

## # Otoscope Assembly Guide

This document outlines the manufacture of a high-quality low-cost open source otoscope. In this document, we will assemble main otoscope body, including the otoscope head, neck and battery area.

You will need the following:

- \* Printed parts (See [Print guide](/docs/PRINT\_GUIDE.md)):
  - \* Handle
  - \* Battery Compartment
  - \* Head Shell x2
  - \* Inner Head
  - \* Button Top
  - \* Button Bottom
  - \* Handle Coupler
  - \* Lens Bottom
  - \* Lens Top
  - \* Specula Holder
  - \* Neck
  - \* Head Lock
  - \* Button Lock
  - \* Name Plate Lock
  - \* Button Block
  - \* Name Plate Unlimited
- \* Other parts:
  - \* 3x acrylic lens
  - \* AA Battery holder
  - \* Switch
  - \* 5mm LED light
  - \* Cyanoacrylate glue
  - \* Soldering iron
  - \* Solder
  - \* Small gauge wire
  - \* Electrical tape or shrinkwrap wire cover

Watch the youtube video tutorial here on how to build the otoscope:  
<https://youtu.be/9h2voI1ipZM>

Is a Link down? Tell us, and in the meantime while we fix it, google the listing title below to find the item/ alternatives.

## AA battery holder

#### Needs to be this exact model, due to the tight fitting nature on the holder in the 3D printed compartment

\* [[Digikey] (<https://www.digikey.ca/product-detail/en/mpd-memory-protection-devices/BC12AAW/BC12AAW-ND/2439232>) \$1.90]

## 10 ohm resistor

\* [[Digikey] (<https://www.digikey.ca/product-detail/en/stackpole-electronics-inc/CF14JT10R0/CF14JT10R0CT-ND/1830306>) \$0.02]

## 5mm LED light

#### Really, any 5mm bright white LED could be used. I like the one listed below because it is much brighter than any other LED light I've used. Check the voltages of the LED you use, if the LED is rated for less than 3.2V, reassess which resistor you put into the circuit.

\* Amazon listing for the LED, listing titled "100pc 5MM White Round Water Clear Ultra Bright LED Light Diodes 30000 mcd - 40000 mcd (White)"

[[Amazon CA] (<https://www.amazon.ca/100pc-White-Round-Bright-Diodes/dp/B0781Z96S6>) \$0.11 (\$11.97/100pc)]

## Rocker Switch

#### Needs to be this model's dimension, due to the tight fitting nature of the switch in the 3D printed compartment

\* Ebay listing for switch, listing titled "20x 250V 3A Mini Boat Rocker Switch SPST ON-OFF KCD1-2Pin Black Plastic Button"

[[Ebay] (<https://www.ebay.com/itm/20x-250V-3A-Mini-Boat-Rocker-Switch-SPST-ON-OFF-KCD1-2Pin-Black-Plastic-Button-/141819484825>) \$0.25 (\$5.00/20pc)]

\* Ebay listing for switch, listing titled "10pcs Small Mini Black On/Off Boat Rocker Switch Rectangle10x15mm-SPST-2PIN V9A3"

[[Ebay] ([https://www.ebay.ca/itm/10pcs-Small-Mini-Black-On-Off-Boat-Rocker-Switch-Rectangle10x15mm-SPST-2PIN-V9A3/264334026704?ssPageName=STRK%3AMEBIDX%3AIT&\\_trksid=p2057872.m2749.12649](https://www.ebay.ca/itm/10pcs-Small-Mini-Black-On-Off-Boat-Rocker-Switch-Rectangle10x15mm-SPST-2PIN-V9A3/264334026704?ssPageName=STRK%3AMEBIDX%3AIT&_trksid=p2057872.m2749.12649)) \$0.15 (\$1.55/ 10pc)]

\* AliExpress Listing for switch, listing titled "10 pcs/lot KCD1 15 10mm 2PIN Boat Rocker Switch SPST Snap-in on off Micro switch Position 3A/250V Mini"

