#11043

KAKUTE F7 HDV AIO

Overview

Holybro Kakute F7 HDV All-In-One is designed to work with the DJI FPV VTx module. The GH port available on the board makes it much more convenient for you to connect Holybro Kakute F7 HDV AIO to the DJI FPV VTx, for both signal and power supply.

Features

- Supports Betaflight.
- High-performance / low-noise IMU. MPU6000 with 6-axis gyro and accelerometer.
- Ready for autonomous flight: Integrated BMP280 barometer and SCL/SDA for use with external GPS/magnetometer units.
- Dedicated bootloader button for easy firmware flashing.
- Low-profile design fits into even very compact frames.
- 2 oz. copper PCB allows up to 120A maximum continuous current.
- Input voltage 7v to 42v. Power the board directly from the flight pack, up to 6S (on "B+" pad only).
- Automatic voltage monitoring. No need to run a separate vBat wire for voltage monitoring; the KAKUTE F7 HDV AIO monitors voltage directly from the power supply.
- Filtered voltage output for clean, noise-free video. 2 On-board regulators output 5V and 8V. 5V output up to 1.5A to power peripherals such as receiver, FPV camera, or LED strip. 8V output up to 2A to DJI FPV VTx.
- Supports BLHeli pass-through for easy ESC upgrade and configuration.

Specifications

- MCU: STM32F745 32-bit processor
- IMU:MPU6000
- Barometer: BMP280
- USB VCP Driver (all UARTs usable simultaneously; USB does not take up a UART)
- 6 hardware UARTS (UART1,2,3,4,6,7)
- All UARTS support hardware inversion. SBUS, SmartPort, and other inverted protocols work on any UART without "uninvert hack".
- Supports serial receivers (SBUS, iBus, Spektrum, Crossfire) only. PPM and PWM receivers are not supported.
- TF card for Blackbox logging
- Dimensions: 45x37mm
- Mounting Holes: Standard 30.5mm square to center of holes
- Weight: 10g

Warranty and Return Policy

If you believe that your Kakute F7 is defective, please contact us. If we determine that the board is defective, it will be repaired or replaced at no charge to you. We may ask you to send your Kakute to our service center for examination or repair. Shipping costs are your responsibility. Returned items should include the original packaging and all accessories.

If product is damaged or defective, we will repair or replace it. Refunds are only given when product is lost by the shipping company. The refund amount is limited to the price of the product. Shipping costs are never refundable.

Contact us at:

- Email: productservice@holybro.com
- Facebook Page: Holybro
- Facebook Group: Holybro Hobby Official Group

Pinout Diagram

Top of board
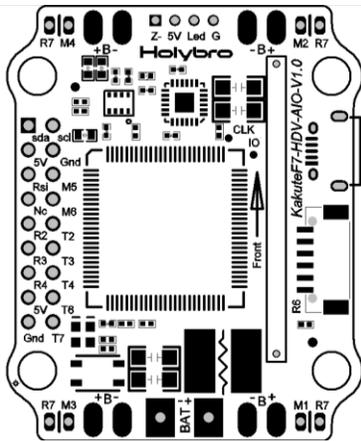
Pad	Function
B+	Battery positive voltage (2S-6S)
SDA, SCL	I^2C connection (for peripherals)
5v	5v output (2A max)
G or GND	Ground
RSI	Analog RSSI (0-3.3v) input from receiver
NC	RSV
M1 to M4	Motor signal outputs (located in plug)
M5, M6	Additional motor signal outputs (located at side of board)
R1, T1	UART1 RX and TX
R2, T2	UART2 RX and TX
R3, T3	UART3 RX and TX
R4, T4	UART4 RX and TX
R6, T6	UART6 RX and TX(RX is located in the GH plug for use for serial RC)
R7, T7	UART7 RX and TX (RX is located in the plug for use with 4-in-1 ESCs)
LED	WS2812 addressable LED signal wire
Buz-	Piezo buzzer negative leg Connect buzzer positive leg to 5v pad
Boot	Bootloader button

