G1-LoTUS™

Field

GNSS SYSTEM SOFTWARE

Getting Started Guide

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

Definition

G1-LoTUS^{TM} 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 fundamental of the G1-LoTUS Field software running on the data collector to precisely survey and stakeout points using GPS

Audience

This guide is intended for G1-LoTUS^{TM} system users. Basic knowledge of GPS, GIS, and surveying and mapping terminology is presumed.
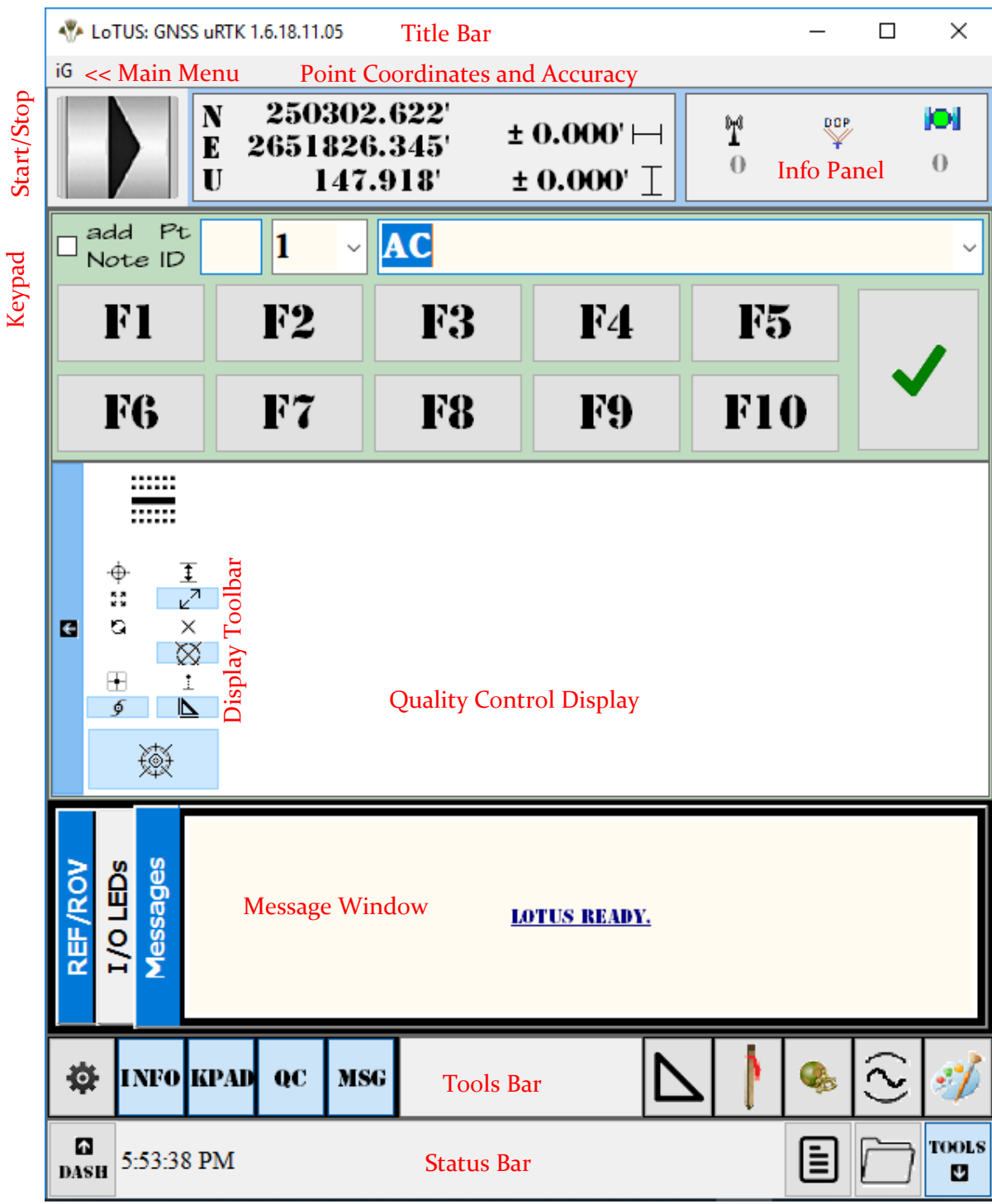
1. Field Software Interface

