

# Control Freak LBCF-L & LBCF-F Users Manual Ver. 0.10.0



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# Contents

Control Freak Features	2
I. Introduction	4
II. Specifications	7
III. Installation	8
A.) Physical	8
B.) Electrical	8
IV. Wi-Fi Setup	9
A.) Standalone Controller	11
B.) Synchronized Controllers	11
C.) Leader Wi-Fi Setup	11
D.) Follower Wi-Fi Setup	12
V. Configuration	13
A.) Presets and Macros	15
VI. OTA Firmware Upgrades	16
VII. Troubleshooting	17
VIII. Limited 1-Year Warranty for Control Freak	18
IX. Contact Info	19

## Control Freak Features

- Advanced controller for RGBIC LED stripes
- Can drive up to 1500 individually-addressable pixels
- Designed specifically for bicycles and such
- USB Type A male power in / JSM SM 3-pin male LED connector out

- Implements WLED firmware in an advanced microcontroller
- 180MHz. 32-bit CPU, 4MB Flash Ram,
- 2.4GHz Wi-Fi 802.11 b/g/n enabled, WPA/WPA2 security
- Over 100 special effects with integrated WS2812FX library
- FastLED noise effects and 50 palettes
- Up to 250 user presets to save and load colors/effects easily
- Web browser User Interface with Color, Effect and Segment controls
- Strip can be divided into Segments with different effects and colors
- Setup, configuration, and even firmware upgrade over network
- Both Access Point and Station mode with automatic failsafe AP
- Multiple Control Freaks can form Wi-Fi LAN for synchronization
- Support for NeoPixel (WS2812B, WS2811, SK6812) & RGBW LEDs
- Presets can be used to automatically execute API calls
- Configurable Auto Brightness limit for safer operation
- Configurable Current Limit to prevent power-pack overloaded

- 1000  $\mu\text{F}$  buffer capacitor, 500mA resettable fuse built-in
- Wire lead connections are O-ring sealed for weather protection

## I. Introduction

The Control Freak is an addressable LED controller designed specifically for bicycles, and other mobile applications. It uses the firmware developed by the Open Source WLED project to drive a fast and feature-rich implementation of an ESP8266/ESP32 webserver to control NeoPixel (WS2812B, WS2811, SK6812) LEDs. WLED was written by an awesome developer named [Aircoookie](#), and now has over a hundred contributors.

The Control Freak electronics are protected by a small plastic box, with the USB-power lead projecting from one end, and the LED connector lead projecting from the other. It is designed to be affixed to the frame, wheel, or other part of the bike with hook-and-loop fasteners, tie-wraps, or similar instruments, and connected directly to a USB power-pack and female JST SM 3-pin LED connector with no additional wiring.

The Control Freak has a builtin webserver, which allows it to be configured and operated via web browser from any device, such as desktop computer, laptop, tablet, or smartphone, that

can connect to the Control Freak via Wi-Fi. There are also apps for both [Android devices](#) and [IOS devices](#).



Android app

IOS app

120 Effects and be combined with over 60 Color Palettes, and custom colors to create an unlimited number of LED effects. That is the Control Freak.

The Control Freak is available in two models. Both models can work standalone, or in a network:

**Model LBCF-L:** Lead Controller, has push button for limited local control.



**Model LBCF-F:** Follower Controller. No button, Wi-Fi control only.



Multiple controllers can be synchronized together so that they respond as one to power up/down, or changes in Effects, Color, and Intensity. This is perfect for the typical bike installation, where electrically separate LED, controller, and power-packs are installed on each wheel, and the frame. With the Control Freak system, a Model LBCF-L, which has a push button, can be installed on the frame, and used to control Model LBCF-F controllers on the wheels.

Each controller has a builtin 1000  $\mu\text{F}$  buffer capacitor to smooth the voltage going to the controller and LEDs, and the Control Freak allows configurable Auto Brightness, and maximum Ampere to insure that the battery back never gets overloaded.

Control Freak firmware can be upgraded via Wi-Fi with full OTA software updatability, (HTTP + ArduinoOTA) with password protection

## II. Specifications

Works with 5VDC individually addressable LED light strips based on the WS2811(5V), WS2812, WS2812b, WS2813, or SK6812 chips.

