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 Doc Ver 1.2

ESP32 Shutter Tester Operating Guide V4 01/10/2024

First use after loading firmware

Assuming the build has been completed correctly and the firmware loaded, when the Shutter Tester is connected to the computer via the USB cable (or another suitable power source), TFT & LCD should light & there will be output to the pc monitor.

Note in these steps, the terms 'turn the encoder' and 'press the encoder' are used.
For normal usage, the encoder is referred to as 'the **Blue Button**'.

Step 1 is to test the encoder. A screen as shown as in the pictures below, will appear on first use.
Turning the encoder will increase or decrease the value between 0-9999. Pushing the encoder will increase the button count from 1-10. (Pushing again returns to 0).

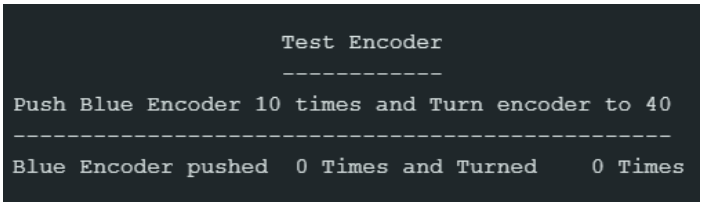
Following the on-screen instructions, press the encoder to show 10 and turn the encoder to show 40.

The screen will now change asking the user to wait, whilst a stability test is carried out. This ensures the encoder is not receiving errant input, from poor connections, for example. If all is well, the screens will change for step 2.

If the encoder test fails, the Shutter Tester will restart.

TFT showing encoder test.

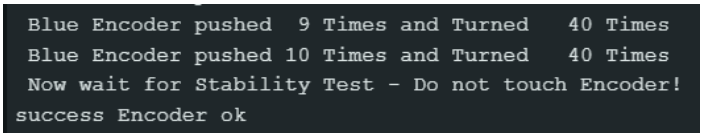
LCD showing encoder test.



PC screen showing encoder test.

(photo of TFT Test Encoder passed to follow)

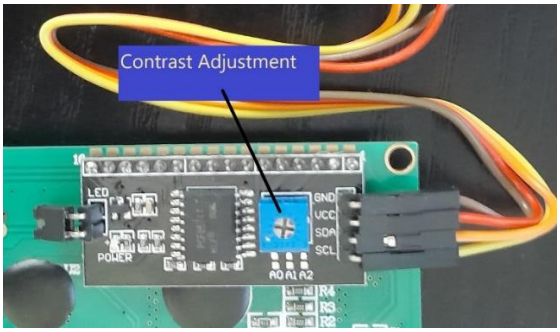
LCD showing encoder test passed.



PC screen showing encoder test passed.

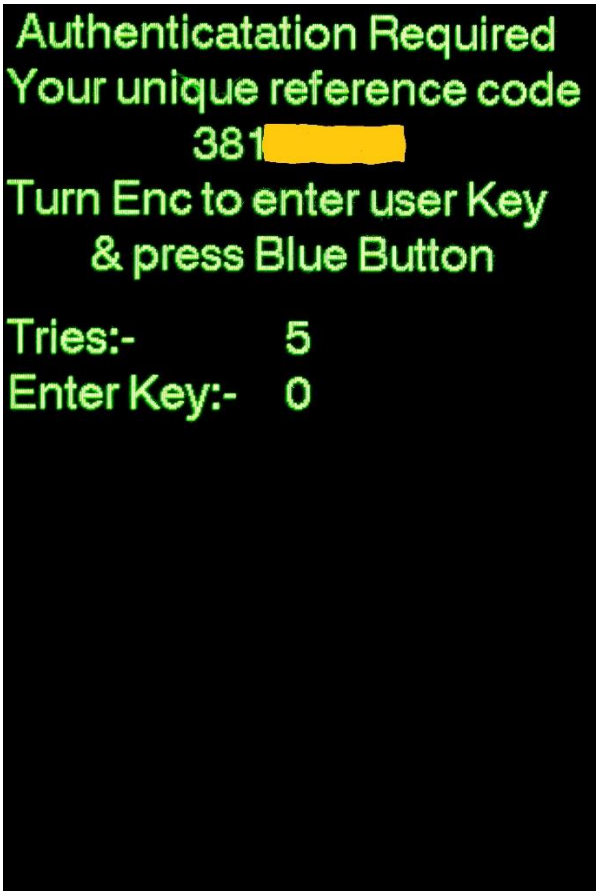
Note on LCD

The LCD is not required for V4. Some users may have it from V3, or would like to add it anyway.
If the LCD lights, but no text can be seen, try adjusting the contrast screw on the back. As an initial setting, turn fully clockwise and then just a small amount back.

