Trimble GNSS quick-start manual

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1 Introduction

This is a quick-start manual for the Trimble differential GNSS and post-processing which is written for the application of measuring stake positions on an glacier. (GNSS stands for Global Navigation Satellite System) For this purpose the *Fast Static* survey method with post-processing is the best. The post-processing data from a base-station is needed, which in our case comes from the norwegian mapping authority *Statkart* which operates one at Platåberget. The system consist of these components:

Receiver with internal Antenna Trimble R4 which contains the antenna and sends data to the controller

Controller Trimble TCS2, stores the data and is actually a handheld computer, also used to change settings

Carbon pole to mount the controller and antenna

2 Setup

2.1 Assembling

Mount the controller and the receiver on the carbon pole see Figure 1. The receiver and controller communicate via Bluetooth so no cables are required but the distance between the receiver and controller should be less than 10 meters.

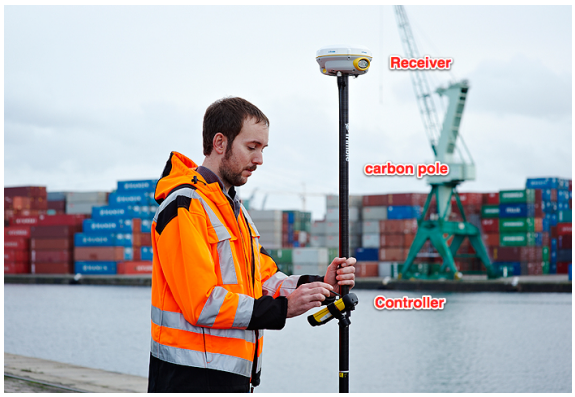

Figure 1: Mounted receiver (top) and controller.

2.2 Power on

Turn on the receiver and controller as shown in Figure 2. The receiver has only one button to turn it on press the button and release it immediately and to turn it off press and hold the button for 2 seconds. Do not press it for more than 10 seconds, because this would reset the receiver.

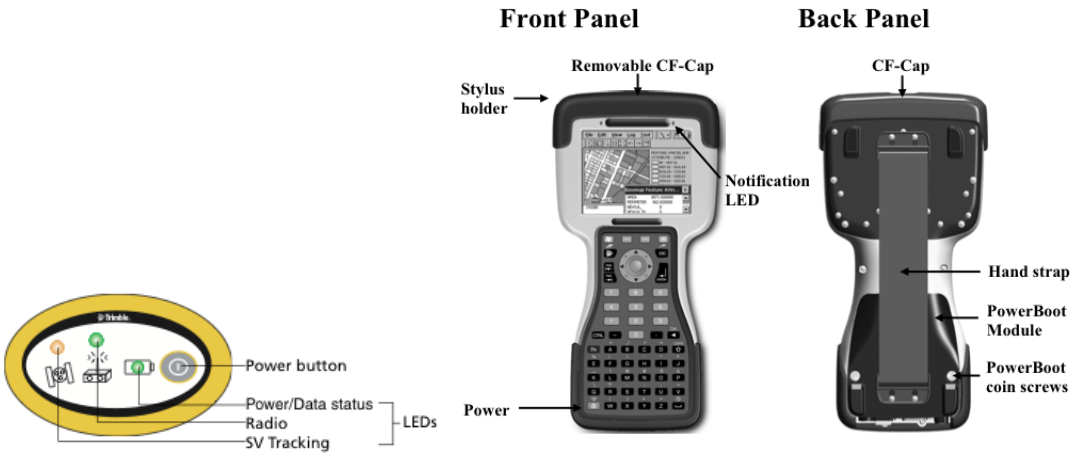

Figure 2: (a) button and LEDs of the receiver and (b) the Controller.

3 Usage in the field

Once the control unit is on you will see the home screen of windows mobile. First make sure that Bluetooth is on: look at the line with Wi-Fi and the *Bluetooth* symbol. If Bluetooth is off then turn in on .

Now start the program *Survey Controller*.

After the controller found the receiver the screen should look like in Figure 3.

