G1-LoTUS™

GNSS NETWORK ROVER SYSTEM
HARDWARE AND SOFTWARE

Getting Started Guide

G1-LoTUS™ | **Geomatics USA, LLC** | June 2017

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Definition

G1-LoTUS™ GNSS NR System is a cm-level real-time differential positioning and navigation system.

Purpose

This guide covers basic field operation of the **G1-LoTUS™ GNSS NR 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.

1. System Components

G1-LoTUS™ GNSS NR is composed of the following main components:

1 A GNSS multi-frequency multi-constellation receiver and built-in antenna as a source of satellite signal for positioning and navigation,

2 A 2-m graduated survey Rod with quick-release bracket, tablet sun-shade hood, compass, and levelling bubble

3 A Windows data collector communicating with the LoTUSTM receiver via Bluetooth and to the correction stream CORS server via cellular connection.

2. System Interface

There are two groups of LED and button indicators: one at the front panel of the GNSS receiver (hardware) and the other one is part of the LoTUS™ GNSS processing software. They both cover all system activities.

2.1 Receiver (Hardware) Interface

Power ON/OFF Button
Soft tactile button: *press to power receiver on; press and hold for 5 seconds to turn it off*

Battery Compartments
Two hot-swappable battery compartments on each side of the receiver; each compartment houses two 3.7V Lipo batteries

External USB Power LED
Yellow LED to indicate external 5V USB power supply attached (overrides battery power)

Satellite LED
Green LED blinks the number of GNSS satellites being tracked from all constellations

GNSS Antenna Housing
6" plastic ray dome housing with a ground plane

Bluetooth LED
Blue LED to indicate receiver and tablet communication over Bluetooth

Battery LEDs
Two red LEDs - one per each compartment, solid red = battery attached and healthy, off=battery not attached, blinking red: battery is unhealthy and must be replaced within 30 min.

Data Recording LED
Orange LED showing data recording activities

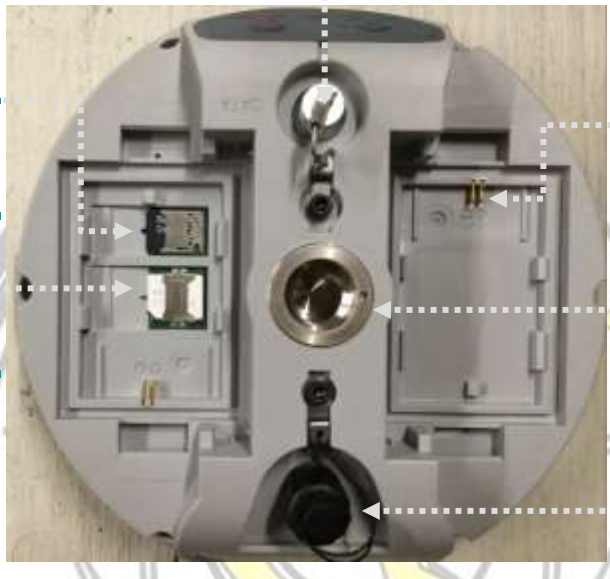
REC Button
Press to start recording raw data to the removable SD card; press and hold for 5 seconds to stop recording

LoTUS™ Front View

AUX Port
7-pin LEMO plug connector for auxiliary operations

uSD Card Holder
Removable data storage

SIM Card Holder
Cellular connectivity (not used in NR)



