

Singularity

Flight Controller

Specs

- STM32F303 processor, 72MHz with FPU and 256KB of flash
- 400mW video transmitter
- Change channels with stick commands or switches from your radio
- Motor outputs in correct corners of board
- 128Mbit/16MB flash for Blackbox logging
- 5V BEC with 2S-4S Lipo input
- 5V power output for camera
- 5V or 3.3V power output for receiver
- MPU6050 gyro/accelerometer
- Micro USB and 3 hardware UARTs
- Dedicated output for RGB LEDs, buzzer and telemetry
- Two auxiliary motor outputs for passthrough
- 36mm format with 30.5mm mounting holes
- 4 layers of 2oz copper, gold plated PCB
- 15g weight (including heatsink)

Power



Warning: Powering the flight controller for extended periods with the VTX power jumper installed and without airflow can cause damage to the video transmitter.

Warning: Powering the flight controller with the VTX power jumper installed and without an antenna connected can cause damage to the video transmitter.

The flight controller can be powered by the USB port or directly from 2S-4S Lipo on the power input pins. It is possible to power the board via both sources at the same time.

Please check polarity before plugging in your Lipo, there is no reverse polarity protection! Please do not apply power to any other pin!

There is a 1A 5V BEC on the board which powers the VTX module as well as having enough capacity to power your FPV camera and RC receiver.

Please do not power an LED strip, OSD or servo from the internal 5V BEC!

The FPV camera and VTX will be powered only by the Lipo input pins. The USB port will never power the FPV camera or VTX.

The VTX will only be powered when the “VTX Power Jumper” pins are bridged.

You must select, via solder jumper, whether to power your receiver with 5V or 3.3V.

Please do not bridge all three pads on the solder jumper, this will connect the 5V rail to 3.3V rail!

RC Input

Both PPM and Serial RX (Spektrum, SBUS etc.) are supported on the same input pin. PWM input is not supported.

Serial RX support is provided by port UART2 and may be enabled in the Cleanflight configurator.

No external inverters are required for any receiver type.

Motor Outputs

When the flight controller is mounted with the VTX upwards and the SMA connector to the rear, the motor outputs are in the correct corners of the board for a standard quadcopter.

Two additional motor outputs, M5 and M6, are provided and can be used for RC pass through.

Telemetry

Voltage monitoring is performed automatically from the Lipo input pins. For the correct voltage to be read by the flight controller the “Voltage Scale” must be set in the Cleanflight configurator to 77.

The dedicated telemetry pins are a Soft Serial port. Once feature SOFTSERIAL is enabled a new port will be available as SOFTSERIAL1 and can be configured for telemetry output.

Smartport telemetry is not supported on a Soft Serial port. Either the UART1 socket or the UART3 solder pads must be used to enable Smartport telemetry.

Blackbox

Support for logging is provided by the 128Mbit dataflash included on the board.

To use the included flash for logging you must enable the BLACKBOX feature and set `blackbox_device=SPIFLASH` in the CLI.

BLHeli ESC Programming

Flashing and configuring BLHeli ESCs is supported via the USB port.

Camera

A camera can be directly connected to the flight controller. The video input pin takes the signal from your camera and the 5V output provides clean power. It is recommended to directly power 5V cameras such as the HS1177 from these pins.

It is possible to use an OSD with the Singularity by installing it between the camera and the Singularity.

Please do not apply attach an external power source to the 5V camera pins and please do not power your OSD from the internal BEC.

VTX

The video transmitter can be controlled by the CLI, with stick commands or with AUX switches. The module can transmit on all 40 commonly used channels, as well as being set to any arbitrary frequency between 5600MHz and 5950MHz.

When Channels Change

Bands and channels can be changed when the board is first powered. Once the board is armed for the first time the selected channel is locked until the board is reset and powered again. Stick commands or AUX switch changes will be ignored after the board is armed. This is a safety feature to stop accidental channel changes or unexpected results from a receiver failsafe.

The flight controller will only send the signal to the VTX module to set the channel when it first boots as well as when a stick command is received or an AUX channel is changed.

If the flight controller is powered with the VTX jumper removed then the initial command to set the channel will be lost. If the power jumper is later installed the VTX will be transmitting on an undefined frequency.

Please do not install the red power jumper when the flight controller is already powered, this can cause transmission on unintended frequencies!

Changing Channel without Transmitting

If you are using channels assigned to an AUX switch, simply select the desired switch position before powering the flight controller.

