



# Application of TF series Lidar in F4

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## 1 Document Instruction

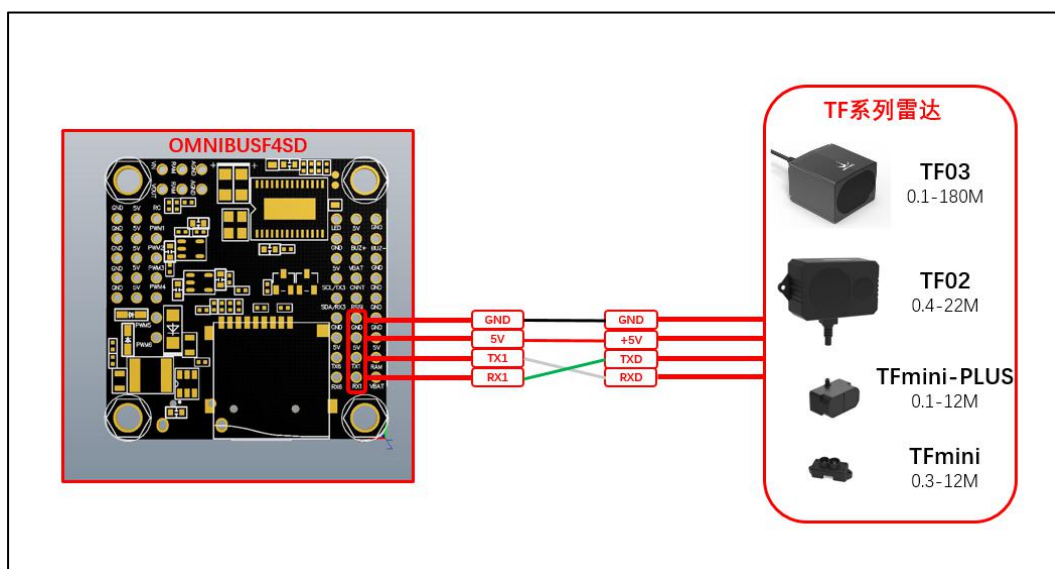
Barometer as the main sensor components height measurement of flight control, although meet the fixed high need of most of the time, but the accuracy is poor, especially in the top flight, such as automatic take-off and landing, it is difficult to ensure the accuracy of pressure data in order to realize high precision range fixed high (terrain model), auxiliary automatic land and take off (especially the fixed wing aircraft), And functions such as obstacle avoidance, which can be used with TF Lidar connected to F4.

This document describes how to establish communication with F4 using TF Lidar. The TF Lidar will act as a rangefinder and will be displayed in the SONAR sensor options of the F4.

## 2 Device and Wiring

TF series Lidar include TF03, TF02, TFMini-Plus and TFmini-S. They all have the UART interface mode, which can be directly welded to F4 and need to occupy a UART interface of F4. When connecting cables, note that the sequence corresponds to TX-Rx and RX-TX.

Taking OMNIBUSF4 SD as an example, it occupies the UART1 interface. The following figure shows the wiring sequence of the device.



