

# **FrSky Horus X12S System**

**OpenTX Firmware and FrOS Flashing  
with  
Windows OpenTX Companion  
and  
Smart Port Flashing with X12S**

**February 7, 2018**

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## **Document Credits**

This document was created by Mike Dailey and Jan Urbanek with support from the OpenTX team members Bertrand Songis and Andre Bernet.

## **About This Document**

This document is in draft form and is for use with OpenTX 2.2.1 or later **If you are just looking for the information on how to do a normal FrSky FrOS OS firmware update with firmware bin files go to page 20.**

## **Overview**

The FrSky Horus X12S has the ability to operate with the factory installed FrSky FrOS OS firmware or OpenTX 2.2.X. The FrOS OS is FrSky's in-house developed powerful menu driven OS and OpenTX is a highly flexible and powerful open source OS developed by the OpenTX Development Team for the X12S.

This document, explains how to switch the X12S system to the OpenTX OS and how to remove OpenTX from the system and return to FrOS OS. The instructions assume the user is already an experienced user of OpenTX Companion. If you have not used OpenTX Companion before read the "Downloading and flashing the firmware" section at the bottom of this page <https://opentx.gitbooks.io/opentx-taranis-manual/content/companion-introduction.html>

Two separate micro SD cards will be used to make the process easier and keep the FrOS and OpenTX files separate to avoid conflicts. One card will be used for FrOS and the other card will be configured for OpenTX.

It is recommended that the user read through the instructions first and then start at the beginning and follow them step-by-step. It is easier to get the process done correctly the first time rather than needing to troubleshoot a problem later.

These instructions are written for users of Windows computers.

### **General Warnings**

These instructions are for use with **ONLY** the FrSky X12S **production system**. When running the FrOS OS the X12S it is flash memory centric and only uses the SD card for Music, Logs and firmware updates.

The FrSky X12S production systems were provided with factory installed FrOS firmware. There is no FrSky support planned for users that flash their X12S with OpenTX and have problems with OpenTX or have problems flashing the system back to FrOS. Considering the risk if there are problems you may not want to flash your system with OpenTX. If you do change the OS system you do so at your own risk.

If you do not consider yourself an experienced user of OpenTX Companion and have not used Companion before you may not want to flash your X12S with OpenTX and stay with FrOS OS.

Even though 2.2.X is in ongoing development, there is little chance that models built in one release might not be compatible with a future build. After building a model the programming needs to be checked very carefully with the aircraft to make sure it works as expected.

The current version of OpenTX Companion only supports an USB connection to the X10S/X10 for flashing of firmware (power off) and the masstorage option to access the SD card via the USB connection (power on) is no longer needed. The masstorage or Joystick option is now selected when the system is connected to the PC.

If you are not an experienced user of OpenTX Companion you might have problems returning to your X12S to FrOS.

### **Preparing X12S For OpenTX Flashing**

Warning: Make sure you know the FrOS build number and keep the number recorded in a safe place. It can be found in SYS/INFO.

Before starting any flashing process make sure you have the correct X12S FrOS OS firmware files saved on your computer or follow the Companion backup process of the X12S system. These files are only available on the FrSky website here [http://www.frsky-rc.com/download/index.php?sort=Firmware&cate\\_id=0&pro\\_id=0](http://www.frsky-rc.com/download/index.php?sort=Firmware&cate_id=0&pro_id=0) As the builds have been released the folder structure and file naming has been changed a number of times. The most recent firmware builds have three folders, Normal (English), L - Localization (localized languages) and C - Simplified Chinese. In most cases FrSky provides dfu files for a one step flashing process, but can be missing in some builds. If a given build is missing the dfu files it can be found in older builds. In the early firmware build there is a dfu file for each X12S mode (1 or 2) and for EU LBT FrOS and FrOS for US. In the later firmware there is no separate file for modes. FrSky has also posted bin for simple firmware updates using the firmware folder.

**We will make a virtual backup of the X12S FrOS bootloader and firmware that can be used to restore that part of the system in the future.**

The SD card eject spring tension has the ability to launch the SD card a significant distance, so caution should be used when removing or inserting the card.

The X12S is not shipped with a micro SD card because the production system keeps its operating folders in an internal flash memory drive. The first step will be setting up the SD card. A class 10 card works the best and 16gig is about the smallest you can buy nowadays. 16gig should be way more storage than needed and 32 gig is the maximum size

1. Format the card using Fat 32 using a Window computer. Mark the card FrOS.
2. Create FIRMWARE, MUSIC and LOGS folders on the card. A MP3 music file can be added as a way to test the card after it is installed.

| Name     | Date modified     | Type        | Size |
|----------|-------------------|-------------|------|
| FIRMWARE | 3/19/2016 9:45 AM | File folder |      |
| LOGS     | 8/16/2016 1:10 PM | File folder |      |
| MUSIC    | 8/16/2016 1:10 PM | File folder |      |

3. With the X12S system power off insert the card in the SD slot. The card contacts face up.
4. Start the system and the SD icon should be visible on the top right side of the display. Press SYS and select the MUSIC player and play the MP3. This is just a quick test to make sure the SD card access is working.
5. At this point the system is ready to use.

The next step is preparing back up files so they can be used to restore the FrOS OS system after using OpenTX on the system. **This is a critical step. Without it you might not be able to easily return the system to FrOS and maintain your system settings and models. OpenTX should never write into flash memory area, but just for best practices backup files are created so the X12S can be recovered even something happens to the flash memory drive at a later date. The factory default contents of the flash memory drive are available on the FrSky download website with each individual firmware release.**

1. With the X12S system power on connect a USB data cable to the USB port on the back of the X12S (do not lay the X12S on its back with the USB cable attached it could damage the USB connector) and connect the USB data cable to a USB port on a Windows computer. The display of the X12S will display a large USB symbol on the screen.
2. After a few seconds two Windows File Explore windows should open.

| Name   | Date modified     | Type        | Size |
|--------|-------------------|-------------|------|
| CONFIG | 2/3/2018 10:02 AM | File folder |      |
| IMAGES | 2/3/2018 10:02 AM | File folder |      |
| MUSIC  | 2/3/2018 10:02 AM | File folder |      |
| SOUNDS | 2/3/2018 10:02 AM | File folder |      |
| SYSTEM | 2/3/2018 10:02 AM | File folder |      |

Flash memory drive folders. The music folder will not be on older firmware.

| Name     | Date modified     | Type        | Size |
|----------|-------------------|-------------|------|
| FIRMWARE | 3/19/2016 9:45 AM | File folder |      |
| LOGS     | 8/16/2016 1:10 PM | File folder |      |
| MUSIC    | 8/16/2016 1:10 PM | File folder |      |

SD card folders

3. Use the File Explore copy function to copy all the flash memory drive folders to a folder on your computer for backup. **Caution: Be careful not to NOT delete the flash memory drive folders.**
4. **Because OpenTX does not use the flash memory drive leave the FrOS folders on the flash memory drive.**
5. Using the Windows USB **eject function eject both drives.**
6. Disconnect the USB cable and the X12S will shut off.
7. With the system off remove the SD card. Store the SD card in a safe place and or note where you made the SD backup on your computer.

## Flashing Firmware

### Flashing OpenTX Firmware

1. A SD card of about 4 gigabytes or more is required and formatted as Fat32
2. Download the latest Horus OpenTX SD card files from the link near the top of this page here <http://www.open-tx.org/downloads.html> and included sounds. Download the newest files.
3. Un-zip the download and copy the files to the SD card.
4. The folders on the SD card will look like the image below. The Models and Radio folders must be manually created and will be empty until the system is flashed. **Be sure to copy the Version file.** IMAGES is used for 192X114 JPG and PNG color model images with a file name length limit of 6 characters. Sound files have a file name length limit of 6 characters. Logs will hold log files when the data “logging” feature is used. **Make sure the VERSION file is on the SD.**

This PC > OPENTX (E:)

| Name                  | Date modified      | Type         | Size |
|-----------------------|--------------------|--------------|------|
| FIRMWARE              | 10/23/2016 8:17 AM | File folder  |      |
| IMAGES                | 6/7/2016 6:49 PM   | File folder  |      |
| LAYOUTS               | 10/23/2016 8:17 AM | File folder  |      |
| LOGS                  | 4/20/2016 5:44 PM  | File folder  |      |
| MODELS                | 5/9/2016 4:42 PM   | File folder  |      |
| RADIO                 | 5/9/2016 4:42 PM   | File folder  |      |
| S6R                   | 10/23/2016 8:17 AM | File folder  |      |
| SCRIPTS               | 10/23/2016 8:17 AM | File folder  |      |
| SOUNDS                | 5/9/2016 7:32 PM   | File folder  |      |
| THEMES                | 7/2/2016 11:27 AM  | File folder  |      |
| WIDGETS               | 7/2/2016 11:27 AM  | File folder  |      |
| opentx.sdcard.version | 10/23/2016 8:18 AM | VERSION File | 1    |

5. With the X12S with the power off install new OpenTX SD card.
6. Download OpenTX Companion 2.2.X from the OpenTX 2.2 branch link here <http://www.open-tx.org/downloads.html> and install. After selecting, review the instructions on the 2.2.X page before downloading the Companion build.
7. With the X12S **power off** connect it to a Windows computer using a USB data cable. Download Zadig from here <http://zadig.akeo.ie/> and install. Not all USB cables are actually “data” cables; some are just a charging cable. Even data cables are not all created equal and one that you have used for other data applications

may not work with STM32bootloader. You must use a compatible data cable or the X12S will not connect. .

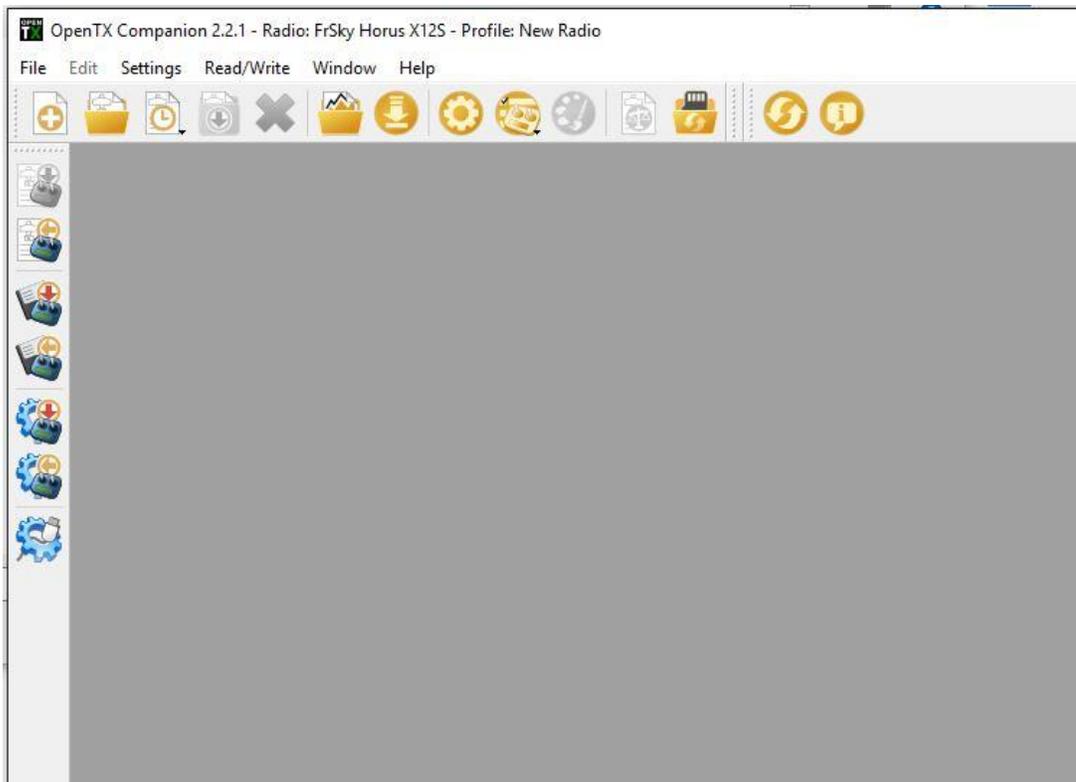
Zaddig is an installer program to install the USB driver called STM32bootloader so that the USB power off connection can be made to the X12S. Zaddig may replace the existing default USB driver. When installed the STM32bootloader should be visible in the USB section of the Window Device Manager with the X12S connected.

Even if you think STM32bootloader was installed for a Taranis, etc. you may need to do the installation again. Also some Windows updates like Windows 10 Anniversary update may remove STM32 Bootloader. If you need help on installing go here <http://open-txu.org/home/undergraduate-courses/fund-of-opentx/using-zadig/>

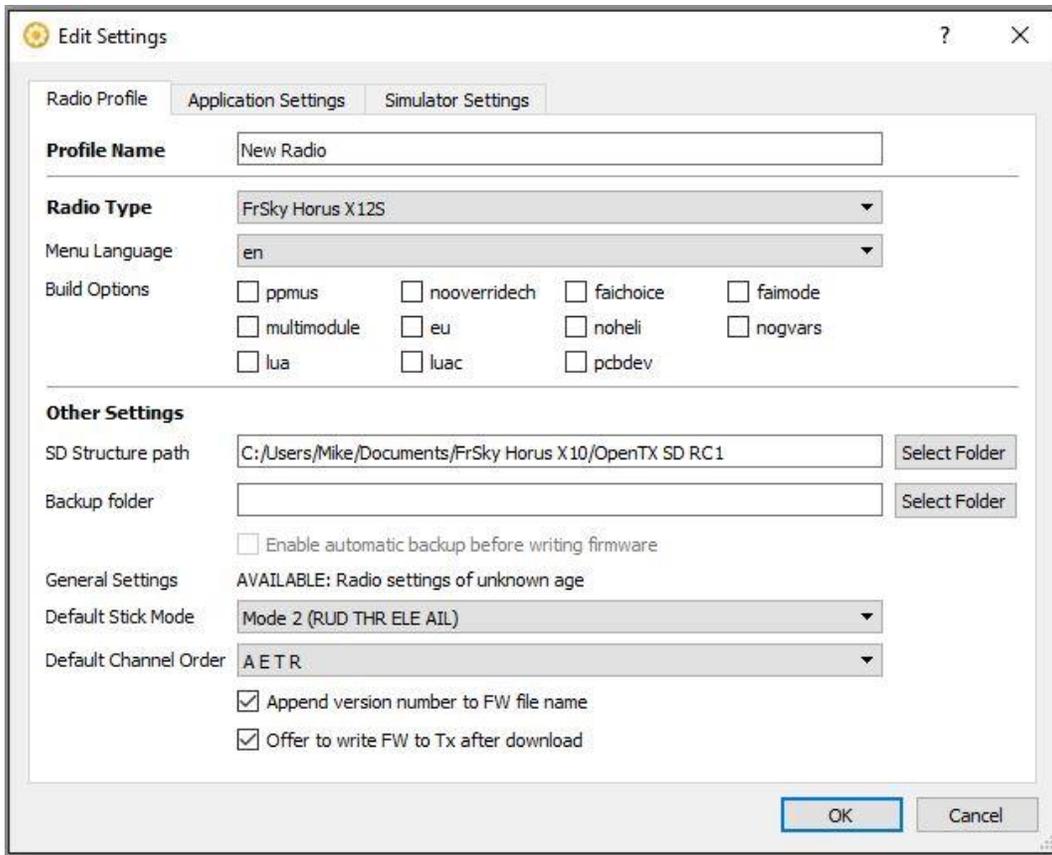
8. The X12S with power off should still be connected to the computer with a USB data cable. Start Companion and in settings, make sure the Radio Type is set to FrSky Horus. Click the lower icon on the left side of Companion that has the left arrow on it (read firmware from radio). This process will make a valid backup of the FrOS firmware and bootloader. This backup creates an image that can be flashed back to the X12S to restore the FrOS boot loader and firmware.

Save the file to a folder on your computer. It would a good idea to use a file name with FrOS included and the firmware release as a reminder that it is the FrOS backup file. Make sure that the backup process actually saved the backup file. The extension should be bin and around 2000KB in size. If there is no file saved check the STM32 Bootloader installation.

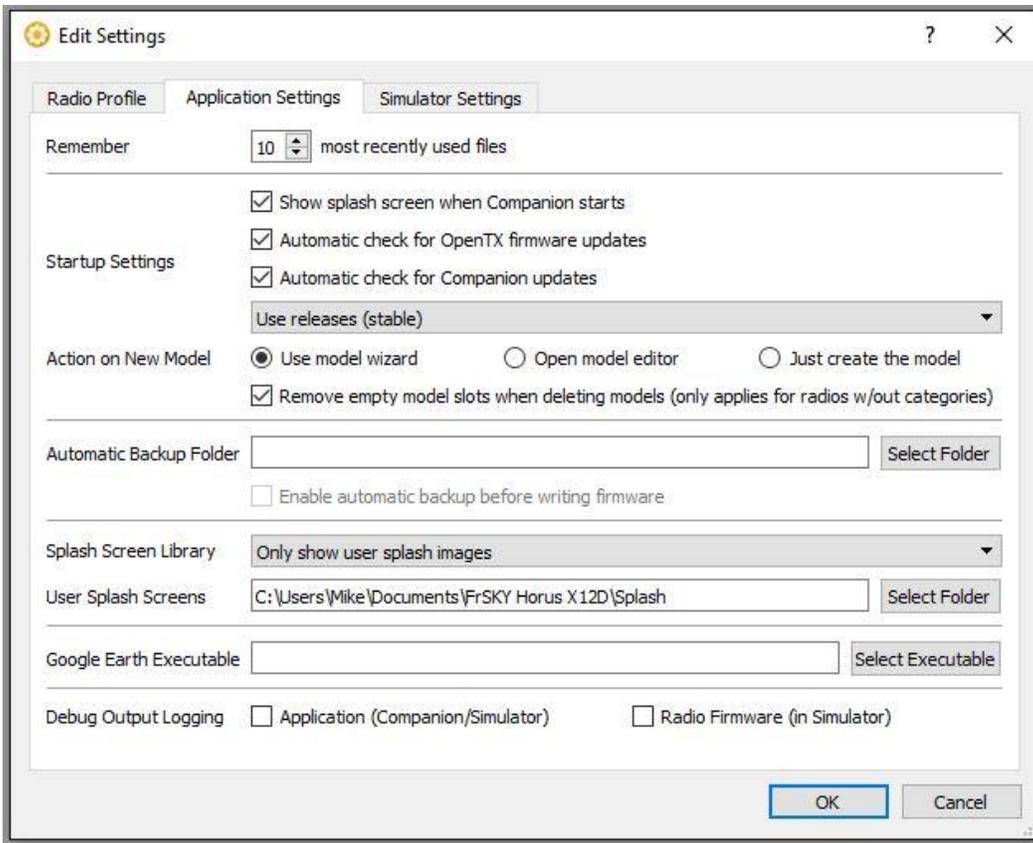
9. Click the settings “Gear” Icon on the top bar to open the settings window.



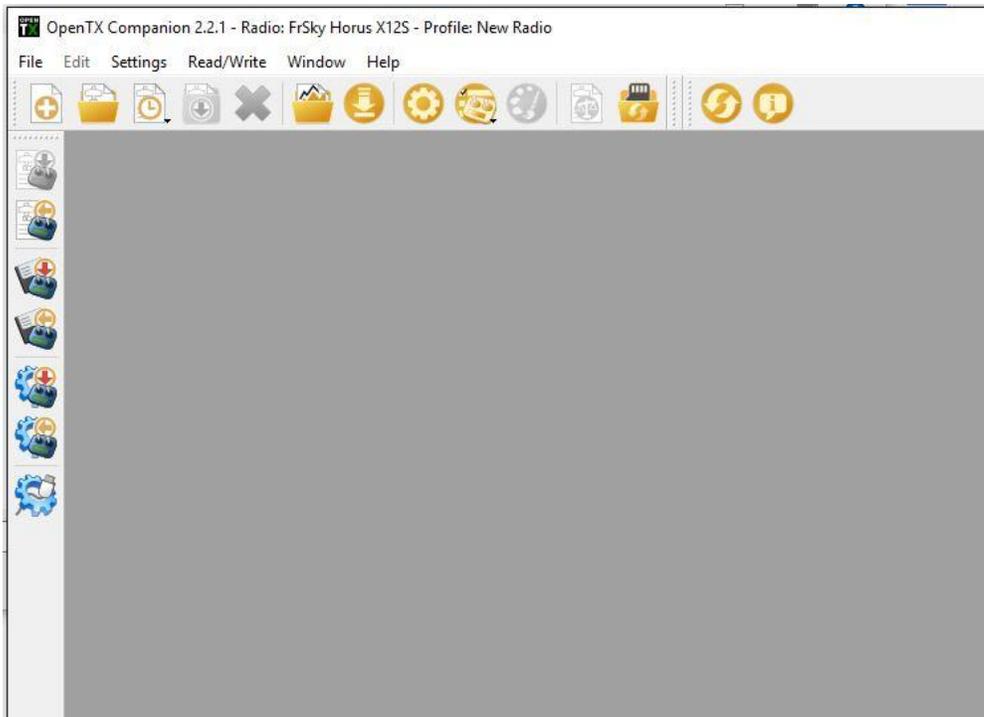
10. In settings, make sure the Radio Type is set to FrSky Horus X12S. There is an option on this page called **pcbdev for downloading the firmware for the early beta X12S systems. DO NOT select this option.** The **masstorage** option is no longer used with 2.2.1.



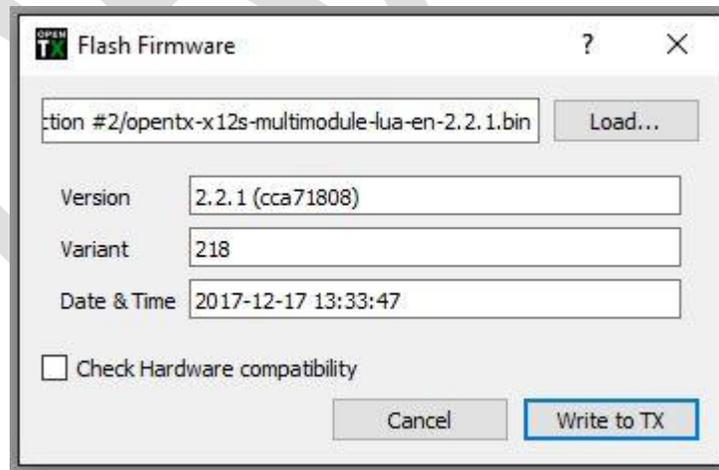
11. In Settings/Application Settings check that the following boxes are checked.



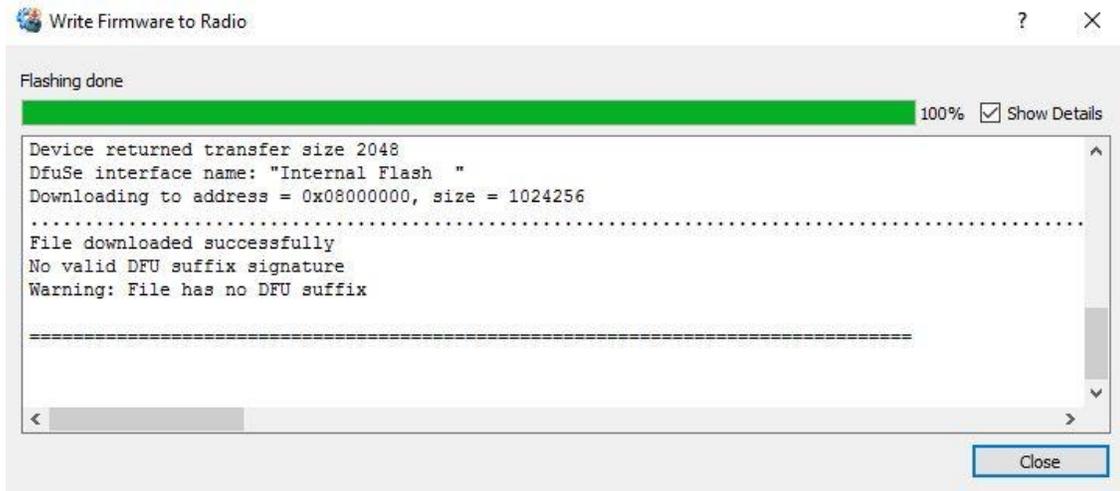
12. Start the download of the OpenTX Horus firmware by clicking down “arrow” icon on the top bar. A window opens and then Click the “Download FW” button and save the firmware.



13. In Companion select “write firmware to radio” icon. It is the “radio” icon with the down arrow on the left of the screen. The window below opens. Check that the firmware that was just downloaded is displayed. If not click “Load” and select the OpenTX Hours firmware bin file. Check Hardware compatibility box may need to be unchecked.



14. Click “Write to TX” and flash the X12S.



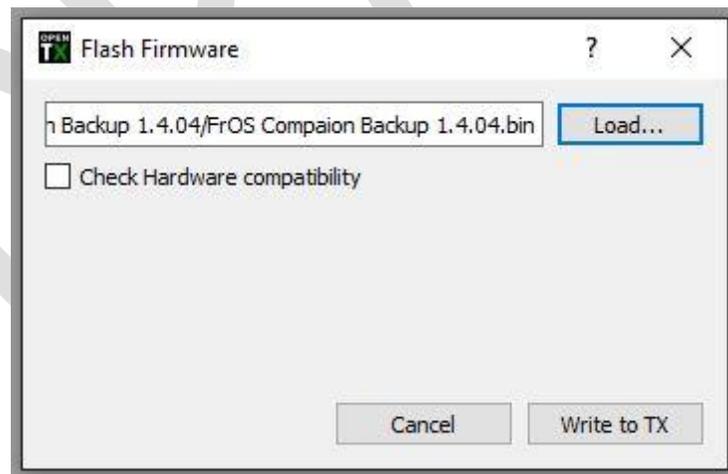
After the flashing is complete the OpenTX Companion screen looks like the above image.

