



FORCE CONTROLLED WARTHOG (FCW)

Installation's manual



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1. Introduction

Congratulations with the purchase of your Force Controlled Warthog.

The FCW is a drop-in replacement for the original warthog gimbals.

Unlike the FCC for the Cougar the Warthog FCW replace completely the electronics of the warthog.

As a consequence, you will not be able to program the warthog stick with Thrustmaster software (Target). Programming will only be available through Direct X.

Please refer to the DX programming capabilities and features of your favourite sims to take full advantages of the DX programming. (For BMS, please refer to the DX Setup Guide.pdf located in ..\Docs\Key Files & Input\Device Setup Guides & Profiles)

Although initially designed for the Warthog, there is no reason that the FCW cannot be installed with a Cougar. The FCW is indeed backwards compatible with the Cougar. If you do install the FCW in a cougar be aware that you will lose the possibility to connect the rudder and throttle on the cougar stick base. You must seek a way to connect the rudder and throttle independently.

I hope you enjoy using your FCW as much as I enjoyed designing, building and using it.

If you have any comments or questions about your FCW you can mail me at info@eaglevision.nu
Arend "Eagle" van Oosten.



CAUTION

The Warthog and FCC printed circuit board are electrostatic sensitive device. This means you can damage the boards if you don't take precautionary measures. Make sure you are not electro-statically charged before working on the PCB. You can do this by grounding yourself and use ESD-approved materials. If you don't have them at least discharge yourself by touching a ground wire of your electrical installation.



2. FCW Installation in a Warthog stick base

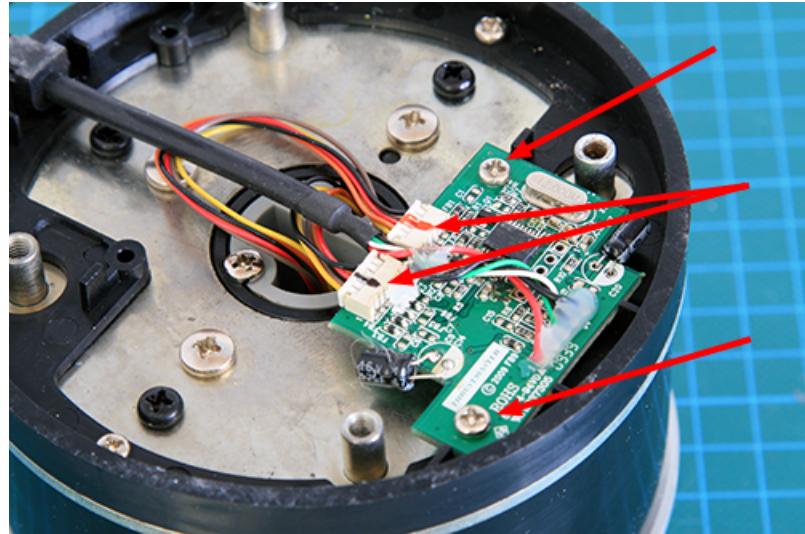
The hardest part of the installation is to disassemble de warthog stick base. Most of the warthog components will not be necessary after the FCC installation. The FCW kit is made of the assembled FCW, the warthog base plate, the FCW PCB and a small bag of screws and washer.



Let's put all the FCW components away for the moment and concentrate on disassembling the warthog base. Make sure you place all screws and components in a small box while you are working.

Turn the base over and unscrew the flat plate from the warthog base. That will separate the base from the plate and give you access to the warthog TM pcb. Let's start by removing this from the warthog. As you see on the following pictures the base I used for this manual is one of the early warthog prototype and is not grounded.

Chances are high that your pcb is grounded and connected to the metal part of your warthog base. Unfortunately, that ground wire is soldered on the PCB and you will have to either unsolder it or cut it, whichever you prefer. We won't need the warthog PCB anymore so cutting it is not the finest solution but it has no consequences.

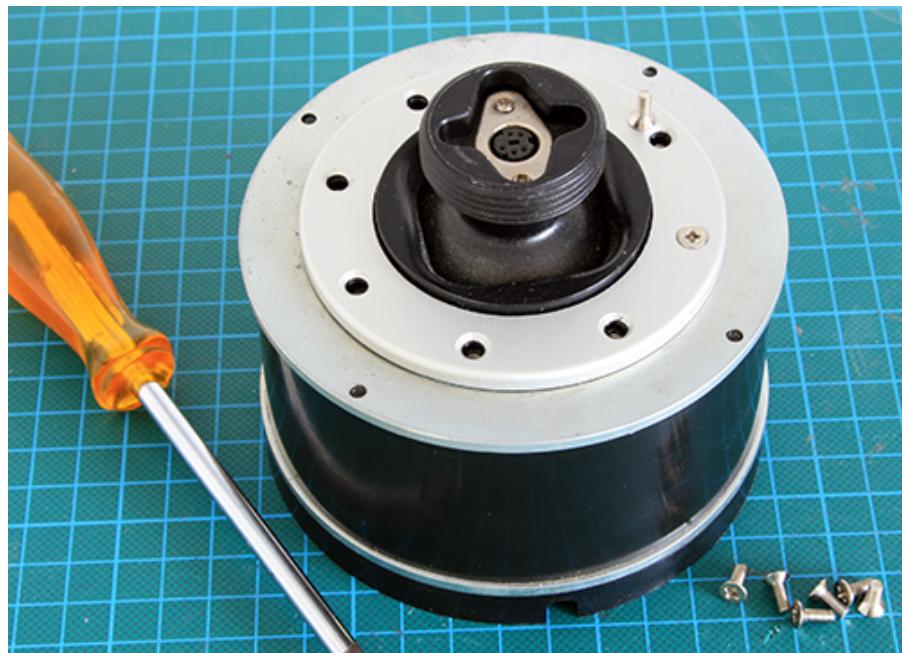


Before disconnecting any connector, I advise to mark them accordingly so you can reconnect them at a later point. In this case, I simply drew a red line on both part of the first connector and a black line over the second.

Remove the connectors by gently separating with a flat screwdriver and pull them away.

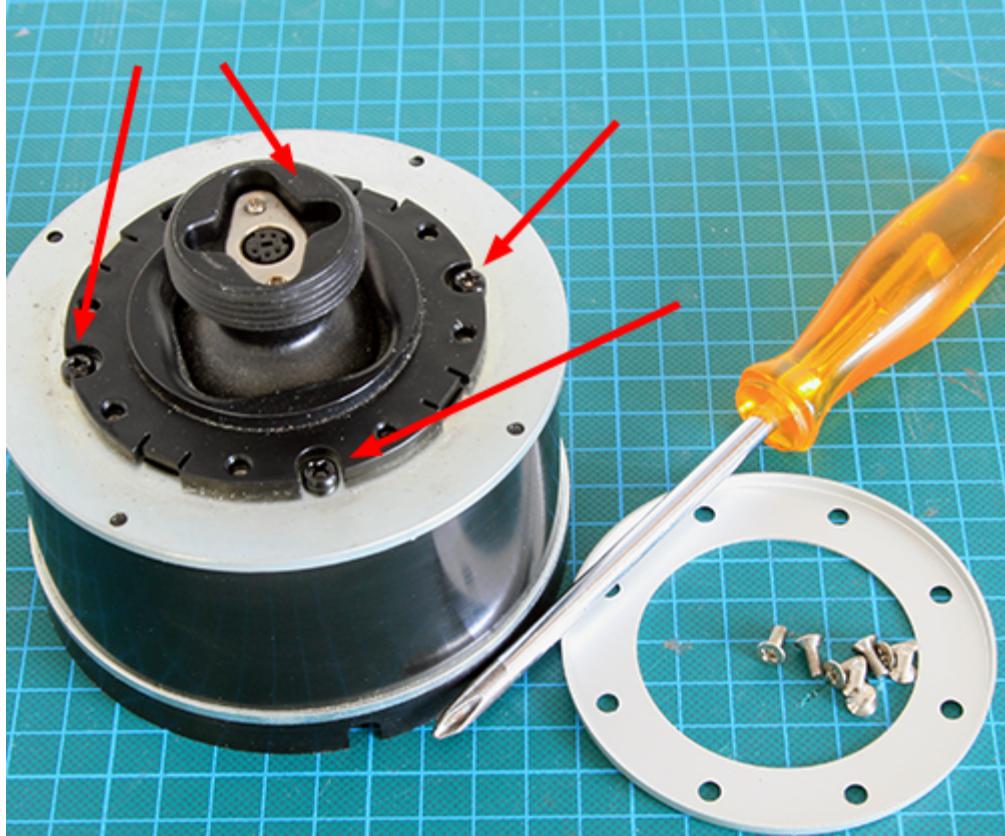
Unscrew then the 2 small PCB screws and store them away, you might need them later on. You can now remove the Warthog PCB and it's cable from the warthog base. Needless to say, it's precious, store it securely away.