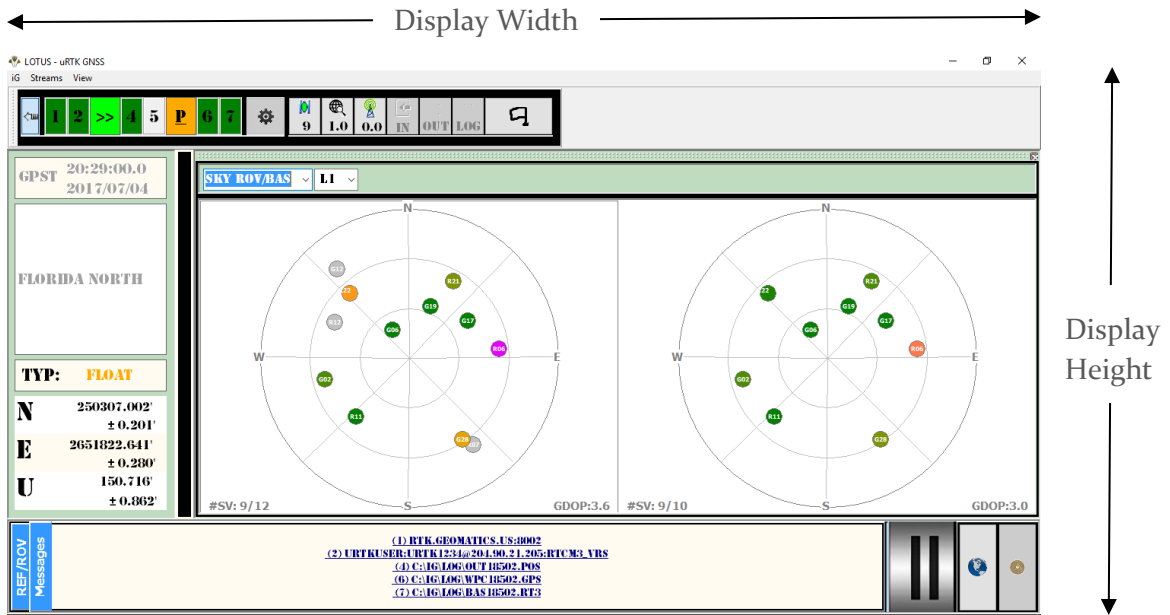LoTUS^{TM} Field is the software running on the data collector. It serves the following purposes:

1. Session configuration
2. Satellite/Position/Message display
3. Survey data collection
4. Point accuracy verification
5. Point stakeout utility

The main zones of the software interface are as shown below:

LoTUS: GNSS uRTK 1.6.18.11.05 — Title Bar

iG << Main Menu — Point Coordinates and Accuracy

Start/Stop

N 250302.622'
E 2651826.345' ± 0.000'
U 147.918' ± 0.000'

DOP
0 — Info Panel — 0

Keypad

add Pt
Note ID — 1 — AC

F1 F2 F3 F4 F5
F6 F7 F8 F9 F10 ✓

Display Toolbar

Quality Control Display

REF/ROV   I/O LEDs   Messages

Message Window — **LOTUS READY.**

INFO KPAD QC MSG — Tools Bar

DASH   5:53:38 PM — Status Bar — TOOLS

LoTUS™ Software Interface

Portrait View (Height > Width)

Display Width

Display Height

LoTUS™ Software Interface

Landscape View (Height < Width)

2.1.1 Session Configuration

This module contains three main functions pertaining to:

1. Processing and output settings (options)
2. Input/output/logging stream information
3. Base and rover station information

Processing and output settings

2.1.2 Satellite/Position/Message Display

I/O LEDs

Play/Pause Button

Stations Button

#SV/AR/ Latency indicator

Rover Position Display

Status & Context Help Bar

Show/Hide Display

Satellite Signal Display / Survey Data Collector

Message Display Zone

Show/Hide Message

Debug

LOTUS - uRTK GNSS

iG   Streams   View

1 2 >> 4 5 P 6 7

15   0   0.0   IN OUT LOG

LT   19:43:07.9
            2017/06/04

FLORIDA NORTH

TYP: FIX

N   74149.500'
          ± 0.014'
E   2733048.975'
          ± 0.016'
U   142.916'
          ± 0.051'

SNR ROV/BAS   L1

GR

GR

(1) GUSA2:GUSA1234@204.90.21.205:0CLA
(2) GUSA:GUSA1234@204.90.21.205:RTCM3_VRS
(4) C:\TEMP\OUT 15505.POS
(5) C:\TEMP\OUT2.NMEA::T
(6) C:\TEMP\RRR 15505.GPS
(7) C:\TEMP\BBB 15505.RT3

