

Application of TFmini Plus in PX4

www.benewake.com Benewake (Beijing) Co., Ltd. PX4 is popular and used by a lot of customers. TFmini Plus is popular in the LiDAR market. This article introduce the detail application of TFmini Plus in PX4. This article is based on QGroundControl v3.4.4 and PX4 v1.8.2, any incomplete function at customer side should be upgraded in Ground Control Station and firmware.

I Hardware connection

We take Pixhawk as an example for connection, see following picture:



Please install TFmini Plus on the aircraft and make sure it's firm, lens should face downward and there is no obstacle before that, it should be at least 10cm between TFmini Plus lens and ground!

II Software setting

1.Choose *Setting--Parameters--EKF2_-EKF2_RNG_AID*, select *Range aid enabled*, see the following picture:



QGroundControl v	/3.4.4			- σ ×
File Widgets				
ي، 🍪 🖸	\land 🗟 🔺 🔏 🛛	 ± 4 🗎 🛛	A Manual Disarme	ext pro
Vehicle Setup	Search:	Clear .		אייין איי אייין אייין אייי
Summary	Standard	EKF2_PCOEF_Y	0.00	
Firmware	Battery Calibration	EKF2_PC0EF_Z	0.00	
Airframe	Comera trigger	EKF2_REQ_EPH		Required EPH to use GPS
	Commander	EKF2_REQ_EPV	8.0 s	Required EPV to use GPS
((4)) Sensors	Data Link Loss	EKF2_REQ_GDOP		Required GDoP to use GPS
Redio	EKF2	EKF2_REQ_HDRIFT	0.30 m/s	Maximum horizontal drift speed to use GPS
ANNUAL C	FW Attitude Control	EKF2_REQ_NSATS		
🚺 Flight Modes	Follow target	EKF2_REQ_SACC	1.00 m/s	Required speed accuracy to use GPS
Contraction of the second	FOLLOW LALEVL	EKF2_REQ_VDR1FT	0.50 m/s	Maximum vertical drift speed to use GPS
- Forer	urs	EKF2_RNG_AID		Range sensor aid
Safety	GPS Failure Navigation	EKF2_RNG_A_HMAX	5.000	Maximum absolute altitude (height above ground level) allowed for range aid mode
1 Juning	Geotence	EKF2_RNG_A_IGATE	1.000 SD	Gate size used for innovation consistency checks for range aid fusion.
161	MAVLink	EKF2_RNG_A_VMAX	1.000	Maximum horizontal velocity allowed for range aid mode
Camera	Mission	EKF2_RNG_DELAY		Range finder measurement delay relative to IMU measurements
Q Parameters	Mount.	EKF2_RNG_GATE	5.0 SD	Gate size for range finder fusion
	ilticopter Attitude Contr	EKF2_RNG_NOISE		Measurement noise for range finder fusion
	Uticonter Position Contr	EKF2_RNG_PITCH	0.000 rad	Range sensor pitch offset
	DBM Chatemater	EKF2_RNG_POS_X	0.000 m	X position of range finder origin in body frame
	Two outputs	EKF2_RNG_POS_Y	0.000 m	Y position of range finder origin in body frame
	Precision Land	EKF2_RNG_POS_Z	0.000 m	Z position of range finder origin in body frame
	Radio Calibration	EKF2_RNG_SFE	0.050 m/m	Range finder range dependant noise scaler
	Radio Switches	EKF2_TAS_GATE	3.0 SD	
	Return Mode	EKF2_TAU_POS		Time constant of the position output prediction and smoothing filter. Controls how tightly the output track the EKF states
	Return To Land	EKF2_TAU_VEL	0.25 s	Time constant of the velocity output prediction and smoothing filter
	SD Logging	EKF2_TERR_GRAD	0.50 m/m	Magnitude of terrain gradient
	Sensor Calibration	EKF2_TERR_NOISE	5.0 m/s	Terrain altitude process noise - accounts for instability in vehicle height estimate
		EKF2 WIND NOISE	0.100 m/s/s	Process noise for wind velocity prediction

Customer setting:

(1) EKF2_RNG_A_VMAX

(2) EKF2_RNG_A_HMAX

Detail description could be found at the parameters place.

2.Select *Setting--Sensors--SENS_EN_TFMINI*, select *Enabled*, see the following picture:

QGroun	dControl	/3.4.4			
File Widg	gets				
۲ 🕄	, ~ ?	10 🗟 🗠 🔏	0.0	Manual Disarmed	
Vehicle	Setup	Search:	Clear		
		LRI'S	CAL_MAG_SIDES		Bitfield selecting mag sides for calibration
- Firm	ware	FW Attitude Control	IMU_ACCEL_CUTOFF	30.000 Hz	Driver level cutoff frequency for accel
		Follow target	IMU_GYRO_CUTOFF	80.000 Hz	Driver level cutoff frequency for gyro
Airf		GPS	SENS_BARO_QNH	1013.250 hPa	QNH for barometer
(1) Sens		GPS Failure Navigation	SENS_BOARD_ROT		Board rotation
6-0		Geofence	SENS_BOARD_X_OFF	0.000 deg	
C Radi		MAVLink	SENS_BOARD_Y_OFF	0.000 deg	
	ht Modes	Wission	SENS_BOARD_Z_OFF	0.000 deg	Board rotation Z (YAW) offset
		#155100	SENS_EN_LL40LS		Lidar-Lite (LL40LS)
Powe:		Mount	SENS_EN_SF0X		Lightware laser rangefinder (serial)
Safety	ilticopter Attitude Contro	SENS_EN_SF1XX		Lightware SF1xx/SF20/LW20 laser range finder (i2c) $% \left(1-\frac{1}{2}\right) =0$	
		Ilticopter Position Contro	SENS_EN_TFMINI		Benewake TFmini laser rangefinder
toni		PWM Outputs	SENS_EN_THERMAL	Thermal control una	vThermal control of sensor temperature
Came		Precision Land	SENS_EN_TRANGER		TeraRanger Rangefinder (i2c)
		Radio Calibration			
Ap Para	meters	Radio Switches			
		Return Mode			
		Return To Land			
		SD Logging			
		Sangar Calibration			
		Soncore			
		Demotr D			
		System			
		Thermal Compensation			
		VTOL Attitude Control			
		Developer -			
		System -			

2. TFmini Plus measurement result will be displayed on the panel, see the following picture:



