



MagTrack[®] Head Tracking System

User Guide

INTRODUCTION

MagTrack[®] is a magnetic Head Track movement system intended to be used during UAV/FPV flight. The system functions by measuring the differences within the magnetic earth field vector and calculates the user's relative position between the HT and the earth magnetic field. Having determined the HT/magnetic position, the system sends a data stream of PPM signals through the trainer port of the Remote Control transmitter, to move the pan/tilt camera servos in the RC plane.

GETTING STARTED - WITH MAGTRACK

Before using MagTrack configure your transmitter. MagTrack operates by utilising 2 channels of a transmitter's trainer port. The choice of transmitter is yours, we suggest a Futaba F9 or F7. If you are unfamiliar with the use of a transmitter's trainer port please see "FF9 Configuration" section on this guide. A training video is available and displays FF7.

<http://www.AvionicsRC.com/>

1. Set the correct channels and activated the trainer section of the transmitter. Connect the MagTrack to the transmitter's trainer port. MagTrack is powered from the transmitter trainer port. When not needed unplug the MagTrack and save your transmitter battery. View the video.
2. Connected to the plug to the trainer port. MagTrack now has to be set up correctly, please see "MagTrack Setup" section on this guide and view the video.
3. Calibrating MagTrack is the final stage. Please read the "MagTrack Calibration" section on this guide and view the video.

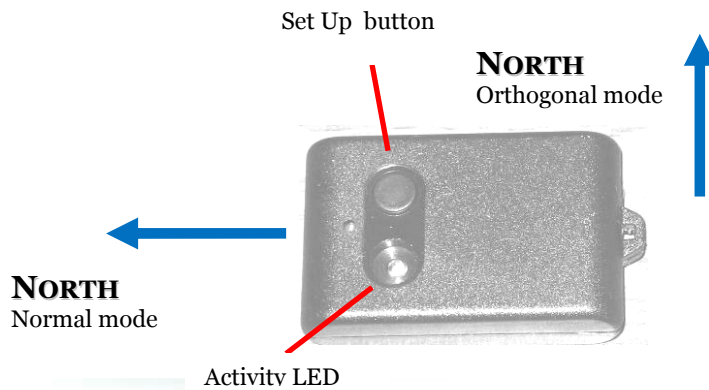
Only after completing all three steps will you, your transmitter and MagTrack be ready to use. Please ensure you read the "Using MagTrack" section on this guide.

MAGTRACK SET UP

<http://www.AvionicsRC.com/>

MagTrack[®] is set to work with different transmitters. The configurable options are as follows:

- PPM Modulation: +PPM/-PPM => Futaba Transmitters use -PPM modulation.
- Number of PPM channels (from 1 to 8) Futaba FF9 admits 8 channel PPM signals.
- Channel assigned to HT Vertical signal (from 1 to 8).
- Channel assigned to HT Horizontal signal (from 1 to 8).
- HT orientation: Normal/Orthogonal.



Here's how to set up the MagTrack head tracker.

To enter to the Set Up mode you have to press the Set Up button, hold down for at least ½ second and no more than 2 seconds.

After that you will hear a set of long and short “beeps” of different tones (low and high tones) these will indicate the options and their values as explained below.

A low beep sound activates the menu option, if the button is not pressed after 1 second the default option will sound with a high sound beep. After a menu-option-low-beep press the Set Up button, a sub-menu options audio beep will sound and by pressing the Set Up button you select the option. After pressing the button the option selected sounds and the menu goes to the next option. It is all in the beep tone and the selection process can be difficult for some. Please watch and listen to the video: <http://www.AvionicsRC.com/>

HOW TO SET UP MAGTRACK – FULLY EXPLAINED

Setting the MagTrack head tracking Option Values is easy IF you follow a set procedure laid out here. Restarting at the beginning is easy if you make a mistake just switch off/on your TX and follow the procedure again. Please view the online streaming video <http://www.AvionicsRC.com>

1. Have a pencil ready to mark your selections.
2. Read the **Order of Selection** table below for the various **Option Values** you need to select

Order of Selection	1 beep	2 beeps	3beeps	4beeps	5beeps	6beeps	7beeps	8beeps
1. PPM	PPM-	PPM+						
2. No. of TX Channels	1	2	3	4	5	6	7	8
3. Vertical mov. - TX Channel	1	2	3	4	5	6	7	8
4. Horizontal mov. - TX Channel	1	2	3	4	5	6	7	8
5. HT Mode	Normal	Orthogonal						
6. Sleep Mode	Disable	Enable						
7. Horizontal Sensitivity	1	2	3	4	5			
8. Vertical Sensitivity	1	2	3	4	5			

3. Put a pencil ring around your selection and then import your selected numbers into the table below - image 3-3.



Here is an example of the selections made for a Futaba 7 Channel TX with channel 5 set for the horizontal movement and channel 7 set for the vertical movement - these would be identified by looking at the connection to the camera's servos.