NodeMcu MiniD1 ESP8266 Module ESP-12F

180 MHz ESP8266EX MPU, 32-bit CPU 4MB flash memory, 50KB RAM

2.4 GHz Wi-Fi, 802.11 b/g/n

Certification: Wi-Fi Alliance

Network Protocols: IPv4 TCP/UDP/HTTP

FCC ID: 2AC7Z-ESPWROOM02

Operating Voltage: 4.5 – 5.5 V

Operating Current: 80 mA

Operating Temperature Range: -10° C – 100° C

USB Type A male connector on ~3 inch 22 ga, cable for power input from USB power-pack

JST SM 3 Pin male connectors on ~3 inch cable to deliver power and data to RGBIC LED strip

Power is passed through from USB input to JST output with 1000  $\mu$ F electrolytic capacitor across these lines for buffering, and 5 VDC tapped to run the microcontroller.

The electrical characteristics of the DATA (middle) lead on the JST LED connector are those of an ESP8266EX microcontroller: Output range -0.3 – 3.6 V, 12 mA max

Size:

Case Dimensions: 55x35x15 mm.

USB Cable Length: ~10 cm.

LED Cable Length: ~14 cm.

Weight

Model LBCF-L: 27 gm.

Model LBCF-F: 33 gm

### III. Installation

#### **A.) Physical:**

The controller should be affixed to the same part of the bicycle as the LED strip(s) to be controlled and the battery pack that is supplying power to them. Hook&loop tabs are provided to aid in mounting, but they may not be sufficient in all cases. On the wheels, special care must be taken, because they rotate. It may be best to use tie-wraps to secure the Control Freak to the spokes. Always rotate the wheel to make sure your installation has adequate clearance at all points.

#### **B.) Electrical:**

The USB 2.0 Connector A Type Male has only two wires connected, +5 VDC and GND, and should be plugged into a USB type power pack. It is recommended that this power pack be able to deliver a peak current of ~2 A to allow maximum brightness for the largest number of lights.

The 3 pin JST SM Male connector on the other end mates with the corresponding female connector at the front of the LED strip being driven.

## IV. Wi-Fi Setup

You will control the controller, and multiple Control Freaks will sync with each other via Wi-Fi. Because of this proper Wi-Fi configuration is critical to proper operation.

## WiFi setup

## Connect to existing network

Network name (SSID, empty to not connect):

Your\_network

Network password:

Static IP (leave at 0.0.0.0 for DHCP):

0 . 0 . 0 . 0

Static gateway:

0 . 0 . 0 . 0

Static subnet mask:

255 . 255 . 255 . 0

mDNS address (leave empty for no mDNS):

http:// wled-659d51 .local

Client IP: Not connected

## Configure Access Point

AP SSID (leave empty for no AP):

WLED-AP

Hide AP name: 

AP password (leave empty for open):

\*\*\*\*\*

Access Point WiFi channel: 1

AP opens: No connection after boot 

AP IP: 4.3.2.1

## Experimental

Disable WiFi sleep: *Can help with connectivity issues.**Do not enable if WiFi is working correctly, increases power consumption.*

As shipped, the Control Freak will broadcast a new 2.4GHz. Wi-Fi access point as **WLED-AP**. Using the default password: **wled1234** you should be able to connect to that network with your smartphone, tablet, laptop, or Wi-Fi enabled computing device with a modern web browser, and browse to IP address 4.3.2.1 [ <http://4.3.2.1> in the address bar. ] This were you will find the Control Freak User Interface

[UI], and the first thing you will want to do is configure the Wi-Fi. This is done on the Wi-Fi configuration screen.

### **A.) Standalone Controller:**

If the controller is to be used in a standalone manner (autonomously), Wi-Fi setup can be as simple as changing the Access Point name and password for security reasons.

### **B.) Synchronized Controllers:**

If, on the other hand, you want it to synchronize with other Control Freaks, certain details must be attended to, and will depend on whether the controller will be a leader or a follower. To enable synchronization and control of multiple Control Freaks they should all be connected to the same Local Area Network [LAN], and since in most mobile applications there is no existing Wi-Fi LAN to connect to, you will create one by continuing to use your dedicated Leader in Access Point [AP] Mode, while configuring the Control Freaks expected to follow it to connect to that AP and get their IP addresses from it via DHCP.

### **C.) Leader Wi-Fi Setup:**

On the Wi-Fi setup page [<http://4.3.2.1/settings/Wi-Fi?>] change the default AP SSID to something of your choosing. Since the Leader is normally a LBCF-L with a push button, and normally attached to the frame—to run LEDs on the frame, you might change it to something like LBLXXX-FRM, with FRM denoting frame controller. You should also choose a new, secure password, and remember it for

configuring the Follower controllers, and logging into your new network.

