 (s)	START	PATTERN	PN11 F	S		R 10^3 Bits		0^3 Bits
BS/BER	Fader	Mod/Dev Pl	ayback Preset	s Utility	BITSYNC	- BER ME	NU	F	SYNC	Re	eturn

Figure 4-46 Bit Sync Data Output Clock Phase on Touch Screen

4.2.5.8 Bit Sync Viterbi FEC Decoder

Figure 4-47 shows how to select the bit sync Viterbi FEC decoder on the GUI. The user clicks on the arrow icon to the right of the <u>Viterbi</u> window to enable a pull-down menu that allows the user to select Viterbi rate = 1/2, k = 7 (R=1/2; k=7).

Bit Sync 1 Status	Rate (bps)	1,000,000	<u>Data Pol.</u>	NORM ~	Input Code	NRZ-L	Viterbi	OFF ~
LOSS	Loop BW	1.5 % ~	Descram.	Disabled ~	Clk Phase	0	<u>Output</u> Code	OFF R=1/2;k=7
	Enable A	GC 🗌 HI-Z Inpu	t 🗌 DC Offs	et 🗌 Filtering				

Figure 4-47 Bit Sync Viterbi FEC on GUI

Figure 4-48 shows how to select the bit sync Viterbi FEC decoder using the touch screen. The user touches the **BS/BER** tab on the bottom of the main touch screen to access the **BIT SYNC-BER MENU** screen and then touches the box next to **VITERBI** to toggle between **OFF** and **R=1/2**; **k=7** as shown.



FREQ (MHz) SYNTH	MODULATION 1	BITSYNC 1	STATUS
2335.0		INPUT NRZ-L	LOSS DESCRAM
	PCM/FM Internal		1,000,000 (bps) Disabled
-50.5	DATA RATE 1,000,000 I (bps)	VITERBI OFF	ERROR RATE
Units 0.5	BITSYNC1 FSYNC LOSS RATE: 1.000.000	OUTPUT NRZ-L BER:	0.00E-00 HI-Z
OUTPUT FADER	BIT ERBOR BATE	CODE AVG B	ER: 0.00E-00 DC OFFST
COMB OFF	OFF START	DATA POL	ED: 000000 (s)
70 MHz 🗙 Internal	BER: Elapsed: START	PATTERN PN11 F STAR	ERR 10^3 Bits
BS/BER Fade	Mod/Dev Playback Presets Utility	BITSYNC - BER MENU	FSYNC Return

Figure 4-48 Bit Sync Viterbi FEC on Touch Screen

4.2.5.9 Bit Sync Output Code

Figure 4-49 shows how to select the bit sync data output code on the GUI. The user clicks on the arrow icon to the right of the <u>**Output Code**</u> window to enable a pull-down menu that allows the user to select one of 12 available data output codes.

-Bit Sync 1 Status	Rate (bps)1,000,000Data Pol.NORMInput CodeNRZ-LViterbi	OFF ~				
LOSS	Loop BW 1.5 % · Descram. Disabled · Clk Phase 0 · Output Code	NRZ-L ~				
	Enable AGC HI-Z Input DC Offset Filtering	NRZ-L				
		NRZ-M				
		NRZ-S				
		NRZ-I				
		BIP-L				
		BIP-M				
		BIP-S				
		BIP-I				
	E immed 1	DM-M				
Figure 4-49 Bit Sync Output Code Selection on GUI						

Figure 4-50 shows how to select bit sync data output code using the touch screen. The user touches the **BS/BER** tab on the bottom of the main touch screen to access the **BIT SYNC-BER MENU** screen and then touches the box next to **OUTPUT CODE** to toggle between the 12 available data output codes.

FREQ (MHz) 2335.0	SYNTH	MODULATION 1 Mode Source		BITS INPUT CODE	YNC NRZ-L	1	STATUS LOSS	DESCRAM
LEVEL (dB)	🛧 Up			OUTP CLK PHASE	0	RATE:	1,000,000 (bps)	Disabled
-50.5 Units 0.5	🐺 Dn	BITSYNC1	FSYNC	VITERBI	OFF		OFF	
OUTPUT	FADER	LOSS RATE: 1,000,000	OFF	CODE	NRZ-L	AVG B	0.00E-00 ER: 0.00E-00	DC OFFST
	OFF	OFF STAP	START	DATA POL	Normal	STAR	SED: 000000 (s) PERIOD	FILTER 10^3 Bits
BS/BER	Fader	Mod/Dev Playback Preset	ts Utility	BITSYNC	- BER ME	ENU	FSYNC	Return

Figure 4-50 Bit Sync Data Output Code Selection on Touch Screen



4.2.5.10 Bit Sync AGC, Impedance, DC Offset and Filtering Controls

The **AGC** feature applies an AGC to the Bit Sync input and is activated by the user when the data stream input level is varying in amplitude. The **DC Offset** feature provides for the removal of any unwanted DC offset on the input data stream. The **Impedance** feature provides for either 4K Ω (Hi-Z) input impedance or 75 Ω input impedance. The **Filter** feature provides the ability to filter an analog baseband video input from an external source (recorded or active data stream).

Figure 4-51 shows these features on the GUI. The user clicks on the box next to each feature as shown.

Bit Sync 1 <u>Status</u> <u>Rate</u> 1,000,000	Data Pol. NORM V Input Code	NRZ-L v <u>Viterbi</u> OFF v
LOSS <u>Loop BW</u> 1.5 % ~	$\underline{\text{Descram.}} \underline{\text{Disabled}} \lor \frac{\underline{\text{Clk Phase}}}{\underline{\text{Out}}}$	0 ~ Output Code NRZ-L ~
Enable AGC 🗌 HI-Z Inpu	ut 🔲 DC Offset 🔲 Filtering	

Figure 4-51 Bit Sync AGC, Impedance, DC Offset and Filtering Controls on GUI

Figure 4-52 shows these features on the touch screen. The user touches the **BS/BER** tab on the bottom of the touch screen to access the **BIT SYNC-BER MENU** screen and then touches the box next to each feature as shown.

FREQ (MHz) SYNTH 2335.0	MODULATION 1 Mode Source		BITSYNC	1 STATUS	DESCRAM
	PCM/FM Internal			RATE: 1,000,000 (bps)	Disabled
-50.5	RATE 1,000,000 I (bps)	FRYNG	VITERBI OFF	BIT ERROR RATE	1.5 % AGC
Units 0.5	LOSS RATE: 1,000,000	OFF	OUTPUT NRZ-L	BER: 0.00E-00	HI-Z
COMB OFF	BIT ERROR RATE OFF START		OUTPUT Normal	AVG BER: 0 1002 30 ELAPSED: 000000 (s)	
70 MHz 🔀 Internal	BER: Elapsed: AVG BER: Structure	START	PATTERN PN11 F	START ERR 10 ^{A3} Bits	10^3 Bits
BS/BER Fade	Mod/Dev Playback Prese	ts Utility	BITSYNC - BER ME	NU FSYNC	Return

Figure 4-52 Bit Sync AGC, Impedance, DC Offset and Filtering Controls on Touch Screen

4.2.6 Bit Error Rate (BER) Control Panel

Figure 4-53 shows the GU Bit Error Rate (BER) Control Panel. There are two identical BER channels and control panels (**BER 1** and **BER Sync 2**). BER 1 and BER 2 are both used for BER testing and can be individually selected for all modulation formats. BER 1 and BER 2 are used together for separate I and Q BER testing when AQPSK or AUQPSK modulation formats are selected.