(Image 3-1)

Order of Selection	1 beep	2 beeps	3beeps	4beeps	5beeps	6beeps	7beeps	8beeps
1. PPM	PPM-	PPM+						
2. No. of TX Channels	1	2	3	4	5	6	7	8
3. Vertical mov. - TX Channel	1	2	3	4	5	6	7	8
4. Horizontal mov. - TX Channel	1	2	3	4	5	6	7	8
5. HT Mode	Normal	Orthogonal						
6. Sleep Mode	Disable	Enable						
7. Horizontal Sensitivity	1	2	3	4	5			
8. Vertical Sensitivity	1	2	3	4	5			

Now the following is the same information transferred and displayed in the column below "YOUR SELECTION".

Example of a Futaba 7 channel TX user's selection (image 3-2):

Line	Number of	Action		YOUR SELECTION	Number of	Action
1	beeps	press button	→	1	beeps	press button
2	beeps	press button	→	7	beeps	press button
3	beeps	press button	→	7	beeps	press button
4	beeps	press button	→	5	beeps	press button
5	beeps	press button	→	1 (Default selection)	beep	press button
6	beeps	press button	→	1 (Default selection)	beep	press button
7	beeps	press button	→	3	beeps	press button
8	beeps	press button	→	3	beeps	press button

NOTE: Lower tone beeps (much quieter) sound at the end of each selection line and before the start of the beeps in the yellow column. Tuning one's ear to these audio changes require you to be in a location without distractive noises or other confusing sounds. Basically be in a quiet place with a friend to watch over you and listen to the beeps.

Sensitivity note: Setting "1" is highly sensitive while "5" is deemed to be least sensitive. The suggested setting is "3" as shown in Line 7 and 8 in the Futaba 7 example.

Now add the information off your own TX

(Image 3-3)

Line	Number of	Action		YOUR SELECTION	Number of	Action
1	beeps	press button	→		beeps	press button
2	beeps	press button	→		beeps	press button
3	beeps	press button	→		beeps	press button
4	beeps	press button	→		beeps	press button
5	beeps	press button	→	1 (Default selection)	beep	press button
6	beeps	press button	→	1 (Default selection)	beep	press button
7	beeps	press button	→		beeps	press button
8	beeps	press button	→		beeps	press button

After item is selected, a sequence of high beep tones indicates the selected option.

4. Applying the data to the MagTrack device.
 - a. Enter Set Up Mode. Press the Set Up button (0.5s < t < 2s); a short pressing has not effect - This will immediately start the process. The Select programmable items listed in Image 3-3 above should be immediately consulted. The first beep sounds after you enter Set Up Mode, you then have to press the setup button almost immediately. Follow the selection in Image 3-3.
5. After completion you can switch off your TX. If you have made an error - switch off and start again.
6. Watch the video: <http://www.AvionicsRC.com>



Calibration procedure

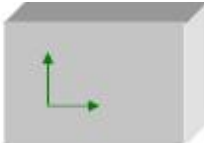
1. Connect the MagTrack Head Tracker to the transmitter port on your TX.
2. Switch on the Transmitter
3. Place the MagTrack Head Tracker as far as possible from big metallic objects or magnets.
4. Place the MagTrack HT level to the earth surface.
5. Press and hold the calibration set up button for at least 3 seconds.
6. Rotate the MagTrack HT 360° while keeping it level; you will hear a weak "beep" when the system finds a value of magnetic field greater than the value stored.
7. Rotate the MagTrack HT in all possible axes. This means you should pick up the MagTrack and move it around in all directions.
8. The calibration process will end when the "beep" stops.
9. Once the "beep" stops, you have to press the calibration set up button to indicate to the MagTrack HT that calibration process has finished - a short press of the set up button.
10. If the calibration is correctly carried out, the MagTrack will work perfectly; if the system doesn't work properly, check the calibration conditions and re-calibrate (repeat the procedure).