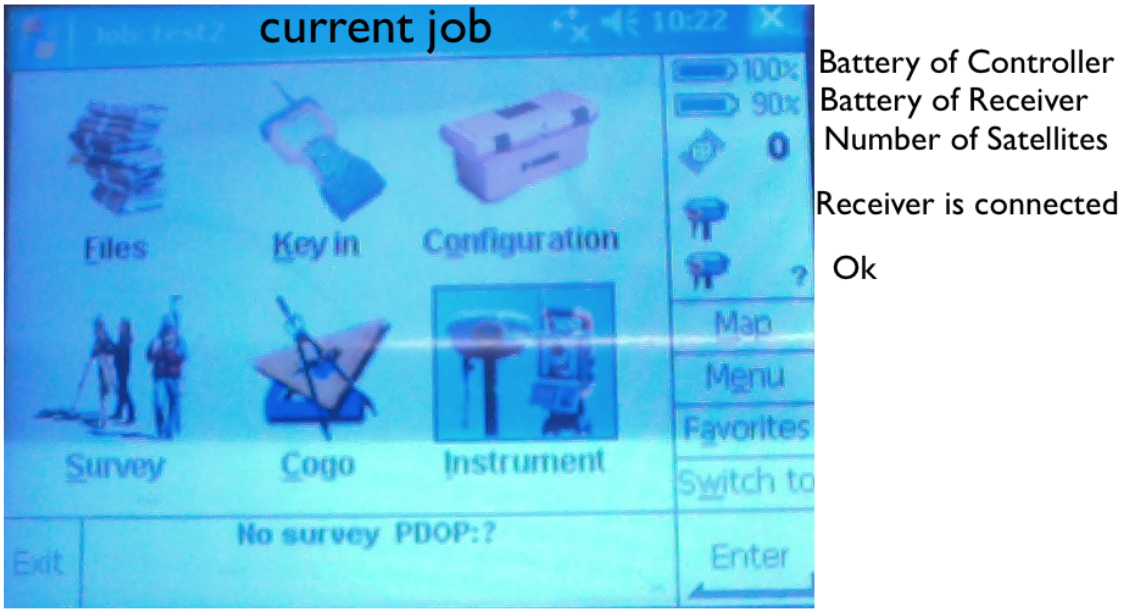

Figure 3: The home screen from Survey Controller as it should look like before starting a survey.

3.1 Creating a new job or use an existing one

A job can contain several different surveys. So for instance you could create one job called *Tellbreen* and all your points will be associated with that job. So you don't need to make a new job every time. To create

a new one:

- **Files/New job**
- A mask will appear
- Give the job an meaningful name
- Coord. sys.: should be 33 X (UTM) and WGS 1984 Datum, no geoid model(if not as default → select form library)
- Description: e.g. AGF212
- Operation: your name
- The rest can be left as is

3.2 Starting a survey

I created a survey style *stake FS* which should be used for measuring stake position.This is based on the factory preset *FastStatic* with a logging interval of 1 seconds and uses GPS and GLONASS satellites with dual frequencies.

- **Survey > stake FS...**
- **measure points**
- now it is waiting for satellites
- if satellites are found (at least 4 are needed)
- tap on **measure points** and a mask will appear
- Following fields must be filled out: Point name, and Antenna height
- now tap on **Measure**
- go to page 2 and wait for the occupation time
- now you can **Store** the point
- continue measuring points or go to **Survey > End Survey**

A note about occupation time: in general the longer the better and not less than 8 minutes.

3.3 More useful things to know

- The receiver can be switched of while traveling between stakes
- You can read the current (uncorrected) position from **Favorites/Position..**.
- The point is still being occupied while you do other things
- with **switch to > Measure points** you will always come back to the current point
- **Favourites > Point manager** gives an overview of the measured points (uncorrected, in UTM or Lat/lon)
- PDOP as a measure of satellite geometry. Low values are good (below 6)

4 Downloading data from the Controller

There are many ways to get to the data. The easiest is to use a USB-stick.

- plug in USB stick into the controller
- go to the Start menu and click on the folder icon
- go to the folder *Trimble Data*
- sort by date
- copy the *.t02 file by pressing long on the filename and chose copy
- go to *Hard Disc* which is the USB stick
- **Menu > Edit > paste**

5 Post-Processing

For Post-processing use the program *Trimble Business Center*, but first we need to get the base station data from Statkart.

5.1 Getting base station data

Write an email to `satref@statkart.no` and ask for base-station data of Longyearbyen for UNIS for a specific day. The data will be in RINEX format and with 1sec timing and dual frequency (L1+L2) and for the whole day. They know all the settings and will upload it onto a ftp-server `ftp://ftpsrv-satref.gdiv.statkart.no/` into the subfolder etpos for you. (You can get the ftp username and password from me.) Now download all data files for that date and copy it to your folder where you stored the *.t02 files.

5.2 starting a new project or open an existing one

First start the windows program *Trimble Business Center* and start a new project with **File > New Project** and choose the blank template. Now you need to change the coordinate system with **Project > Change coordinate System**. **New System > Coordinate System and zone**. Then set it to UTM with the zone 33X (Svalbard) and WGS 1984 Datum and use no geoid model.

5.3 Import data

Now you need to import the rover and base-station data. Go to **File > Import** and chose the folder and files. No you see the points appearing in the map and the project explorer. Import all data, the points form the rover (*.t02) files and the zipped base station data from Statkart.

5.4 The actually post-processing

When you imported the data you see all possible baselines between your measured points and the base station. Now you need to define which point is your fixed point which is shown in Figure 4. Open the LYRS point and right-click onto the red point an choose **properties** and a panel will appear to the right. Now you need to klick on the "world" icon in the global coordinates and set all to *survey quality* and the icon will change into a yellow tripod.