### 3 Ground Station and F4 firmware

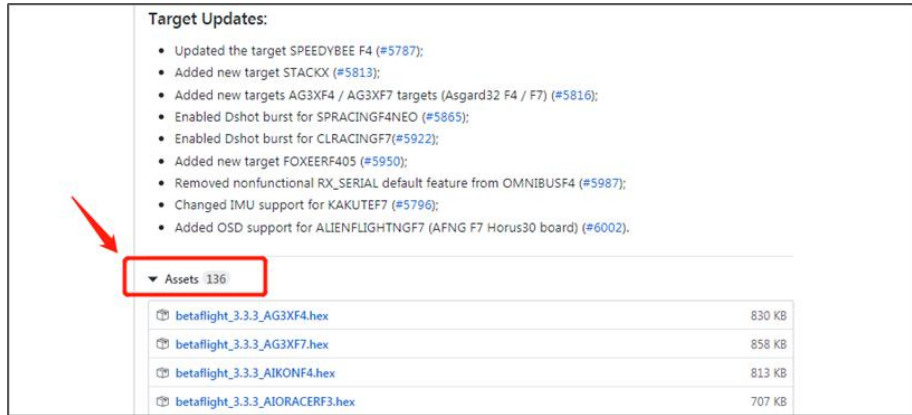
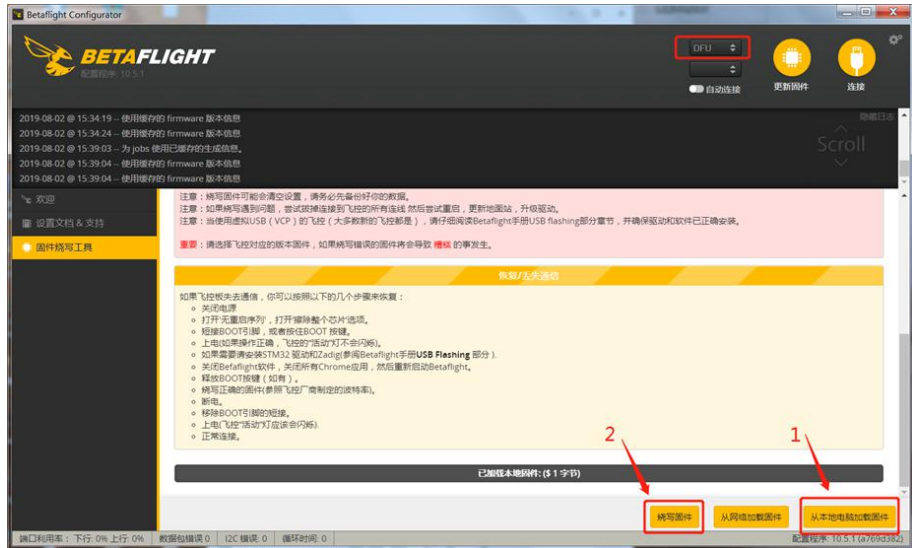
The communication between TF Lidar and F4 needs to be configured by ground station, and the corresponding F4 firmware version that can support communication needs to be fired. Next, the Betaflight and INAV ground station will be introduced for demonstration.

Ground Station	Firmware versions are supported	Download Link
BF	3.3.2 3.3.3	<a href="https://github.com/betaflight/betaflight/releases">https://github.com/betaflight/betaflight/releases</a>
CF	2.3.2	<a href="https://github.com/cleanflight/cleanflight/releases">https://github.com/cleanflight/cleanflight/releases</a>
INAV	2.2.0 2.2.1	<a href="https://github.com/iNavFlight/inav/releases">https://github.com/iNavFlight/inav/releases</a>

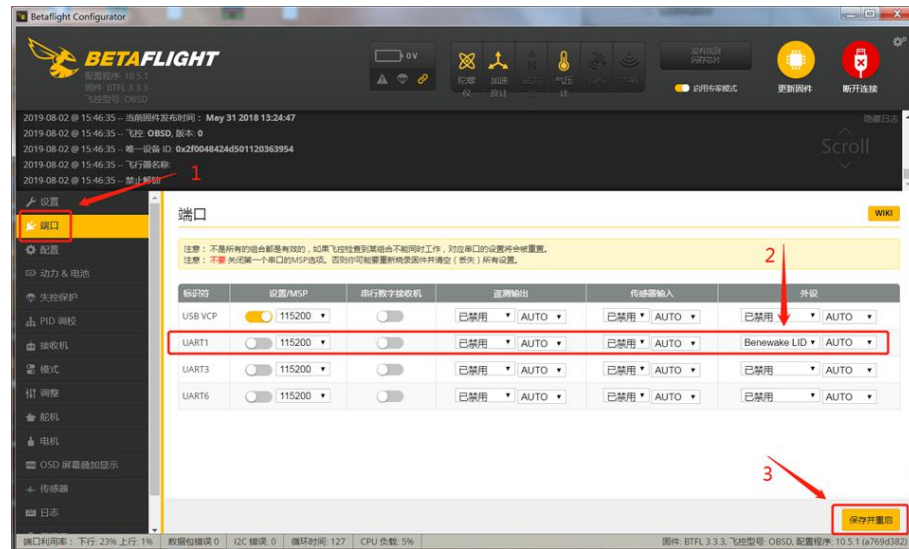
To ensure full functionality, please use the latest version of the ground station.

