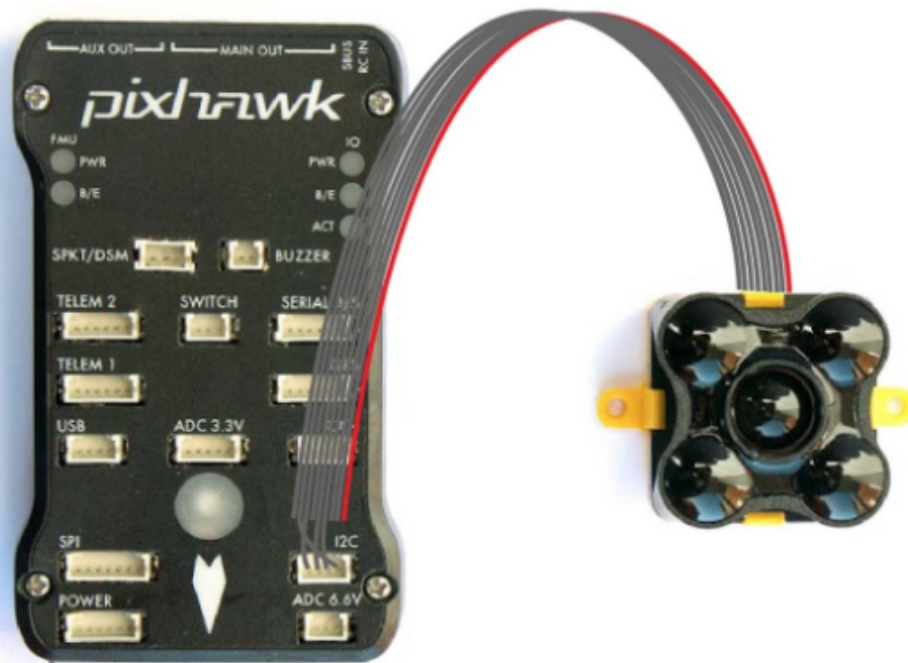


Instruction Manual for:

TeraRanger Evo Connection to Pixhawk Autopilots



Published March 2018

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1 Introduction

The purpose of this document is to explain how to connect a TeraRanger Evo sensor to a Pixhawk board through the I2C interface and how to setup PX4 or ArduPilot firmware to enable TeraRanger Evo sensor use.

2 Compatibility table

At the time of writing, to make the TeraRanger Evo sensor work you must use the developer build version of Arducopter or a PX4 version higher than v.1.7.0. QGroundControl makes it easy to flash the required firmware through the advanced settings. For APM 2 software, see here: <http://firmware.ardupilot.org/>. Refer to the table below for compatibility.

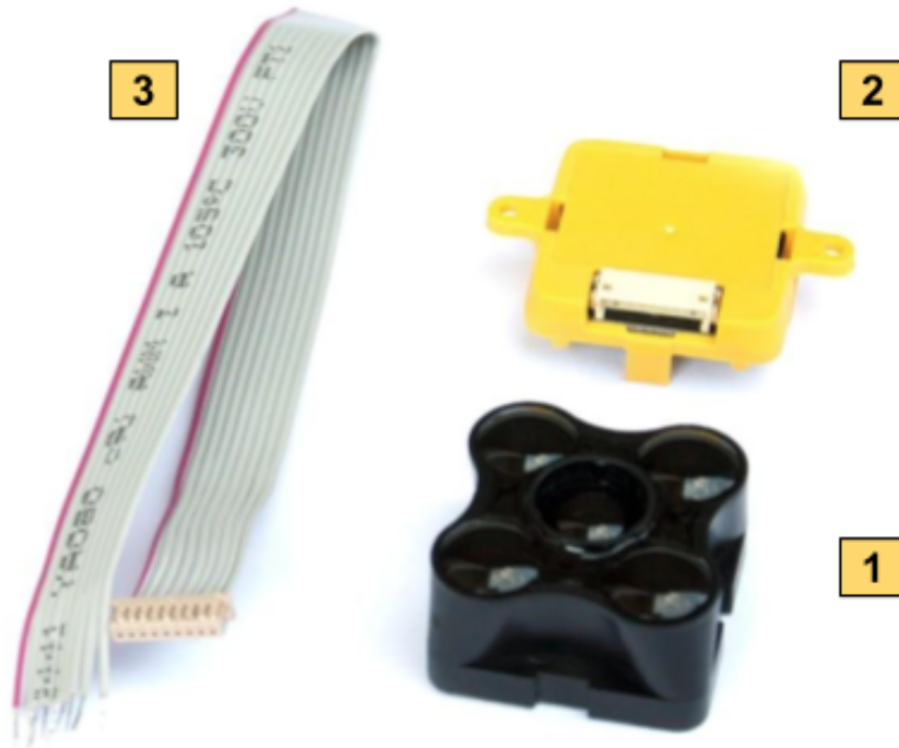
Sensor Version	Firmware Version compatibility
TR-Evo	<ul style="list-style-type: none"> - PX4: from Flight Stack v.1.7.0 onwards - APM: from CopterV3.6-dev onwards

