Seriously Pro

SP Racing F7 DUAL Flight Controller

Thank you for directly supporting the Cleanflight project with your purchase.

About

The Seriously Pro Racing F7 DUAL Flight Controller (SPRacingF7DUAL) was designed to give awesome flight performance in a stackable race-ready package. It has a very high-performance CPU, dual gyro/acc sensors, PID-Audio system, OSD, race timing & logging technology backed by excellent connectivity options at an excellent price.

Featuring a race timing transponder system the SPRacingF7DUAL is truly designed for racers. Analyze your race and flight telemetry/blackbox logs using the built-in MicroSD card socket.

The SPRacingF7DUAL is the first Cleanflight FC that features DUAL SIMULTANEOUS GYRO support. Having two gyros is better than one, especially when they are not identically aligned! Two gyros working together means that erroneous sensor readings and vibrations can be futher mitigated and filtered out to allow your aircraft to fly smoothly in the toughest of conditions.

The SPRacingF7DUAL is also the first Cleanflight FC that has the PID-Audio feature. PID-Audio allows to you to hear how hard the PID controller is working and thus wether your tuning is optimal for your style of flight. You will learn to hear how your aircraft sounds, this is useful in many scenarios, such as detecting weather conditions, broken/damaged props, damaged arms, loose screws, etc. It's suprising what you can identify from audio feedback!

The SPRacingF7DUAL gives you all the features you need for the heart of your aircraft, whether you're into FPV racing, freestyle acrobatic flying or aerial photography it's perfect.

Features

- Next-generation STM32 F7 processor with hardware floating point unit for efficient flight calculations and faster ARM-Cortex M7 core running at 216Mhz.
- PID-Audio to let you hear what the flight-controller is doing in real-time as you fly. With practice you'll recognise when your FC is tuned how you like it by listening to the CPU generated audio-stream.
- Configurable On Screen Display (OSD) system gives you all the information you need when flying and a menu system to allow you to configure the FC.
- Race transponder built in - just turn up at a race and have your lap times recorded.
- MicroSD-Card socket for black box flight log recorder - optimize your tuning and see the results of your setup without guesswork.
- Features two of the latest 32khz capable Accelerometer, Gyro sensor devices connected via the fast SPI bus.
- High-accuracy Baro/Altitude sensor.
- MEMS Microphone to allow you to hear the motors while flying.
- Audio mixer with balance control to adjust the balance between the PID-Audio and the microphone.
- Solder-from-top design makes installation and maintenance simple.
- Excellent IO scenarios. e.g. Use two Gyros/Accs + Baro + OSD + USB + SmartPort + SBus + LED Strip + Battery Monitoring + 8 motors + Transponder LED + External SmartAudio VTX, GPS and MAG - all at the same time!
- 8 DSHOT/OneShot/PWM output lines for ESCs and Servos. When using using VTX board with FX756-2-SPI only 4 DSHOT outputs are usable; use a TBS SmartAudio VTX or IRC Tramp VTX if you need 8 motor outputs and need FC-based VTX control.
- Supports direct connection of SBus, SumH, SumD, Spektrum1024/2048, CRSF, XBus receivers. No external inverters required (built-in). Legacy PWM 1 wire per channel receivers are not supported.
- Supports direct connection of 3.3v Spektrum Satellite receivers - use 3v3 pad for Satellite RX.
- 5 Serial Ports - NOT shared with the USB socket.
- Micro USB socket.
- Dedicated output for programmable LEDs - great for orientation, racing and night flying.
- Dedicated I2C port for connection of OLED display or MAG without needing flight battery.
- Battery monitoring for voltage and current.
- RSSI monitoring (analog or PWM).
- Buzzer port for audible warnings and notifications.
- Developer friendly debugging port (SWD) and boot mode selection, unbrickable bootloader.
- Side-press boot button for easy firmware updating.
- Side-press bind button for easy receiver binding and VTX control.
- Symmetrical design for a super tidy wiring.
- 3x JST-SH sockets for IO (I2C, UART3,UART4), SWD, UART5/Camera OSD control.
- 1x 5-way Picoblade socket for receiver connections.
- Header pin pads for recevier connections (UART2), IR LED, UART1, 5V/GND and Buzzer
- Flashing via USB or serial port.
- Stackable design - optional VTX board available.

- Standard 30.5mm mounting hole pattern with 4mm holes and grommets for 3mm screws.
- LEDs for 3v, 5v and Status for easy diagnostics.
- Cleanflight and SP Racing logos.

Software

The SPRacingF7DUAL runs the open-source Cleanflight flight control (FC) software (and forks, like Betaflight) which has an ever-growing community of friendly developers and users. Being open-source means that you too can contribute to the system.

Cleanflight comes with a detailed manual that is reviewed and maintained by the Cleanflight developers and community. No more out-of-date wiki pages and second-hand information.

See http://cleanflight.com for links to the manual. PDF copies can be downloaded from the github releases pages. Ensure you reference the manual that is appropriate to your firmware version.

History

The hardware was designed by the lead developer of Cleanflight to be more capable than the previous-generation STM32F3/4-based boards and to set the benchmark for a premium STM32F7 based board with never seen before DUAL GYRO and PID-Audio features. It has other features not seen on most other F7 boards including an OSD, 8 DSHOT outputs and simultaneous Transponder, LED Strip and Telemetry support along with the ability to stack with a VTX board.

WARNINGS

Failure to adhere to these warnings will void your warranty and destroy your flight controller.

