GURU™ v1.0

GEOMATICS ULTIMATE RECEIVER UTILITY

Getting Started Guide

G1-LoTUS™ | **Geomatics USA, LLC** | January 2019

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Definition

G1-LoTUS™ GNSS System is a real-time differential positioning and navigation system utilizing the widely available correction services from Continuously Operating Reference Stations (CORS) across the world to yield cm-level positional accuracy.

Purpose

This guide covers how to configure the **G1-LoTUS™ GNSS System** to precisely survey and stakeout points using GPS

Audience

This guide is intended for G1-LoTUS™ system users. Basic knowledge of GPS, GIS, and surveying and mapping terminology is presumed.

Preamble

To use GURU, you must have the following:

- G1-LoTUS receiver
- A Windows-based personal computer running the GURU software
- A communication link between the receiver and the computer, e.g. AUX cable or Bluetooth

Contents

Chapter 1
GURU - Geomatics Ultimate Receiver Utility

This section describes how to configure the G1-LoTUS receiver using a PC running GURU.

1.1 Three Steps to Configure the G1-LoTUS Receiver

1. - Power the receiver up and start GURU on the PC to sspecify the communication path between the receiver and the PC;

   Note: click the 

button under the "Common Parameters" heading to invoke the serial communication dialog to specify the link settings

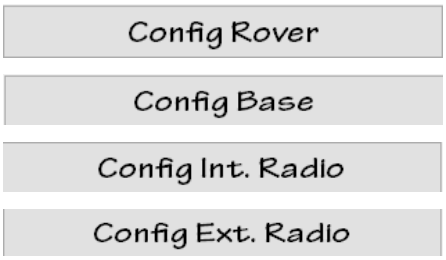
2. - Enable the link between the receiver and the PC by clicking the "Connect"  "Disconnect"  button; then choose the receiver mode to use, e.g. 

   Notes: the "Rover Parameters" become available to change after the "Rover" mode is chosen; the "Common Parameters" are always available in all modes

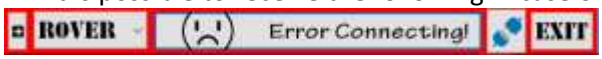
3. - Set the parameters to the required values and then click the configuration button
   You will receive the "Done" and "Happy Face" caption to indicate successful configuration

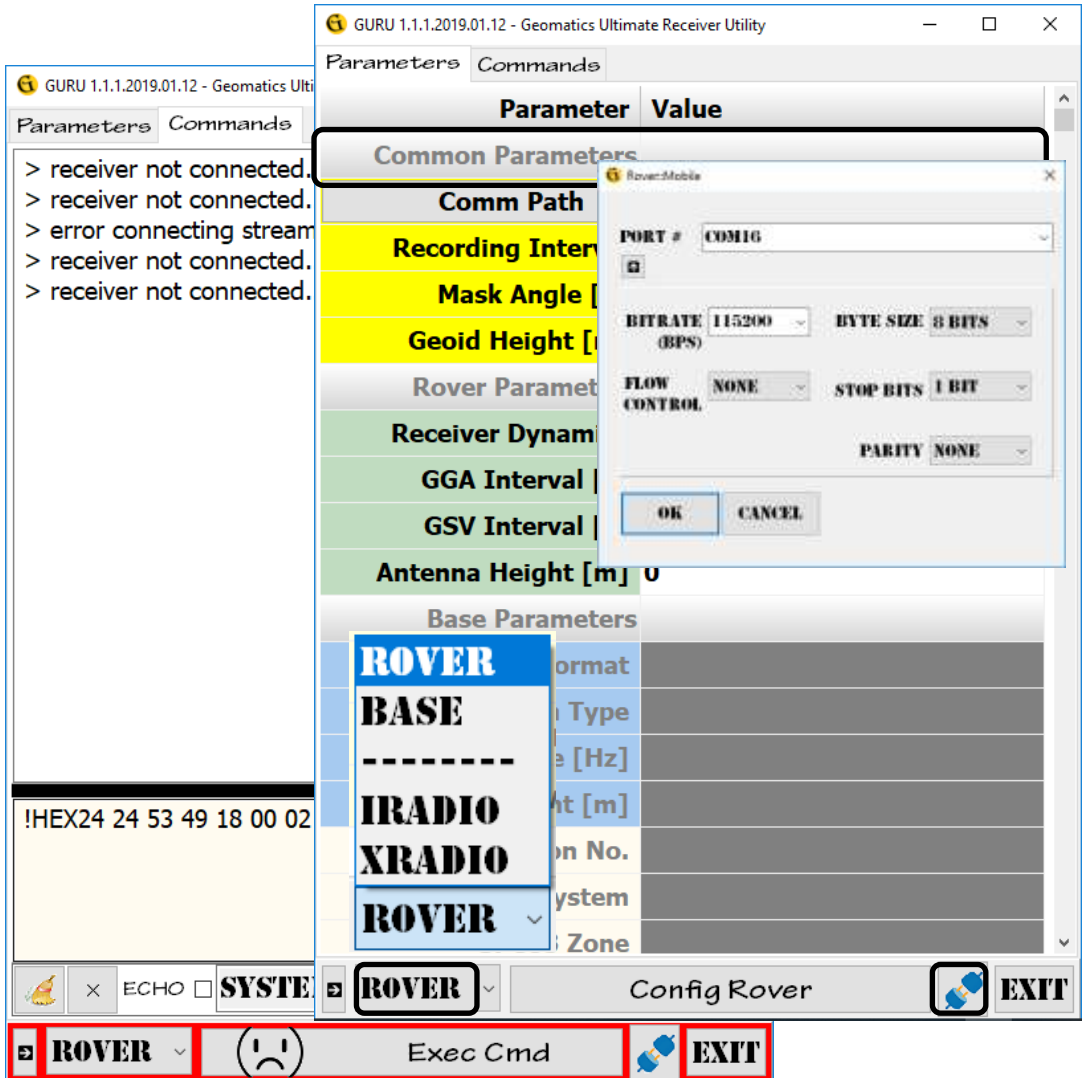
   Note: it is a must that you click the  button to release the communication link between the receiver and the PC before the receiver is disconnected and ready to operate