BER 1 and BER 2 are used for BER testing of TTL baseband video inputs that have been processed by Bit Sync 1 and Bit Sync 2, respectively.

Figure 4-53 also shows the touch screen BER controls. The user touches the **BS/BER** tab on the bottom of the touch screen to access the **BIT SYNC-BER MENU** screen. The BER controls are located in the center of the screen under **BIT ERROR RATE**. This screen controls BER 1 when **1** is selected and BER 2 when **2** is elected as shown (**BER 1** is selected in the Figure 4-53 example).





Figure 4-53 BER Functions and Controls

4.2.6.1 BER Status

Referring back to Figure 4-53, BER status is indicated under the GUI <u>Status</u> label as either OFF or SYNC. BER status on the touch screen is either a LOSS or GREEN SYNC indication under the BIT SYNC-BER MENU BIT ERROR RATE label. BER status is also displayed on the main touch screen under the BIT ERROR RATE label as shown. BER 1 status is displayed when 1 is selected, and BER 2 status displayed when 2 is selected.

4.2.6.2 BER PN Pattern

Figure 4-54 shows how to select a PN Pattern on the GUI. The selected BER 1 PN Pattern must match the PN Pattern of the incoming baseband video TTL signal that was processed by Bit Sync 1, and the selected BER 2 PN Pattern must match the PN Pattern of the incoming baseband video TTL signal that was processed by Bit Sync 2.

The user clicks on the arrow icon to the right of the <u>Pattern (2ⁿ)</u> window to enable a pull-down menu that allows the user to select one of 12 available PN pattern formats.

BER 1		Test BER	Test Errors	Test Period	Start/Stop
	Seconds			10^6 Bits ~	
	000000	Avg. BER	Accum. Errors	Pattern (2^n)	
				PN11 F ~	Restart
				PN23 F	
				PN23 R	
				PN15 F	
				PN15 R	
				PN11 F	
				PN11 R	
				PN9 F	
				PN9 R	
				PN7 F	
				PN7 R	
				PN6 F	
		Figu	ıre 4-54	PN6 R	



Figure 4-55 shows how to select a PN Pattern on the touch screen. The user touches the **BS/BER** tab on the bottom of the main touch screen to access the **BIT SYNC-BER MENU** screen and then touches the box next to **PATTERN** to toggle between the 12 available pattern formats.

FREQ (MHz) SYNTH 2335.0	MODULATIO Mode Source PCM/FM Internal	B I T S Y N O 1 STATUS INPUT NRZ-L BATE: 1 000 000 (brs)	DESCRAM
LEVEL (dB) -50.5	DATA 1,000,000 I (bps)	OUTP CLK 0 PHASE BIT ERROR RATE	1.5 %
Units 0.5 OUTPUT FADER	BITSYNC1 FSYNC LOSS RATE: 1,000,000 OFF	OUTPUT NRZ-L BER: 0.00E-00 AVG BER: 0.00E-00	HI-Z DC OFFST
	BIT ERROR RATE START OFF START BER: Elapsed; START	OUTPUT Normal ELAPSED: 000000 (s) PERIOD START FRR 1042 Dite	FILTER
BS/BER	AVG BER: 000000 (s) Mod/Dev Playback Presets Utility	BITSYNC - BER MENU FSYNC	Return

Figure 4-55 BER PN Pattern Selection on Touch Screen

4.2.6.3 BER Test Period

Figure 4-56 shows how to select a test period on the GUI. The user clicks on the arrow icon to the right of the <u>Test Period</u> window to enable a pull-down menu that allows the user to select one of 7 available test periods (10³ thru 10⁹ Bits) or Continuous (Contin.).



Figure 4-57 shows how to select a test period on the touch screen. The user touches the **BS/BER** tab on the bottom of the main touch screen to access the **BIT SYNC-BER MENU** screen and then touches the **PERIOD** box in the **BIT ERROR RATE** window next to **the ERR** button to toggle between the 7 available test periods (**10^3** thru **10^9 Bits**) or Continuous (**Contin.**).

FREQ (MHz)	SYNTH	MODULATIO 1		BITS	YNQ	1	STATUS	
2335.0				INPUT CODE	NRZ-L		LOSS	DESCRAM
LEVEL (dB)	A 110			OUTP CLK	0	RATE:	1,000,000 (bps)	Disabled
-50.5	ար Մր Մր	RATE 1,000,000 I (bps)			OFF	BIT	ERROR RATE	1.5 %
Units 0.5		BITSYNC1	FSYNC	OUTPUT		BER.		HI-Z
ουτρυτ	FADER	RATE: 1,000,000	OFF	CODE	NRZ-L		ER: 0.00E-00	DC OFFST
COMB	OFF	OFF START		OUTPUT DATA POL	Normal	ELAPSI	ED: 000000 (s)	FILTER
70 MHz 🗙	Internal	BER: Elapsed: AVG BER: 0000000 (s)	STARI	PATTERN	PN11 F	START	ERR 10^3 Bits	10^3 Bits
BS/BER	Fader	Mod/Dev Playback Preset	s Utility	BITSYNC	- BER MEN	1U	FSYNC	Return

Figure 4-57 BER Test Period Selection on Touch Screen



4.2.6.4 BER Start/Stop

Figure 4-58 shows the Start/Stop function on the GUI. The user clicks on **Start/Stop** (turns gray when enabled) to start a BER test as shown. When this occurs, a **Restart** window is also enabled. Clicking again on **Start/Stop** stops the BER test. Clicking on **Restart** resets and starts the BER test again.

BER 1 <u>Status</u> SYNC	<u>Seconds</u>	<u>Test BER</u> 0E00	Test Errors 0E+00	Test Period 10^3 Bits ~	Start/Stop
	7	<u>Avg. BER</u> 0E00	<u>Accum. Errors</u> 0	Pattern (2^n) PN11 F ~	Restart

Figure 4-58 BER Start/Stop Selection on GUI

Figure 4-59 shows how to start and stop a BER test using the touch screen. The user touches the **BS/BER** tab on the bottom of the main touch screen to access the **BIT SYNC-BER MENU** screen and then touches **START** as shown. Touching the box again resets and starts the BER test again.



