Piksi Multi - GNSS RTK Position with Stationary Base

Caution: Piksi Multi uses a powerful processor that can generate a significant amount of heat. Use caution when handling the board, as components may reach upwards of 140° F (60° C).

This procedure must be performed outdoors and does not require an Internet connection.

Overview

This article details the RTK Position with Stationary Base feature available on Piksi® Multi and Duro. This article provides instructions to obtain an RTK Position solution using hardware from the Piksi® Multi Evaluation Kit. Please be sure to complete all prerequisites before proceeding with the guide.

Prerequisites

Installing Swift Console
http://support.swiftnav.com/customer/en/portal/articles/2756825

Installing USB to Serial Adapter Drivers
http://support.swiftnav.com/customer/en/portal/articles/2757197

Powering Piksi Multi
http://support.swiftnav.com/customer/en/portal/articles/2746937

Connecting to Piksi Multi - USB to Serial Adapter
http://support.swiftnav.com/customer/en/portal/articles/2747195

Upgrading Piksi Multi Firmware
http://support.swiftnav.com/customer/en/portal/articles/2757403

GNSS Antenna Placement Guidelines
http://support.swiftnav.com/customer/en/portal/articles/2770372

Piksi Multi - Standalone Position
http://support.swiftnav.com/customer/en/portal/articles/2770419

GNSS RTK Position

Note: The **RTK Position Solution** is a high-precision GNSS position solution, with an accuracy of a few centimeters. This is a relative position between two Piksi Multi receivers, which are both required to calculate the solution.

To learn more about RTK technology read Understanding Piksi RTK GPS Technology article. (http://support.swiftnav.com/customer/en/portal/articles/2492803-understanding-gps-rtk-technology)

This test must be performed outdoors and does not require an Internet connection.

Goal

In this section, you will setup two Piksi Multi outdoors. One will work as a base station (stationary) and another as a rover (moving). The base station will transmit GNSS correction data over the radio link to rover. You will be able to display a rover RTK position solution on the Swift Console.

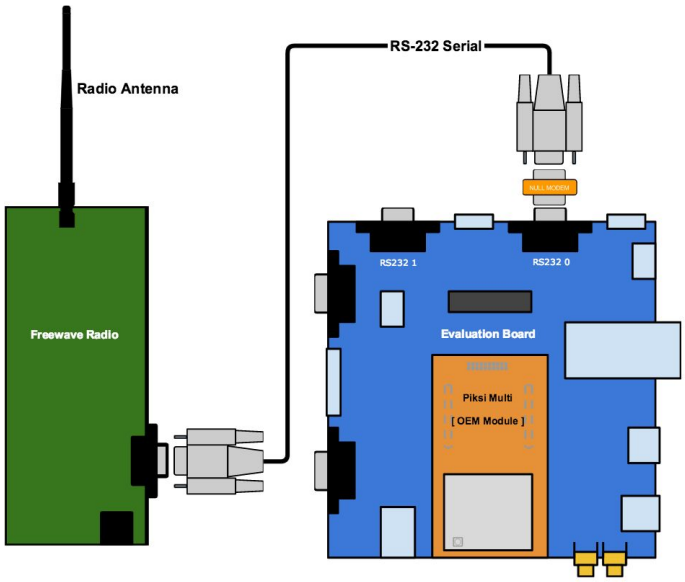
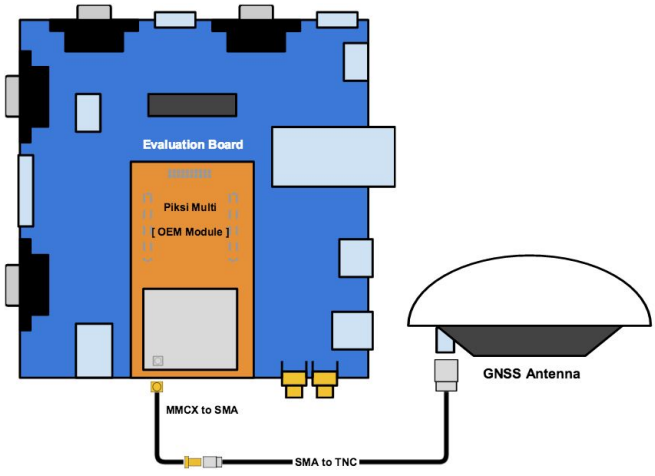
Radio Configuration

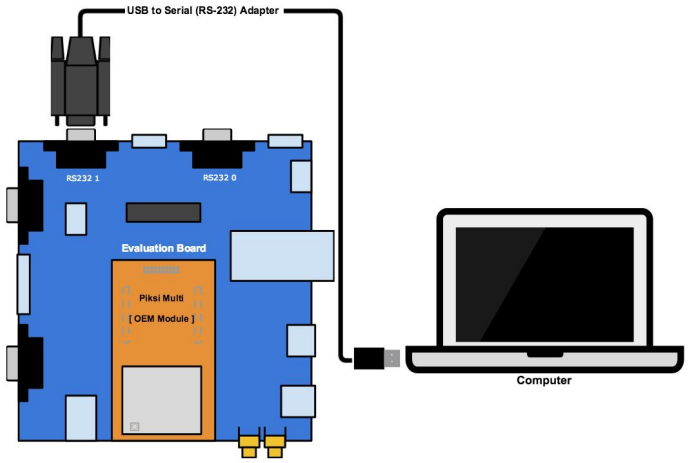
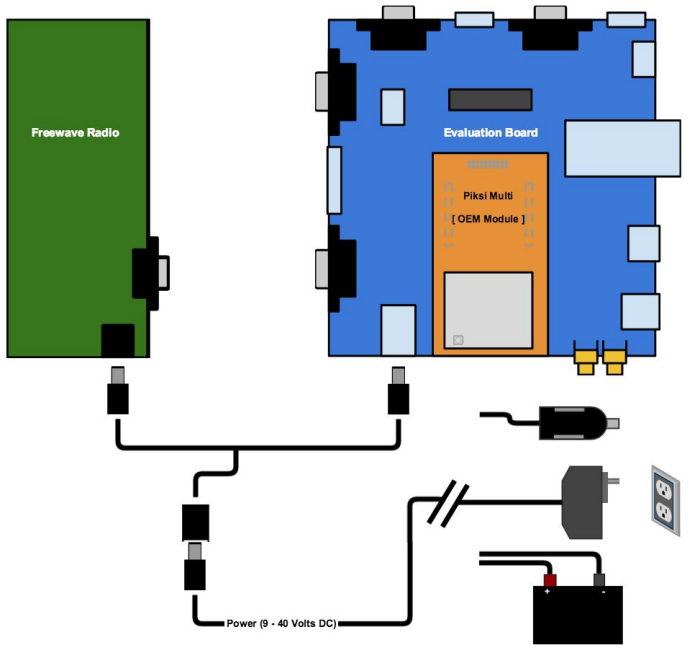
In order to achieve an RTK solution, the rover receiver will need to receive correction data from a base station receiver. The Piksi Multi Evaluation Kit includes two radios to provide this link.