If you are setting an arbitrary frequency or using stick commands, you can power the flight controller without the VTX power jumper installed, then change the frequency as desired. Power down the flight controller and reinstall the VTX power jumper. When the flight controller is powered again it will start up transmitting on the newly selected channel or frequency.

Bands and Channels

	CH 1	CH 2	CH 3	CH 4	CH 5	CH 6	CH 7	CH 8
Band A	5865	5845	5825	5805	5785	5765	5745	5725
Band B	5733	5752	5771	5790	5809	5828	5847	5866
Band E	5705	5685	5665	5645	5885	5905	5925	5945
Band F	5740	5760	5780	5800	5820	5840	5860	5880
Band R	5658	5695	5732	5769	5806	5843	5880	5917

CLI

There are four new variables in the CLI:

'vtx_mode', 'vtx_band', 'vtx_channel' and 'vtx_mhz'

There is one new CLI command:

'vtx 0 0 0 0 900 2100'

vtx_mode = 0

When 'vtx_mode' is set to 0 the Singularity will transmit on the band and channel selected by 'vtx_band' and 'vtx_channel'.

'vtx_band' can be set to numeric values 1 to 5.

'vtx_channel' can be set to numeric values 1 to 8.

In this mode stick commands are active for changing channels and bands after powering the flight controller and before it is first armed.

vtx_mode = 1

When 'vtx_mode' is set to 1 the Singularity will transmit on the frequency selected by 'vtx_mhz'.

In this mode stick commands and AUX switch positions are ignored.

vtx_mode = 2

When 'vtx_mode' is set to 2 the Singularity will transmit on the channel selected by the mappings to AUX switches using the 'vtx' CLI command.

In this mode changes to AUX switch positions are active for changing channels and bands after powering the flight controller and before it is first armed.

Please take care when using this mode that the relevant AUX switches are in the desired positions before powering on the flight controller!

vtx 0 0 0 0 900 2100

The 'vtx' CLI command can be used to map bands and channels to ranges on AUX channels for use with switches. For settings made with this command to be active 'vtx_mode' must be set to 2.

The command takes the following 5 arguments:

1. Slot number (0 - 9)
2. AUX channel index (zero based, AUX1 = 0, AUX2 = 1 etc)
3. Band (1 - 5)
4. Channel (1 - 8)
5. Low position, from 900 to 2100
6. High position, from 900 to 2100

If the low and high position are the same then the values are ignored. You can display the VTX configuration by using the 'vtx' command with no arguments.

Example usage:

- Configure slot 0 to enable band 4 and channel 1 when AUX3 is within 900 and 1300.
 - Configure slot 1 to enable band 4 and channel 3 when AUX3 is within 1300 and 1700.
 - Configure slot 2 to enable band 4 and channel 7 when AUX3 is within 1700 and 2100.
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- vtx 0 2 4 1 900 1300
 - vtx 1 2 4 3 1300 1700
 - vtx 2 2 4 7 1700 2100

Stick Commands

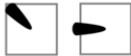
Using stick commands causes the values of 'vtx_band' and 'vtx_channel' to be changed. If the flight controller has not yet been armed the changes will be effective immediately. Once the flight controller has been armed, stick commands will be ignored until the board is reset and powered again. All changes are saved to EEPROM and the selected channel will be automatically set when the flight controller is next powered on.

Changes to band and channel are indicated by both a number of beeps and flashes of the red LED.

Changing channels with stick commands can be accomplished when 'vtx_mode' is 0 by using the following inputs.

	Throttle	Yaw	Pitch	Roll
Decrease Band	HIGH	LOW	CENTRE	LOW
Increase Band	HIGH	LOW	CENTRE	HIGH
Decrease Channel	HIGH	HIGH	CENTRE	LOW
Increase Channel	HIGH	HIGH	CENTRE	HIGH

Mode 2 Examples

Decrease Band 

Increase Band 

Decrease Channel



Increase Channel



Flashing

Firmware builds can be found on the [Betaflight releases page](#).

The Hex files available for download can be flashed with the [Cleanflight Configurator](#) available from the Chrome store.

Since the Singularity uses the native USB support in the STM32F3 chip the correct drivers need to be installed before Configurator can be used to flash. On Windows machines the drives can be installed and checked with a double click using [ImpulseRC Driver Fixer](#).

If you have trouble running the ImpulseRC Driver Fixer you may need to install [.NET Framework 4.5](#)