- When using ESCs that support active braking or battery regeneration ensure the FC is protected with a power supply filter. Damage to the FC caused by lack of protection is not warrantable.
- Observe polarity at ALL TIMES. Check and DOUBLE CHECK before applying power. Do not rely on wire color-coding alone.
- POWER OFF before unplugging, plugging in or making any connections.
- Do not connect SOURCES of power to the pins marked with 5v. They are OUTPUTS for supplying power to other devices.
- The 3.3v supply is for low-current use only. 100mA MAX.
- Do not connect GND, 5v, VBAT or 3.3v to each other (short circuit).
- Do not connect GND, 5v, VBAT or 3.3v to any inputs or outputs unless specifically stated.
- Do not connect any input or output to any other input or output unless specifically stated.
- Do not connect all three pads of the 3 pin solder bridges, connect center and one triangle pad only.
- Do not allow dirt/dust/glue/etc into the pressure sensor (barometer) and microphone.
- Keep magnets away from the flight controller.
- Do not use excessive force when inserting or removing MicroSD cards.
- Always align USB plug and socket when inserting/removing USB cables to prevent damage to the USB socket.
- Never power up any VTX without an antenna connected otherwise you will DESTROY the VTX.

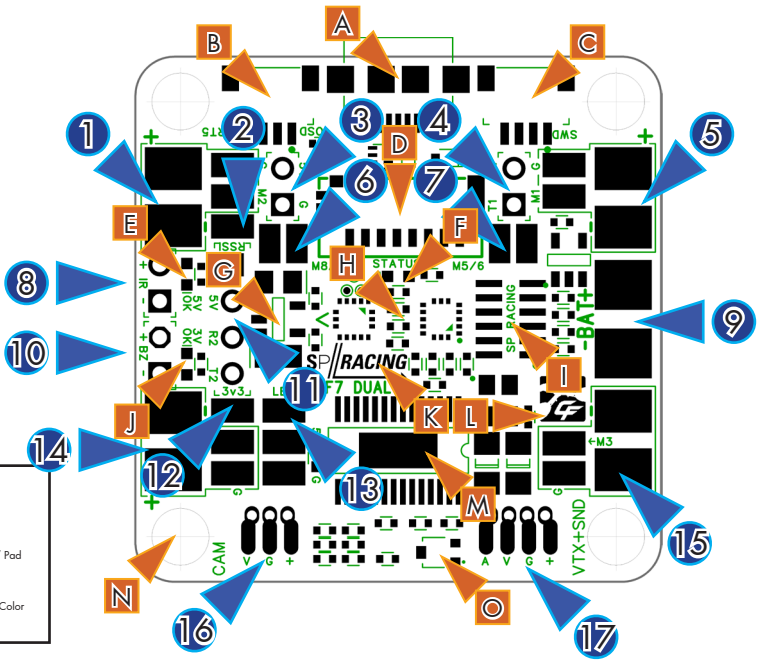
GENERAL ADVICE

Follow the advice below for best performance and long-life of your flight controller:

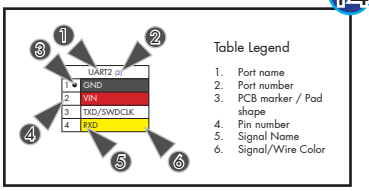
- Apply resin/glue to reinforce JST-SH connectors - helps if you crash your aircraft.
- To further protect the board from crashes you can add a some additional solder to the edges of the JST-SH and USB sockets to reinforce them.
- Support JST connector sockets when inserting cables.
- Install open-cell foam over the pressure sensor for more accurate readings.
- If the noise from motors is too loud you can also install open-cell foam over the microphone.
- Do not cover the hole in baro and microphone sensors (e.g. with glue, resin, etc) or allow foreign object to enter it.
- Using color-coded wires and connectors is recommended, especially for BATTERY connections.
- For optimum performance do everything you can to prevent vibrations reaching the accelerometer/gyro sensor. e.g. balance motors, props use rubber isolation grommets and secure everything.
- If any twitching or incorrect flight behaviour is observed check props, motor bearings and other sources of vibrations BEFORE adjusting any software filters or other settings.

TOP

1. Motor 2 pads (4x pads).
2. RSSI pad.
3. 5V and GND headers.
4. UART1 headers.
5. Motor 1 pads (4x pads).
6. Motor 8/7 signal pads.
7. Motor 5/6 signal pads.
8. IR LED headers.
9. Battery pads.
10. Buzzer headers.
11. UART2/Receiver headers.
12. 3.3v pad.
13. LED Strip pad.
14. Motor 4 pads (4x pads).
15. Motor 3 pads (4x pads).
16. Camera pads.
17. VTX + Audio pads.



A. MicroUSB socket.
B. UART5/Camera OSD socket.
C. SWD debug socket.
D. Micro SD socket.
E. 5V OK LED (Green).
F. Status OK LED (Red).
G. 3v3 Voltage Regulator.
H. Dual Gyro and Accelerometer sensors.
I. Stacking connector.
J. 3V OK LED (Blue).
K. SP Racing Logo.
L. Cleanflight Logo.
M. OSD.
N. 4mm Mounting Holes.
O. MIC/PID-Audio balance control.



Motor Pads (1,5,14,15)	
1 -	Battery - -
2 +	Battery +
3 M	Motor Signal
4 G	Motor Signal Ground

Motor 1-4 Pads

4 pads per motor/ESC. Pads are inside the white border.
Connect Battery+/Battery - pads to ESC power pads/wires.
Connect Signal and GND to ESC signal and ground pads/wires.
When using 4in1 ESC do not use Battery+/- pads; Use 4in1 PADS instead (see Bottom).