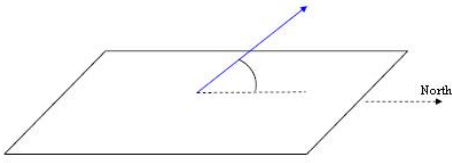


More about Calibration

- HT is equipped with 2 orthogonal magnetic sensors.



- During the calibration process, the controller measures both sensors to determine the maximum value of the magnetic field in each one.
- To get the best results from the system it is very important to obtain a reading of the maximum magnetic field for each axis.
- The Earth's magnetic field is not parallel to the earth surface:

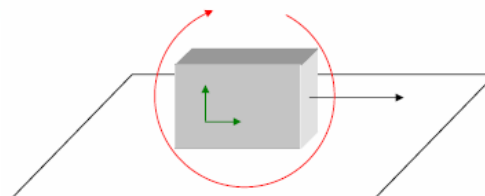
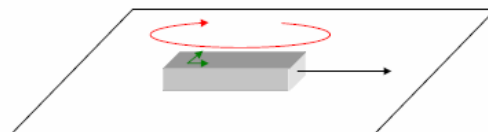


The magnetic sensors are polarized, so it is very important to obtain a good reading in both directions for each sensor.

It is important to get 4 correct readings using the method outlined in the user guide. Failure to accurately carry out the task will result in the MagTrack system not functioning correctly.

To obtain the max readings it should be necessary to align both sensors in both orientations with the magnetic earth vector. In practice is difficult to align exactly the HT with the earth magnetic vector to obtain max readings, so to calibrate the sensor is convenient to move both sensors in the vicinity of the max value of earth magnetic vector: first one of them and after the other one.

For this reason a good approach to calibrate the system is moving the HT 360° in all directions in order to obtain maximum readings, but if during the process the sensors are not aligned at least one time with the earth magnetic sensor, the calibration would be incorrect, what means that the system would work, but not properly.

