

WAAS SIGGEN GUI User Guide

D25548

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1 Introduction

This document describes the WAAS SIGGEN Graphical User Interface (GUI) software. This software is used to control the SIGGEN hardware using its WMP Control interface.

The SIGGEN contains an L1 and an L5 signal generator. Each is controlled separately using the WMP control interface. The GUI allows control of these generators either individually or together and provides status indications for each.

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2 Software Installation

The SIGGEN GUI application is created for Windows 7 or 10 installations. It is an x86 (not a 64-bit) application.

The SIGGEN GUI and a corresponding Command-Line Interface (CLI) application are installed together from a single Windows install (.msi) file provided on the distribution media.

Refer to the document “WAAS SIGGEN Command-Line Interface (CLI) Specification [D24894]” for details on the CLI application.

Installation is begun by double-clicking to run the setup.exe file.

Click “Next” when the Welcome window appears, as shown in Figure 2-1.

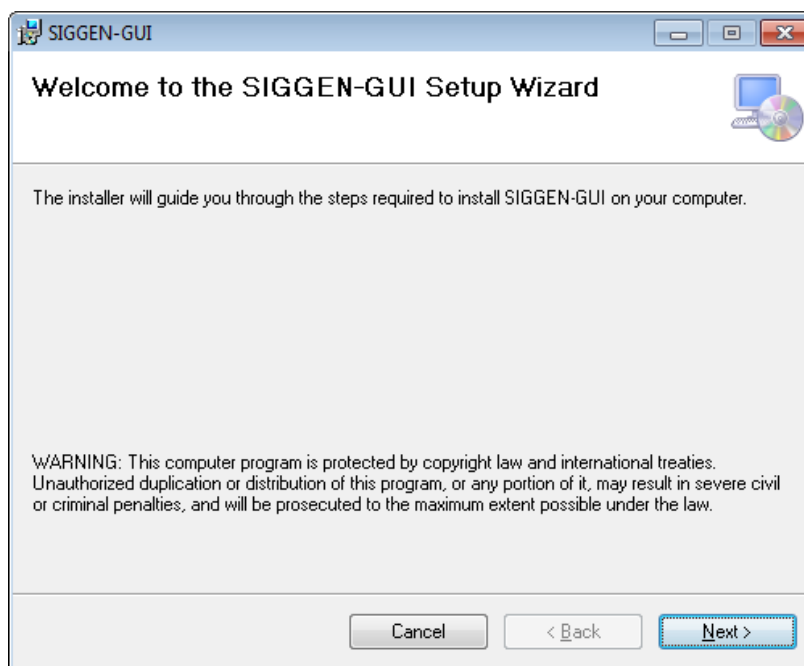


Figure 2-1: SIGGEN GUI Installation Welcome Window

There are limited options for installation that are covered in the following windows: the installation directory, and whether the application is available to the current user or to all users. You must also agree to the software license agreement. These are standard for Windows application installations, and so will not be described in detail here.

After installation, the program will be available on the Start Menu under “NovAtel Inc”.

2.1 Missing Runtime Libraries

In rare instances the Microsoft runtime libraries may be missing from the computer where these applications are being installed. This will produce an error similar to that shown below.

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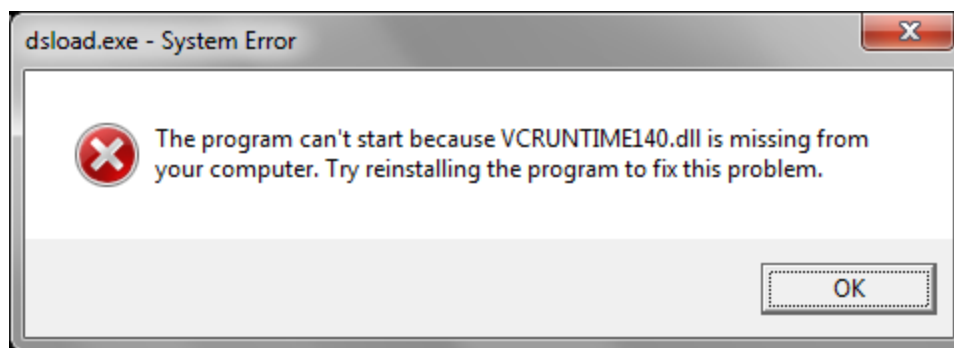


Figure 2-2: SIGGEN GUI Installation Error 1

In some cases, this error will show up differently, such as:

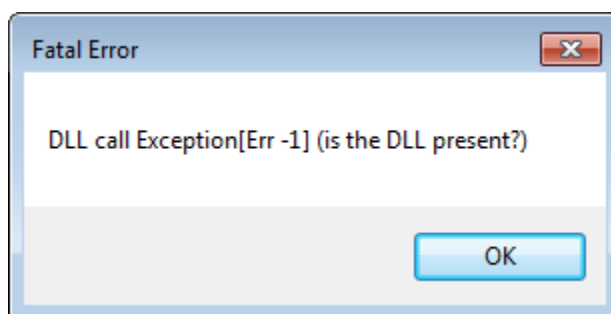


Figure 2-3: SIGGEN GUI Installation Error 2

While the setup.exe file could have been configured to download this dependency automatically, tests have shown that this can interfere with previous software installations.

Running through all pending Windows updates may fix this. In other cases the libraries may have to be manually installed. At the time of writing, this is available for download and installation at the following link:

<https://www.microsoft.com/en-us/download/details.aspx?id=48145>

The x86 version of this DLL is required, but the 64-bit version can also be installed if desired.

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3 Quick Start Guide

The following procedure will bring a SIGGEN from the powered-up state to an operational state using default configuration parameters.

3.1 Hardware Setup

Refer to WAAS SIGGEN User Guide (NovAtel Document OM-2000187) for details on setting up the SIGGEN and associated equipment.

3.2 Control Interface

When a SIGGEN is powered, both generators perform extensive internal calibration and self-test activities. Under normal conditions, provided the SIGGEN is receiving 1 PPS pulses, and each generator is receiving messages on its CMP interface, this should take no more than three minutes (typically less than one minute). When complete, each generator will begin sending status messages on the WMP interface (the interface used by the GUI) once per second.

A SIGGEN generator accepts four types of commands: Reset, Control, Initialization, and Code Chip Rate and Carrier Frequency. These commands are denoted within this document as:

RESET
 CONTROL
 INITIALIZE
 RATE/FREQUENCY

A SIGGEN generator can be in any one of the following states:

RESET
 INITIALIZED
 CALIBRATION
 OPERATIONAL

The generator starts in a RESET state and must be brought to an OPERATIONAL state by following the sequence (illustrated in Figure 3-1):

RESET state – send INITIALIZATION command

INITIALIZATION state – send CONTROL command

CALIBRATION state – wait for completion of internal calibration processes

OPERATIONAL state – accepts RATE/FREQUENCY commands

The RESET command will be accepted in any state and places the generator back in a RESET state. The other commands are only accepted if the generator is in the correct state, as shown in the above sequence.

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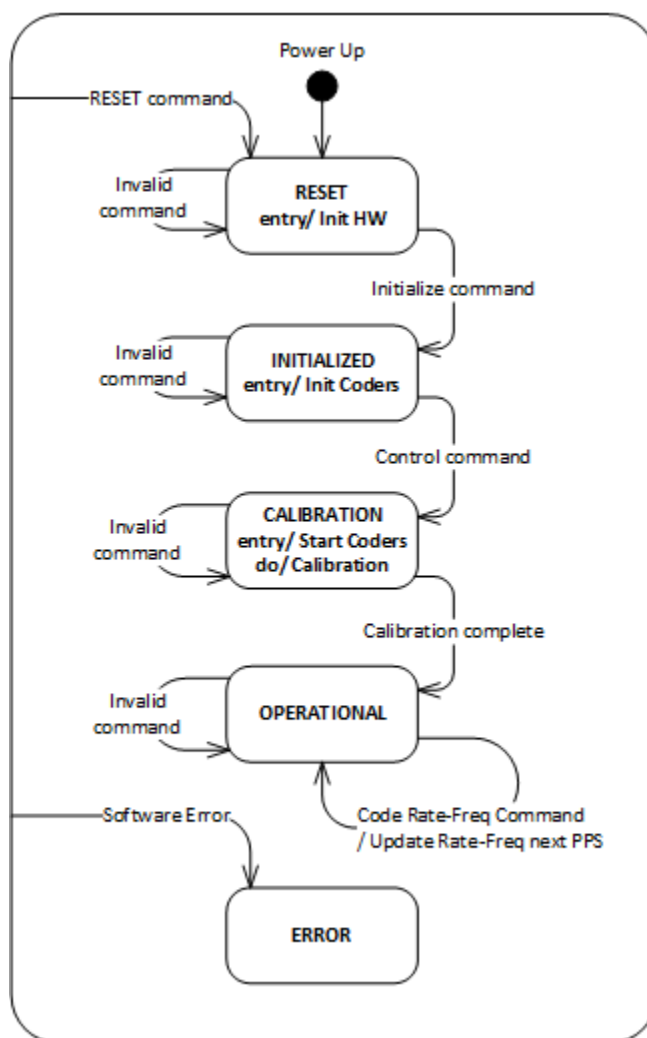


Figure 3-1: SIGGEN States and Command Transitions

3.3 First Run

3.3.1 Set COM Parameters

The SIGGEN GUI requires setup of the COM ports needed to control the SIGGEN generators. When the GUI is run for the first time after the software is installed, or if one or both COM ports have previously been disabled, this dialog opens automatically before the Main Window is shown.

A small “Finding Available COM Ports” window will appear before the Setup COM Ports dialog is shown for the first time. This indicates the software is searching for available COM ports.

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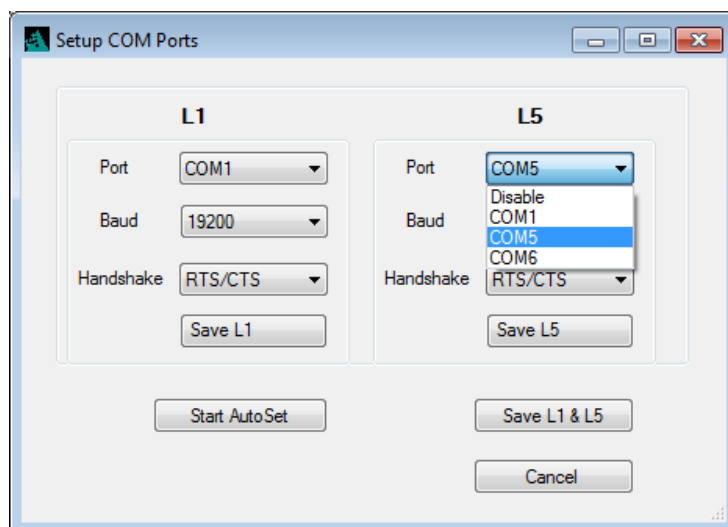


Figure 3-2: Selecting COM Ports

The port and baud rate can be chosen for each generator, and the “Save L1 and L5” button will save the chosen values and proceed on to the GUI’s Main Window. See the section “Setup COM Ports Dialog” for more details.