RSSI (2)	
2 ■	RSSI

RSSI

RSSI is for 0 - 5v PWM RSSI or 0 - 3.3v Analog RSSI - Disabled until RSSI select pads (see Bottom) are set.

5V/GND (3)	
1 ■	GND
2 ●	5V

5V/GND

Primarily used for Stacking VTX board. May be used to power other 5V devices.

UART1 (4)	
1 ■	TXD (T1)
2 ●	RXD (R1)

UART1

Use for connecting to OSD/GPS/BlueTooth. 5v signals OK.

Motor Pads (6, 7)	
1 ■	Motor Signal
2 ■	Motor Signal

Motor 5-8 Pads

1 pad per motor/ESC.
Ensure each ESC is also connected to a Motor Signal Ground pad. e.g. from M1-4 pads.

IR LED (8)	
1 ■	IR -
2 ●	IR +

IR LED

IR headers are used to a connect single IR LED - either direct-solder the LED or attach the LED via a cable. The LONG leg of the LED goes in the ROUND hole. The SHORT leg of the LED goes in the SQUARE hole.

BATTERY (9)	
1 ●	Battery +
2 ■	Battery -

BATTERY - IMPORTANT: DOUBLE CHECK and TRIPLE CHECK POLARITY!

For connecting a 2-5S LiPo battery (21V MAX). Connect to battery MALE connector, e.g. the XT60 with the pins. Your battery should have with a female connector.

BUZZER (10)	
1 ■	BUZZER- (B-)
2 ●	BUZZER+ (B+) / 5v

BUZZER

Use 5V and BUZZER- to connect to an external buzzer.
5.0v is also supplied when powering via USB.

UART2 RX/TLM (11)	
1 ■	GND
2 ●	5v
3 ●	RX/PPM
4 ●	TX/TLM

UART2/PPM - Serial RX or PPM RX + Telemetry

For receiver connections.

Note: Some receivers like the FrSky XSR/X8R require the use of two serial ports for RX and Telemetry in this case use UART2 (for RX) and UART5 (for Telemetry) - See also the receiver connector on the bottom of the PCB.

3.3v Pad (12)	
1 ■	3.3v

3.3v Pad.

This pad is for use when connecting to 3.3v received, e.g. Spektrum Satellite receiver.

LED Strip Pads (13)	
1 ■	LED Strip Data Out (DO)
2 ■	5V BEC
3 ■	GND

LED Strip Pads

Pads for connecting an LED strip. Note that some LED strips require a MAXIMUM voltage LESS than 5V. In this case connect a DIODE between the LED strip + and the 5V BEC pad to drop the voltage. See Cleanflight manual for further details. The LED Strip signal pad is marked "LED" and closest to the middle of the board.

Camera (16)	
1 V	Video Signal
2 G	GND
3 +	CAM Voltage

Camera (17)	
1 A	Audio Signal
2 V	Video Signal
3 G	GND
4 +	VTX Voltage

SWD/DEBUG socket (C)	
1 ●	GND
2 R	NRST
3 D	SWDIO
4 C	SWDCLK

UART5/OSD socket (B)	
1 ●	GND
2	CAM_OSD_CONTROL
3	TXD
4	RXD

Camera

Connect an NTSC or PAL FPV camera.

CAM voltage is configured by the CAM bridge on the bottom of the board. Set the voltage to either BATTERY or 5V.

VTX

Connect an NTSC or PAL Video transmitter camera. Ensure your VTX uses the same video format as the camera. i.e. Use an NTSC camera for an NTSC video transmitter.

IMPORTANT: Ensure you use a VTX with AUDIO IN otherwise you will not be able to use PID-Audio and MIC.

VTX voltage is configured by the VTX bridge on the bottom of the board. Set the voltage to either BATTERY or 5V.

SWD/DEBUG connector - Used for software development or flashing via SWD

Use a compatible SWD debugger. Black Magic Probe, ST-Link, Segger J-Link, etc.

If for some reason you cannot flash using USB DFU or UART1 you can reinstall firmware using this port.

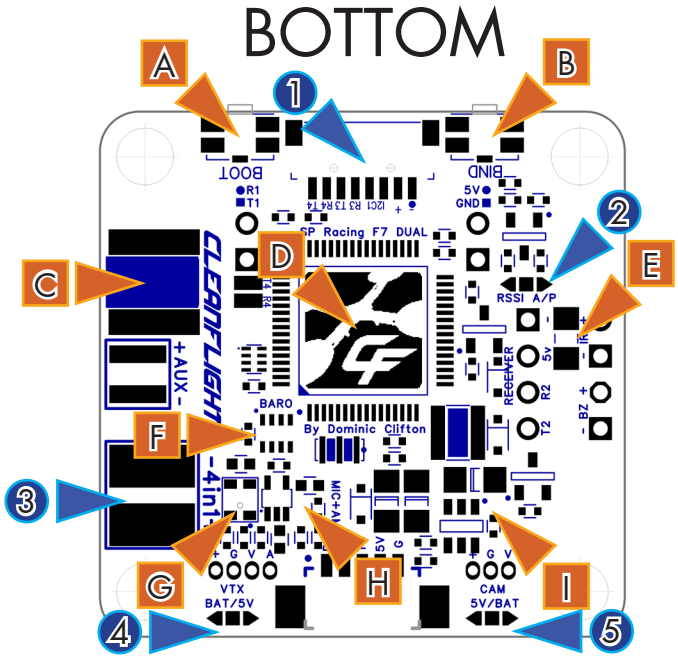
UART5/Camera OSD Control connector

Use the CAM_OSD_CONTROL and GND connections to control cameras OSD with the transmitter sticks. See Cleanflight manual/Betaflight wiki for details of connections and supported cameras. The FC uses a 1uF capacitor to ground and 470ohm resistor in series with the data signal on PA0 - the usual camera OSD circuit.