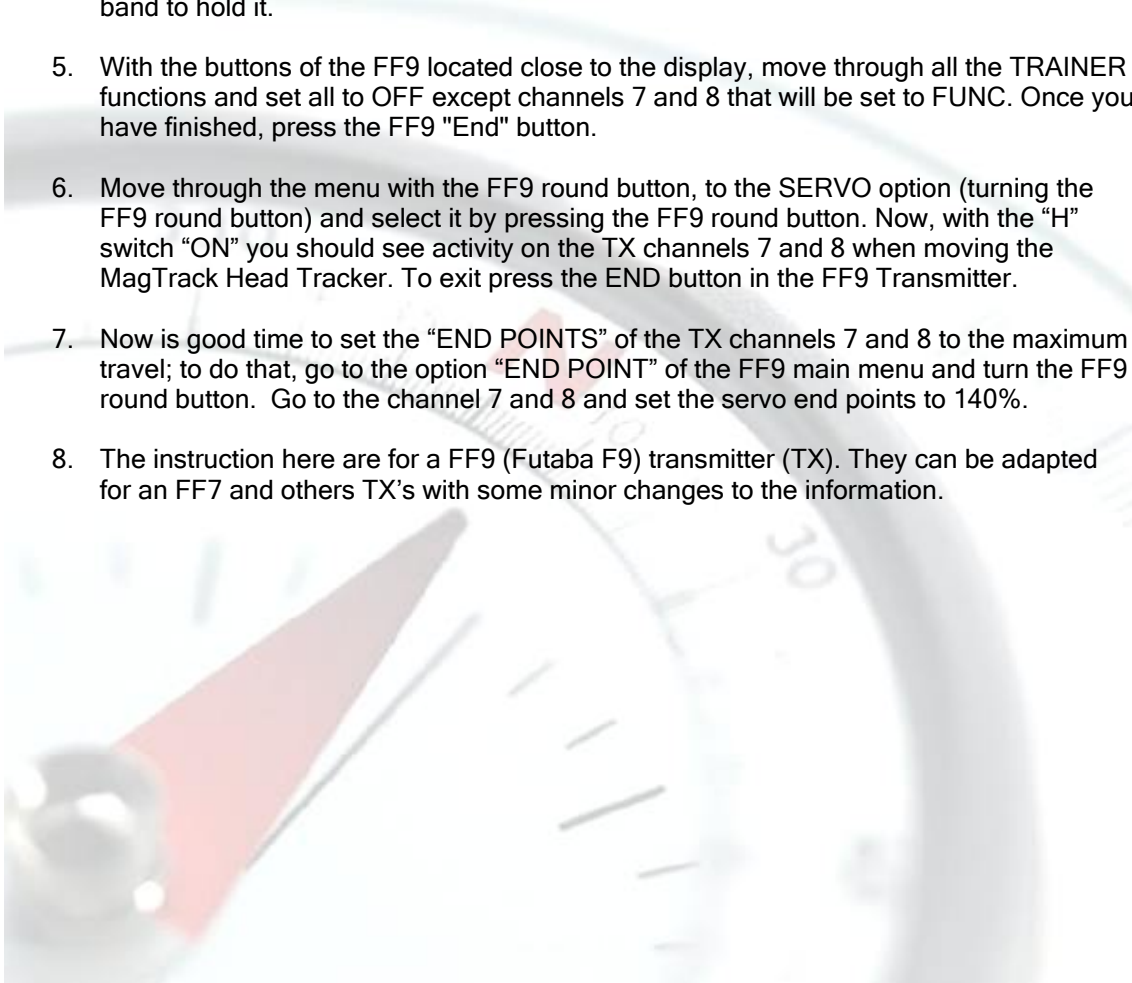


The calibration process suggested is a good approach but keep in mind that the most important thing is to align both sensors with the earth magnetic vector.



FUTABA F9 CONFIGURATION – ADAPT FOR OTHER FUTABA TX'S

1. Switch on your Futaba TX.
2. Press MODE button until the main menu appears on the FF9 display.
3. Move through the menu with the FF9 round button, to the TRAINER option (turning the FF9 round button) and select it by pressing the FF9 round button.
4. Now turn the FF9 round button until the first option (Marked normally as INH) appears as OFF. At this moment, if you pull the "H" switch on the Futaba TX, the "OFF" will turn in "ON" and when you release the "H" switch; the "ON" will revert back to "OFF" as in TRAINER default settings. The MagTrack Head Tracker works with the "H" button in the "ON" control position. To ensure the switch is fixed to the "ON" position, jig up a rubber band to hold it.
5. With the buttons of the FF9 located close to the display, move through all the TRAINER functions and set all to OFF except channels 7 and 8 that will be set to FUNC. Once you have finished, press the FF9 "End" button.
6. Move through the menu with the FF9 round button, to the SERVO option (turning the FF9 round button) and select it by pressing the FF9 round button. Now, with the "H" switch "ON" you should see activity on the TX channels 7 and 8 when moving the MagTrack Head Tracker. To exit press the END button in the FF9 Transmitter.
7. Now is good time to set the "END POINTS" of the TX channels 7 and 8 to the maximum travel; to do that, go to the option "END POINT" of the FF9 main menu and turn the FF9 round button. Go to the channel 7 and 8 and set the servo end points to 140%.
8. The instruction here are for a FF9 (Futaba F9) transmitter (TX). They can be adapted for an FF7 and others TX's with some minor changes to the information.

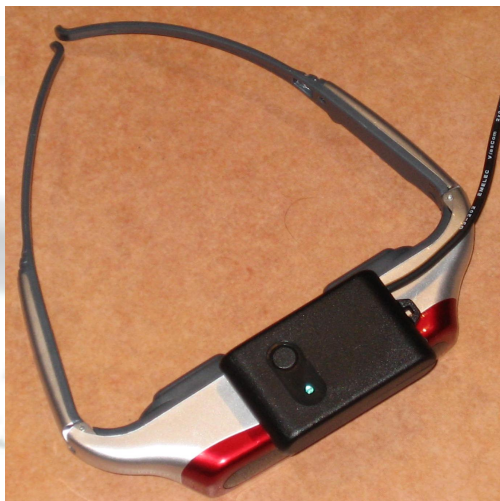




USING MAGTRACK

Once everything has been configured and calibrated, you will be ready to use the MagTrack; next step will be to install the HeadTrack on the head (on a cap or on the top of your glasses with a Velcro tape).

- ⇒ Note: If you test the system with your hands, you will obtain a fast movement on your pan&tilt servo mount due to the sensibility of the Head Tracker, this is normal. A smooth movement will be obtained only when installed properly on your head.



Place the Head Tracker completely horizontal on your cap/glasses and be sure it will not be moved by the cables action.



Don't pull strongly the HT cable, otherwise you may damage the unit and in an extreme case the transmitter.

Depending on how you mounted the HT in your head you should point to the north or to the south to make it work properly. When the system finds the north or the south it generates a weak "beep". If you are pointing to the wrong cardinal point, the horizontal movement will be very fast and it will be impossible to center the HT, in this case, turn your head 180° and point to the opposite cardinal point.