[[Aliexpress] ([https://www.aliexpress.com/item/32880358926.html?spm=2114.search0302.3.1.5a7a118e4QEAbi&ws\\_ab\\_test=searchweb0\\_0,searchweb201602\\_0\\_10130\\_453\\_454\\_10618\\_536\\_317\\_537\\_319\\_10059\\_10696\\_10084\\_10083\\_10547\\_10546\\_10887\\_10307\\_321\\_10548\\_322\\_10065\\_10068\\_10103\\_10884\\_10545,searchweb201603\\_0,ppcSwitch\\_0&algo\\_pvid=8fdccf1d-54b3-4fad-b18d-6b211bd21dcf&algo\\_expid=8fdccf1d-54b3-4fad-b18d-6b211bd21dcf-0](https://www.aliexpress.com/item/32880358926.html?spm=2114.search0302.3.1.5a7a118e4QEAbi&ws_ab_test=searchweb0_0,searchweb201602_0_10130_453_454_10618_536_317_537_319_10059_10696_10084_10083_10547_10546_10887_10307_321_10548_322_10065_10068_10103_10884_10545,searchweb201603_0,ppcSwitch_0&algo_pvid=8fdccf1d-54b3-4fad-b18d-6b211bd21dcf&algo_expid=8fdccf1d-54b3-4fad-b18d-6b211bd21dcf-0)) \$0.09 (\$0.92/ 10pc)]

## 3x magnification lens

#### Probably the trickiest part to source. Below are several links to lenses that would work with the otoscope. Following the video tutorial, you should manipulate the lens to fit in the holder. I recommend also checking local department stores for these items too. They can go by the name of "pocket reader", "3x magnifier with LED", and "Easy reader".

\* Ebay Listing for a pocket reader, listing titled "A Credit Card LED Magnifier Loupe with Light Case Magnifying Glass Utility

[[Ebay] (<https://www.ebay.com/p/Credit-Card-LED-Magnifier-Loupe-With-Light-Leather-Case-Magnifying-Glass-Utility/3029465108?iid=362601347786&rt=nc>) \$2.39]

\* Ebay Listing for a pocket reader, listing titled "Credit Card Magnifier With LED Light Square Magnifier 3X 6X + Leather Case"

[[Ebay] (<https://www.ebay.com/itm/Credit-Card-Magnifier-With-LED-Light-Square-Magnifier-3X-6X-Leather-Case/113707693815?hash=item1a7981b6f7:g:l08AAOSwqpJcpcXI>) \$1.95]

\* AliExpress Listing for a pocket reader, listing titled "Pocket Ultra-thin Card Reading Magnifier Loupe Lamp 3X/6X with LED Light Magnifying Tool" [[Aliexpress] (<https://www.aliexpress.com/item/32305107433.html>) \$2.25]

\* Amazon Listing for a more expensive pocket reader, listing titled "Pocket Magnifying Glass with LED Light 3X Small EasY Magnifier Hand Held Lighted Magnify Glasses for Close Work Reading Books Menu Pill Bottles; Mini Lens for Visually Impaired A Low Vision Aid" [[Amazon US] ([https://www.amazon.com/EasY-Magnifier-Original-Magnifying-Visually/dp/B00Z6T9TXE/ref=sr\\_1\\_2?keywords=pocket+reader+3x+with+led&qid=1565995891&s=gateway&sr=8-2](https://www.amazon.com/EasY-Magnifier-Original-Magnifying-Visually/dp/B00Z6T9TXE/ref=sr_1_2?keywords=pocket+reader+3x+with+led&qid=1565995891&s=gateway&sr=8-2)) \$17.95]

\* Amazon Listing for a more expensive pocket reader, listing titled "Nicolarisin Rectangular LED Lamp Card Magnifier Business Card Magnifier Learning 3x/6x, Page Reader - Jewelers Loupe, Big Reading Aid for Pocket Map, Book, Travel" [[Amazon CA] ([https://www.amazon.ca/Nicolarisin-Rectangular-Magnifier-Business-Learning/dp/B07S2XRDL4/ref=sr\\_1\\_1?keywords=pocket+reader+3x+with+led&qid=1565995914&s=gateway&sr=8-1](https://www.amazon.ca/Nicolarisin-Rectangular-Magnifier-Business-Learning/dp/B07S2XRDL4/ref=sr_1_1?keywords=pocket+reader+3x+with+led&qid=1565995914&s=gateway&sr=8-1)) \$8.78]

\* Amazon Listing for small 3x magnifying glasses, listing titled "Handheld Magnifier with Safety Lanyard (Set of 10)" [[Amazon CA] ([https://www.amazon.ca/gp/product/B008AK673Q/ref=ppx\\_yo\\_dt\\_b\\_asin\\_title\\_o01\\_s00?ie=UTF8&psc=1](https://www.amazon.ca/gp/product/B008AK673Q/ref=ppx_yo_dt_b_asin_title_o01_s00?ie=UTF8&psc=1)) \$1.96 each]

# This document shows how to make the lens compartment for the V2 edition otoscope (legacy). A new guide for the V3 otoscope is currently in development. The same general principles will apply.