IMPORTANT: The UART5_RX signal is also connected to the BIND button, pressing BIND will interrupt UART5_RX communications, avoid using UART5_RX if you need to use the button. Currently this doesn't cause an issue as you can only use the button when you're not flying (e.g. binding RX or changing VTX channel). Do not use Serial RX on UART5.

NOTE:

You can check the transponder LED is working by using a mobile phone camera pointed straight at the LED when the transponder is enabled via the board and in the software. The LED will pulse an infrared signal which usually shows up purple via a mobile phone camera.



1. IO socket.
2. RSSI Analog/PWM bridge.
3. 4in1 ESC pads.
4. VTX voltage select bridge.
5. Receiver socket.
6. Camera voltage select bridge.

A. Boot Button.
B. BIND Button.
C. Current sensor.
D. STM32F722 CPU.
E. IR Transponder circuit.
F. Air pressure (Baro) sensor.
G. MEMS Microphone.
H. Audio Mixer.
I. 5V BEC.

VTX Voltage (4)	
1◀	Battery +
2 ■	VTX Voltage
3▶	5V BEC

VTX Voltage select bridge pads

Create a solder bridge between TWO PADS ONLY to select VTX voltage.
a) bridge ◀ and ■ to set the VTX voltage to BATTERY voltage.
b) bridge ■ and ▶ to set the VTX voltage to 5V.

Camera Voltage (5)	
1◀	5V BEC
2 ■	CAM Voltage
3▶	Battery +

Camera Voltage select bridge pads

Create a solder bridge between TWO PADS ONLY to select the Camera voltage.
a) bridge ◀ and ■ to set the camera voltage to BATTERY voltage.
b) bridge ■ and ▶ to set the camera voltage to 5V.

RSSI PWM / ANALOG SELECT (2)	
1◀	ANAGLOG RSSI
2 ■	INPUT
3▶	PWM RSSI

RSSI PWM / ANALOG select bridge pads

Create a solder bridge between TWO PADS ONLY to select the function of the INPUT pad.
a) bridge ◀ and ■ to use the "RSSI" pad for ANALOG RSSI - for 0 - 3.3v Analog Signals.
b) bridge ■ and ▶ to use the "RSSI" pad for PWM RSSI - for 0 - 5v PWM signals.

NOTE:

When bridging select pads with solder, put a small blob of solder on two pads, let the solder cool, then bridge them together with a little more solder.

IMPORTANT: DO NOT CONNECT ALL THREE PADS TOGETHER.

IO socket (1)	
1 ●	GND
2	5v
3	SCL
4	SDA
5	RXD (R3)
6	TXD (T3)
7	RXD (R4)
8	TXD (T4)

IO socket for I2C/UART3/UART4

Use this socket to connect a GPS receiver with I2C MAG sensors to use Cleanflight GPS features.

IMPORTANT: The SCL and SDA are 3.3v signals

5.0v is also supplied when powering via USB.

IMPORTANT: 5.0v to 3.3v logic level converters are REQUIRED for SCL/SDA if your sensors use 5.0v signals.

IMPORTANT: 3.3v ONLY signals for UART3 R3/T3, UART4 can use 5.0v signals (T4/R4).

RECEIVER (5)	
1 ●	RXD (R2 / PPM)
2	TXD (T2 / FrSky TLM)
3	TXD (T5 / SmartPort/Hott TLM)
4	5v
5	GND

RECEIVER port - Molex Picoblade connector

Connect to a receiver using either of the two supplied cables.

FrSky XSR - Use Straight though cable. UART2 for Serial RX, UART5 for SmartPort.
Other Serial RX - Use dupont cable. UART2 for Serial RX, T5/UART5 for Telemetry (Hott/Smartport/etc).
PPM RX - Use dupont cable. RXD/R2/PPM for PPM, TXD/T2/UART2 for Telemetry.

NOTE: There are also header pins and holes for other receivers.

5.0v is also supplied when powering via USB.

4in1 ESC pads (3)	
1 +	Battery +
2 -	Battery -

4in1 ESC pads - IMPORTANT: DOUBLE CHECK and TRIPLE CHECK POLARITY!

For connecting to a 4in1 ESC. See Connections section below.

Receiver Connections

The F7DUAL has many methods to allow receiver connections, the main ones are as follows (listed in order of popularity):

1) Serial RX on UART2 + Telemetry on UART5 via Picoblade connector (e.g. FrSky XSR).
2) Serial RX on UART2 via Headers Pins + 3v3 PAD (Spektram Satellelite)
3) Serial RX on UART1 via Stacking Header Pins when stacking with VTX board (e.g. FrSky XM+).
4) PPM + Telemetry via UART2 on Header Pins (e.g. FrSky D4R-II)

When using the FrSky XM+ on the Stacking VTX board use the group of 4 header pins marked "T1/R1/5v/-" and solder the very-low-profile stacking sockets to the 5v/G and R1/T1 either side of the MicroSD card socket. Solder the very-low-profile stacking pins to the bottom of the Stacking VTX board.