The radios must be configured properly before continuing with this guide.

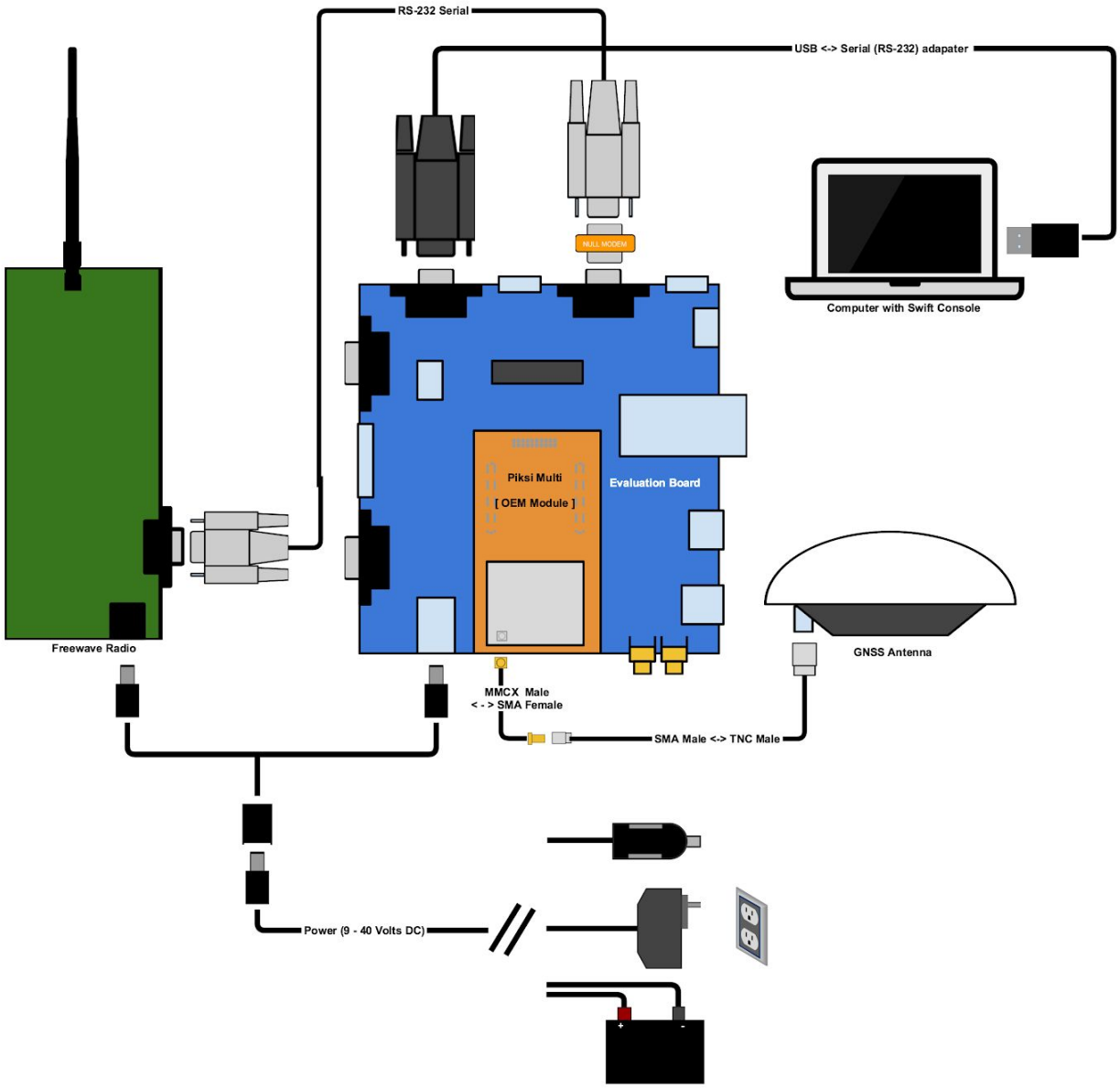
Please follow the Radio Configuration Guide found here:
http://support.swiftnav.com/customer/en/portal/articles/2739642

Base Station Setup

Connect the radio to the evaluation board. • Connect the radio antenna to the radio module. • Connect the DE-9 Null Modem Adapter to the Piksi Multi Evaluation *RS232 0* port. • Connect the straight RS-232 serial cable to the Null Modem Adapter • Connect the other end of the serial cable to the radio module	
Place the GNSS antenna on a tripod or on other stable structure with an unobstructed sky view. (See *GNSS Antenna Placement Guidelines*) It is recommended to secure Piksi Multi and the radio to the antenna tripod or structure.	
Connect the GNSS Antenna to Piksi Multi. • Connect the short MMCX to SMA adapter cable to the primary antenna connector on the Piksi Multi GNSS module. • Connect the SMA to TNC cable to the SMA female connector of the MMCX to SMA cable. • Connect the TNC connector to the GNSS antenna.	

