

Express LRS

How to configure the receiver as a GYRO

Prepared By

Carlou Joseph Torres
SAP EAM Application Associate

User Guide

Table of Contents

Topic	Title	Page
1.	Parts list	3
2.	Wiring Diagram	3
3.	Download the firmware from Github	4
4.	Flash the firmware into the receiver	6
5.	How to enter binding mode	9
6.	Receiver hardware requirement	10
7.	How to navigate to the GYRO menus	10
8.	Gyro Inputs	12
9.	Gyro Output	15
10.	Gyro Mode	17
11.	Gyro PID's	18
12.	Gyro Settings	19
13.	Gyro Gain	19
14.	3D Printed receiver cradle	20
15.	Weight and EXPO control Error! Bookmark not defined.	
16.	Inputs Error! Bookmark not defined.	
17.	Mixer Error! Bookmark not defined.	
18.	Special functions Error! Bookmark not defined.	
19.	Basic setup – No Stabilization Error! Bookmark not defined.	
20.	Receiver with an Accelerometer Error! Bookmark not defined.	

1. Parts list

Receiver

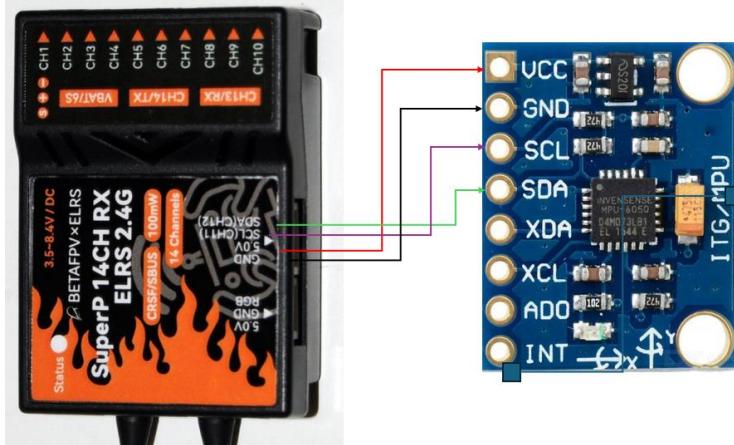
- Express LRS – Beta FPV Super 14CH Diversity Receiver



- GY-521 MPU-6050 MPU6050 3 Axis Accelerometer Gyroscope Module 6 DOF 6-axis Accelerometer Gyroscope Sensor Module 16 Bit AD Converter Data Output IIC I2C



2. Wiring Diagram



3. Bugs identified during my testing

1. With the BetaFPV SuperP receiver, after flashing the GYRO firmware, it does not enter WiFi mode even after the WiFi Interval time has elapsed. Refer to Chapter 5 for a workaround. I have not tested other receivers.
2. The Gyro Align on FLIP (Receiver inverted) are not working. Refer to chapter 13 for more details.
3. The master gain is only applicable to Rate mode. You will not be able to remotely adjust the gain on the other modes (i.e. SAFE, LEVEL HOVER). On these modes, the max gain set in the Axis gain is used. If its too much, the plane will shake on that axis during flight. The only way to fix it is to land and adjust the axis gain of that surface. Refer to chapter 14 for more details.
4. Can I request to add 5 positions in the mode channel in order to control the five modes if the GYRO either via two switches or via the 6-position switch of the RadioMaster? Refer to Chapter 11

4. Download the firmware from Github

URL = <https://github.com/awigen/ExpressLRS/tree/add-rx-gyro-support>

This branch is 14 commits ahead of, 321 commits behind ExpressLRS/ExpressLRS:master .

Code

awigen / ExpressLRS Public
forked from [ExpressLRS/ExpressLRS](#)

Code Issues 3 Pull requests Actions Projects Security Insights

add-rx-gyro-sup... 6 Branches 0 Tags Go to file

awigen Gyro: Add hover mode strength setting 127765d · 2 years ago 1,752 Commits

.github Use external targets repo (ExpressLRS#2400) 2 years ago

src Gyro: Add hover mode strength setting 2 years ago

.gitattributes Initial commit 7 years ago

.gitignore Use external targets repo (ExpressLRS#2400) 2 years ago

LICENSE Create LICENSE 4 years ago

README.md Gyro: Change README.md to be a warning ... 2 years ago

betafpv-mpu6050.jpg Gyro: Change README.md to be a warning ... 2 years ago

About
STM32/ESP32/ESP8265-based High-Performance Radio Link for RC applications

Readme
GPL-3.0 license
Activity
20 stars
0 watching
4 forks
Report repository

Releases
No releases published

Packages

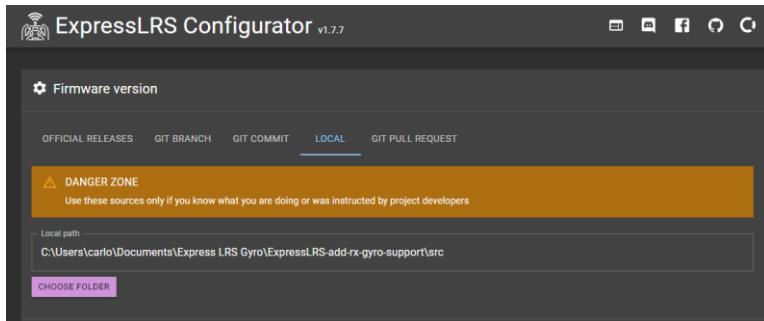
- Extract the firmware and save it in your local drive. In this example we will save it at C:\Users\carlo\Documents\Express LRS Gyro\ExpressLRS-add-rx-gyro-support