Camera/VTX/LED-Strip BEC Connections.

The F7DUAL supports 5V or BATTERY voltage Cameras and VTXs, however the on-board 5V regulator is rated for 1.5Amps by it's manufacturer but other devices, such as the FC itself and any receivers or LED strip connected to it will use the regulator. To be on the safe side do not use more than 1A at 5V. Suggest measuring the current usage of each connected device, one at a time prior to using them all at the same time. If you run more than a few LED-STRIP LEDs it is better to have a seperate BEC for the LEDs to ensure that LED operation doesn't interfere with flight behavior. When checking current draw of LEDs set them to WHITE as this will use the most current.

Cameras and VTXs that support LiPo battery voltages are more flexible and can be connected to either 5V or BATTERY and thus allow you to spread the load.

Camera Connection.

Set the CAM voltage bridge to either 5V or BATTERY voltages, refer to your Camera manual.

4in1 ESC Connection.

If you are using a 4in1 ESC then connect the 4in1 ESC as follows:

1. Connect Battery wires to FC.
2. Connect 4in1 pads on the bottom of the board to ESC.

This allows the FC to measure the current used by the 4in1 ESC board and supplies the FC with power.

VTX Connection

When using the stacking VTX board do NOT install the supplied 4 PIN Picoblade socket, instead use the 4 pin stacking socket supplied with the stacking VTX board. Solder stacking socket in the FC, solder stacking pins in Stacking VTX board.

Set the VTX voltage bridge on the bottom of the board to 5V if using the Stacking VTX board with the FX758-2-SPI module.

For other VTXs use set the VTX voltage bridge to either 5V or BATTERY voltages, refer to your VTX manual.

Soldering

VERY IMPORTANT! - Do NOT solder your flight controller until you have plugged in a USB cable and checked that the GREEN, BLUE and RED lights operate! Red will flash, GREEN and BLUE must be ALWAYS ON. Once you have checked the FC is OK then unplug it and solder your wires.

IMPORTANT:

- Use a high quality soldering iron and good solder.
- Tin/Lead solder is MUCH easier to use than other Lead-free solder.
- Use solder with flux and remove any flux residue after soldering. AVOID CORROSIVE FLUX!
- Check for and remove solder balls you may have created after soldering - use a magnifying glass.
- Ensure you have sufficient fume extraction when soldering.
- Pin headers that connect to the GND signal and large battery/esc pads will be more difficult to solder because the PCB will sink the heat from your soldering iron. Solder the signal pins, then the VIN pins, then the GND pin or large pads - by the time you get to the GND pins or large pads you will have heated the board and it will be easier to solder them.
- If you have never soldered before then DO NOT attempt to solder the flight controller, practice on something else first.
- Position your soldering iron tip so that you do not accidentally de-solder other components on the board.

The flight controller is supplied with a some pin-headers and connectors. Choose very carefully which ones you want to use. You can solder headers to top or the bottom of the board.

Once you have soldered pin headers or connectors in place DO NOT attempt to remove them unless you are highly skilled in de-soldering and have the correct tools. Overheating the board or components will destroy it.

Cables

The flight controller is supplied with camera and VTX cables and sockets for them.

IMPORTANT: Ensure that you leave some slack in your cable routing as this will help if you crash your aircraft.

Spare or replacement cables are available from your retailer.

Do not rely on cable color-coding due to manufacturer variations. Always check before applying power.

MicroSD Card

The MicroSD socket allows MicroSD/SDHC/SDXC to be inserted.

HOWEVER, Currently only MicroSD and MicroSDHC are supported. MicroSDXC is NOT currently supported by Cleanflight.

For full details on how to enable logging, SD card speed requirements and how to view logs please see the Cleanflight software manual.

Your aircraft will fly better if you analyze your logs and tune accordingly.

Getting started

Verify flight controller operation via the configuration software.

- Disconnect the flight controller from your computer.
- Disconnect ALL connectors and headers from the flight controller.
- Install latest STM32 Virtual COM Port Driver
  http://www.st.com/web/en/catalog/tools/PF257938
- Install and launch the Cleanflight Configurator tool
  https://chrome.google.com/webstore/detail/cleanflight-configurator/enacoimjcgeinfnnnpajinjgmkahmfgb
- Connect flight controller to computer via USB cable.
- Select the correct COM port if it is not automatically detected.
- Click connect, verify that communication is established. (Fig 3)

[Figure 3 - Setup tab after connection established]

- Verify all sensors on your board are giving correct readings. (Fig 4)

[Figure 4 - Sensors tab showing all sensors.

Disconnect and upgrade the firmware using the Cleanflight configurator tool. (See Firmware Upgrade section)

For further software configuration see the getting started guide in the Cleanflight manual.

The basic steps, after firmware upgrade, are as follows.

- Choose board alignment - you can mount it in any orientation, not just with the arrow facing forwards.
- Calibrate sensors.
- Configure serial ports.
- Choose model/mixer (default is Quad X)
- Enable features.
- Configure receiver, set channel mapping.
- Configure channel mid and endpoints (1000-2000) and trim channels on transmitter.
- Configure voltage monitoring.
- Configure outputs (servos/ESCs)
- Ensure ESC calibration matches ESC configuration, recalibrate ESCs if needed.
- Learn about flight modes and configure channels/switches to activate them as required.
- Learn how to arm/disarm.
- Bench-test failsafe.
- Read safety notes.
- Learn how to download and view your flight logs to help tune your aircraft.
- Insert correctly formatted MicroSD/SDHC Card before your first flight (so you have a log).
- Learn how to recognise un-tuned flight characteristics and the effects of a PID controller. (Watch some videos).
- First flight should be in Acro/Rate mode (the default mode when no other modes are active).
- Tune PIDs.
- Backup settings.
- Contribute to the Cleanflight project with feedback, suggestions, code, etc.