3.3.2 Application Data Folder

The SIGGEN application will create an Application Data area in the user’s AppData folder, if it is not already present. Typically, this is at

C:\Users\<username>\AppData\Roaming\NovAtel Inc\SIGGEN

3.4 SIGGEN Startup

When the SIGGEN GUI program executes, the Main Window appears. This window provides status indications and buttons for sending SIGGEN commands. Status indications in this window are dependent on messages being received from the SIGGEN generators. Figure 3-3 shows the Main Window before a valid message has been received from either SIGGEN generator.

The Main Window is relatively complex and has many functions and status indications. The section “Main Window Details” provides a full explanation of this window.

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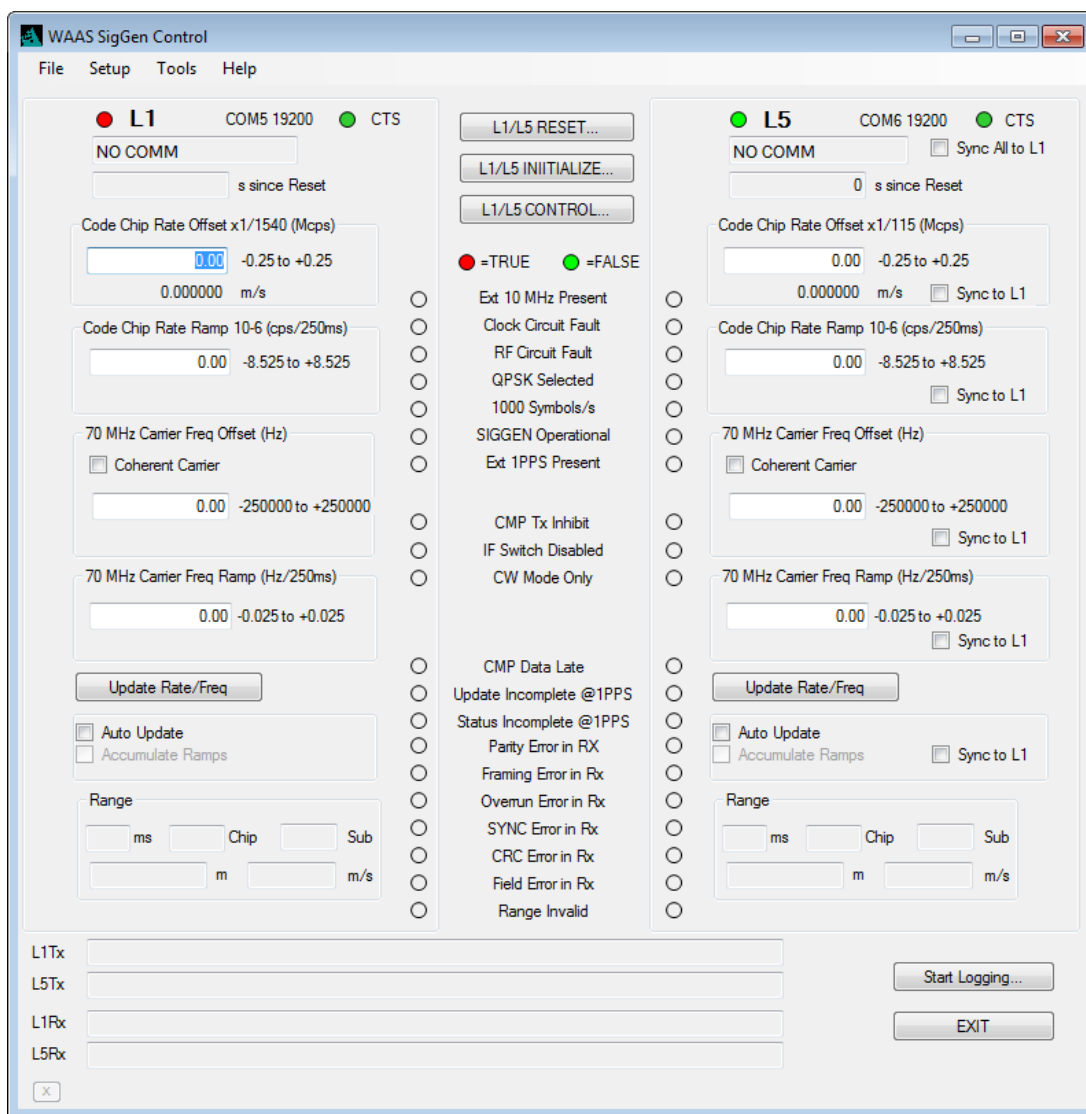


Figure 3-3: Main Window During SIGGEN Startup

The state field, under the main **L1** and **L5** headings, shows the connection status and (when messages are being received) the SIGGEN state. “NO COMM” indicates that the COM port has been opened properly but no messages are currently being received. “Unconnected” appears instead if the COM port has been set to Disabled, or the port cannot be opened (perhaps being used by another application). In the latter case, an error message should appear at the bottom of the window.

Once the SIGGEN has completed its startup activities, it will be in a RESET state and will start sending status messages. Several status indications will be updated, and the raw message windows at the bottom of the window (L1Rx and L5Rx) will show the messages arriving once per second.

Figure 3-4 shows a case where L1 has been set to COM5 but was unable to be opened (as per the message at the bottom of the window), while L5 has connected correctly and is in a RESET state, waiting for

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commands. Some of the L5 status fields have been set: the status (LED-like) indicators and the “L5Rx” raw messages, while the L1 fields remain uninitialized.

Note that the status indicators are red for a TRUE state, and green for FALSE (this can be counterintuitive but was chosen for visual compatibility with previous SIGGEN GUI software).

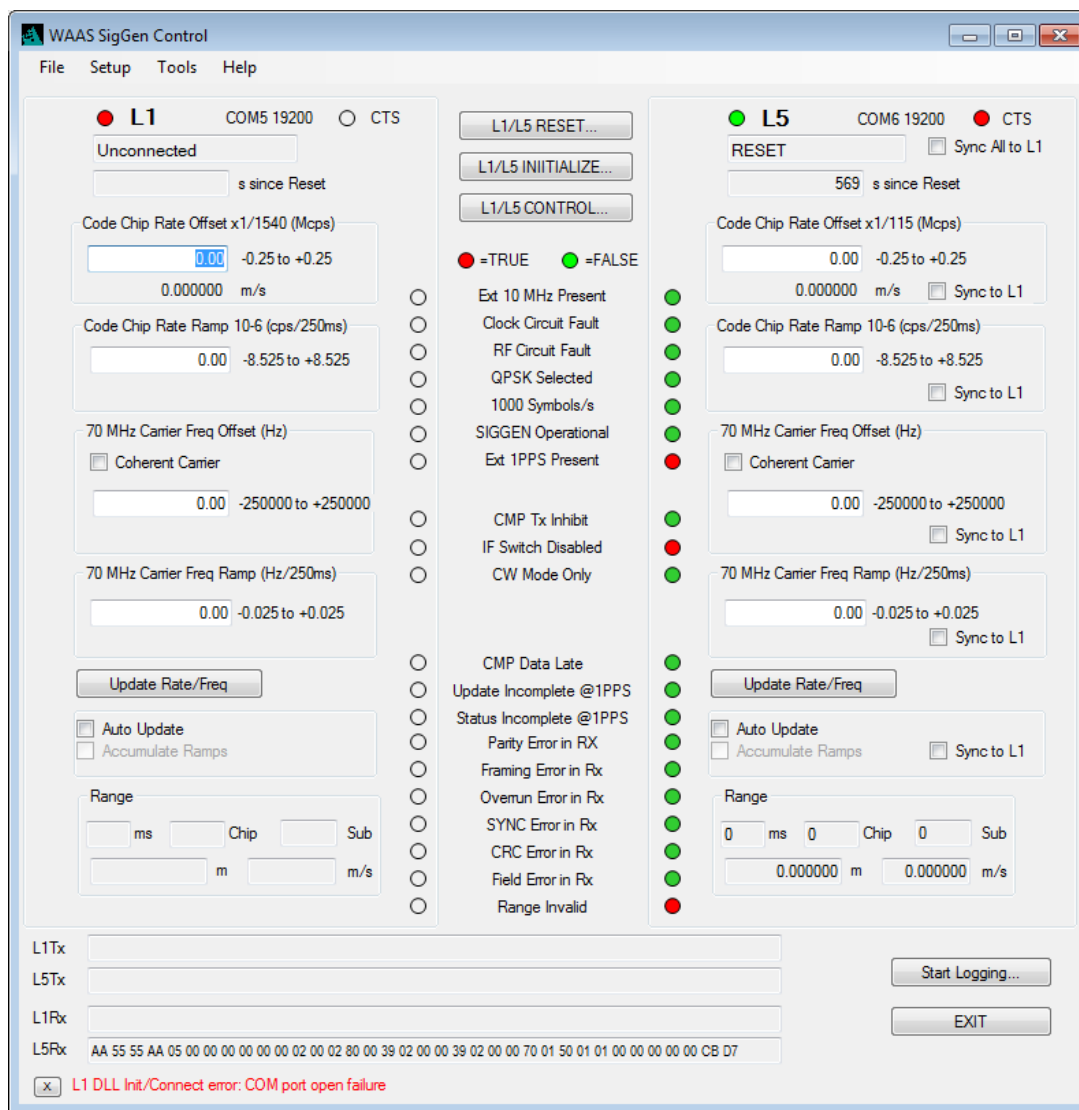


Figure 3-4: L1 Unconnected, L5 in RESET

If the SIGGEN has been previously initialized, the state may be something other than RESET. To restore one or both of the SIGGEN’s generators to RESET, from any state, press the L1/L5 RESET button. This brings up the Reset Dialog, shown in Figure 3-5. Either of the L1 or L5 generators, or both, can be reset by pressing the appropriate button, which sends the command(s) and returns to the Main Window. The Cancel button (or pressing the Escape key) will return to the Main Window without sending a command.