3 Wiring Connection to Pixhawk

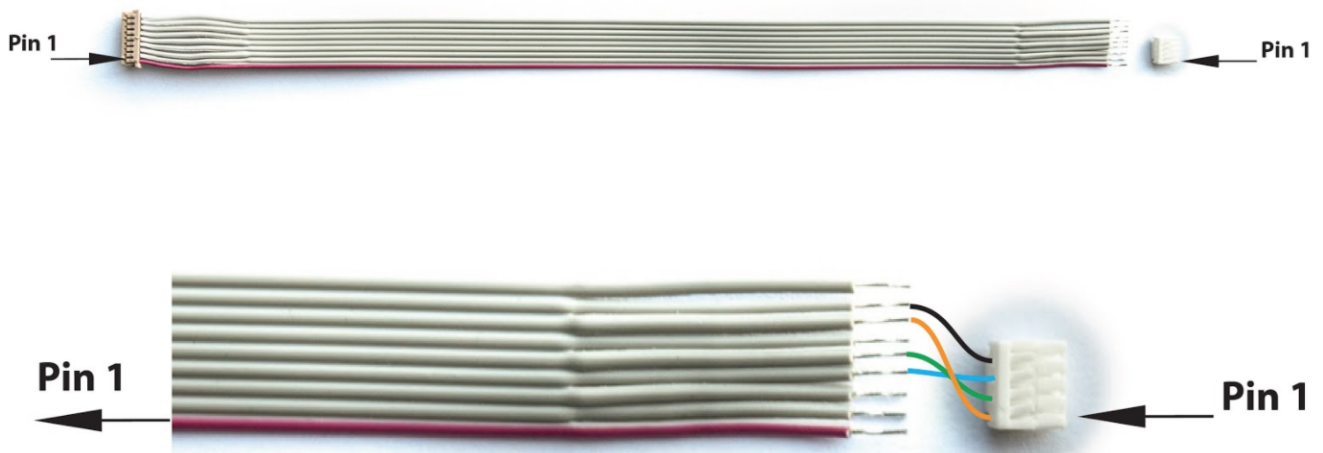
3.1 TeraRanger Evo wiring connection – Pixhawk 2.1

For brevity we will refer to TeraRanger Evo as TR-Evo. To connect a TeraRanger Evo sensor module to Pixhawk please make sure you have a **TeraRanger Evo I2C version**, composed of:

1. TR-Evo sensor
2. TR-I2C/UART backboard
3. DF13 9P to open-ended cable



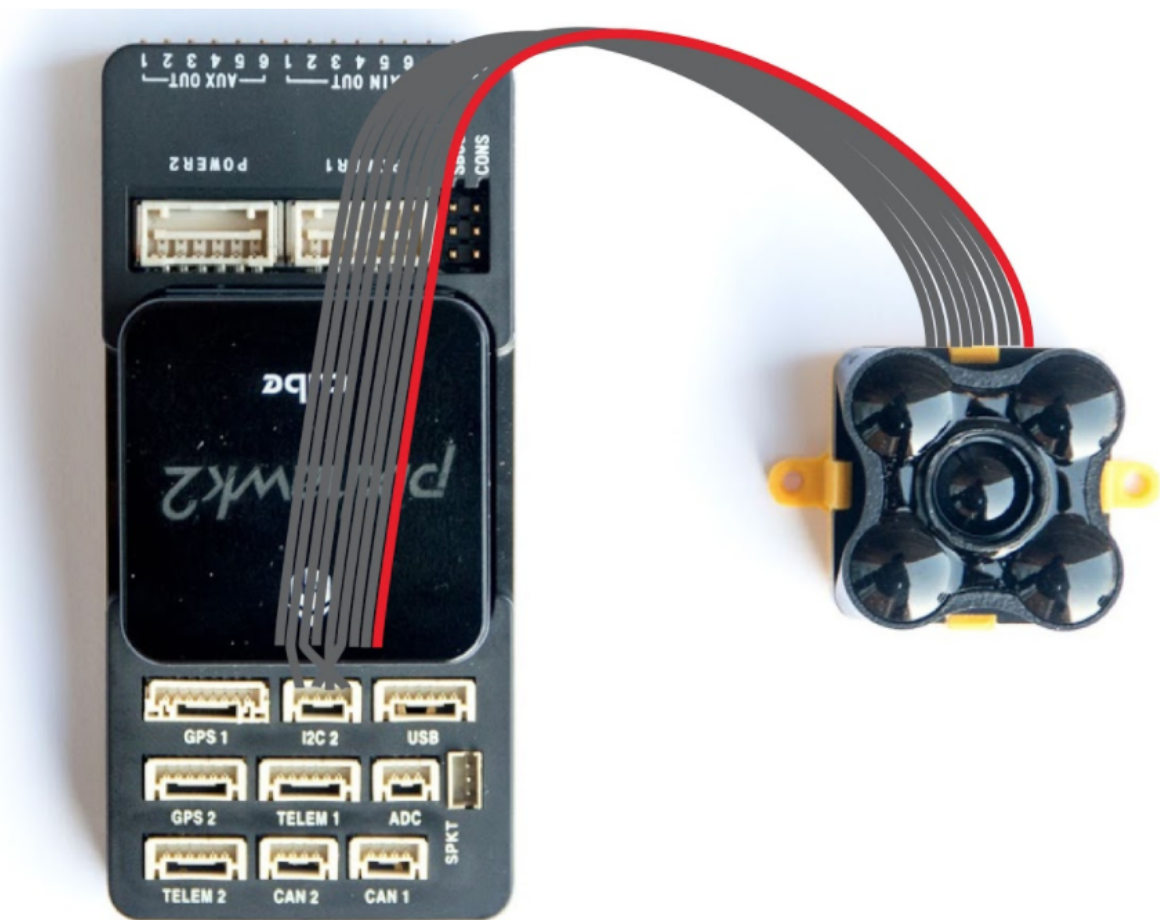
To connect the sensor to the Pixhawk, please use the open-ended cable and make your connection as shown below:



Pixhawk I2C connector ref is : JST-GH 4pins

Evo I2C backboard pins	Pixhawk 2.1 I2C port pins	Color
1 Tx		
2 Rx		
3 GND		
4 SDA	3 SDA	Blue
5 SCL	2 SCL	Green
6		
7 VCC	1 VCC	Orange
8 GND	4 GND	Black
9		

