Marvelmind and PX4 integration

v2022_09_16

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Version Changes

V2022_09_16

- Super-Beacon 2 and Super-Beacon 3 connection scheme updated

V2022_05_13

- Super-Beacon 2 and Super-Beacon 3 connection scheme added to section 3
- Connect Pixhawk4 to R8EF radiolink scheme updated

1. Used hardware and software

To integrate Marvelmind with PX4 you will need:

- 1 x Pixhawk4 flight controller, firmware PX4 v1.10.1, QGroundControl v4.0
- 1 x Holybro Pixhawk 4 Power Module (PM07)
- 1 x R8EF RadioLink
- 1 x T8FB FHSS system
- 1 x Drone with battery
- 8 x Marvelmind Super-Beacon (6 x stationary beacons, 2 x paired mobile beacons on the drone) firmware V6.215+, NIA architecture, Dashboard v6.215+
- 1 x Modem HW v4.9 firmware V6.215+, NIA architecture, Dashboard v6.215+

2. Pixhawk4 setup:

- Update firmware on PX4 v1.10.1



- Choose your drone airframe



- Carry out the necessary calibrations according to the instructions of Qgroundcontrol:

- Disable Compasses inconsistency check

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Vehicle Setup	Search:	Clear Show mo	dified only	
Summary	Standard	COM_ARM_AUTH	256010	Arm authorization parameters, this uint32_t will be split between starting from the LSB: - 8bits to authorizer system id - 16bits to authen
Firmware	Battery Calibration	COM_ARM_CHK_ESCS		Require all the ESCs to be detected to arm
anna anna anna anna anna anna anna ann	Camera Control	COM_ARM_IMU_ACC	0.70 m/s/s	Maximum accelerometer inconsistency between IMU units that will allow arming
Airframe	Camera trigger	COM_ARM_IMU_GYR	0.250 rad/s	Maximum rate gyro inconsistency between IMU units that will allow arming
((=)) Sensors	Commenter	COM_ARM_MAG_ANG		Maximum magnetic field inconsistency between units that will allow arming Set -1 to disable the check
	Commander	COM_ARM_MIS_REQ		Require valid mission to arm
Radio	DShot	COM_ARM_SWISBTN		Arm switch is only a button
	Data Link Loss	COM_ARM_WO_GPS		Allow arming without GPS

- Enable external Marvelmind compass as primary

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Vehicle Setup	Search:	Clear Show m	nodified only		
Summary	Standard	- CAL_MAGO_EN		Mag 0 enabled	
Firmware	Developer	- CAL_MAG0_ID		ID of Magnetometer the calibration is for	
	Other	CAL_MAG0_ROT	Internal mag	Rotation of magnetometer 0 relative to airframe	
Airframe	System	CAL_MAG0_XOFF		Magnetometer X-axis offset	
((•)) Sensors	Commander	CAL_MAG0_XSCALE		Magnetometer X-axis scaling factor	
	EKF2	CAL_MAG0_YOFF		Magnetometer Y-axis offset	
e e Radio	Land Detector	CAL_MAG0_YSCALE		Magnetometer Y-axis scaling factor	
Flight Mode	S Sansar Calibration	CAL_MAG0_ZOFF		Magnetometer Z-axis offset	
Downr	Sensor Calibration	CAL_MAG0_ZSCALE		Magnetometer Z-axis scaling factor	
Power	Sensors	CAL_MAG1_EN		Mag 1 enabled	
Motors	System	CAL_MAG1_ID		ID of Magnetometer the calibration is for	
Safebr		CAL_MAG1_ROT		Rotation of magnetometer 1 relative to airframe	
Salety		CAL_MAG1_XOFF	0.000	Magnetometer X-axis offset	
Tuning		CAL_MAG1_XSCALE	1.000	Magnetometer X-axis scaling factor	
Camera		CAL_MAG1_YOFF	0.000	Magnetometer Y-axis offset	
Concid		CAL_MAG1_YSCALE	1.000	Magnetometer Y-axis scaling factor	
Parameters		CAL_MAG1_ZOFF	0.000	Magnetometer Z-axis offset	
		CAL_MAG1_ZSCALE	1.000	Magnetometer Z-axis scaling factor	
		CAL_MAG2_ID	0	ID of Magnetometer the calibration is for	
		CAL_MAG2_ROT	No rotation	Rotation of magnetometer 2 relative to airframe	
		CAL_MAG3_ID	U alla antabian	ID or Magnetometer the calibration is for	
_		CAL_MAG3_ROT	No rotation	Rotation of magnetometer 2 relative to airframe	
		CAL_MAG_PRIME	396809	Primary mag ID	