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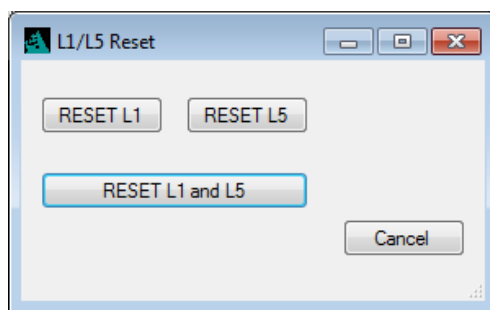


Figure 3-5: Reset Dialog

As described earlier, configuration of the SIGGEN from a RESET state is done in two phases: INITIALIZE and CONTROL.

3.5 SIGGEN Initialization

Sending an INITIALIZE command is only applicable if the SIGGEN is in a RESET state, although for test purposes the GUI allows it from any state (providing messages are currently being received from the SIGGEN). Pressing the L1/L5 INITIALIZE button brings up the Initialize dialog, as shown in Figure 3-6.

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The dialog box is titled "Initialize Command Settings" and contains two main sections: L1 and L5. Each section has four sub-sections: Initial Symbol Advance, Initial Code Chip Advance, Initial Sub-Chip, and Channel Coders. The L1 section also includes an RF Center Frequency dropdown and an "Initialize L1 Only" button. The L5 section includes an RF Center Frequency dropdown and an "Initialize L5 Only" button. At the bottom right, there are buttons for "Initialize L1 AND L5" and "Cancel".

Section	Parameter	Default Value	Range
L1	Initial Symbol Advance	66	0 to 499
	Initial Code Chip Advance	435	0 to 1022
	Initial Sub-Chip	110	0 to 255
	1 ms Epoch	ODD	-
L5	Initial Symbol Advance	66	0 to 499
	Initial Code Chip Advance	4354	0 to 10229
	Initial Sub-Chip	69	0 to 255
	1 ms Epoch	ODD	-

Channel Coders:

Section	Parameter	Default Value
L1 (G2)	PRN-I	120
	PRN-Q	121
L5 (XB)	PRN	120
	XB-Q	0x134B

RF Center Frequency:

Section	Default Value	Unit
L1	1227.6	MHz
L5	1176.45	MHz

Figure 3-6: Initialize Dialog with Default settings

The various settings are shown with their default values, which can be changed as desired. The section “Initialize Dialog” provides details on this.

Note that it is possible to pre-load configuration settings from a file before opening the Initialize dialog; this is described in a later section.

Press the “Initialize L1 AND L5” button to send the INITIALIZE command with the settings to the SIGGEN. Alternatively, press “Initialize L1 Only” or “Initialize L5 Only” to initialize only one of the two generators. Any of these options will close the window, send the command message(s), and store the

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settings if the Initialize dialog is opened again. The settings are not, however, retained if the SIGGEN GUI is exited.

Click “Cancel” to abandon any settings changes and return to the Main Window.

If an error occurs when the command is sent to the SIGGEN, an error window will appear, as shown in Figure 3-7, before returning to the Main Window.

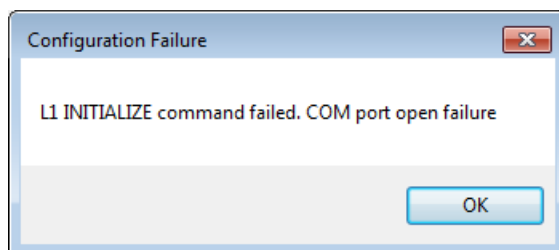


Figure 3-7: Typical Command Failure Window

Sending an INITIALIZE command when the generator is not in the RESET state is considered by the GUI software to be valid (for test purposes). This only results in a temporary status error indication from the SIGGEN.

When a SIGGEN generator has successfully received and processed the INITIALIZE command, its state will be changed to “INITIALIZED” and is ready for the CONTROL command.

3.6 SIGGEN Control

A CONTROL command is only valid if the SIGGEN generator is in an INITIALIZED state. Figure 3-8 shows the Main Window with both generators in this state. Note in particular that the “SIGGEN Operational” indications are green, meaning FALSE, or **not** operational, and the IF Switches are Disabled.

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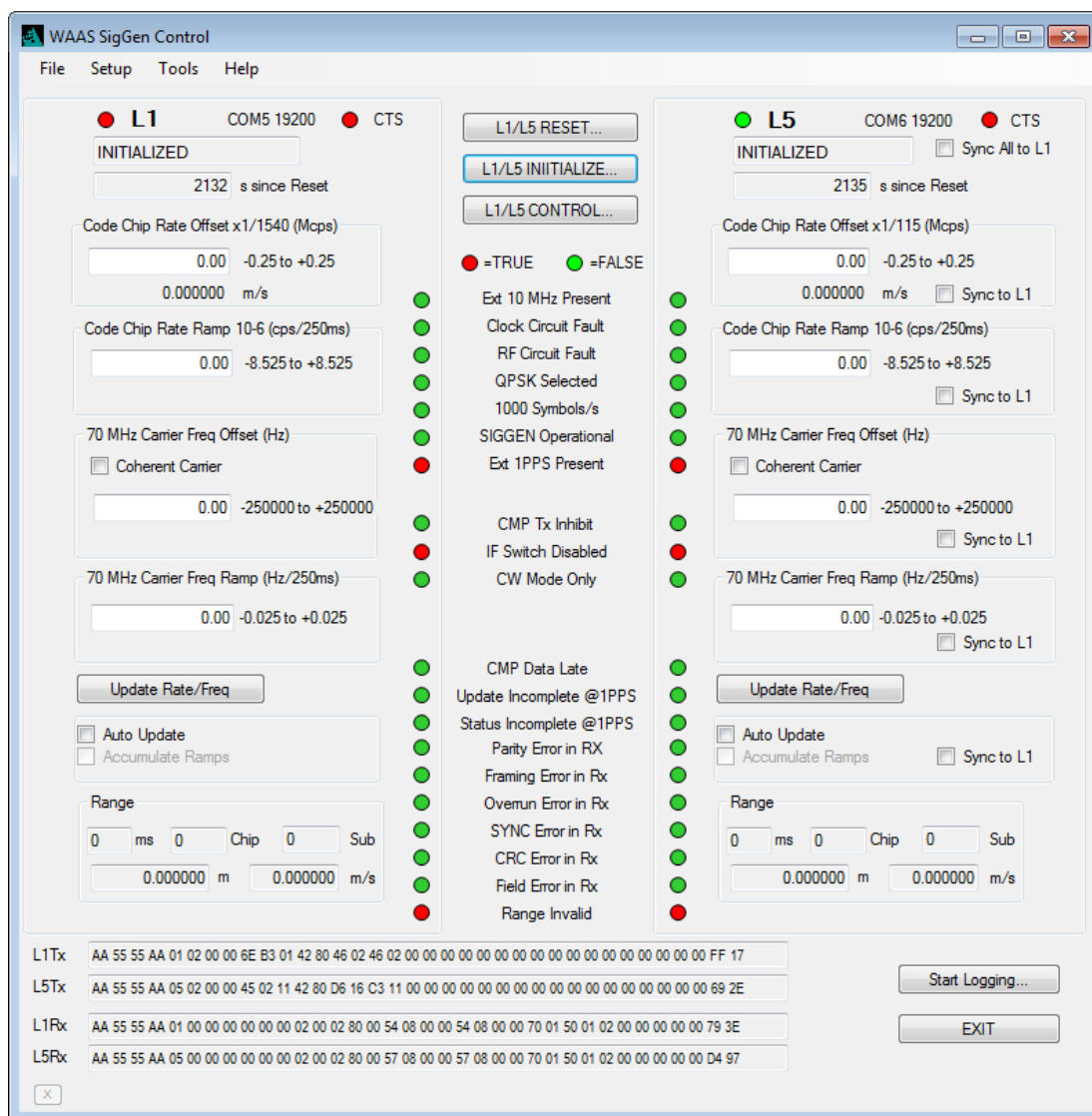


Figure 3-8: SIGGEN in INITIALIZED State

Press the L1/L5 CONTROL button to bring up the Control dialog, as shown in Figure 3-9. Again, the default values for the various settings are shown and can be changed as desired. The section “Control Dialog” provides full details on setting these values.

In general, the “Coherent Carrier” box should always be checked if offsets and/or ramps are in use.

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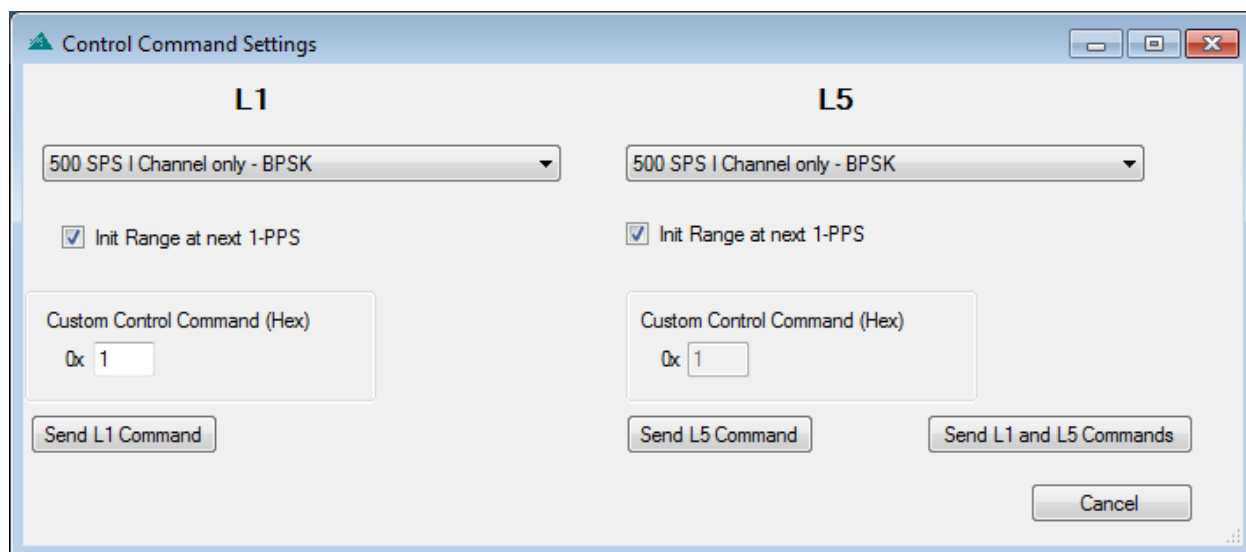


Figure 3-9: Control Dialog with Default Settings

Similar to the Initialize dialog, a CONTROL command can be sent to either or both generators; alternatively, changes can be abandoned, and no command sent, by pressing the Cancel button. Either will cause a return to the Main Window.

