Helena

User Manual

1 Preface

Helena is an alternative driver for the popular Yinding or KD2 Headlight Cycling Lamp with following features:

- Two independent 3A Step-Down constant current sources, each capable of driving two white LEDs in series. The intended setup is one Cree XHP50 LED equipped with a flood optic and one Cree XM-L equipped with a spot optic.
- Integrated motion sensor to drive the LEDs in dependency of the head inclination, resulting a nearly constant brightness level, no matter if you're looking down or straight forward.
- Bluetooth interface for wireless remote control, lamp daisy-chaining and Smartphone based configuration.
- Integrated temperature regulation to prevent lamp from overheating.
- Smooth output power reduction when battery is low.
- Low standby current (less than 100µA).
- Works with input voltages between 3V and 4.25V (only 1 LED per current source), 6V and 8.5V and between 9V and 12.75V (max. output current is limited to 2.4A).

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2 Installation

2.1 Connections

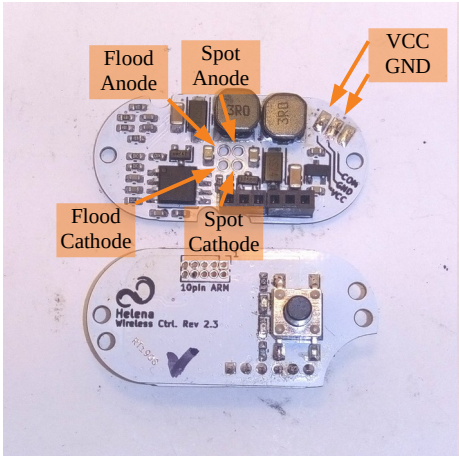

Image 1: board connections

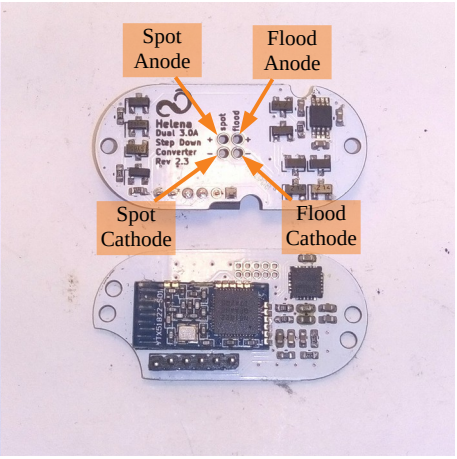

Image 2: board connections

2.2 Driver Swap for KD2

Step 1. Disassemble lamp and remove old driver. Mount LED board witch the notches facing to the top and route both cables through the left one. Then cut the cables to a length of 20-25mm and cover the screws with electric tape.

Image 3: LED board preparations

Step 2. Connect the LED cables to the spot driver output of the LED driver. Route the cables as shown in the image.

Image 4: LED connection

Step 3. Attach the power cable (and optionally the communication line). Route the cables along the board-to-board connector and use the notch next to it to lead it through the opening.

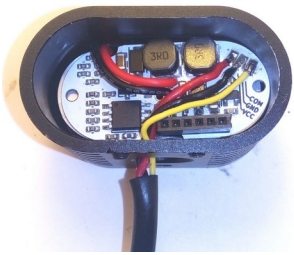

Image 5: power cable routing

Step 4. Mount the controller board to the lid.

Image 6: mounted Controller board

Step 5. Put a pair of tweezers, zip ties, toothpicks or a similar object between the LED- and driver board to lift it a couple of millimeters, then put the lid on and.

Image 7: Lift driver board for proper connection

Step 6. When the connector fits properly, remove the tweezers, close the lid and you are done.

Image 8: closed lid

2.3 Driver Swap for Yinding

Step 1. Disassemble lamp and remove old driver. Cut the cables to a length of 20-25mm.

Image 9: prepared LED cables

Step 2. Attach the power cable (and optionally the communication line) Don’t forget to run the cable through the opening in the lamp body.

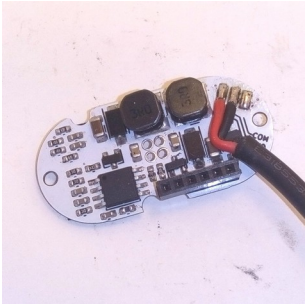

Image 10: attached power cable

Step 3. Now attach the cables from the LED board to the spot output. Connect them from the bottom side.