Then go to **Survey > Process Baselines** and wait. This will do calculate the corrections which you need to save. After this is finished you can look at the Report: **Reports > Baseline Processing Report**

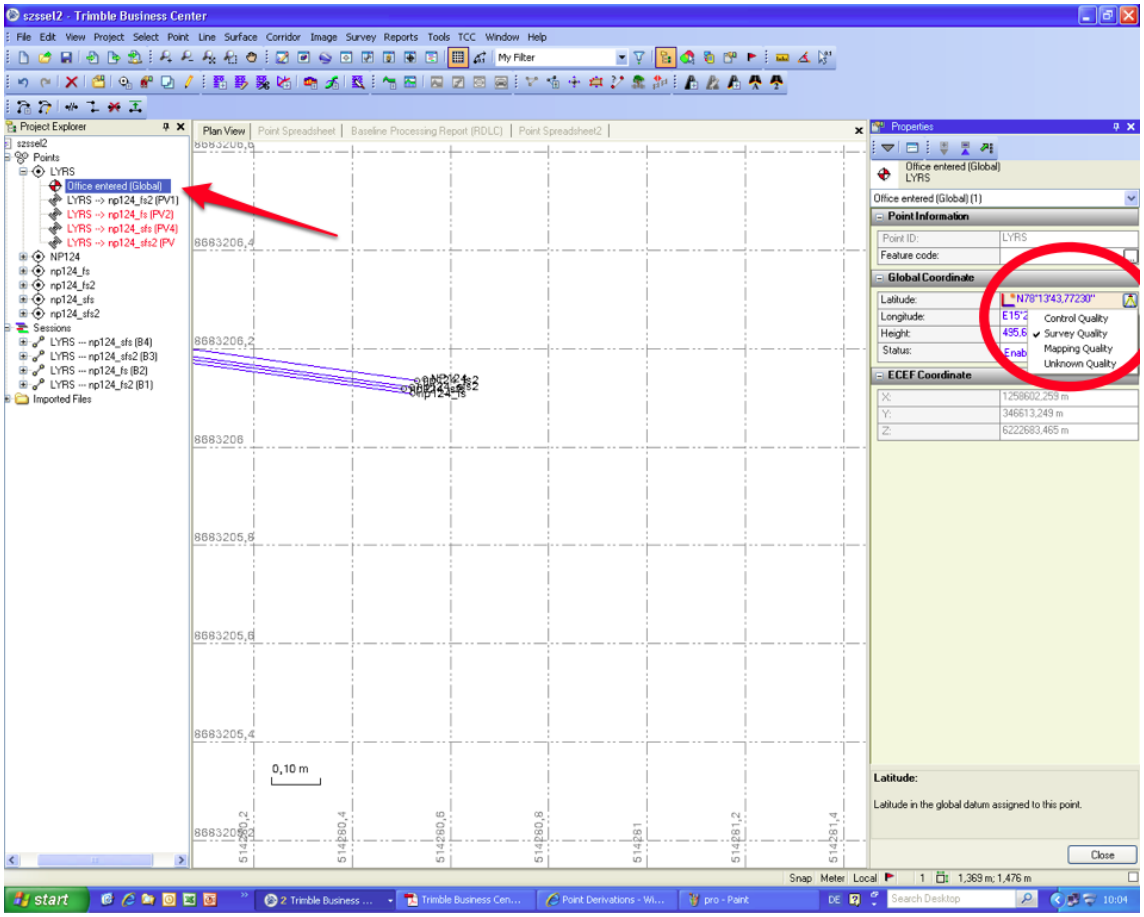

Figure 4: Trimble business centre with imported base station (LYRS) and some points. This shows how the properties for the LYRS point should look like before baseline-processing.

5.5 Measure distances between two points

First you need to change a system setting: On the lower grey bar click on Snap and deselect Free. This ensures that you always select a point. Now go to **Tools > Measure** and can select two points and read the distance.

5.6 Exporting data

First we need to make some adjustment in the Project Settings: **Project > Project Settings > View > Points Spreadsheet** and select Show for Global Coordinates Latitude and Longitude. Now go to **View > New Point Spreadsheet**. Now you have a nice spreadsheet with UTM and Lat/Long coordinates you could export. Now you need to create your own format in order to include the UTM (Grid) coordinates and Global Lat/Lon coordinates. Go to **Files > Export Format Editor** and create a new one. The process is straight forward and needs only to be done once. Keep in mind the program you want to read the data with, for example Matlab. File format Custom and chose the format you created before. Now you need to select the points you want to export and click on export.

5.7 Accuracy

For Fast Static the horizontal accuracy is 3mm + 0.1ppm and vertical 3.5 + 0.4ppm. Where the ppm means parts per million of the baseline length. The baseline length is the distance between the base-station and rover. So for example for a baseline of 20km: 0.003m + 0.1ppm of 20000m the result is just 5mm. For the same baseline the vertical accuracy would be 11.5mm. These are for the ideal cases and accuracy may be effected by atmospheric conditions, signal multipath, obstructions and satellite geometry.