## 4 Betaflight Configuration

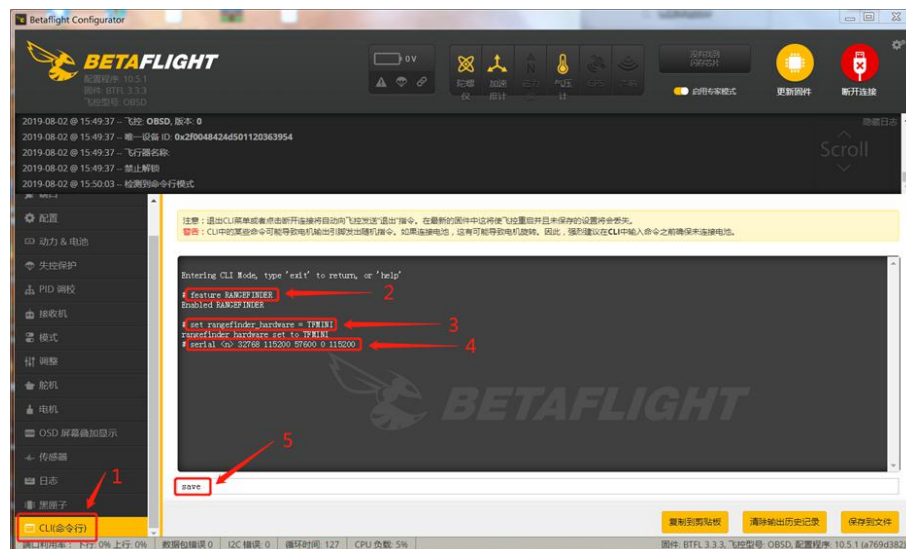
Take the F4 flight control model as OMNIBUSF4 SD for example. The steps are as follows:

Steps	Content								
①	<p>Go to the website to download the related F4 firmware</p>  <p><b>Target Updates:</b></p> <ul style="list-style-type: none"> <li>Updated the target SPEEDYBEE F4 (#5787);</li> <li>Added new target STACKX (#5813);</li> <li>Added new targets AG3XF4 / AG3XF7 targets (Asgard32 F4 / F7) (#5816);</li> <li>Enabled Dshot burst for SPRACINGF4NEO (#5865);</li> <li>Enabled Dshot burst for CLRACINGF7 (#5922);</li> <li>Added new target FOXEERF405 (#5950);</li> <li>Removed nonfunctional RX_SERIAL default feature from OMNIBUSF4 (#5987);</li> <li>Changed IMU support for KAKUTEF7 (#5796);</li> <li>Added OSD support for ALIENFLIGHTNGF7 (AFNG F7 Horus30 board) (#6002).</li> </ul> <p><b>Assets 136</b></p> <table border="1"> <tbody> <tr> <td>betafight_3.3.3_AG3XF4.hex</td> <td>830 KB</td> </tr> <tr> <td>betafight_3.3.3_AG3XF7.hex</td> <td>858 KB</td> </tr> <tr> <td>betafight_3.3.3_AIKNF4.hex</td> <td>813 KB</td> </tr> <tr> <td>betafight_3.3.3_AIORACERF3.hex</td> <td>707 KB</td> </tr> </tbody> </table>	betafight_3.3.3_AG3XF4.hex	830 KB	betafight_3.3.3_AG3XF7.hex	858 KB	betafight_3.3.3_AIKNF4.hex	813 KB	betafight_3.3.3_AIORACERF3.hex	707 KB
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②	<p>Burn the downloaded firmware into F4 flight control</p>  <p><b>Betaflight Configurator</b></p> <p>2019-08-02 @ 15:34:19 -- 使用缓存的 firmware 版本信息  2019-08-02 @ 15:34:24 -- 使用缓存的 firmware 版本信息  2019-08-02 @ 15:39:03 -- 为 jobs 使用已缓存的生成信息。  2019-08-02 @ 15:39:04 -- 使用缓存的 firmware 版本信息  2019-08-02 @ 15:39:04 -- 使用缓存的 firmware 版本信息</p> <p>注意：烧写固件可能会清空设置，请务必先备份你的数据。  注意：如果烧写遇到问题，尝试按顺序连接到飞控的所有设备，然后尝试重启，更新地图，并升级固件。  注意：当使用 USB (VCP) 的飞控（大多数新的飞控都是），请仔细阅读 Betaflight 手册 USB Flashing 部分章节，并确保驱动和软件已正确安装。</p> <p><b>重要：</b>请选择飞控对应的版本固件，如果烧写错误的固件将会导致 硬件 的损坏。</p> <p><b>数据/失去通信</b></p> <p>如果飞控失去通信，你可以按照以下的几个步骤来恢复：</p> <ul style="list-style-type: none"> <li>关闭电源</li> <li>打开“无响应序列”，打开“清除整个芯片”选项。</li> <li>短接 BOOT 引脚，或者按住 BOOT 按钮。</li> <li>上电（如果操作正确，飞控的“活动”灯不会闪烁）。</li> <li>如果不需要安装 STM32 驱动和 J-Link 驱动（参阅 Betaflight 手册 USB Flashing 部分）。</li> <li>关闭 Betaflight 软件，关闭所有 Chrome 应用，然后重新启动 Betaflight。</li> <li>短接 BOOT 按钮（如有）。</li> <li>烧写正确的固件（参阅飞控厂商制定的波特率）。</li> <li>断电。</li> <li>移除 BOOT 引脚的连接。</li> <li>上电（飞控“活动”灯应该闪烁）。</li> <li>正常连接。</li> </ul> <p>已加载本地固件：(51 字节)</p> <p>烧写固件 从网络加载固件 从本地电脑加载固件</p>								

After burning, connect to the "port" option, find the UART port connected to the TF Lidar, select "Benewake LIDAR" in the "peripheral", and finally click "Save and restart".

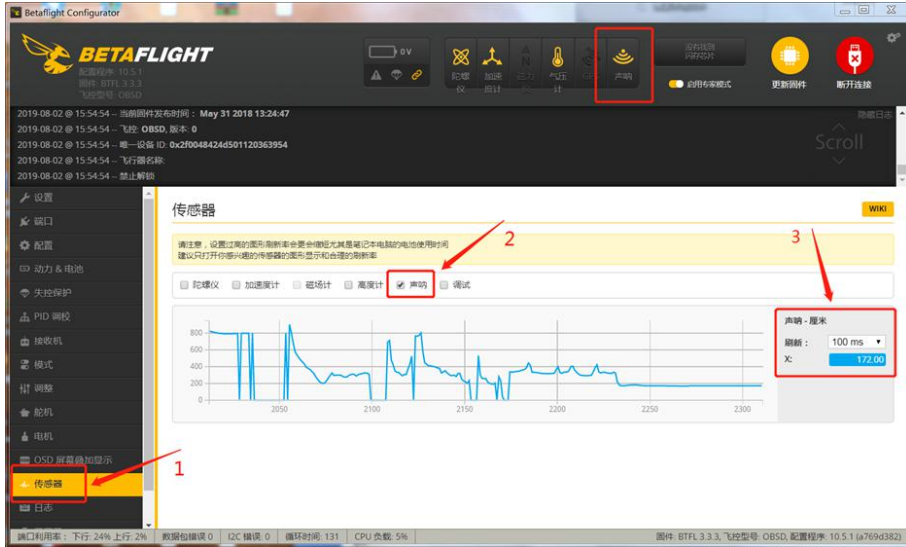


Open the CLI(Command line) and run the following commands:  
 feature RANGEFINDER  
 set rangefinder\_hardware = TFMINI  
 serial <n> 32768 115200 57600 0 115200  
 save