## #Lens Assembly

This document explains how to make the lens part of the otoscope.

You will need the following:

\* Printed parts (See [Print guide](/docs/PRINT\_GUIDE.md)):

\* Lens holder (large)

\* Lens holder (small)

\* Jig parts #1, #2 and #3

\* Other parts:

\* One lens, 3x magnification (example:

[amazon](<https://www.amazon.com/Advanced-Magnifier-Magnification-Handheld-Magnifying/dp/B008H1Z856>))

\* Cyanoacrylate glue ([amazon](<https://www.amazon.ca/Gorilla-7805201-20g-Super-Glue/dp/B00K2N525I>))

\* Clamps ([amazon](<https://www.amazon.ca/TEKTON-3901-4-Inch-Opening-10-Piece/dp/B00BRL59UM>))

![Parts for lens assembly](/media/lens\_assembly/lens\_assembly-01.png)

### ## Step 1

Shave down the lens so that all edges are straight with no protrusions. You can use a rotary tool or other cutter for this.

![Lens with the original edges](/media/lens\_assembly/lens\_assembly-02.png)

![Lens with straight edges](/media/lens\_assembly/lens\_assembly-03.png)

### ## Step 2

Place the lens in printed jig #1. While the lens is in the jig, draw a straight cut line from the tops of jig. Secure the lens with masking tape.

Cut off excess lens above the line using a rotary cutting tool, grinder or belt sander.

![Lens in jig #1](/media/lens\_assembly/lens\_assembly-04.png)

### ## Step 3

Take lens out of jig #1 and place into jig #2. \*\*Ensure that previously smoothed side is not cut again so as to ensure the correct focal point.\*\*

Draw a straight line from tops of jig. Secure with masking tape. Cut off excess lens above the line.

![Lens in jig #2 before cutting](/media/lens\_assembly/lens\_assembly-05.png)

![Lens in jig #2 after cutting](/media/lens\_assembly/lens\_assembly-06.png)

#### ## Step 4

Place lens in centered fashion in jig #3 and secure with masking tape. Cut off excess lens while shaping it to the jig.

![Lens in jig #3 before cutting](/media/lens\_assembly/lens\_assembly-07.png)

![Lens in jig #3 after cutting](/media/lens\_assembly/lens\_assembly-08.png)

#### ## Step 5

Place lens in the large lens holder piece. Some parts of the lens may need to be further cut or ground to achieve a secure fit.

![Lens in large lens holder](/media/lens\_assembly/lens\_assembly-09.png)

#### ## Step 6

Dry fit with the smaller lens holder piece.

![Lens in both lens holders](/media/lens\_assembly/lens\_assembly-10.png)

#### ## Step 7

Glue the two parts together. If using cyanoacrylate glue, ensure that none touches the lens. If it does, wipe away immediately, as any glue on the lens will ruin it. Clamp parts together until bonded.

![Clamped lens holders](/media/lens\_assembly/lens\_assembly-11.png)

## # Print Guide

This document explains how to orient and print the various printed parts. This guide uses [Slic3r](<http://slic3r.org/>)

### ## Print settings

All parts (other than the handle) should be printed with an infill of 100% and layer height of 0.2mm. The handle should be printed with an infill of 20%.

### ## Supports

The following parts can be printed without any supports:

- \* Handle cover
- \* Handle coupler
- \* Button Bottom
- \* Lens bottom
- \* Lens Top
- \* Specula Holder
- \* Head Lock
- \* Button Lock
- \* Name Plate Lock
- \* Name Plate Unlimited

The following part must be printed with full supports:

- \* Battery Compartment
- \* Head Shell
- \* Inner head
- \* Button Top
- \* Neck

### ## Orientation

Orient the parts as in the build plate below:

![Slic3r bed with all parts](/media/print\_guide/print\_guide-01.png)