- The firmware that we will be using is in the SRC the folder.
C:\Users\carlo\Documents\Express LRS Gyro\ExpressLRS-add-rx-gyro-support\src

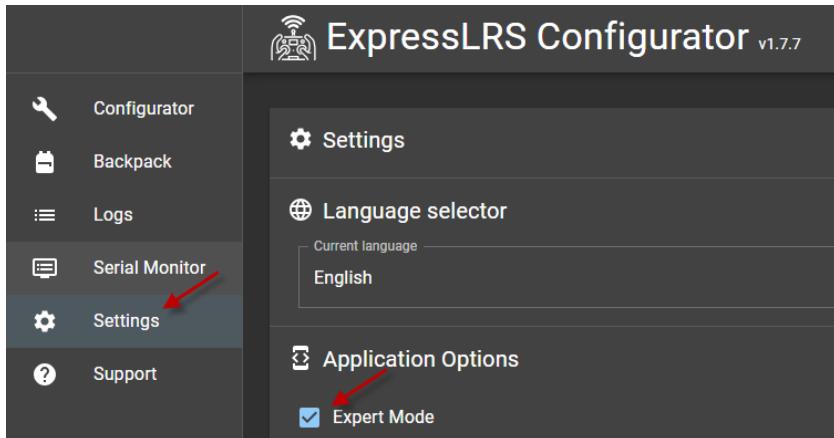
5. Flash the firmware into the receiver

Launch ExpressLRS Configurator

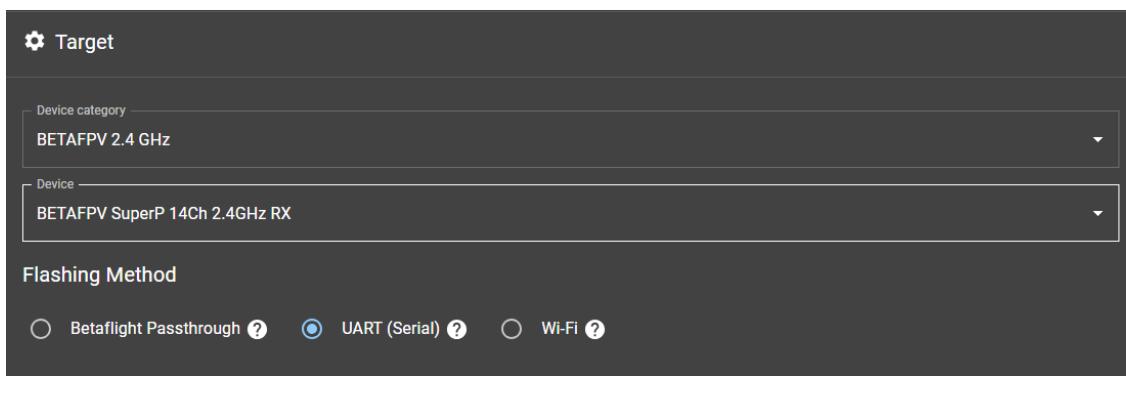
In the firmware section, select LOCAL and in the Local Path, enter the folder where you extracted the firmware under SRC folder. Refer to screen shot



If you don't see Local folder, navigate to Settings and set the Expert Mode

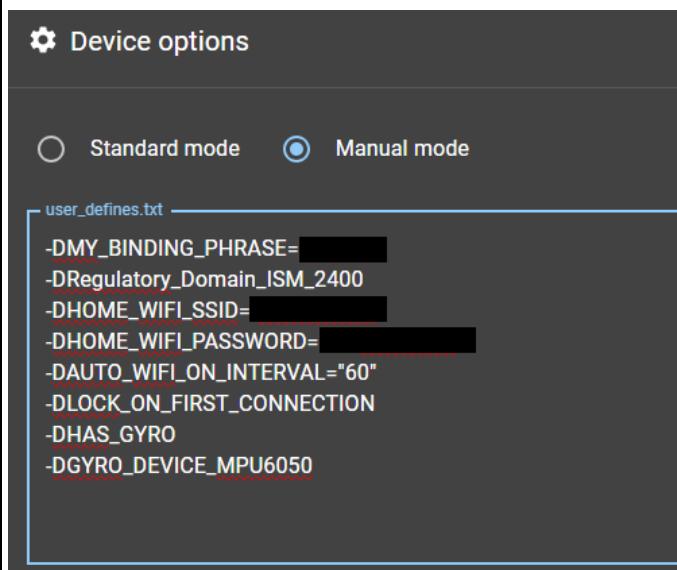


In the target section, select the receiver category. In this example its BETAFPV 2.4GHz. In the Device, select BETAFPV SuperP 14CH 2.4GHz RZ. Lastly select UART as the Flashing Method.