SATELLITE AND SIGNAL INFORMATION
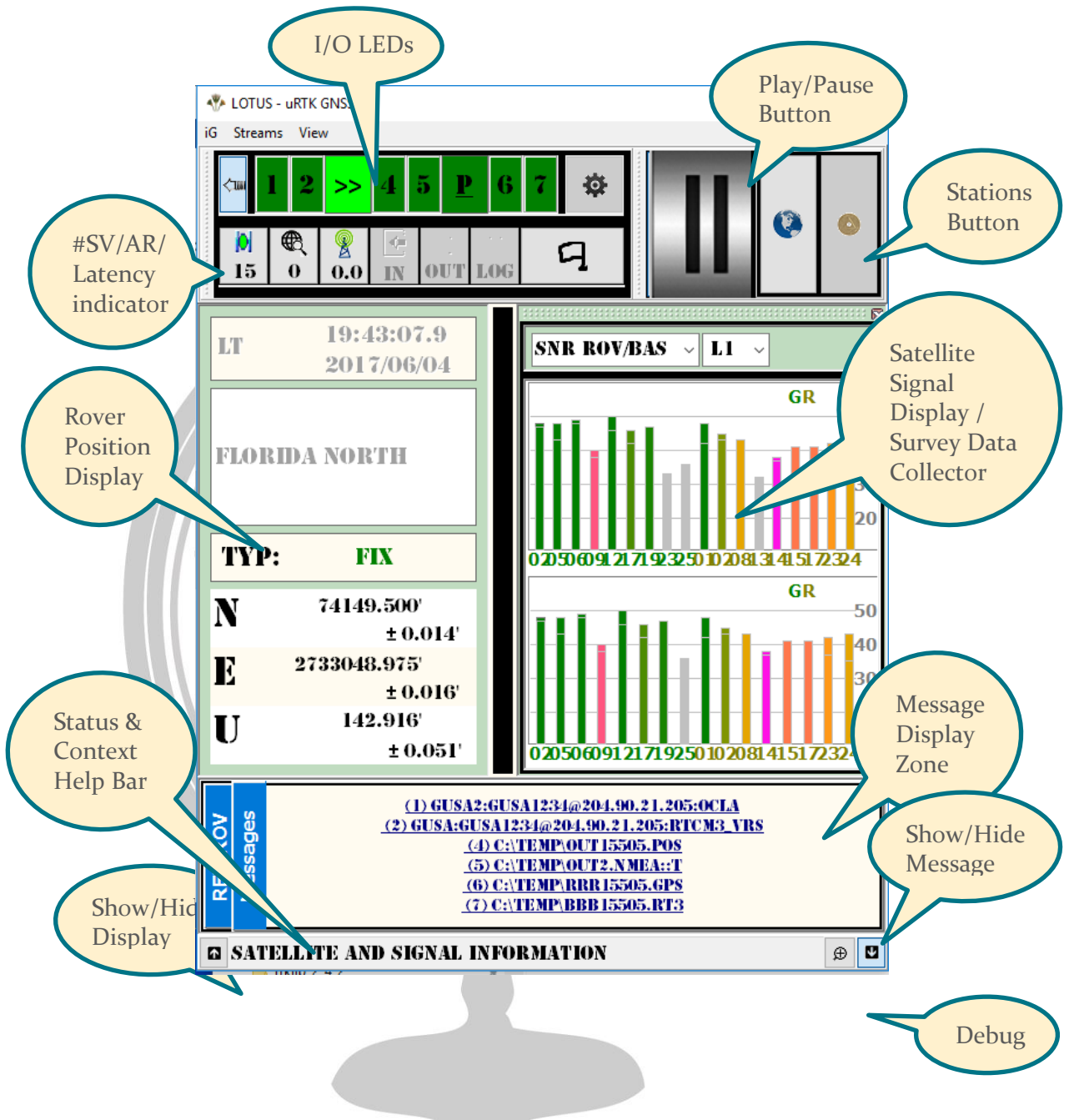
2.1.3 Field Survey Data Collector
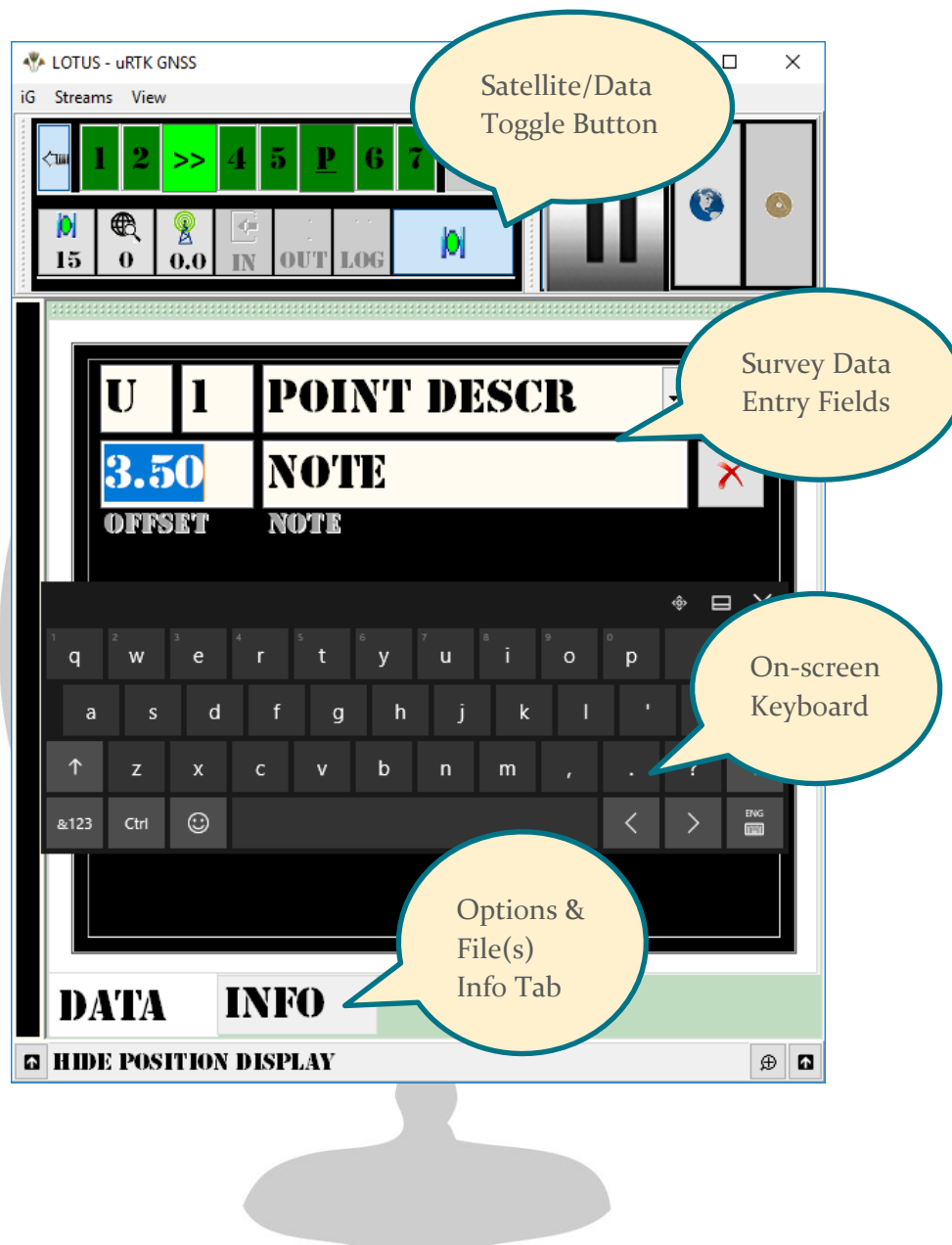
2.1.4 Accuracy verification and stakeout utility
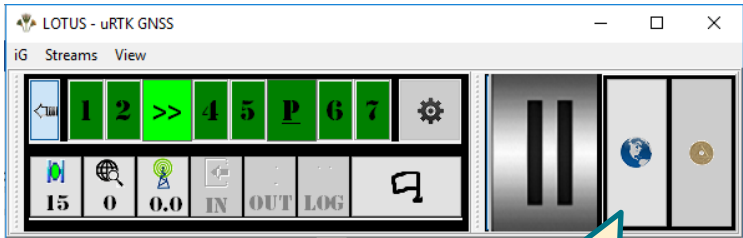
Plot Button

