I would really be grateful if you start to build the Shutter, that you go to the Photrio thread and say hi. Also please post photos of your completed tester.
[Build a shutter tester for Focal Plane shutters - Cheap, Easy & it Works | Page 18 | Photrio.com Photography Forums](#)

Please refer to Photrio for further build help

ESP32 Shutter Tester Film-Gate Sensor V1.2   08 09 2024

The Lasers work perfectly when aligned horizontally, using the 'block of wood' layout and is my personal preferred method of using the shutter tester. This of course can be improved upon by mounting them in project boxes or bespoke 3d printed housings, so they do not get knocked out of alignment.

However, trying to align them in a diagonal formation, for testing both horizontal and vertical sensors is quite challenging.

A different approach is to mount the sensors in a small box that fits into the film-gate of the camera. An LED light, shining into the mirror-box is used to illuminate the sensors. It is possible to mount the complete sensor modules into the box, but very fiddly and the lid cannot be put on. One could use a second box, joined open-end-to-open end, to make the box twice as deep.
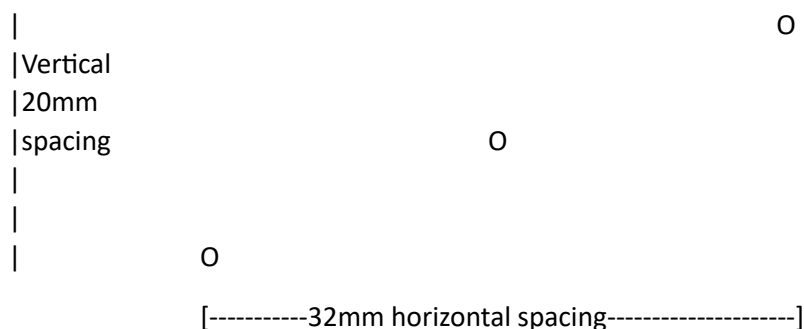
Another option is to remove the sensor and add the capacitor & resister directly to the senor legs, making it much smaller. This method is detailed below.

Other options
A 3d printed box, incorporating a lip to align it in the film-gate is the best and some project builders have made boxes & housings, see the Photrio thread for further details. STL files for 3d printing a box can be found on the Github. These are open source and have not personally been tried by myself.

The sensors are arranged so the left and right Laser are spaced 32mm horizontally and 20mm vertically, with a central sensor as per the diagram below. With this layout, they can be used for both horizontal and vertical shutters. Placing them all horizontally or vertically is an option, which makes camera alignment easier, but it will then only work for that orientation of shutter. Separate sensor boxes could be made for horizontal & vertical shutters.

Another sensor box can be made for the light sensor, requiring just the central hole.

```
|                                                O
|Vertical
|20mm
|spacing                              O
|
|
|                    O
               [-----------32mm horizontal spacing--------------------]
```

LED Light Box

Now here is the problem. Lasers give a nice narrow collimated light beam, which is why they are used for this shutter tester.

Professional testers were made before the age of lasers or LED lighting. They used a light source in a reflective chamber to diffuse the light.

To try and make a light source instead of the lasers will require some ingenuity and experimentation.

If using LED, it must be constant current, and not controlled by PWM, which rapidly turns the lights on & off to control brightness. Else the sensors will see this on/off as shutter movement.

A LED panel is made of a number of individual LEDs. These must be diffused so the sensors will not see an individual LED.

Personally, I purchased a cheap camera LED light from aliexpress. With temperature and colour turned up full, it gave a constant current output, or PWM at 100%. Turning down would immediately cause issues with the shutter tester seeing the PWM as rapid on/off pulses. My purchased light works fine with the tester, but another builder purchased the same light, but even on full, still gave PWM.

It will be up to the builder to tinker & design their light. When done, please share your build on the Photrio thread.

Here are some random items on Aliexpress. The links are for examples of parts available as a guide. Without experimentation, they may or not be suitable.

This looks interesting, a cooling system & lens to give 60 or 120 degree light.
A cone shaped 3d printed housing, to hold LED assembly at one end and a diffuser at the other, may work very well. COB LED and power supply is required.
Led Cooling System LED Aluminium Heat Sink Cooling Fan + 60/120degree 44mm Lens + Reflector Bracket For 20-100W High Power LED - AliExpress 39

Similar to above.
1 Set LED chip Radiator Beads Heatsink Aluminum Heat Sink Cooling Cooler With 12V fan Fit Transistor Module Power 20W 50W 100W - AliExpress 39

flat bare panel (needs regulated power supply).
Sumbulbs DIY LED Panel Light 94x50MM 1500LM Ultra Bright Warm Natural Cold White Blue DC 12V 15W COB Board LED Lamp - AliExpress 39

Comple mains powered panel.
25W Square LED Panel Light Recessed Kitchen Bathroom Ceiling Lamp AC85-265V LED Downlight Warm White/Cool White Free shipping - AliExpress 39

Example of Fresnel lens.
Fresnel lens sample Stage lights diy Projector ed light Spotlight thickness 0.9mm 3X magnification 45x45mm F29mm Customizable - AliExpress 1420

Parts.

Shrink Tube.
Used to cover the legs of the sensor. Electrical tape could also be used.

[127pcs/lot 2:1 Thermoresistant tube Shrink wrapping Black heat shrink Sleeving set Wire Cable Polyolefin Wrap Tubing - AliExpress](#)

USB C chassis connector (Optional)
If using the large project box, this can be used, with a short USB-C to USB-C cable, to make the USB socket on the ESP32 board accessible. Alternate is to have a trailing USB lead from the ESP-32 board, exiting the project box via a suitable drilled hole.

[D-Shape USB Type-C Female Socket Chassis Panel Mount Connector Round Type Black Sliver Zinc alloy Industry Waterproof Extendsion (aliexpress.com)](#)

RJ45 Chassis connector (Optional)
This can be used to enable the sensor cable to be unplugged from the project box. Useful if making different sensor heads. However, they are comparatively expensive.

Any suitable connector could be used (5 pin din or 9-way D type, for example). Or the sensor hardwired.

Caution:- It is important not to use pairs of wires (e.g blue and blue/white) for the sensors as they will interfere with each other. A good colour scheme is

Brown	+3.3V
Brown/White	0V
Blue	Sensor 1
Green	Sensor M
Orange	Sensor 2

A second RJ45 chassis connector can be used if using the light sensor.

Caution:- Ensure the 3.3V and 5V are wired such that accidently plugging the film-gate or light sensor into the wrong socket, will not apply power to the wrong connector and damage it. A good colour scheme is

Brown/White   0V
Blue/White   +5V
Green/White   SDL
Orange/White SDA

RJ45 Network Cable Connector CAT5E Panel Installation Module Shielded Solder-free Network Cable Extender Category 5 Panel Socket - AliExpress


RJ45 Cable. (Optional – if using RJ45 chassis socket)

There are many to choose from, or most likely you will have an odd one lying around.
One cable will make both gate-sensor box and light meter.
Ensure the finished length is no more than 0.5 metres length, preferably shorter. If the cable is too long, interference can upset the sensors.

## Multicore cable. (Optional – needed if hardwiring or using plug & socket other than RJ45)

6 core 20AWG will be fine.
Speaker Audio Wire 2/3/4/5/6/7/8 Conductor 12V Flexible Electrical Multi Core Round Car Automotive Cable For LED Light Speakers - AliExpress 13
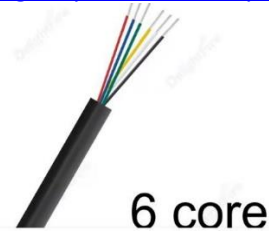
Project box for sensor 55 X 35 X 20
1pc Waterproof Black/white Housing Instrument Case ABS Plastic Project Box Storage Case Enclosure Boxes Electronic Supplies - AliExpress
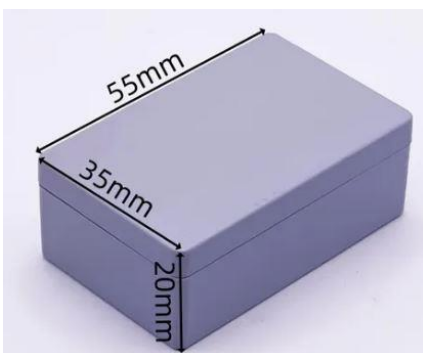
10K resisters

[100PCS Metal Film Resistor 1/4W 1% 100R 220R 1K 1.5K 2.2K 4.7K 10K 22K 47K 100K 100 220 1K5 2K2 4K7 Ohm Resistance 1R~22M - AliExpress](#)

0.1uF Capacitors (104 100NF)

[100PCS/ Porcelain Chip Capacitors 104 0.1uF 100NF 50V 30PF 103 0.01UF 22P 102 20PF 473 683 104 224 47NF 68NF 220NF 4.7NF 6.8NF - AliExpress](#)


Additional parts.

Short USB-C to USB-C cable, if using optional USB chassis socket.

RJ545 cable(s) if using optional RJ 45 chassis socket.