Turn the base over and unscrew the round metal plate held in place with 8 Philips screws.



There is a huge spring inside the Warthog base. As you unscrew the following plate (with the 4 screws marked in red on the following picture), that spring will extend unless you hold the plate firmly in place until all screws are out.

Please make sure you don't unscrew the last one unless you're pushing the plate down. Failure to do so may damage the screw thread and create problems when you attempt to reassemble the base.

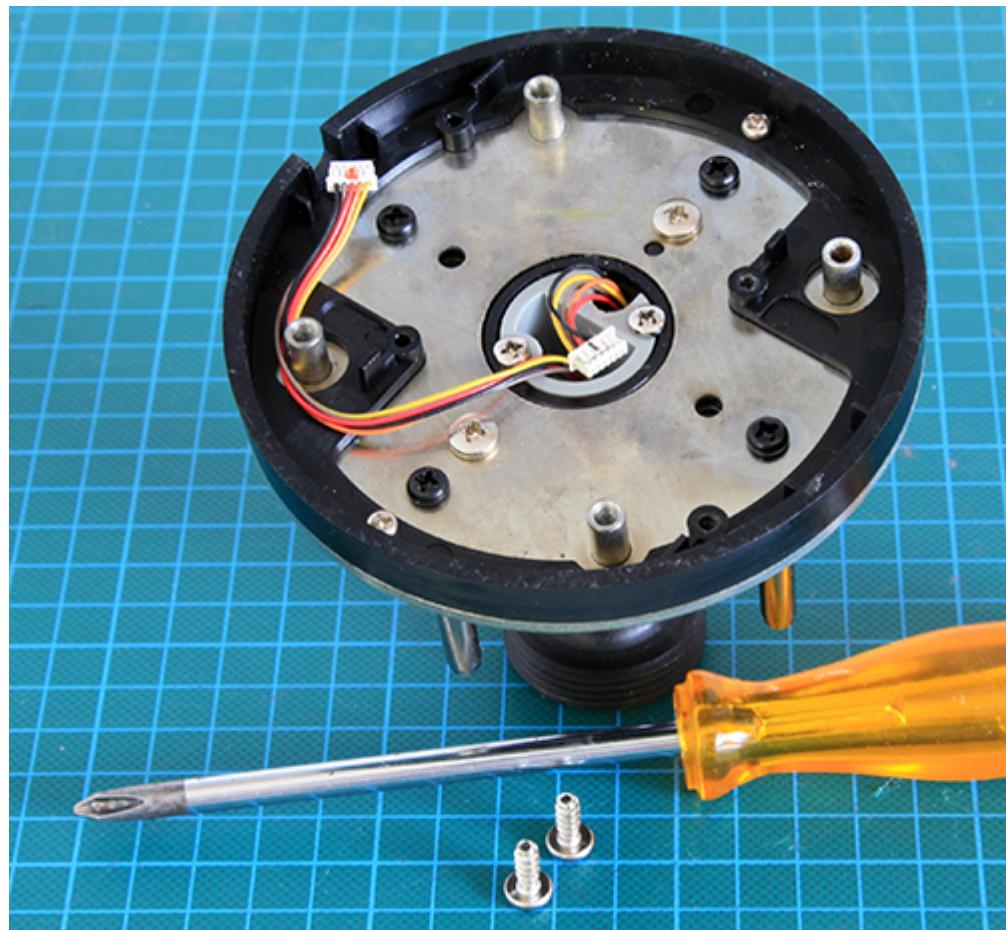




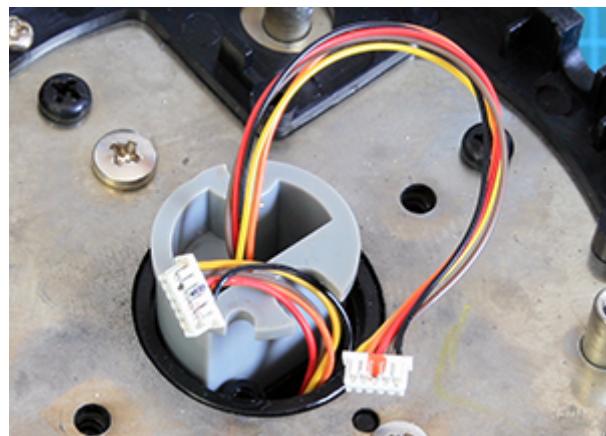
I didn't lie to you, that spring is huge!

Remove the top plate and remove the spring by lifting it up from the base. Be careful, the spring may be full of grease. You can now lift the cylinder casing. It's simply pinned in the base with 4 pins.



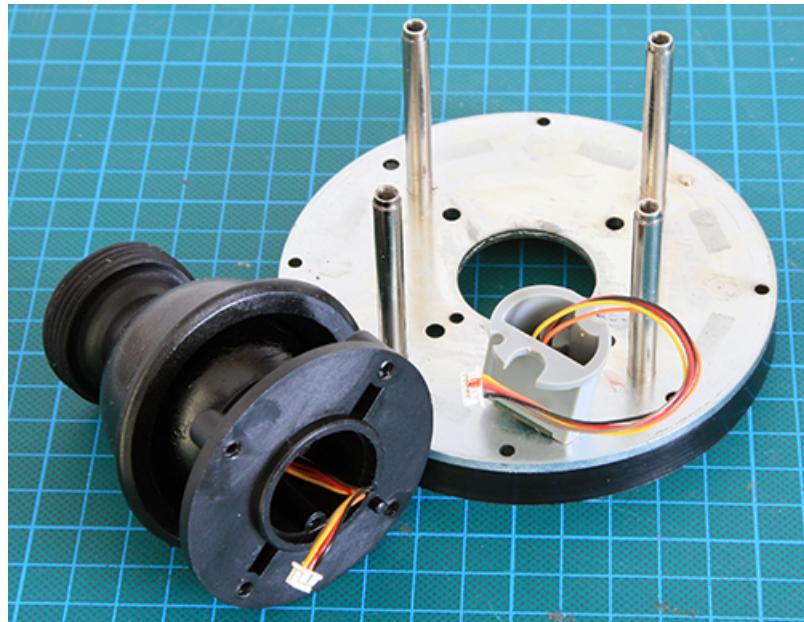


Turn the base over again we will now remove the gimbals. They are held in place with the 4 silver screws, of which you may already have unscrewed 2 when removing the ground wire before. Before unscrewing them all 4, you may also unscrew the centre light grey piece held in place with the 2 smaller screws. The grey part can be lifted up or flip the base so gravity can help.



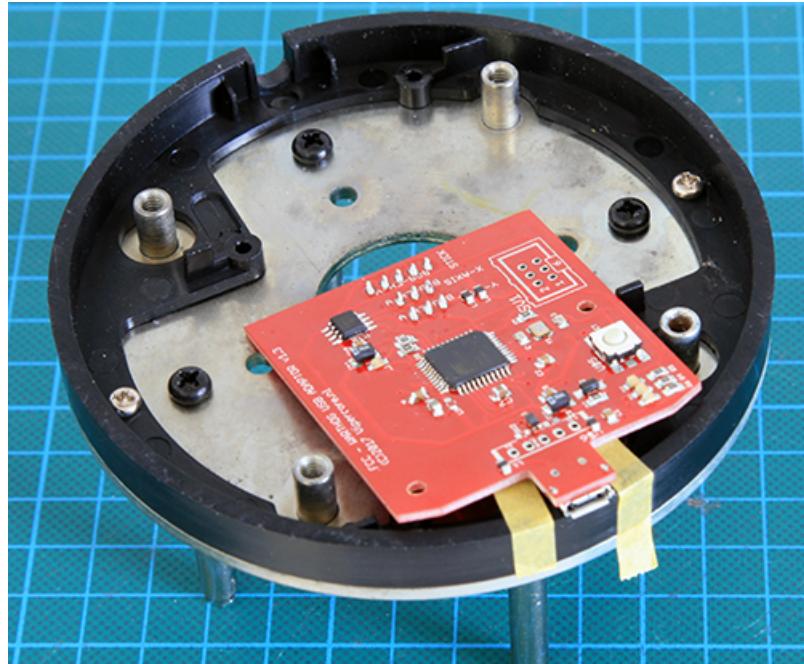


You can now unscrew the last screws holding the Warthog gimbals. Make sure you hold it to avoid having the precious fall on the floor.



