

3DR Solo Integration Guide

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Introduction

This guide presents a step-by-step tutorial for integrating the Pixsi RTK GPS receiver as a secondary, high precision GPS unit aboard the 3DR Solo.

We recommend you use the standard Ublox module as the primary GPS and Pixsi as the secondary GPS on your vehicle. This provides the highest reliability and safety. ArduPilot will automatically switch to the GPS with the most accurate solution. In Pixsi's case, it will switch to Pixsi's solution once it has a float or integer fixed RTK solution.

IMPORTANT NOTE: The driver will NOT function if the base station Pixsi does not send its own surveyed position.

Prerequisites

1. Please **first** follow the [Pixsi User Getting Started Guide](#) and read [RTK Fundamentals](#) before following this guide!
2. Successfully complete a [bench test of RTK Fixed positioning performance](#) with two Pixsis connected to your computer.

To achieve RTK position solutions, the vehicle's Pixsi needs to receive GPS Observations from a ground station Pixsi, and the ground station Pixsi's location must be known as accurately as possible. There are two methods of getting ground station data to the Pixsi on the Solo. First, a dedicated pair of radios can be used to send this data. Radios supplied in a Pixsi RTK kit will work perfectly. The second method is to send data over a UDP bridge on the Solo Link.

Dedicated Radio Setup

One Time Hardware Setup

Vehicle

Install Piksi on the Solo with the following important factors in mind:

1. Piksi should be installed on the bottom of the Solo
2. Piksi should be installed using foam tape to prevent vibrations effecting it

Install GPS antenna and Ground plate with the following important factors in mind:

1. Install the Antenna on top of the Solo with a clear sky view
2. Try to mount antenna away from the stock GPS which is housed behind the battery
3. Connect antenna's sma port to the sma jack on the Piksi

Install Piksi radio with the following important factors in mind ** Not needed if sending SBP data through SoloLink:

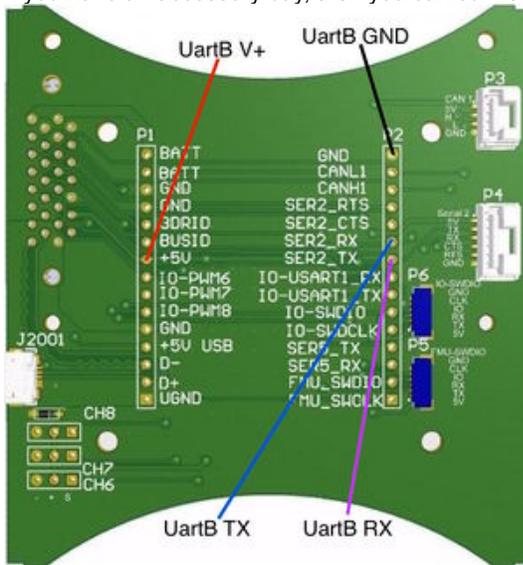
1. Install the radio as far away from Piksi as possible
2. Position the radio antenna so that it points down (keep it away from the propellers)
3. Connect the radio to UartA on Piksi

Connect Piksi to Solo with the following important factors in mind:

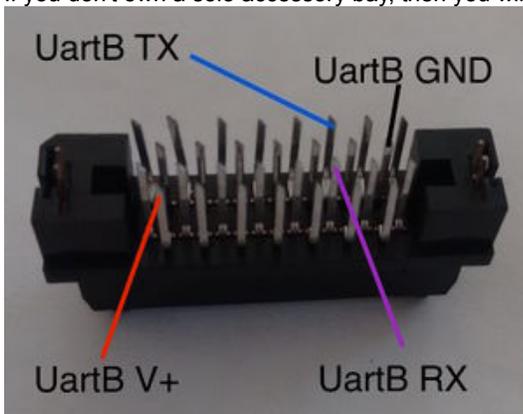
Piksi (UartB)	Accessory Port
GND	GND
RX	SER2_TX
TX	SER2_RX
VCC	+5V

1. You must create a wire to connect Piksi's UartB port to Serial 2 port on Solo.

- If you have an accessory bay, then you can connect straight to the board using 0.1mm connectors.



- If you don't own a solo accessory bay, then you will need to buy an adaptor and solder straight to it



- Detailed information about the connector type, pin layout, and connection design can be found [here \(http://dev.3dr.com/hardware-accessorybay.html\)](http://dev.3dr.com/hardware-accessorybay.html)

Base

In order to achieve RTK position solutions, the vehicle's Piksi needs to receive information from a stationary Piksi. The stationary Piksi relays observations over radio to the vehicle's Piksi.

1. Connect the ground station Piksi to the ground station computer via the micro USB connection.
2. Use the provided radio cable to connect UART A from the Piksi to the radio.
3. Mount an antenna for the Piksi acting as a ground station.
 - It is important that ground station antenna have clear sky view.
 - This antenna should have a ground plane.
 - For best results mount this antenna on a pole or tripod at least 6ft from the ground and away from any obstacles.



One Time Software Setup

Vehicle (Solo)

The solo needs to be configured to read the data from Piksi on Serial 2. The following instructions show how to talk to the solo and make changes to the pixhawk parameters.

1. Power up the solo and the controller. Connect to the wifi hotspot created by the solo controller. (The default password is "sololink")
2. Once connected, access the pixhawk on UDP port 0.0.0.0:14500 using the GCS of your choice
3. Change the following parameters on the pixhawk on Solo.