**Note** : There are protocols of TFMINI and TF02 in the firmware source code, so the command sending of different TF Lidars corresponds to the following:

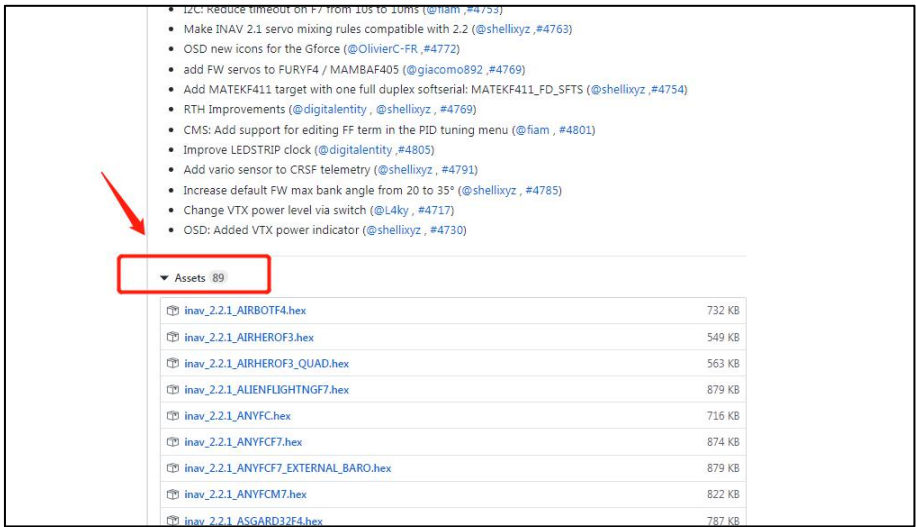
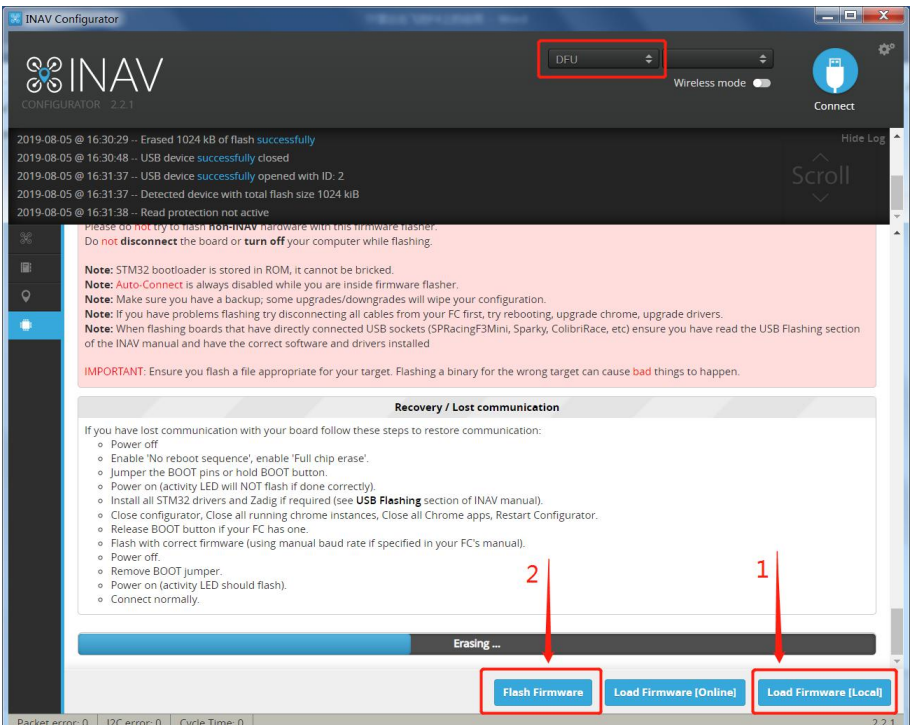
TFmini-S, TFmini-Plus, TF03— set rangefinder\_hardware = TFMINI  
 TF02— set rangefinder\_hardware = TF02