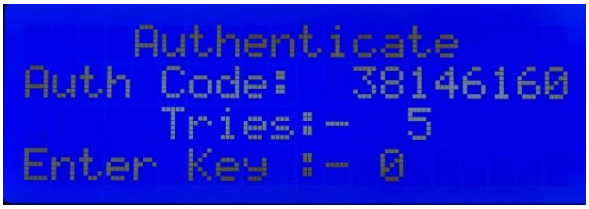


Step 2 is to input the user-key. This is supplied free of charge upon request. Make a note of it, in case you ever perform a factory reset.

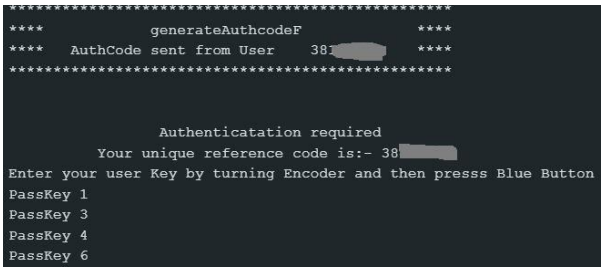
Following the on-screen prompts, turn the encoder to show the user key value. Then press the encoder.
If correct, the Shutter Tester will restart.



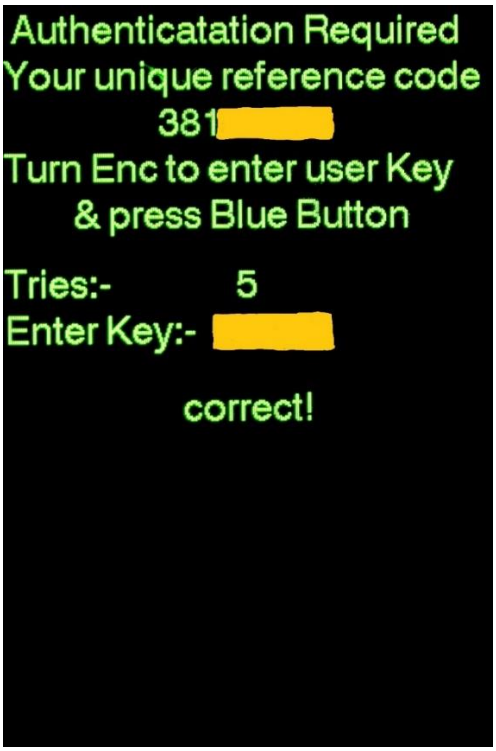
TFT showing user key input screen.



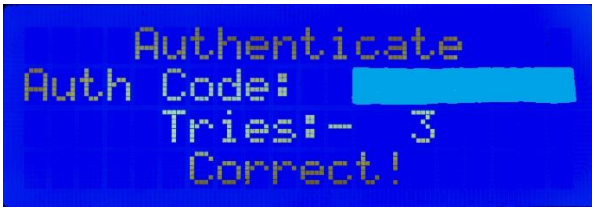
LCD showing user key input screen.



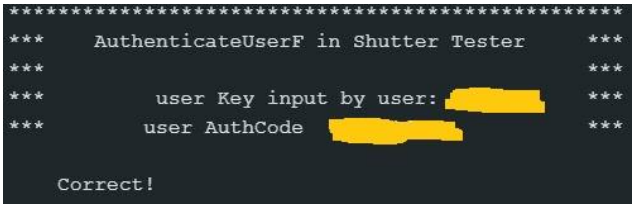
PC showing user key input screen.



TFT showing user has input correct user key.



LCD showing user has input correct user key.



PC showing user has input correct user key.

If the user key has been entered correctly, 'Correct! Will be displayed' and the Shutter Tester will restart in normal operation mode.

Note: - Sometimes a firmware upgrade will require the Shutter Tester is reset to default factory settings, so ensure you keep a note of your user-key.

Normal use.

An initial splash screen is shown on TFT, LCD & PC screen. The LED Matrix will display firmware version.

This is displayed for a set period, before changing to the Testing Screen.
Note pressing the Black Button will jump straight to the Testing Screen.