Figure 4-59 BER Start/Stop on Touch Screen

4.2.6.5 BER Indicators

Referring to Figure 4-60, the following GUI displays are provided when running a BER test:

- A. Status Status displays a BERT OFF, SYNC or LOSS status indication.
- B. Seconds <u>Seconds</u> displays the BERT test interval in seconds.
- C. Test BER <u>Test BER</u> displays the current BER.
- D. Test Errors Test Errors display the number of bit errors during the test interval.
- E. Average BER <u>Avg. BER</u> provides a readout of the average BER over the BERT test interval.
- F. Accumulated Errors <u>Accum. Errors</u> adds up the total number of errors that occurred during a test interval.



BER 1		Test BER	Test Errors	Test Period	Start/Stop
SYNC	Seconds	0E00	0E+00	10^3 Bits ~	
	7	Avg. BER	Accum. Errors	Pattern (2^n)	
		0E00	0	PN11 F ~	Restart

Figure 4-60 BER Indicators on GUI

Figure 4-61 shows the touch screen displays correlating to the GUI when running a BER test:

- A. Status A BERT OFF or SYNC indication is provided.
- B. Seconds ELAPSED displays the BERT test interval in seconds.
- C. Test BER BER displays the current BER.
- D. Average BER AVG BER provides an average BER readout over the BERT test interval.



Figure 4-61 BER Indicators on Touch Screen

4.2.7 Frame Sync Control Panel

Figure 4-62 shows the Frame Sync Control Panel. There are two identical Frame Sync channels and control panels (**Frame Sync 1** and **Frame Sync 2**). Frame Sync 1 and Frame Sync 2 can be individually selected for all modulation formats and are used together for separate I and Q testing when AQPSK or AUQPSK modulation formats are selected.

Frame Sync 1 and Frame Sync 2 are used to set up and achieve a Frame Sync LOCK on TTL baseband video data that is frame synced and received from an external source (TSS200B Data In 1 and Data In 2). The TSS200B can also be externally modulated with Frame Synched PCM data and in this manner be used as a simulation source for receiver testing. In this test scenario, the TSS200B frame sync is formatted to match the major frame format of the TTL baseband signal used for externally modulating the TSS200B. A TSS200B frame sync LOCK if achieved if there is a match. This test scenario can also be performed using recorded mission data in TSS200B File Playback mode.



Figure 4-62 Frame Sync GUI Functions and Controls



Figure 4-63 shows the touch screen Frame Sync controls. The user touches the **BS/BER** tab on the bottom of the touch screen to access the BIT SYNC-BER MENU screen, and then touches the FSYNC tab on the bottom of the **BIT SYNC-BER MENU** screen to access the **FSYNC MENU** screen as shown.

The FSYNC MENU screen controls Frame Sync 1 when 1 is selected and Frame Sync 2 when 2 is elected as shown (Frame Sync 1 is selected in the Figure 4-64 example). A Frame Sync START control and Frame Sync Status indicator are also available on the main screen under the FSYNC label as shown.



Figure 4-63 Frame Sync Touch Screen Functions and Controls

4.2.7.1 **Frame Sync Pattern**

Figure 4-64 shows how to type in the frame sync pattern (main word). The user types in the hexadecimal frame sync pattern in the GUI window under FSYNC PAT and then hits Enter on the Keyboard. There are also test frame sync patterns that are available by clicking on the arrow icon located on the right of the FSYNC PAT window and selecting a frame sync pattern in the pull-down menu as shown.





Using the touch screen, the desired frame sync pattern is entered by touching the **BS/BER** tab on the bottom of the touch screen to access the BIT SYNC-BER MENU screen, and then touching the FSYNC tab on the bottom of the BIT SYNC-BER MENU screen to access the FSYNC MENU screen as shown in Figure 4-65. The user than touches the box next to **PAT** to enable a keyboard that is then used to type in the desired hexadecimal frame sync pattern as shown.



FREQ (MHz)	SYNTH	MO			BITS	YNC	1	STATUS	
2335.0		Mode				NRZ-L		LOSS	DESCRAM
		PCM/FN	Internal		OUTP CLK	0	RATE	1,000,000 (bps)	Disabled
	👚 Մր		.000.000 L (bps)		PHASE	U	BIT	ERROR RATE	1.5 %
-50.5	🐺 Dn	RATE		EEXNO	VITERBI	OFF		OFF	AGC
Units 0.5				FSTNC	OUTPUT	ND7-I		0.00E-00	HI-Z
OUTPUT	FADER		DATE	OFF	CODE			BER: 0.00 E-00	DC OFFST
COMB	OFF	OFF	START		OUTPUT DATA POI	Normal		SED: 000000 (s)	FILTER
70 MHz 🔽		BER: -	Elapsed:	START	PATTERN	PN11 F	STAR	T ERR 1043 Bits	10^3 Bits
Ref X	Internal	AVG BER: -	000000 (s)					TO O DICS	
BS/BER	Fader	Mod/De	ev Playback Prese	ts Utility	BITSYNC	- BER MI	ENU	FSYNC	Return
			,,						
			FSYNC	1					
			DAT						
			PAT	EB90	STATUS			-	
			FS LEN	16	OFF	89	AB		
						4 5	6 7		
			BLISWRD	8	START				
			WRDS/FRM	1024	and the second second second	JU] 1	12 3		
						ENT	ER <		
			FS THRESH	15					
			ESYNC MENU		BS/BER	R	eturn		



4.2.7.2 Frame Sync Word Length

Figure 4-66 shows how to enter the frame sync word length using the GUI. The user clicks on the **<u>Sync</u> <u>Length</u>** window, types in a frame sync word length from 1 to 32 bits and hits the keyboard **return**.

-Frame Sy	/nc 1	\sim		FOUND THE	
Status	FSYNC PAT	Sync Length Bits/Word	<u>Words/Frame</u>	15	Start/Stop
	LDSU				

Figure 4-66 Frame Sync Word Length Selection on GUI

Using the touch screen, the frame sync word length is entered by touching the **BS/BER** tab on the bottom of the touch screen to access the **BIT SYNC-BER MENU** screen, and then touching the **FSYNC** tab on the bottom of the **BIT SYNC-BER MENU** screen to access the **FSYNC MENU** screen as shown in Figure 4-67.

The user than touches the box next to **FS LEN** to enable a keyboard that is then used to type in the desired frame sync word length of 1 to 32 bits as shown.