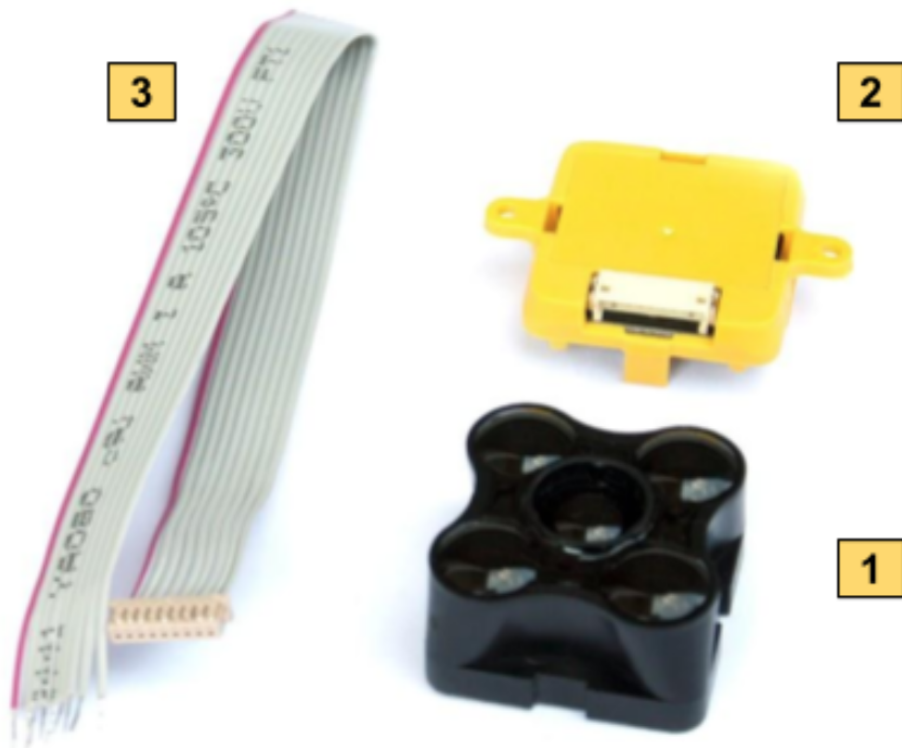
Then connect the cable to the Pixhawk I2C port:



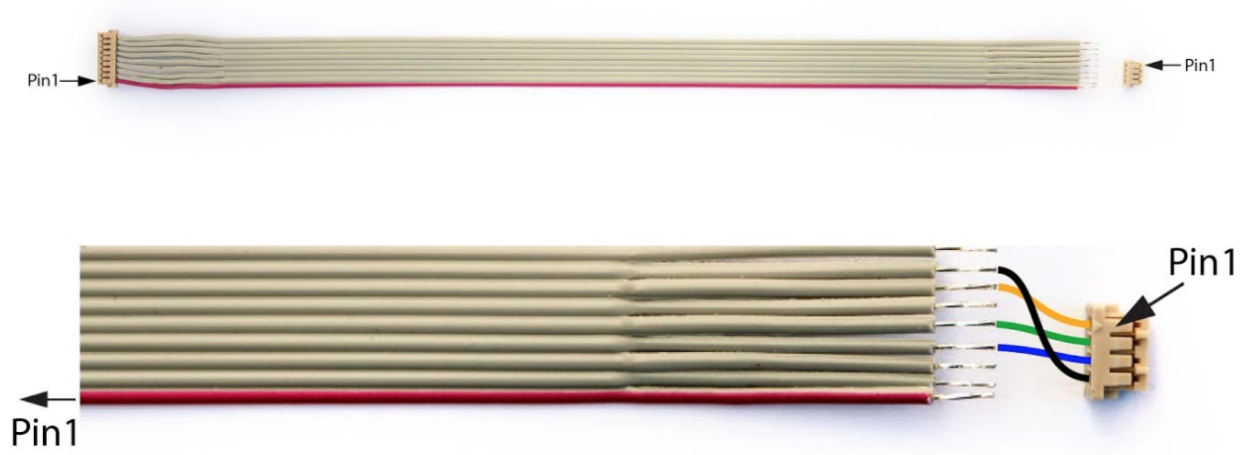
3.2 TeraRanger Evo wiring connection – Pixhawk 1

For brevity we will refer to TeraRanger Evo as TR-Evo. To connect a TeraRanger Evo sensor module to Pixhawk please make sure you have a **TeraRanger Evo I2C version**, composed of:

1. TR-Evo sensor
2. TR-I2C/UART backboard
3. DF13 9P to open-ended cable



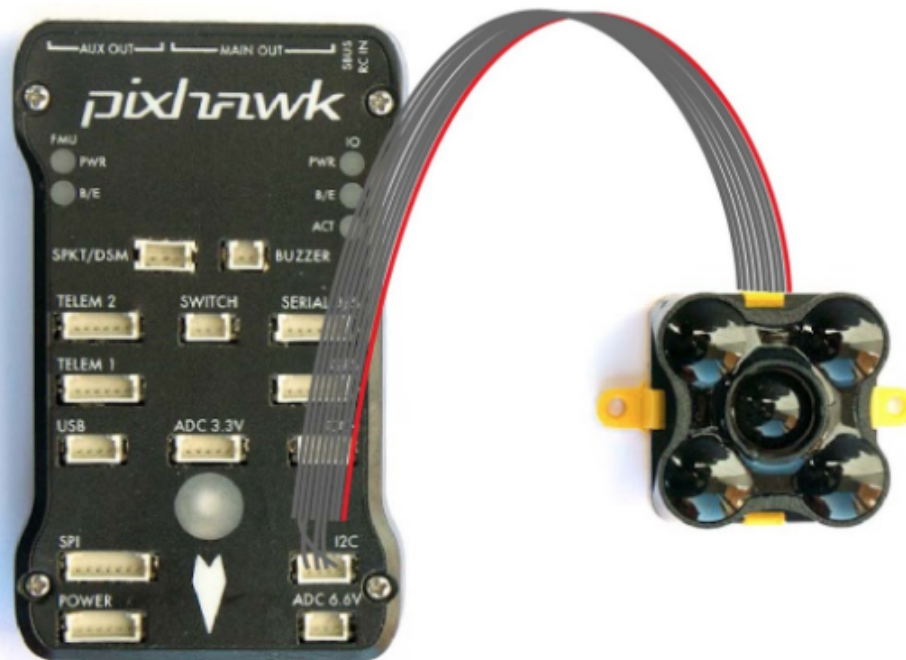
To connect the sensor to the Pixhawk, please use the open-ended cable and make your connection as shown below:



Pixhawk I2C connector ref is : DF13 4pins

Evo I2C backboard pins	Pixhawk I2C port pins	Color
1 Tx		
2 Rx		
3 GND		
4 SDA	3 SDA	Blue
5 SCL	2 SCL	Green
6		
7 VCC	1 VCC	Orange
8 GND	4 GND	Black
9		

Then connect the cable to the Pixhawk I2C port:



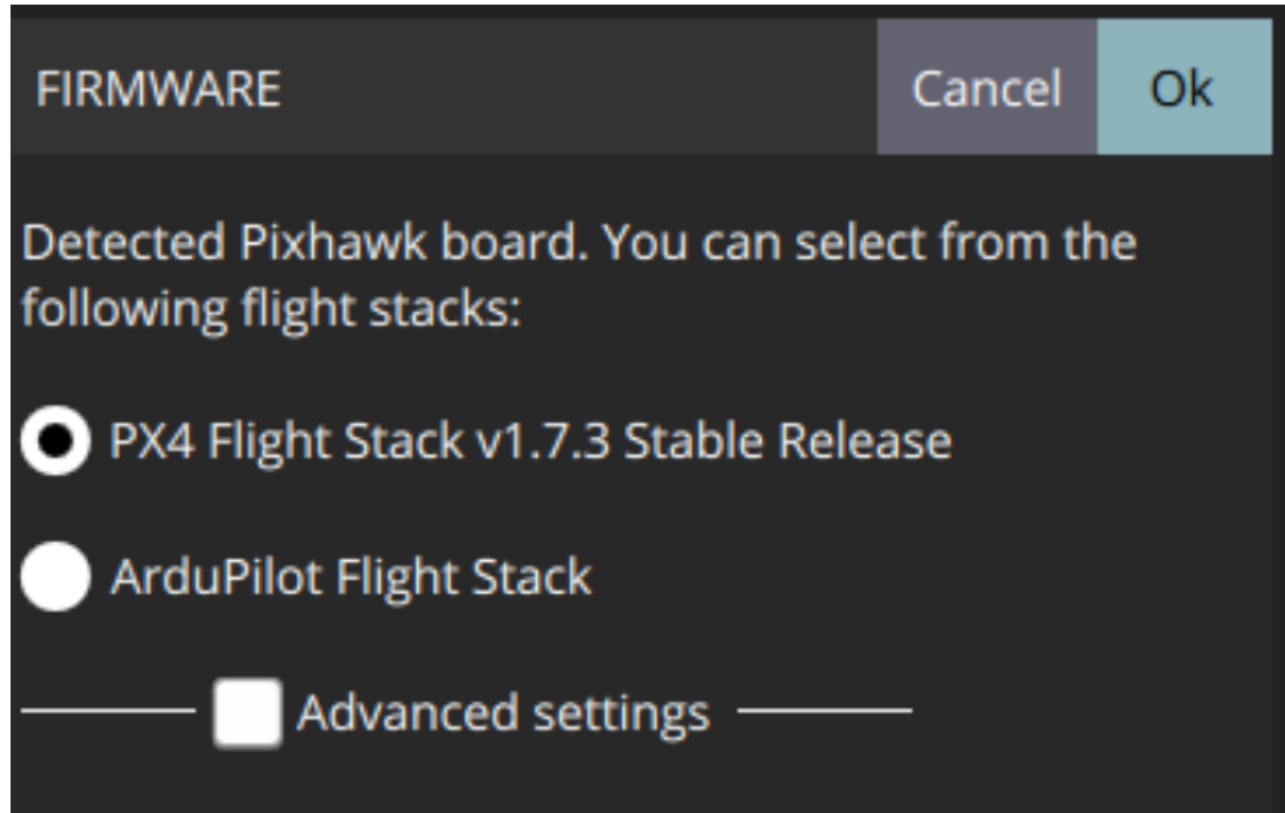
4 Setup the onboard firmware steps to follow:

4.1 PX4 – QGroundControl

Note: **Please always use the latest QGroundControl version**, available from: https://docs.qgroundcontrol.com/en/getting_started/download_and_install.html

1. Launch QGroundControl software
2. Open Vehicle setup menu and go into the Firmware tab (unplug and replug autopilot if needed).