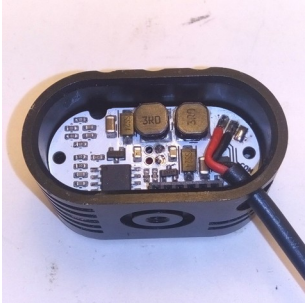

Image 11: attached LED cables

Step 4. Mount the controller board to the lid.

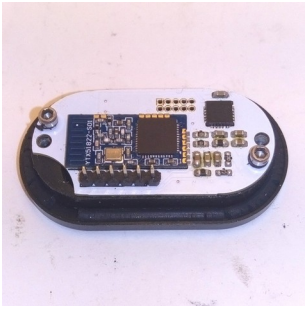

Image 12: mounted Controller board

Step 5. Close the lid and reassemble the lamp.

2.4 Full conversion for Yinding

Step 1. Prepare LED boards by attaching cables and cutting them to a length of 25-30mm.

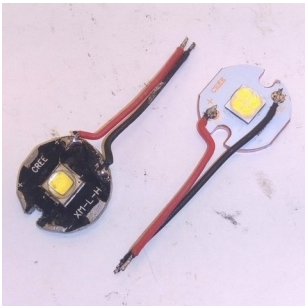

Image 13: prepared LED boards

Step 2. Attach the power cable (and optionally the communication line) Don’t forget to run the cable through the opening in the lamp body.

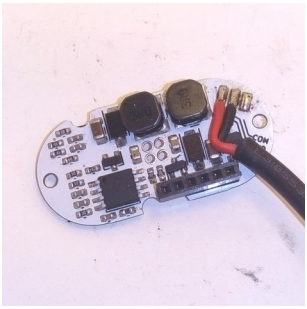

Image 14: attached power cable

Step 3. Route the LED boards cables through the inner hole.

Image 15: cable routing

Step 4. Now attach the cables from the bottom side. Solder the cables of the XHP50 to the flood output and the cables of the XM-L to the spot output.

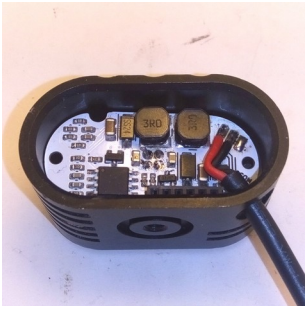

Image 16: attached LED boards cables

Step 5. Mount the controller board to the lid and close the lid.

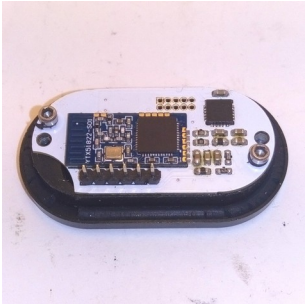

Image 17: mounted Controller board

Step 6. Flip the lamp around and tighten the screws to secure the lid and LED boards. Position the XHP50 board a bit to the top and the XM-L board a bit to the bottom.

Image 18: LED boards alignment

Step 7. Insert the lenses and use some spacers to tilt the spot lens upwards and the flood lens downwards. The spacers should have a height of 0.7-1.0mm, a quartered O-Ring works fine.

Image 19: tilted lenses

Step 8. Finally mount the lens cover.

Image 20: reassembled

3 Usage

3.1 Modes and Groups

3.1.1 Helena Modes

Helena has 8 individually configurable modes. Each mode is defined by several setup flags and an intensity field.

Here is a description of the setup flags:

- flood:
  If this flag is set, the flood driver circuit is enabled.
- spot:
  If this flag is set, the spot driver circuit is enabled.
- pitch compensation:
  If this flag is set, the pitch compensation algorithm is enabled. This means, the enabled drivers are not delivering a constant current, instead the output current is depending on the pitch angle of the lamp. Pointing it down, reduces the output current, pointing towards the front increases the output current.
- cloned:
  This flag can only be set, if only one output is selected (either flood, or spot). If it is selected, the output of the selected driver will be cloned to the other driver circuit as well.

The meaning of the intensity field is depending on the state of the `pitch compensation flag`. If the flag is set, it represents the desired maximum illumination in lux, otherwise it represents the desired output current in %.

3.1.2 Billina Modes

Helena can alternatively be loaded with the `Billina` firmware. This is the recommended firmware, if you want to mount the light on the handlebars. With this firmware each mode is defined by two setup flags and two intensity fields

Here is a description of the setup flags:

- main beam: If this flag is set, the flood driver is enabled.
- high beam: If this flag is set, the spot driver is enabled.

The first intensity field represents the output current in % for the main beam, the second for the high beam.