Connect the Evaluation Board to your computer. • Connect the USB to Serial Adapter cable to the *RS232 1* port of the Evaluation Board. • Connect the opposite end of the USB to Serial cable to your computer.	
Connect power to the system. • Connect the included power adapter splitter to the radio and Evaluation Board • Connect your power source to the splitter. Once powered - the LED indicators of Piksi Multi will illuminate.	

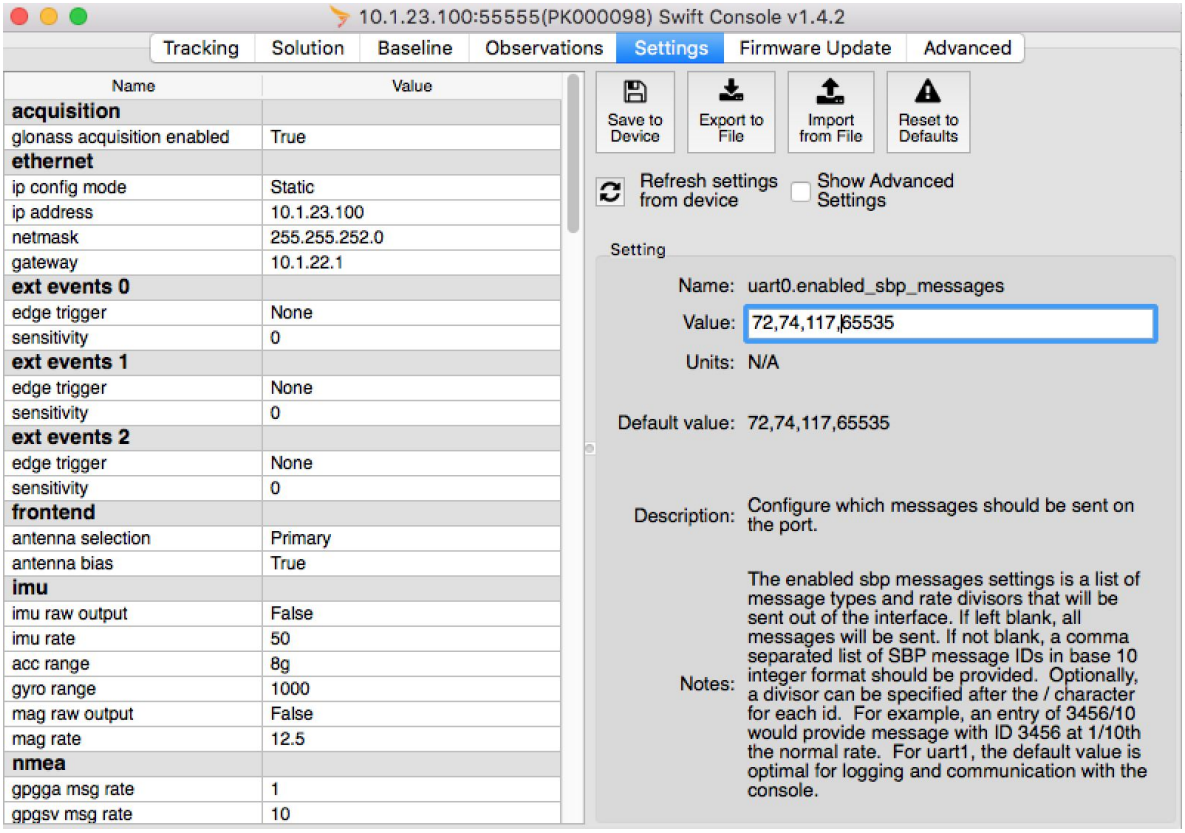
Base Station Wiring Diagram - Overview



Configuring Base Station Radio Messages

In the RTK system, the Base Station transmits its observations and its position to the Rover. The following steps will configure transmission of the base data to the rover.

- Open the *Settings* tab
- Locate the *uart0* section
- Set *enabled_sbp_messages* to *72,74,117,65535*
- Click *Save to Device* button



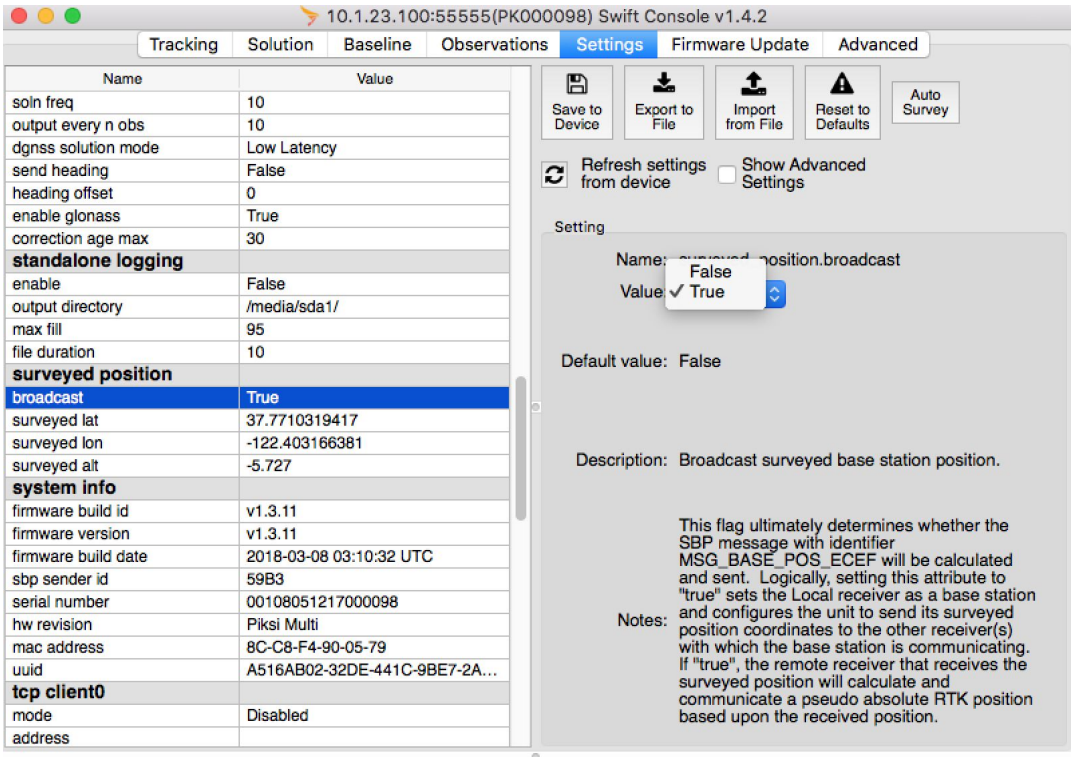
The value of the "*enabled_sbp_messages*" setting in the *uart0* section is used to configure which SBP messages are sent over *uart0*. Other communications interfaces may also feature this setting, and are configured independently.