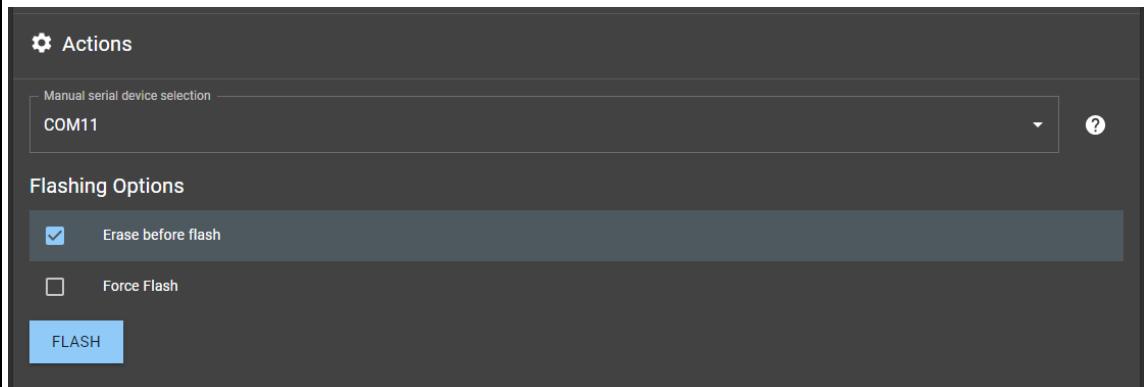


In the Device Option, select Manual Mode, Click COPY FROM STANDARD MODE and add 2 line highlighted in yellow:

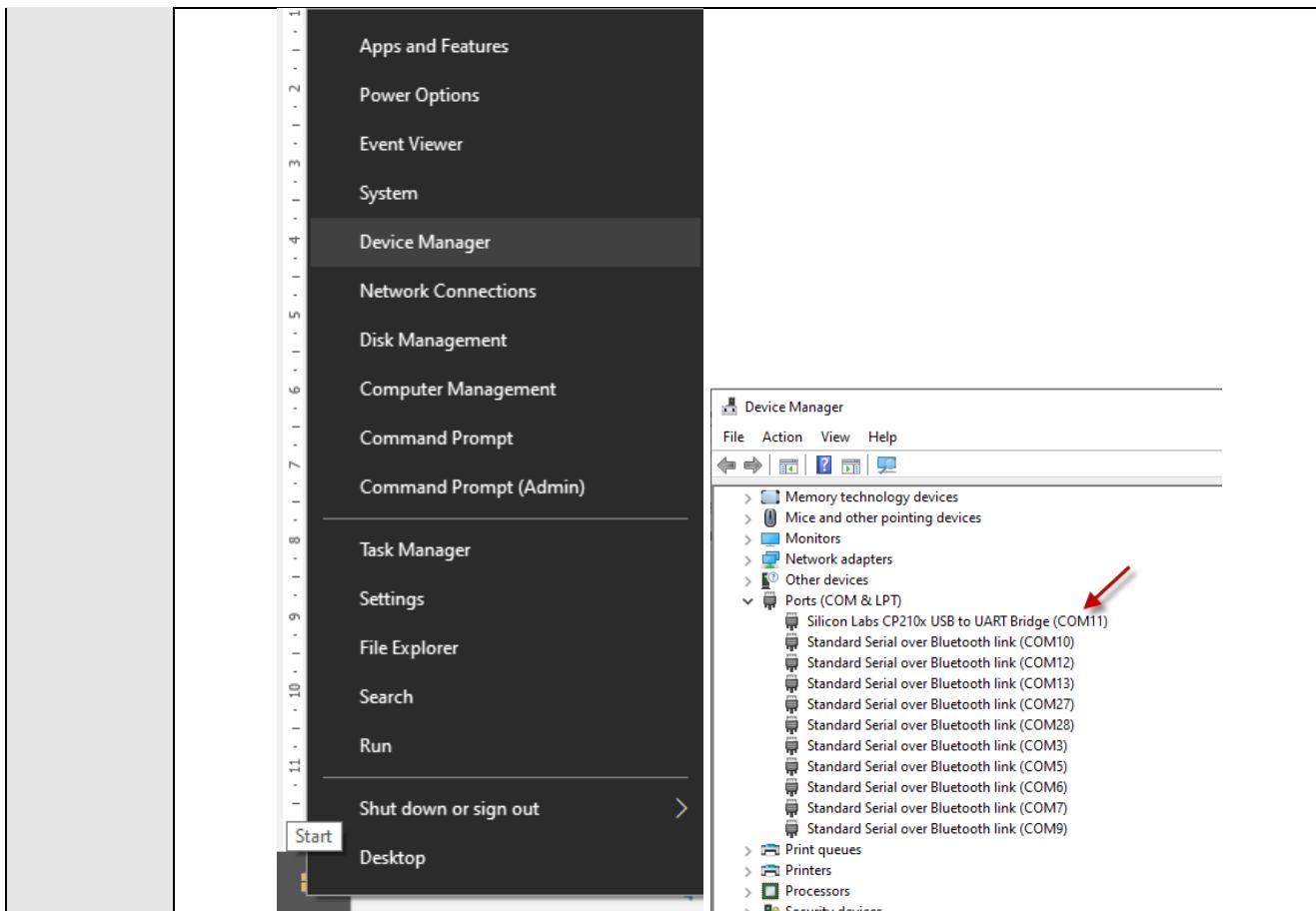
```
-DMY_BINDING_PHRASE="*****"  
-DRegulatory_Domain_ISM_2400  
-DHOME_WIFI_SSID="*****"  
-DHOME_WIFI_PASSWORD="*****"  
-DAUTO_WIFI_ON_INTERVAL="60"  
-DLOCK_ON_FIRST_CONNECTION=DHAS_GYRO  
-DGYRO_DEVICE_MP6050
```



In the Action section select the COM Port where the USB cable is connected and set the Flashing Option to Erase before flash. Lastly click the FLASH button and wait until it is completed.