TFT splash screen.

PC splash screen.

LCD splash screen, due to size limitation only subset of info can be displayed.

Alignment & Setup Utility

Pressing the **Black Button** will take you to the Setup & Alignment Utility.
This is the first screen to go to when initially using the Shutter Tester.

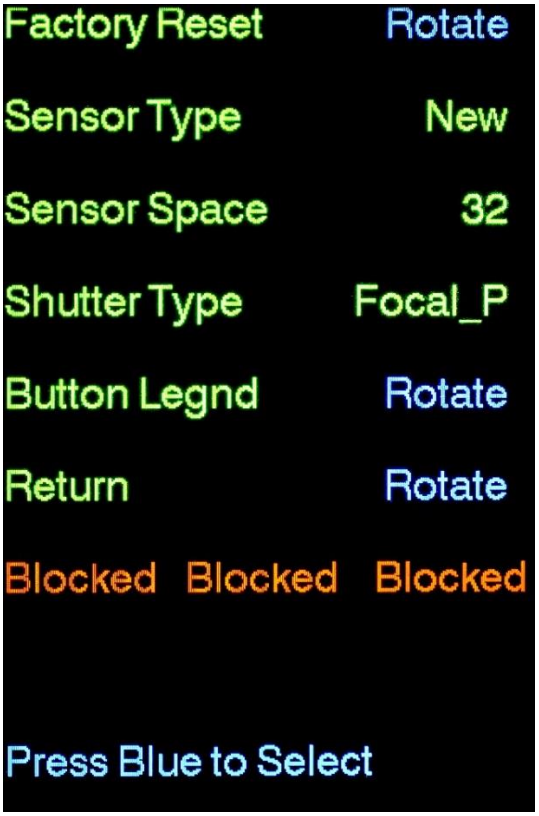
The TFT, LCD & PC screen will show the current settings.

***To change a setting, press the* Blue Button.**
On the TFT screen, a red marker will appear next to 'Factory Reset'. Indicating this is the setting to be changed.
On each additional press, the red marker will move to the next menu item, to select it.

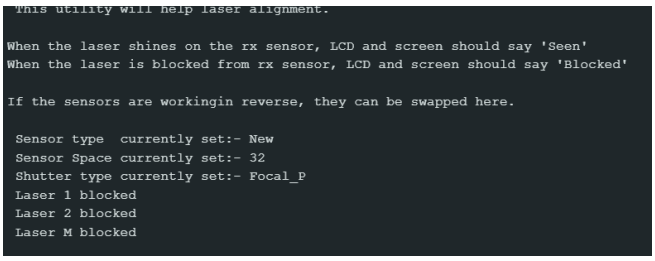
The lower line of the LCD will change, showing which setting is being changed.

The PC screen will give a text prompt.

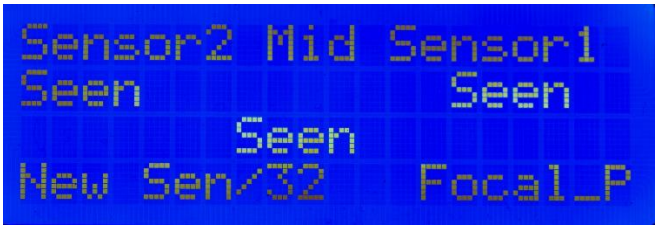
Turning the **Blue Button** will change the selected setting.
Each of the settings are described below: -



TFT showing Settings & Alignment screen.



PC showing Settings & Alignment screen.



LCD showing Settings & Alignment screen.

Factory Reset This will restore the firmware to the same state as initially loaded onto the microcontroller.

Sensor Type. There are two different versions of the sensor, referred to as ‘original’ and ‘new’. Both look identical, so there is no way to tell by looking, which type they are. The only difference between the two is that one has an inverse output to the other. If the Laser Alignment Utility seems to be working backwards, it means you have the other type of sensor.

Sensor Space This is the distance in millimetres between the two sensors, measured centre to centre. The standard is usually 32mm for horizontal and 20mm for vertical shutters.

Shutter Type Focal Plane, Leaf, or single sensor (sensor no. 1 is used for single sensor readings).

Button Legend Shows the initial splash screen detailing Button use.

Return To exit the utility, or press **Black Button**.

