Thank you for supporting this community project. The FW3A was designed by Fritz15 and the flashlight forums TLF & BLF. Brought to life by Lumintop.
- the FW3A team -

The FW3A uses Andúril Firmware

FW3A Manual

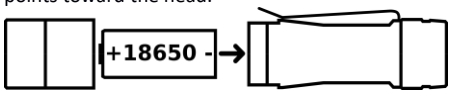
Safety precautions

- Use only a reputable 18650 cells of known origin. Quality high drain cells (over 10A) unprotected, flat top type cells, from Samsung, Panasonic/Sanyo, Sony or LG are recommended.
  The supported maximum length is 66 mm.
- Use a reliable battery charger. Never over-charge or over-discharge cells.
- Remove and recharge the cell when the low voltage indication is given by the Lamp (repeated step-downs in light level and eventual shutdown of the light).
- The extraordinary energy density that 18650 cells offers also means that hazardous conditions are created when a cell is short-circuited or damaged. Always treat cells with respect and properly dispose of damaged cells.
- The FW3A is a very high-intensity flashlight. Do not point directly at a person, animal, moving vehicles or flammable materials.
- When running at higher output levels the head of the Lamp will quickly heat. This is normal. In warmer ambient conditions this temperature may exceed 50ºC depending on your settings, so please take the necessary precautions when handling the Lamp.

Quick start

- Use a 18650 cell. Please note that the FW3A requires unprotected cells.

  Unscrew the front half from the back half and insert the battery (The tail isn't meant to disassembled). Take care with the polarity: Plus points toward the head.



- Screw the head back. The FW3A blinks once to confirm it has power and is now operational. Tighten the head. Do not over-tighten.
- When you change the battery the lamp starts always at the regulated level at ~120 lm (1x7135).
- All functions are performed using the electronic tail button. And basic usage is very simple: **Click for on/off, hold to change brightness. Release and hold again to change brightness the other way.**
- From **OFF**, hold the button. The light output will ramp up from a very low level to Ceiling-Of-The-Ramp. Release the button when the required light level is reached. (The full ramp takes about 3 s.) Use a single-click at any time to turn the FW3A **OFF**. Please see below for further details.
- While ramping it does subtle blinks to signal: Max regulated levels (1x7135, Nx7135) and CEILING.
- The FW3A has two different ramps: **SMOOTH RAMP** and **STEPPED RAMP.** You can change between them when the lamp is **ON** with three clicks. **Each ramp has its own individual settings** – for floor (lowest level), ceiling (highest level). And the stepped ramp can also have a configurable number of steps.
- **TURBO** is only for short times. At around 10 s you may notice it dims slowly down! The user should use it only for short periods instead of relying on thermal regulation to prevent heat damage. Full turbo is powerful enough to start fires in just a few seconds, especially when aimed at dark-colored materials.

Specifications

A small 18650 triple LED lamp with tail switch and a great, easy user interface.

Emitter: Three LEDs on a copper DTP MCPCB e.g. Cree XP-L Hi or Samsung LH351D

Optic: Standard TIR Carclo 10511 (matte)

Lens: Glass with anti-reflective coating

Flux: ~2800 lm (XP-L Hi)

Intensity: ~10 000 cd ANSI throw ~200 m (XP-L Hi)

Firmware: The FW3A uses free software called Andúril, distributed under the terms of the GPL v3. Code is available from http://tiny.cc/TKAnduril

User interfaces: [1] By default the FW3A is set to use **SMOOTH RAMPING**. Instant access to **TURBO** mode is also provided.

[2] A more conventional **STEPPED RAMPING** UI is available if you like discrete modes level. You can choose how many steps you want.

[3] **MOMENTARY** mode is useful for signaling purposes or rapidly/briefly lighting up targets.
To exit this mode, physically disconnect power

[4] **MUGGLE** mode uses a reduced output.

[5] It has an electronic **LOCKOUT** for safety, but acts also as momentary low light.