FREQ (MHz) SYNTH	MODULATION 1		<u> B I T S Y</u>	NC 1	STATUS	
2335.0				Z-L	LOSS	DESCRAM
	PCM/FM Internal			RATE	: 1,000,000 (bps)	Disabled
-50.5 _	DATA 1,000,000 I (bps)		PHASE	BI	ERROR RATE	1.5 %
Units 0.5	BITSYNC 1	FSYNC	VITERBI OF		OFF	AGC
	LOSS RATE: 1,000,000	OFF	CODE NR:	Z-L BER:		
COMB OFF	BIT ERROR RATE START			mal ELAF	SED: 000000 (s)	EILTER
	BER: Elansed	START		A F STAL		1043 Bits
Ref 🔀 Internal	AVG BER: 000000 (s)		PATTERN		TUP3 Bits	
BS/BER Fade	r Mod/Dev Playback Prese	ts Utility	BITSYNC - B	ER MENU	FSYNC	Return
	<u>FSYNC</u>	1				
	PAT	EB90				
			STATUS			
	FSLEN	16	OFF			
	BITS/WRD	8	START			
	WRDS/FRM	1024	and the second second second			
		45				
	I S HIKESH	10				
	ESYNC MENU		BS/BER	Return		



4.2.7.3 Frame Sync Bits/Word

Figure 4-68 shows how to enter the frame sync bits/word using the GUI. The user clicks on the **Bits/Word** window, types in a frame sync bits/word from 1 to 64 bits and hits the keyboard **return**.

There are also test frame sync bits/word that are available by clicking on the arrow icon located on the right of the **<u>Bits/Word</u>** window and selecting a bits/word value in the pull-down menu as shown.

Frame Sy Status OFF	ync 1 <u>FSYNC PAT</u> EB90 ~	Sync Length	Bits/Word	Words/Frame	FSYNC Thresh	Start/Stop
			8			
			16			
			32			
			64			
			Figu	re 4-68		

Frame Sync Bits/Word Selection on GUI

Using the touch screen, the frame sync bits/word is entered by touching the **BS/BER** tab on the bottom of the touch screen to access the **BIT SYNC-BER MENU** screen, and then touching the **FSYNC** tab on the bottom of the **BIT SYNC-BER MENU** screen to access the **FSYNC MENU** screen as shown in Figure 4-69. The user than touches the box next to **BIT/WRD** to enable a keyboard that is then used to type in bits/word value of 1 to 64 bits as shown.



FREQ (MHz)	SYNTH	MOI			<u> B I T S</u>	<u>YNC</u>	1	STATUS	
2335.0		Mode	Source			NRZ-L		LOSS	DESCRAM
LEVEL (dB)		PCM/FM	Internal		OUTP CLK	n	RATE	E: 1,000,000 (bps)	Disabled
-50.5	👚 Up	DATA 1	.000.000 I (bps)		PHASE	•	BI	T ERROR RATE	1.5 %
-00.0	🐳 Dn	BITSYN	C 1	ESYNC	VITERBI	OFF		OFF	AGC
Units U.5		LOSS	RATE: 1.000.000		OUTPUT	NRZ-L		0.00E-00	HI-Z
OUTPUT	FADER	BIT ERROR	RATE	OFF	CODE			BER: 0.00E-00	DC OFFST
COMB	OFF	OFF	START		DATA POL	Normal	ELAF	PSED: 000000 (s)	FILTER
70 MHz 🔽	Internal	BER: -	Elapsed:	START	PATTERN	PN11 F	STA	RT ERR 10^3 Bits	10^3 Bits
Ref 🔼		AVG BER: -	000000 (s)		l		Second and a second and a second as a seco		
BS/BER	Fade	r Mod/De	v Playback Prese	ts Utility 🏲	BITSYNC	- BER ME	NU	FSYNC	Return
			<u>FSYNC</u>	1					
			DAT	5000					
			FAI	EBan	STATUS		2 3		
			FS LEN	16	OFF	4	5 6		
			RITS/A/RD	9		🗕 🗕 🗖 i	8 9		
			BHOWIND	0	START				
			WRDS/FRM	1024					
			FS THRESH	15		—	MHz		
						EN	TER		
			ESYNC MENU		BS/REF	R Re	aturn		



4.2.7.4 Frame Sync Words/Frame

Figure 4-70 shows how to enter frame sync words/frame using the GUI. The words/frame are programmable up to 65000. However, words/frame values used during BER testing normally do not exceed 2048. The user clicks on the **Words/Frame** window, types in words/frame and clicks on **return**.

Typical test frame sync words/frame are also available by clicking on the arrow icon located on the right of the **Words/Frame** window and selecting a words/frame value in the pull-down menu as shown.



Figure 4-70 Frame Sync Words/Frame Selection on GUI

Using the touch screen, the frame sync words/frame value is entered by touching the **BS/BER** tab on the bottom of the touch screen to access the **BIT SYNC-BER MENU** screen, and then touching the **FSYNC** tab on the bottom of the **BIT SYNC-BER MENU** screen to access the **FSYNC MENU** screen as shown in Figure 4-71.

The user than touches the box next to **WRDS/FRM** to enable a keyboard that is then used to type in a words/frame value as shown.







4.2.7.5 Frame Sync Threshold

The frame sync threshold value is tied to both the frame sync pattern and length, which is 1 to 32 bits. Accordingly, the frame sync threshold should always be set to a value at least less than or equal to the frame sync word length in order to achieve frame sync lock.

Figure 4-72 shows how to enter the frame sync threshold using the GUI. The user clicks on the **FSYNC** <u>**Thresh**</u> window, types in a frame sync threshold value less than or equal to the frame sync word length and hits the keyboard **return**.

Frame sync threshold values are also available by clicking on the arrow icon located on the right of the **FSYNC Thresh** window and selecting a frame sync threshold value in the pull-down menu as shown.





Using the touch screen, the frame sync threshold value is entered by touching the **BS/BER** tab on the bottom of the touch screen to access the **BIT SYNC-BER MENU** screen, and then touching the **FSYNC** tab on the bottom of **BIT SYNC-BER MENU** screen to access the **FSYNC MENU** screen (Figure 4-73).

The user than touches the box next to **FS THRESH** to enable a keyboard that is then used to type in a frame sync threshold value as shown.

FREQ (MHz) SYNTH M O D U L A T I O N 1 2335.0 Mode Source 1 LEVEL (dB) Up DATA 1,000,000 I (bps) -50.5 Dn DITS Y N C 1 F S Y N Units 0.5 LOSS RATE 1,000,000 F S Y N	BITSYNC 1 STATUS INPUT NRZ-L LOSS OUTP CLK 0 RATE: 1,000,000 (bps) PHASE BIT ERROR RATE VITERBI OFF OFF OUTPUT NRZ-L BER: 0.00E-00	DESCRAM Disabled 1.5 % AGC HI-Z
OUTPUT FADER OFF OFF COMB OFF BIT ERROR RATE START OFF OFF START 70 MHz X Internal BER: Elapsed: AVG BER: 0000000 (s)	CODE AVG BER: 0.00E-00 OUTPUT Normal DATA POL ELAPSED: 000000 (s) PATTERN PN11 F START ERR 10^3 Bits	DC OFFST FILTER 10^3 Bits
BS/BER Fader Mod/Dev Playback Presets Utili <u>FSYNC</u> 1	ITTER MENU FSYNC	Return
PAT EB90 FS LEN 16 BITS/WRD 8	STATUS 1 2 3 OFF 4 5 6 START 7 8 9	
WRDS/ERM 1024 FS THRESH 15		
FSYNC MENU	BS/BER Return	

Figure 4-73 Frame Sync Threshold Selection on Touch Screen

4.2.7.6 Frame Sync Start/Stop

Figure 4-74 shows how to enable the frame sync on the GUI. The user clicks on **Start/Stop**, which turns gray when enabled. <u>Status</u> is either OFF, LOSS or LOCK.