When the CONTROL command is sent to a given generator, its state will change to CALIBRATION and then (after 20 to 30 seconds) automatically change to OPERATIONAL.

If a generator does not become OPERATIONAL, there may be some kind of fault with the SIGGEN or an interruption in communication. Look for an error message at the bottom of the Main Window and verify that messages are being received as shown by the L1Rx and L5Rx fields. The L1/L5 RESET button will bring up the Reset dialog, as described earlier; if communication with the SIGGEN is occurring, this will always bring a generator back to its RESET state.

NOTE: the “Init Range at next 1-PPS” should always be checked (the unchecked option is only for specialized development testing). If this is set unchecked, the generator will never complete its CALIBRATION state.

3.7 SIGGEN Operational

With both generators in their OPERATIONAL states, the Main Window should look similar to that shown in Figure 3-10. The Range fields, near the bottom of the Window on both the L1 and L5 sides, are updated once per second as new Status messages are received from the SIGGEN.

The Main Window also allows sending RATE/FREQUENCY commands by pressing the “Update Rate/Freq” button. The Code Chip and Carrier Frequency configuration values that are used in the RATE/FREQUENCY commands are shown above this button and can be edited (within the limits shown) directly. Details on setting these configuration values is described in the section “RATE/FREQUENCY Command”.

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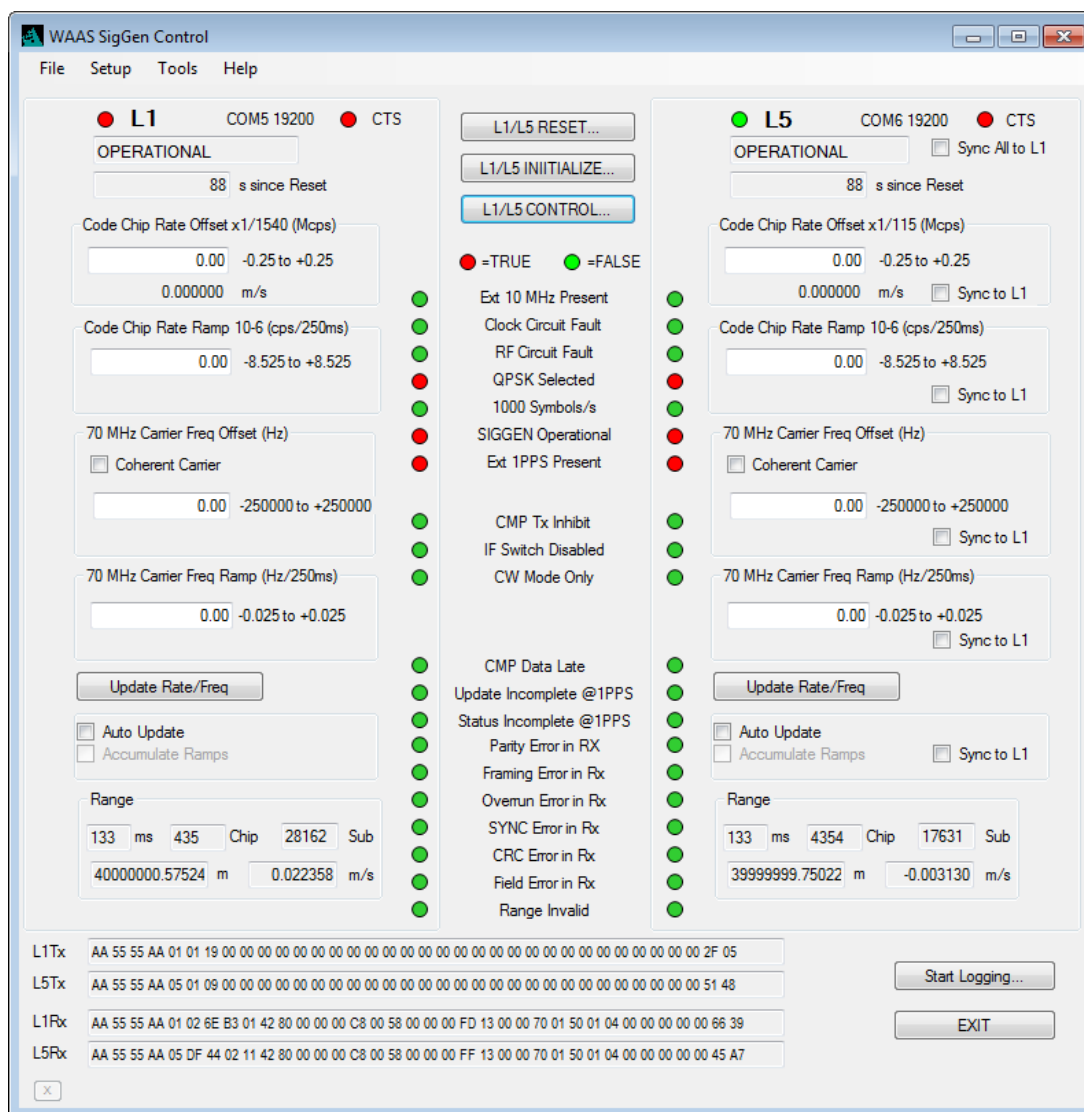


Figure 3-10: SIGGEN in OPERATIONAL State

Detailed descriptions of the various status and entry fields on the Main Window and all the other dialogs are provided in the following sections.

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4 Main Window Details

The Main Window provides indications of status for both SIGGEN generators, and a means of sending commands to the SIGGEN. It also provides a limited set of menu commands for various operations.

4.1 Status Fields

Figure 4-1 highlights the areas on the Main Window that have status indication fields. The fields will be described in the following sections, grouped by these areas.

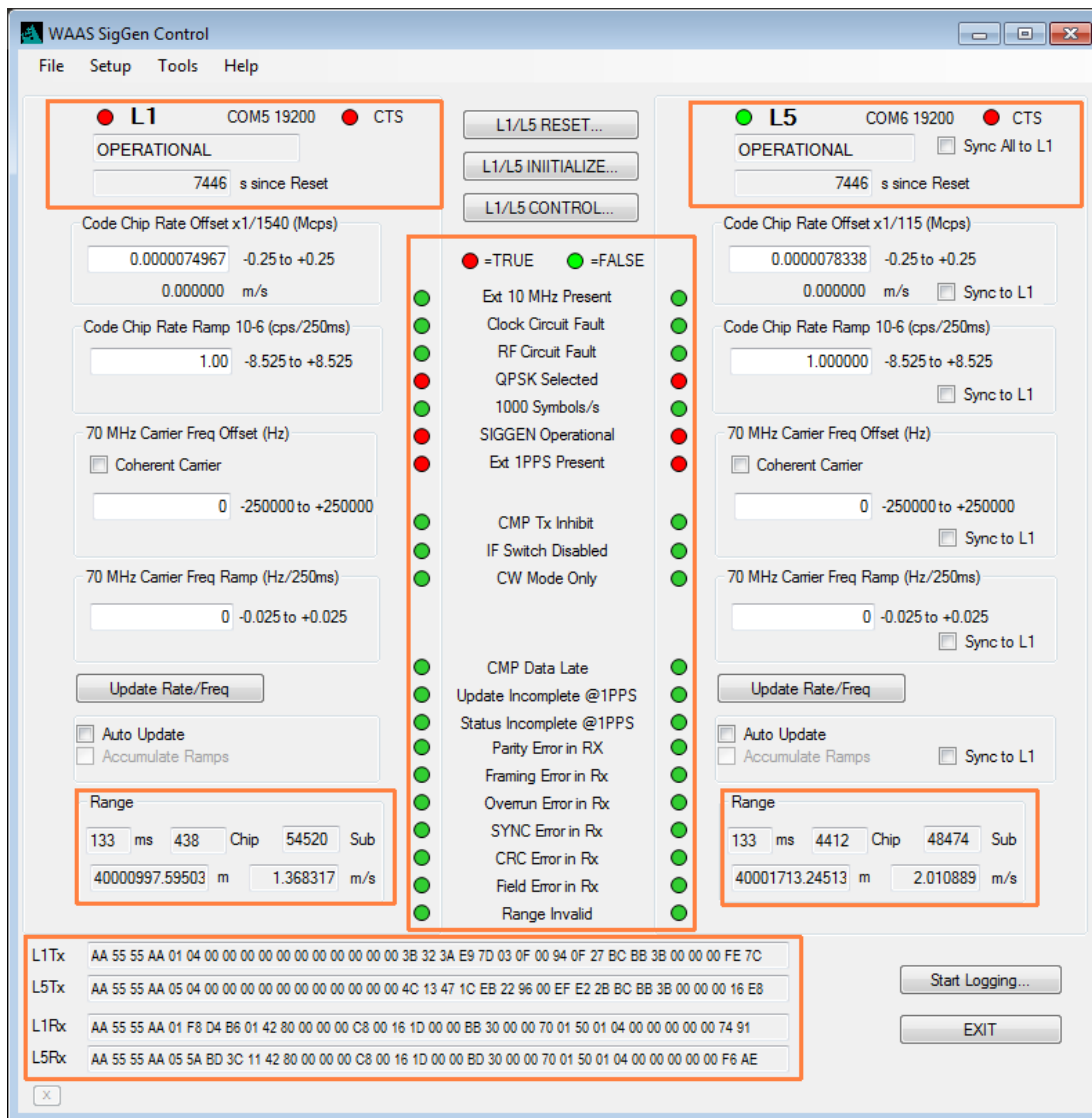


Figure 4-1: Main Window Status Areas

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4.1.1 Overall Generator Status Area

These are the areas at the top of the window on the left and right sides, for the L1 and L5 generators respectively. The red indicator to the left of the L1 heading, and the green indicator on the L5 side, simply indicate the LED color of a connected Datasource module. Refer to WAAS SIGGEN UDSM User Guide (NovAtel Document D25598) for details.

To the right of the L1 and L5 headers are shown the current COM port settings. Further to the right the current state of the port's CTS line is shown: red indicates TRUE or asserted (this is used for certain designer and system tests).

Below the L1 and L5 headers are the generator state (**RESET**, **INITIALIZED**, **CALIBRATION**, or **OPERATIONAL**). If there is a serious generator hardware malfunction, the state may appear as **INVALID (SW ERR)**.

If the specified COM port could not be opened (if it has been set to Disabled or if another application is using it), this will show as **Unconnected**.

If the port is opened but no status messages are being received it will show **NO COMM**.

Below the state is a field showing the number of seconds that the generator has been active since the last Reset. If the generator is connected and active, this should change once per second.