That's it, the warthog base, or what's left of it, is ready for the FCW. Once again, make sure you stow securely away the left over from the warthog, you may need them one day to help a fellow virtual pilot.

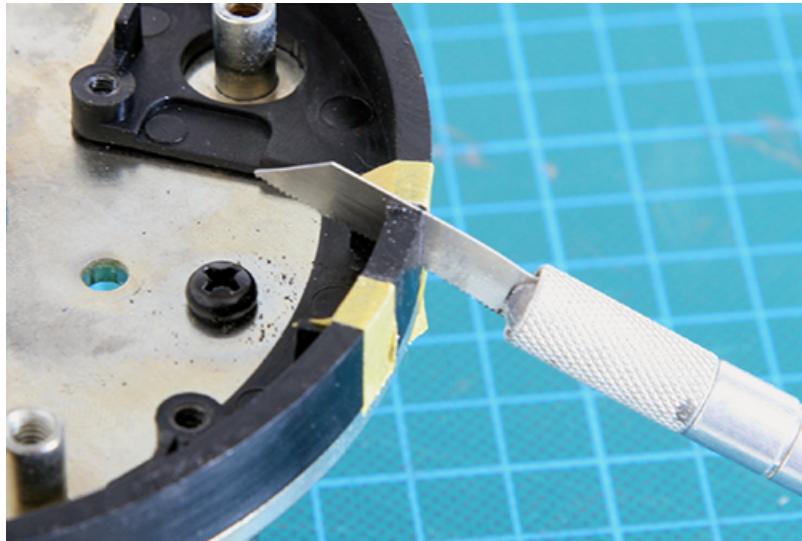
The next thing we need to do is to secure the FCW PCB inside the Warthog base. This is the only intrusive modification to your hardware. Although the PCB takes the place of the old Thrustmaster PCB it does feature a mini USB port that needs to go through the plastic of the base.



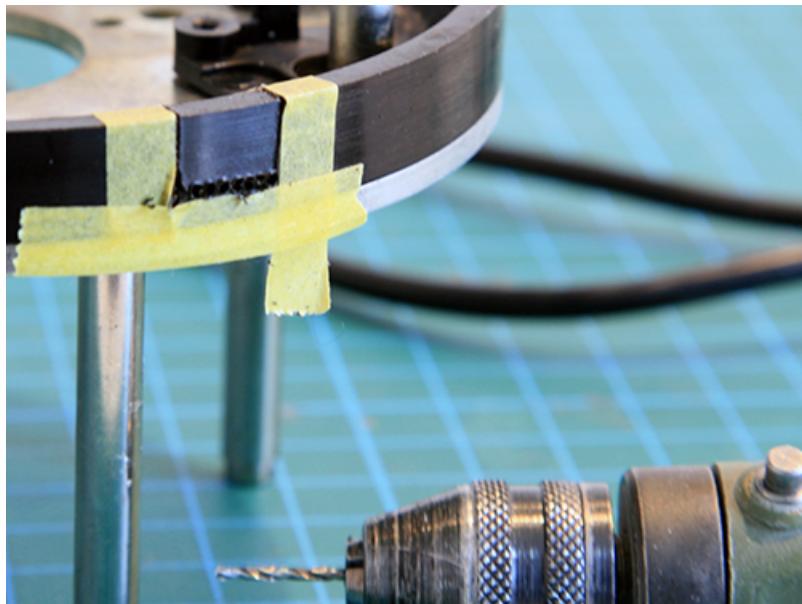
Yep you got it right, you'll need to cut a slot of your base to let go the connector. Don't worry your warthog base will sport the scar with pride. There is another way to bypass that modification if you find it too intrusive, see below. ([add page](#))

The first thing to do is to mark the cuts. I used tape but a pen works equally fine.

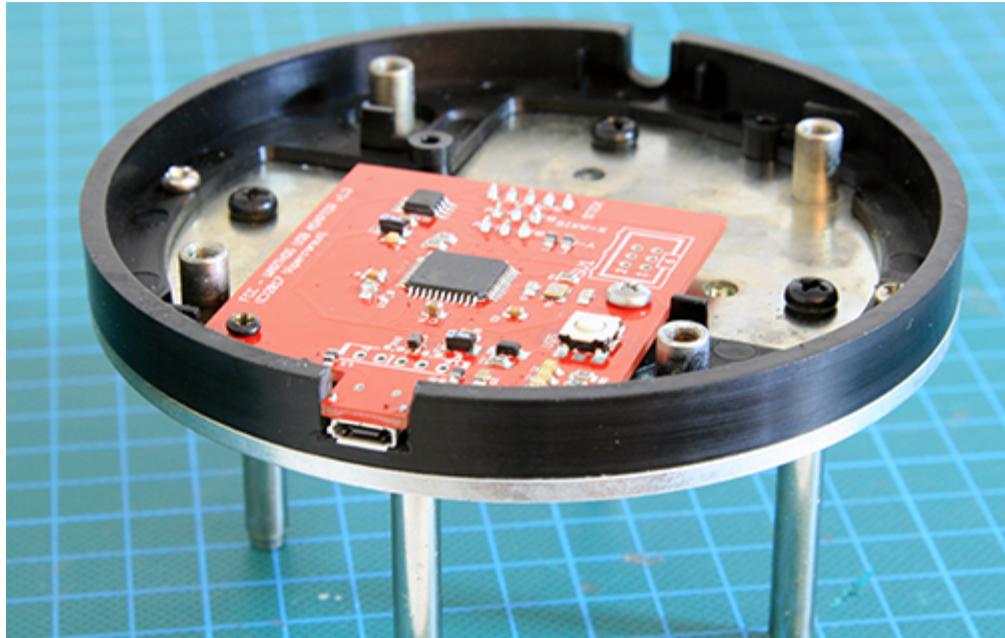
Saw alongside the tape vertically until you meet the flat bottom (don't go all the way through the plastic touching the metal) Stop when the connector has enough room to slide through. Repeat on the other side, alongside the other piece of tape



Cutting the horizontal part is a bit more difficult but here is a modalism trick. Using a precision drill, bore a few small holes as close to each other alongside the horizontal bit of tape.



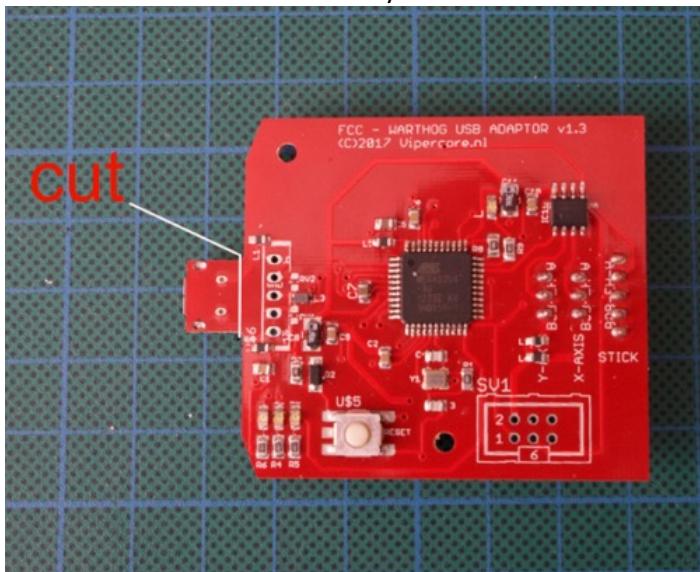
Then hold the bit about to be removed with a pair of pliers and snap it off the base by successive back and forth gentle motion. Eventually the part will separate from the mainframe. Sand the edges flat with a small file (yes it helps to do some plastic models)



Then PCB can now be placed flat over it's supporting holes. The FCW kit doesn't provide new screws and expect you to re-use the original ones to screw the PCB in place. Flip the base and we're ready to reassemble the base.

If you do not want to cut your warthog base, you can modify the red PCB to reuse the warthog USB cable. Please be aware this modification is done at your own risk and imply a minimum of experience soldering.