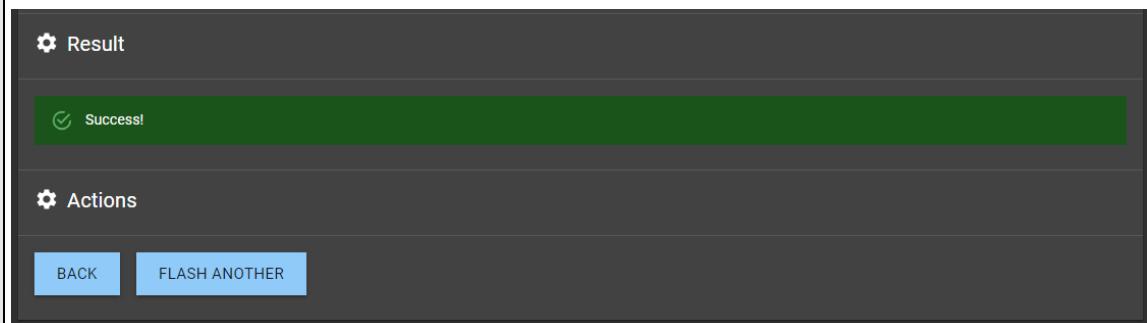


If you don't know the COM Port, right click the windows start button and then click Device Manager



The COM Port is COM11 indicated by the description “Silicon Labs CP210X”

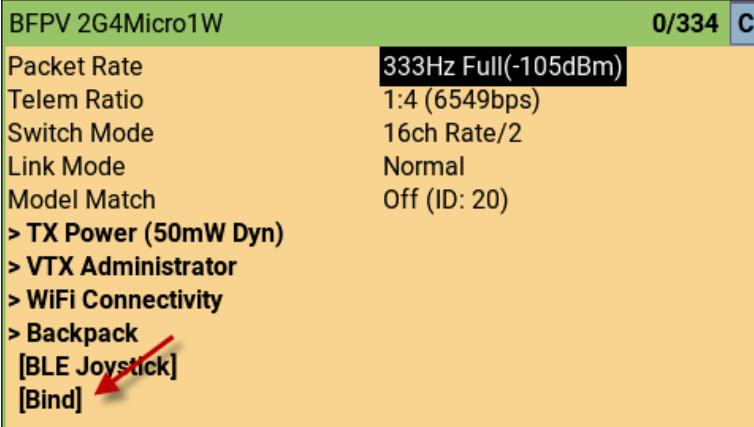
Congratulations: You succeeded flashing the receiver with the BETA firmware for ExpressLRS with Gyro Stabilization.



Bug identified

With the BetaFPV SuperP receiver, after flashing the GYRO firmware, it does not enter WiFi mode even after the WiFi Interval time has elapsed. Refer to Chapter 5 for a workaround. I have not tested other receivers.

6. How to enter binding mode

Issue:	<p>After uploading the GYRO firmware, the receiver LED will slow flash orange. Which means, the receiver will not enter WiFi mode nor can be bound to a receiver. What you are looking for is for the LED to double flash orange so that you can bind the receiver to the radio.</p> <p>RGB status indication for SuperP 14CH Diversity Receiver is shown below.</p> <table border="1" data-bbox="319 496 1298 990"> <thead> <tr> <th data-bbox="319 496 509 541">RGB Color</th><th data-bbox="509 496 811 541">Status</th><th data-bbox="811 496 1298 541">Description</th></tr> </thead> <tbody> <tr> <td data-bbox="319 541 509 586">Rainbow</td><td data-bbox="509 541 811 586">Fade effect</td><td data-bbox="811 541 1298 586">Power on</td></tr> <tr> <td data-bbox="319 586 509 631">Green</td><td data-bbox="509 586 811 631">Slow flash</td><td data-bbox="811 586 1298 631">WIFI upgrading mode</td></tr> <tr> <td data-bbox="319 631 509 676">Red</td><td data-bbox="509 631 811 676">Quick flash</td><td data-bbox="811 631 1298 676">No RF chip detected</td></tr> <tr> <td data-bbox="319 676 509 720">Orange</td><td data-bbox="509 676 811 720">Double flash</td><td data-bbox="811 676 1298 720">Binding mode</td></tr> <tr> <td data-bbox="319 720 509 765">Orange</td><td data-bbox="509 720 811 765">Triple flash</td><td data-bbox="811 720 1298 765">Connected, but mismatched model-match configuration</td></tr> <tr> <td data-bbox="319 765 509 810">Orange</td><td data-bbox="509 765 811 810">Slow flash </td><td data-bbox="811 765 1298 810">Waiting for connection</td></tr> <tr> <td data-bbox="319 810 509 990"></td><td data-bbox="509 810 811 990">Solid on</td><td data-bbox="811 810 1298 990">Connected and color indicates packet rate</td></tr> </tbody> </table>	RGB Color	Status	Description	Rainbow	Fade effect	Power on	Green	Slow flash	WIFI upgrading mode	Red	Quick flash	No RF chip detected	Orange	Double flash	Binding mode	Orange	Triple flash	Connected, but mismatched model-match configuration	Orange	Slow flash 	Waiting for connection		Solid on	Connected and color indicates packet rate
RGB Color	Status	Description																							
Rainbow	Fade effect	Power on																							
Green	Slow flash	WIFI upgrading mode																							
Red	Quick flash	No RF chip detected																							
Orange	Double flash	Binding mode																							
Orange	Triple flash	Connected, but mismatched model-match configuration																							
Orange	Slow flash 	Waiting for connection																							
	Solid on	Connected and color indicates packet rate																							
Solution	<p>In order for the receiver to enter binding mode, you need to apply power to the receiver 3 times in quick succession. On the third application of power, the LED must double flash orange indicating that the receiver is ready to be bind.</p> <p>In the radio, navigate to ExpressLRS LUA script and hit the BIND button. Make sure that the binding phrase of the receiver and the model ID are the same and the distance between the receiver and radio is more than 1 meter.</p> 																								
WiFi mode	<p>To activate the Access Point of the receiver, navigate to the Enable Rx WiFi from the LUA script.</p>																								