   Notes:
   - upon changing the receiver mode in the dropdown box, the "Configuration Button" changes its caption to one of the following:



- it is possible to receive the following in case of error; check the error source and retry.

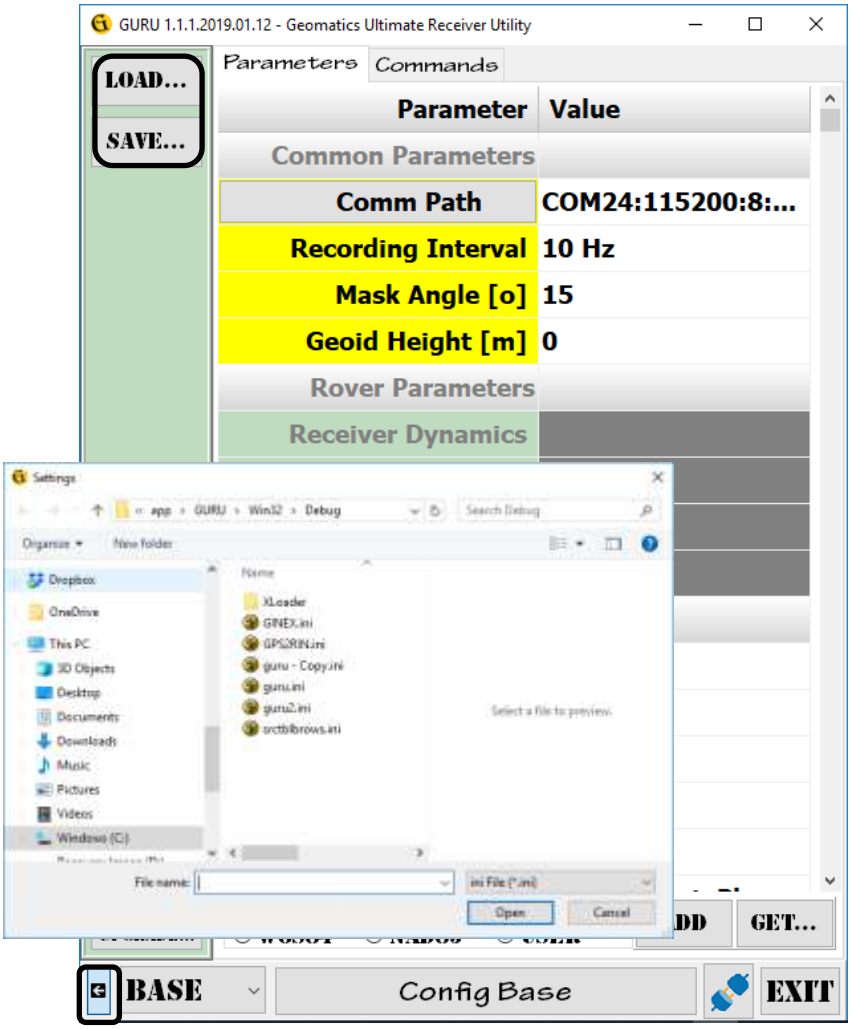




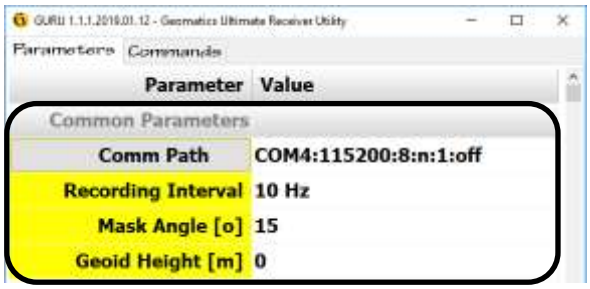
1.2 Saving and Loading the Configuration Parameters

To load or save the configuration parameters for later use, use the "***Load...***" or "***Save...***" buttons. The buttons are accessible in an accessory panel. Press the "->" button at the lower-left corner of the main dialog to show/hide such panel.

Note: The configuration files are text only and can have any name and any extension. The default file extension, however, is "ini". Follow the dialog instructions to complete the load/save tasks.



1.3 Common Parameters Setup



On top of the "Comm Path" used to specify the communication link between the receiver and the PC, three parameters are common to all configurations, they are:

1. **Recording Interval**
   Sets the rate at which the receiver records RAW GPS data to its internal memory for post-mission processing; a zero value indicates no recording.

2. **Mask Angle [o]**
   Sets the value the receiver uses to mask low elevation satellites.