Display Toolbar

Main Menu

Stakeout Way Points Tab

Stakeout Inverse Info

COGO Toolba

Points Plot and Statistics

Status Bar

1" Stakeout Circle

Show/Hide Toolbar

1. 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

+0.1 m

Rod connected without QR   Rod connected with QR

Note: *if used, the QR attachment adds 0.100 m to the overall rod height*

2. Use the tablet QR bracket to attach the data collector to the survey rod

Portrait View   Landscape View

Note: *the tablet bracket rotates clockwise about an axis normal to the tablet plane to render a landscape view; counter clockwise rotation will render portrait view back*

3. Switch receiver power on by tapping on the receiver power button

Receiver Interface

Receiver Power Button
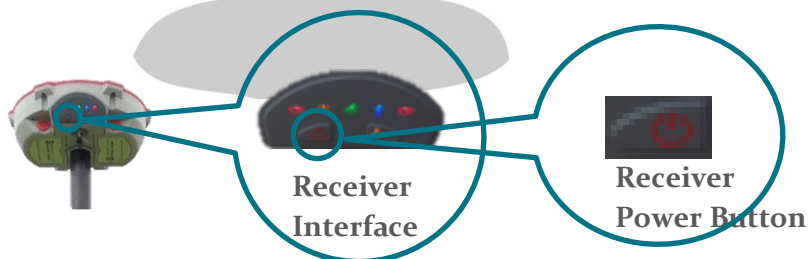
4. Switch the data collector tablet power on by ***pressing and holding*** its power button for 5 seconds; watch for Windows 10 booting on the data collector