15. Use “Safely Remove USB Hardware” feature on your computer to close the USB port.
16. Disconnect the X12S from the USB
17. Turn on the X12S and test (if this is the first OpenTX flash for the system it will start on the calibrate screen) **Detailed testing of models should be done before flight to make sure the programming works as expected. Always range check the system in range check mode before flight.**

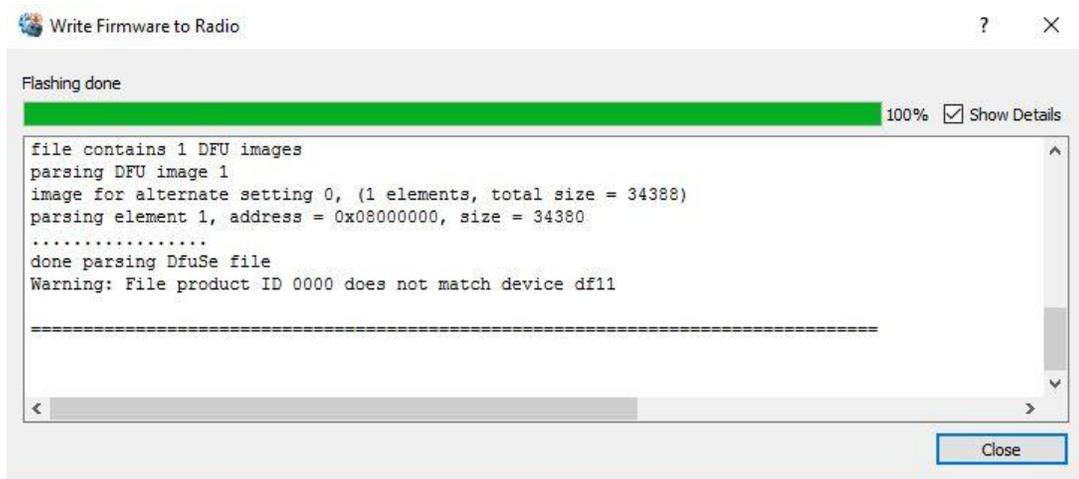
**In the rare case that the X12S will not start after flashing, reconnect the X12S to the PC and re-flash the system. If the X12S system is not recognized by the PC then there is a possibility that a bad flash process has hung the system and the battery needs to be disconnected for a few minutes to fully shut down the system and then re-flash. In some cases the battery may need to be disconnected until the flashing process is complete. See page 31 for how to open case and disconnect the battery.**

## Removing OpenTX Option 1 - Flashing the FrOS Bootloader and Firmware – Using the FrOS Companion Backup

1. This process will remove OpenTX and install the FrOS bootloader and the FrOS firmware.
2. With the X12S power off remove the OpenTX SD card from the X12S **The OpenTX SD card contains all the X12S OpenTX configuration information including the model files created while using OpenTX and can be used again starting with step #5 of the OpenTX flashing instructions, but not before the FrOS folders are backed up. See the Preparing X12S For OpnTX Flashing section on page 3.**
3. Insert the FrOS SD card in the X12S
4. With the X12S power off connect it to the computer with a USB data cable.
5. Start Companion, select “write firmware to radio” icon, in the window that opens click “Load” and select the FrOS backup file that was made before OpenTX was flashed. **Caution make sure the FxTX file is selected and not the OpenTX file.** Check Hardware compatibility box may need to be unchecked.



6. Click “Write to TX” to flash the X12S



After the flashing is complete the OpenTX Companion screen looks like the above image.

7. Use "Safely Remove USB Hardware" feature on your computer to close the USB port.
8. Disconnect the X12S from the USB

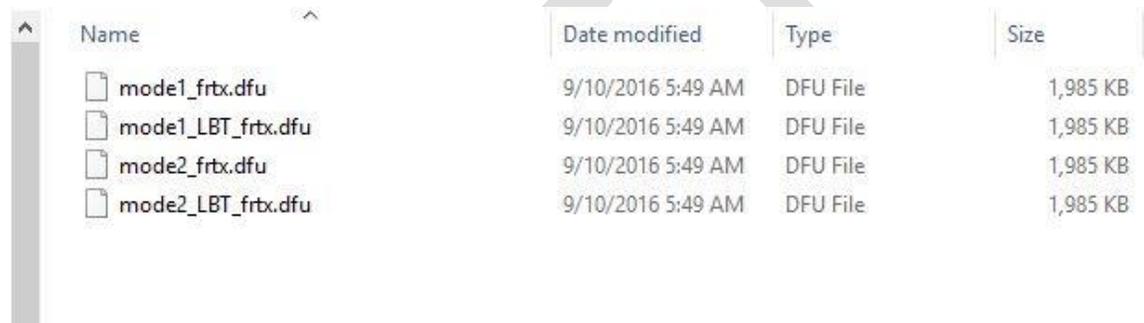
At this point the system has OpenTX removed. Power on the system and it should be restored to FrOS.

### **Removing OpenTX Option 2 - Flashing the FrOS dfu – One Step Using FrOS Files (for systems that were on FrOS 1.3.01 or older)**

1. This process will remove OpenTX and install the FrOS bootloader and FrOS firmware.
2. With the X12S power off remove the OpenTX SD card from the X12S **The OpenTX SD card contains all the X12S OpenTX configuration information including the model files created while using OpenTX and can be used again starting with step #5 of the OpenTX flashing instructions, but not before the FrOS folders are backed up. See the Preparing X12S For OpnTX Flashing section on page3**

This process assumes you have the FrOS **dfu** files from the FrSky Website. **As the**

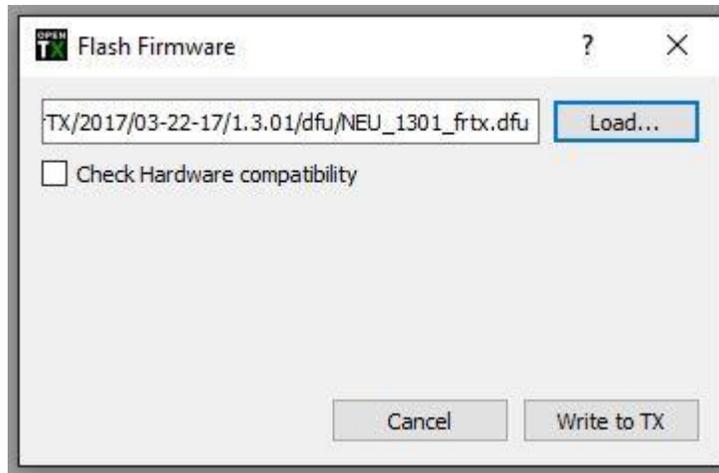
builds have been released the folder structure and file naming has been changed a number of times and is not consistent. The most recent firmware builds have three folders, Normal (English), L - Localization (localized languages) and C - Simplified Chinese. In most cases FrSky provides **dfu** files for a one step flashing process, but can be missing in some builds. If a given build is missing the **dfu** files it can be found in older builds. In the early firmware build there is a **dfu** file for each X12S mode (1 or 2) and for EU LBT FrOS and FrOS for US. In the later firmware there is no separate file for modes and are not necessary because mode is selected when building a model. The most recent builds are just EU\_XXXX\_FrOS, NEU\_XXXX\_FrOS (N=NOT EU).



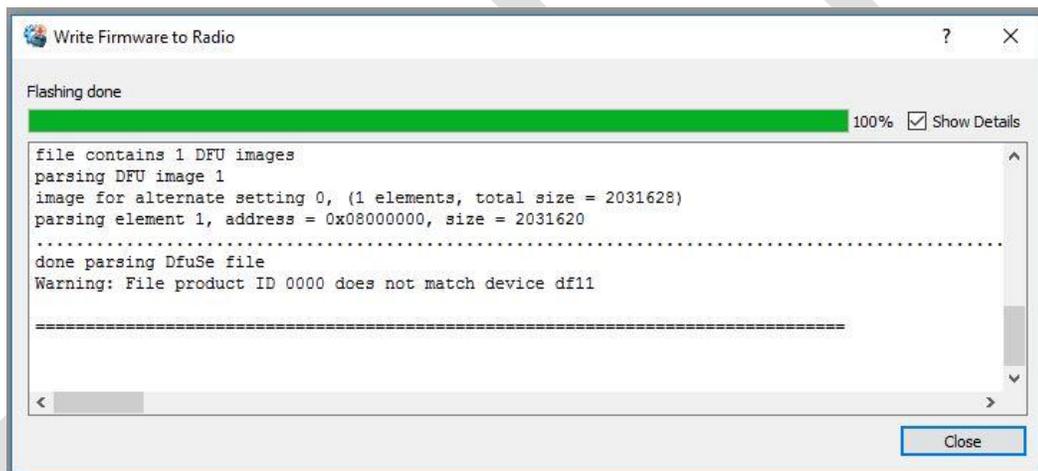
| Name               | Date modified     | Type     | Size     |
|--------------------|-------------------|----------|----------|
| mode1_frtx.dfu     | 9/10/2016 5:49 AM | DFU File | 1,985 KB |
| mode1_LBT_frtx.dfu | 9/10/2016 5:49 AM | DFU File | 1,985 KB |
| mode2_frtx.dfu     | 9/10/2016 5:49 AM | DFU File | 1,985 KB |
| mode2_LBT_frtx.dfu | 9/10/2016 5:49 AM | DFU File | 1,985 KB |

**Dfu** file list from FrSky website.

3. Insert the FrOS SD card in the X12S
4. With the X12S power off connect it to the computer with a USB data cable.
5. Start Companion, In settings, make sure the Radio Type is set to FrSky Horus, then select “write firmware to radio” icon, in the window that opens click “Load” and select the **dfu** file. **Caution make sure the FxTX file is selected and not the OpenTX file.**



Click "Write to TX" to flash the X12S.