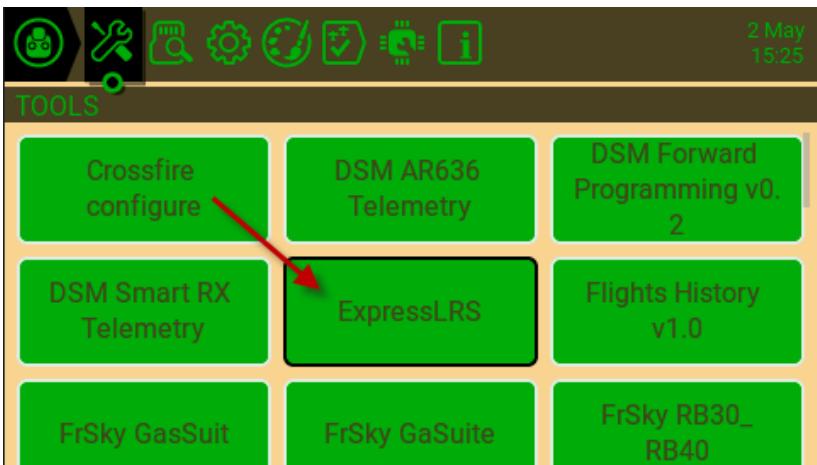
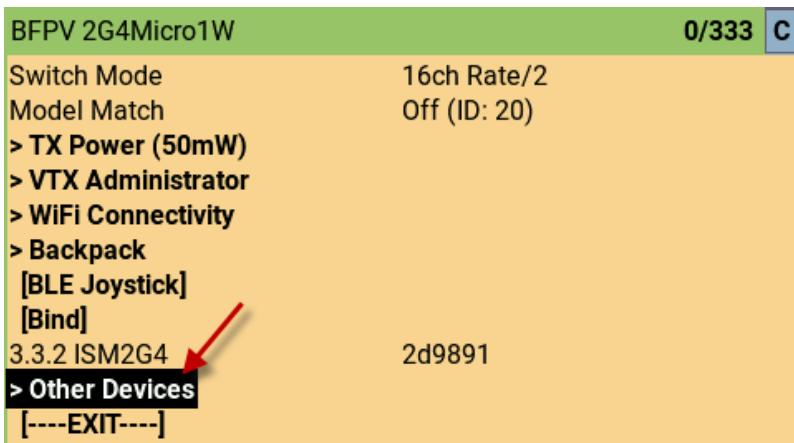
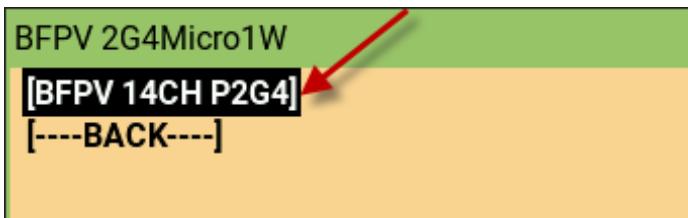
	<p>BFPV 2G4Micro1W</p> <ul style="list-style-type: none"> [Enable WiFi] [Enable Rx WiFi] [Enable Backpack WiFi] [Enable VRx WiFi] [---BACK---
WEB Interface	<p>To enter the receiver WEB Interface execute the following:</p> <ol style="list-style-type: none"> 1. On a mobile phone or PC, connect to Access Point ExpressLRS.

7. Receiver hardware requirement

	<p>Using a mobile phone or a PC, connect the access point. Password = expresslrs.</p> <p>After the mobile phone or PC is connected to the access point, you can enter the WEB Interface by:</p> <ol style="list-style-type: none"> 1. Opening a WEB browser and enter URL = 10.0.0.1 2. Opening a WEB browser and enter URL = http://10.0.0.1/hardware.html <p>To configure the receiver to talk to the Accelerometer, you need to enter the hardware interface (http://10.0.0.1/hardware.html). Scroll down until you see PWM Output pins and delete pins 19 and 22. Don't forget to SAVE TARGET CONFIGURATION and REBOOT</p>
--	---

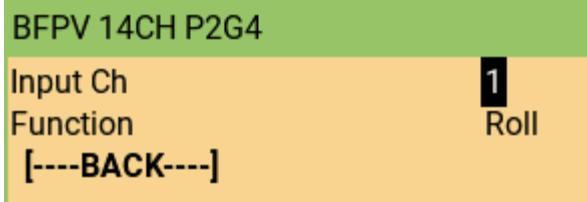
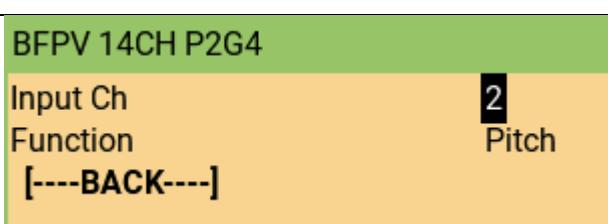
8. How to navigate to the GYRO menus

	Turn on your radio and make sure that you are in the correct model
	Power on your receiver.

	<p>Check if the radio binds with the receiver. If not, refer to chapter 5 on how to bind the receiver.</p>
	<p>After you radio binds with the receiver, Press the SYS button on the radio. Then press Express LRS.</p>  <p>If you don't have this option, you need to install the LUA script for ExpressLRS from https://www.expresslrs.org/quick-start/transmitters/lua-howto/</p>
	<p>Now click on Other Devices</p> 
	<p>Then click BFPV 14CH P2G4</p> 
	<p>You will be presented with the GYRO Configuration Options.</p>

	BFPV 14CH P2G4 Protocol CRSF Rx Mode Diversity Tlm Power 100mW [Loan Model] [Return Model] -> Output Mapping -> Set Failsafe Pos -> Gyro Modes -> Gyro Gains -> Gyro Inputs -> Gyro Outputs	
--	---	--

9. Gyro Inputs

	In the "Gyro Inputs" menu you can setup mappings between input channels to gyro functions. Assign the input function according to the screen shots below.
	To enter the GYRO Input configuration click Gyro Inputs 
	
	

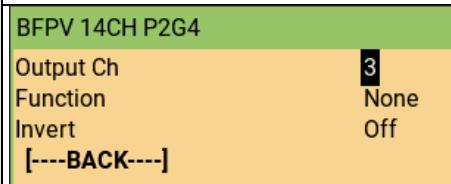
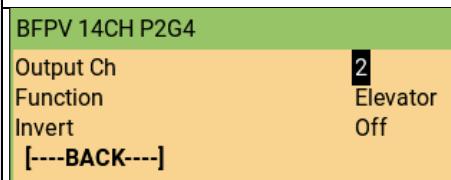
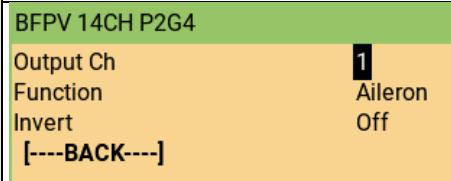
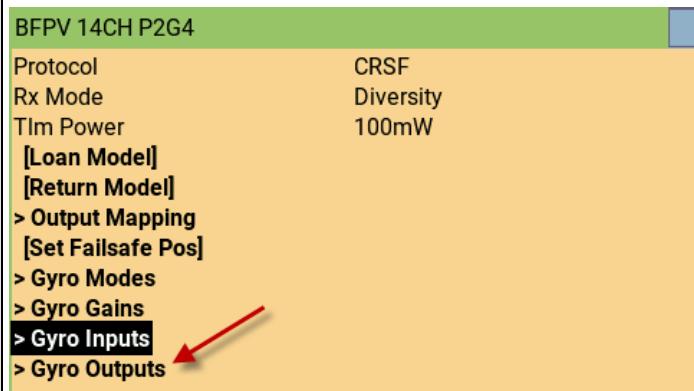
	<p>BFPV 14CH P2G4</p> <p>Input Ch 3</p> <p>Function None</p> <p>[---BACK---]</p>	
	<p>This is used as the throttle channel. Do not assin a fuction.</p>	
	<p>BFPV 14CH P2G4</p> <p>Input Ch 4</p> <p>Function Yaw</p> <p>[---BACK---]</p>	
	<p>BFPV 14CH P2G4</p> <p>Input Ch 5</p> <p>Function None</p> <p>[---BACK---]</p>	
	<p>This is used as the Arm/Disarm channel. Do not assin a fuction.</p>	
	<p>BFPV 14CH P2G4</p> <p>Input Ch 6</p> <p>Function Mode</p> <p>[---BACK---]</p>	
	<p>This is used to control the flight mode of the GYRO</p>	
	<p>BFPV 14CH P2G4</p> <p>Input Ch 7</p> <p>Function Roll</p> <p>[---BACK---]</p>	
	<p>BFPV 14CH P2G4</p> <p>Input Ch 8</p> <p>Function Pitch</p> <p>[---BACK---]</p>	
	<p>BFPV 14CH P2G4</p> <p>Input Ch 9</p> <p>Function None</p> <p>[---BACK---]</p>	

	I use this for my FLAPS. Do not assin a fuction.																																				
	BFPV 14CH P2G4 Input Ch 10 Function None [---BACK---]																																				
	I use this for my FLAPS. Do not assin a fuction.																																				
	BFPV 14CH P2G4 Input Ch 11 Function Gain [---BACK---]																																				
	This is used to remotely control the Gain of the GYRO from your radio.																																				
	In summary, the input mapping are: <table border="1"><thead><tr><th>Input Channel</th><th>Function</th><th>Remarks</th></tr></thead><tbody><tr><td>1</td><td>Aileron Left</td><td></td></tr><tr><td>2</td><td>Elevator Right</td><td></td></tr><tr><td>3</td><td>None</td><td>This is your throttle control</td></tr><tr><td>4</td><td>Rudder</td><td></td></tr><tr><td>5</td><td></td><td>This is the Arm/Disarm control</td></tr><tr><td>6</td><td>Mode</td><td></td></tr><tr><td>7</td><td>Aileron Right</td><td></td></tr><tr><td>8</td><td>Elevator Left</td><td></td></tr><tr><td>9</td><td></td><td>This can be used to control FLAPS</td></tr><tr><td>10</td><td></td><td>This can be used to control FLAPS</td></tr><tr><td>11</td><td>Gain</td><td></td></tr></tbody></table>	Input Channel	Function	Remarks	1	Aileron Left		2	Elevator Right		3	None	This is your throttle control	4	Rudder		5		This is the Arm/Disarm control	6	Mode		7	Aileron Right		8	Elevator Left		9		This can be used to control FLAPS	10		This can be used to control FLAPS	11	Gain	
Input Channel	Function	Remarks																																			
1	Aileron Left																																				
2	Elevator Right																																				
3	None	This is your throttle control																																			
4	Rudder																																				
5		This is the Arm/Disarm control																																			
6	Mode																																				
7	Aileron Right																																				
8	Elevator Left																																				
9		This can be used to control FLAPS																																			
10		This can be used to control FLAPS																																			
11	Gain																																				