Select the latest stable release of PX4 Flight Stack. Press the Ok button to flash the autopilot. Go to: Parameters/Sensor Enable



3. In the field SENS_EN_TRANGER select your TeraRanger sensor type:

- TREvo

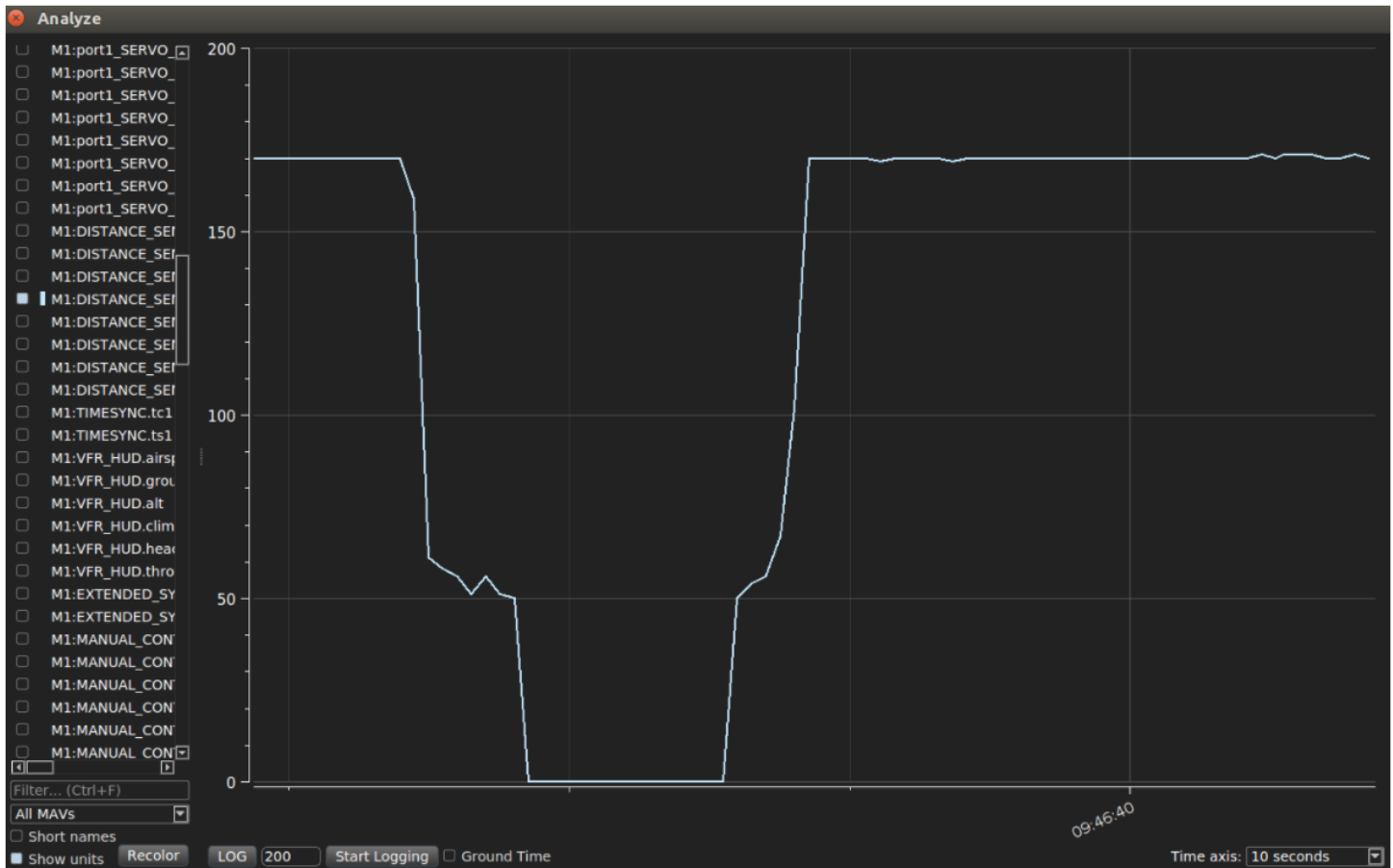
Press Save to confirm.

The screenshot shows the PX4 Parameter Editor interface. On the left, a sidebar lists various vehicle setup categories: Summary, Firmware, Airframe, Radio, Sensors, Flight Modes, Power, Safety, Tuning, Camera, and Parameters. The Parameters section is expanded, showing a list of parameters. The parameter SENS_EN_TRANGER is highlighted in red, indicating it is the selected parameter. The main area displays the configuration for SENS_EN_TRANGER, which is set to 'TRevo' and is currently disabled. The description for this parameter is 'TeraRanger Rangefinder (I2C)'. The right sidebar shows the Parameter Editor for SENS_EN_TRANGER, with a 'Reset to default' button and a dropdown menu set to 'TRevo'. A warning message is displayed: 'Warning: Modifying values while vehicle is in flight can lead to vehicle instability and possible vehicle loss. Make sure you know what you are doing and double-check your values before Save!'. There is also an 'Advanced settings' checkbox which is currently unchecked.

Parameter Name	Status	Description
SENS_EN_LL40LS	Disabled	Lidar-Lite (LL40LS)
SENS_EN_MB12XX	Disabled	Maxbotix Soanr (mb12xx)
SENS_EN_SF0X	Disabled	Lightware laser rangefinder (serial)
SENS_EN_SF1XX	Disabled	Lightware SF1xx/SF20/LW20 laser rangefinder (I2c)
SENS_EN_THERMAL	Thermal control unavailable	Thermal control of sensor temperature
SENS_EN_TRANGER	TRevo	TeraRanger Rangefinder (I2C)