Battery Contacts
Battery compartment contacts

5/8”-11 Connector
Survey rod connector

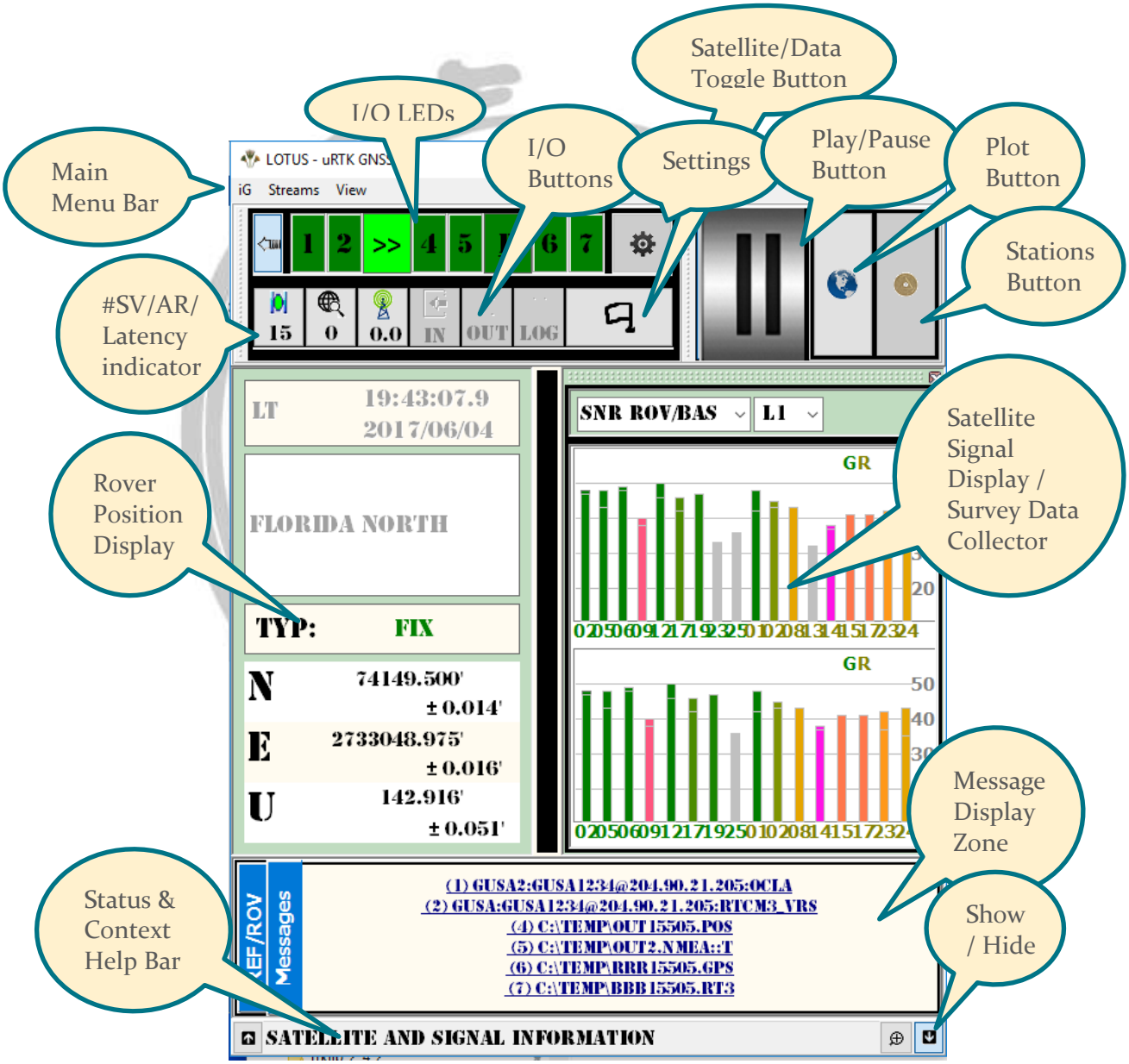
TNC Connector
UHF radio antenna connector for base-rover systems (not used in NR)