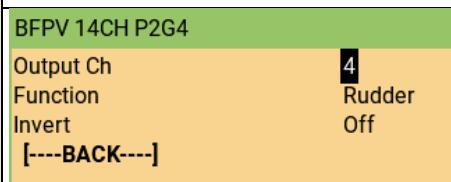
10. Gyro Output

In the "Gyro Outputs" menu you can setup mappings between gyro functions and PWM output channels. For each channel you can setup gyro output inversion. A typical setup is having two aileron servos where one of the output channels needs to be reversed.

To enter the GYRO Input configuration click Gyro Outputs



No assignment here. This is the throttle output.



BFPV 14CH P2G4

Output Ch

5

Function

None

Invert

Off

[---BACK---]

No assignment here. This is the Arm/Disarm output.

BFPV 14CH P2G4

Output Ch

6

Function

None

Invert

Off

[---BACK---]

BFPV 14CH P2G4

Output Ch

7

Function

Aileron

Invert

Off

[---BACK---]

BFPV 14CH P2G4

Output Ch

8

Function

Elevator

Invert

Off

[---BACK---]

BFPV 14CH P2G4

Output Ch

9

Function

None

Invert

Off

[---BACK---]

No assignment here. This is the flaps output.

BFPV 14CH P2G4

Output Ch

10

Function

None

Invert

Off

[---BACK---]

No assignment here. This is the flaps output.

BFPV 14CH P2G4

Output Ch

11

Function

None

Invert

Off

[---BACK---]

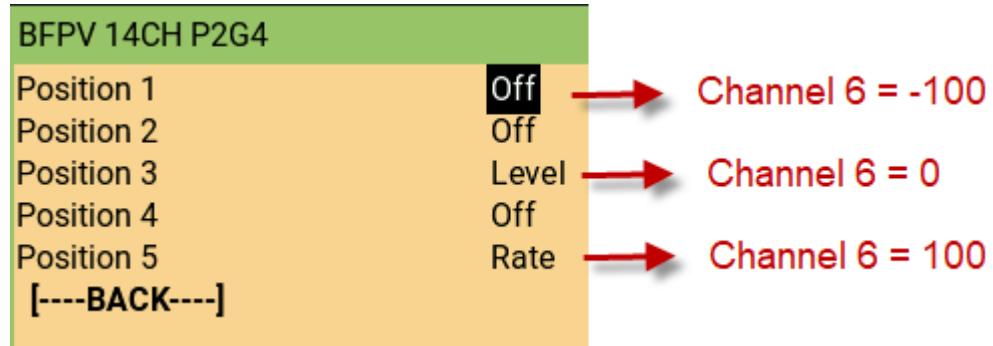
No assignment here. This is the Gyro Gain output.

11. Gyro Mode

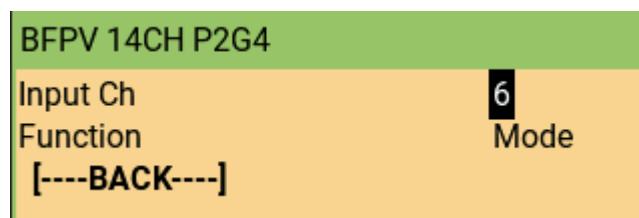
The gyro mode is controlled using Channel 6. The available flight modes are:

GYRO Mode	Channel 6	Remarks
Off	-100	Gyro is in OFF mode
Rate	100	This is the most basic gyro mode. Changes to the angular velocity in any direction will result in a correction.
Lock/Hold		Not yet available
Safe		In this mode the gyro will work to limit pitch and roll angles within the configured limits.
Level	0	In this mode the gyro will work to keep the pitch and roll angles at zero when channel inputs are zero. If the roll stick command is 50%, the gyro will attempt to keep the roll angle at 50% of the max roll angle.
Hover		In this mode the gyro will add corrections to elevator and rudder channels in order to keep aircraft pointing directly upwards.
Knife Edge		Not yet available

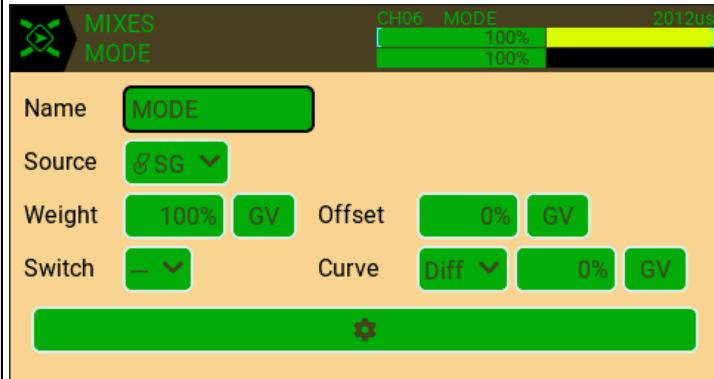
For this exercise, we will only be testing Level and Rate mode.