	<p>The distance varies according to the Settings. You can modify the firmware source code to customize the Settings.</p> <p>The 'n' in <code>serial &lt;n&gt;</code> is the identifier of port, for example, "UART1" means <code>serial &lt;1&gt;</code></p>
⑤	<p>Enter the "sensor" option, check the "sonar", you can see the distance display.</p> 



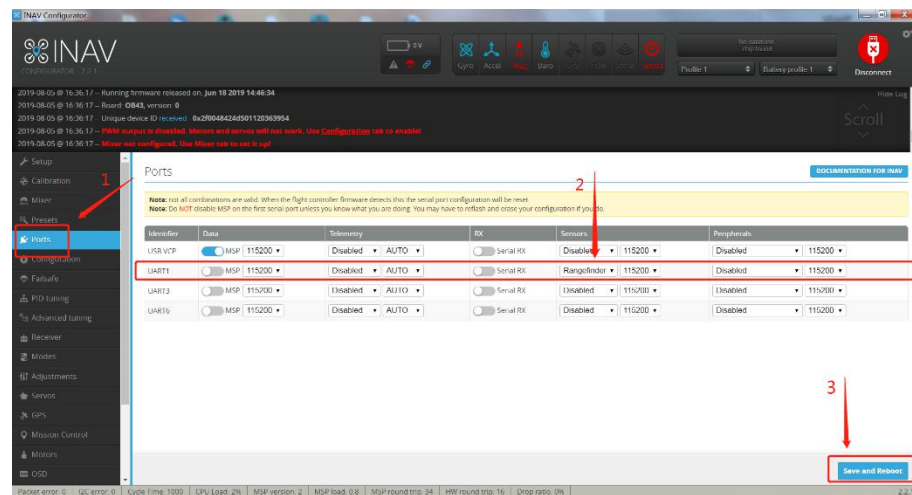
## 5 Inavflight Configuration

Ground station: INAV. The F4 flight control model used is OMNIBUSF4 V3. The steps are as follows:

Step	Content																				
①	<p>Go to the website to download the related F4 firmware</p>  <ul style="list-style-type: none"> <li>• I2C: reduce timeout on F7 from 10s to 10ms (@fiam, #4752)</li> <li>• Make INAV 2.1 servo mixing rules compatible with 2.2 (@shellxyz, #4763)</li> <li>• OSD new icons for the Gforce (@OlivierC-FR, #4772)</li> <li>• add FW servos to FURYF4 / MAMBAF405 (@giacomo892, #4769)</li> <li>• Add MATEKF411 target with one full duplex softserial: MATEKF411_FD_SFTS (@shellxyz, #4754)</li> <li>• RTH Improvements (@digitalentity, @shellxyz, #4769)</li> <li>• CMS: Add support for editing FF term in the PID tuning menu (@fiam, #4801)</li> <li>• Improve LEDSTRIP clock (@digitalentity, #4805)</li> <li>• Add vario sensor to CRSF telemetry (@shellxyz, #4791)</li> <li>• Increase default FW max bank angle from 20 to 35° (@shellxyz, #4785)</li> <li>• Change VTX power level via switch (@L4ky, #4717)</li> <li>• OSD: Added VTX power indicator (@shellxyz, #4730)</li> </ul> <table border="1"> <thead> <tr> <th>File Name</th> <th>Size</th> </tr> </thead> <tbody> <tr> <td>inav_2.2.1_AIRBOTF4.hex</td> <td>732 KB</td> </tr> <tr> <td>inav_2.2.1_AIRHEROF3.hex</td> <td>549 KB</td> </tr> <tr> <td>inav_2.2.1_AIRHEROF3_QUAD.hex</td> <td>563 KB</td> </tr> <tr> <td>inav_2.2.1_ALIENFLIGHTNGF7.hex</td> <td>879 KB</td> </tr> <tr> <td>inav_2.2.1_ANYFC.hex</td> <td>716 KB</td> </tr> <tr> <td>inav_2.2.1_ANYFCF7.hex</td> <td>874 KB</td> </tr> <tr> <td>inav_2.2.1_ANYFCF7_EXTERNAL_BARO.hex</td> <td>879 KB</td> </tr> <tr> <td>inav_2.2.1_ANYFCM7.hex</td> <td>822 KB</td> </tr> <tr> <td>inav_2.2.1_ASGARD32F4.hex</td> <td>787 KB</td> </tr> </tbody> </table>	File Name	Size	inav_2.2.1_AIRBOTF4.hex	732 KB	inav_2.2.1_AIRHEROF3.hex	549 KB	inav_2.2.1_AIRHEROF3_QUAD.hex	563 KB	inav_2.2.1_ALIENFLIGHTNGF7.hex	879 KB	inav_2.2.1_ANYFC.hex	716 KB	inav_2.2.1_ANYFCF7.hex	874 KB	inav_2.2.1_ANYFCF7_EXTERNAL_BARO.hex	879 KB	inav_2.2.1_ANYFCM7.hex	822 KB	inav_2.2.1_ASGARD32F4.hex	787 KB
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②	<p>Burn the downloaded firmware into F4 flight control</p>  <p>INAV Configurator 2.2.1</p> <p>2019-08-05 @ 16:30:29 -- Erased 1024 kB of flash successfully  2019-08-05 @ 16:30:48 -- USB device successfully closed  2019-08-05 @ 16:31:37 -- USB device successfully opened with ID: 2  2019-08-05 @ 16:31:37 -- Detected device with total flash size 1024 kB  2019-08-05 @ 16:31:38 -- Read protection not active</p> <p>Please do <b>not</b> try to flash <b>non-INAV</b> hardware with this firmware flasher.  Do <b>not</b> <b>disconnect</b> the board or <b>turn off</b> your computer while flashing.</p> <p><b>Note:</b> STM32 bootloader is stored in ROM, it cannot be bricked.  <b>Note:</b> Auto-Connect is always disabled while you are inside firmware flasher.  <b>Note:</b> Make sure you have a backup; some upgrades/downgrades will wipe your configuration.  <b>Note:</b> If you have problems flashing try disconnecting all cables from your FC first, try rebooting, upgrade chrome, upgrade drivers.  <b>Note:</b> When flashing boards that have directly connected USB sockets (SPRacingF3Mini, Sparky, ColibriRace, etc) ensure you have read the USB Flashing section of the INAV manual and have the correct software and drivers installed</p> <p><b>IMPORTANT:</b> Ensure you flash a file appropriate for your target. Flashing a binary for the wrong target can cause <b>bad</b> things to happen.</p> <p><b>Recovery / Lost communication</b></p> <p>If you have lost communication with your board follow these steps to restore communication:</p> <ul style="list-style-type: none"> <li>• Power off</li> <li>• Enable 'No reboot sequence', enable 'Full chip erase'.</li> <li>• Jumper the BOOT pins or hold BOOT button.</li> <li>• Power on (activity LED will NOT flash if done correctly).</li> <li>• Install all STM32 drivers and Zadig if required (see <b>USB Flashing</b> section of INAV manual).</li> <li>• Close configurator, Close all running chrome instances, Close all Chrome apps, Restart Configurator.</li> <li>• Release BOOT button if your FC has one.</li> <li>• Flash with correct firmware (using manual baud rate if specified in your FC's manual).</li> <li>• Power off.</li> <li>• Remove BOOT jumper.</li> <li>• Power on (activity LED should flash).</li> <li>• Connect normally.</li> </ul> <p>Erasing ...</p> <p>Flash Firmware Load Firmware [Online] Load Firmware [Local]</p>																				