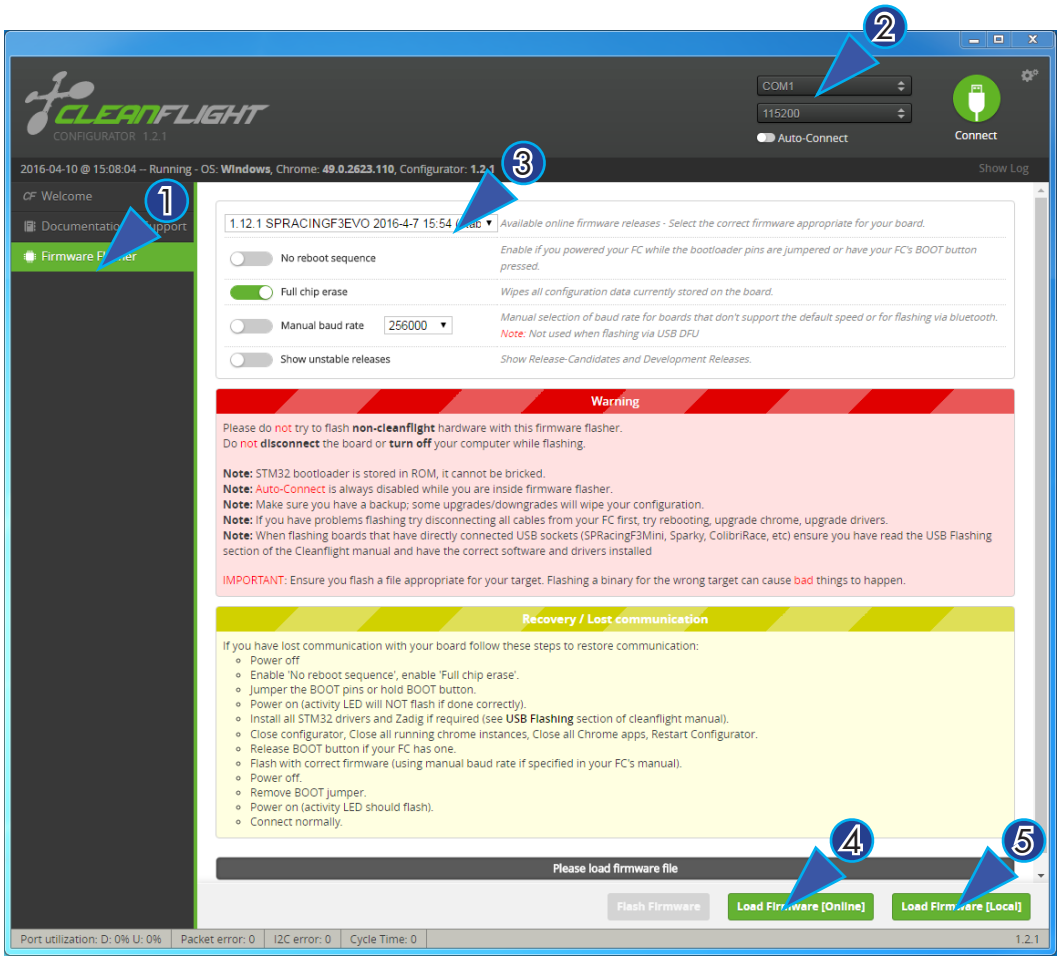
Firmware Upgrade

VERY IMPORTANT:

It is REQUIRED that you immediately upgrade the firmware of the flight controller so that you have the latest features and bug fixes. DO NOT ATTEMPT TO FLY until you have installed the latest CLEANFLIGHT firmware. Due to the fast-paced development cycle of Cleaflight/Betaflight and manufacturing lead-times the firmware installed in the factory may not have all features enabled.

On Windows USB DFU drivers must be installed. See the Cleanflight manual for latest installation instructions.

1. Click the Firmware Flasher tab.
2. Select the correct COM port and speed, use the default speed unless you have changed it on the FC.
3. Select the latest "SPRACINGF7DUAL" stable release. (Do not use other targets). If no firmware is currently available do NOT attempt to flash. NOTE: Flashing the wrong firmware can cause the FC to be permanently damaged.
4. Click 'Load firmware [Online]' and wait for firmware to download and read release notes before flashing.
5. Click 'Flash Firmware'. At this point the FC should reboot into DFU mode. DFU will appear in the list of ports and flashing via DFU will proceed. After flashing the virtual COM port will re-appear.



IMPORTANT: Verify operation using latest CLEANFLIGHT firmware before attempting to use alternative firmware. Not all features may be supported by alternative firmware.

Troubleshooting

Q: Unable to flash firmware via DFU.
A: Likely the correct DFU drivers are not installed. Put the board in BOOTLOADER mode (Press BOOT button, connect USB cable). Then update DFU drivers. See USB Flashing section of Cleanflight manual for details.

Q: The COM port does not show up.
A: Ensure latest USB STM VCP (Virtual Com Port) drivers are installed.

Q: DFU does not appear in the port list when flashing.
A: Try disconnecting the FC, press and HOLD the boot button. Connect the USB cable. Release BOOT, retry flashing.