Other functions: Battery check, sunset, beacon, tactical strobe, party strobe, bike flasher, candlelight, lightning storm

Battery: One flat-top or button-top 18650 cell. An unprotected cell is recommended. Max. length 66 mm. Cell is not included.

Driver: FET+7+1 driver. Low parasitic drain while **OFF**

Body: Aluminum with hard-coat anodizing

Switch: Electronic tail switch

Ingress rating: Equivalent to IPX7

Weight: Approximately 53 g without cells

Size: 25.5 mm Ø head x 92.5 mm length.

LUMINTOP

Made in China

LUMINTOP TECHNOLOGY CO., LTD
Address: 11th Floor, Block B , Fuchangsheng Industrial Park, No.2 Chengxin Road, Longgang District, Shenzhen, China

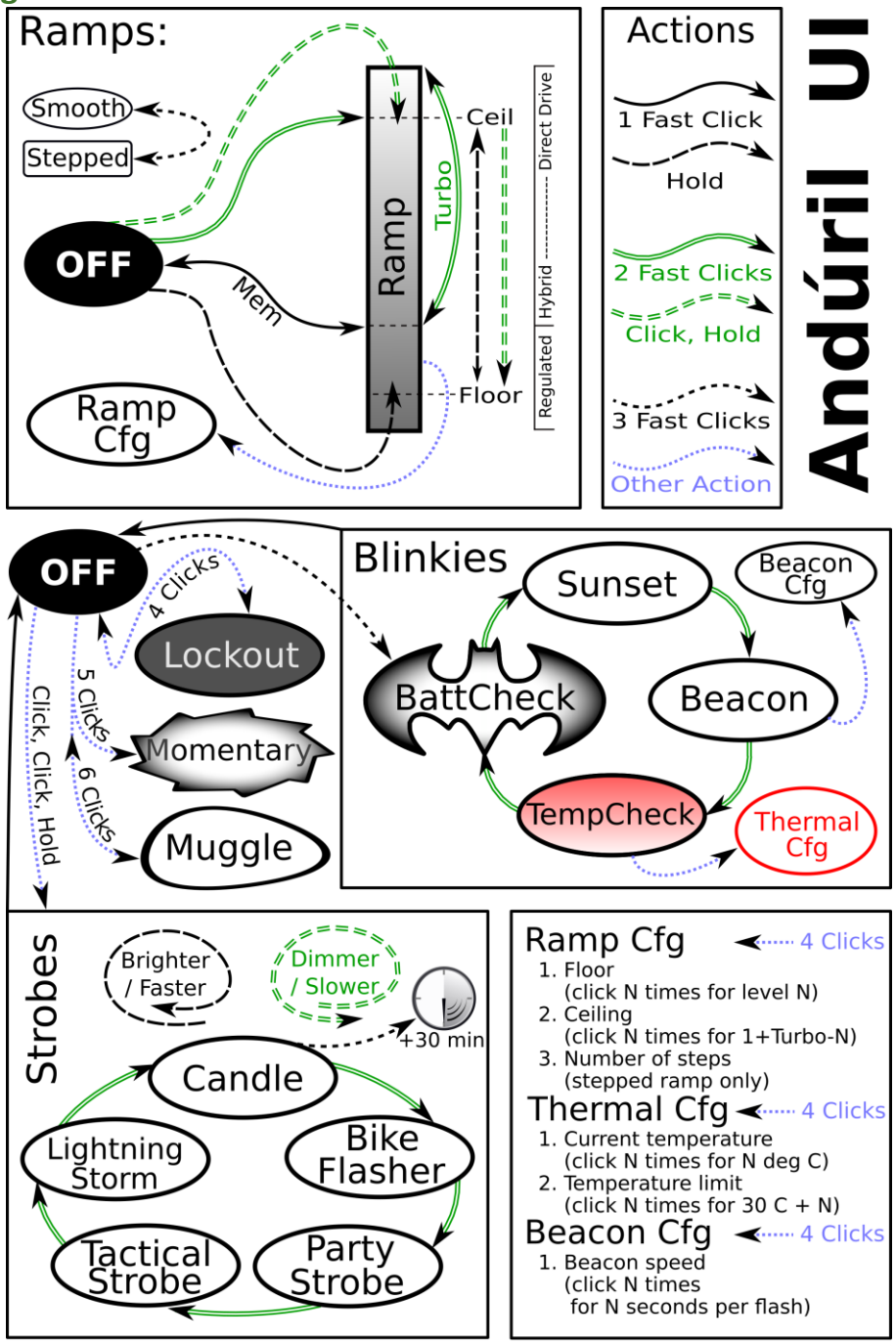
Web: www.lumintop.com
Tel.: +86-755-88838666
E-mail: service@lumintop.com