After the flashing is complete the OpenTX Companion screen looks like the above image.

6. Use "Safely Remove USB Hardwar" feature on your computer to close the USB port.
7. Disconnect the X12S from the USB

8. Hold the power button down on the X12S until you see text below.



The update process runs with an ending message to “restart system please” and shuts off automatically.

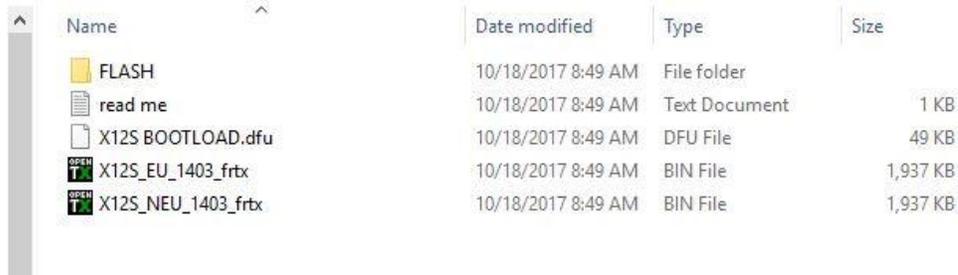
9. Power on the system and test.

### Removing OpenTX Option 3 - Flashing the FrOS boot dfu – Two Steps Using FrOS Files (for systems that were on FrOS 1.4.03 or newer)

1. This process will remove OpenTX and install the FrOS bootloader, but no FrOS firmware. The firmware is installed in a second step.
2. With the X12S power off remove the OpenTX SD card from the X12S **The OpenTX SD card contains all the X12S OpenTX configuration information including the model files created while using OpenTX and can be used again starting with step #5 of the OpenTX flashing instructions, but not before the FrOS folders are**

**backed up.** See the [Preparing X12S For OpnTX Flashing](#) section on page3

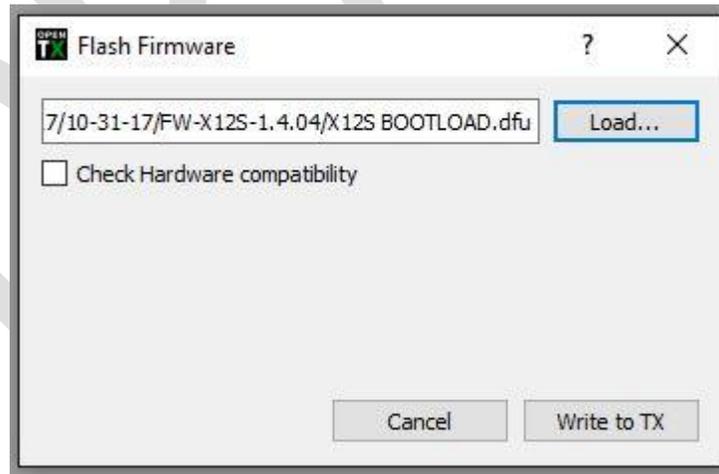
This process assumes you have the FrOS bootloader **dfu** file from FrOS 1.4.03 or newer from the FrSky Website saved on your computer.



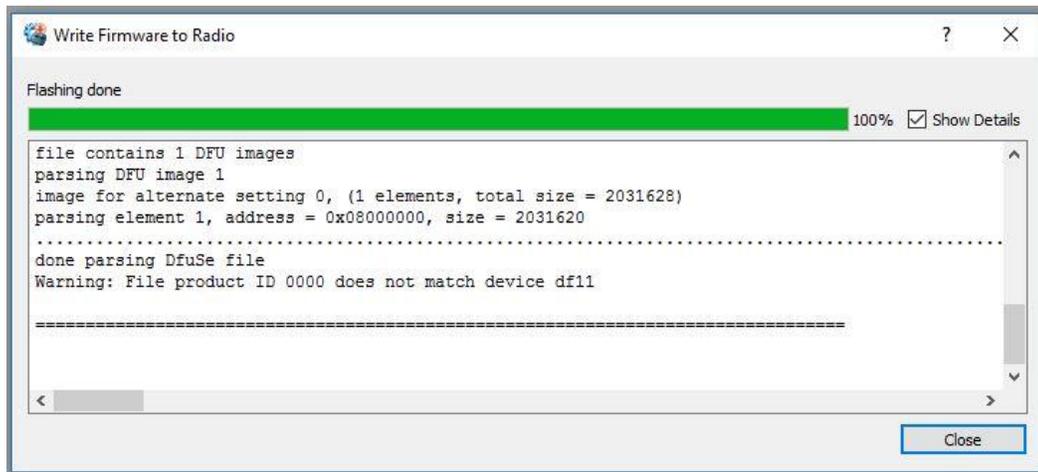
| Name                | Date modified      | Type          | Size     |
|---------------------|--------------------|---------------|----------|
| FLASH               | 10/18/2017 8:49 AM | File folder   |          |
| read me             | 10/18/2017 8:49 AM | Text Document | 1 KB     |
| X12S BOOTLOAD.dfu   | 10/18/2017 8:49 AM | DFU File      | 49 KB    |
| X12S_EU_1403_frtrx  | 10/18/2017 8:49 AM | BIN File      | 1,937 KB |
| X12S_NEU_1403_frtrx | 10/18/2017 8:49 AM | BIN File      | 1,937 KB |

Example file list from the FrSky website showing **Dfu** Bootload file.

3. With the X12S power off connect it to the computer with a USB data cable.
4. Start Companion, In settings, make sure the Radio Type is set to FrSky Horus, then select “write firmware to radio” icon, in the window that opens click “Load” and select the **dfu** file. **Caution make sure the FxOS file is selected and not the OpenTX file.**



Click “Write to TX” to flash the X12S.



After the flashing is complete the OpenTX Companion screen similar text but not the same to the above image.

5. Use “Safely Remove USB Hardware” feature on your computer to close the USB port.
6. Disconnect the X12S from the USB. At this point the system is ready for the actual firmware installation using the “Normal FrOS OS Firmware Update – Using Firmware Bin File” listed below. **Please note that the system only has the bootload file installed, cannot start and the FrOS firmware bin file will need to be copied to the SD card using a Windows computer.**

### Normal FrOS OS Firmware Update – Using Firmware Bin Files

This process is for performing a normal FrOS OS **bin** file update on systems that are currently operating with the FrOS OS. **Always make a backup of the flash memory drive before starting a firmware update.**

1. From the FrSky Firmware Download Website [http://www.frsky-rc.com/download/index.php?sort=Firmware&cate\\_id=0&pro\\_id=0](http://www.frsky-rc.com/download/index.php?sort=Firmware&cate_id=0&pro_id=0) . Download the X12S firmware zip file and un-zip the file. This process assumes you have the FrOS **bin** files from the FrSky Website. The most recent firmware builds have three folders, Normal (English), L - Localization (localized languages) and C -

Simplified Chinese. In the early firmware build there is a **bin** file for each X12S mode (1 or 2) and for EU LBT FrOS and FrOS for US. In the later firmware there is no separate file for modes and are not necessary. Depending on the build there could be LBT (Listen Before Transmit) is used for EU countries and FrOS for the US and other countries that do not use LBT. The most recent builds have EU\_XXXX\_FrOS and NEU\_XXXX\_FrOS (N=NOT EU).

2. The firmware **bin** file copy function can be done by connecting the powered on X12S to your Windows computer with a data USB cable or removing the SD card and writing directly to the SD card.

Note: If this system is being updated from FrOS builds older than 1.4.02 there are flash memory files that will need to be copied from the FLASH folder provided in the firmware zip. There are FrSky readmes provided that explains what needs to be done. Always check the readmes as there could be other files in the future that need to be added to the flash memory drive. From the FLASH folder provided in the download. Copy the files in the CONFIG folder and overwrite the files in the flash memory drive CONFIG folder. In the IMAGES folder copy bitmap folder and its files to the flash memory drive IMAGES folder. Copy the Music folder and its files to the flash memory drive root. Always make a backup of the flash memory drive after changing the files.