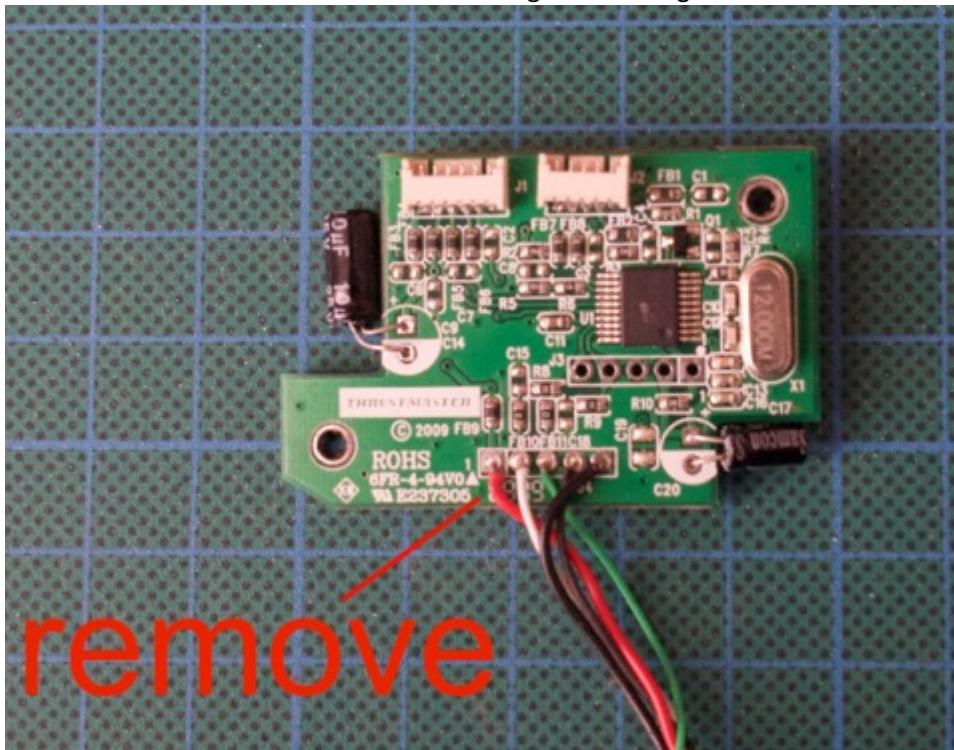
1. Cut the mini usb connector away from the red PCB



Here is the result after the cut:



2. Unsolder the USB cable 5 wires from the original warthog PCB:

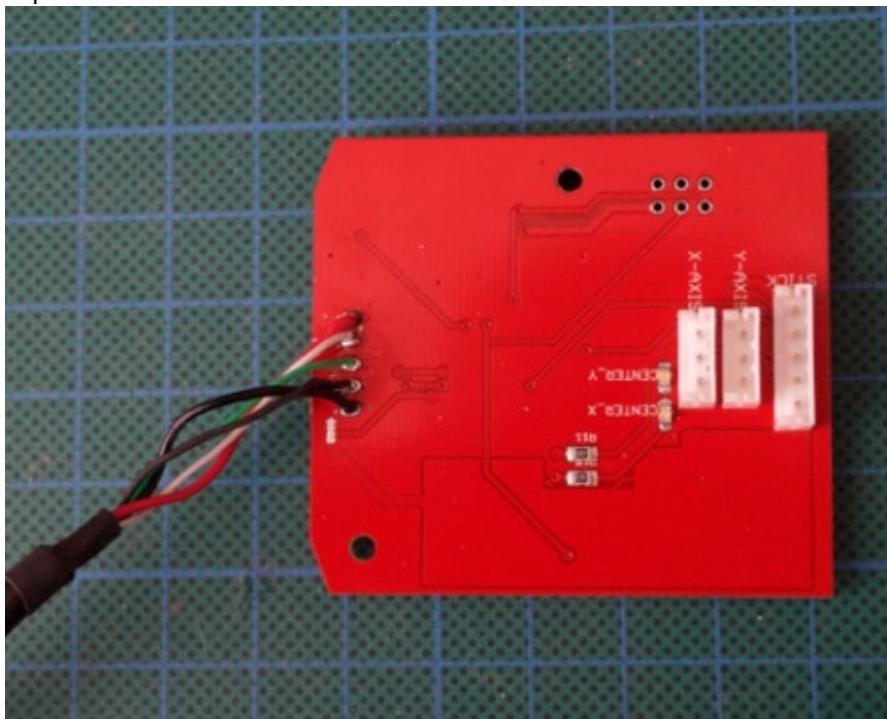




3. Insert the 5 wires of the USB cable into the red FCW PCB following the order seen in the picture below:



4. Flip the PCB on the other side and solder all 5 wires:

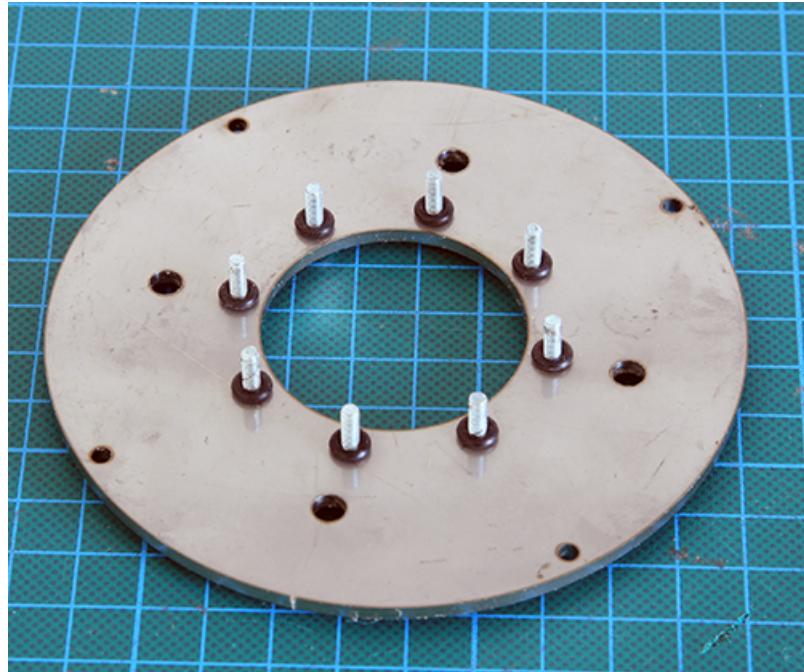




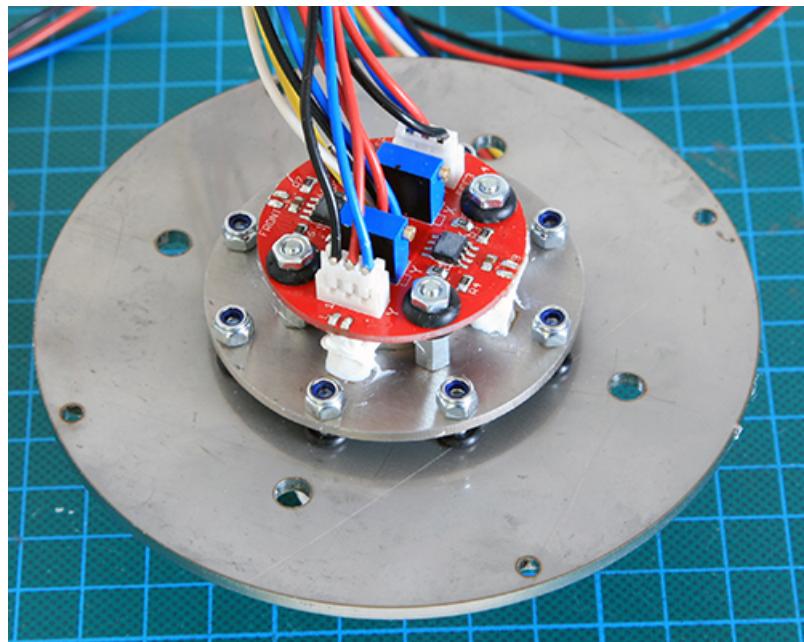
5. Place the PCB into the base with the usb cable through the original opening:



Let's now continue FCW install by attaching the FCW to it's support plate.
Insert all 8 provided screws through the support plate centre screw holes and slide the O-rings on the other side of the support plate.