#### **D.) Follower Wi-Fi Setup:**

On the Wi-Fi setup page [<http://4.3.2.1/settings/Wi-Fi?>] change Network name (SSID) from ‘Your\_Network’ to the SSID you created for the Leader, and put the same password in the Network password field. Down below, it is suggested that you change the default AP SSID to something that references the network and location, such as LBLXXX-FW for the Control Freak on the front wheel, and LBLXXX-RW for the Control Freak on the rear wheel. You will also want to update the AP password, for simplicity you might want to use that same Network password. If the Leader isn’t on, or can’t be found by a Follower, it will come up as its own AP, advertising the SSID you have given it, and accepting the password you have given it in this configuration. That’s why its useful to make its AP SSID reflect its location, and the number of passwords associated with the system small.

**Both:** After Wi-Fi setup, you should power cycle the controller, and log into the new SSID with the password you set in the Wi-Fi setup screen. If it is a Follower, that joins the network of a live Leader, rather than starting its own network, you can switch to it via the **Instance List** on the **Info** tab of the Leader.

In any case, once you have the WLED Controls loaded in your browser, you can continue with the configuration of the Control Freak.

## V. Configuration

After Wi-Fi, you will want to configure a few important settings on the **LED & Hardware setup** screen [<http://4.3.2.1/settings/leds?>]:

Back Save

### LED & Hardware setup

Total LED count: 30

Recommended power supply for brightest white:  
**5V 2A supply connected to LEDs**  
(for most effects, ~1A is enough)

Enable automatic brightness limiter:   
Maximum Current: 850 mA  
Automatically limits brightness to stay close to the limit.  
Keep at <-1A if powering LEDs directly from the ESP 5V pin!  
If you are using an external power supply, enter its rating.  
(Current estimated usage: 477mA)

LED voltage (Max. current for a single LED):  
5V default (55mA)   
Keep at default if you are unsure about your type of LEDs.

### Hardware setup

LED outputs:

1: WS281x  Color Order: GRB

Pin: 2

Start: 0  Count: 30

Reverse:

+

LED Memory Usage: 90 / 5000 B

Button pin: 0  x

IR pin: -1  x

Relay pin: -1  x

Active high

### Defaults

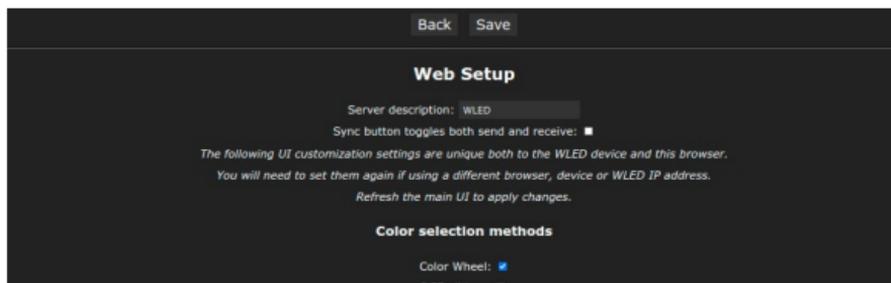
Turn LEDs on after power up/reset:   
Default brightness: 128 (0-255)

Apply preset: 0  at boot (0 uses defaults)

Set the **Total LED count** to the number of LEDs this controller will be driving. If you leave it at default, only the first 30 LEDs will light up.

It's suggested that you also **Enable automatic brightness limiter**, and set **Maximum Current** to a value that won't overload your power source, which is 2000 mA for many common USB power packs.

Confirm that the other settings are at their defaults. **LED outputs** is set to **Pin: 2**, and **Button pin: 0**. After you have created some presets, you can set one to apply at boot on this screen.



On the **Web Setup** screen [<http://4.3.2.1/settings/ui?>], you should change the default **Server description**: This will show up as the name of the web server, so it's useful to have its name reference the location it's controlling, and also be related to the SSID. Examples: LBL-FR (frame), LBL-FW (front wheel), LBL-RW (rear wheel)

Sync setup is very important for the proper operation of a multi-controller setup, but you shouldn't have to change anything on this screen. Just confirm that the **WLED Port**: is set to **21324**, and **2<sup>nd</sup> Port**: to **65506**. They can be changed to create groups in more advanced setups, but for now stick with

these. Also make sure both **Enable instance list:** and **Make this instance discoverable:** are ticked.