4.1.2 Status & Error Indications

These are in the central area in the middle of the Main Window and consist of a number of indications that are intended to look like LEDs. They can be red for TRUE, green for FALSE, or transparent if a status message for the given generator has not yet been received. The color can be misleading (for example, sometimes red means 'good' and green means 'bad'), but this scheme was chosen to be the same as the Legacy version of the SIGGEN GUI.

The various indications are described individually in Table 4-1. Note that these are all set / cleared on the reception of each status message from the SIGGEN.

Table 4-1: Status & Error Indications

Indication	Description (as per the SIGGEN Specification)
Ext 10 MHz Present	Indicates if the External 10 MHz clock signal is present.
Clock Circuit Fault	Indicates if the clock circuit board is faulty.
RF Circuit Fault	Indicates if the RF circuit board is faulty.
QPSK Selected	Indicates the modulation mode selected is QPSK (otherwise it is BPSK).
1000 Symbols/s	Indicates the symbol rate for an L5 SIGGEN is 1000 symbols/second. This is reserved for possible future use and should always be FALSE.

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Indication	Description (as per the SIGGEN Specification)
SIGGEN Operational	Indicates if the generator is in an operational state.
Ext 1PPS Present	Indicates if the External 1 PPS signal is present.
CMP Tx Inhibit	Indicates that the transmitter has been disabled through the CMP Message Interface. Note that there may also be other reasons why a transmitter is disabled.
IF Switch Disabled	Indicates that the IF switch has been disabled.
CW Mode Only	Indicates that the CW Mode Only Switch (on the rear panel) is activated and that the generator is in CW mode only.
CMP Data Late	Indicates that an error occurred during the CMP symbol download in the previous one second epoch.
Update Incomplete @1PPS	Indicates that a command received during the previous 1-second epoch was incomplete. This will appear if a command shorter than 36 bytes was sent to the SIGGEN and will not be cleared until another command is received (which will then result in a temporary SYNC or CRC error indication).
Status Incomplete @1PPS	Indicates that a status message was not transmitted completely during the previous 1second epoch. This is an internal SIGGEN error.
Parity Error in RX	The SIGGEN UART detected a parity error in one or more command bytes received during the previous 1-second epoch.
Framing Error in Rx	The SIGGEN UART detected a framing error in one or more command bytes received during the previous 1-second epoch.
Overrun Error in Rx	The SIGGEN UART detected an overrun error in one or more command bytes received during the previous 1-second epoch.
SYNC Error in Rx	The SIGGEN did not receive a valid sync byte in a command packet during the previous 1-second epoch.
CRC Error in Rx	The SIGGEN detected an invalid CRC field in a command packet during the previous 1-second epoch.
Field Error in Rx	The SIGGEN detected an invalid field value in the last command received, during the previous 1-second epoch. This shows up (for one second) if a command is sent that is not applicable to the current generator state, for example a CONTROL command when the generator is OPERATIONAL.

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Indication	Description (as per the SIGGEN Specification)
Range Invalid	This indicates that the range fields contained in this status message are invalid and should not be used. However, for test purposes the Range fields as displayed in the GUI will still be updated, using the invalid value(s).

4.1.3 Range Area

The status fields in this area are extracted and/or calculated from the Range fields in the SIGGEN status messages. Because of space restrictions they are tagged with very brief labels. They are described individually in Table 4-2.

Table 4-2: Range Status Fields

Field Label	Description
ms	Time in milliseconds corresponding to the current symbol count from the status message.
Chip	Raw Chip count, directly from the status message.
Sub	Raw Chip sub-phase count, directly from the status message.
m	Pseudorange in meters, calculated from the above.
m/s	Velocity: rate of pseudorange change over the time between status messages.

4.1.4 Raw Messages Area

This shows (in Hex-ASCII format) the most recently sent and received messages to and from the SIGGEN.

The L1Rx and L5Rx fields will be updated with each status message received from the SIGGEN.

The L1Tx and L5Tx fields show the last command sent to the respective generator; these will only be updated when a RESET, INITIALIZE, CONTROL, or RATE/FREQUENCY command is sent (and therefore the fields will be empty at startup).

4.1.5 Error Message Area

This is not highlighted in Figure 4-1 but is immediately below the Raw Messages area. Certain types of errors will result in a display of red text in this area. In some cases, this is cleared automatically; otherwise it can be cleared by pressing the small ‘x’ button to the left. Figure 4-2 shows this area when a COM port open error has occurred.

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L1Tx	
L5Tx	
L1Rx	AA 55 55 AA 01 DF 6D B3 01 42 80 00 00 00 C8 00 23 23 00 00 23 23 00 00 70 01 50 01 04 00 00 00 00 3F 7C
L5Rx	AA 55 55 AA 05 BA 44 02 11 42 80 00 00 00 C8 00 37 23 00 00 37 23 00 00 70 01 50 01 04 00 00 00 00 90 2B
x L1 DLL Init/Connect error: COM port open failure	

Figure 4-2: Error Message Area

4.1.6 COM Port Reversal

If the COM ports are inadvertently set up so that L1 messages from the SIGGEN are arriving on the COM port assigned to L5, and vice-versa, the status messages are not processed and a message appears in the Error Message area (two messages actually occur but the first is immediately overwritten by the second). If this occurs, the simplest solution is to use the COM Port AutoSet feature (see section “Setup COM Ports Dialog” for details).

4.2 Sending SIGGEN Commands

As previously noted, the various SIGGEN commands must be sent in the proper sequence:

RESET (if the generator is not already in a RESET state)

INITIALIZE

CONTROL

RATE/FREQUENCY (can be repeated as desired)

4.2.1 RESET, INITIALIZE, and CONTROL Commands

The three buttons at the top of the Main Window will open dialog windows to configure and send the RESET, INITIALIZE, and CONTROL commands respectively to either or both L1 and L5 generators. The Reset dialog is simple and was described earlier in the section “SIGGEN Startup”. The other dialogs were also previously described, but more details appear in the “Configuration Dialogs Details” section.

4.2.2 RATE/FREQUENCY Command

RATE/FREQUENCY commands can be sent immediately (“on the fly”) by setting the appropriate Rate and Frequency parameters and then pressing the Update Rate/Freq button. This uses the values in the fields above the button to form the command. Offset and ramp values for both code chip rate and carrier frequency can be specified, within the limits shown. Figure 4-3 shows a closeup of this area of the Main Window for one generator.

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Code Chip Rate Offset x1/1540 (Mcps)

0.00
-0.25 to +0.25

0.000000 m/s

Code Chip Rate Ramp 10⁻⁶ (cps/250ms)

0.00
-8.525 to +8.525

70 MHz Carrier Freq Offset (Hz)
☐ Coherent Carrier

0.00
-250000 to +250000

70 MHz Carrier Freq Ramp (Hz/250ms)

0.00
-0.025 to +0.025

Update Rate/Freq

☐ Auto Update
☐ Accumulate Ramps

Figure 4-3: RATE/FREQUENCY Command Configuration

Checking the “Coherent Carrier” box ties the Frequency offset value to the specified Code Chip Rate (offset and ramp value, if nonzero). In this condition, the Frequency offset field will be calculated and is not editable.

If the “Auto Update” box is checked, it has the same effect as pressing the “Update Rate/Freq” button once per second (but timed to be sent immediately after the reception of a generator status message).

Ramp values are applied to the given offset once, or once per second if “Auto Update” is checked, for both Code Chip Rate and Carrier Frequency. As per the SIGGEN Specification, the ramp only applies for the next second and so the original offsets will be restored after this period.

However, when Auto Update is enabled, it enables the “Accumulate Ramps” checkbox. This will cause the GUI to calculate and apply a new offset each second that effectively continues the specified ramp rate until the maximum possible offset is reached. In this condition, the offset values are not editable but the calculated values are shown and updated once per second.

Figure 4-4 shows this situation, with both L1 and L5 set to Accumulate Ramps and with L1 set to Coherent Carrier. Note that the ramp values (but not the offsets) can be edited and, when changed, will be applied to the next Rate/Frequency command. Because L1 is set to Coherent, its Carrier Frequency ramp cannot be edited.

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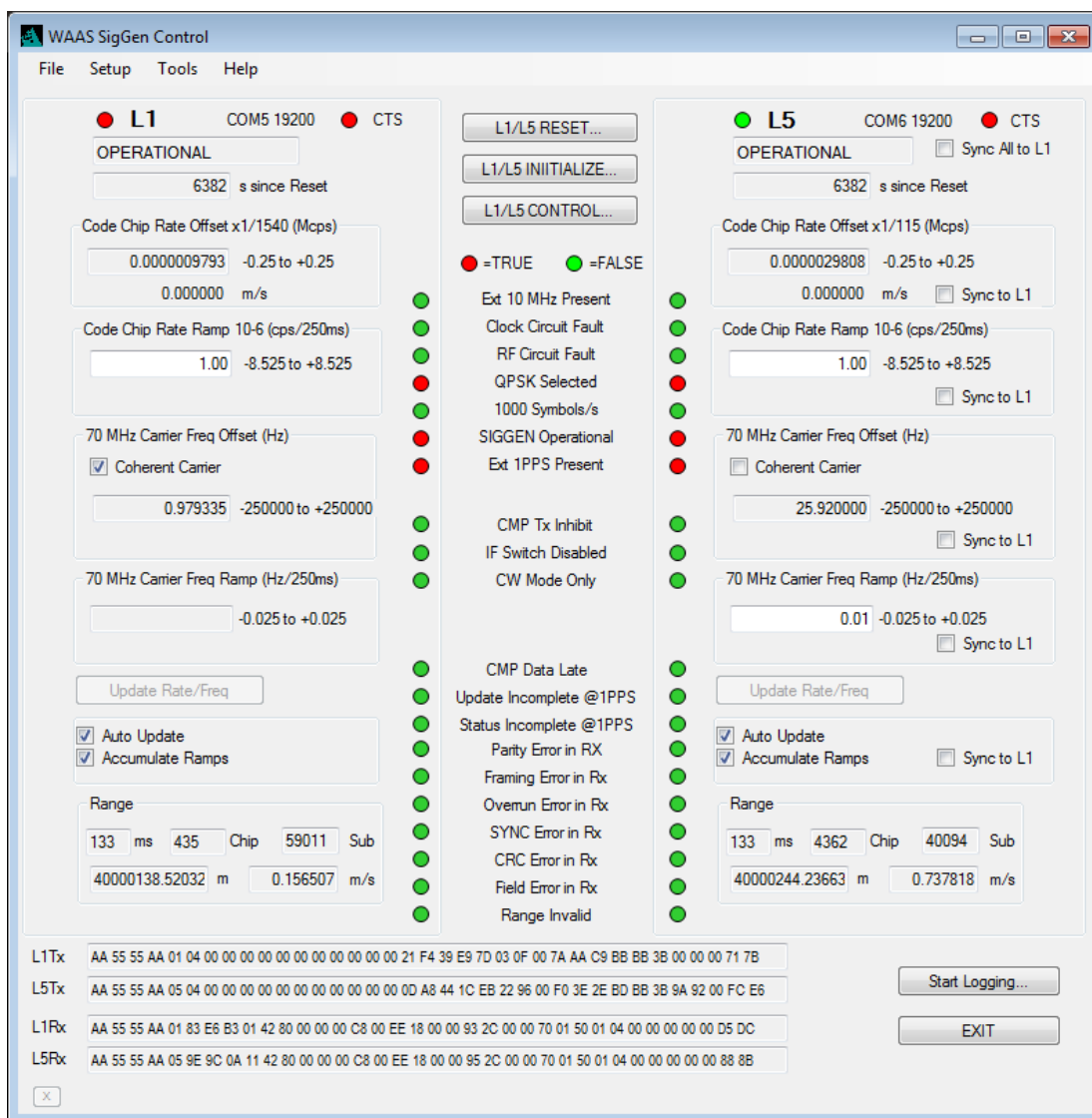