Then insert the FCW through the hole on the side of the o-rings and match all screws with the FCW holes. You can now bolt each screw using the provided nylon secured bolts. Do not overtight them. They have to be secure but they won't unscrew anyway thanks to the nylon washer included in the bolt.



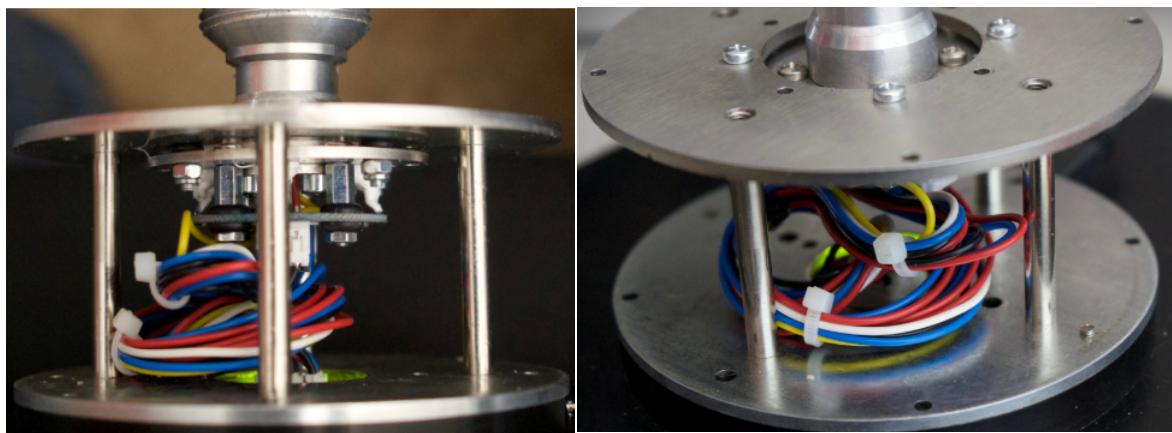
A good tip is to insert a coin between the two plates and screw the nylon bolts in. This will give a good reference for tightening the bolts in.



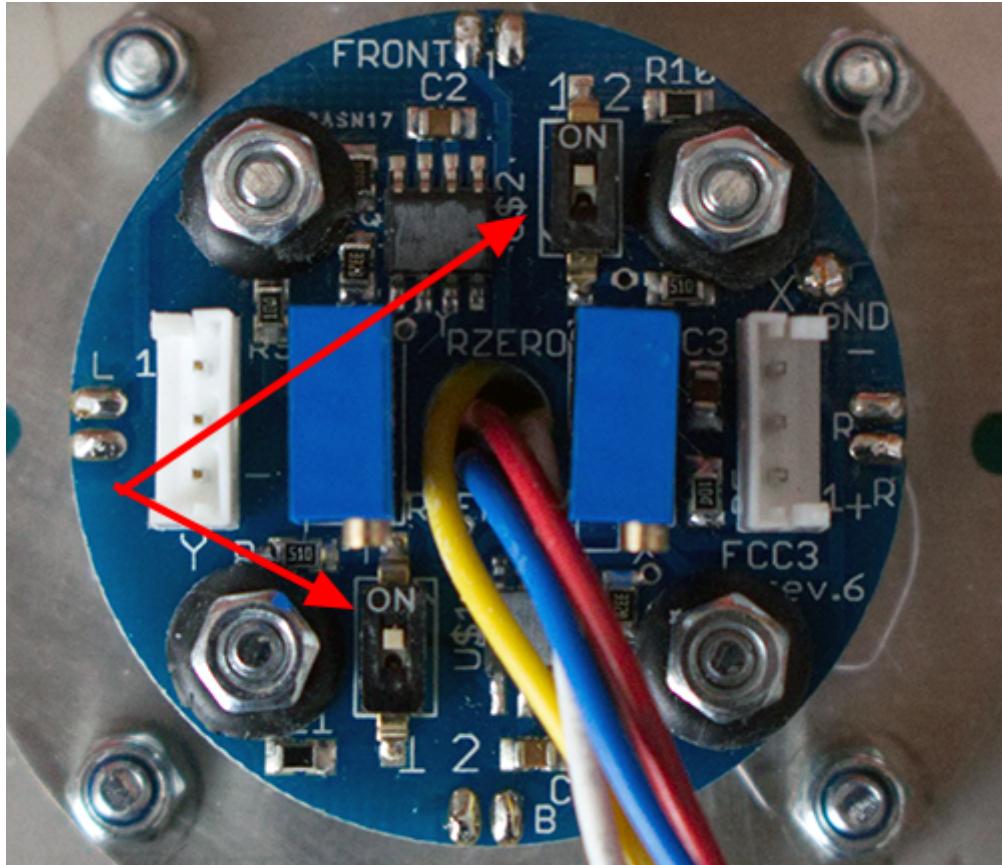
The PCB is printed with the word FRONT this will be very handy in the next couple of minutes. Slide the black cylinder casing on the base and align it with the 4 notches.

Connect the 3 connectors to the base PCB while supporting the PCB from under with your finger as you plug them in. Make sure you match Y with Y and X with X. It's also referenced on both PCB so if you mess it up, it's because you didn't read

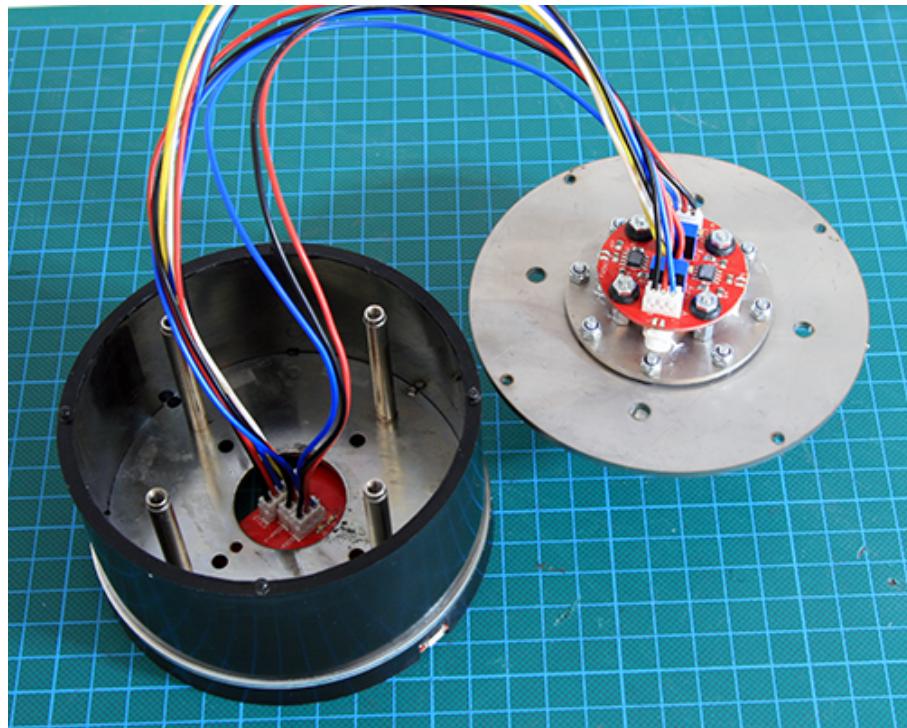
Secure the wires in place with the supplied cable zips, it's important that the cables are not severed as you screw the base closed. Here are pictures helping you see how the cables are supposed to be placed inside the base:



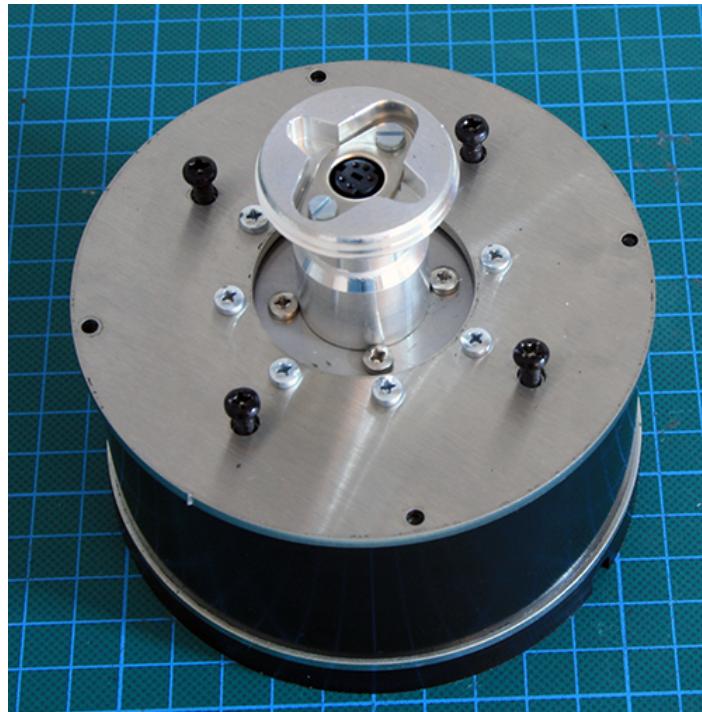
Before you place the top plate on the base, please mind a close look at the FCW round PCB. There are two dip switches you can set depending if you intend to use the mod with a cougar or a warthog. Set both Dip to ON if you intend to use a warthog stick and set both dip to off if you intend to use the mod with a Cougar. Response curves are slightly better with the warthog settings but



You have 4 possibilities to orient the base according to your exit cable. The FCW PCB tells you where the front is (another option is to screw the warthog handle in place. By rotating the top plate by 45° you can make the cable exit to the front, the left, the right or the rear of the round base. Since the stick is to the right of the computer I chose to have the exit on the left



Place the FCW and it's support plate over the base, aligned first with the 4 small notches then with the 4 supporting poles and screw it securely with the 4 black original screws.



Screw the large flat plate from under the base (you will need it) and replace your Warthog handle in place. Connect a mini USB cable to the FCW warthog PCB.
That's it, the FCW warthog installation is finished



3. Installing the Warthog FCW into other bases

3.1 Cockpit base

The advantage of the warthog FCW mod is the ability to mount the FCW into a smaller cockpit base. It's a feature exclusive to the FCC/FCW. The cockpit base bolted on the right auxiliary console is quite smaller than a warthog base.

There is no specific instructions to mount the FCC into a cockpit base as the 8 holes in the FCW match the holes in the cockpit base. The support plate is not used and the PCB can be placed anywhere under the right auxiliary console at cable length. So installation is even easier than in a warthog base.

3.2 Cougar base

As said earlier the FCW is backward compatible with the Cougar. Installation in the cougar base is possible with the adapter plate which can be ordered along the FCW. **PIX** To install the FCW into a Cougar base, please refer to the FCC manual.

Bear in mind that if you install a FCW in a Cougar, it will become Standalone Direct X.

You won't program it as before (or as with the FCC) with foxy

You won't be able to connect the TQS straight to the Cougar stick but you must seek a solution to make your Cougar throttle standalone as well.

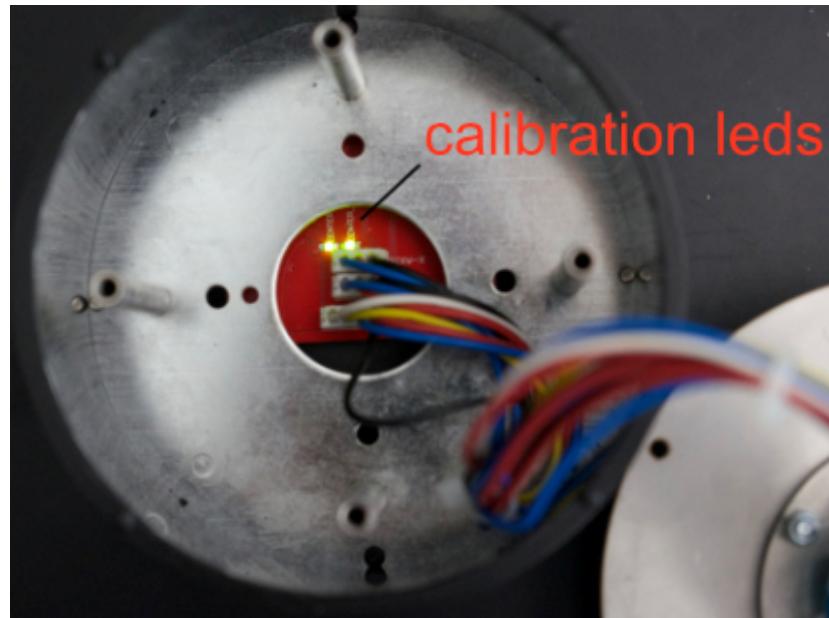
See the throttle adaptor from our website: www.vipercore.nl



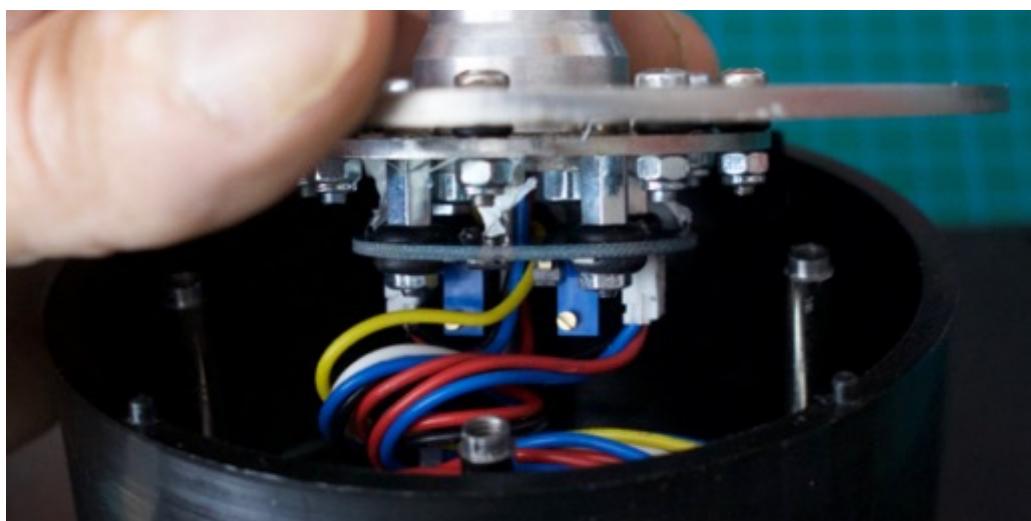
4. Setting up your FCW

4.1 Electronic Calibration:

Initial electronic calibration is required. The FCW PCB has two status led that will confirm each axis is centred. These leds are placed on the connector side and are labelled "Centre_X" and "Centre_Y". These leds are visible with the PCB screwed in the base, by looking through the warthog base from the top:



Each axis also features a potentiometer with an adjustable screw on top. These potentiometers are located on the FCW round pcb attached to the stick base.





Connect the FCW to the USB port of your computer. The calibration leds might not be on, which indicates a non-centred axis. To calibrate the centre proceed with the following steps for both axis:

- Connect the FCW to the computer
- Turn slowly the adjusting screw until the relevant led turns green to indicate a centred axis.
- Repeat for the other axis.
- Once both leds are on, the FCW is electronically centred

Please note, it's an electronic calibration so it does not matter the position of the weight applied to the stick. You can perform this calibration with the stick mount in any position and no handle installed.