Figure 4-74 Frame Sync Start/Stop on GUI

Figure 4-75 shows how to enable the frame sync using the touch screen. The user touches **START**, and **STATUS** is **GRAY OFF**, **RED LOSS** and **GREEN LOCK**. The Frame Sync can also be enabled on the main screen under the **FSYNC** label as shown.







4.2.8 GUI Toolbar Settings

The SGCMS GUI Toolbar (Figure 4-76) allows the user to select a variety of functions and features as pulldown menus or displays under the headings of **Presets**, **System Config**, **Windows**, **Network Settings**, and **Help**.



Figure 4-76 Toolbar Selections

4.2.8.1 Presets (Saving a Preset)

Figure 4-77 depicts the pull-down menu for **Presets – Save >System** selection. With this selection, the user can name and save TSS200B setups in the system Solid State Drive. Clicking on **Presets – Save >System** directs the user to a directory where the TSS200B set-ups can be named and saved as a .chs file. The example shown is Test Setup 1 and Test Setup 2.

×



SEMCO SGCMS System Name Presets System Config Windows Network Settings Help	Complete System Preset	47-4			×
Load > Save > System	$\leftarrow \rightarrow \checkmark \uparrow$ \textcircled{a} > This PC > Documents $\checkmark \bigtriangledown$				
RI- <u>Frequency (MHz)</u> Level (dBm)	Organize 🔻 New folder			== - (
2335.0 ÷ -50.5 ÷	LCD ^ Name	^ Date modified	Туре	Size	
70 MHz Source Outputs	 OneDrive Test Setup 1.chs 	8/18/2020 4:28 PM	CHS File	2 KB	
	This PC	8/18/2020 4:29 PM	CHS File	2 KB	
Modulation	🧊 3D Objects				
Mode Deviation (Hz)	Desktop				
PCM/FM 350,000 -	Documents				
Internal ~	Downloads Music				
Internal Data	Pictures				
1,000,000 + NRZ-L > PN11 F (2(>	📕 Videos				
	🏪 Local Disk (C:)				
	SB Drive (D:)				
FEC - Of	🔜 USB Drive (D:) 🗸 🗸				
Fader	File name: C:\Users\User\Documents\T	est Setup 2			\sim
Depth (dB) Phase (Degrees) Rate (Hz)	Save as type: Complete System Presets (*.	chs)			~
0 0 00000000000000000000000000000000000				Court	
	∧ Hide Folders		Save	Cancel	
	Eiguro 4	77			

Figure 4-77 Save Presets

4.2.8.2 Presets (Loading a Preset)

Figure 4-78 depicts the sequence for loading the Test Setup 2 example previously saved (Figure 4-77).

SEMCO SGCMS System Name	R Complete System Preset				×
Presets System Config Windows Network Settings Help	telp ← → ✓ ↑ 🗄 > This PC > Documents v ♂ ♂ Search Documents				,p
Save)	Organize 👻 New folder			See 🔹 🔲	?
2335.0 ÷ -50.5 ÷	Documents A Name	Date modified	Туре	Size	
70 MHz Source Outputs Internal V CH 1 V	LCD	8/18/2020 4:28 PM 8/18/2020 4:29 PM	CHS File CHS File	2 KB 2 KB	
	OneDrive				
Modulation	💻 This PC				
Mode Deviation (Hz)	3D Objects				
Pata Samea	Desktop				
Internal ~	🗄 Documents				
Internal Data	- Downloads				
Kate (Dps) Data Code Pattern (2^n) 1.000.000 - NRZ-I PN11 F (2)	J Music				
	Videor				
	Local Disk (C)				
FEC - Off	USB Drive (D:)				
Fader	- USB Drive (D-)				
Depth (dB) Phase (Degrees) Rate (Hz)	File name:		 Complete 	System Presets (*.c	hs 🗸
0 € 360 € 100,000€			Open	Cance	1
	Figure 4-78				

Loading a Preset



4.2.8.3 System Config (Naming Options)

Figure 4-79 depicts the **System Config – Naming Options** selection on the Toolbar. Selecting this feature allows the user to type in and save a name for both the **System** and **SigGen 1** GUI displays, which then appear on the two corresponding GUI headers.



Figure 4-79 Naming Options Feature

4.2.8.4 System Config (One Touch Presets Configuration)

Figure 4-80 depicts the Toolbar System Config – One Touch Presets Configuration selection, which provides for configuring the One Touch Presets feature that loads a selected preset with one click of the mouse. The user clicks on System Config and then the One Touch Preset Configuration as shown.

Presets that have been saved in the Complete System Preset directory (see Figure 4-78) can now be moved to the **One Touch Preset Configuration** by clicking on and then a **Preset** that has been saved in the directory. The selected preset is now in the One Touch Preset Configuration window as shown in Figure 4-80.

Test Setup 1 and Test Setup 2 have been moved in the Figure 4-80 example.

Once the desired Presets have been put into the **One Touch Preset Configuration** window, then the user clicks on the Toolbar **Windows** and **One Touch Presets Full System** to enable the **One Touch Presets** window as shown in Figure 4-81. Presets can now be automatically loaded with one click from this window.

Test Setup 1 and Test Setup 2 are now in the Figure 4-81 example and each can be loaded with one click.

Up to 10 Presets can be loaded following the process shown in Figures 4-80 and 4-81.



SEMCO SGCMS System Name	- • ×
Presets System Config Windows Network Settings Help	
SinGan Naming Options	
One-Touch Presets Configuration > Full System Presets	
RF Calibration th Bit Sync 1	
Fréquency (MITIZ) Level (aBm) LOCK Status Rate 1.000.000 Data Pol. N	$ORM \vee \underline{Input Code} NRZ-L \vee \underline{Viterbi} R=1/2;k=7 \vee$
2335.0 ÷ -50.5 ÷ One-Touch Preset Configuration	× ~
70 MHz Source Outputs	×
Internal V CH 1 V Preset# 1	C > Documents v (b) Search Documents ,0
Toot Sotup 1	III • 🔟 💡
Modulation Bosoft	Date modified Type Size
Fictures #	Test Setup 1.chs 8/18/2020 4:28 PM CHS File 2 KB
Mode Deviation Preset# 2	2 Test Seturations 8/18/2020 4:29 PM CHS File 2 KB
PCM/FM V 350,1 Tost Sature 2	
Internal Desitop	
Preset# 3	
Internal Data	
Rate (bps) Data Code	
1,000,000 - NRZ-L	
rec-or Preset#4	
Reset Fisher (P)	a La Campita Colo Decete (Colo -
Preset# 5	
Fader None None	
Depth (dB) Phase (Degrees)	Reset

Figure 4-80 One Touch Presets Configuration Window



Figure 4-81 One Touch Presets Feature



4.2.8.5 Accessing One-Touch Presets from the Touch screen

Once Presets have been loaded and saved into the One-Touch Preset window (Figure 4-81), then these Presets can be accessed via the touch screen by touching **Presets** and then touching) the desired **Preset #** as shown in Figure 4-82. As an example, Test Setup 1 and Test Setup 2 can now be loaded from the touch screen.