Making the Sensor Box.

(Photos show a larger box, made specifically for a Zenit. The smaller 35mm box is required for most other camera).
The box is covered in masking tape and carefully marked out to give the 35 X 24 film gate opening.
Then the centre hole & diagonal holes carefully measured and drilled with a 1mm drill bit.
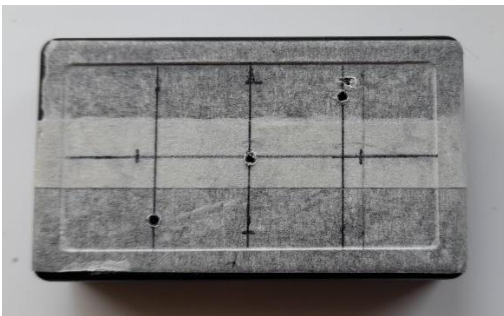
The sensors have a rectangular protrusion just below the lens which must be filed and scraped off. Cover the lens with masking tape and then carefully remove the protrusion on the three sensors.
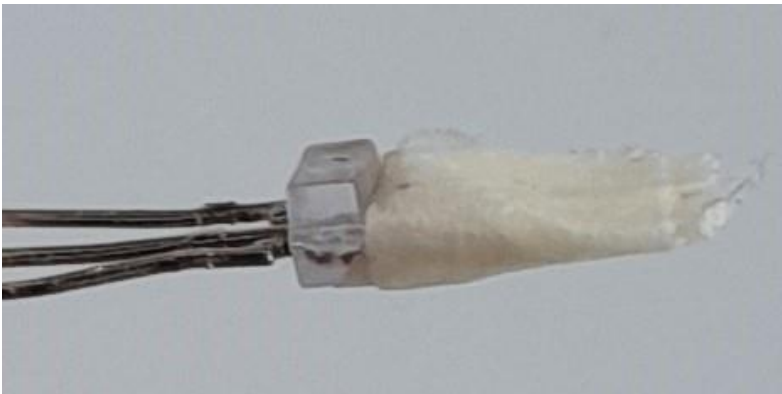

Rectangular protrusion almost removed.

A capacitor is soldered across GND & VCC (outer legs)
and a 10k resister between VCC and OUT.

Twisting the wires of the resister & capacitor around the legs of the sensor helps keep them in place.

A surface mount resister was originally used, which proved too fiddly.
Photo from rear of sensor.

Please pay attention about the side when install it

VCC
OUT
GND
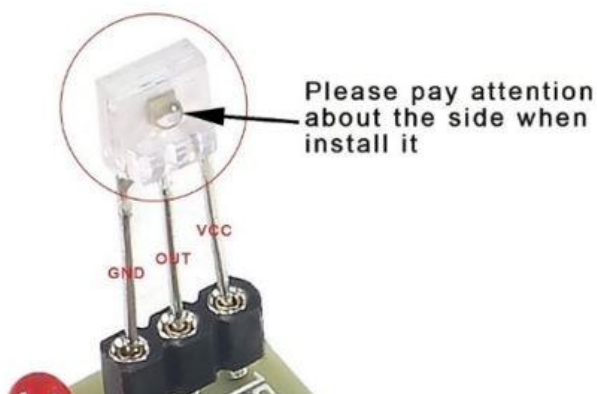
The sensors can now be located into the project box, the lens should drop into the drilled hole, to locate them. They can be held in place with hot-glue.