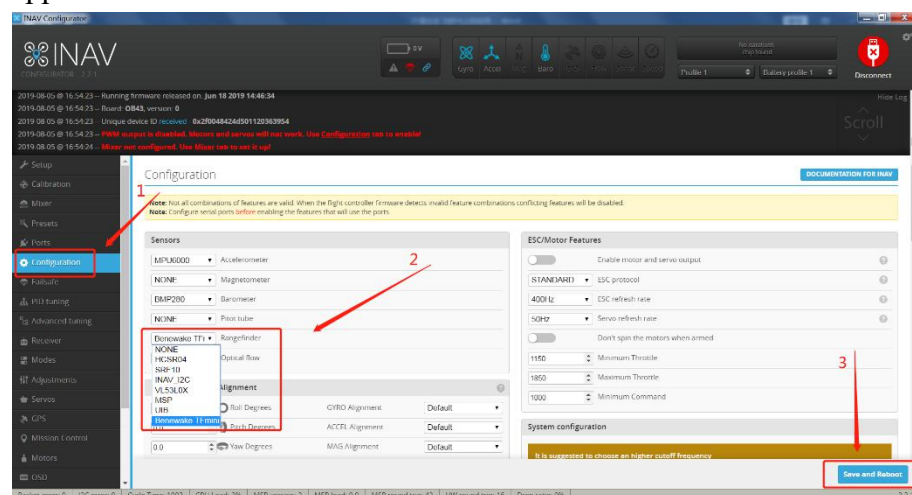
After burning, connect to "Ports", find the UART port connected to TF Lidar, select "Rangefinder" in "Sensors", and click "Save and Reboot".

③



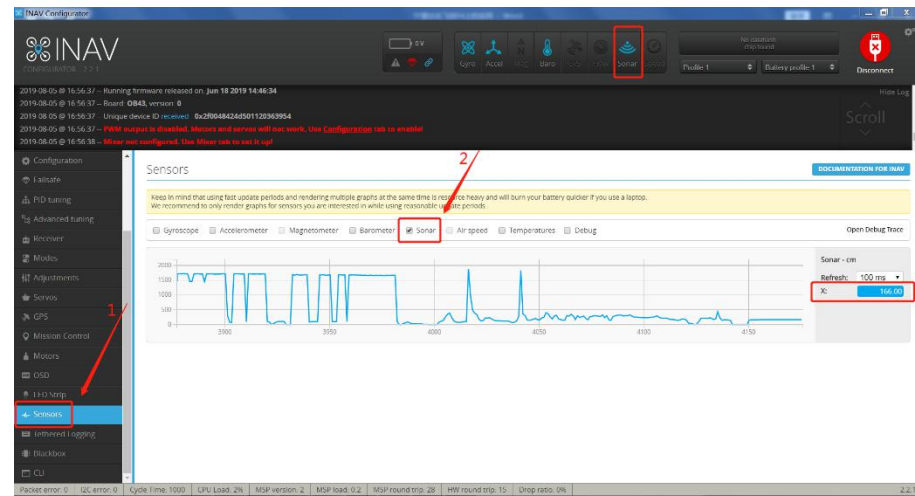
After the Reboot, go to the "Configuration" option, select "Benewake TFmini" in the "Rangefinder", and finally click "Save and Reboot".  
Note: TFmini-S, TFMini-Plus and TF02 are applicable.

④



Enter "Sensors" option, check "Sonar", then can see the distance display.

⑥



## 6 Cautions

- ① TF Lidar should be the factory default serial mode
- ② The serial port of F4 flight control terminal shall not be occupied by other peripherals such as receiver
- ③ F4 flight control should be placed horizontally, otherwise will show "-1"
- ④ In BF and CF source code, there are "TFMINI" and "TF02" two protocols,

Protocol	Applicable TF Lidar
"TFMINI"	TFmini-S、 TFmini-Plus、 TF02、 TF03
"TF02"	TFmini-Plus、 TF02

- ⑤ TF03 cannot be used in INAV