Tablet Power Button

5. Watch the satellite LED on the ***receiver interface*** as it tracks and blinks the number of GNSS satellites in view

Satellite Tracking LED

Note: *it may take up to 45 seconds to get a full scan of all GNSS 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

Lotus desktop

7. Click the LoTUS™ icon/button on the data collector desktop screen to invoke the software

Lotus Software Booting

Note: *the software may take a few 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
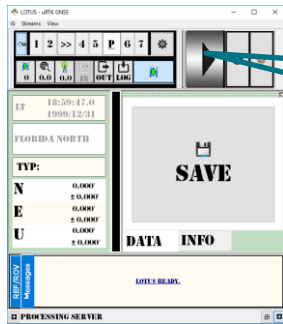
SW Play/Pause Button (Portrait View)
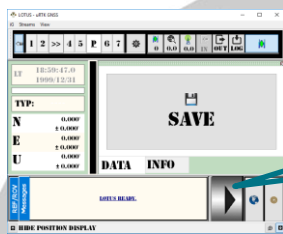
SW Play/Pause Button (Landscape View)

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

REC Button
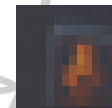
10. Click the satellite/flag toggle switch of the LoTUS™ software interface on the top toolbar; this will allow to watch for the receiver and satellite display as the software processes received ranges between the receiver and satellites and computes the rover location

Rover and Base Stream LEDs

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^TM 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^TM receiver, press and hold its POWER button for 5 seconds until all LEDs turn off

16. To quit the LOTUS^TM 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^{TM} 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

Windows 10 Basics

Taskbar and Action Center

Tablet Touch Screen Gestures

Gesture	Mouse Equivalent	Meaning	Remark
Click	left click	select	
Dbl Click	left double click	execute	
Press-hold	right click	speed menu	
Press-move	left click + move	pan	
Press-hold-move	wheel movement	zoom in / zoom out	

Cellular Connection

LoTUSTM receivers CORS correction data over the internet through NTRIP protocol. LoTUSTM data collector has a cellular modem and SIM card to connect to the internet anywhere cellular coverage is available. To ensure cellular connectivity, do the following:

1. Disconnect any means of internet connectivity on the tablet such as WiFi or Mobile Hotspots

    Note: *you can disconnect WiFi from the connection itself or switch the WiFi modem off by clicking the WiFi button (concentric radiating quarter circles symbol) in the action center until it is disconnected.*

2. The cellular modem is setup to connect automatically when the WiFi connection is not available; in such case, the cellular modem will show the internet connection

    Note: *in case the cellular modem shows no internet connection, check the following: 1) the modem itself is turned on, 2) the SIM has valid subscription with cellular Internet service provider, such as T-Mobile, Verizon, etc.*

    Note: *In case you ran out of data on the SIM card, you can purchase a data plan on the go for a day, a week, or a month by following the on-screen instructions provided by the cellular internet service provider*

CORS Connection

LoTUSTM receives CORS corrections through the NTRIP protocol. To change CORS communication parameters, do the following:

1. Invoke the NTRIP Client Options as shown below
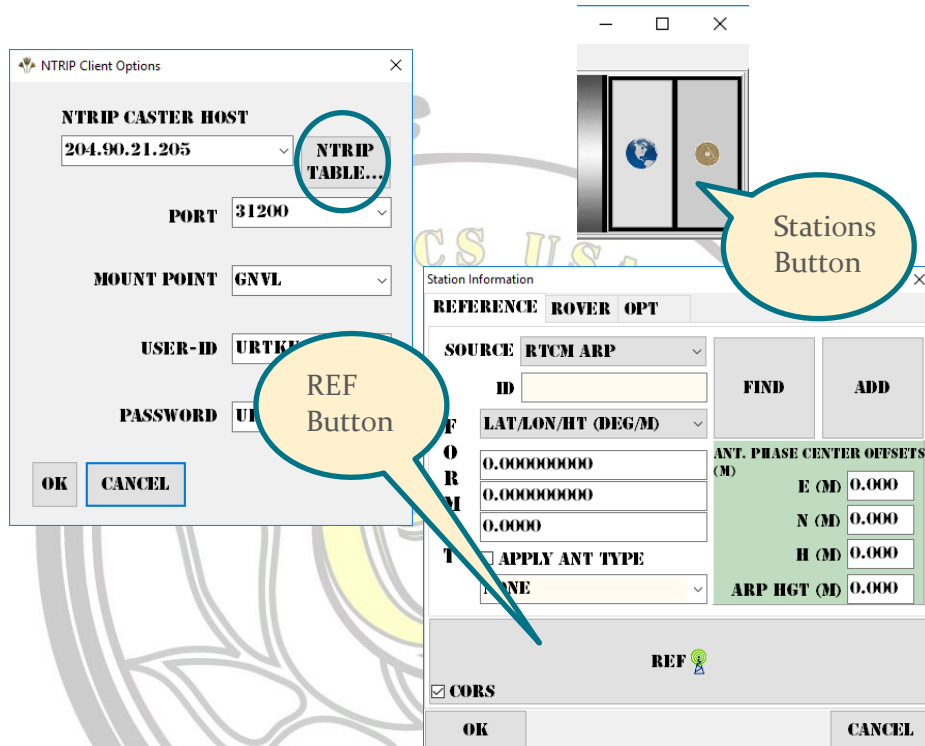
2. Enter the NTRIP Caster Host IP or its alias, the port number and the mount point. Some casters require user authentication such as user-ID and password.

Note: *users have to consult their NRTK correction service provider for the above information. For a list of free worldwide casters, click on the NTRIP TABLE... button to browse through the information.*

.shp and .jpg Georeferencing Information

PloTUS™ imports *georeferenced* jpg ortho-rectified images (map-like) and Esri shape files in

Geographical Latitude and Longitude

Decimal degree format

Before importing a shape file or a jpg image file into PloTUS™, make sure they are georeferenced to an appropriate datum using the format above.

.shp Georeferencing Information

Shape file entities are stored with their coordinates in vector format without specific order. Hence, every vector is assigned its coordinates and no extra information is required to import the whole shape file. Though, the entity coordinates have to be defined according to the format specified above (geographical lat/lon DecDeg) for PloTUS™ to import it properly.

.jpg Georeferencing Information

Unlike shape files, jpg files are raster images arranged in rows and columns of predefined scales. Knowing coordinates of the image center pixel and the image pixel size allows PloTUS™ to calculate the coordinates of every image pixel. The two assumptions implied here are:

- Image rows/columns are aligned with the map E/N directions
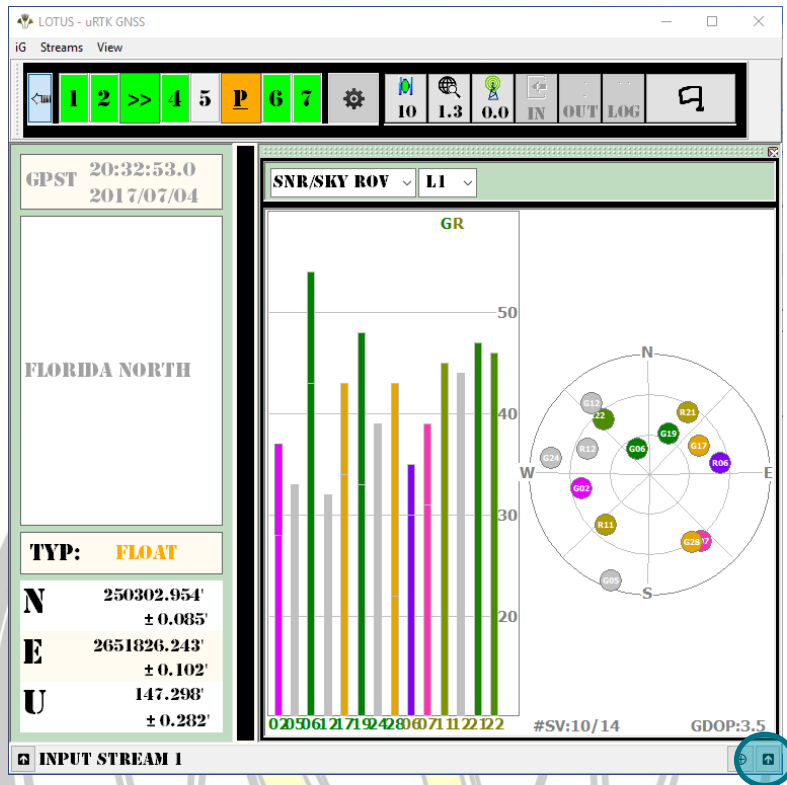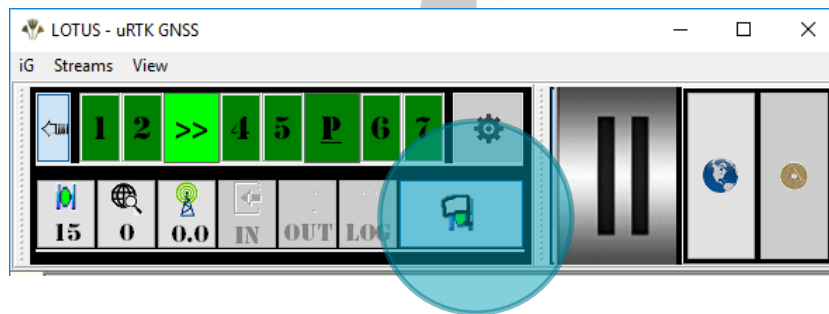- Image is ortho-rectified (map-like projected) and is distortion free
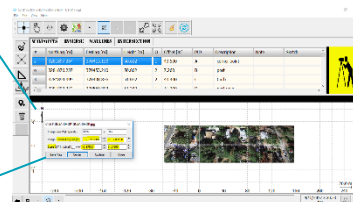
Appendix: LoTUS™ Software Interface - Show/Hide Views