Installation Guide

Solder the main battery connector to the large + and - pads on the board. The battery connector should use either 12 gauge or 14 gauge, fine-strand, silicone-insulation wire. This type of wire is commonly referred to as "silicone wire". **Do not use regular stranded copper wire for the battery lead.** It will become brittle over time and break. The battery connector will most commonly be an XT60.	
Install the Kakute F7 HDV AIO in your quadcopter frame. Do not completely reassemble the frame. Leave the Kakute F7 HDV AIO accessible so that you can solder wires to it. For example, leave the top plate of your frame off so that you are working only with the base-plate. Having the Kakute F7 HDV AIO mounted in the frame will allow you to ensure that wire lengths are correct as you solder accessories to the board. When in doubt, it's always better to leave a little extra wire. **Be 100% sure that the front-facing arrow on the Kakute F7 HDV AIO faces the front of the quadcopter!** If for some reason this is not possible, then you must use Cleanflight or Betaflight's "board align" feature to compensate.	
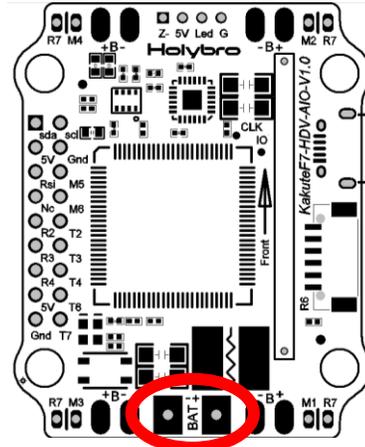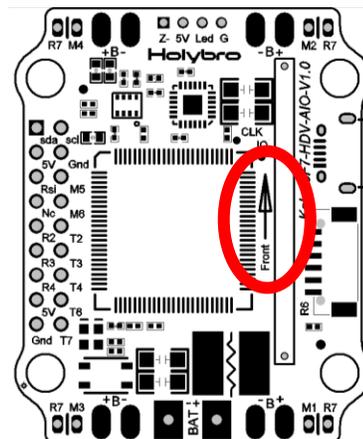
"Board Align" Feature Documentation

https://www.youtube.com/watch?v=QeuSq71pYF0

Solder the ESC power wires to the G and B+ pads at the corners o the Kakute F7 HDV AIO. ESC power wires are typically 18 or 20 gauge. Some ESCs are sold without attached wires, in which case you will need to provide your own. We recommend 20-gauge silicone wire for this purpose.

Each ESC should be soldered to the pads in the corner closest to it. Cut the wires short to eliminate excess wire that can get caught up in props, but be sure to leave yourself a little slack. You can always shorten a wire a little more if you need to, but you can't easily make it longer again.

Be absolutely sure that you do not mistakenly reverse the wires. Red goes to B+ and black goes to G.

Be absolutely sure that you do not mistakenly bridge the pads with solder. Use a multimeter to test for continuity between the G and B+ pads after soldering each ESC. Continuity must not exist, or the Kakute F7 HDV AIO and ESC will be damaged when you plug in the battery. Also, the battery can explode.

RSSI monitoring allows you to view the signal strength of the control link between your transmitter and your receiver in the OSD. This can give a warning when you are getting close to the edge of your range, as well as showing you if you have damaged equipment, such as an antenna that has been cut by a prop.

If you intend to use the RSSI input, solder the analog RSSI output of your receiver to the RSSI pad on the Kakute F7 HDV AIO.