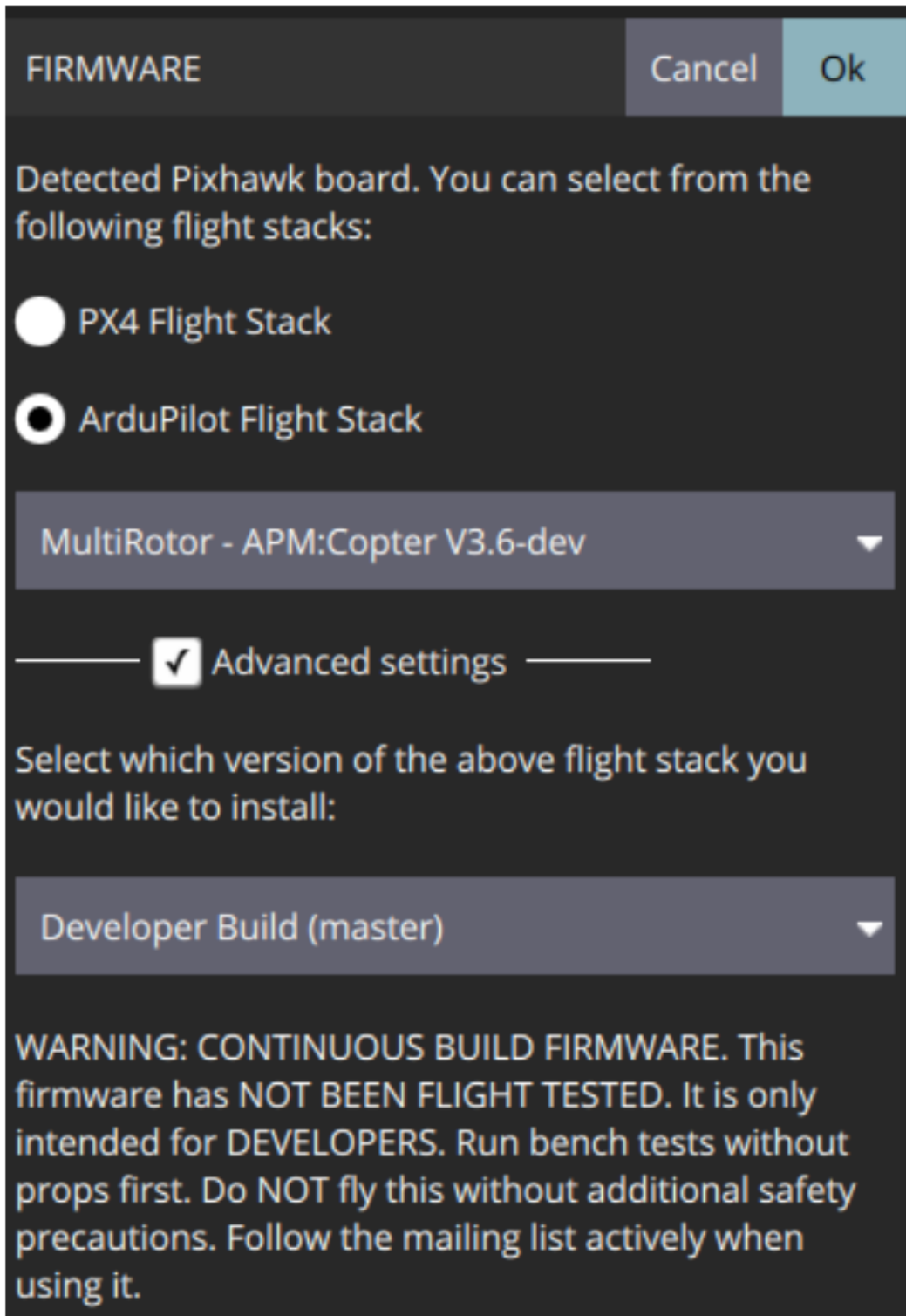
4. After making sure the sensor is connected to the Pixhawk I2C port, reboot the autopilot.

5. To verify that the sensor is operational open an Analyze Widget (Widgets/Analyze). From the list on the left hand side select; M1:DISTANCE_SENSOR.current_distance. The plot showing distance measurements should indicate that the sensor is working correctly.



4.2 ArduCopter – QGroundControl

1. Go to the Firmware tab on QGroundControl (reconnect autopilot in order to flash a new firmware). Select ArduPilot Flight Stack. In the dropdown menu select MultiRotor – APM:Copter. Check Advanced settings and select Developer Build (master) **(Warning: This is test firmware. Fly at your own risk!)**. Press OK to flash the updated firmware.



2. Go to Parameters/RNGFND and update the following fields:

- RNGFND_TYPE : 14 / TrOneI2c / TeraRangerI2C
(each of these values should work, but they might appear differently based on the GCS software version.)