Configuring Base Station Location

GNSS RTK provides a very precise baseline measurement between the base station and the rover. For the rover to provide precise latitude, longitude and altitude, however, the base station must be programmed with its own location. Accuracy of the computed rover's location directly depends on the base station position accuracy. For the best results, position of the base station antenna should be surveyed. To enter the base station location:

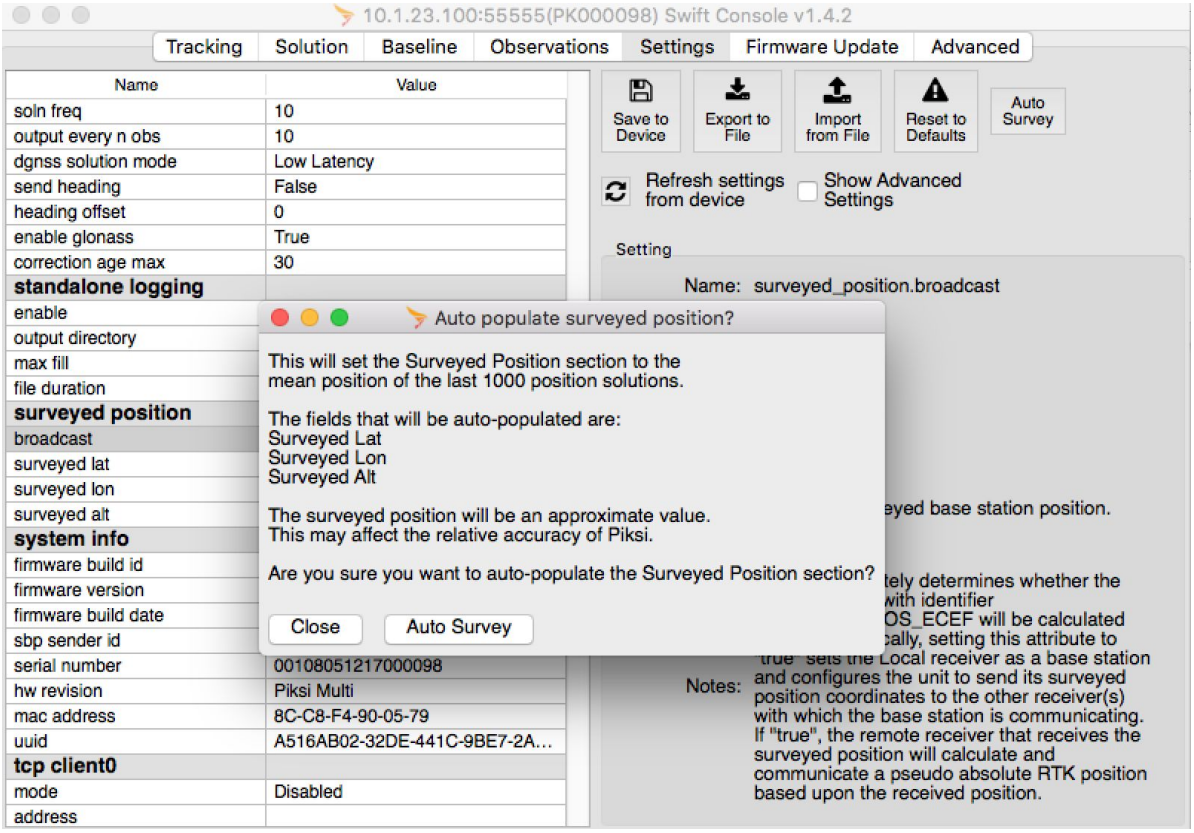
- Open *Settings* tab
- Locate *surveyed position* section
- Set *surveyed lat*, *surveyed lon*, and *surveyed alt* to their corresponding values

- Select *broadcast* and change it's value to *True* using the drop down menu.
- Click *Save to Device*



If the surveyed position is not available, you can use the *Auto Survey* button. This is based on an average of the last 1000 SPP position solutions and therefore not as accurate as a proper survey of the base station location. To use *Auto Survey* for the base station position:

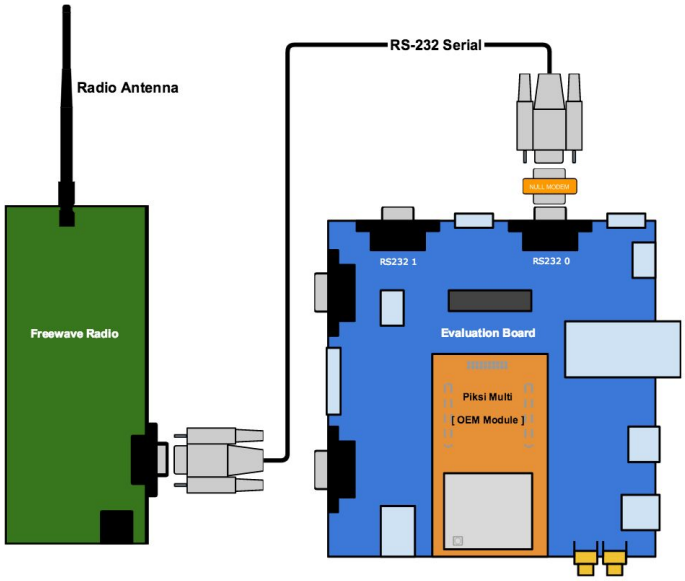
- Open *Settings* tab
- Locate *surveyed position* section
- Select *broadcast*
- Click the *Auto Survey* button the upper right hand corner
- Click *Auto Survey* - note the *surveyed lat*, *surveyed lon*, and *surveyed alt* fields are now populated.
- Select *broadcast* and change it's value to *True* using the drop down menu.
- Click *Save to Device*



Finishing Base Station Setup

At this point the Piksi Multi base station setup is complete. Close Console, disconnect Piksi Multi from the computer. Leave the base station powered, so that it can continue to provide corrections to the rover.