QGroundContro		2	Contraction of the	- feet
ک <mark>ی چہ</mark> ک	१ 📣 🗟 । 📢	🌜 📥 📶 📋 N/A	• Disarmed •	Manual -
Vehicle Setup	Search:	Clear Show mo	dified only	
Summary	Standard	EKF2_MAGB_K	0.20	Maximum fraction of learned mag bias saved at each disarm. Small
Firmware	Battery Calibration	EKF2_MAGB_VREF	0.00000025 mGauss**2	State variance assumed for magnetometer bias storage. This is a r
	Camera Control	EKF2_MAG_ACCLIM	0.50 m/s**2	Horizontal acceleration threshold used by automatic selection of m
Airframe	Comoro triogor	EKF2_MAG_B_NOISE	0.000100 Gauss/s	Process noise for body magnetic field prediction
((-))	Camera trigger	EKF2_MAG_DELAY	0.0 ms	Magnetometer measurement delay relative to IMU measurements
Sensors	Commander	EKF2_MAG_E_NOISE	0.001000 Gauss/s	Process noise for earth magnetic field prediction
o o Radio	DShot	EKF2_MAG_GATE	3.0 SD	Gate size for magnetometer XYZ component fusion
001 Flinks Medee	Data Link Loss	EKF2_MAG_NOISE	0.050 Gauss	Measurement noise for magnetometer 3-axis fusion
	EKF2	EKF2_MAG_TYPE	Magnetic heading	Type of magnetometer fusion
Power	Events	EKF2_MAG_YAWLIM	0.25 rad/s	Yaw rate threshold used by automatic selection of magnetometer i
Motors	FW Attitude Control	EKF2_MIN_OBS_DT	20 ms	Minimum time of arrival delta between non-IMU observations befo
	Esilura Datastar	EKF2_MIN_RNG	0.10 m	Expected range finder reading when on ground
Safety		EKF2_MOVE_TEST	1.0	Vehicle movement test threshold
م الم Tuning	Follow target	EKF2_NOAID_NOISE	10.0 m	Measurement noise for non-aiding position hold

- Set the compass usage mode EKF_MAG2_TYPE:

- Enable the use of GPS to determine the height of EKF2_HGT_MODE:

🖸 Q(GroundControl	a Barrowski	a di manta) ×
٩	<mark>%</mark> %	al 🗟 i 🛋 🔊	5 10 📥 л 📋	N/A • Disarmed	Hold	PX4
Ve	ehicle Setup Summary	Search:	Clear Show mo EKF2_GPS_POS_Z	odified only 0.000 m	Z position of GPS antenna in body frame (down axis with origin relative to vehicle centre of gravity)	Tools
- P**		Standard	EKF2_GPS_P_GATE	5.0 SD	Gate size for GPS horizontal position fusion	
	Firmware	Battery Calibration	EKF2_GPS_P_NOISE	0.50 m	Measurement noise for gps position	
	Airframe	Camera Control	EKF2_GPS_TAU	10.0 s	Multi GPS Blending Time Constant	
••		Camera trigger	EKF2_GPS_V_GATE	5.0 SD	Gate size for GPS velocity fusion	
((•))	Sensors	Commander	EKF2_GPS_V_NOISE	0.50 m/s	Measurement noise for gps horizontal velocity	
00	Radio	DShot	EKF2_GYR_B_NOISE	0.001000 rad/s**2	Process noise for IMU rate gyro bias prediction	
		Data Link Loss	EKF2_GYR_NOISE	0.0150 rad/s	Rate gyro noise for covariance prediction	
N Flight	Flight Modes	odes	EKF2_HDG_GATE	2.6 SD	Gate size for magnetic heading fusion	
Power	Power		EKF2_HEAD_NOISE	0.30 rad	Measurement noise for magnetic heading fusion	
		Events	EKF2_HGT_MODE		Determines the primary source of height data used by the EKF	
Ŵ	Motors	FW Attitude Control	EKF2_IMU_POS_X	0.000 m	X position of IMU in body frame (forward axis with origin relative to vehicle centre of gravity)	
ê	Safety	Failure Detector	EKF2_IMU_POS_Y	0.000 m	Y position of IMU in body frame (right axis with origin relative to vehicle centre of gravity)	
		Follow target	EKF2_IMU_POS_Z	0.000 m	Z position of IMU in body frame (down axis with origin relative to vehicle centre of gravity)	
ំំំំំំ	Tuning	GPS	EKF2_MAGB_K	0.20	Maximum fraction of learned mag bias saved at each disarm. Smaller values make the saved mag bias learn slower from flight to flight. Larger values make it lea	arn faster. M
D	Camera	GPS Failure Navigation	EKF2_MAGB_VREF	0.00000025 mGauss**2	2 State variance assumed for magnetometer bias storage. This is a reference variance used to calculate the fraction of learned magnetometer bias that will be use	ed to update
	_	Geofence	EKF2_MAG_ACCLIM	0.50 m/s**2	Horizontal acceleration threshold used by automatic selection of magnetometer fusion method. This parameter is used when the magnetometer fusion method is	s set autom
Ap Param	Parameters	Tridium CPD	EKF2_MAG_B_NOISE	0.000100 Gauss/s	Process noise for body magnetic field prediction	
		Indian SDD	EKF2_MAG_DELAY	0.0 ms	Magnetometer measurement delay relative to IMU measurements	
		Land Detector	EKF2_MAG_E_NOISE	0.001000 Gauss/s	Process noise for earth magnetic field prediction	
_		MAVLink	EKF2_MAG_GATE	3.0 SD	Gate size for magnetometer XYZ component fusion	
		Miscellaneous	EKF2_MAG_NOISE	0.050 Gauss	Measurement noise for magnetometer 3-axis fusion	
		Mission	FKF2 MAG TYPF		Type of magnetometer fusion	