FREQ (MHz)	SYNTH	MODULATION 1 Mode Source		Preset #1	Test Setup 1	Preset #6	None
2335.0		PCM/EM Internal					
LEVEL (dB)	A IIn			Preset #2	Test Setup 2	Preset #7	None
-50.5	∎ ∨p	RATE 1,000,000 I (bps)	/	Preset #3	None	Preset #8	None
Units 0.5		BITSYNC1	FSYNC	TTOJOC #0		110301 #0	
OUTPUT	FADER	LOSS RATE: 1,000,000	OFF	Preset #4	None	Preset #9	None
COMB	OFF	BIT ERROR RATE START					
70 MU -	24 - S.	BER: Elapsed:	START	Preset #5	None	Preset #10	None
Ref X	Internal	AVG BER: 000000 (s)					
BS/BER	Fade	Mod/Dev Playback Prese	ts Utility				Return

Figure 4-82 Accessing One Touch Presets from the Touch Screen

4.2.8.6 System Config (Calibration)

Figure 4-83 shows the window that appears when the Toolbar **System Config – Calibration** is selected. This password-protected feature provides access to all on-screen factory calibration procedures and can only be accessed by personnel who have been trained and certified as TSS200B maintenance technicians. Contact the factory if having this capability is essential to operations and maintenance training is desired.



Figure 4-83 On-Screen TSS200B Calibration Feature



4.2.8.7 Windows (System Configuration)

Selecting the Toolbar **Windows** and then **System Configuration** on the software control panel accesses a window as shown in Figure 4-84. This display indicates what CCAs are installed in the system, what firmware revision level is installed in each CCA, and the Serial Number of each CCA.

The **System Configuration** window is created by polling each CCA upon start-up and extracting the displayed information accordingly. This provides an indication of system software communication health as well as being a source for a status accounting of each system's hardware and software configuration.

SEMCO SGCMS System Name				- 🗆 X
SigGen 1 Name SigGen 1 Name System Configuration One Touch Presets Trequency (MIL 2335.0 Power Meter Window Auto BERT	Bit Sure 1		x	IRZ-L ∨ <u>Viterbi</u> R=1/2;k=7 ∨ ∨ <u>Output</u> NRZ-I ∨ <u>Code</u>
70 MHz Source Multi-Ray Internal V	TSS200D	v1.03	0170	Test Period Start/Stop
Modulation <u>Mode Deviation (Hz)</u> PCM/EM × 250,000	I/Q Card	R13	0000	Pattern (2^n) I11 F → Restart
Data Source Internal	LDA-602E	N/A	2356	C Thresh
Internal Data Data Code Patterm (2^m) 1,000,000 ↓ NRZ-L PN11 F (2C ∨ From	LDA-602E	N/A	<mark>2356</mark>	IRZ-L × <u>Viterbi</u> OFF × <u>Output</u> NRZ-I ×
	BSBERT	519:230	0000	Test Period Stat/Stop 73 Bits
Fader Depth (dB) Phase (Degrees) Rate (Hz)	BSBERT	519:230	0000	N11 F Restart
0 * 360 * 100,000 * Fader OFF	OFF EB90 ~	16 <mark>8 ~</mark>	1024 ~ 15	Start/Stop

Figure 4-84 System Configuration Feature

4.2.8.8 Windows (One Touch Presets)

The One Touch Presets feature was previously addressed in paragraph 4.2.8.4.

4.2.8.9 Windows (Step Function)

The **Step Function** feature (Figure 4-85) provides the user with the ability to automatically "step" the RF frequency and amplitude through selectable ranges. This feature is especially useful in performing premission "Step-Cals", where the user steps the input to telemetry receivers while recording the AGC outputs.

Both RF output amplitude and frequency can be set up with selected overall range, step size and dwell time per step. A repeat feature allows the user to repeat these auto step functions. Each of these features is described in subsequent paragraphs and illustrated in Figures 4-86 and 4-87.

A. <u>Level Step (dBm)</u> - The user can enter a <u>Start</u> dBm level from +5.1 to -100.1 dBm, or set a level using the up-down arrow (▲ ▼) icons located on the right of the <u>Start</u> window.

The user can then enter <u>**# of Steps**</u> or use the up-down arrow ($\blacktriangle \lor$) icons located on the right of the <u>**# of Steps**</u> window. The <u>**Step Size**</u> can be entered from 0.1 dBm to 99.9 dBm or set using the up-down arrow ($\blacktriangle \lor$) icons located on the right of the <u>**Step Size**</u> window.



The number of steps and step size will set the output level (dBm) range from the starting point to an end point.

- B. <u>Dwell Time (mS)</u> Dwell time is the time that is programmed for each dBm step level and can be selected from 300 ms to 9999 ms (9.999 sec). The user can type in the desired "step level dwell time" or set using the up-down arrow (▲▼) icons located on the right of the <u>Dwell Time (mS)</u> indicator window.
- C. <u>Repeat</u> The <u>Repeat</u> feature is a pull-down menu feature which allows the step function to be a onetime occurrence by selecting **Single (none)**, or as a repeat **Saw Tooth** or **Triangular** pattern. Figure 4-86 shows how this <u>Repeat</u> function works.

SEMCO SGCMS System Name Presets System Config Windows Network Settings Help		- 🗆 X
SigGen 1 Name System Configuration	Auto Step: Generator 1	
RF Step Function Window 2335.0 Power Meter Window	Level Step (dBm)	Frequency Step (MHz)
Auto BERT 70 MHz Source Multi-Ray Internal CH 1 B	<u>Start</u> -50.0	<u>Start</u> 2485.0 ÷
Modulation	⁸ <u># of Steps</u> 2 ↓	# of Steps 2
Mode Deviation (Hz) PCM/FM V 350,000 +	<u>Step Size</u> 10.0 ↓	<u>Step Size</u> 10.0
Internal Data Rate (bps) Data Code Pattern (2^n) 1,000,000 + NRZ-L PN11 F (2C	<u>Dwell Time</u> (mS)	Dwell Time 2000
re-or	Pattern Down-Up Sc □ Repeat	Pattern Down-Up ✓ □ Repeat
Depth (dB) Phase (Degrees) Rate (Hz) 0 100,000 + Fader OFF	Start Close CFF LB90 V 10 8 V 1024	Start

Figure 4-85 Step Function Feature



D. <u>Frequency Step (MHz)</u> - The user can enter a <u>Start</u> Frequency from 199.8 MHz to 5150.2 MHz or set a start frequency using the up-down arrow (▲▼) icons located on the right of the <u>Start</u> indicator window.