LoTUS™ Bottom View

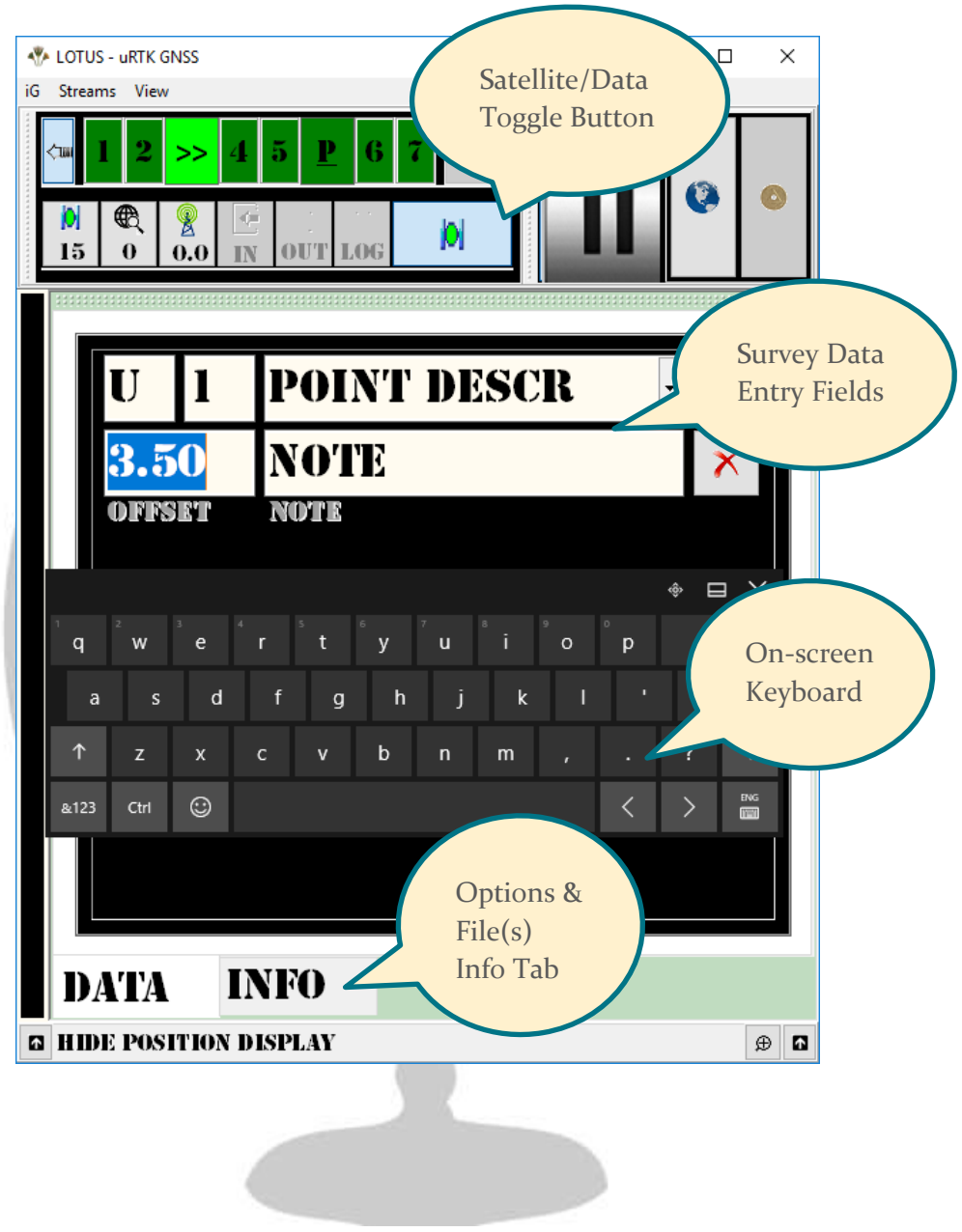
2.2 Software Interface

LoTUS™ is also the name of the processing software running on the data collector. It serves three purposes, namely:

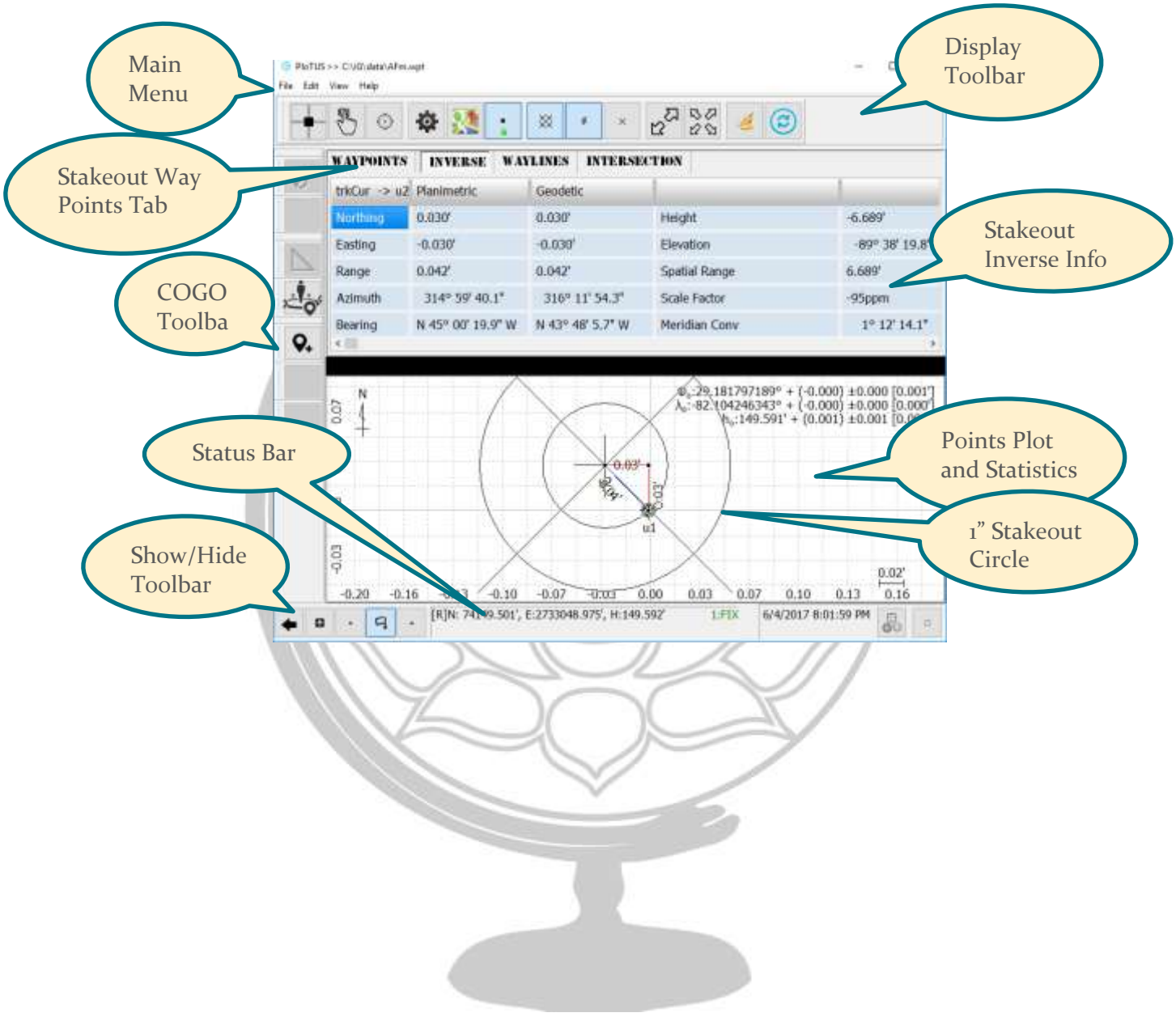
2.2.1 Session configuration and satellite signal display



2.2.2 Field survey data collector



2.2.3 Accuracy verification and stakeout utility



3. Operation

The following is a brief description of how to operate the LoTUS™ GNSS Network Rover system.