The **Time & Macros** screen [<http://4.3.2.1/settings/time?>] have some important setting influencing button actions for the LBCF-L, These are pre-configured with Button short press Preset: 98 [Next Effect], Long Press: 99 [Toggle Power]

## A.) Presets and Macros

Presets are specific combinations of **Colors**, **Effects**, **Intensity**, and **Segments** stored as a numbered, and typically named, preset.

A **Segment** is a contiguous subset of the attached LED strip(s). A string of LEDs may be divided into many Segments, and Segments can overlap. Each Segment can be set to **Reverse direction** or not, **Mirror effect** or not, **Intensity**, and even **Color** palette, and **Effects** can be set on per **Segment** basis.

Here's a simple example of how Segments could be used on a bike wheel. You have LED strips running around the rim on both sides of the spokes for a total of 204 LEDs going around the wheel twice. So, you divide it into two Segments of 102 LEDs each. Now effect patterns on both circles move together. If you turn on **Reverse direction** on one, each rotates in the opposite way.

Segments represent a very powerful tool for organizing the LEDs attached to the Control Freak, and together the enormous **Color palette**, and over 120 **Effects**, the possibilities are virtually infinite.

Once you have created a particular LED display you want to preserve, you can save all that information to a preset.

A preset can also be a list of commands or Macros. The Control Freak can store over 250 presets. On the LBCF-L two preset have already been created to enable button actions:

Those two presets

Predefined Macro Presets associated with button press (LBCF-L only)

Button Action	Preset #	Preset Name	Action
Macro			
Short Press:	98	Next Effect	Cycles
through Effects	FX=~		
Long Press:	99	Power Toggle	Turns
LEDs off and on	T=2		

## VI. OTA Firmware Upgrades

As the Control Freak firmware is improved or enhanced by our efforts, or others in the WLED community, new versions will likely become available, and will be made available for download at <https://LinuxBeach/bikelights/upgrade>. There is also a tab on this screen for downloading the latest WLED

firmware. You'll want the `WLED_0.X.X_ESP8266.bin` binary for the Control Freak. Since the Control Freak can be upgraded over the WiFi network without removing it from its service location, or opening it up to use the internal micro-USB connector, firmware upgrades are exceptionally easy to implement.

In the **Security & Update setup** screen of the web or smartphone app, you will see a section in the middle of the screen titled **Software Update**. Make sure **Enable ArduinoOTA** is checked, then click **Manual OTA Update**. On the next screen, use **Choose File** to navigate to the firmware update that you have previously downloaded, and then click **Update!** It's important that this process not be disturbed, or power removed, before it's complete. You should also enable password protection of OTA firmware updates in the top section of the **Security & Update setup** screen to insure you aren't subjected to any unauthorized firmware "updates."

## VII. Troubleshooting

Even the best designed project can run into difficulties. If your firmware configuration gets so messed up that nothing seems to work right, you may be forced to do a **Factory reset** to set things right. You will find the click-box for enabling that on the **Security & Update setup** screen. Be aware that a factory reset will erase all your existing presets and configurations. You will have to reconfigure the device from scratch.

In a worst-case scenario, such as after a failed or interrupted firmware upgrade, you may not be able to connect to the device by WiFi at all. Be sure to give it 5 or 10 minutes after a firmware upgrade, and try several times before concluding that this is the case. If it does, in fact, appear to be 'bricked,' you will have to pry open the clam-shell case with a small blade in the seam, so that you can access the internal micro-USB connector. There are a number of ways to perform a fresh firmware installation using this USB connector, and they are covered in some detail at <https://LinuxBeach.net/bikelights/upgrade>.

### VIII. Limited 1-Year Warranty for Control Freak

This product is guaranteed against physical and electrical defective, as well as any defects in workmanship, or any broken components under normal use, and will be repaired by us at our expense for the first year after original purchase. If you experience such a failure, please contact us ASAP at [bikelights@LinuxBeach.net](mailto:bikelights@LinuxBeach.net) or (818)964-0860 for a Return Merchant Authorization (RMA), and instructions on how to return the unit for repair or replacement.

The WLED-based firmware, and other Open Source software components are provided AS-IS, and with no warranty of any kind. There is also no warranty against physical damage to the controller or its connecting cables, as the final utility of installation is beyond our control.

Some states do not allow the exclusion or limitation of incidental or consequential damages or allow limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights that vary by state to state.

## IX. Contact Info

Linux Beach has been in the forefront of bringing Open Source technology to peoples lives since 1999.

For more information and support, please visit our website at <https://LinuxBeach.net/bikelights>.

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