3.1.3 Groups

The 8 modes can be configured in either

- 1 group with 8 modes,
- 2 groups with 4 modes each or
- 4 groups with 2 modes each.

3.1.4 Preferred Mode

One of the 8 available modes can be selected as the preferred mode. If one mode is selected as the preferred mode this will change the switch off behavior. With activated preferred mode the will only shut off, if it already is in the preferred mode. Otherwise a shut off command will result in a jump to the preferred mode.

3.1.5 Temporary Mode

One of the 8 available modes can be selected as a temporary mode. If a mode is selected as temporary mode, it is possible to jump directly into this mode. When leaving the mode, Helena jumps back to the previously used mode.

3.2 Remote Connection

Currently three different types of remote connections are supported.

3.2.1 Xiaomi Yi Remote Control

To connect Helena with a Xiaomi Yi remote, you have to

- shut of Helena,
- make sure, that all other unwanted compatible devices are shut of or out of range,
- wake up the remote by clicking any button (If the remote's led flashes blue this means that is already in connection with another device. This has to be disconnected first),

- press Helena's button for at least 2 sec.

Helena will save this device, and automatically reconnect if available.

3.2.2 R51 Remote Control

To connect Helena with a R51 remote, you have to

- shut of Helena,
- make sure, that all other unwanted compatible devices are shut of or out of range,
- put the remote in pairing mode by pressing the mode button at least 2 sec. until the remote's led is blinking green-white.
- press Helena's button for at least 2 sec.

Helena will save this device, and automatically reconnect if available.

3.2.3 Connecting with other Helena

To connect Helena with a another Helena, you have to

- shut of Helena,
- make sure, that all other unwanted compatible devices are shut of or out of range,
- wake up the remote Helena (e.g. by power cycling).
- press Helena's button for at least 2 sec.

Helena will save this device, and automatically reconnect if available.

3.3 Button Control

There are 4 button control commands:

- next mode:
  This command jumps to the next mode.
  If this mode is not used, it is skipped.
  If the last mode within a group is reached, it will roll over to the first mode.
  If the light is currently off it jumps to the first mode.

- next group:
  This command jumps to the next group.
  If the group does not contain any valid mode, it will be skipped.
  If the current group is the last group, this command will jump to the first group.
  If the light is currently off, it jumps to the first mode in the second group.

- preferred mode:
  If the preferred mode is not set, the light will shut off.
  If the preferred mode is set, the light will jump directly to the preferred mode.
  If the light is already in the preferred mode, it will shut off.

- temporary mode:
  If the temporary mode is set, the light will jump into the temporary mode and jumps back to the previous mode.

3.3.1 Integrated button


Image 21: integrated button

- short click:
  next mode command
- long click:
  next group command
- press and hold > 2 sec., light is off:
  start searching for remotes (previously saved remote connections will be deleted)
- press and hold > 10 sec., light is off:
  initiate a factory reset and reset device afterwards
- press and hold > 2 sec., light is on:
  preferred mode command
- press and hold > 10 sec., light is on:
  enter SOS mode (not available in `billina` firmware)

3.3.2 Xiaomi Yi remote control


Image 22: Xiaomi Yi RC

- main button, short click:
  next mode command
- main button, long click:
  next group command
- secondary button, short click:
  preferred mode command

- secondary button, press and hold > 2sec.:
  enter temporary mode
- secondary button, release after hold:
  leave temporary mode

3.3.3 R51 remote control

- volume up button, short click:
  next mode command
- volume down button, short click:
  next group command
- play/pause button, short click:
  preferred mode command
- mode button, short click:
  enter/leave temporary mode

Image 23: R51 remote

3.4 Remote Synchronization

If Helena is connected to another lamp, both lamps will synchronize their current mode. This means if one light receives a button command, it will change its mode according to the description in the previous chapter and then relay this new mode (the number, not the configuration!) to the other lamp.

This lamp will then also jump into this mode, nevertheless if this mode is used or not. With this behavior it is possible to generate configurations where one lamp is on and the other not.

3.5 Status LED

Helena is equipped with a red and blue status LED, which is visible through the transparent button cap.

The blue LED gives information about the wireless connection. If is on, Helena is connected to a remote or another lamp. A fast blinking indicates, that Helena is searching for any compatible device. A slow blinking blue LED indicates, that Helena is searching for a already known device.

The red on turns on whenever the output is limited due to high temperature or dropping input voltage.

When Helena enters standby mode, the Status LED is shut off for minimum current consumption (but an established connection or the scanning for a known device will not be stopped).