3. **Geoid Height [m]**
   Sets the Geoidal height the receiver broadcasts in the GPGGA message
   Note: most data collection software packages offer calculating this value based on a precise model. It is then recommended to input zero here and configure the data collection software to handle the height conversion between GPS and Orthometric heights

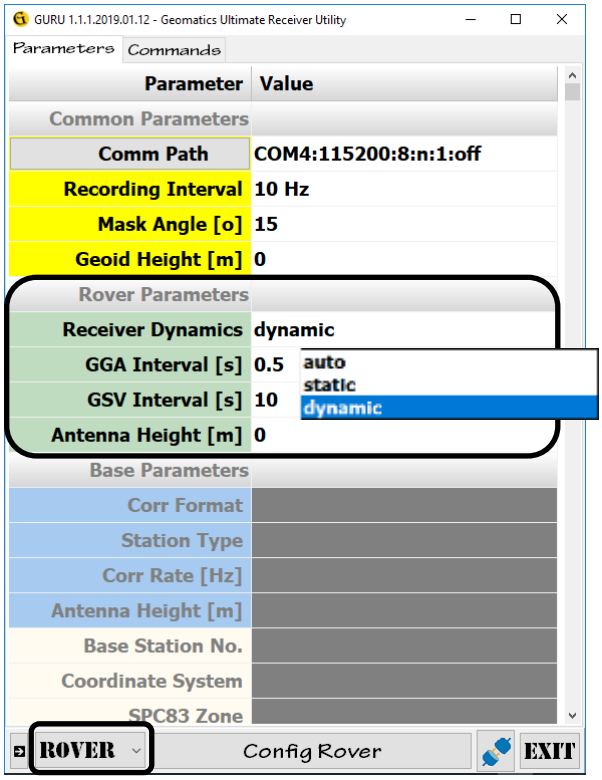
1.4 Rover Parameters Setup

To configure the G1-LoTUS as a real-time or post-processing kinematic rover receiver, set the mode dropdown menu to "**ROVER**"

The ***green*** section of the enabled grid are rover-only parameters.

***Note**: the yellow section is common among all configurations.*

The rover configuration parameters are:



1. **Receiver Dynamics**
   Sets to one of three options:
   "***auto***": to allow the receiver to decide,
   "***static***": for static sessions, e.g. PPK UAV,
   "***dynamic***": for mobile sessions, e.g. RTK surveys

2. **GGA Interval [s]**
   Set the NMEA ***position*** interval in seconds, e.g. 1 for updating once a second of an RTK survey session. Set the "GGA Interval" to zero for PPK UAV sessions only

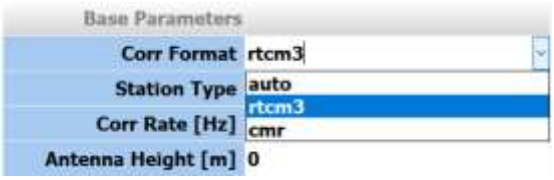
3. **GSV Interval [s]**
   Set the NMEA ***satellite orbit*** interval in seconds, e.g. 10 for updating satellite information every 10 seconds

4. **Antenna Height [m]**
   This value can be set to be transferred to other receivers; it, however, can be set to zero here and be controlled by the data collection software

1.5 Base Parameters Setup

The base parameters section is split in two parts:

a. Base *Receiver* Settings



The ***base receiver*** configuration parameters (blue section) are:

1. **Correction Format**
   Sets to one of three options:
   "***auto***": the receiver generates compact RTCM messages recommended between LoTUS receivers,
   "***rtcm3***": the receiver generates legitimate RTCM V3 messages only recognizable by all receiver brands
   "***cmr***": GPS-only compact measurement records/messages

2. **Station Type**
   Sets to one of two options:
   "***static***" for stationary base stations
   "***dynamic***" for moving base stations, e.g. moving baseline

3. **Correction Rate [Hz]**
   Sets the frequency at which the base receiver generates and broadcasts the correction messages

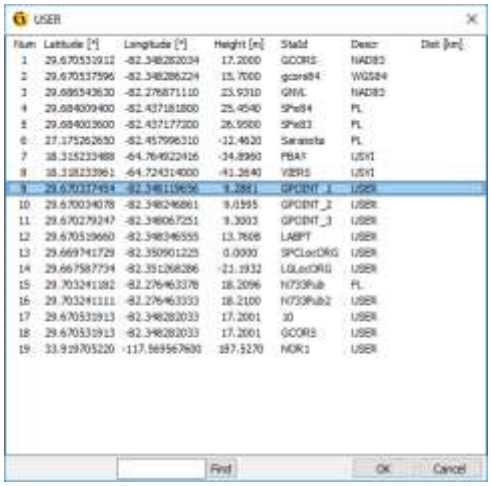
4. **Antenna Height [m]**
   This value can be set here to be broadcast to the rover receiver with the correction messages; it, however, can be set to zero here and be controlled by the data collection software

b. Base *Station* Settings

The ***base station*** configuration parameters (light brown section) are:

1. **Base Station Number**
   Sets the base station ID number; only numeric values allowed

2. **Base Station Coordinates**
   Sets the following:
   Coordinate System
   One of six systems
   USPC83 Map Zone
   UTM Zone
   Height Type: Orthometric/Ellipsoidal
   Geoid Model
   Distance Unit: m/International foot/US foot
   Latitude and Longitude Format
   Values for:
      Northing or Latitude
      Easting or Longitude
      Height



Note: ***The base station coordinates can be stored/retrieved from a predefined database set by the "ADD/GET…" buttons and one of the "WGS84/NAD83/USER" databases.***

1.6 Radio Parameters Setup

The internal radio can be configured like the base or rover using wired or wireless communication link. The external radio, however, has to be wired over the radio DB9 connection. Whether it is 900MHz ISM or 450MHz UHF licensed band, the configuration parameters (dark yellow section) are the exact same.