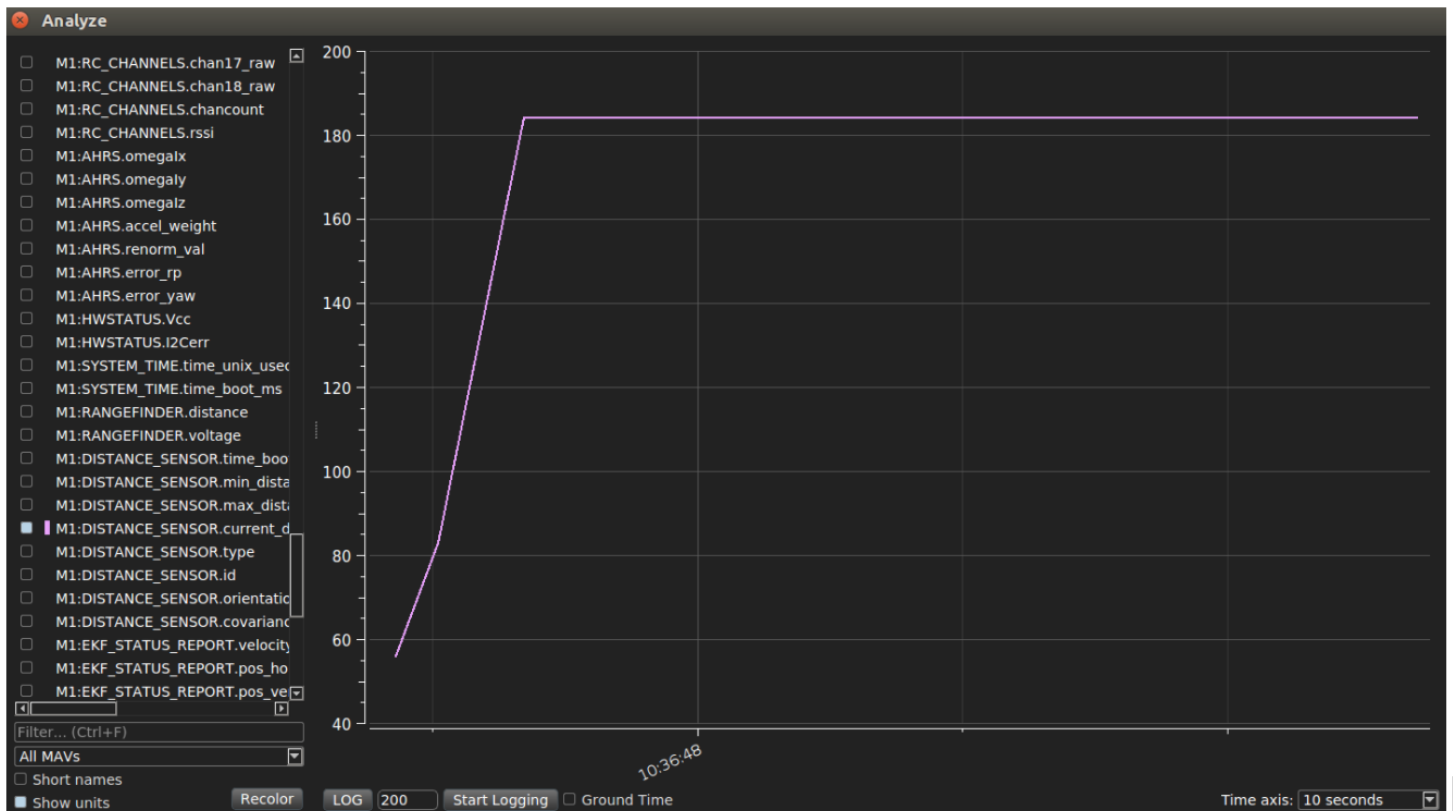
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Evo 60m	Evo 600Hz
RNGFND_ADDR: 49	RNGFND_ADDR: 49
RNGFND_MIN_CM: 50	RNGFND_MIN_CM: 75
RNGFND_MAX_CM: 6000	RNGFND_MAX_CM: 800

After setting the values in these fields, please reboot the autopilot.

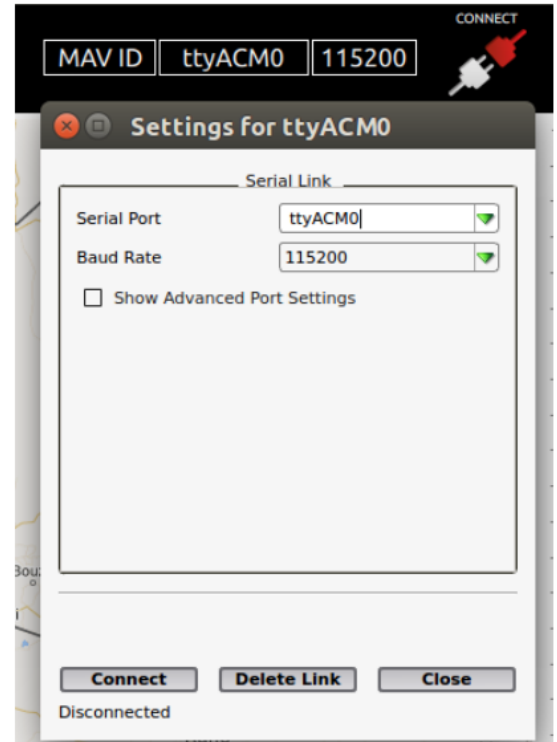
3. To verify that the sensor is operational open an Analyze Widget (Widgets/Analyze). From the list on the left hand side select; M1:DISTANCE_SENSOR.current_distance. The plot showing distance measurements should indicate that the sensor is working correctly.