To fine tune the HT vertical movement, may be you will need to tilt a little bit the HT upwards or downwards => this is not mandatory for a correct use of the HT. Instead to do that, you may adjust the vertical servo travel and center.

With the system pointing to the right cardinal point, you will listen a weak "beep", and when moving the system to the East or to the West, the horizontal servo will have a



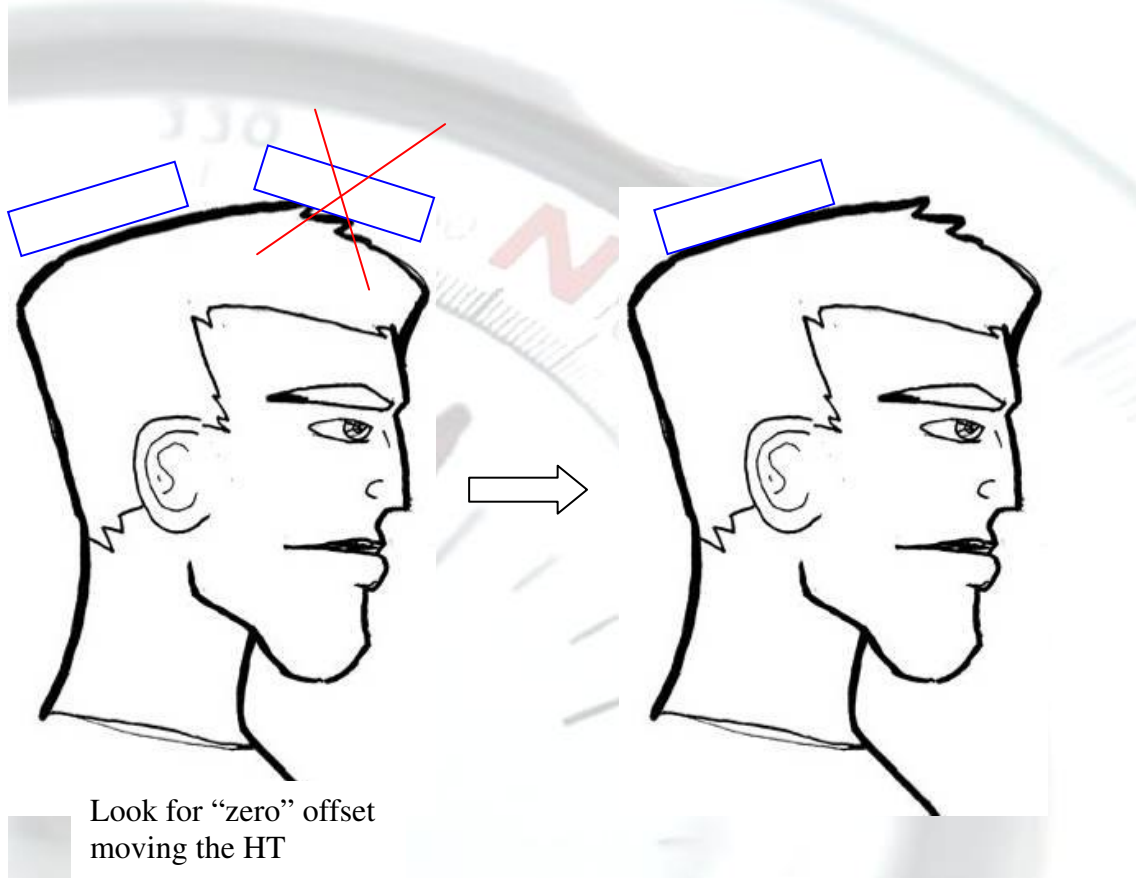
smooth movement to the right or to the left. The travel angles are 45° (approx) to the East and (45° approx) to the West. These are the operating angles. Inside this range if you move the HT upwards or downwards, maintaining the horizontal angle, vertical servo, will move smoothly upwards or downwards.

If the servos doesn't move smoothly, check the position of the HT (change 180° its orientation and try again) or recalibrate the system.

Reference Angles

The reference angle (zero) for the **horizontal movement** is the BEEP sound sent by the HT. From this point you will have a movement of $45^\circ + 45^\circ$.

The reference angle (zero) for the **vertical movement**, may be fine tuned by tilting a little bit the HT slightly upwards or downwards as indicated in the figure, although this is not mandatory => you may adjust the zero servos position from the transmitter.



Important Note: Don't try to open the unit; doing that, you may damage the unit and the transmitter trainer port.