Many receivers do not support analog RSSI output, so you may not be able to use this feature.
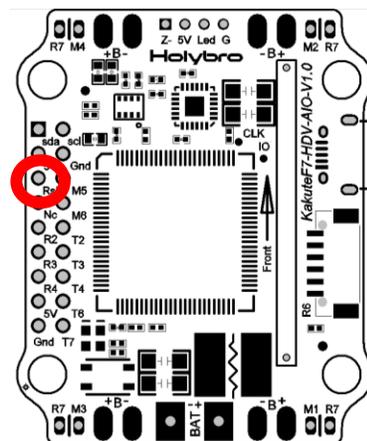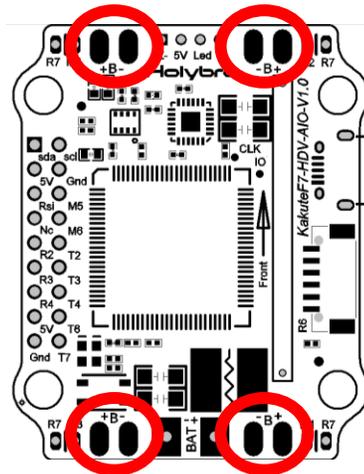
The GH port available on the board makes it much more convenient for you to connect HolyBro Kakute F7 HDV AIO to the DJI FPV VTx, for both signal and power supply.

No.	Pin out	Function
1	VDD	8V/2A
2	G	Ground
3	T1	UART1 TX
4	R1	UART1 RX
5	G	Ground
6	R6	UART6 RX
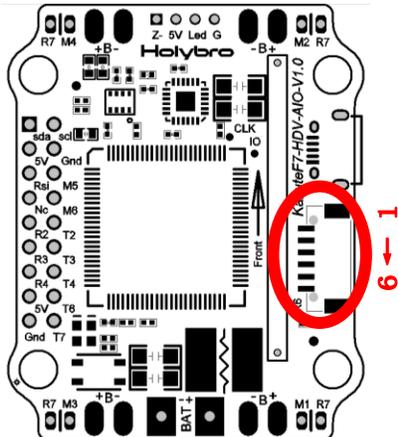
How to wire up analog RSSI to your receiver

https://www.youtube.com/watch?v=pX_PWoLhooU

An alternate way to get RSSI in your OSD

https://www.youtube.com/watch?v=t-evOAS9Mkg

Installing Betaflight Configurator

Betaflight is managed using the Betaflight Configurator application, also known for short as the Betaflight GUI, or just, "The GUI". (GUI is pronounced "gooey" in case you wondered. Only weirdos say, "Gee You Eye".) Download the Betaflight Configurator application here:

https://github.com/betaflight/betaflight-configurator/releases

This is a standard application package for Windows, MacOS, or Linux. After you download it, install and run it the same as any other application.

On MacOS you must give the application permission to run and access the network. The simplest way to do this is to right-click the installer and choose Open. A security prompt will appear asking, "Are you sure you want to open it?" Click Open on this prompt and the relevant configuration changes will be made automatically.
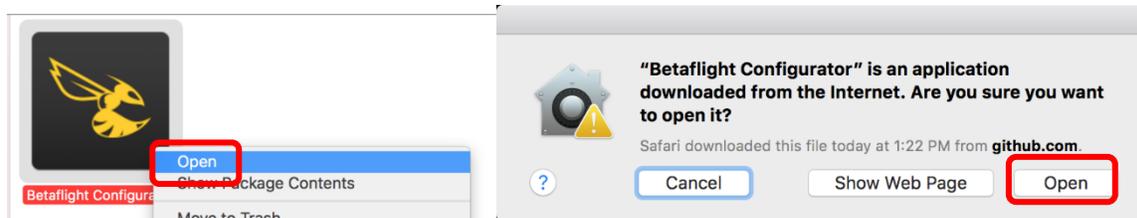

Flashing New Firmware

At this point, if you want to update your firmware, here is how to do it. But if you just want to go fly, please, go for it! You don't have to be running the absolute latest firmware to have a good time. Just forget about this nonsense!

To flash your firmware, you must connect the board in "bootloader mode". Bootloader mode means that the board is ready to accept new programming. To put the board into bootloader mode, hold down the bootloader button while plugging in the USB cable. Leave the button pressed for a moment after plugging in the USB cable to be sure it "takes".