At the bottom of the screen, the state of each sensor is shown (**Blocked or Seen**) This is to allow the sensors and Lasers to be correctly aligned. If the legends are working in reverse, then change the sensor type setting as detailed above.

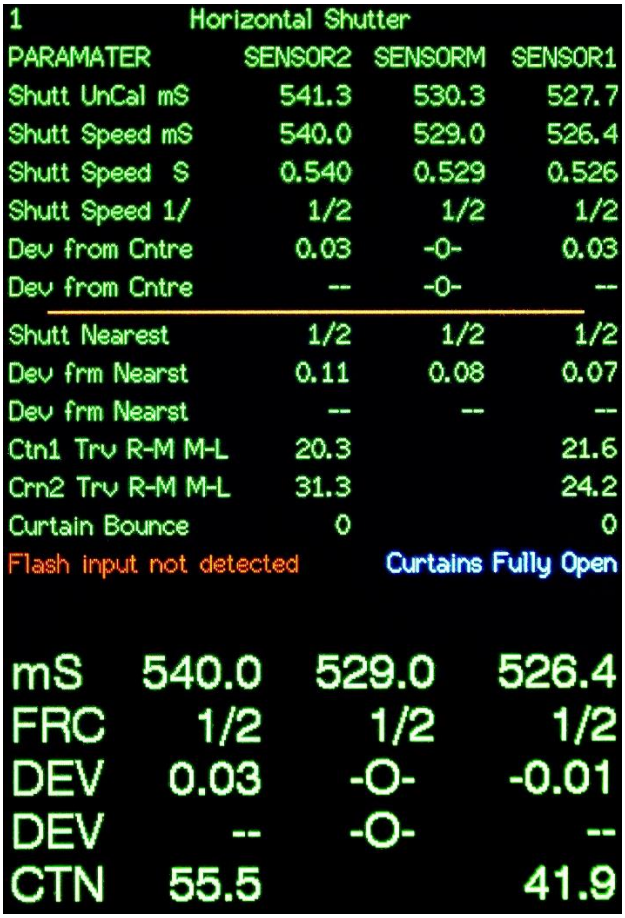
Below the sensor state, will be a ***flicker warning*** if interference is being detected by the sensors. The most common cause for this is LED lighting (including computer screens) using PWM to control brightness. It can also be caused by electrical interference being picked up on the wiring to the sensors.

Note:- You will probably find that the Laser barrel is not affixed to the pcb other than by its connecting wires. Adding a bit of hot-glue, or another suitable adhesive, will hold it in place.

When the laser is shining onto the sensor, the LCD will report ‘Seen’ When the laser is blocked, by a piece of card or your hand, the LCD will say ‘blocked’. Changes notifications are also sent to the PC screen.

Testing screen. (Detailed).

TFT The testing screen of the TFT is arranged into four columns. The first column describes the measurement and the next three columns show the readings, one from each sensor.



TFT showing completed test.

Shutter UnCal mS	raw reading from each sensor in milliseconds
Shutter SpeedmS	calculated reading from each sensor in milliseconds
Shutter Speed S	calculated reading from each sensor in seconds
Shutter Speed 1/	calculated reading from each sensor in milliseconds
Dev from Centre	calculated deviation from centre sensor in decimal stops
Dev from Centre	calculated deviation from centre sensor in 1/3 stops

Shutter Nearest	Nearest standard shutter speed to actual reading
Deviation from	Nearest Deviation from nearest standard shutter speed in decimal stops
Deviation from	Nearest Deviation from nearest standard shutter speed in 1/3 stops
Curtain 1 Travel	S2<M M<S1 Curtain travel time from right to centre and from centre to left
Curtain 2 Travel	S1<M M<S1 Curtain travel time from right to centre and from centre to left
Curtain Bounce	Number of times the curtain bounced on closure.

Below this, adjunct readings are shown.

If connection to the camera flash socket was detected, analysis of the flash will be shown.

If the first curtain was fully open before the second started to close, this is displayed.
Other warnings or error messages appear here.

The word ‘Ready will also appear here, in white, when the Shutter Tester is able to perform another test.
This stops erroneous readings if, for example, a sensor is still being triggered or the shutter curtain is stuck partially closed.

Below this, are the main readings repeated, but in a larger typeface.

LCD The first row are the legends for sensor 2, M and 1.

Second shows the calculated reading for each sensor in milliseconds, third row is in fractional seconds.