Unfortunately, you can only use 3 flight modes at a time. In this exercise, we will be using switch SG. Refer to chapter 8 on how to assign the mode channel.



Here's the mixer configuration to control the flight modes.



Feature request

Can I request to add 5 positions in the mode channel in order to control the five modes if the GYRO either via two switches or via the 6-position switch of the RadioMaster?



12. Gyro PID's

BFPV 14CH P2G4

Gyro Axis	Roll
P Rate	35
I Rate	0
D Rate	10
Axis Gain	50
[---BACK---]	

BFPV 14CH P2G4

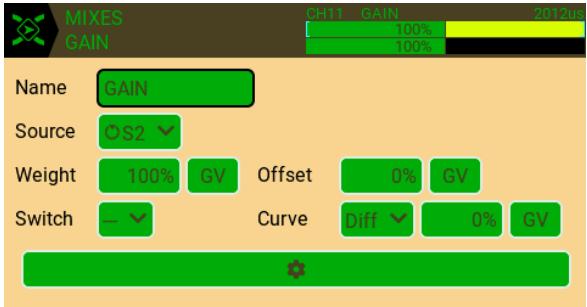
Gyro Axis	Pitch
P Rate	35
I Rate	0
D Rate	10
Axis Gain	50
[---BACK---]	

	<p>BFPV 14CH P2G4</p> <table border="1"> <tbody> <tr><td>Gyro Axis</td><td>Yaw</td></tr> <tr><td>P Rate</td><td>35</td></tr> <tr><td>I Rate</td><td>0</td></tr> <tr><td>D Rate</td><td>10</td></tr> <tr><td>Axis Gain</td><td>50</td></tr> <tr><td colspan="2">[---BACK---]</td></tr> </tbody> </table>	Gyro Axis	Yaw	P Rate	35	I Rate	0	D Rate	10	Axis Gain	50	[---BACK---]	
Gyro Axis	Yaw												
P Rate	35												
I Rate	0												
D Rate	10												
Axis Gain	50												
[---BACK---]													

13. Gyro Settings

	<p>BFPV 14CH P2G4</p> <table border="1"> <tbody> <tr><td>Gyro Align</td><td>90</td></tr> <tr><td colspan="2">[Calibrate Gyro]</td></tr> <tr><td colspan="2">[Set Subtrims]</td></tr> <tr><td>SAFE Pitch</td><td>45deg</td></tr> <tr><td>SAFE Roll</td><td>45deg</td></tr> <tr><td>Level Pitch</td><td>60deg</td></tr> <tr><td>Level Roll</td><td>60deg</td></tr> <tr><td>Launch Angle</td><td>10deg</td></tr> <tr><td>Hover Auth</td><td>8</td></tr> <tr><td colspan="2">[---BACK---]</td></tr> </tbody> </table>	Gyro Align	90	[Calibrate Gyro]		[Set Subtrims]		SAFE Pitch	45deg	SAFE Roll	45deg	Level Pitch	60deg	Level Roll	60deg	Launch Angle	10deg	Hover Auth	8	[---BACK---]	
Gyro Align	90																				
[Calibrate Gyro]																					
[Set Subtrims]																					
SAFE Pitch	45deg																				
SAFE Roll	45deg																				
Level Pitch	60deg																				
Level Roll	60deg																				
Launch Angle	10deg																				
Hover Auth	8																				
[---BACK---]																					
Bug identified	The Gyro Align on FLIP (Receiver inverted) are not working.																				

14. Gyro Gain

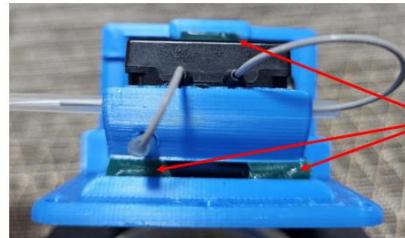
	<p>The gain channel is configured in chapter 8 wherein in this example, channel 11 is the gain channel.</p> <p>BFPV 14CH P2G4</p> <table border="1"> <tbody> <tr><td>Input Ch</td><td>11</td></tr> <tr><td>Function</td><td>Gain</td></tr> <tr><td colspan="2">[---BACK---]</td></tr> </tbody> </table>	Input Ch	11	Function	Gain	[---BACK---]	
Input Ch	11						
Function	Gain						
[---BACK---]							
	<p>The gain is controlled using potentiometer S2 where -100 is the minimum gain and +100 is the maximum gain.</p> 						
Bug identified	<p>The master gain is only applicable to Rate mode. You will not be able to remotely adjust the gain on the other modes (i.e. SAFE, LEVEL HOVER). On these modes, the max gain set in the Axis gain is used. If its too much, the plane will shake on that axis during flight. The only way to fix it is to land and adjust the axis gain of that surface.</p>						

15. 3D Printed receiver cradle

I have read that GYRO performance is affected by excessive vibration so I decided to 3D print a cradle and use the Kyosho Z8006 Zeal Vibration Absorption Sheet to protect the receiver and accelerometer from vibrations. Here's the cradle and how it is assembled.



Receiver cradle



Vibration dampening