The 900MHz ISM configuration settings are:

- 900MHz Point to Multi-point **Master**
- 900MHz Point to Multi-point **Slave**

No further configuration parameters are required.

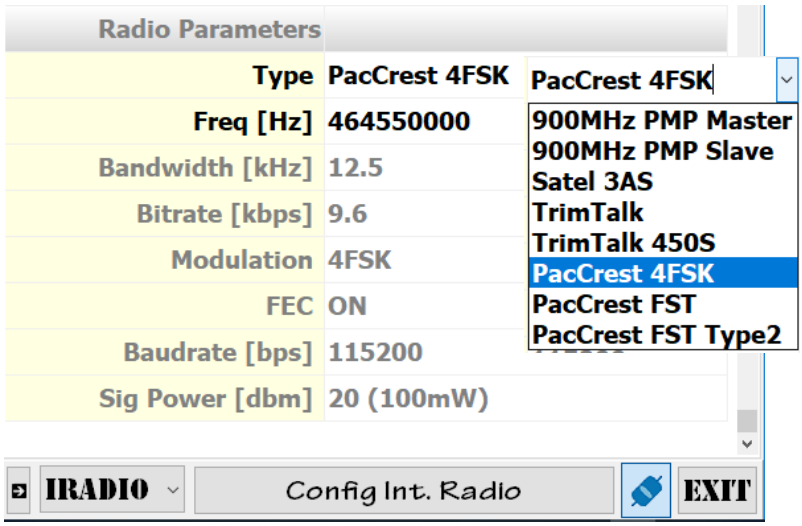
The supported 450MHz UHF protocols are:

- Satel 3AS
- TrimTalk
- TrimTalk 450S
- PacCrest 4FSK
- PacCrest FST
- PacCrest FST Type2

In all of the above protocols, the licensed frequency MUST be entered in The "Freq [Hz]" field. The rest of the parameters are automatically filled in by GURU.

The configuration parameters are as follows:

1. **Type**
2. **Freq [Hz]**
3. **Bandwidth [kHz]**
4. **Bitrate [kbps]**
5. **Modulation**
6. **FEC**
7. **Baudrate [bps]**
8. **Signal Power [dbm]**



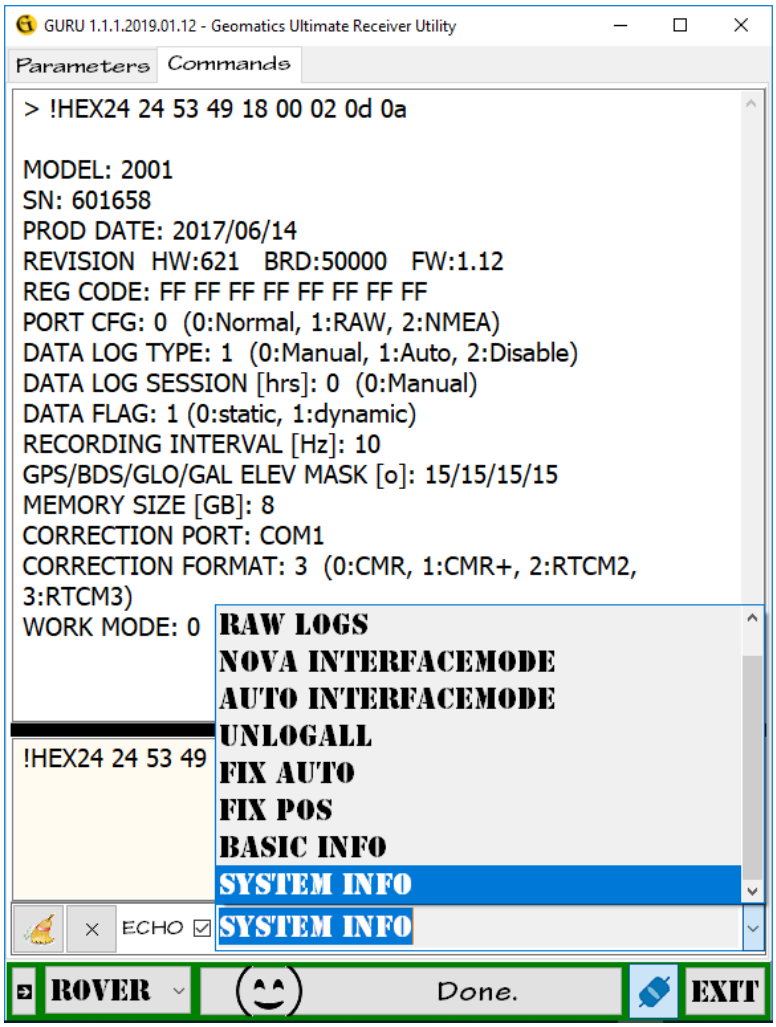
Notes: The Bitrate is the airlink rate between the radio modems; the baudrate is the wired link rate between the receiver/computer and the radio modem. For more configuration options, please contact Geomatics USA or refer to the radio modem manual.