The config files are changed on some builds because they control how the models work with the new firmware. The bitmaps are being added to the flash memory drive to move them out of the system memory. The bit maps are the icons you see on the FrOS screens when it is operating.

3. When the powered on X12S is connected with the data USB cable two Windows File Explorers will appear within a minute, one for the SD card and one for the Flash Memory Drive.
4. Copy the correct FrOS firmware **bin** file for your system to the SD FIRMWARE folder. Only **ONE** file can be in this folder.

5. Use “Safely Remove USB Hardwar” feature on your computer to close the USB port.
6. Disconnect the X12S from the USB
7. Press and **hold** the rotary encoder down (the enter knob) and **at the same time press and hold** the power switch until text is displayed on the screen.

See below:



The flashing process will run and finish with a “Successful” press the power off button briefly and the system shuts off.

8. Next. Press hold the power switch until text is displayed on the screen.

See below:



9. The flashing process runs with an ending message to “restart system please” and shuts off automatically.
10. Press the power switch to start the system. The system should have the normal FrOS screen with all models, etc. If there is a problem do not try going back to an older release without seeing the FrOS Firmware File Compatibility section page 33.

## FrOS Sound and Image Files

### Audio Files

WAV -TRACK FOLDER - Flash Memory Drive. Size < 100K; Number <100; name length <10 chars (.wav not included); format should be .wav. Track wav files are the user created files that are used with Special Functions.

If more than a few custom sounds are planned rather than using up space on the internal USB Flash Memory drive the least used sound files can be stored on the SD card. The files need to be in a path on the SD card that is the same path that is used

on the Flash Memory drive. The path on the SD would be SOUNDS\en\Track. When programming a sound in Special Function the system looks for the sound on the Flash Memory drive first and then the SD card.

Model Sounds - Size < 50k ,format should be .wav;, name length < 30. path: SOUNDS/en/model. Model sounds are the user created files that speak the model name when models are selected.

OpenTX Speaker is an easy way to create WAV files <http://www.open-tx.org/2014/03/15/opentx-speaker>

### Image Files

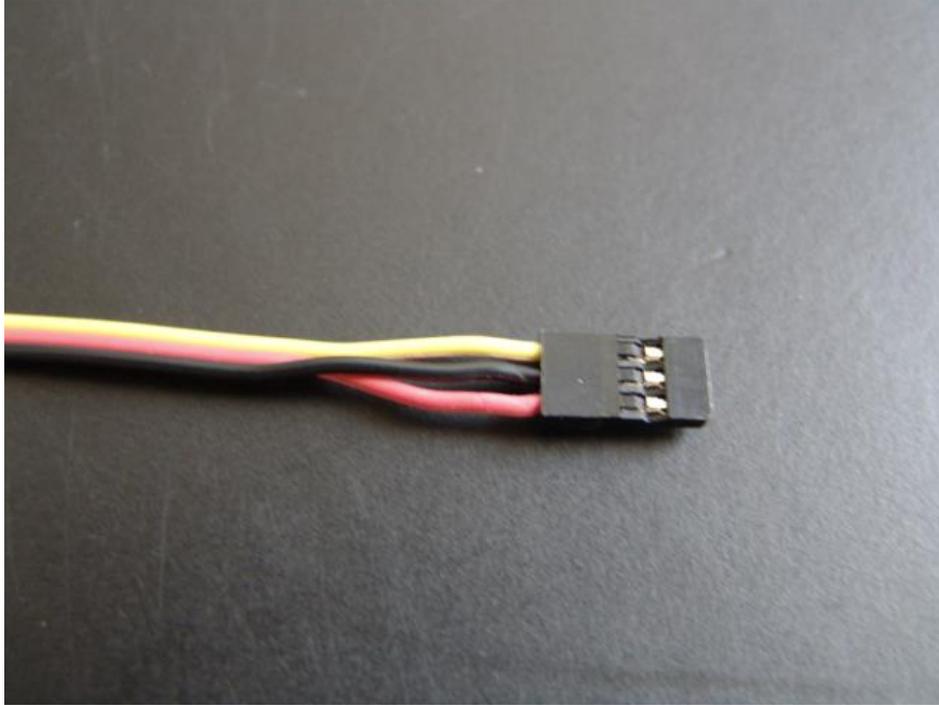
Size 50K or less, max number <100, name length up to 30 chars (.jpg extensions not included), format jpg 155x100 (larger or smaller size will not display as well, cut off, etc..

The Model images go in the folder IMAGES/modelimages on the Flash Memory drive.

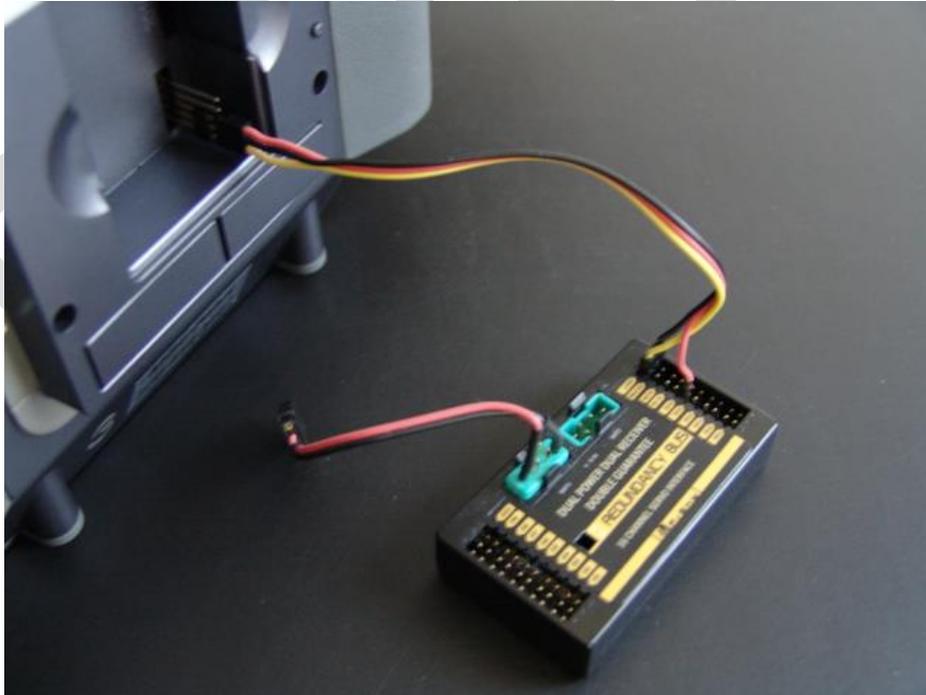
Starting with FrOS 1.4.04 and later model images can also be stored on the SD card by creating a SD folder IMAGES/modelimages and placing the image files in the folder.

### Smart Port Flashing of Devices with X12S FrOS OS

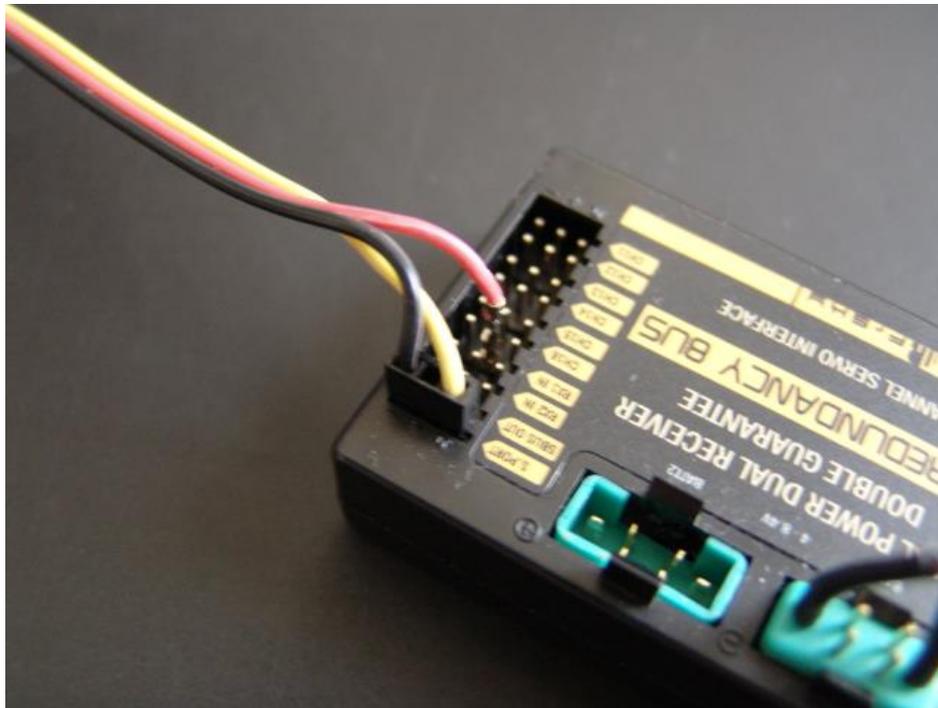
1. For this flashing example we will update the FrSky Redundancy Bus, but the process can be used for the XJT module, receivers, etc. **Caution: Because the TX voltage is used for power when you flash devices make sure there is nothing connected to the device, servos, etc.**
2. Copy the file to be flashed to the X12S SD card FIRMWARE folder. If the file name is too long it may need to be renamed shorter to appear in the X12S update selection window.
3. Change the order of the connector wires in a Smart Port cable for the X12S connection by reversing the black and red wire.



4. With the X12S powered off connect the cable to the lower three pins of the module bay connector (yellow on the lowest pin) and to the Redundancy Bus.



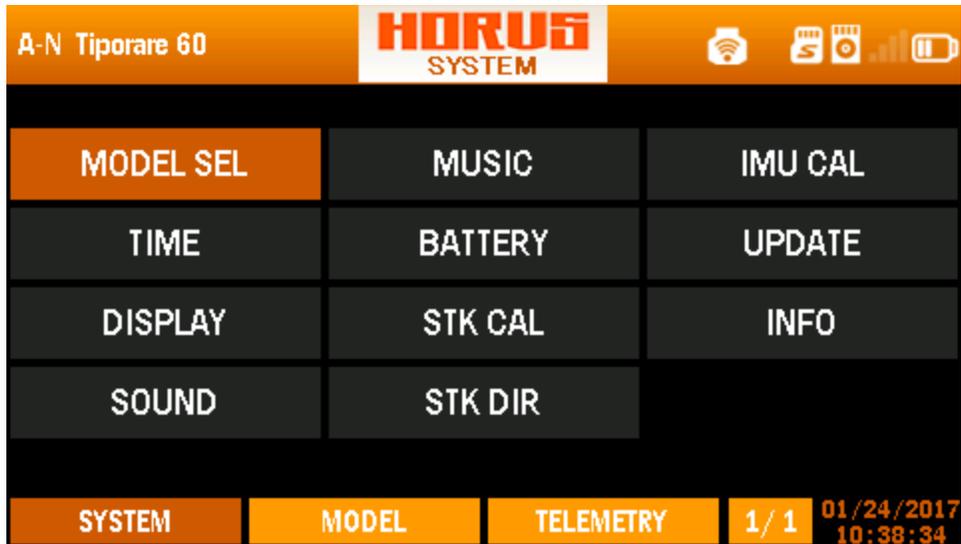
5. The connection on the Redundancy Bus is on the Smart Port with the red wire on Channel 18 + connection.



6. Power on the X12S. At the main screen press SYS.



7. At the SYSTEM screen select UPDATE



8. At the SPORT UPDATE Screen select the file to be flashed and select UPDATE



9. When UPDATE is selected a flash progress bar pops up.



10. The progress bar during flashing.



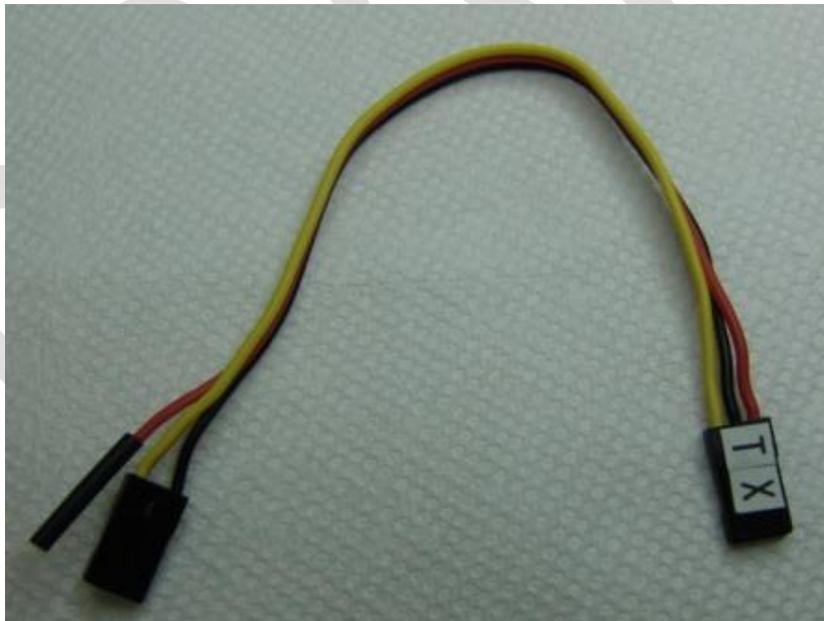
11. When the flashing is complete the progress bar closes and SUCCESS is displayed.

Use the **DELETE** function to delete the file. Test

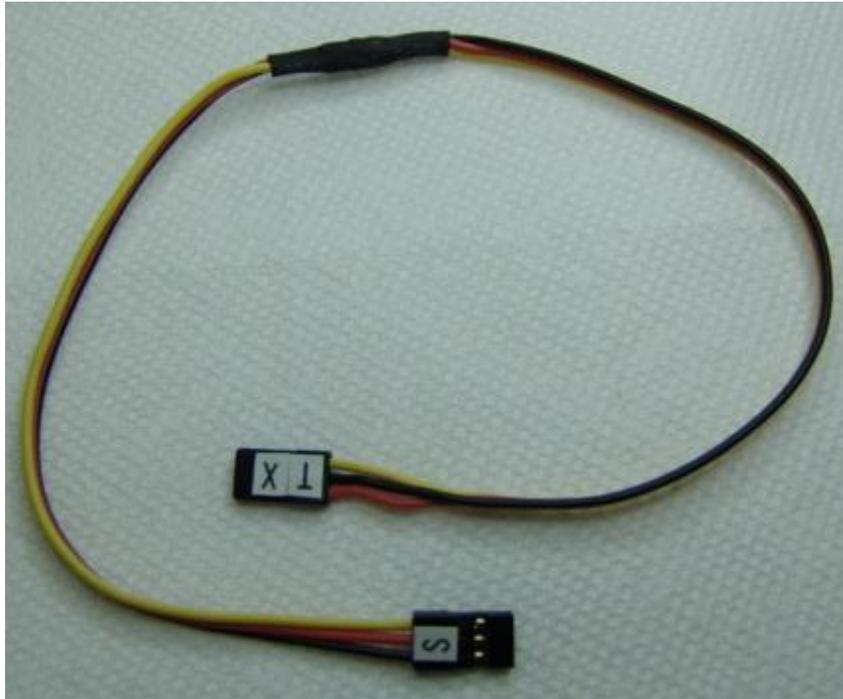


12. Power the X12 off and disconnect the Smart Port cable. As always carefully test any device flashed to make sure it functions correctly. OpenTX RC11 and above also has a Sport flashing feature.