If your Kakute F7 is in bootloader mode, then you will see "DFU" in the pulldown menu in the upper-right of the configurator, as shown here:
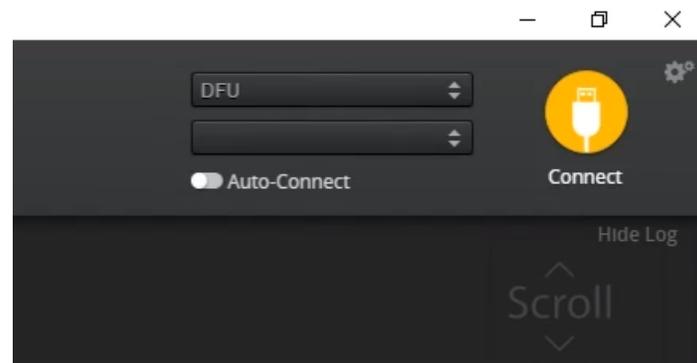
If you don't see DFU in the pulldown menu, then either the board didn't detect that you had the bootloader button pressed or your drivers are not installed correctly. If you don't see DFU in the pulldown menu, you cannot flash new firmware to the board. It won't work.

For the advanced users, a simpler way of getting into bootloader mode is to go to the CLI and type "bl". This will reboot the board into bootloader mode. This is especially useful if the board is installed in a copter where it isn't convenient to press the bootloader button. In rare cases, the "bl" command doesn't work and you must press the bootloader button on the board.
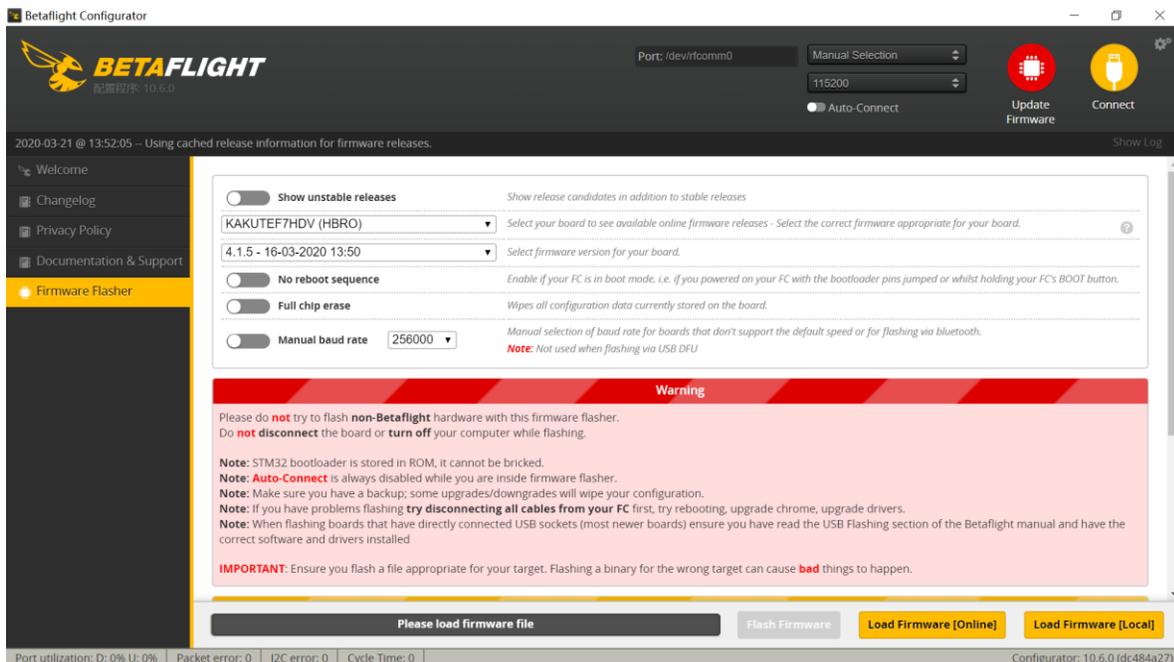
Here are the remaining steps:

1. Go to the "Firmware Flasher" tab.
2. Select "KAKUTEF7HDV(HBRO)" in the "Choose a board" pulldown menu. If you flash any other board type, the Kakute F7 will not function. It won't be damaged, it just won't work until you flash KAKUTEF7 to the board.
3. Select the latest version of Betaflight in the "Choose a firmware version" pulldown menu.
4. Click the "Load Firmware (Online)" button. The button will change to read "Downloading". The Flash Firmware button will change from gray to orange.
5. Click the "Flash Firmware" button. The screen should automatically scroll down to show the status bar, which will fill with orange as the flashing process completes.
6. Flashing will be followed by a process called "Verifying". Verification sometimes fails, but this isn't a problem. If the flash completes, everything is usually fine.
7. Un-plug your board and then plug it back in again, this time without holding down the bootloader button.
8. For Windows users, the pulldown menu in the upper right of the configurator will read COM3 (or some other number). For MacOS and Linux users, the pulldown will read something starting with /dev/tty. This is normal. If the pulldown menu reads "Manual Selection" then your board is not being detected. This may indicate that you did not use the KAKUTEF7 target when you

flashed the board. Or it may indicate that your Virtual COM Port (VCP) drivers were not installed correctly.

You are ready to configure your board.

Initial Configuration

The full configuration of Betaflight could take hours to document. In this section, we'll describe a few things that are specific to this board. This won't be enough to get you into the air, so we'll also point you to some videos you can watch if you're not perfectly sure what else you need to do. Even people have a few builds under their belt may be skipping some important steps without realizing it!

Connect to The Board

Plug the board in to USB. Start Betaflight Configurator. You should see "COM3" (or some other number) in the upper-right menu. Click "Connect".
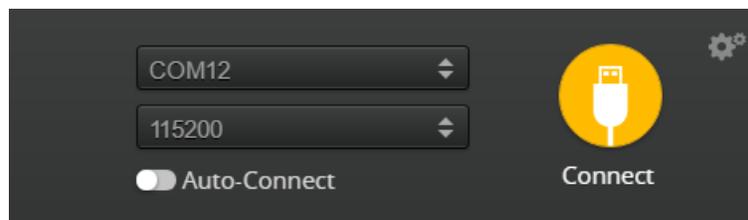
The GUI will load.

Ports

Click on the "Ports" tab on the left side of the window.

The UARTs on your Kakute F7 are versatile; any UART can be used for any function. This is different from the Kakute F4, in which certain functions had to be assigned to certain UARTs. In the wiring instructions above, certain UARTs were suggested, such as soldering the SBUS receiver to R6. However you don't

have to follow these recommendations if for some reason they don't work for you. If you followed the instructions in this guide, the screen shot above shows how to configure the Ports tab.

When you configure the Ports, keep the following guideline in mind: each UART can be used for one function only. Each column (Serial RX, Telemetry Output, Sensor Input, Peripherals) represents a single function. So each UART row should only have one function active at a time. If you try to enable multiple functions, the configuration may be rejected, or the results may be unpredictable.

For each function, identify which UART number you connected the peripheral to. So if you soldered your receiver signal wire to pad R3, that would be UART3. If you soldered your SmartPort telemetry wire to pad T1, that would be UART1. The number following the R or T indicates the UART number.

On each row in the Ports tab, enable the one function that you connected ot the TX and/or RX pads for that UART. The most common options are below.