4 Configuration

4.1 Connecting with the App

To connect to your lamp plug in the battery, open the App on your phone and press the `SEARCH` button. The App will then search and connect to all compatible lamps in range. Tap on the the light you want to configure.

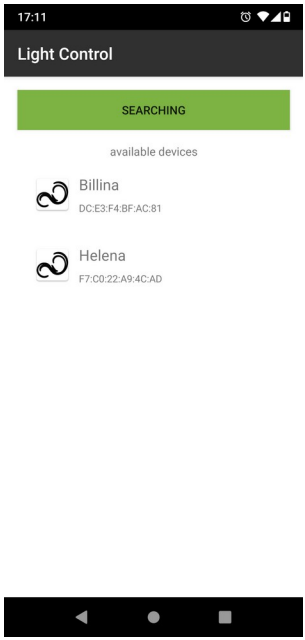

Image 24: Connecting

4.2 Light status

The `STATUS` page gives you information about the current state of the lamp. A click at a mode in the `available modes` list will put the lamp into this mode. To turn it off, click on the `current mode`.

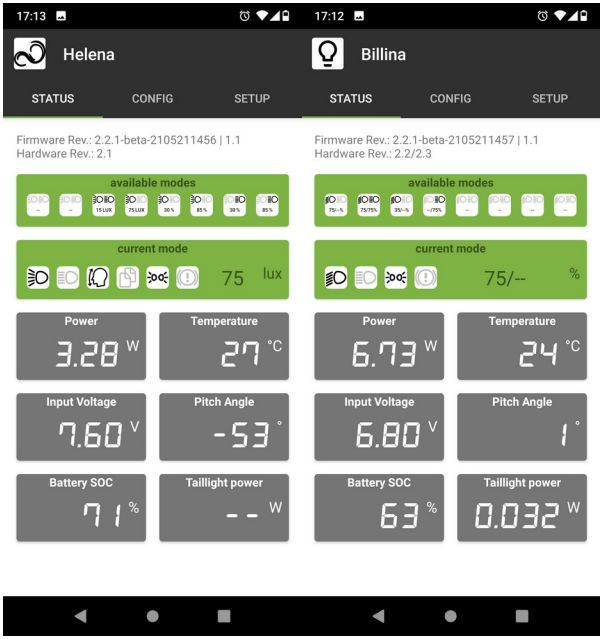

Image 25: Helena status Image 26: Billina status

4.3 Configuration

On the CONFIG page you can configure the group setup, the preferred and temporary mode and all of the eight modes. A click on the write button writes the selected configuration to the lamp. A click on the read button reloads the current configuration from the lamp.

Image 27: Helena configuration

Image 28: Billina configuration

4.4 Setup

The SETUP page contains some optional setup features.

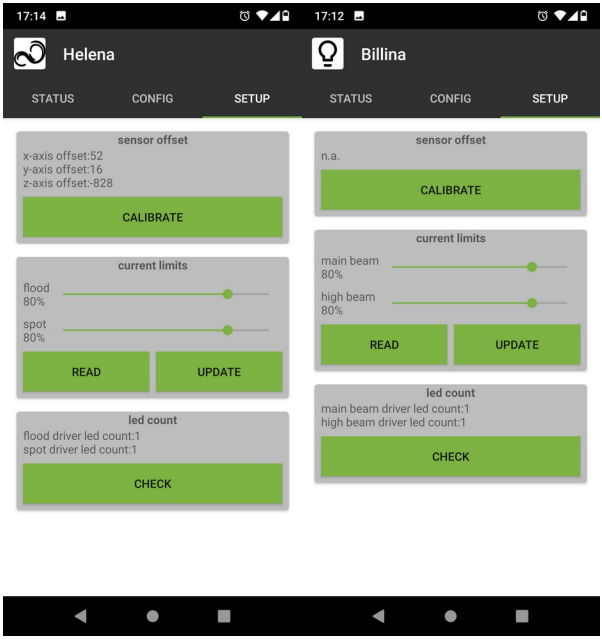

Image 29: Helena setup Image 30: Billina setup

- sensor offset:
  A sensor calibration is necessary, if your light is not showing a 0° inclination in horizontal position. Just click the CALIBRATE button and follow the instructions.

- current limits:
  Here you can limit the output current of the both LED drivers, e.g. if you have mounted a LED that is not capable of handling the full output current of 3A, or if you want to increase the battery lifetime.

- led count:
  If you click the CHECK button, the light will flash and try to detect the correct number of connected LEDs. This is just necessary to calculate the correct output power in the STATUS page.