Q: I have no LEDs on at all.
A: Check 5v supply. (Battery Charged?, USB cable damaged?)

Q: The status LED never lights or is always on.
A: Follow recovery procedure in the configurator. Likely caused by flashing wrong firmware. Could also be caused by stuck-down BOOT switch - check button for dirt, etc.

Q: Unable to connect and a repeating light sequence occurs on the activity LED.
A: Check the Cleanflight manual for how to interpret the error code (count the long flashes).

Q: Unable to connect to the board (and status LED shows non-repeating pattern at boot-up).
A: Close all Chrome browsers and Chome apps, retry. COM Port drivers not installed? Try connecting via different UART OR Reset the board to defaults using buttons OR reflash firmware using 'full chip erase'. (Likely caused by mis-configuration of ports).

Q: Transponder code not recognised by receiver.
A: Check transponder enable bridge. Check IR LED orientation and light beam exit path. Ensure transponder feature enabled in software. Ensure transponder code correctly configured.

Q: The COM port does not show up after flashing firmware.
A: Wrong firmware was flashed; Use SPRacingF7DUAL target and follow recovery steps in the Cleanflight Configurator firmware flasher to restore the firmware.

Q: The receiver tab does not show any activity.
A: Check configuration tab - receiver mode. Center sticks, configure endpoints and trim on transmitter. Check ports tab if using Serial RX. Check wiring.

Q: You have a problem not listed here.
A: Reset and/or upgrade the firmware, try again, report issues via the forums - links are in the configurator on the 'Documentation & Support' tab. Before contacting your retailer reflash with latest CLEANFLIGHT and double check - perhaps the firmware you are using is old or incorrect?

Q: Only 5V LED lights up, No BLUE 3V LED or RED STATUS LED.
A: Most common cause is misconnection or short of VBAT pins - FC will be destroyed! Check for short in Spektrum Satellite cable if using Spektrum Satellite RX. Always caused by destroyed CPU or overloaded/shorted voltage regulator.

Mounting

The SPRacingF7DUAL and Stacking VTX board are supplied with grommets. Install the grommets in each corner of each board. Then use appropriate spacers between your frame and between each board.

When using the Stacking VTX board ensure the gap between the FC and the Stacking VTX board is the same on all sides and that all stacking connectors are properly mated and connected.

Ensure that all wires soldered to the FC do NOT touch the bottom of the Stacking VTX board. Use appropriate guage cable and solder neatly! Especially for the Battery and ESC power cables.

The SP Racing F7 DUAL has a directional arrow on it indicating the front of the board. The USB socket should be on the RIGHT when the quad is facing FORWARDS.

Transponder

The SPRacingF7DUAL features a IR LED transponder system. For optimum performance ensure you read the following section.

Mounting - Ensure that the IR LED can shine light from its installed location onto the track-side receiver, unobstructed. e.g. ensure that props, motors, arms, etc, are not in the way of the light shining from the LED.

Orientation - Ensure the LED points outwards from the aircraft towards the track-side receivers. The more receivers you use the better the code reception will be.

Verifying operation - Ensure that the TRANSPONDER feature is enabled in Cleanflight. Ensure that the correct pads of the IR/LED SELECT solder pads are bridged with solder. Ensure that the TRANSPONDER code has been configured via the Race Transponder configuration section in the Cleanflight Configurator. Once this is done you can use a CMOS/CCD camera without IR block pointed directly at the IR LEDs and you should see them pulsing. A mobile phone camera works well for this, your FPV camera and screen/goggles may be OK if it doesn't block IR light.

Once you have verified that the IR LED pulses IR light then you can scan your SPRacingF7DUAL past one of the iLAP receivers. The iLAP receiver just needs power, no software configuration is required to verify that the code is working.

The first time the iLAP receiver can read the transponder code the LAP light will pulse once, while the iLAP receiver can read the code then the activity light (ACT) will be flashing.

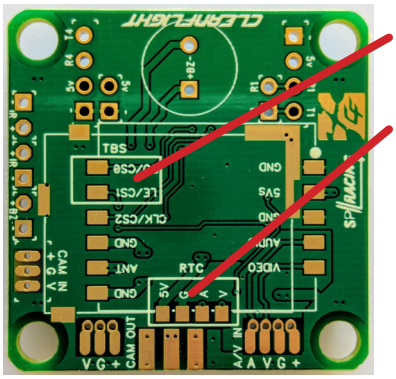
Each time the LAP light flashes the receiver transmits transponder code and timing information via it's COM port to the computer it is attached to.

By default the iLAP receivers will not transmit the transponder code to the PC twice in a row unless the transponder code has not been received for over one second.

For further iLAP receiver configuration and setup advice refer to the iLAP documentation.

Stacking VTX board

VERY IMPORTANT: The Stacking VTX board is supplied with two peices of yellow Polyimide/Kapton insulating tape.
You MUST installed ONE peice of tape under the VTX on the UNUSED connections so that your VTX module does not contact them, as follows:



TBS Unify Pro: Install ONE peice of Polyimide tape over the 2 pads in the box labelled `TBS`.

FX758-2-SPI / RTC 6705 module: Install ONE peice of Polyimide tape over the 4 pads in the box labelled `RTC`.

Install the 4-pin male very low profile stacking connectors into the BOTTOM of the Stacking VTX board and solder them from the TOP of the board. Install the female connector into the TOP of the FC.