Figure 4-4: Accumulate Ramps Active

4.2.3 Sync L5 to L1

The “Sync to L1” checkboxes, which are present only on the L5 side of the Main Window, provide a means to ‘slave’ the L5 Rate/Frequency entry values to the corresponding L1 values. Code Chip Rate Offset and Ramp, Carrier Frequency Offset and Ramp, Coherent Carrier, and Auto Update/Accumulate Ramps can all be synchronized. The different Chip Rate and Carrier Frequency values are taken into account to calculate the L5 values.

There is also a master Sync checkbox to the right of the L5 State status field. This will check or uncheck all of the Sync checkboxes below it.

4.3 Logging

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4.3.1 Start Logging

To start logging, click the “Start Logging” button on the Main Window. This opens the “Set Logging Directory” dialog shown in Figure 4-5.

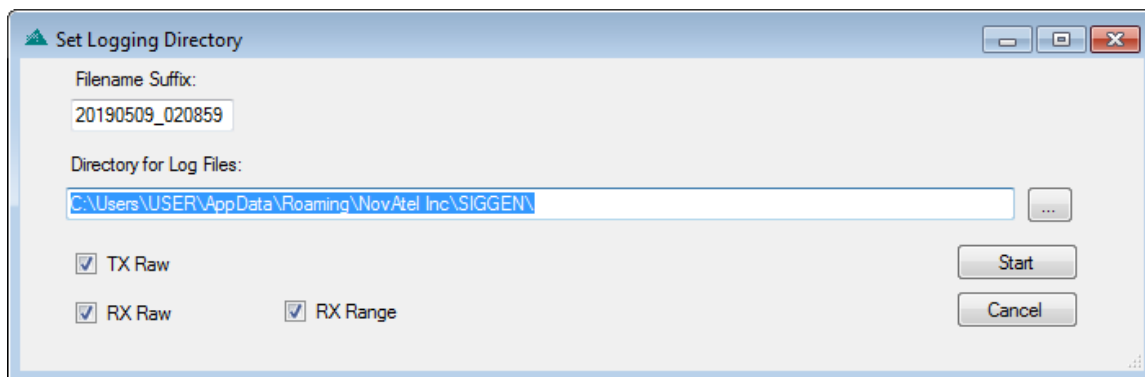


Figure 4-5: Set Logging Directory Dialog

The Filename Suffix is not the file extension, but part of the created files’ names; see details below. It defaults to a date/time string, but can also be specified by typing it in.

A directory can be typed / pasted in, or the (“...”) button can be used to browse to it.

The default directory is set to the User AppData area, under NovAtel Inc\SIGGEN (this directory is created when the software is installed).

Logging of raw TX (to the SIGGEN) and/or RX (from the SIGGEN) messages can be selectively enabled (both TX and RX raw messages are written to the same log file). Range logs (which are derived from the SIGGEN RX messages) can also be enabled or disabled and are written to their own file.

Click the “Start” button to start logging. This closes the window, and the “Start Logging” button on the Main Window changes to “Stop Logging”, which is now used to stop logging.

If none of the checkboxes are selected, Logging will seem to have started but no files are created.

4.3.2 Log Filenames

Logging consists of up to four files; Range logs and Raw logs for each generator (L1 and L5). If Range logs are not enabled, then no Range log files are created. If neither TX nor RX Raw messages are selected, then no Raw log file is created. Assuming Raw or Range have been selected, both L1 and L5 log files are created, even if L1 or L5 has been disabled in the GUI.

Files are given names of the form

<Lx>-RANGE-<suffix>.log

and

<Lx>-RAW-<suffix>.log

where:

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<Lx> is “L1” for the L1 generator and “L5” for the L5 generator, and

<suffix> is specified when logging is started.

Logging files are automatically overwritten without warning. If a new set of logging files are to be collected, the suffix must be changed. It is recommended that some form of date/time be used for the suffix to aid in identification and to avoid overwriting previous logs.

4.3.3 Range Log Format

Range logs are in ASCII comma-delimited (CSV) format. The first line provides the headings for each field:

```
Date,Time,Timeup,ms,Symcnt,Chip,Subchip,m,m/s
```

Each data line has the format:

```
YYYY-MM-DD,HH:MM:SS,<timeup>,<ms>,<symcnt>,<chip>,<sub>,<m>,<m/s>
```

The resulting file can be brought into a spreadsheet and parsed into columns using the “Text to Columns” feature or its equivalent.

The fields are described in Table 4-3.

Table 4-3: RANGE Log Fields

Field	CLI Status Parameter Name	Description
<timeup>	TIMEUP	Time since reset, in seconds
<ms>	RANGEMSEC	Range in milliseconds
<symcnt>	RANGESYM	Symbol Advance (directly from status message)
<chip>	RANGECHIP	Range: Chip
<sub>	RANGESUBCHIP	Range: Subchip
<m>	RANGEM	Range: m
<m/s>	RANGEVEL	Velocity: m/s

For example (spaces have been added for clarity):

```
2018-11-15,12:42:16, 93547, 694, 1245, 20720, 208092460.1230, 50965.6830
2018-11-15,12:42:17, 93548, 694, 2984, 29414, 208143425.7980, 50965.6749
2018-11-15,12:42:18, 93549, 694, 4723, 37839, 208194391.3527, 50965.5546
```

4.3.4 Raw Log Format

A Raw log shows both status messages received from the SIGGEN (“RX”) and commands sent to the SIGGEN (“TX”). Each line denotes RX or TX and has a date and time stamp in addition to the raw data.

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An example line is (note the line is wrapped due to document width restrictions):

```
RX,2019-04-17,14:54:55,AA 55 55 AA 01 C3 6D B3 01 42 80 00 00 00 C8 00 D8 2C 00 00 73 61 00 00 70
01 50 01 04 00 00 00 00 00 C1 A5
```

4.3.5 Capturing an stdout.log File

To aid in debugging certain features, a debug log file can be captured. This is described later in the “Tools / Start & Stop Debug Logging” section. For Windows 7, the full path for the debug log will be similar to

```
C:\Users\<USER>\AppData\Roaming\NovAtel Inc\SIGGEN\stdout.log
```

To capture one of these files, follow this procedure:

1. After the SIGGEN GUI has started up, wait a few seconds, then select Tools / Start Debug Logging.
2. Run the feature or sequence that causes the issue. Make sure that the issue has occurred (i.e. it duplicates the error that was previously observed).
3. Stop debug logging by selecting Tools / Stop Debug Logging.

4.4 Menu Commands

4.4.1 File / Load or Save Configuration (L1 or L5)

These menu items allow loading a set of configuration parameters from a text file, or saving the current set of default parameters to a file. Either option will start by opening a standard “Browse For File” dialog.

Saving a configuration file writes, to the specified file, the current value of all configuration parameters, as shown on the Initialize and Control dialogs and on the Main Window.

Configuration files are in plain text and by default use a .txt extension. Details on these files and a list of their configuration parameters are described in the later section “

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Configuration Parameter Files”.

Loading a configuration file is subject to a validation procedure that checks the syntax of the file and checks each parameter against its acceptable limits. These limits can be seen in the GUI on the Initialize dialog, on the Control dialog, and on the Main Window (for RATE/FREQUENCY parameters).

If an error occurs while loading a configuration file, a window will appear giving details of the error(s). The error listing is also copied to the Windows clipboard so that it can be pasted to a text editor and consulted while correcting the errors in the configuration file.

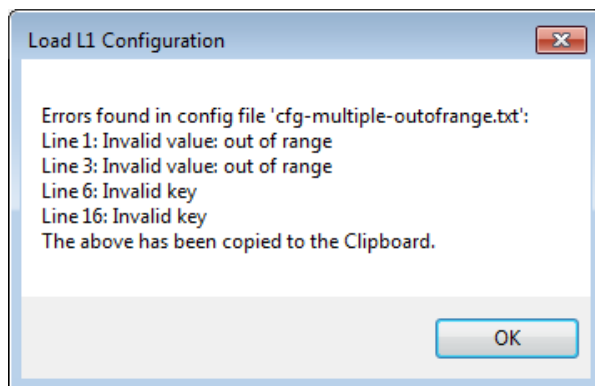


Figure 4-6: Load Configuration Errors

To create a new configuration file, it is easiest to save a configuration file from the GUI, then it can be edited if needed using a standard text editor (MS Word is not recommended due to its use of extended characters).

4.4.2 Setup / COM Ports

This menu item brings up the Setup COM Ports dialog, described in detail in the later section “Setup COM Ports Dialog.”

4.4.3 Tools / SIGGEN Versions

This brings up a window that provides the SIGGEN’s Firmware and FPGA source code versions, as shown in Figure 4-7. The version information is decoded from the raw message received from the SIGGEN; if the SIGGEN is not connected via a communications port, the Version window will display a version of “Not Available.”

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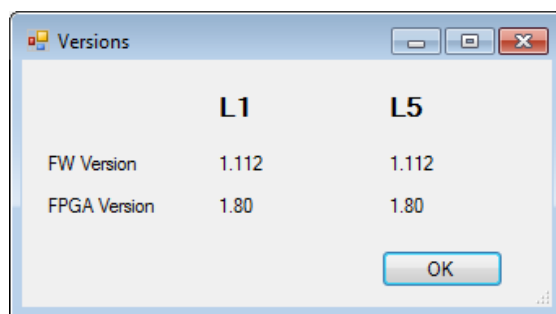


Figure 4-7: SIGGEN Versions Window

4.4.4 Tools / Send Corrupt RESET Message

This is used for certain designer and system tests to send deliberately-corrupted commands. It brings up the dialog shown in Figure 4-8.