Manual design and concept by J. Hollmann. Content from budgetlightforum, collected over time. Many thanks to ToyKeeper for her great software!

Rev. A

UI Diagram

Not everything is covered in the diagram, please read the text.



Default UI: Smooth ramping

This UI provides smooth dimming of the light output between **FLOOR** (lowest level) and **CEILING** (highest level), with an easily accessible 100% **TURBO** mode.

Switch to STEPPED RAMP: when the lamp is **ON:** Three clicks
(Hint: If you use 3 clicks from OFF you engage battery check)

Turn the lamp ON: single-click the button, the FW3A turns **ON** using the previously used light output level (MEM)

Ramp up; brighter: hold the button

Reverse ramp: while ramping in one direction, release button briefly and hold again

Ramp down; darker: Click, hold, when **ON**
(means: double-click, but hold the second click a bit longer)
If you do this when the lamp is **OFF**, it ramps down from the CEILING (dashed double lines)

Instant top CEILING: from **OFF**: double-click (double lines)

TURBO: from **ON**: double-click toggles between turbo and the memorized level
from **OFF** (You must first switch ON): Click, then double-click

FLOOR / MOON mode: from **OFF**: Hold
turns on at the FLOOR level, it makes a subtle "blink" to provide a timing hint if you want to stay there.
If you keep holding, it ramps up

Battery check: from **OFF**: triple-click (4 blinks, a short pause, then 1 blink would indicate 4.1 V)

Turn the FW3A OFF: single-click

UI: Stepped ramping

Using this UI the output does not ramp, it steps from one mode to the next using hold. The firmware tries to optimize these steps as equally-spaced on a cube-root curve (considered an ideal mode-spacing by many).
In **STEPPED RAMPING** you can choose how many steps you want. (See Ramp configuration for details).

All operations are the same as in smooth ramping

Switch to SMOOTH RAMP: when the lamp is **ON:** Three clicks
(Hint: If you use 3 clicks from OFF you engage battery check)

UI: Momentary mode

5 clicks from **OFF** to enter Momentary mode
To exit this mode, physically disconnect power (unscrew the light).
This mode locks the flashlight into a single-mode interface where the LEDs are only on when the button is held down. It is intended for Morse code and other signaling tasks.
Brightness is the last-ramped level, so adjust that before entering momentary mode.

UI: Muggle mode

Muggle mode is for lending the FW3A to others. It has a reduced output to make sure somebody won't start a fire. An extremely simple interface with a limited brightness range — ~5 lm to ~240 lm, with slow smooth ramping and no blinkies. Persists after a battery change.

MUGGLE mode ON: from **OFF** 6 clicks to enter

MUGGLE mode OFF: 6 clicks to exit

One click ON / OFF and HOLD to ramp up / down.

UI: Electronic Lockout

4 clicks form **OFF** to disable the FW3A, same to re-enable the lamp.
Lockout makes the light safe to carry in a pocket or a bag or anywhere else it might be pressed by accident.
Lockout doubles also as a momentary moonlight mode, so the user can do quick tasks without having to unlock the light. It uses the FLOOR of the current ramp.