13. Flashing Cables.



RBUS Cable



Receiver Cable X6R and X8R



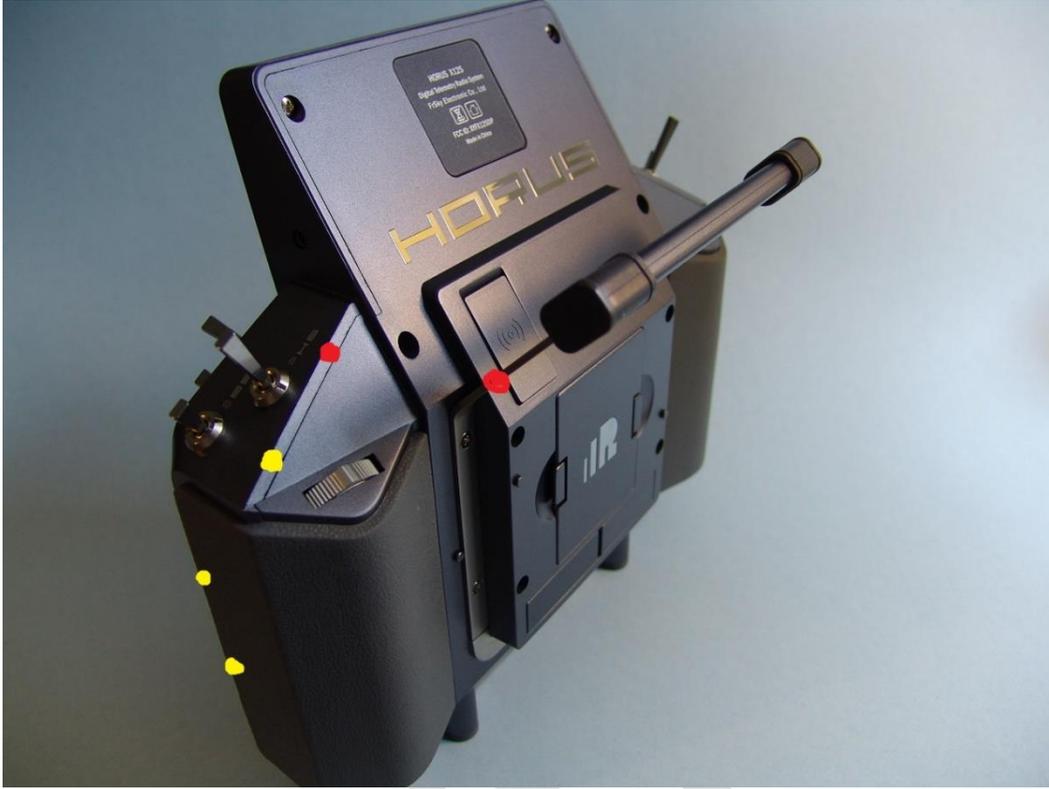
Receiver Cable X4R

## How to Open X12S Case – Battery Disconnect

1. If the flashing of OpenTX or the FrOS dfu does not complete properly there possibility that the X12S will not start and also a possibility that it will not be recognized again when reconnect to the PC. If the X12S system will start and is not recognized by the PC it is most likely in a hung condition and will need to be reset by disconnecting the system battery. In some cases the battery will need to be left disconnected during the flash and then reconnected when the flash process is complete.
2. The case will be opened for access to the battery.
3. After removing the case screws (6 round head chrome) and bolts (4 black, not used in the later cases) place the X12S on a table face down and padded with a thick folded towel. Do not remove the rubber side grips. Stand so your leg is against the edge of the table. Pull the X12S to the edge of the table so the bottom/base is against your leg to brace the X12S.
4. With your right hand wrap your fingers around the base of the handle (red dot) and put your right thumb on the front of the case edge (red dot). With your left had grip the front edge of the rubber grip with your fingers and place your thumb on the front edge of the case (yellow dot). Using your leg to brace the X12S, grip the case back with your fingers as described above and press on the front edge of the case with both thumbs until that side of the case pops lose.
5. Be careful that you just pop the case open  $\frac{1}{4}$ " or less and then release the other side. There are connections to the case back for the GPS antenna, external antenna, haptic motor and the two back sliders. Just open the case far enough to reach between the front and back case to reach the battery connector from the bottom of the case.

See images below....

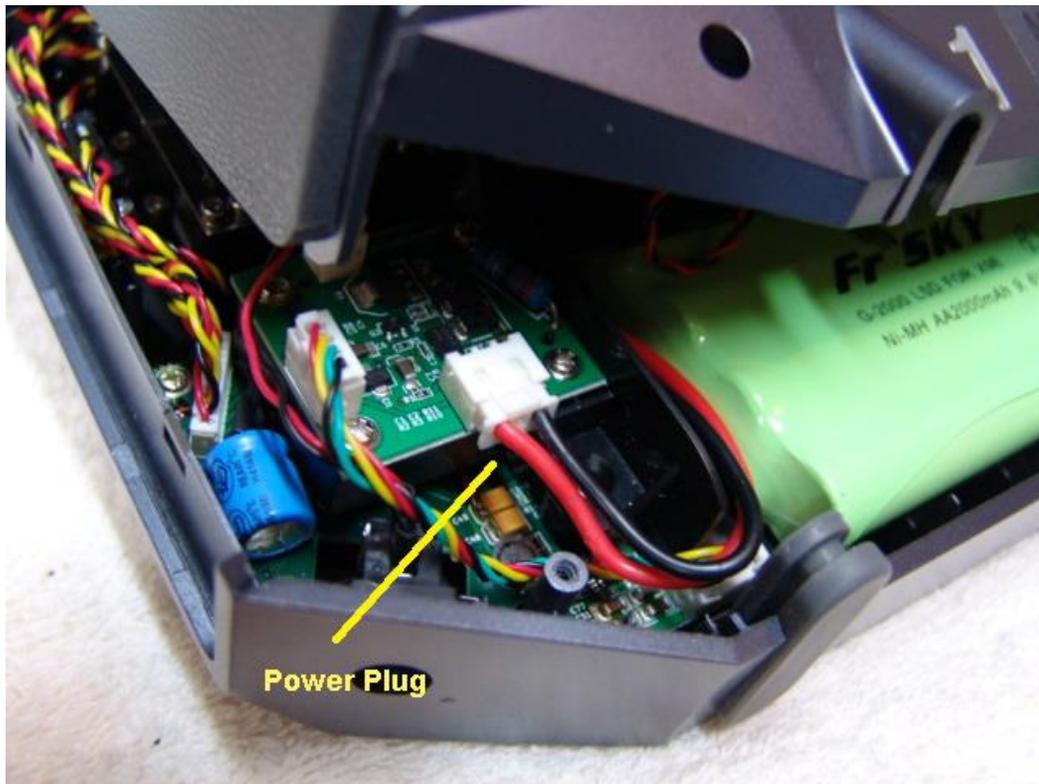




X12S case back

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Looking from the back of the X12S the battery connector plug is in the lower left corner of the front case and has heavy red and black wires,



The battery connector plug. **Be careful when reconnecting the battery connector that the power wires are clear of the front case mounting stud near the wire.**

## FrOS Firmware File Compatibility

### Warning

Always make a backup of the system flash memory drive and copy it to your computer before starting a firmware update. The firmware update process requires that the user be proficient with the use of Microsoft File Explorer and a Windows computer. Use only a Windows computer for the file copy process.

### Firmware Release Numbers

How the FrOS firmware release numbers impact the file compatibility between releases as the release numbers change.

|                |   |    |     |
|----------------|---|----|-----|
| Release Number | X | .X | .XX |
| Table Legend   | A | B  | C   |

## Legend

- A. Major firmware changes, no model or configuration file compatibility available between previous firmware and new firmware.
- B. Model file changes, but a compatibility method is added to the update when going to a higher “B” number build. Update may require new configuration files or other files specified in the release notes and provide in the FLASH folder included with the update zip to be copied to the flash memory drive of the system. Only the files specified with the release notes are needed not all the folders in the FLASH folder. Be sure to use only the FLASH folder provided with the current update zip that is being used for the update.

Because of the compatibility methods added to files on this type of update it is not a good idea to attempt to go back to an earlier build once the update has been started. For an example the model files modified by the update will not be able to be read by the previous build and the system may not be able to start.

- C. No difference in model or configuration files. Usually just a simple update with just the firmware bin file used for updating.

## Returning System To An Older “B” build Number

It is not recommended to return a system to an older “B” build number because if you make a mistake in the file copy process you could create a situation where the system will not start. If the system will not start then you cannot access the Flash Memory Drive to recover. But there are some situations where returning to an older build is desirable and being very careful with file changes it can be done.

Depending on the older model file backups available and changes made in the current model files not all of the old model files may have current data. Because the “B” number model files are not compatible between builds when going to a lower “B” number the following is the best solution available.

1. Determine the “B” number build you want to use and have those update files available and your model file backups that match that build.
2. Connect the system power on to a Windows computer using a data USB cable. After connection two File Explorer windows will open.
3. Make a copy of the Flash Memory Drive folders and save them to your computer. The Flash Memory Drive has the Config, Images, Sounds, System, etc. folders on it.
4. From the “B” number build you want to use copy the Config files from the FLASH Config folder provided with the build to the Config folder on the system Flash Memory Drive and overwrite the files.
5. Delete the current model files from the system Flash Memory Drive. The model files are in sub folders in the System folder. Delete only the model files not the folders. It is important to delete the files because incompatible files will result in the system not starting and displaying “HORUS SD\_STATUS\_MODEL\_VERSION\_”. The model files will be added later process after the system has been flashed and working.
6. Copy the “B” number firmware bin file for the build you want to use to the firmware folder on the SD drive. Only one file can be in the firmware folder.
7. Using the Windows Eject feature Eject the Flash Memory Drive and the SD drive then disconnect the USB cable.
8. At this point follow the normal firmware update listed in the system flashing document, i.e. start the system while holding the enter key down and follow the process.
9. When the flashing process is complete and the system is started it will power up to a screen asking to create a model. Follow the screen prompts and create a new model and load it. Test the system to make sure the model is working. At this point the system is ready to use. If you have backup model files that match the “B” build number, proceed to the next steps.
10. After the system has been tested as working OK, connect the system power on to a Windows computer using a data USB cable. After connection two File Explorer windows will open.
11. Copy the model files from you model file backup that match the “B” number build to the model folders in the System folder.
12. Using the Windows Eject feature Eject the Flash Memory Drive and the SD drive then disconnect the USB cable.

13. Start the system and test it by selecting the model files that were restored. If the correct model files are in place the system will select the files without error and they should work correctly.
14. Test everything very carefully including a range test in range test mode before flying.

**Happy Flying!**

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