Small wires are soldered to each of the VCC legs and then connected together. The same is done with the GND.
The VCC & GND can now be connected to the cable to the box, along with the individual wires for each of the sensors. Ensure shrink tube is placed onto the wires before soldering. These are then slid over the soldered joint.
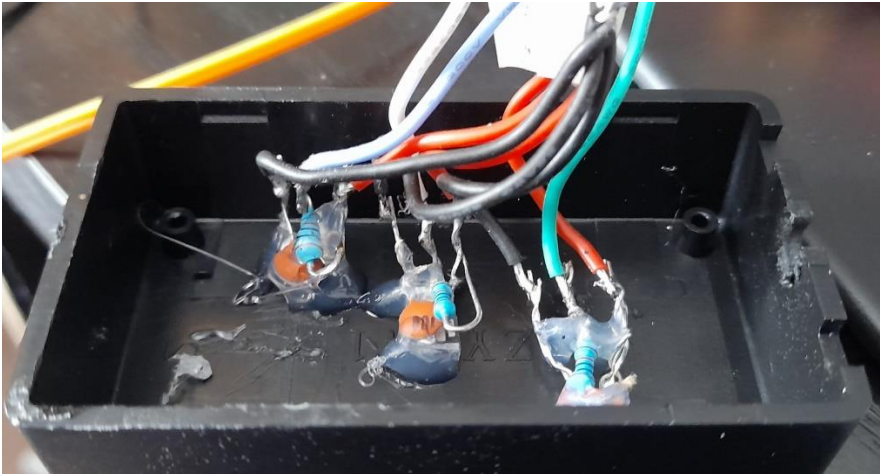
Prototype sensor box.
Masking tape removed from the 35 X 24mm section which is the size of the film gate. Strips of card added top and bottom, to locate sensor box into the film gate. Ensure the card is not too high & does not touch the shutter blades.
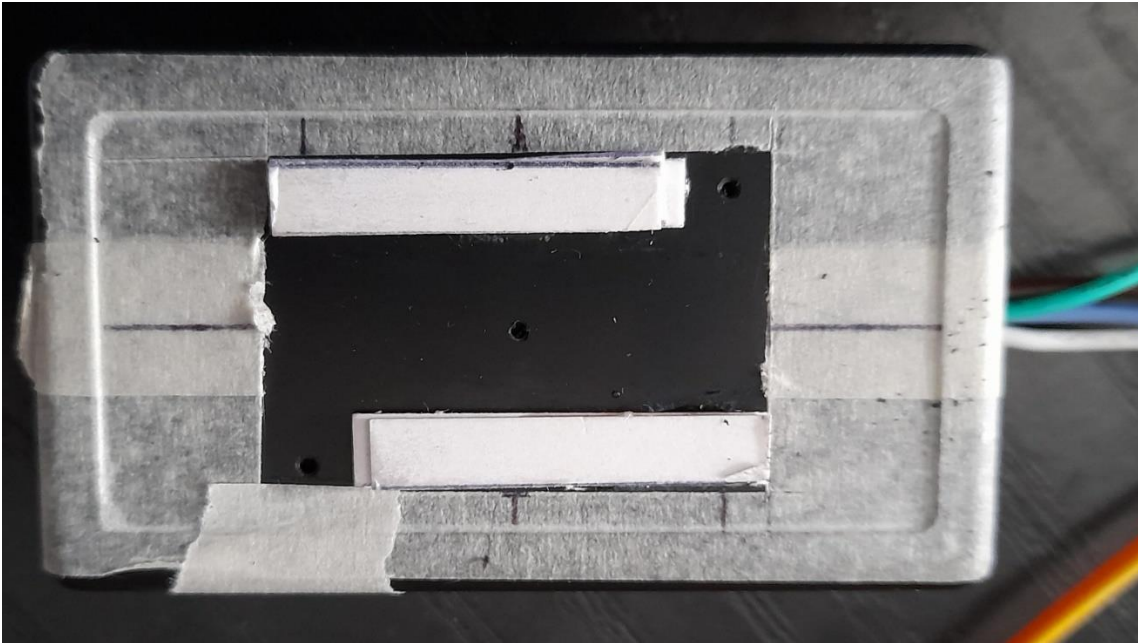
Smaller sensor box, still with some masking tape yet to be removed, showing the 36 x 24mm gate size.
Two pieces of hardwood align the box within the film gate. Ensure they protrude only enough and do not touch the shutter blinds.

Old wooden block Laser & sensor frame at the top.

Larger project box with both TFT & LCD.
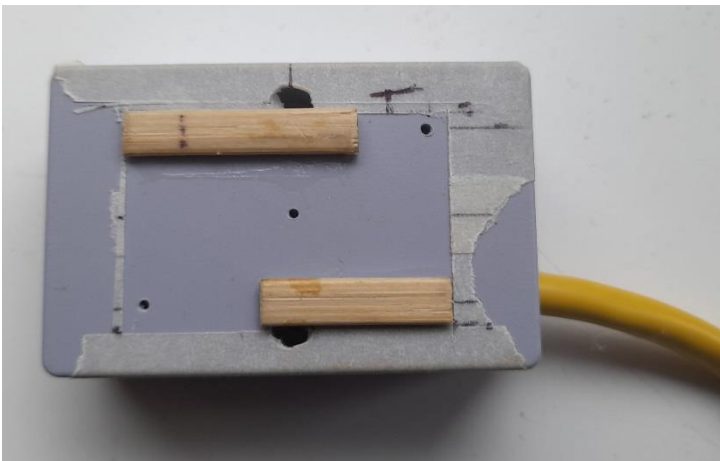
Below the camera, is the new sensor unit, still with masking tape, currently hard-wired to the ESP32 board & below this, the LED light box.