Blinkies

Two groups worth of blinkies are included. To reach them, do “click click click” from **OFF** or a “click click hold” from **OFF**. To change to the next blinky use a double-click. These include:

Group 1 Blinkies / utility modes:

(starts always at battcheck)
from OFF: “click click click”

- **BattCheck:**
  Shows the remaining charge in volts and tenths. E.g. 4 blinks, then pause, 1 blink are 4.1 Volt. A "zero" is represented by a very quick blink.
- **Sunset / Goodnight mode:**
  Starts at a low level, then slowly dims down to moon for an hour, then shuts off. It is intended for use when going to bed.
- **Beacon:**
  Beacon mode uses the last ramped level for its brightness. You must adjust the brightness before you turn beacon on. It blinks at a slow speed: Once every N seconds at the last-ramped level.
  N is configurable in **beacon config mode:** Click 4 times to enter beacon config mode, wait for the light to stutter, then click to enter the number of seconds per blink. For example, to do a 10-second alpine beacon, click 10 times.
  Hint: If you want faster blinks per second use party strobe mode and set it to three blinks per second or more
- **TempCheck:**
  Blinks out the current temperature in degrees C. and optionally configure settings for thermal regulation. E.g. 3 blinks, then pause, 4 blink are 34 degrees Celsius. A "zero" is represented by a very quick blink.
  This number should be pretty close to what a real thermometer says. If not, it would be a good idea to click 4 times to enter **thermal config mode**, and calibrate the sensor.

Group 2 Strobes:

(remembers the last-used mode)
from OFF: "click click hold”

Click three times, but hold the third click for a moment. To change to the next blinky use a double-click.
To set adjustments you can use:
- **Hold:** Increase brightness, or strobe faster. (except lightning)
- **Click, hold:** Reduces brightness, or strobe slower. (except lightning)

- **Candle mode:**
  Simulates a flickering candle or fireplace, until you switch it OFF.
  Or you add timer for 30min: Each triple click adds 30 min including a burn down simulation at the end. Candle mode timer can go for up to 4.5 hour. Adjustable brightness.
- **Bike flasher:**
  Steady output with a “stutter” once per second. Designed to be more visible than a normal ramping mode, but otherwise works mostly the same. Adjustable brightness.
- **Party strobe:**
  Motion-freezing strobe. Can be used to freeze spinning fans and falling water. Adjustable speed.
- **Tactical strobe:**
  Bright, disorienting strobe light. Can be used to irritate people. Adjustable speed, and the duty cycle is always 33%.
- **Lightning storm mode:**
  Flashes at random brightness and random speed to simulate lightning strikes during a busy lightning storm. Do not look directly at the flashlight when this mode is running, because it may suddenly go to full power without warning.

General configuration

Every config mode use the same interface. It has one or more options the user can set, and it will go through its configuration numbers in order. The FW3A confirms each click with a blink.

For each menu item, the light will follow the same pattern:

- Blink one or more times = configuration number
To indicate which setting you are in. All config menus “fall through” with no changes if you don’t press the button.
- “buzz” = The lamp waits for input
Buzz is a stutter quickly between two brightness levels for a few seconds. The User can click one or more times to enter a number. It will keep buzzing until the user stops clicking, so there is no need to hurry.
- Pause, and then go to the next option
After the light has gone through all of the menu options, it should return to whatever mode the light was in before entering the config mode.

Ramp configuration

Both the **SMOOTH RAMP** and the **STEPPED RAMP** are configurable. The user can set the lowest level, the highest level, and (STEPPED only) the number of steps.

While the light is **ON** in one of the ramping modes, click 4 times to enter **RAMP CONFIGURATION** for the **current** ramp.

For **SMOOTH RAMPING**, there are 2 menu options:
1. Floor (default level = 1/150)
2. Ceiling (default = 130/150)

For the **STEPPED RAMPING**, there are 3 menu options:
1. Floor (default level = 20/150)
2. Ceiling (default = 130/150)
3. Number of steps (default = 7)

To configure the floor level, click the button equal to the number of ramp levels (out of 150) at which the floor should be. To set the lowest possible level, click once. (MOON)
To configure the ceiling level, each click goes one level lower. So 1 click sets the highest possible level, 2 clicks is the 2nd-highest, 3 clicks is the 3rd-highest level, etc.
Ceiling clicks: **151 – (level you want) = Clicks**
To set the default of 130/150, click 21 times.

When configuring the number of steps, the value can be anything from 2 to 150.

If you want to change the floor and ceiling to the lowest and highest values, you click once for each.

Defaults settings FW3A (lumen are form prototype 4)

FW3A	SMOOTH		STEPPED	
	Level	ca. lm	Level	ca. lm
max FET	150	2800	150	2800
Nx7135 max regulated	130	760	130	760
Default Ceiling	**130**	760	**130**	760
single 7135 max	65	120	65	120
Default Floor	**1**	Moon	**20**	3.6
Default Steps	-		**7**	

Thermal configuration

Look at a thermometer to check the current room temperature. Let us assume it says 21 Celsius.
Turn the light off and wait for its temperature to settle to room temperature.
Go to TempCheck (from OFF: “Click Click Click”. Ascend with double-clicks three times)

When you are in TempCheck, then click 4 times to enter thermal config mode, and calibrate the sensor.

Thermal config mode has two settings:
1. Current temperature Calibration. Click once per degree C to calibrate the sensor. For our example, the ambient temperature is 21 C = click 21 times.

°C	°F	
100	212	Boiling Water
60	140	
55	131	
50	122	Touch limit
45	111	**[Default]**
40	104	
37,4	99	Body temp.
25	77	
20	68	
0	32	Frozen Water
MaxTemp. – 30°C = Clicks		

2. Temperature limit. This sets the maximum temperature the light can reach before it will start doing thermal regulation to keep itself from overheating. Click once per degree C above 30. For example, to set the limit to 50 C, click 20 times. The default is 45 C (15 clicks).

Hint: If you don’t click, the lamp will leave the value unchanged. The lowest value the user can set is 31 C, by clicking once.

Protection Features

Some features which aren’t visible on the diagram:
Andúril includes low voltage protection (LVP) and thermal regulation.

LVP makes the light step down to a lower level when the battery is low, and if the light is already at the lowest level, it shuts itself off. This activates at 2.8V. LVP adjustments happen suddenly, in large steps.

Thermal regulation attempts to keeps the light from overheating and otherwise adjusts output to stay as close as possible to the user-configured temperature limit. Thermal adjustments happen gradually, in steps so small they are difficult for humans to perceive. It ramps smoothly across 512 internal steps (from 1x7135 to full power) to adjust output while it searches for the highest level it can maintain without overheating.

Usage of the flashlight

You can do a little bit more with your new light …

Because the FW3A is a pocket rocket (AKA nut roaster), it is recommended to use lockout. It can burn things! Backside is, a normal lockout is awkward if you need quick little illumination for the keyhole or in your bag.

FW3A **LOCKOUT** mode doubles as a momentary moon mode. That way, after locking it and tossing it in a bag, it can still be used to look around inside the bag without unlocking it.

Lockout uses as moonlight the floor of the current ramp. If you have two different settings for this, you can have different illumination also.

Or you can use Muggle Mode if you want a safer way to carry your lamp with a reduced output and don't want lock out.

While on, a double click toggles between turbo and the memorized level. So, if you hear a noise and want full power for a moment, double click. When you're done, double click again to return to the original brightness. This is handy for **walking the dog:** With low you can stroll, and when your dog runs away: TURBO, when he comes back, low again.

You can have full power in one ramp and a lower ceiling in the other. By default, both ramps only go up to ~760 lm. And one starts at moon, while the others starts at ~3.6 lm. But you can change this.