The last row, C2 & C1 show the time each curtain took to travel the distance between the outer sensors, in milliseconds.

If ‘B’ appears in the top row of the LCD, it is indicating that shutter bounce has been detected.

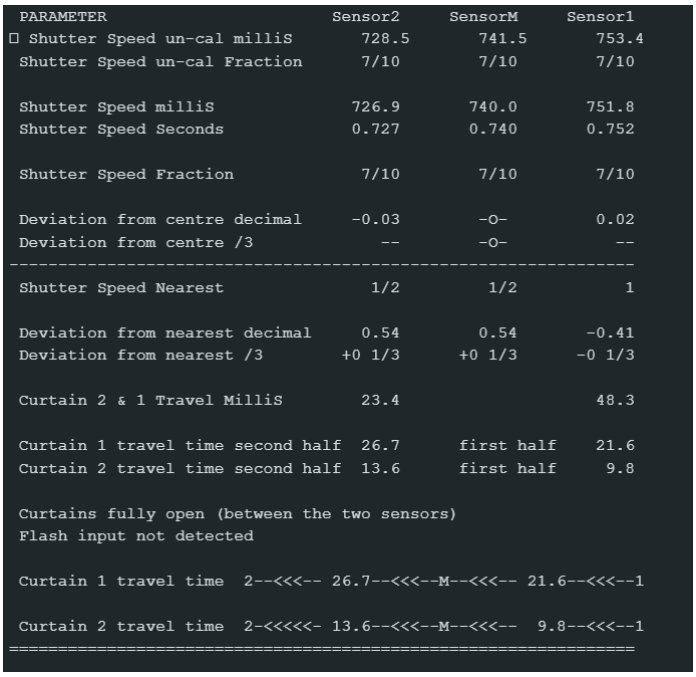
H or V will be shown on the top row of the LCD, if sensor space has been set to 32mm (H) or 20mm (V).

If ‘F’ appears in the top row of the LCD, it indicates that a successful flash sync was detected.

LCD showing a successful test

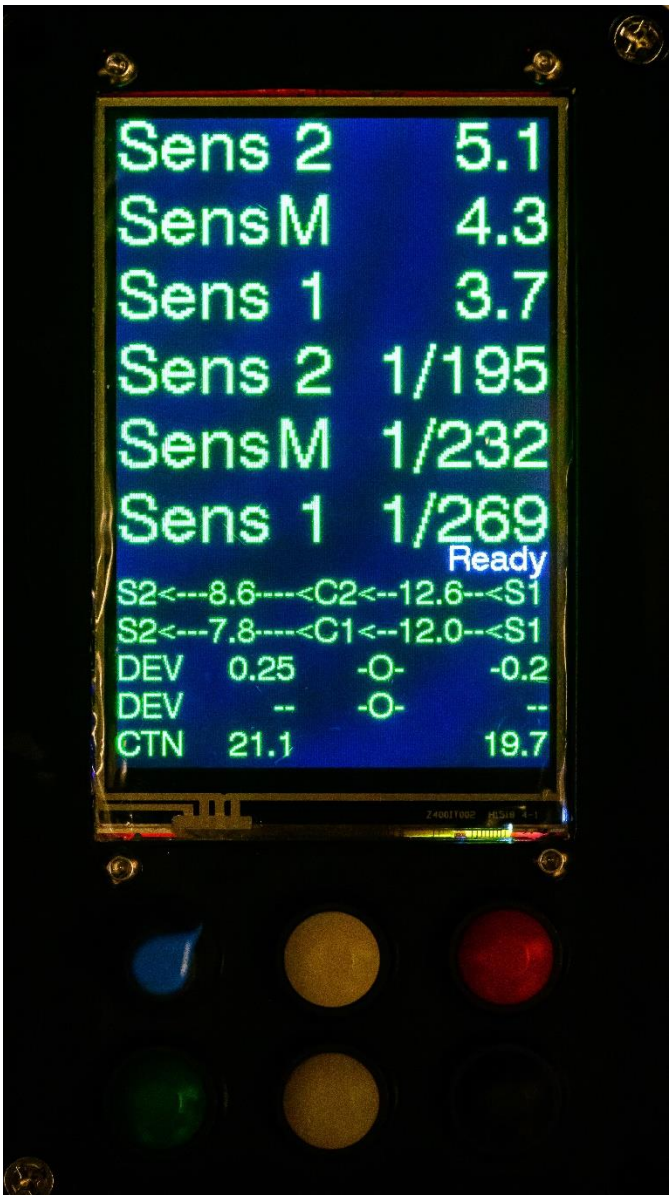
The PC screen gives a similar display to the TFT screen.