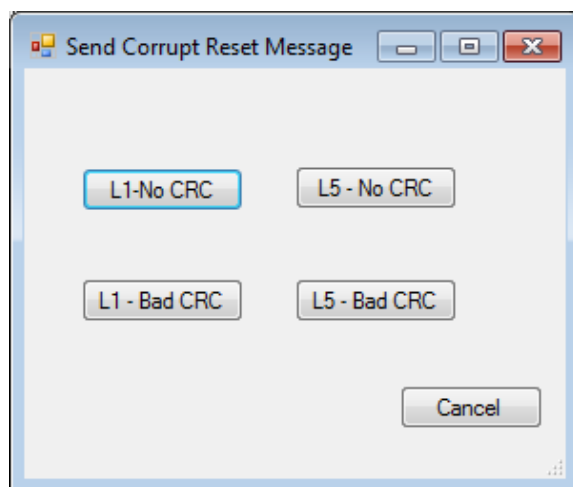


Figure 4-8: Send Corrupt Message Dialog

“No CRC” means that a RESET command is sent without the last 2 bytes, the CRC field. This produces an unusual effect where the generator continues to wait for the CRC, and the “Update Incomplete @1PPS” indication becomes TRUE (red) until another command is sent (which produces other errors).

“Bad CRC” sends a complete RESET message except that the CRC bytes have been altered. This causes a CRC Error indication to temporarily become TRUE.

4.4.5 Tools / GUI Statistics

This brings up a window with certain values that are useful for debugging. It is intended only for designer testing.

4.4.6 Tools / Start & Stop Debug Logging

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This is intended for designer testing only. When the GUI is starting up, it writes debug messages to a file called stdout.log, in the default log file area (see the earlier section Logging). For Windows 7, the full path for the debug log will be similar to

C:\Users\<USER>\AppData\Roaming\NovAtel Inc\SIGGEN\stdout.log

Writing stops when initialization is complete, but can be restarted using the Tools / Start Debug Logging option, and stopped by using the Stop Debug Logging option. Each time Debug Logging is started, the previous stdout.log file is discarded.

4.4.7 Help / About

This displays the window shown in Figure 4-9, which provides information on the GUI software version and that of the underlying DLL.

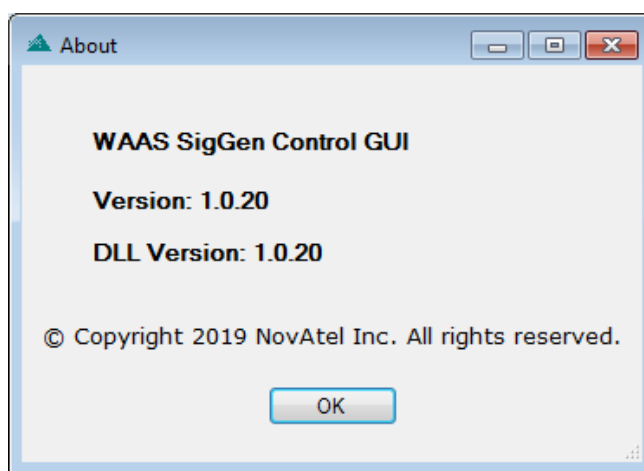


Figure 4-9: Help / About Window

4.5 Exiting the GUI

Press the Exit button, or use the File / Exit menu option, to terminate the GUI. If logging is in progress it will be stopped.

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5 Configuration Dialogs Details

5.1 Setup COM Ports Dialog

This dialog opens automatically when the GUI is run for the first time after installation, or if one or both of the COM ports in the most recent session were left as disabled. It is also available from the Main Window using the Setup/COM Ports menu option. See Figure 5-1.

COM ports are closed when this dialog is opened (and so could be used by other applications), then re-opened when it is closed.

A small “Finding Available COM Ports” window will appear before the Setup COM Ports dialog is shown for the first time. This indicates the software is searching for available COM ports to populate the selections.

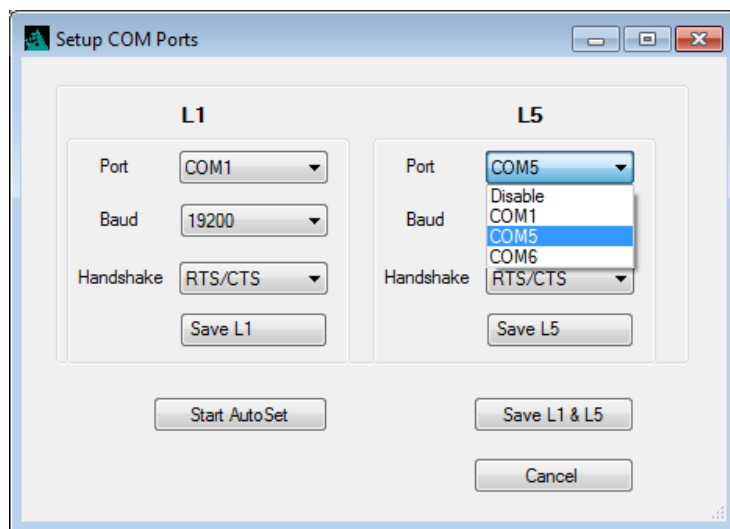


Figure 5-1: Selecting COM Ports

If the PC’s COM ports that connect to the SIGGEN are known, and the SIGGEN’s configured baud rates (by default, 19200) are also known, they can be selected directly (as shown). If only one of the SIGGEN outputs (L1 or L5) will be used, the other COM port can be set to “Disable”.

Alternatively, but only if the SIGGEN has been connected correctly and powered up for some time, the “Start AutoSet” button can be pressed to test all available COM ports for the SIGGEN generators’ L1 and L5 messages. If the messages are found, the Port and Baud will be selected automatically, as shown in Figure 5-2.

Note that messages will not be sent by the SIGGEN until roughly one minute after being powered up (assuming its external connections are correct), so AutoSet will fail if the SIGGEN is still starting up.

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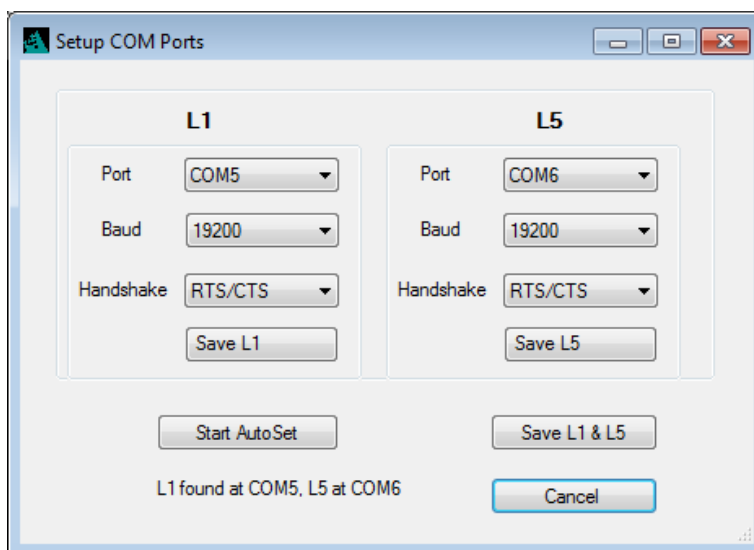


Figure 5-2: COM Ports AutoSet

In either case, the “Save L1 & L5” button can be pressed to continue to the Main Window. The COM settings will be stored and used automatically the next time the GUI is run. COM Port settings for L1 and L5 can also be saved individually, although this is rarely useful.

Pressing the “Cancel” button will abandon any changes made and return to the Main Window, re-opening the COM ports with their previous settings.

Refer to the previous section “SIGGEN Startup” for a description of cases where a COM port cannot be opened, or no messages are received from the SIGGEN.

5.2 Initialize Dialog

This window is brought up from the Main Window when the L1/L5 INITIALIZE button is pressed. It is only useful if the generator is in a RESET state, but can (for test purposes) be used at any time. Figure 5-3 shows the Initialize dialog.

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Initialize Command Settings

L1

Initial Symbol Advance
0 **66** 499
1 ms Epoch **ODD**

Initial Code Chip Advance
0 **435** 1022

Initial Sub-Chip
0 **110** 255

G2 Channel Coders Initialization
PRN-I **120** G2 - I **0x246**
PRN-Q **121** G2 - Q **0x2A1**

RF Center Frequency **1227.6** MHz

Initialize L1 Only

L5

Initial Symbol Advance
0 **66** 499
1 ms Epoch **ODD**

Initialize Code Chip Advance
0 **4354** 10229

Initialize Sub-Chip
0 **69** 255

XB Channel Coders Initialization
PRN **120** XB-I **0x8CB**
XB-Q **0x134B**

RF Center Frequency **1176.45** MHz

Initialize L5 Only

Initialize L1 AND L5

Cancel

Figure 5-3: Initialize Dialog

Slidebars are used to change the “Initial Symbol Advance”, “Initial Code Chip Advance” and “Initial Sub-chip Advance” fields (they cannot be entered directly). The default values for these are chosen for both L1 and L5 to generate a pseudorange of approximately 40 000 km, which can be seen on the Main Window after the generator becomes OPERATIONAL.

Each sliderbar is limited to values acceptable to the generator (note these can be different for L1 and L5). Dragging the slider or clicking on the sliderbar will change the value by a fixed amount (greater than 1). To decrease or increase a value by one, click on the slider then use the left or right arrow keys.

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The PRN selections provide a means to set the Channel Coder initialization values – the Channel Coder values, not the PRN, are used in the INITIALIZE command. When the Initialize dialog appears, the Channel Coder values are shown and the PRN selections are then set from these values.

Note there are two PRN values for L1, but only one for L5. The standards define only a single Channel Coder for each PRN on L1, but define two values (I and Q) for each PRN on L5.

The L1 PRN values must be set differently for I and Q in order for a receiver to be able to decode the channel data.

If the Channel Coder values do not correspond to a valid PRN, the PRN is left blank (unselected). This is possible after loading a configuration file with coder values that do not correspond to any given PRN. It is still possible at this point to select a PRN value using the dropdown control, this will populate the coder values that correspond to the chosen PRN. Using a configuration file is the only way to set arbitrary Channel Coder values with the GUI.

The L1 and L5 generators each have two possible RF center frequencies. These can be chosen using their dropdown controls.