4.3 ArduCopter – APM Planner 2

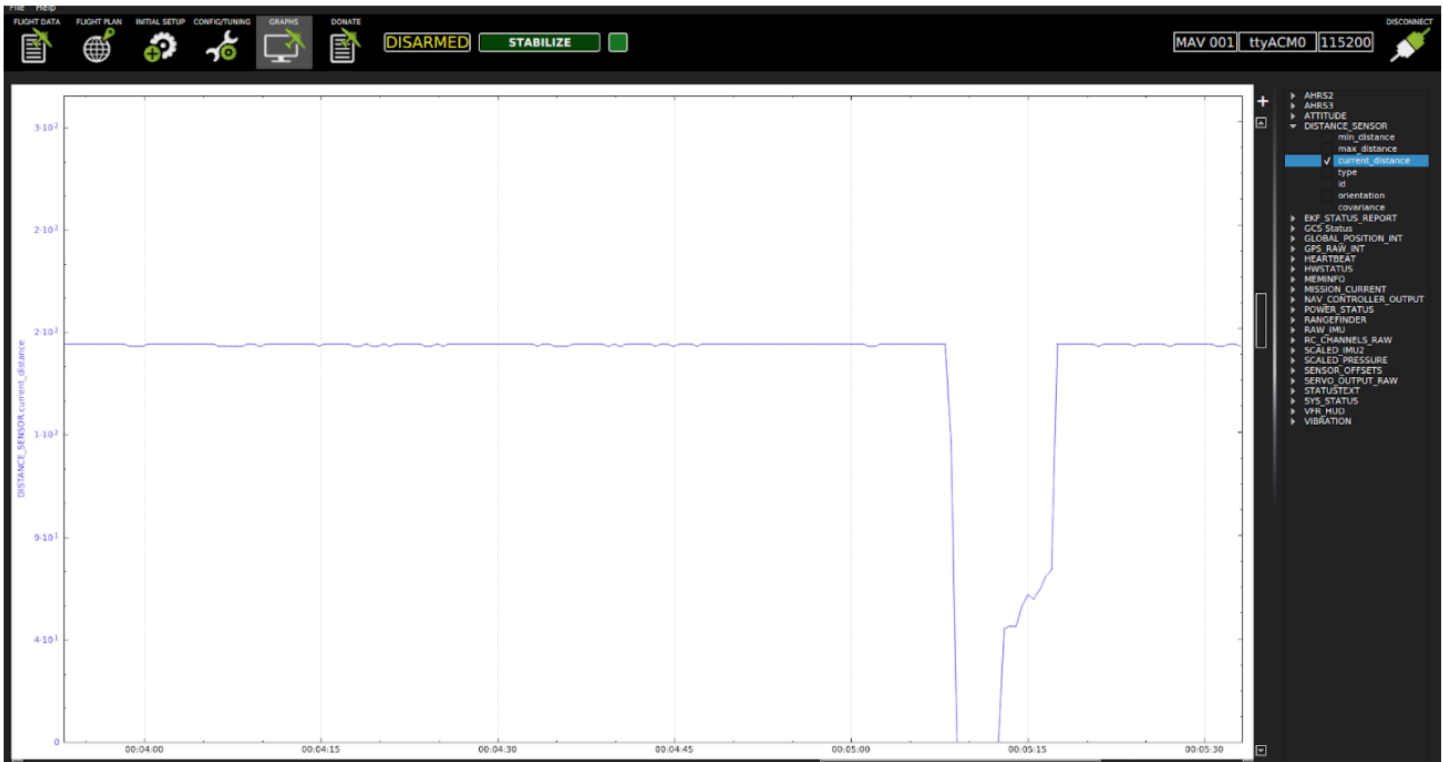
Please make sure you are running the latest version of APM Planner 2, available here: <http://firmware.ardupilot.org/Tools/APMPlanner/>

1. Open APM Planner. Go to Initial Setup, Instal Firmware and flash the latest firmware of ArduPilot.
2. Click on USB device name on the right hand side and select the appropriate Serial Port and Baud Rate for your device and press the Connect button.
3. Go to Parameters/RNGFND and update the following fields:
 - RNGFND_TYPE : 14 / TrOneI2c / TeraRangerI2C (each of these values should work, but they might appear differently based on GCS software version.)



	
Evo 60m	Evo 600Hz
RNGFND_ADDR: 49	RNGFND_ADDR: 49
RNGFND_MIN_CM: 50	RNGFND_MIN_CM: 75
RNGFND_MAX_CM: 6000	RNGFND_MAX_CM: 800

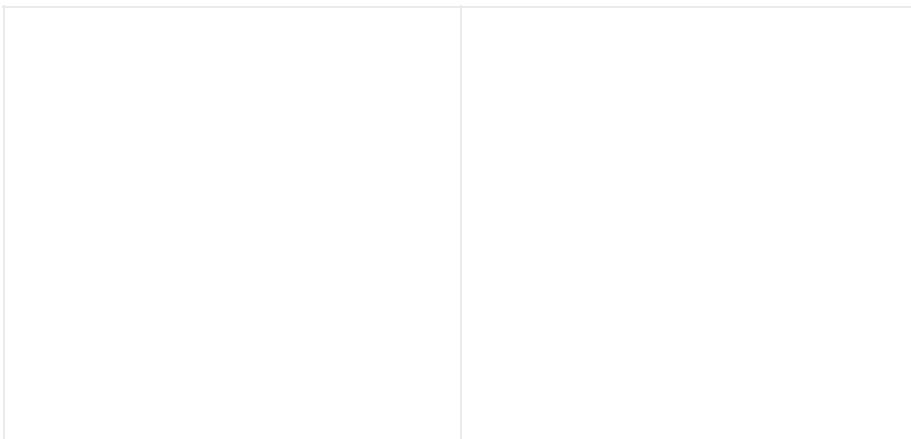
4. Reboot the autopilot and select the GRAPHS tab. On the right hand side you should see the messages from the autopilot. From the list select; DISTANCE_SENSOR/current_distance:



4.4 ArduCopter – Mission Planner

Please ensure you are running the latest version of Mission Planner, available here: <http://firmware.ardupilot.org/Tools/MissionPlanner/>

1. Open Mission Planner. Go to Initial Setup, Instal Firmware and flash the latest firmware.
2. Click on USB device name on the right-hand side and select appropriate Serial Port and Baud Rate for your device and press the Connect button.
3. Go to Parameters/RNGFND and update the following fields:
 - RNGFND_TYPE : 14 / TrOneI2c / TeraRangerI2C (each of these values should work, but they might appear differently based on GCS software version).





Evo 60m	Evo 600Hz
RNGFND_ADDR: 49	RNGFND_ADDR: 49
RNGFND_MIN_CM: 50	RNGFND_MIN_CM: 75
RNGFND_MAX_CM: 6000	RNGFND_MAX_CM: 800

4. Reboot the autopilot and select the Flight Data tab. On the left window you should see a quick tab with displayed value. Double click on one and check SonarRange. The distance is now displayed on the Quick flight data menu.