Rover Setup

Connect the radio to the evaluation board. • Connect the radio antenna to the radio module. • Connect the DE-9 Null Modem Adapter to the Piksi Multi Evaluation *RS232 0* port. • Connect the straight RS-232 serial cable to the Null Modem Adapter • Connect the other end of the serial cable to the radio module	
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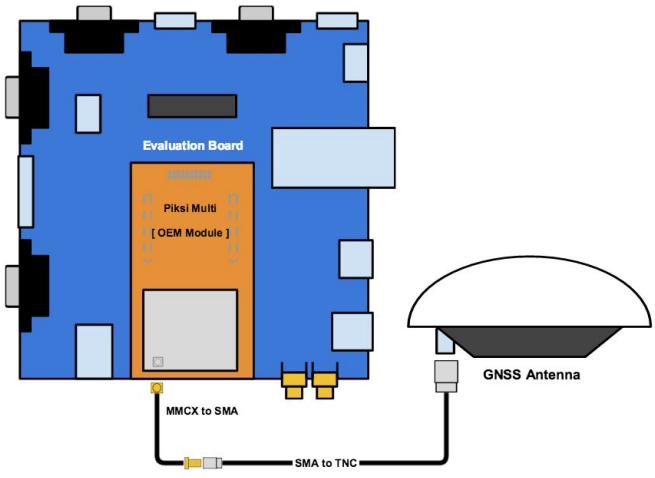
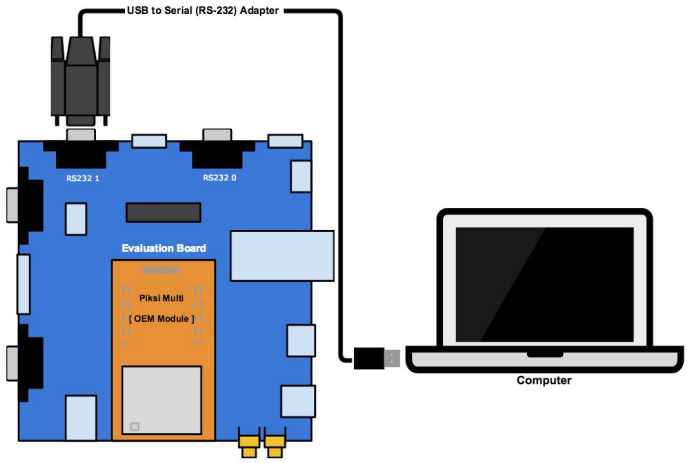
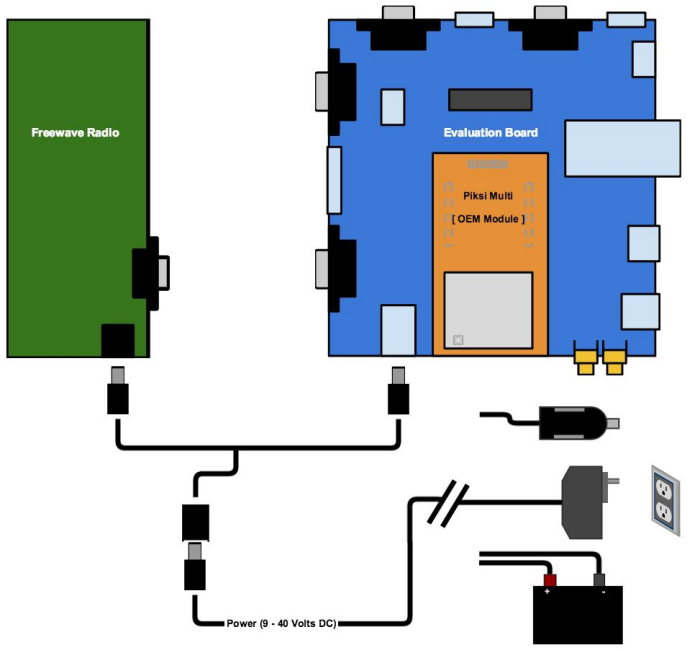
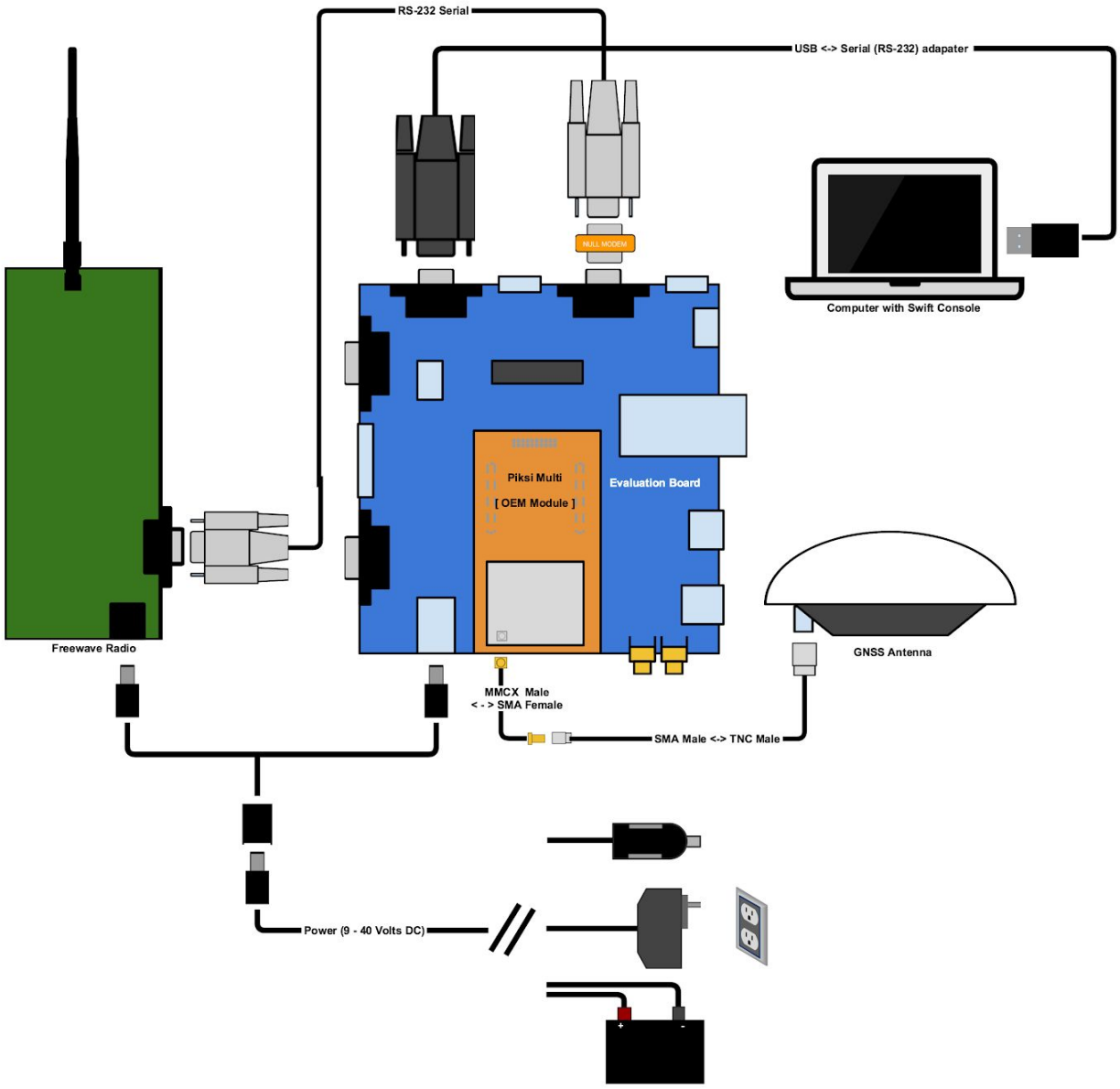
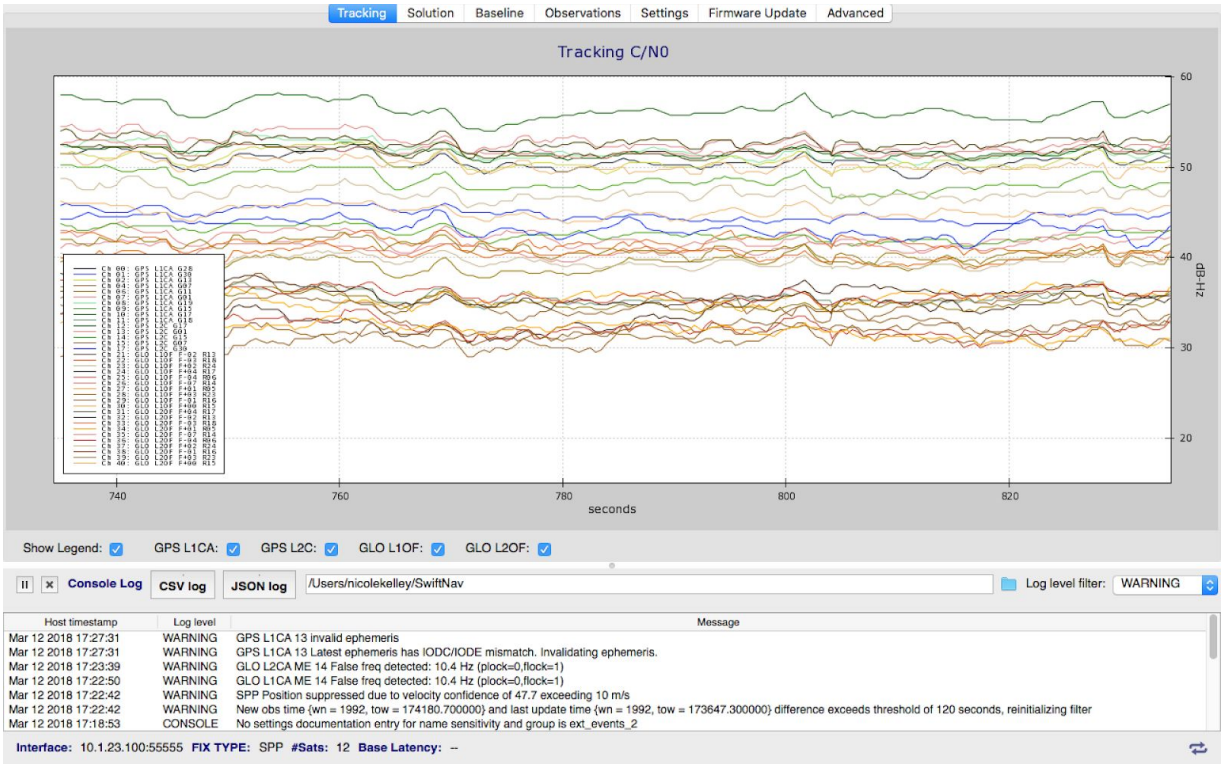
Connect the GNSS Antenna to Piksi Multi. • Connect the short MMCX to SMA adapter cable to the primary antenna connector on the Piksi Multi GNSS module. • Connect the SMA to TNC cable to the SMA female connector of the MMCX to SMA cable. • Connect the TNC connector to the GNSS antenna.	