Note: *make sure system batteries are charged before heading out to the field*

3.1 Starting and Stopping the System

1. Secure LoTUS™ smart antenna to the survey rod using the 5/8”-11 connector either by screwing it directly in or by using the quick release (QR) connector
   Note: *add 0.100 m to the rod height to compensate for the QR connector, if used*
2. Use the tablet QR bracket to attach the data collector to the survey rod
3. Switch receiver power on by tapping on the receiver power button
4. Switch the data collector power on by pressing and holding its power button for 5 seconds; watch for Windows 10 booting on the data collector
5. Watch the satellite LED on the receiver interface as it tracks and blinks the number of GNSS satellites in view
   Note: *it may take up to 45 seconds to get a full scan of all satellites in view*
6. As the GNSS receiver tracks satellites, the data collector tablet will have booted and the whole system is ready for operation
7. Click the LoTUS™ icon/button on the data collector desktop screen to invoke the software
   Note: *the software may take couple of seconds to initialize and load the most recent satellite almanac*
8. Once the software is operational and the receiver satellite LED blinks enough satellites (more than 5), click the “Play” button on the LoTUS™ software interface
9. You may also press the “REC” button on the LoTUS™ receiver interface to record a backup copy of the rover raw observations on the removable micro SD card
10. Click the satellite/flag toggle switch of the LoTUS™ software interface on the top toolbar to watch for the receiver and satellite display as the software processes received ranges between the receiver and satellites and computes the rover location
    Note: *Soft LEDs 1 and 2 on the LED soft dashboard should be blinking green indicating healthy connection with the rover and the correction source, respectively*
11. You may check for the following:

a. The blue Bluetooth LED on the receiver interface to make sure the connection between the tablet and the receiver is functioning as it should (soft LED1 would turn orange or red)

b. The cellular or WiFi connection on the tablet to the correction source, in case the correction data is not coming through (soft LED2 would turn orange or red)

12. Soft LEDs 4 and 5 indicate saving output1 and output2 to files, while soft LEDs 6 and 7 are to show logging the base and rover raw observations to files
    Note: *Soft filenames are assigned automatically by the LoTUS™ software in the form:* ***aaaDOYxx.ext***
    Where
    aaa: three-letter prefix set by the user,
    DOY: Day of Year,
    xx: two alphanumeric characters between 0-Z allowing for 36x36=1296 files per day
    ext: three letter extension set by the user
13. Trouble shoot any problem before proceeding to the next step to collect or to stake out survey data
14. To stop recording data to the uSD card, press and hold the REC button for 5 seconds
15. To power down the LoTUS™ receiver, press and hold its POWER button for 5 seconds until all LEDs turn off
16. To quit the LOTUS™ software, click the main window "X" menu bar button

3.2 Survey Data Collection

To collect survey data over points, users can use one of two methods:

3.2.1 Direct Occupation

In this case, the operator

- occupies the designated point with the LoTUS™ system
- stay static for a few epochs,
- then click the save button of the survey data collector application

  Note: a screen shows up to enter point description where the operator ends the entry session by hitting the "Return" key to accept changes or escape to cancel the entry

3.2.2 Offset Occupation

This is a method suitable for inaccessible target points. The operator, while not able to directly occupy the designated point, can use auxiliary information (called offsets here) to survey the point. There are several ways to achieve such objective, namely:

- Inline Offset or Side Shot
- Swing Ties
- Line-Line Intersection

Point Stakeout

Staking points out can be achieved inside of PloTUS™, an add-on application to the LoTUS™ software package. Waypoints are of known coordinates beforehand and uploaded to PloTUS™ in the form of a comma separated variables (csv) file with extension "wpt". The software calculates inverse information required to locate the designated point(s) in one or more of the following forms:

- Northing and Easting displacements
- Length and Azimuth
- Offsets from known points: inline, swing ties, or line-line intersection