If you were supplied with 3-pin very low profile stacking connectors you can install the male pins in the CAM-OUT holes from the BOTTOM of the Stacking VTX board, install the female socket into the TOP of the FC. Then you can connect your camera to the CAM IN pads/holes instead of to the FC.

TBS Unify Pro option

- Install Poliyimide tape over box labelled 'TBS' as illustrated.
- Install the TBS Unify, line up the board with the 4 signal pads and the box, then solder the 'V' pad first. Check alignment after soldering one pad, then solder remaining pads.
- Set 'VTX BAT/5V' bridge on FC to 5V.
- Enable 3 bridges on the bottom of the Stacking VTX board.
  1. 'VTX+ 5V ONLY'
  2. 'SA_EN'
  3. 'AU_EN'

  All three jumpers are located near the 'AV/IN' pin holes.
- Enable SmartAudio on UART4.

FX758-2-SPI Option

- Install Poliyimide tape over box labelled 'RTC' as illustrated.
- Install the FX758-2-SPI module, ensure the orientation is correct. Use the pins marked 'ANT' on both the VTX module and the Stacking VTX board for orientation reference. Solder a corner pin first, CS1 or VIN pads are best. Check alignment, solder opposite corner pin. Check alignment again. Solder remaining pins.
- Set 'VTX BAT/5V' bridge on FC to 5V.
- Enable 'VTX+ 5V ONLY' bridge.
- Do NOT bridge 'SA_EN' or 'AU_EN'.

IMPORTANT: Do NOT attempt to remove either VTX module from the board once you have soldered it in place unless you have specialist equipment - they are very hard to remove, removal will likely destroy both the VTX module and the stacking VTX board itself.

NOTE: SmartAudio and PID-Audio can be used at the same time.

Hardware Specifications

- STM32F722 CPU, 216Mhz inc FPU
- 2x Low-noise ICM20602 accelerometer/gyro (both connected via SPI)
- On-board MEMS microphone
- PID-Audio with CPU audio out and audio mixer
- BMP280 Barometer - bottom mounted for wind isolation
- OSD with customisable layout
- Amperate meter/current sensor (110A)
- MicroSD card slot (SD/SDHC, upto 32GB)
- 5 Serial Ports - None shared with USB
- 5V Switching regulator, 1A
- TVS protection diode
- 36.8x37.8mm PCB with 30.5mm mounting hole pattern
- 4mm mounting holes for soft-mount grommets and M3 bolts
- Durable 1.6mm thick 6-layer copper gold-plated PCB
- FPV stack weight of FC/PDB + OSD/VTX ~16 grams
- Analog and Parallel RSSI circuit
- Transponder circuitry (LED and code available separately)
- MicroUSB socket for configuration and ESC programming
- 3 LEDs for 5V, 3V and STATUS (Green, Blue, Red)
- STM32F722 CPU, 217Mhz inc FPU
- Supplied with 4x soft-mount grommets.
- Supplied with 8x right-angled pin headers.
- Supplied with 2x Audio/Video cables. (Camera Input, VTX Output)
- Supplied with 2x Audio/Video PicoBlade connectors. (for Camera Input, VTX Output)
- 4x pairs of solder pads for ESC Signal/GND connections (DSHOT compatible)
- 4x pairs of solder pads for ESC Power/GND connections
- 4x solder pads for ESC Power/GND connections (DSHOT compatible)
- 3x special solder pads with through-holes for Camera In
- 4x special solder pads with through-holes for Audio+Video Out (VTX)
- 1x solder pad for PWM RSSI
- 1x solder pad for LED Strip
- 2x solder pads for 5V/GND power
- 2x solder pads for battery
- 2x large solder pads for 4in1 ESC connection
- 1x 2pin though-holes for pin headers for UART1 RX/TX
- 1x 2pin though-holes for pin headers for BUZZER
- 1x 2pin though-holes for pin headers for 5V/GND
- 1x 2pin though-holes for pin headers for IR Transponder LED
- 1x 4pin though-holes for pin headers for Receiver (GND/5V/UART2 RX+TX)
- 1x 8pin bottom mounted, JST-SH socket for GND/5V/I2C/UART3/UART4 (IO port, e.g. for external GPS module)
- 1x 5pin bottom mounted, PicoBlade receiver socket for UART2(PPM/SerialRX)/UART5 TX(Telemetry)/GND/5V
- 1x 4pin top mounted JST-SH socket for SWD debugging
- 1x 4pin top mounted JST-SH socket for Camera OSD/UART5 RX/ UART5 TX/GND
- 1x 12pin stacking connector (SPI, UART4 RX/TX, DSHOT/PWM 5-8, 5V BEC, 3.3V, etc)
- 1x Side-press BOOT button (top mounted)
- 1x Side-press VTX/Settings button (top mounted)
- 1x Mixer control (top mounted, by VTX output)
- 2x 5V/BATTERY voltage selectors for Camera and VTX outputs
- 1x Analog/Digital RSSI selectors
- 2x solder pads for UART4 RX/TX (bottom mounted, handy for developers)
- Weight ~6 grams

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Hardware design by Dominic Clifton.
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Seriously Pro website by Dominic Clifton.
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The GUI tool was based on software by cTn.

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https://www.youtube.com/user/Painless360/playlists

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Software support and contributions from many, many authors. For a complete list see github contributors.
https://github.com/cleanflight/cleanflight/graphs/contributors

Community

Thanks to everyone from the AWESOME Cleanflight community for code, artwork, support, ideas, feedback, and everything else. Without you all this product would not exist.