Parameter	Value
GPS_TYPE	1
GPS_TYPE2	1
SERIAL2_BAUD	115
SERIAL2_PROTOCOL	5
SERIAL3_BAUD	38
SERIAL3_PROTOCOL	5
EKF_POSNE_NOISE	0.1

Vehicle (Piksi)

The follow changes need to be made to the default Pixsi settings.

Section	Setting	Value	Notes
UART B	sbp message mask	65280	
UART A	baudrate	57600	
solution	soln freq	5	(5 solutions per second)
solution	output every n obs	1	
telemetry	configuration string	AT&F,ATS1=57,ATS2=64,ATS3=50,ATS5=0,AT&W,ATZ	Sets the NetID of radio to 50 (from default of 25)*

Base

The follow changes need to be made to the default Pixsi settings.

Section	Setting	Value	Notes
Surveyed Position	latitude	<determine this value>	This value must be as accurate as possible
Surveyed Position	longitude	<determine this value>	This value must be as accurate as possible
Surveyed Position	altitude	<determine this value>	This value must be as accurate as possible
Surveyed Position	Broadcast	True	
solution	soln freq	5hz	
solution	output every n obs	1	
sbp	obs message max size	102	
UART A	baudrate	57600	
telemetry	configuration string	AT&F,ATS1=57,ATS2=64,ATS3=50,ATS5=0,AT&W,ATZ	Sets the NetID of radio to 50 (from default of 25)*

Sololink SBP Relay Setup (UDP)

This setup allows the SBP data to relay through the solo-link, thus eliminating the need of a radio. Follow the setup instructions in the [#Dedicated Radio Setup](#) section first. Unplug and remove the radio on the Solo.

Setup Overview

1. Use the Piksi console to forward observations from your ground station Piksi to your ground control station software (Mission Planner or MAVProxy)
 - Use a ground station computer running Mission Planner (<http://planner.ardupilot.com/>) (1.3.29 or later) or MAVProxy (<http://tridge.github.io/MAVProxy/>) (1.4.15 or later) and [Piksi Console (http://downloads.swiftnav.com/piksi_console/)] v0.23 or later
2. Use your ground control station to inject GPS messages to your vehicle
3. Wait until your vehicle's Piksi reaches RTK lock: your ground station will report a GPS Fix of type "DGPS" for Float and "RTK" for integer fix.
4. Fly!

Starting Ground Station Piksi

You only need to change anything on the ground station Piksi if you have moved the antenna since the last flight. If so, follow [#Piksi \(ground station\) Setup](#).

1. Connect your ground station Piksi to its ground station antenna.
2. Plug the ground station Piksi into your ground station computer using a microUSB connector.
3. Open the Piksi Console
 - Navigate to the "Advanced": "SBP Relay" tab.
 - Set the "Messages to Broadcast" to "Observations"
 - Set the IP address to "127.0.0.1" (this is the default value)
 - Set the Port to 13320 (this is the default value)
 - Click "Start"
4. The console is now forwarding observations over UDP which the ground station can inject onto the main telemetry stream. Keep the console running for the duration of your flight!
 - Note, there is alternatively a command line tool to broadcast SBP over UDP which is part of the Piksi_tools repository. Please see [the file on github (https://github.com/swift-nav/piksi_tools/blob/master/piksi_tools/ardupilot/udp_bridge.py)] for more info.

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Connecting to the GCS

Connect to the wifi link of the solo. The default password is "sololink". After that, we need to use a GCS to start injecting the base Piksi data to the solo network.

MAVProxy (Windows, Linux and OS X)

1. Run MAVProxy and connect to the flight controller
 - In terminal this command will connect to the solo "mavproxy.py --master"
2. Start DGPS module
 - use this command to start injecting the data into the serial stream "module load DGPS"

Mission Planner (Windows only)

It is necessary to configure your ground control software to receive packets from Piksi Console and inject into the serial stream. Mission Planner has this capability with the instructions below provided it is version 1.3.29 or later.

1. Start Mission Planner
2. Connect to your vehicle as normal.
3. Hit Ctrl-F to access the experimental mission planner features:
Error creating thumbnail: Unable to save thumbnail to destination
4. Click the Inject GPS button
Error creating thumbnail: Unable to save thumbnail to destination
5. Select "UDP Host" in the upper drop-down
6. Click Start
7. In the ensuing pop-up window, choose the default port (13320)
Error creating thumbnail: Unable to save thumbnail to destination

8. You should see the "waiting for UDP packet" message briefly. This window will go away if the Pixsi console UDP client is sending UDP packets.

Using the Pixsi-Solo System for Accurate Flight

Power the base Pixsi using a laptop or other source of power. Power the copter with the solo battery.

Expected Vehicle Behavior

Confirm that red light is blinking on vehicle Pixsi. It shows that GPS observations are being received from the ground station Pixsi !

- The vehicle will use ublox until Pixsi gets a float/fixed RTK fix
- GPS STATUS2 will report DGPS or RTK fix (level 4, 5) in your GCS when Pixsi obtains a solution.
- Initially the float filter jumps around a lot, this can trigger many gps glitch messages in arducopter. We will be working to improve this.
- Once in RTK Fixed, take off!

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