Each time the camera shutter is fired, the display will automatically update.



PC screen showing completed test.

Testing screen. (Simple).



Whilst in the Testing Screen, pressing the **Blue** Button will toggle between the Detailed and Simple screen.

The testing screen of the TFT is arranged into two columns. The first column details the senor and the second displays the reading taken from that sensor

.

The first three rows show the recorded shutter speed in milliseconds.

The next three rows show the reading in vulgar fraction.

The small space below will show any error reading & ‘Ready’

Below this, the curtain travel times between each sensor are displayed.

Deviation in decimal and in 1/3 fractions.

The final line details total travel time for each curtain.

Note: - Due to limited space, flash Details are not displayed on the Simple display.

Buttons.

Whilst in the Testing Screen, the Buttons have the following functions: -

Pressing Button1 White will show the average of (up to) the last ten readings.

Pressing Button2 Yellow will clear the accumulated average readings.

Pressing Button3 Green will go to the Light-meter Utility

Pressing Button4 **Black** will go to the Alignment & Setup Utility.

Pressing Button5 **Red** will go to Optical LED Shutter Tester Utility.

Pressing Button6 **Blue** toggles between Detailed & Simple TFT display.

Error and validity checks are performed from the received test data.
Some of the errors shown can be a little cryptic, as they may report code blocks or internal measurements.
In the TFT display below 'SSmicro>400000000' indicating the shutter has been open for longer than 40 seconds, indicating, for example a stuck curtain.

Note: - Due to limitations of memory & speed, error checking cannot be performed for every permutation. So strange readings may occur for example, if fingers are waved across the lasers or a seriously badly behaving camera is being tested.

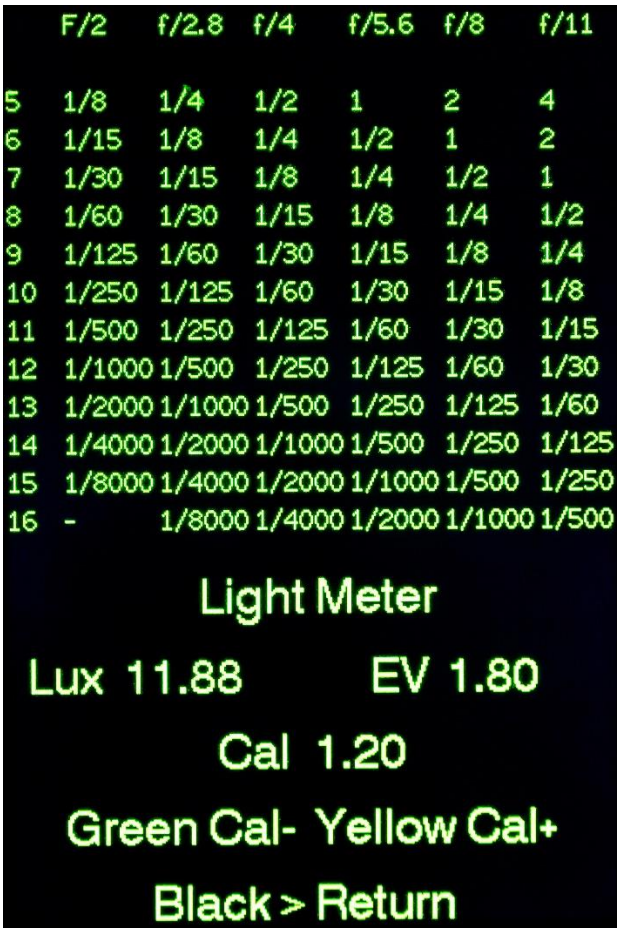
Testing Flash.

Connecting the Shutter Tester to the camera's flash socket will allow testing of the flash sync.
If a flash connection is detected, the tester will give a report after each shutter test.
It will detail the flash fired time in relation to the curtain travel & opening and whether flash sync is ok or not.

The report allows accurate setting of the camera flash contacts, to ensure the flash is trigged at the current time.
Both TFT and PC screen will show the report. Limitations of the LCD mean 'F' will be displayed if successful flash sync was seen

Note: - Flash sync is measured between the two outer sensors, so ensure the flash timing is not set at extremes of time measurements, else actual flash use may not be in sync.