The user can then enter <u># of Steps</u> or use the up-down arrow ($\blacktriangle \lor$) icons located on the right of the <u># of Steps</u> window. The <u>Step Size</u> can be entered from 0.1 MHz to 9999.9 MHz or set using the up-down arrow ($\blacktriangle \lor$) icons located on the right of the <u>Step Size</u> window.



The number of steps and step size will set the frequency range from the starting point to an end point.

- E. <u>Dwell Time (mS)</u> Dwell time is the time that is programmed for each frequency step level and can be selected from 300 ms to 9999 ms (9.999 sec). The user can type in the desired "step level dwell time" or set using the up-down arrow (▲ ▼) icons located on the right of the <u>Dwell Time (mS)</u> window.
- F. <u>Repeat</u> The <u>Repeat</u> feature is a pull-down menu feature which allows the step function to be a onetime occurrence by selecting **Single (none)**, or as a repeat **Saw Tooth** or **Triangular** pattern. Figure 4-87 shows how this <u>Repeat</u> function works, using a level step range of 2185 MHz to 2485 MHz as an example.



Figure 4-87 Frequency Step Function Repeat Feature

G. <u>Start Button</u> – Once the <u>Start</u> and <u># of Steps</u>, <u>Step Size</u>, <u>Dwell Time</u> and desired <u>Repeat</u> function is selected, the user starts the Level Step (dBm) and/or the Frequency Step (MHz) by clicking on the respective Start button. The Auto Step Generator function is stopped by clicking on Close.

4.2.8.10 Windows (RF Power Meter Sensor Calibration Option)

Figure 4-88 shows the pull-down menu selection for the RF Power Meter Calibration Option when installed. This option provides the ability to closely calibrate the simulator's RF outputs when more precise RF signal levels are desired. The **Power Meter Window** is selected as shown, and an RF jumper cable is connected from the **CH 1** <u>or</u> **CH 2 RF Out** "N" connector (J1 or J2) to the **CAL IN** "N" connector (J14) as shown in Figure 4-89.

Referring to Figure 4-88, the **PowerSensor** window lets the user select the simulator's RF Out to be calibrated (<u>Channel Selection</u>), and then either the specific frequency that the simulator is currently set (<u>Cal Current Freq. Sub-Band</u>) or a selected Frequency Range (<u>Cal Selected Frequency Band</u>).

The <u>Status</u> box indicates that the RF jumper cable has been installed and the RF Power Sensor is functioning properly when displaying OK. A Bad status indication indicates that the power sensor option is malfunctioning or is not installed (which is the case in the Figure 4-88 example). Each PowerSensor setting is described in the following paragraphs:

- A. <u>Channel Selection</u> Each RF output is separately selected and calibrated, moving the rear panel jumper cable as required.
- B. <u>Cal Current Sub-Freq. Sub-Band</u> This setting is used for calibrating the RF output at a specific frequency. The frequency of interest is entered into the <u>Cal Current Freq. Sub-Band</u> window. Clicking on the Cal box begins the calibrating process as shown in Figure 4-88, with the calibrated RF output displayed in the <u>Output Level (dBm)</u> window.



C. <u>Cal Selected Frequency Band</u> - This setting is used for calibrating the RF Output power across a selected frequency band. The user clicks on the (▼) icon to the right and below the <u>Cal Selected</u> <u>Freq. Band</u> to access a pull-down menu of all frequency bands installed in the simulator. Figure 4-88 shows this pull-down menu.

Selecting the desired Frequency Band and then clicking on the **Cal** button in the **Cal Selected Freq. Band** box begins the automatic calibration routine as shown in Figure 4-88. The RF power output is then calibrated at a 0 dBm reference point across the entire Frequency Band that has been selected.



Figure 4-88 RF Power Meter Sensor Calibration Option



Figure 4-89 RF Power Meter Sensor Rear Panel Connection

4.2.8.11 Auto-BERT Feature

The TSS200B **Auto-BERT** feature provides the ability to run a BER test automatically for a given modulation mode and data rate and displays an E_b/N_o waterfall graph on the GUI. The AUTO-BERT feature also populates a window with all BER test results, which can be saved as a .cvs script.


Figure 4-90 illustrates the **Auto BERT** feature. The user sets up for a receiver BER test as previously described in paragraphs 4.2.6 thru 4.2.6.5. The user then selects **Windows** on the GUI Tool Bar and then **Auto BERT to enable the Auto BERT** window as shown.

Once enabled, the user then types in the <u>Start</u> RF Power Level (-80 dBm shown), the <u>Stop</u> RF Power Level (-92 dBm shown) and the RF Power Level <u>Step Size</u> (1.0 dB shown). The user then selects **Bits** and selects the desired BER test period (1E7 shown).

The window to the right of the graph displays all the BER test results and, as previously mentioned can be named and saved to a .cvs script file by selecting **Save To File**. The **Auto BERT** screen can also be printed by selecting **Print**.



4.2.8.12 RF Multi-Path Simulator

The RF Multi-Path Simulator feature employs a **Multi-Ray Simulator (MRS)** that can produce up to four copies of the TSS200's Modulator output, introduce I & Q signal impairments to the simulator's RF output and then sum them back together to simulate multi-path interference. A block diagram of the MSR is shown in Figure 4-91.

The user has the ability to simulate RF Multi-Path conditions using the MRS. This is accomplished by entering the following variables:





Multi-Ray Simulator Block Diagram

- A. <u>**Channel Delay**</u> Each I & Q signal channel can be delayed from 0 to 8184 nS in 8 nS steps.
- B. <u>Frequency Offset</u> Each I & Q signal channel can be offset from -250 kHz to +250 kHz in 1 kHz steps.
- C. <u>**Phase Offset</u>** Each I & Q signal channel can be phase offset from -180 degrees to +180 degrees in 0.1-degree steps.</u>
- D. <u>Magnitude</u> Each I & Q signal channel can be set for a relative output magnitude (level) from 0.0 to 100.0 % in 0.1 % steps.
- E. <u>Fixed Magnitude</u> The I & Q signal paths are summed based on the configuration of the Fixed Magnitude Check Box:
 - CHECKED Each signal path contributes 25% of the total power. In this mode, each channel's
 power contribution is fixed based solely on its Magnitude setting. Adding or subtracting
 additional paths will not affect its power contribution.
 - UNCHECKED Each I & Q signal channel provides 1/N, where N = Number of Enabled Channels, of the total power of the MSR output. In this mode, each channel's power will change depending on the number of enabled channels.



Note:

If all channels are disabled, the modulated I & Q signals bypass the MSR and are routed directly to the Simulator's internal I/Q Modulator.