Expanded Display View

Dashboard View

Satellite Display / Data Entry Toggle Button

Data Entry / Expanded Data Entry Views

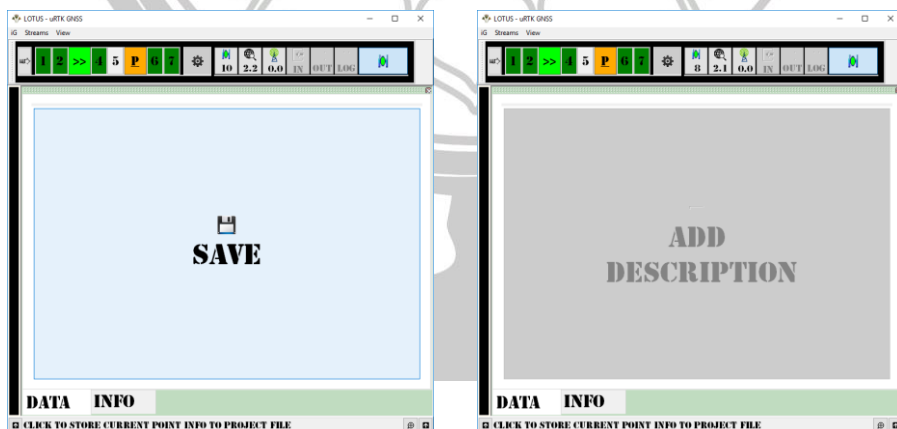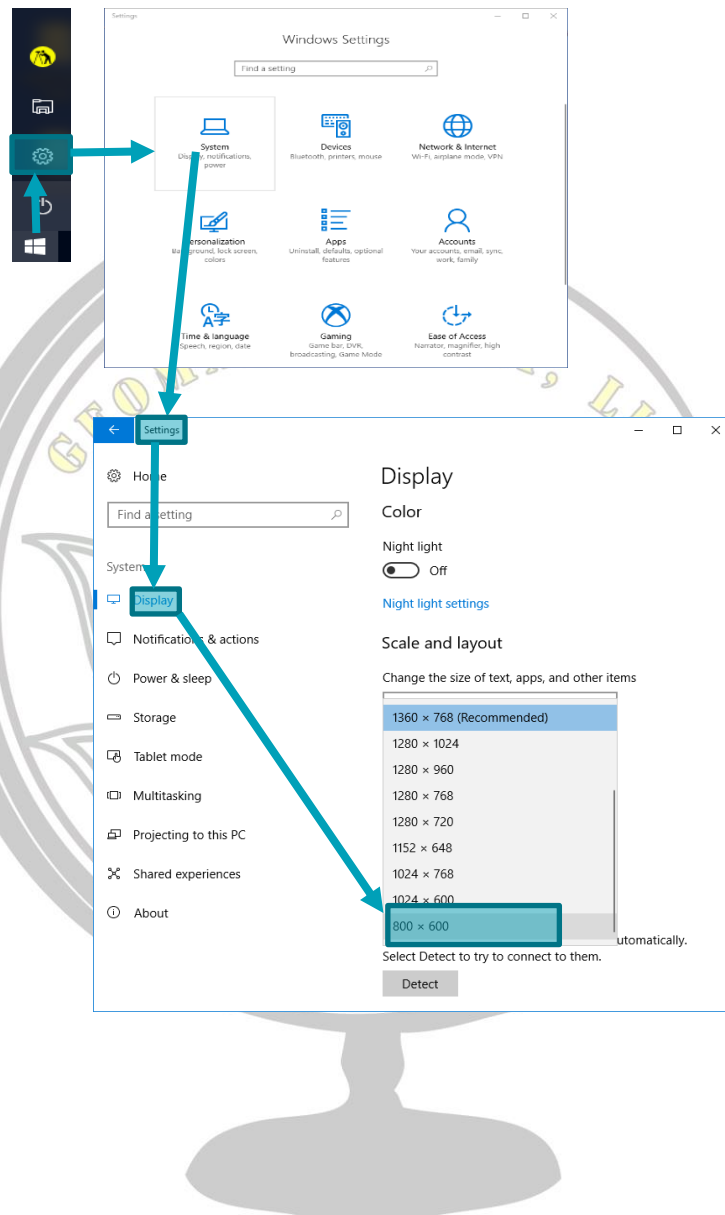## Expanded Info View