Light-meter Utility



TFT Light-Meter screen

The Light-meter Utility will show the Lux light level and EV, based on 100 iso, in the range EV 0 to 16
The calibration value of the sensor is also shown. If the user has access to a calibrated Lux meter, calibration of the shutter tester light meter can be achieved by pressing **Yellow Button** or **Green Button** to change the calibration figure between the value of 0.94 and 1.44. Default setting is 1.20

The displayed light-meter reading is automatically updated as the light level changes.

~~**Note:** DO NOT use the lasers as a light source. The user will have to provide their own light. Maybe a dimmable LED light panel or a photographic continuous light. Note some LED panels are PWM (which cause flickering) rather than current controlled, so can create issues and cause continually changing values.~~
The TFT shows an EV chart, based on 100 iso from EV 5 to 16. If the light-meter reading falls between 5-16, the corresponding EV row will be highlighted.

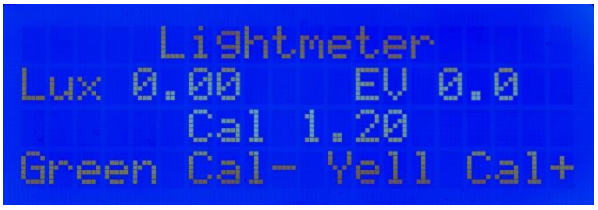
A full EV chart is included at the end of this document.

Pressing Button4 **Black** will exit the utility.

Pressing the **Green Button** will increase calibration value.

Pressing the **Yellow Button** will decrease calibration value.

The LCD shows Lux, EV, Cal value & button legends.



LCD showing Light-meter screen

```
BH1750 sensor is alive :o)
conversion time: 121ms
lux: -0.0000        EV: -0.0        BH1750: 1.20
lux: 7.5000         EV: 1.1         BH1750: 1.20
lux: 5.4331         EV: 0.7         BH1750: 1.20
lux: 4.0748         EV: 0.3         BH1750: 1.20
lux: 9.2815         EV: 1.4         BH1750: 1.20
lux: 30.7874        EV: 3.2         BH1750: 1.20
lux: 46.8602        EV: 3.8         BH1750: 1.20
lux: 50.2559        EV: 3.9         BH1750: 1.20
lux: 49.1240        EV: 3.8         BH1750: 1.20
lux: 56.4813        EV: 4.0         BH1750: 1.20
lux: 59.0846        EV: 4.1         BH1750: 1.20
```
PC screen showing Light-meter screen

Note:- DO NOT use the lasers as a light source. The user will have to provide their own light. Maybe a dimmable LED light panel or a photographic continuous light. Note some LED panels are PWM (which cause flickering) rather than current controlled, so can create issues and cause continually changing values.

Optical Shutter Tester

For full instructions on using the Optical Shutter Tester, please read the user guide for the stand-alone version.

The notes below are just a brief overview.

LCD screen when Optical Shutter Tester is selected

If the optional LED matrix can be accessed by pressing the **Red Button**.

It works in the same way as the old idea of photographing a CRT (old fashioned television screen), the strobing effect can give an indication of the camera's shutter speed. It is not terribly accurate so should be used as an indication only. Whilst it shows shutters that are slower than the set speed, it will not show shutter speeds that are faster than the set value.

The matrix will display the speed 1/30s and then start strobing a row of LEDs moving to each new row at 1/30s intervals.

When photographing, or looking though the film gate of a film camera, if the shutter speed is correct, one or two rows of LEDs should be seen.

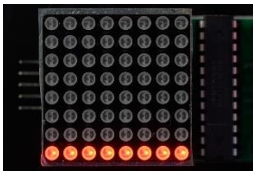
If more than two rows of LEDs are seen, it is an indication that the shutter speed is slow.

Pressing the **Red Button** will increase the strobing speed to the next standard shutter speed. Each shutter speed can be tested in a similar manor.

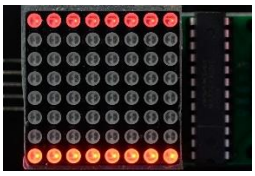
For a digital camera, take a photo & review it. For a film camera, open the back of the camera and look through the film gate when taking a photo.