Now you can play with FLOOR, CEILING and two ramps e.g.: Let's say your favorite is smooth ramping and you don't like the quick step down from a ceiling at level 130. You can choose level 101 (50 clicks) for the smooth ramp ceiling. This keeps the ceiling at a reasonable cooler level. Smooth floor on level 1 for a really dim moonlight. You can set 20 clicks for stepped floor for a usable low outdoors. And 130 for stepped ceiling if you also like to have a powerful ceil.

An option against too much heat can be different ceilings for SMOOTH RAMP and STEPPED RAMP. Lower for your preferred ramp the ceiling and with 3 clicks you can switch to the other ramp, where you can have full power if you need it.

If you click zero times, the floor or ceiling value doesn't change. This is great because you can change just the floor or just the ceiling without reprogramming the other.

The FW3A has a nice candlelight mode, the effect is bigger if you use a diffuser.
Lightning storm is also more fun with a diffuser.

Searching things:
If you drop a little piece, lay your light flat on the ground and rotate it like a lighthouse. The small piece should cast a long shadow and it is easier to find.

In case you lose your light, you can store a piece of paper in the tube with: "This Lamp belongs to NAME. If found please call: 1234 or Name@mail.com.

General voltage level of a LiIon battery

Voltage	Note for a 18650
4.2 V	fully charged
3.7 V	half full *
3.1 V	below 10% capacity, time to charge *
2.8 V	low voltage protection from a lamp should start
2.5 V	begin of deep discharge

Pay attention that the voltage level under load is lower than without load.
*on these two entries, please note smaller battery sizes (e.g. 16350, 18350) have a bit higher voltages.

There are also some other interfaces available for this hardware, but it requires the user to flash different firmware. You can make it work like other brands. However, these are not tested and not officially supported.

Links

Review of prototype #4 from Maukka
Because it has not the final 5D LEDs and a different optic numbers can differ.
http://budgetlightforum.com/node/65619

Changes in Andúril: Commit log (instead a change log):
https://bazaar.launchpad.net/~toykeeper/flashlight-firmware/fsm/changes

UI Diagram from ToyKeeper:
http://toykeeper.net/torches/fsm/anduril-ui.png

FW3A main thread:
http://budgetlightforum.com/node/54239

Discussion on TLF in German:
http://www.taschenlampen-forum.de/threads/fw3a-tlf-sonderedition-in-kleinserie-diskussionsthread.56306/

Stable firmware from:
Bazaar Launchpad resp. http://tiny.cc/TKAnduril
Newest HEX from: http://toykeeper.net/torches/fsm/

FSM Thread:
Andúril is part of a bigger framework called FSM. You can choose from different user interfaces.
http://budgetlightforum.com/node/56105

A Youtube Video with a Andúril walk through: How to use and set up ToyKeeper's Andúril flashlight firmware from Tech-test
https://youtu.be/h_mZ35IPLMA

Hoops Flashing Firmware thread:
http://budgetlightforum.com/node/36216

FAQ FW3A

- The FW3A uses a tube in tube design to realize the electronic tail switch. The outside tube is the regular battery negative, the inside carries the switch signal.
- If there is a short between neg. and switch tube the lamp is constantly on.
- If side bumps misalign the inner tube: Loosen and retighten the head
- You tried to configure your lamp and now it is only working if you press the button.
  When you press 4x from **OFF** you lock out the lamp. Press four times again to unlock. When you want to config the lamp must be **ON**, and then click four times.
- If I turn on using moon shortcut, it won't memorize moon.
  In short: the FW3A has only memory if you ramp to a value.
  It doesn't memorize the floor, ceiling, or turbo levels when they're reached **by a shortcut**. This is on purpose, because people didn't like losing their memorized level after using moon or turbo. To make it remember moon, the user must ramp to it… typically, by ramping up a little then back down. Basically, it behaves that way because that's what people asked for.