Connect the Evaluation Board to your computer. • Connect the USB to Serial Adapter cable to the *RS232 1* port of the Evaluation Board. • Connect the opposite end of the USB to Serial cable to your computer.	
Connect power to the system. • Connect the included power adapter splitter to the radio and Evaluation Board • Connect your power source to the splitter. Once powered - the LED indicators of Piksi Multi will illuminate.	

Rover Wiring Diagram - Overview



Checking Rover Satellite Signals

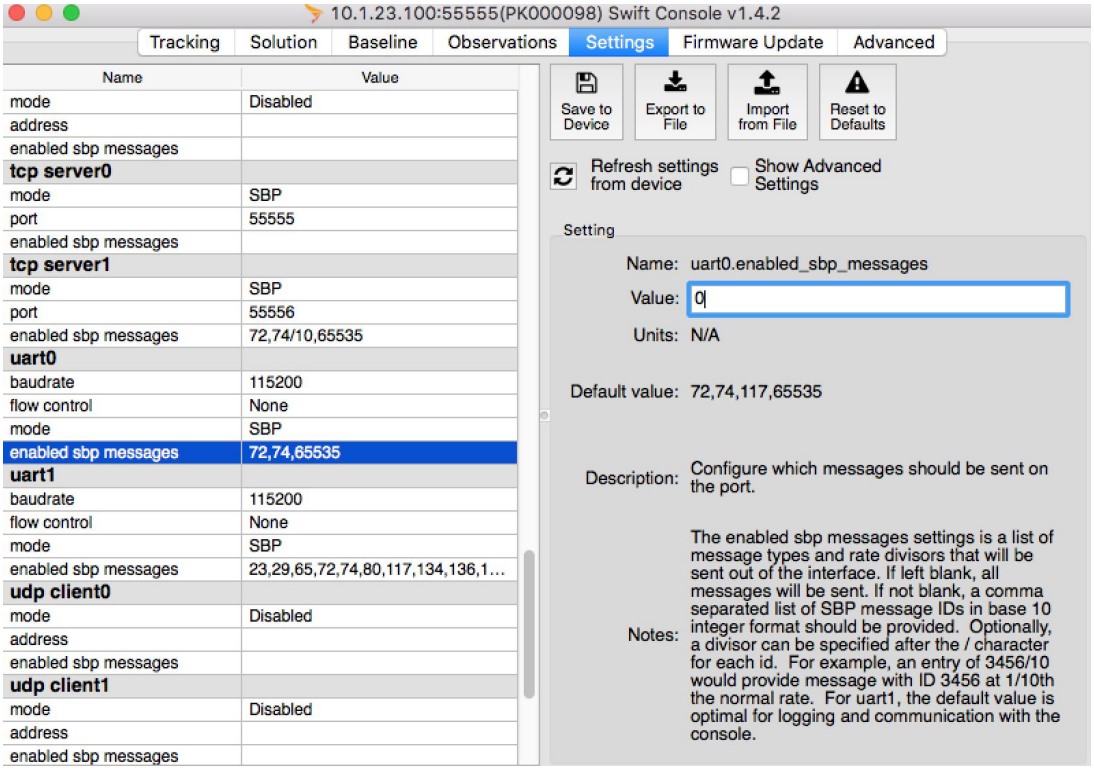


Open *Tracking* tab. Wait until at least 5 satellites have signal strength above 33 dB-Hz and Piksi computes a Single Point Solution or SBAS solution. The POS LED on Piksi Multi will show solid orange once it has a position solution.

Configuring Rover Radio Messages

In a typical RTK system, the Rover is only receiving observations (corrections) from the Base Station. The following steps will disable transmission of the rover observations.

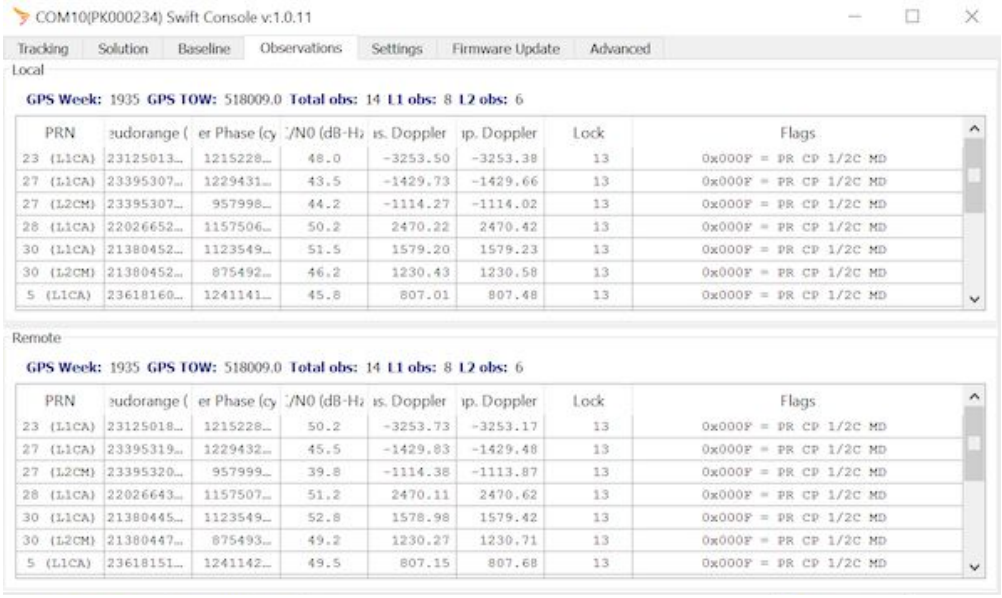
- Open *Settings* tab
- Set *uart0 enabled_sbp_messages* to *0*
- Click *Save to Device* button



Checking Communication Between Piksi Receivers

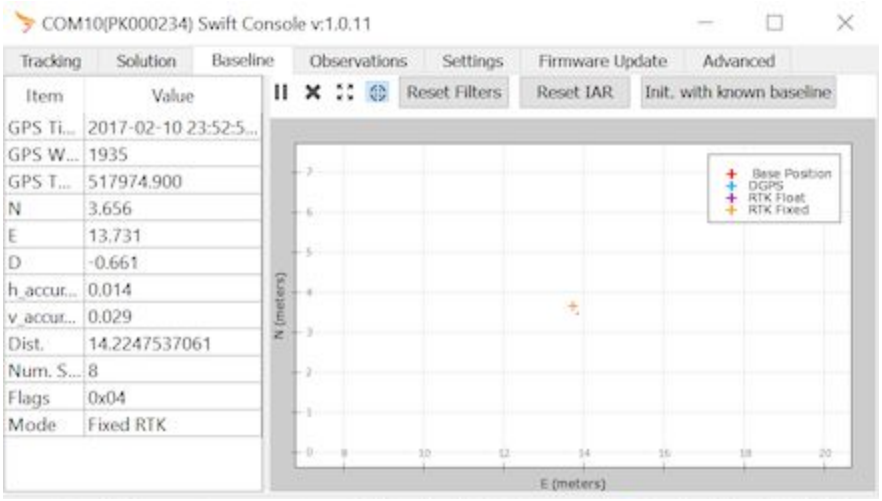
The red LINK LED on Piksi Multi rover board will flash when it correctly receives an observation data from the other Piksi Multi (base station). This LED may be solidly illuminated in the case that your piksi or Duro has a route to the internet, but it will still blink when an observation is received.

Open Observations tab. You will see the rover's observations in the upper *Local* table, and the observations that have been received over the radio from the other Piksi in the lower *Remote* table. Wait until you can see at least 5 satellites in common between the Base and Rover.

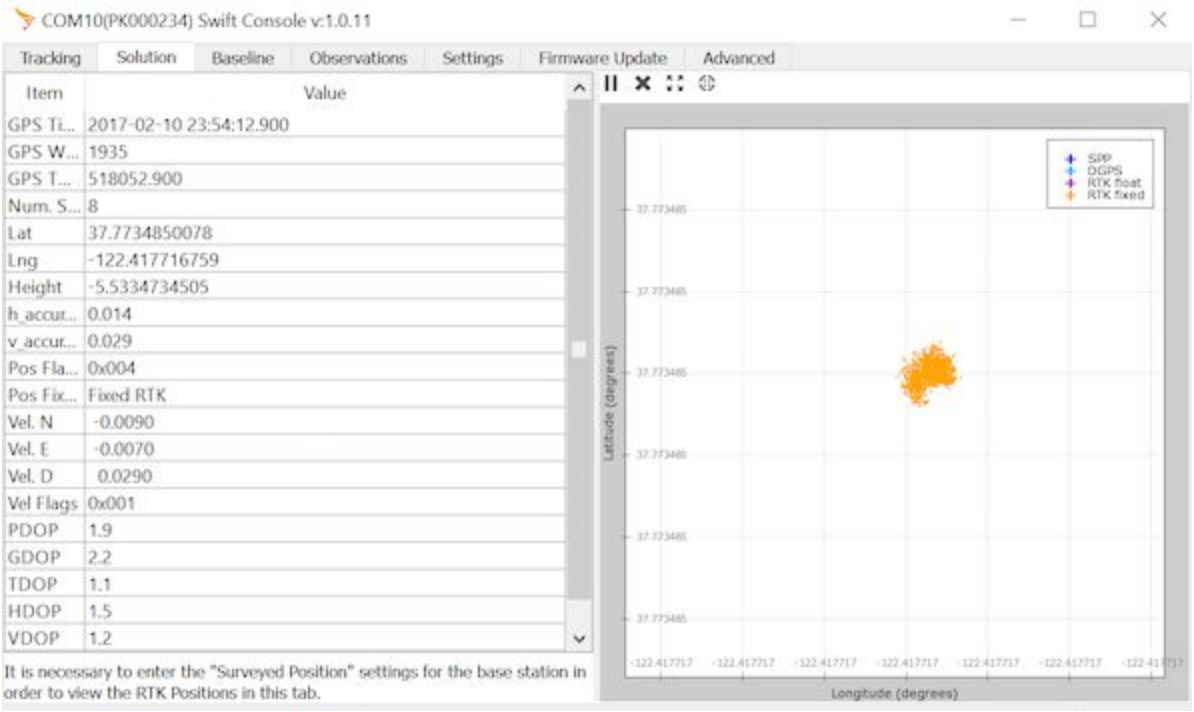


Viewing RTK Position Solution

Once at least 5 satellites are in common between the Rover and Base, Piksi will start producing differential solutions. Open the Baseline tab and you will see differential solutions being outputted. Initially Piksi will begin in *Float* mode (less accurate) and will transition to *Fixed* mode (most accurate). When this happens, your Piksi has a fixed RTK lock. You should now see a centimeter-accurate distance between your base Piksi and rover Piksi, visualized on the Baseline tab, like in the example shown below.



If the surveyed position was programmed on the base station and broadcasting was enabled (see *Configuring Base Station Radio Messages* above) you can see the rover's position on the Solution - RTK Position tab.



Congratulations!

You now know how to setup and use Piksi Multi. To learn more, visit the Swift Navigation Support Center - http://support.swiftnav.com/.