- USB VCP is the port that is used to talk between the Kakute F7 and the Configurator GUI. MSP is the protocol that they use to talk to each other. If you turn off MSP on USB VCP, you will not be able to contact the board any more via the Configurator. You will have to re-flash the board and erase your configuration to get back into it. Suffice it to say, this is bad, and you shouldn't do it. **Don't turn off MSP on the USB VCP line in the Ports tab.**
- If you are using FrSky SmartPort telemetry, in the Telemetry Output column, choose SmartPort from the pulldown menu.
- Enable "Serial RX" for the UART that you soldered the receiver signal wire to. If using an SBUS or Spektrum receiver, this will have been the RX pad only. For a Crossfire receiver, you will have used both the TX and RX pad of the same UART.
- If you are using RunCam digital camera control, in the Peripherals column, choose RunCam Device.
- If you are using ESC Telemetry, on the UART7 line, in the Sensor Input column, choose ESC. Although you can technically use any RX pad for ESC Telemetry, the R7 pads are specifically located at the corners of the board for this purpose.
- If you are using SmartAudio or ImmersionRC Tramp Telemetry to control your video transmitter: in the Peripherals column, choose either TBS SmartAudio or IRC Tramp, depending on which type of transmitter you are using.

Configuration

Click on the "Configuration" tab on the right side of the window. Scroll down to the "Other Features" section.

- If you are using any kind of telemetry (SmartPort, Crossfire, etc.), enable TELEMETRY.
- If you are using a programmable LED strip, enable LED_STRIP.
- Air Mode increases authority when the throttle is all the way down. We recommend leaving this option on all the time.
- If you are using ESC telemetry, enable the ESC_SENSOR option.
- The ANTI_GRAVITY option increases the stability of the copter when the throttle is raised or lowered quickly. We recommend enabling this option, and setting Anti Gravity Gain to 3.0 in the PID Tuning tab. Detailed instructions for tuning this value are outside the scope of this manual, but this default setting will work well for most quads.
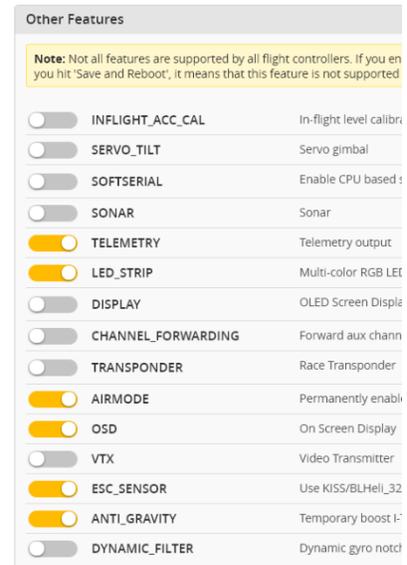
Next, go to the Receiver section of the "Configuration" tab. Since the Kakute F7 only supports serial-type receivers, configuration of this section is simple.

- Set the Receiver Mode to "Serial-based receiver".
- Set the Serial Receiver Provider to the type that matches what kind of receiver you have. FrSky and other SBUS receiver should use SBUS. Spektrum Satellite receivers should use SPEKTRUM2048 or SPEKTRUM1024 depending on whether they are DSM2 or DSMX. FlySky receivers use iBus. Crossfire receivers use CRSF.
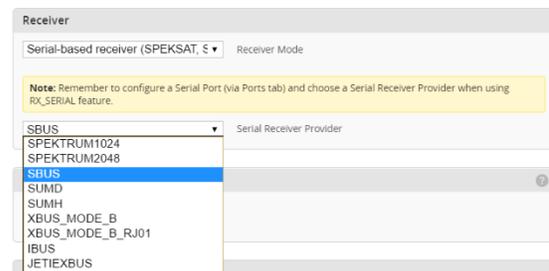
These are the most common serial receiver types that are likely to be encountered.

Blackbox

If you have enabled the Blackbox feature, go to the Blackbox tab on the left-hand side of the configurator window. In the Blackbox tab, at the top, set the Blackbox logging device to "SD Card" (it should be set like this by default). Set the Blackbox Logging Rate to 2 kHz. To use Blackbox logging, insert a FAT-formatted SD card of 32 GB or smaller into the SD card slot on the Kakute F7. You can use the Betaflight Blackbox Log Viewer app to examine blackbox logs.