1.7 Advanced Setup

Advanced users may want to use console commands to communicate with the receiver. The "***Commands***" tab serves that purpose.

Users can type in commands in the "light brown" area and then click the "***Exec Command***" button to execute them; the white area is the console.

Note: There are a few "pre-set" commands in a dropdown list including: "Raw Logs", "System Info" ...etc.



Appendix A: Receiver *Mode-Selection Button* Operation

This section describes how to configure the G1-LoTUS receiver in the field by using the Mode Selection Button (MS Button).

1.1 Mode Selection Button

The MS Button  **has two functions:**

a. In Operation

In this case, the operator can do the following:

- Power the internal radio on or off
  Note: The orange LED blinks several times for acknowledgment
- Switch the receiver Bluetooth on or off
  Note: ***The orange LED blinks twice for (ON) and three times for (OFF)***

  It is advisable to switch Bluetooth off when not in use.

b. In Configuration

To enter this mode (*receiver configuration mode*):

- Press and hold the MS Button while powering the receiver on.
- Once the orange LED goes on, release the MS Button; the orange LED blinks several times a second for acknowledgment.
- The receiver is set to configuration mode.

To ***select a mode***, do the following:

1. ***Press and release*** the MS Button as many times as the mode number is, e.g. three presses and releases to select mode number three
2. ***Wait for about 5 seconds*** until the orange LED blinks the same number you entered; e.g. the orange LED will blink three times to annunciate mode number three is entered, indefinitely
3. To ***cancel*** the mode entered, press and hold the MS Button until it goes back to fast blinking (selection mode)
4. To ***accept*** the mode entered, press and release the MS Button quickly; the MCU executes the selected mode and then goes back to fast blinking (selection mode)
5. Repeat steps 1 to 4 to execute another mode

1.2 Configuration Selections

#	Function	Steps	Comments
1	**Save Configuration**	- Set the receiver in configuration mode by holding the MS Button while powering on - Connect the data collector running the GURU software utility to the receiver via Bluetooth - Pass the configuration parameters to the receiver via GURU ***Note: do not power the receiver off before finishing all steps*** - Press the MS Button once to enter mode 1 - After the MCU annunciates the entered mode, press the MS Button to accept the selection and save the GURU entered configuration parameters into the receiver	Use with the GURU utility connected to the receiver over Bluetooth
	reserved		
5	**900MHz Master**	sets internal radio to ISM 900MHz Point-to-Multi-Point (PMP) Master	configure output via GURU
6	**900MHz Slave**	sets internal radio to ISM 900MHz Point-to-Multi-Point (PMP) Slave	
7	**400MHz Satel 3AS**	BitRate=9.6kbps,BW=12.5kHz,FEC Off, 4FSK, Type 1	
8	**400MHz TrimTalk**	Bit Rate=4.8kbps, BW=12.5kHz, 2FSK	
9	**400MHz TrimTalk 450s**	BitRate=8kbps, BW=12.5kHz, 2FSK	
10	**400MHz PacCrest 4FSK**	BitRate=9.6kbps,BW=12.5kHz,FEC On,4FSK	Random unit address between 3 and 200 assigned
11	**400MHz PacCrest FST**	BitRate=9.6kbps,BW=12.5kHz,FEC On,4FSK	
12	**400MHz PacCrest FST Type 2**	BitRate=9.6kbps,BW=12.5kHz,FEC On, 4FSK, Type2	

Note: Recycle power on the receiver to go to normal operation after configuration to start collecting data

Appendix B: GiNEX - GPS to RINEX Conversion Utility

This section describes how to convert raw GPS data files (.cnb) to RINEX files (.obs).

DOWNLOAD RECORDED DATA OFF THE RECEIVER INTERNAL MEMORY

Use the provided download cable to connect the receiver to the computer. The receiver internal memory will show up as a new drive in the File Explorer; it will pop up a new File Explorer window automatically showing the drive content. The receiver arranges the files in folder named after the data collection day.

FILENAME CONVENTION

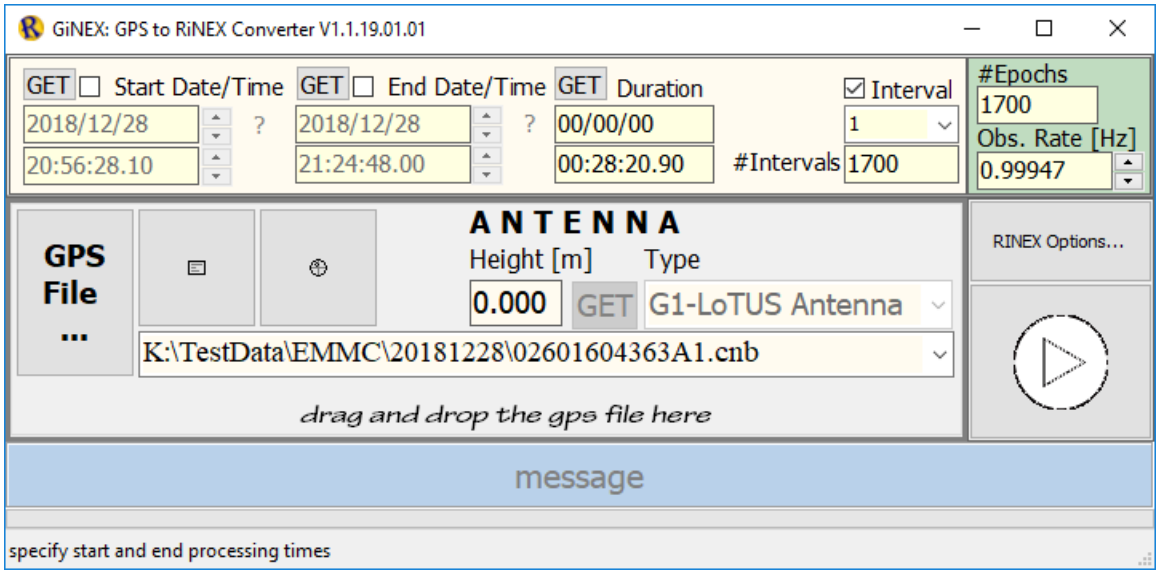
Filenames are assigned automatically on the receiver memory in the form:

sDOYAn.cnb

Where
s: receiver serial number,
DOY: Day of Year, e.g. January 1st is 1
A: an alpha character between A-Z
*n: a numeric digit between 0-9 allowing for 26x10=**260 filenames per day***

WARNING: NEVER process the raw file inside the receiver memory. Always copy or preferably move the raw GPS files from the memory to a folder on the desktop computer.

RAW GPS FILE TO RINEX CONVERSION



To convert a raw GPS file to RINEX format:

- Drag the file from its location and drop it on the GiNEX window or click the "GPS File …" button to specify the filepath. The "GPS File" input field changes to show the dropped file path.
- Click the "Play" button to start the conversion process.
  Note: The blue message window and the bar below it show conversion progress.
- When done, a "new rinex file created" message will show in the message window and the progress bar resets to the zero position.
  Note: The "Duration" box and the green window on the top right corner show observation statistics. A file with the same name as the GPS file will be created with extension "obs"; this is the RINEX observation file sought.

NOTES:

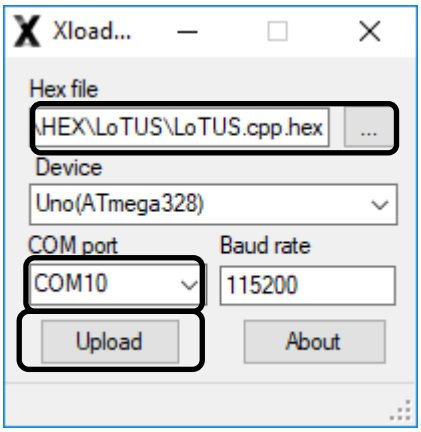
- The buttons with square and round icons above the GPS File path show textual and graphical views of the converted RINEX file
- Antenna height can be entered to be included in the RINEX header
- Use the "RINEX Options…" button to enter RINEX header information
- Start and End times along with data rate can be specified to produce custom RINEX files; make sure the box next to the option is ***checked*** to enable it

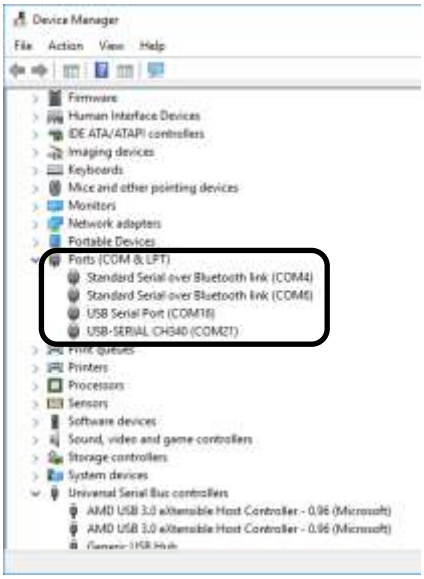
Appendix C: xLoader – Firmware Update Utility

In order to fix hardware issues or to improve performance of the receiver, firmware updates are sometimes necessary.

To upload the new firm to the G1-LoTUS receiver, do the following:

- Connect the receiver to the computer using the provided AUX port cable; make sure to add the DB9-USB programming dongle.
- Note the com port number specified to the programming dongle by the device manager, com10 in the example.
- Locate and specify the NEW "HEX" file provided to you in the "Hex file" field.
  Note: Device and Baud rate should not change.
- Click on the "upload" button and wait a few seconds for the update to finish.





Appendix D: Using Third-party Software to Operate G1-LoTUS

This section describes how to configure and operate the G1-LoTUS receiver with a third-party GPS data collection software. In general, the G1-LoTUS receiver can be configured by GURU and used under any third-party software as a NMEA DGPS receiver.

HOW IT WORKS

The G1-LoTUS receiver gets the DGPS corrections from the data collector and sends corrected positions to it back over Bluetooth. It is the data collector that connects to the differential corrections source, usually over cellular internet network in the form of NTRIP, and conveys them to the receiver over Bluetooth.

1

G1-LoTUS receives RTCM corrections via the internet-connected data collector over Bluetooth. It crunches the corrections and generates corrected receiver positions in the NMEA form over Bluetooth to the connected data collector.

2

Internet connected data collector dials the DGPS correction source using NTRIP over IP and forwards the received RTCM corrections to the G1-LoTUS receiver over Bluetooth. It, later over Bluetooth, receives corrected receiver positions and processes them inside the data collection software.