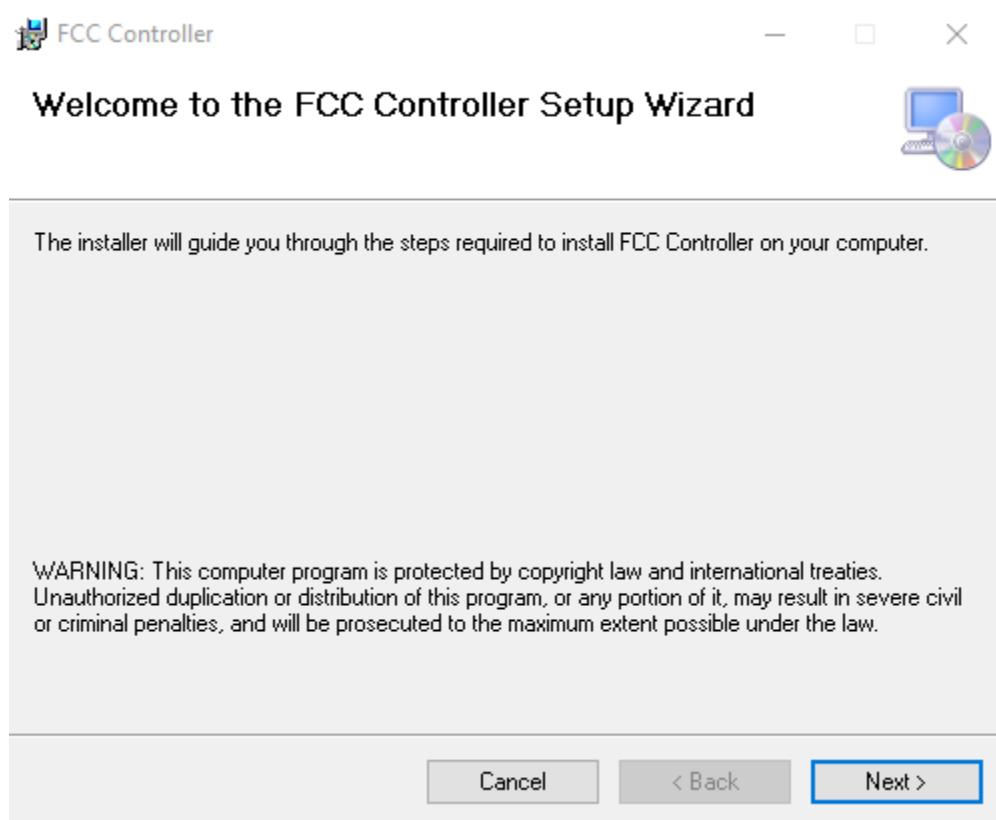
4.2 Installing the software

The Warthog FCW is supplied with a software which you can download on the ViperCore website:

<http://www.vipercore.nl/index.php/download/software>

The warthog does not require the use of any software as options can be set with button press combinations (for further information, read the chapter “using your FCW”). The supplied software is mainly a Graphic User Interface (GUI) that gives you another way of setting up the Warthog FCW and update it's firmware.

Unzip de installer package in a temporary folder and launch the “fcc_configurator_0.1.3.2.msi” file. Windows may block the execution of the file, you may override windows security and install anyway.



Follow the on screen instructions

Select Installation Folder



The installer will install FCC Controller to the following folder.

To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".

Folder:

C:\Program Files (x86)\FCC Controller\

Browse...

Disk Cost...

Install FCC Controller for yourself, or for anyone who uses this computer:

Everyone

Just me

Cancel

< Back

Next >

Choose an installation folder

Installation Complete



FCC Controller has been successfully installed.

Click "Close" to exit.

Please use Windows Update to check for any critical updates to the .NET Framework.

Cancel

< Back

Close

Installation is complete

You can then now launch the FCW configurator via the FCW icon placed on your desktop.

Please note the same icon is in your tray when the FCW is connected.



Upon launching the software you will be automatically notified if software or firmware updates are available through a message in your windows taskbar.

Click on the Updates tab to check the version of the installed firmware/software and the availability of a new one. When you update always update the firmware first if both are available.

Two screenshots of the FCW Configurator software interface. The left screenshot shows the 'Settings' tab active, displaying 'Sensitivity Settings' with a radio button selected for '4.5 Kg/f (10 lb/f)', a dropdown for force setting from 3.0 to 47.84 Kg/f, and 'Special Features' with checkboxes for 'Sensor Rotation Emulation' (ON) and 'Proportional Force Mapping' (ON). The right screenshot shows the 'Updates' tab active, displaying 'Update Manager' with 'Firmware version on device: 0.1.2' and 'Latest Firmware Version: 0.1.4', and buttons for 'Update Firmware' and 'Check for updates'. Below this is 'Control Software Version' with 'Latest Software Version: 0.1.3.2' and '0.1.8.0', and buttons for 'Update Software' and 'Check for updates'. Under 'Update Notifications', there are two checked checkboxes: 'Notify when a Firmware update is available' and 'Notify when a software update is available'. The bottom of both screenshots shows a status bar with 'Connected' and a three-dot menu icon.

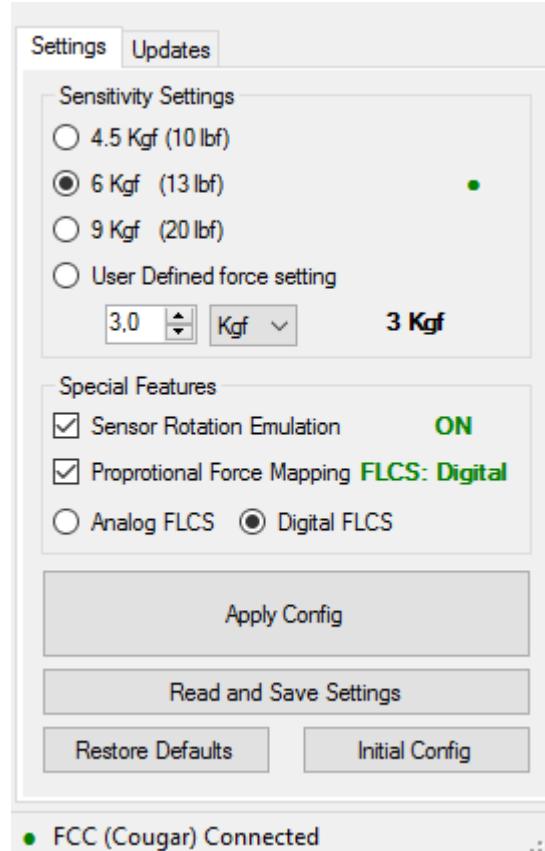
- Click the Update firmware button. A DOS windows will open and the firmware will be automatically updated. The two versions number will match after a successful update.
- Click the Update Software button. The software will close and you will prompted for a new installation. Follow the instructions and restart the software upon completion. check the Updates tab for version match.

It is recommended to restart the device after either a firmware or a software update by simply hot plugging the USB

5. Using your FCW

5.1 Changing options through software

The supplied GUI allows you to change a few options. These options can also be changed on the fly without the use of the software by pressing a few buttons combination. We will come back to that later.



The Sensitivity Settings allows you to either choose one of three defined forces:

- 4.5 Kgf (10 Lbf)
- 6 Kgf (13 Lbf)
- 9 Kgf (20 Lbf)
- Or a custom setting which is set through the user defined force setting option boxes (mind the unit)



Special features allow you to further tweak the FCW according to the real F-16 blocks you're simulating.

- The Sensor Rotation Emulation rotates the FCW references axis 12° outboard (right)

There were a lot of discussions in the cockpit builder community about the real SSC being rotated outboard in the F-16 cockpit to be perfectly aligned with the pilot's arm force vectors. Many denied it was the case because they couldn't see the stick grip being offset to the right or because they considered early blocks. But if the stick grip is not offset, the sensors inside are (at least from the block 40/42 and later)

Check the Sensor Rotation Emulation box to enable it.

To see which option suits best your stick position, start your favourite sim and fly an Immelman or a loop. If you feel the aircraft rolls at the same time as you pitch up, you probably don't have the right setting

- Proportional Force Mapping enable different force ratio in the 4 directions according to the type of FLCS simulated. Check the box in front of Proportional mapping and then decide if you want to emulate an analog FLCS or a digital FLCS.

There is no one fits all SSC in the real F-16. The sidestick controller was updated often along the operational life of the F-16 and force settings and ratio have been modified accordingly.

The nominal value of the ratio is the full pitch up command (maximum required force) Pitch down and roll forces are emulated with a certain ratio of the above pitch up reference. Please note, the sensitivity setting chosen above are the maximum force required for pitch up. The ratio is calculated from that set value.

Analog FLCS:

Full pitch up command is 180 Newtons (about 18Kgf)

Full pitch down and roll commands are 80N (about 8 Kgf)

The ratio is therefore $180/80 = 9/4$.

For example, if you set 9 Kgf in the sensitivity settings and have the Analog FLCS enabled for the proportional force mapping then the maximum pitch up command will be 9 Kgf and maximum pitch down and maximum roll forces will be 4 Kgf.

Analog FLCS was implemented up to Block 30 & 32. Please note the SSC was not rotated on these blocks so if you want to implement a true early block up to 30/32 you can disable the sensor rotation option.

Digital FLCS:

Full pitch up command is 25 lbf (11.34 Kgf)

Full pitch down is 16 lbf (7.26 Kgf)

Full roll command is 17 lbf. (7.71 Kgf)

The ratio is therefore $25/16$ in pitch and $25/17$ in roll.