Blackbox
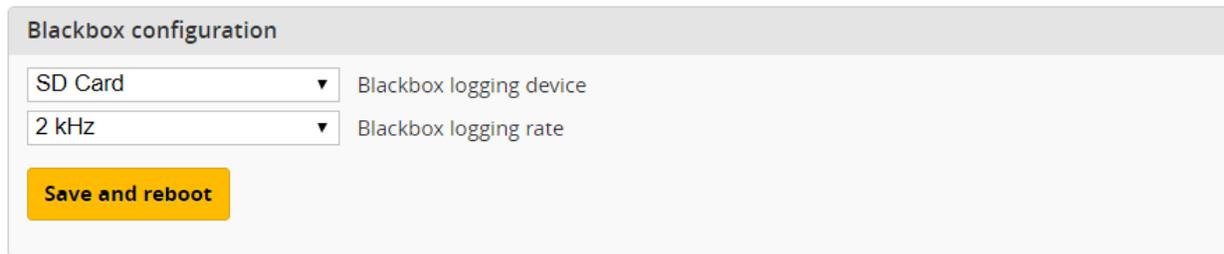
Blackbox configuration	
SD Card ▾	Blackbox logging device
2 kHz ▾	Blackbox logging rate
Save and reboot	

Saving Your Configuration

Once you have finished building, configuring, and tuning your multirotor, it's a good idea to back up your configuration so that you can restore it later. This is useful if you lose your quad, or if you damage your flight controller, or if you accidentally lock yourself out of your flight controller and must reset it to get back in.

Before we show you the right way to save and restore your configuration, let us warn you about the wrong way. Betaflight and Cleanflight have a "save configuration" and "restore configuration" button. Without going into too much detail, they have some significant drawbacks that mean we don't recommend that you use them.

The correct way to save your configuration is as follows.

1. Connect your Kakute to your PC by plugging in USB.
2. Start the Betaflight GUI app.
3. Go to the CLI tab.
4. In the text box at the bottom of the CLI, type "diff all" and hit enter. This will cause the flight controller to display all configuration options that you have changed from the default values.
5. In the lower-right corner of the configurator, click the "Save to File" button.
6. Save the file somewhere you won't lose it.

To restore your configuration, do this:

1. Open the text file in your text editor.
2. Highlight the entire contents of the file.
3. Right-click in the text editor window and choose "Copy".
4. Connect your Kakute to your PC by plugging in USB.
5. Start the Betaflight GUI app.
6. Go to the CLI tab.

7. Click the mouse once in the text box at the bottom of the CLI tab to place the cursor there.
8. Instead of typing any commands, right-click in the text box and choose "Paste".
9. Press the Enter key on your keyboard. The pasted-in text will rapidly scroll past.
10. Type "save" in the text box at the bottom of the screen.
11. Press Enter. The flight controller will reboot and the configuration will be restored.

Additional Reference

Here are some links to additional videos to help you build your quadcopter successfully.

Betaflight 3.3 Ultimate Setup Guide

https://www.youtube.com/watch?v=8vJCrHj9s6s

How to Calibrate Your ESCs

https://www.youtube.com/watch?v=o3Mg-9M0l24

If you are using an analog protocol like Oneshot or Multishot, calibrating your ESCs is mandatory. Most ESCs today support Dshot. If your ESCs support Dshot, you should use it, and you can skip this step.

Failsafe

https://www.youtube.com/watch?v=dikr9oDzQqc

Failsafe is what happens when you fly too far away or your receiver gets disconnected from your flight controller. If you don't configure failsafe, the quad could fly away, or it could crash into something… or someone.

DON'T FLY WITHOUT VERIFYING THAT FAILSAFE WORKS CORRECTLY.

To verify failsafe, remove your props, then plug in your battery and arm your copter. Then turn off your transmitter. Your motors should stop within 1 to 3 seconds at most.

If your motors don't stop when you turn off your transmitter, DO NOT FLY YOUR MULTIROTOR UNDER ANY CIRCUMSTANCES.