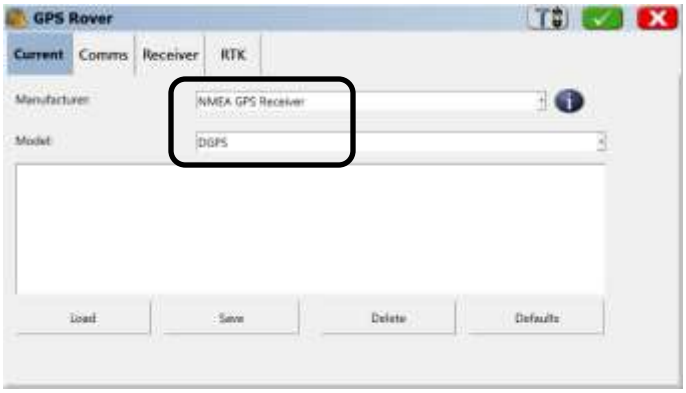
a. Carlson SurvPC

There are two ways to use Carlson SurvPC with the G1-LoTUS: 1) as a NMEA receiver, and 2) as a NovAtel OEM6 receiver.

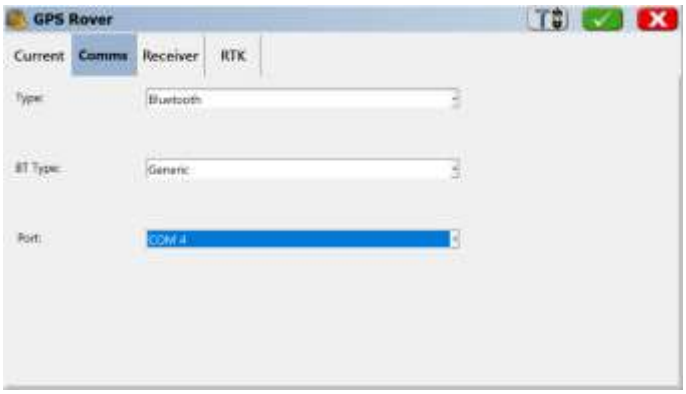
1) As a NMEA Receiver (Recommended)

- Start Carlson SurveyPC and create a new job
- Go to the "Equip" tab and choose GPS Rover

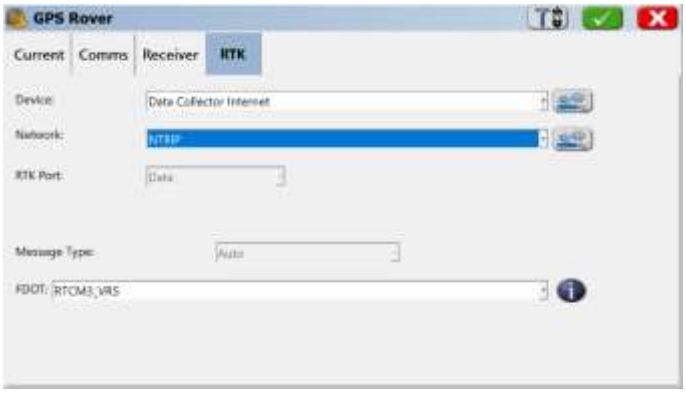
- In the "GPS Rover" dialog, click the "Current" tab and choose "NMEA GPS Receiver" from the Manufacturer menu and the "DGPS" from the Method menu



- Click the "Comms" tab and choose "Bluetooth" for the type, "Generic" for the BT Type, and paired Bluetooth port number under the port menu

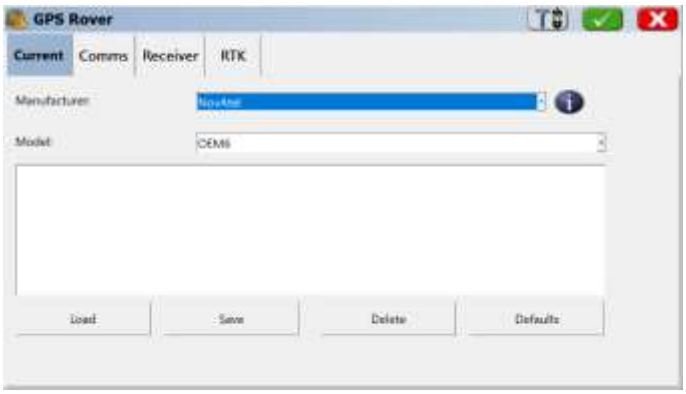


- Click the “Receiver, tab to enter receiver specific parameters, like the antenna height, into the software
- Click the “RTK” tab to specify the IP and NTRIP parameters of the corrections source



2) As a NovAtel Receiver (Not Recommended)

Instead of choosing the NMEA option for the Manufacturer menu, click on “NovAtel”, and choose Model OEM6. Then, follow the normal usage of the Carlson SurvPC software. The software will automatically configures the receiver and communicates the RTCM corrections and the NMEA positions between the data collector and the receiver. GURU would not be needed in this case.