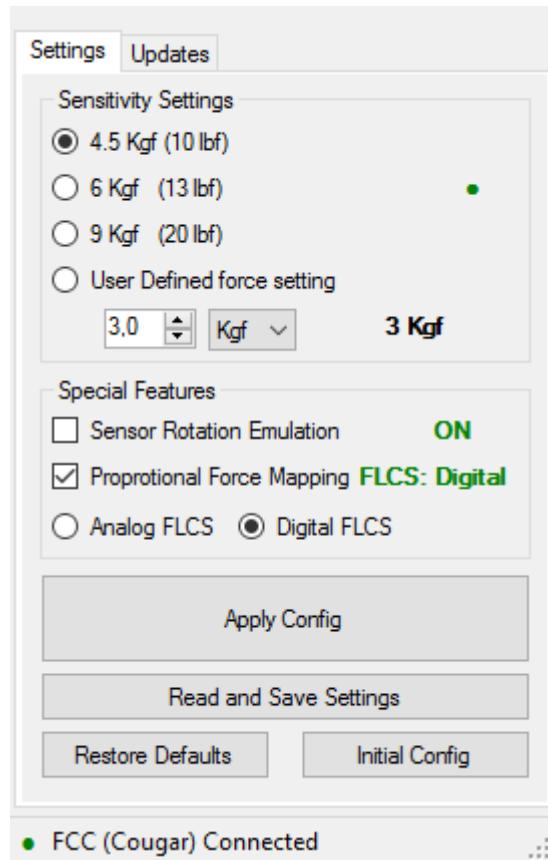
For example, if you set 9 Kgf in the sensitivity settings and have the Digital FLCS enabled for the proportional force mapping then the maximum pitch up command will be 9 Kgf and maximum pitch down command will be 5.76 Kgf and maximum roll forces will be 6.12 Kgf.

Digital FLCS was implemented from the block 40/42 and beyond. The SSC was rotated in that case.

Please note: Implementing high forces and real force ratio might not be practical according to your stick position. Always prefer comfortable settings instead of realism settings which might not suit a the use of the stick on a desktop table which is not representative of a cockpit position.

Once you have set all options to your liking click the Apply Config button. Settings will then be transferred to the device.

The Read and Save Settings button is used to sync the settings between the FCW and the GUI. It will read the settings from the FCW and save them in the GUI. As you may have noticed the GUI tells you which current setting is enabled in the device with a green dot or value.



As seen on the left picture, some options might not be synchronized which is normal as the settings can be changed with stick buttons combination.

The green dots and text report the device settings.
(6 kgf and no sensor rotation)

To sync the settings from the GUI to the FCW,
simply click Apply Config

To sync the settings from the FCW to the GUI, click
the Read and Save Settings button.

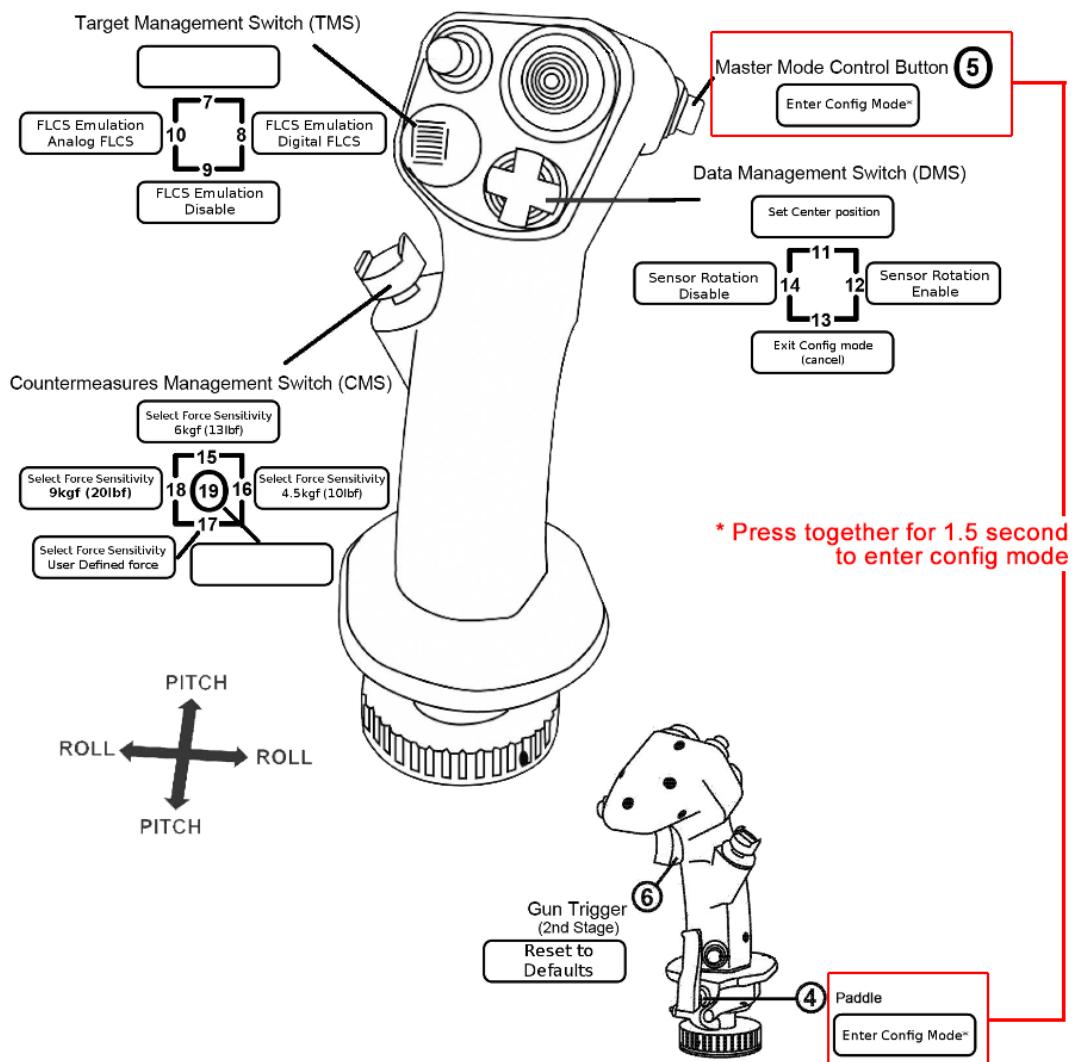
The next two buttons are self-explanatory: Restore
the default values and restore initial config.

5.2 Changing options through stick button combinations

As mentioned before the force settings can also be changed without the GUI by pressing a combination of buttons on the warthog stick.

To enter configuration mode, press the Master mode control button (5) and the paddle lever (4) together for 1.5 second.

Config mode is not a toggle. It will exit right after one button press. Basically you enter config mode and activate the option you like with the button press listed below. After that config mode is exited and if you need to set another option you will have to re-enter config mode again. Do not expect to remain in config mode until you manually exit it. The idea is to have in game access to quick change of the options in case one of the option is not set to your liking. The core of the setup should be done in the GUI before flight.



The CMS switch will manage the force setting:

CMS up will set 6Kg/f (13Lbs/f)



CMS right will set 4.5Kg/f (10Lbs/f)

CMS left will set 9Kg/f (20Lbs/f)

CMS down will set whatever forces is set in the user defined force of the GUI.

The TMS switch will manage the FLCS emulation:

TMS left will set Analog FLCS

TMS right will set Digital FLCS

TMS down will disable FLCS emulation

The DMS switch will manage the sensor rotation:

DMS left will disable sensor rotation

DMS right will enable sensor rotation

DMS up will set centre positions

DMS down will exit config mode

Second trigger detent will restore the settings to default value



6. Programming your FCW

As said earlier in this manual the FCW is DirectX only.

You will lose Thrustmaster programming capability.

Your only way to assign function to the stick is to use DirectX programming.

In most cases this is very simple as it all comes to select a function in the sim user interface and press the corresponding button on your stick.

For advanced function (like DirectX shifting capabilities), please refer to your favourite sim documentation.



7. Contacts and credits

All questions about your FCW should be directed to this email address: info@vipercore.nl

Project Manager & Designer:

Arend "White Eagle" Van Oosten.

Software Manager:

Uri "Uri_ba" Ben-Avraham.

FCW Manual & Alpha/Beta tester:

Olivier "Red Dog" Beaumont

Beta tester:

Jochen "Sneakpeek" Schmich
Jorge "Mr. Well" Pozo