- If you need to test arming with a USB-connected Pixhawk, enable this feature (CBRK_USB_CHECK):

QGroundControl		Contract of the local division of the local	The second	And the second sec	
🕲 <mark>🗞</mark> 🍳	/ 🗟 🗸	🔪 🔏 🗓 📥 💷	N/A 🔶 Disarmed - Hold -		
Vehicle Setup	Search: cbrk	Clea			
Summary	CBRK_AIRSPD_CHK	0 Chan	ge of parameter CBRK_USB_CHK requires a Vehicle reboot to take effect.	×	
Firmware	CBRK_BUZZER	0			
	CBRK_ENGINEFAIL	284953	Circuit breaker for engine failure detection		
Airframe	CBRK_FLIGHTTERM	121212	Circuit breaker for flight termination		
((a)) Sensors	CBRK_GPSFAIL				
((-))	CBRK_IO_SAFETY		Circuit breaker for IO safety		
Radio	CBRK_RATE_CTRL		Circuit breaker for rate controller output		
NOL Flight Modes	CBRK_SUPPLY_CHK		Circuit breaker for power supply check		
100	CBRK_USB_CHK		Circuit breaker for USB link check		
Power	CBRK_VELPOSERR		Circuit breaker for position error check		
Motors	COM_POSCTL_NAVL	Altitude/Manual. Assu	me Position control navigation loss response		
	FD_FAIL_P	60 degrees	FailureDetector Max Pitch		
Safety	FD_FAIL_R	60 degrees	FailureDetector Max Roll		
¦d Tuning					
Camera					
Parameters					

3. Wiring connections (disconnect USB from Pixhawk4 before doing this).

Connect Pixhawk4 to Super-Beacon hedgehog: -

Data from Super-Beacon

Connect Pixhawk4 to Super-Beacon 2 and Super-Beacon 3 hedgehog: -

			Data fi	om Pixhawk
		Pixhawk4 GPS MOUDLE	part	
Super-beacon external interface 4x4 pinout		Pin	Signal	Volt
- External pins		1 (red)	VCC	+5V
Internal solderable contacts Safety sw	itch	2 (black)	TX (out)	+3.3V
SPI1_SCK1 VCA MC1_dets MC1_dets CR0 SPI1_MISO1		3 (black)	RX (in)	+3.3V
		4 (black)	SCL1	+3.3V
		5 (black)	SDA1	+3.3V
	ц <u> </u>	6 (black)	SAFETY_SWITCH	+3.3V
MIC3_data / GND PPS Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q		7 (black)	SAFETY_SWITCH_ LED	+3.3V
		8 (black)	VDD_3V3	+3.3V
MIC_clock		9 (black)	BUZZER	+5V
MIC4_data VBAT		10 (black)	GND	GND
Reset I2C1_SDA1				

Data from Super-Beacon

- Connect Pixhawk4 to R8EF radio link

Radiolink R8EF, 2.4G 8 channels receiver, S-BUS, PPM and PWM signal support, use for radiolink transmitter T8FB

- Connect Pyxhawk4 to Holybro Pixhawk 4 Power Module (PM07):
 - Connect Power1 port on Pixhawk4 to Pwr1 port on PM07 by 6-wires pin-to-pin cable
 - Connect **I/O PWM OUT** port on Pixhawk4 to I/O-PWM-in port on PM07 by 10wires pin-to-pin cable
- Connect PWM inputs of SCM motor controllers on drone to FMU-PWMout connector on PM07 board
- Adjust Marvelmind hedgehog streaming output as shown on the picture:

Interfaces	(-) collapse		
UART speed, bps	115200		
Streaming output	USB+UART		
Protocol on UART/USB output	UBX (u-blox)		
External device control	No control		
Raw inertial sensors data	disabled		
Processed IMU data	disabled		
Raw distances data	disabled		
Quality data stream	disabled		
Telemetry stream	disabled		
Locations of other hedgehogs	enabled		
IMU via modem	(+) expand		
User payload data size (032)	0		

- Place stationary beacons and build map as shown in section 7.7 of operating manual (use vertical submap for precise height)
- Place two mobile beacons on drone (one connected to Pixhawk4 and second not connected) and enable paired beacons feature as shown in section 7.10 of operating manual

- Connect battery power to PM07 board. Make sure Pixhawk4 is powered after waking the Marvelmind hedgehog connected to it
- Arm the motors and try to fly