Once the values have been set appropriately, one of the Initialize buttons can be pressed to send commands to the L1 and/or L5 generators. Typically, both would be initialized together, but if only one generator is connected, pressing its Initialization button will avoid having an error appear for the other generator. After the command(s) have been sent, the dialog is closed and focus is returned to the Main Window. The values set in the Initialization dialog (except the PRN) are retained and will be used if the dialog is invoked again. They are not, however, retained when the GUI is exited and then restarted.

If the Cancel button is pressed, any value changes that have been made are discarded and control is returned to the Main Window without sending any commands.

To restore Initialization values to their defaults, exit the GUI and restart it.

If the INITIALIZE command is sent to a generator which is not in a RESET state, the generator will report a Field Error in its next status message. This can be seen on the Main Window. Figure 5-4 shows a Field Error indication for the L1 generator. Note this is automatically cleared after one second, when the next SIGGEN status message arrives.

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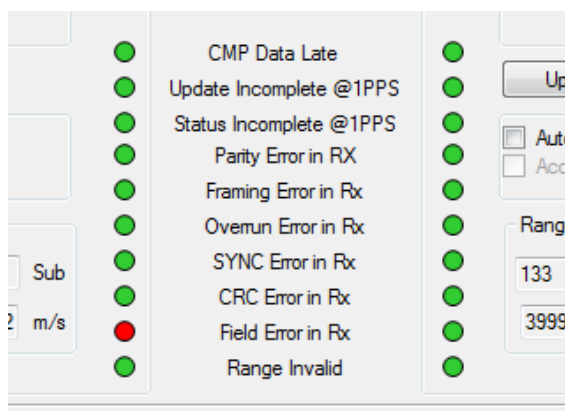


Figure 5-4: Field Error: Invalid Command

If an Initialize button is pressed for a generator which is not connected, an error window will appear as shown in Figure 5-5.

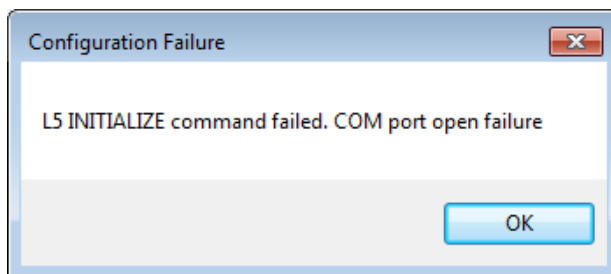


Figure 5-5: Initialize Command Failure Window

5.3 Control Dialog

Figure 5-6 shows this window. It is brought up when the L1/L5 CONTROL button is pressed in the Main Window.



Figure 5-6: Control Dialog

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The desired modulation for each generator is set from the respective generator’s pull-down menu. There are three standard settings, and “Custom.” The standard settings are listed in Table 5-1 and Table 5-2.

Table 5-1: L1 Standard Modulation Settings

500 SPS I Channel only – BPSK	I channel – Data symbols encoded with PRN sequence Q channel – not used
500 SPS I Channel and Q Channel with no data – QPSK	I channel – Data symbols encoded with PRN sequence. Q Channel – 20 symbol NH encoded with PRN sequence.
500 SPS I Channel and 500 SPS Q Channel – QPSK	I channel – Data symbols encoded with PRN sequence. Q Channel – Data symbols encoded with PRN sequence.

Table 5-2: L5 Standard Modulation Settings

500 SPS I Channel only – BPSK	I channel – Data symbols with Manchester coding, and encoded with PRN sequence Q channel – not used
500 SPS I Channel and Q Channel with no data - QPSK	I channel – Data Symbols with Manchester coding, and encoded with PRN sequence. Q Channel – 20 symbol NH encoded with PRN sequence.
500 SPS I Channel and 500 SPS Q Channel - QPSK	I channel – Data symbols with Manchester coding, and encoded with PRN sequence Q Channel – Data symbols with Manchester coding, and encoded with PRN sequence

In addition to the modulation selection, there is a Checkbox for “Init Range at next 1-PPS.” As noted earlier:

NOTE: the “Init Range at next 1-PPS” should always be checked (the unchecked option is only for specialized development testing). If this is set unchecked, the generator will never complete its CALIBRATION state.

The “Custom” setting enables the direct entry of a control command byte – this is typically used only for test purposes. Not all custom settings are valid and using an invalid setting will result in unpredictable behavior. Table 5-3 below provides the bit field definitions for this command byte. If one of the standard modulation settings is chosen, the command byte is shown but cannot be edited.

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Table 5-3: Custom Control Command Byte

L1/L5 Control Command Bit Fields			
Bit	Description	Range	Purpose
D0	Initialize Range	0 - 1	1 = Start coders at next valid Reference 1 PPS pulse
D1	Disable PRN Code (I)	0 - 1	1 = Coder output not used in modulation
D2	Disable Message (I)	0 - 1	1 = Symbol not used in modulation
D3	BPSK/QPSK Modulation Mode Select	0 - 1	0=BPSK 1=QPSK
D4	Disable NH / Manchester (Q)	0 - 1	1 = Disable NH code for dataless operation and Manchester Code for data operation
D5	Disable Manchester (I)	0 - 1	1 = Disable NH code for dataless operation and Manchester Code on Data for L5 (Not used for L1 I Data)
D6	Disable Message (Q)	0 - 1	1 = Symbol not used in modulation
D7	Disable PRN Code (Q)	0 - 1	1 = Coder output not used in modulation

Note that if “Custom” modulation is chosen, the control command byte is affected by the “Init Range” checkbox, and vice-versa.

Like the Initialize dialog, the CONTROL command can be sent to either or both L1 and L5 generators by pressing the appropriate Send button, and the values are retained. Pressing Cancel abandons any changes.

Also similar to the Initialize dialog:

- Sending CONTROL to a generator that is not in an INITIALIZATION state will be rejected by the generator and result in a temporary Field Error indication.
- Default values can only be restored by exiting the GUI and restarting it.
- CONTROL command failures will be indicated by a Command Failure window.

6 Configuration Parameter Files

6.1 File Format

Configuration parameter files are in plain ASCII text format, consisting of parameter key-value pairs, one per line, with a '=' character delimiter. Parameter keys and values consist only of alphanumeric characters. They may consist of all or a subset of the configuration parameters listed in the next section.

When the GUI loads a configuration file:

- Any missing parameters are left unchanged (all are initially given default values when the GUI is run).
- If there are characters other than end-of-line after a value, there must be at least one space character after the value; any following characters are ignored.
- All lines must be limited to 120 characters maximum.
- Lines that consist of anything other than a parameter=value pair are ignored. Any line that appears like a parameter-value pair but has an invalid parameter name is flagged as an error.
- All values are checked against their corresponding limits (in some cases these limits are different for L1 and L5).
- Some values must be expressed in hexadecimal; they can optionally include a '0x' prefix but this is not required. Therefore, a configuration line like this

```
CODERINITI = 48
```

will load a value of decimal 72 (hex 48).

When there are errors in a configuration file to be loaded, the entire file is rejected (none of the configuration values are applied). Errors will be listed in a popup window and also pasted to the Windows clipboard so they can be opened in the same text editor that is used to edit the configuration file.

6.2 Configuration Parameters

Configuration parameters can be logically grouped into Initialization, Control, and Rate parameters, as given below. However, they can appear in a parameter file in any order and there is no need to delimit them into groups.

Note that the COM Port settings are not considered configuration parameters. They are stored within the GUI application itself.

Table 6-1: Initialization Parameters

CLI Name	Full Name	Validity
INITSYMAVANCE	Initial Symbol Advance	0-499
INITSYMPHASE	Symbol Phase	0=ODD/1=EVEN

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INITCHIPADVANCE	Initial Code Chip Advance	L1: 0-1022 L5: 0-10229
INITSUBCHIP	Initial Subchip	0-255
INITRFFREQ	RF Centre Frequency	L1: 0=1227.6 1=1575.42 L5: 0=1176.45 1=1227.6
CODERINITI	I Coders Init G2 [L1] I Coders Init XB(I) [L5]	Must be hexadecimal; can begin with a leading "0x". 0 - 0x3FF 0 - 0x1FFF For test purposes, coder init values do not need to correspond to a given PRN.
CODERINITQ	Q Coders Init G2 [L1] Q Coders Init XB(I) [L5]	Must be hexadecimal; can begin with a leading "0x". 0 - 0x3FF 0 - 0x1FFF

Table 6-2: Control Parameters

CLI Name	Full Name	Validity
CTRLINIRANGE	Init range on next PPS	1=Init range on next PPS 0 = disabled
CTRLMODCODE	Custom Control Command	Must be hexadecimal; can begin with a leading "0x". 0 – 0xFF (bit D0 duplicates the CTRLINIRANGE setting) The standard settings are (note these all also have the Init range on PPS bit set): 0x01: 500 SPS I Channel only - BPSK 0x49: 500 SPS I Channel and Q Channel with no data - QPSK 0x19(L1) or 0x09(L5): 500 SPS I Channel, And 500 SPS Q Channel – QPSK

Table 6-3: Rate Parameters

CLI Name	Full Name	Validity	Notes
CHIPRATEOFFSET	Code Chip Rate Offset	+/-0.25	
CHIPRATERAMP	Code Chip Rate Ramp	+/-8.525	
FREQCOHERENT	Coherent Carrier checkbox	0=FALSE, else TRUE	When enabled, calculates and sets 70 MHz Carrier Frequency Offset from the code chip rate/ramp.
FREQOFFSET	70 MHz Carrier Freq Offset	+/- 25000	Ignored as a configuration parameter if Coherent Carrier.
FREQRAMP	Carrier Freq Ramp	+/- 0.025	Ignored as a configuration parameter if Coherent Carrier.
RATEAUTOUPDATE	Auto Update	0=FALSE, else TRUE	Sends a Rate/Freq Update command every second with the current Rate parameter values.
ACCUMRAMPS	Accumulate Ramps	0=FALSE, else TRUE	Ramp parameters (both code chip and frequency) are constantly being overwritten with the appropriate value to keep the 250ms ramp going every PPS .

6.3 Example File

The L1 configuration file shown below was generated by starting the SIGGEN GUI and immediately using the File / Save Configuration file option.

INITSYMAADVANCE=66

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```
INITSYMPHASE=1
INITCHIPADVANCE=435
INITSUBCHIP=110
INITRFFREQ=0
CODERINITI=0x246
CODERINITQ=0x246
CTRLINITRANGE=1
CTRLMODCODE=0x18
CHIPRATEOFFSET=0.000000
CHIPRATERAMP=0.000000
FREQCOHERENT=0
FREQOFFSET=0.000000
FREQRAMP=0.000000
RATEAUTOUPDATE=0
ACCUMRAMPS=0
```

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