Figure 4-92 illustrates how to enable the MRS feature. The user clicks on **Windows** and then selects **Multi-Ray** to access the **SGCMS Multi-Ray** window. The user then enables Ray 1, 2, 3 or 4 (or any combination thereof) and enters the desired variables for <u>Delay (nS)</u>, <u>Frequency (Hz)</u>, <u>Phase (deg)</u> and <u>Magnitude</u> Fixed or Variable).

SEMC Presets SigGen 1 RF Free 2 70 Int	O SGCMS Sys System Config I Name quency (XIHz 250.0 • MHz Source ternal • station SEMCO SGCM	tem Name Windows Network Settings Help System Configuration One Touch Presets Step Function Window Power Meter Window Auto BERT Multi-Ray Outputs COMB IS MultiRay	Bit Sync 1 Status LOSS LOSS Loop BN ✓ Enable BER 1 Status OFF S	10,000,000 Data Pol. NORN W 1.0 % Descram. Disabl AGC HI-Z Input D C Offset Fit Image: Image of the state of the st	M ~ Input Code NRZ-L ~ 1 ed ~ Cik Phase 0 ~ 2 Out 0 tering 10 ~ 6 Bits ~ Accum Errors Dattorn (2 / n)	- · ×	
	Enable	Delay (nS)	Frequency (Hz)	Phase (deg)	Magnitude	Fixed Mag	
	Ray 1	0	0	0.0		100.0%	
	Ray 2	0	0	0.0		100.0%	
	Ray 3	0	0 🗧	0.0		100.0%	
	Ray 4	0	0 ÷	0.0 📫		100.0%	
Fader PN11 F Restart Depth (dB) Phase (Degrees) Rate (Hz) Frame Sync 2 Sync Length Bits/Word Words/Frame FSYNC Thresh 0 2 2 Fader OFF OFF 7FD6 16 8 30 15 Sat/Stop							

Figure 4-92 Multi-Ray Simulator Set-Up

As a practical matter, a logical way to set up a desired RF Multi-Path condition is to visually look at a spectrum that is displaying the actual RF Multi-Path being encountered at a given ground station under a variety of conditions. Once observed, then the user can enter the required variables and number of rays that replicates this observed RF multi-path scenario at the TSS200B RF outputs.

Once this replication of the RF multi-path condition is observed on the TSS200B Simulator RF output, the user then injects this signal into the receiver under test. The user then enables the receiver's Adaptive Equalization feature and verifies that the receiver processes the RF multi-path signal and produces a spectrum with no RF multi-path present.

Table 4-4 below provides 3 test examples of this process for a PCM/FM modulated signal.



Table 4-4RF Multi-Path Test Samples

Test 1	Enable	Delay (nS)	Freq. (Hz)	Phase (deg)	Magnitude
Ray 1	Yes	0	0	0	100%
Ray 2	Yes	300	0	180	100%
Ray 3	No	0	0	0	0
Ray 4	No	0	0	0	0



TSS200B RF Output (Multi-Path Scenario 1)



Receiver Under Test (Adaptive Equalization Enabled)

Test 2	Enable	Delay (nS)	Freq. (Hz)	Phase (deg)	Magnitude
Ray 1	Yes	0	0	0	100%
Ray 2	Yes	100	0	180	100%
Ray 3	No	0	0	0	0
Ray 4	No	0	0	0	0



TSS200B RF Output (Multi-Path Scenario 2)



Receiver Under Test (Adaptive Equalization Enabled)

Test 3	Enable	Delay (nS)	Freq. (Hz)	Phase (deg)	Magnitude
Ray 1	No	0	0	0	0
Ray 2	No	0	0	0	0
Ray 3	Yes	0	0	0	100%
Ray 4	Yes	250	0	180	100%



TSS200B RF Output (Multi-Path Scenario 3)



Receiver Under Test (Adaptive Equalization Enabled)

4.2.8.13 Network Settings

Refer to **Paragraph 3.2**, **SGCMS Network Program Description** for a detailed explanation of the Network Settings Toolbar feature.



4.2.8.14 Help

Figure 4-93 depicts the **Help** selection on the Toolbar. The Help menu includes **About**, which provides information pertaining to the SGCMS software revision level that is installed. The Help menu also provides the ability to select and view a PDF file containing the TSS200B User's Guide.

SEMCO SGCMS System Name	_	X				
Presets System Config Windows Network Settings Help	Presets System Config Windows Network Settings Help					
SigGen 1 Name Users Manual						
About						
RF Frequency (V(Hz) Level (dBm) Sate Control of TouchScree	reen Rate 1 000 000 Date Dat NODM Input Code NRZ-L V Vitarbi R=10	/2·k=7 v				
	(bps) 1,000,000 Data Pol. NORM V Appareout Inte C Viteroi Inte	2,n-7 ·				
2335.050.5 -	<u>Loop BW</u> 1.5 % \checkmark <u>Descram.</u> RNRZ11 \checkmark <u>Clk Phase</u> 0 \checkmark <u>Output</u> NRZ	Z-1 ~				
70 MHz Source Outputs	Enable AGC HI-Z Input DC Offset I Filtering					
Internal × CH 1 ×	BER 1					
	Status Test BER Test Errors Test Period	Start/Stop				
	OFF Seconds 0.00E-00 0.00E+00 10*3 Bits ~					
Modulation	000000 <u>Avg. BER</u> <u>Accum. Errors</u> <u>Pattern (2^n)</u>					
Mode Deviation (Hz)	PN11 F v	Restart				
PCM/FM ~ 350,000 ÷	Frame Sync 1					
	Status FSYNC PAT Sync Length Bits/Word Words/Frame FSYNC Thresh	0.10				
Data Source	OFF EB90 v 16 8 v 1024 v 16 v	Start/Stop				
Internal V	Bit Sync 2					
Internal Data	Status Rate 1,000,000 Data Pol. NORM v Code In NRZ-L v Viterbi OFF	~				
Rate (bps) Data Code Pattern (2^n) Insert 10°3	LOSS Lean BW 15 % or Decreme Displied of Clk Phase 0 Output ND:	71				
1,000,000 - NRZ-L ~ PN11 F (2(~ Error Errors	<u>Loop Bw</u> 1.5 % V <u>Descram.</u> Disabled V <u>Out</u> 0 V <u>Code</u>	- 1 *				
FEC - Off	Enable AGC HI-Z Input DC Offset Filtering					
	BER 2 Test BER Test Errors Test Period	0				
	Status	start/stop				
	OFF OCONTS OF Accum Fronts Battern (20m)					
		Restart				
Fader	PNIIF					
Depth (dB) Phase (Degrees) Rate (Hz)	Frame Sync 2 Status FSYNC PAT Sync Length Bits/Word Words/Frame FSYNC Thresh					
0 ÷ 360 ÷ 100,000 ÷ Fader OFF	OFF EB90 V 16 8 V 1024 V 15 V	Start/Stop				

Figure 4-93 Toolbar Help Feature