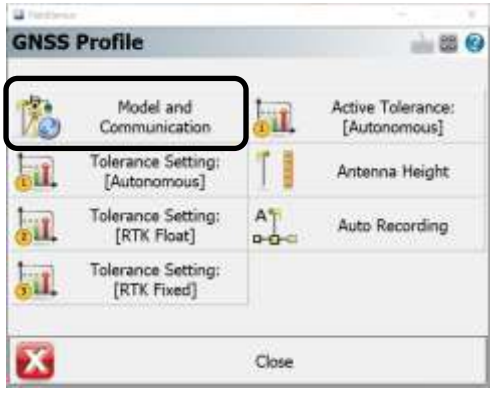
b. Micro-Survey Field-Genius

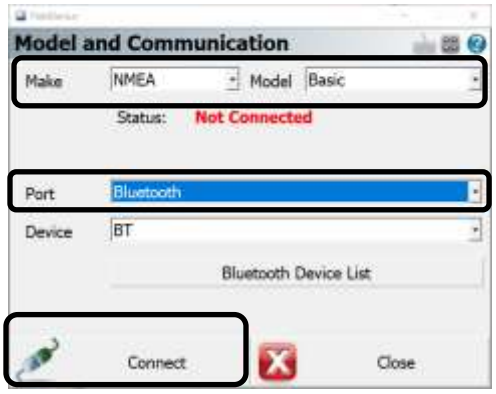
There are two ways to use Micro-Survey Field-Genius with the G1-LoTUS: 1) as a NMEA receiver, and 2) as a NovAtel OEM4 receiver.

1) As a NMEA Receiver (Recommended)

- Start Micro-Survey Field-Genius and create a new project
- Click the "Connect" button and choose GNSS Rover under the "Instrument Selection" dialog

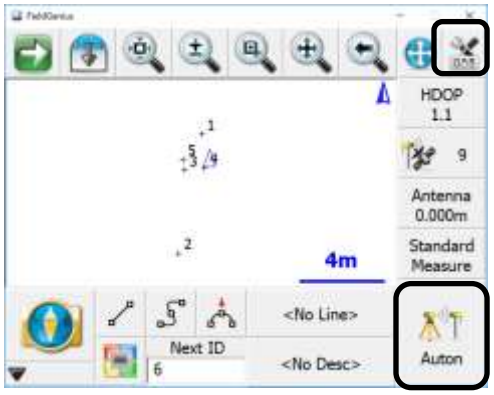
- Click the "Edit" button to specify the GNSS profile
- Click the "Model and Communication" button to Specify the "Make", "Model", and "Port" as "NMEA", "Basic", and "Bluetooth", respectively
- Click the "Connect" button to connect the receiver to the data collector



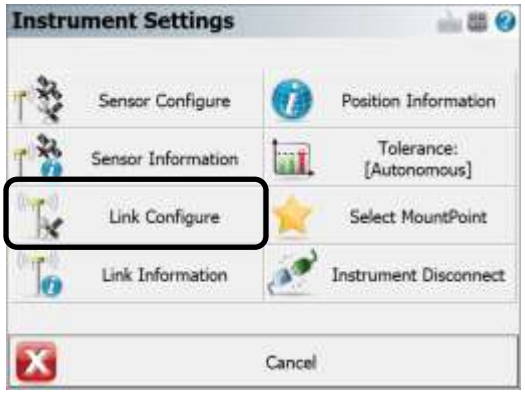


- Unless a data correction service is pre-defined, the receiver will report "Auton" mode. In this case, click the tools button on the top-right corner to specify the correction service parameters

Note: make sure to set the G1-LoTUS receiver in "Rover" rover using GURU for the corrections to reach the receiver.

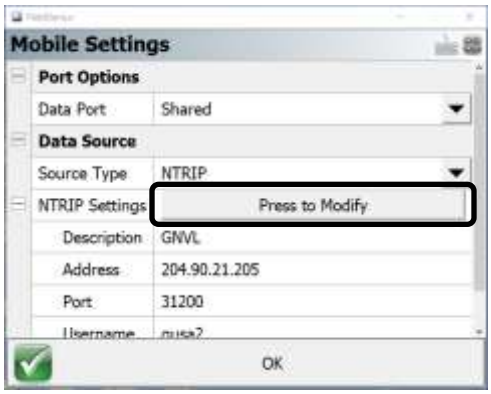


- When the "Instrument Settings" dialog opens, click "Link Configure" button to specify the "Device" parameters
- Use "Data Collector Internet" for the "Device Type"
- Click "Press to Setup" to setup the NTRIP parameters

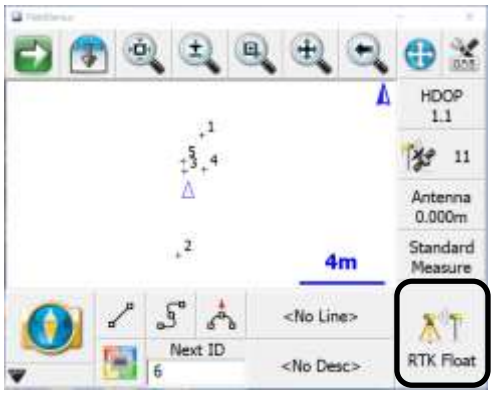


- Leave the "Data Port" on "Shared"
- Use "NTRIP" for the "Source Type", then Click the "Press to Setup" to specify the NTRIP parameters
- Now you are ready to click on the "Connect" button to start receiving GNSS differential corrections from the service provider and go back to the main window

Note: if you're asked to download a "Source Table" from the server, answer "YES". Look at the table and choose the right NTRIP option



- The main window now shows a "RTK Float" solution signalling the receipt of corrections



Note: make sure the solution is "RTK Fixed" before you start collecting and storing survey points

2) As a NovAtel Receiver (Not Recommended)

As in the Carlson SurvPC case, The G1-LoTUS receiver can be treated as a NovAtel OEM4 by the Micro-Survey Field-Genius software, as shown below.