## Save / Add Description Expanded Views

Appendix: Screen Resolution

LoTUS^{TM} software works best under Windows 10 at screen resolution **800x600**. Users can change the screen resolution as shown below:

Appendix: Interface LED Colour Codes

LED Colour	Meaning	Remark
Solid Green	Port communication established – receiver connected to stream	
Blinking Green	Port open - data being transferred from receiver to data collector	
Solid Blue	Bluetooth communication established	
Solid Orange	WARNING: port negotiation failed; retry in progress	
Solid Red	ERROR: port communication could not be established	
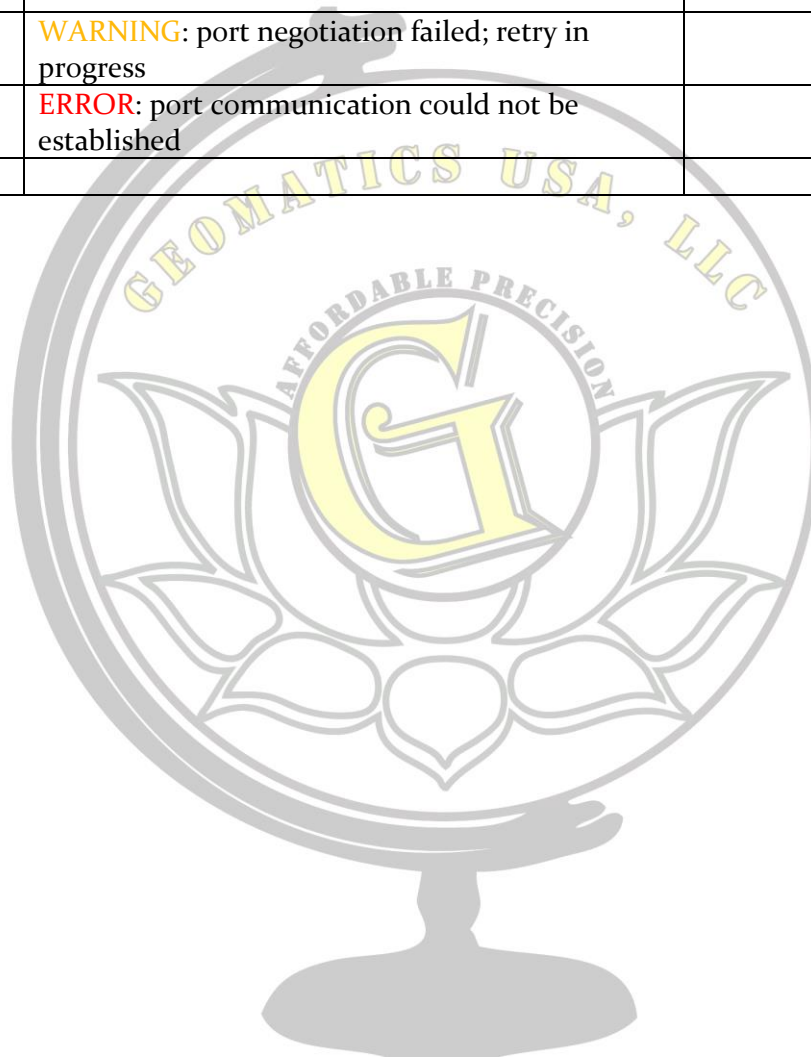
Appendix: Position "P" Colour Codes

Colour	Solution	Processed Ranges	Type	QF	Accuracy		Remark
					Hz	VL	
Green	Fixed	integer carrier	RTK	1	sub-inch	two-inches	
Orange	Float	non-integer carrier	PPK	2	sub-foot	sub-foot	
Blue	Differential	pseudo-code (no carrier)	DGPS	3	sub-meter	sub-meter	
Red	Single Point Position	pseudo-code - no range corrections	SPP	5	3m-10m	10m-30m	