Camera & tester set at

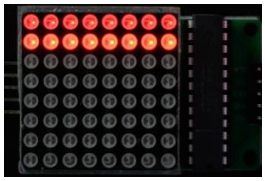
1/30s



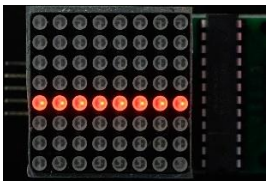
1/60s



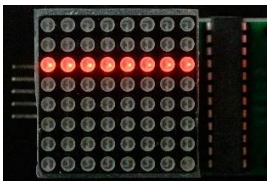
1/125



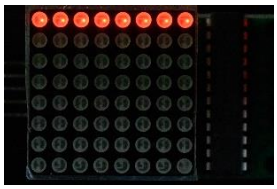
1/250s



1/500s



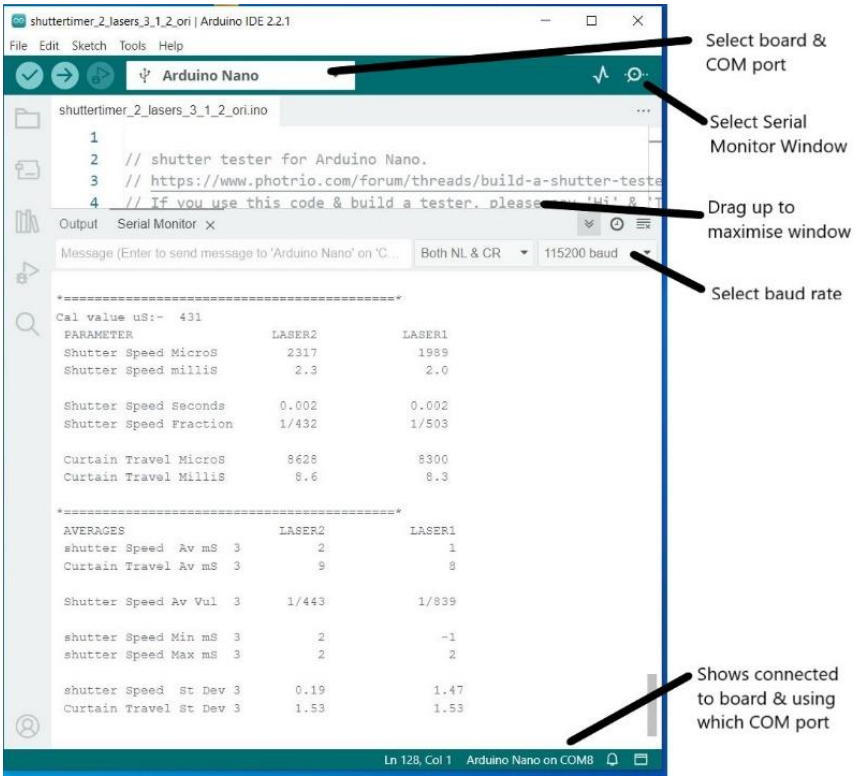
1/1000s



Computer Screen Display

Similar information as shown on the TFT can be displayed on the computer screen.
For this, a computer program called 'Arduino IDE' will be required. See separate document of how to install this program. You can use another serial monitor program if you wish.

In the top drop-down box, select your board and com-port. Note: - a new install of Arduino IDE will not recognise an ESP32 board. Just select Nano.
Select 'Serial Monitor by clicking the icon as shown.
The Serial Monitor window will be small, so drag the bar up, to make it larger
Select the correct baud rate of 115200 for Esp32.



The display follows a similar format to that of the TFT, but sometimes with more information.

Shutter bounces will be shown, as well as flash sync report.

Averages are updated and displayed. The number of cumulative tests used to calculate the average are shown (in this picture, 3 can be seen).

A maximum of ten individual tests are used to calculate the average. After this, the oldest is lost from the calculation and the latest reading added.

Link to a good web recourse for measuring light & EV

[Understanding Exposure Value, with calculator and EV chart (including for third stops) (scantips.com)]

The Standard EV chart of Full stops

EV Chart of Full stops

EV	f/1.4	f/2	f/2.8	f/4	f/5.6	f/8	f/11	f/16	f/22	f/32	EV
0	2"	4"	8"	15"	30"	64"	128"	256"	512"		0
1	1 sec	2"	4"	8"	15"	30"	64"	128"	256"	512"	1
2	1/2	1 sec	2"	4"	8"	15"	30"	64"	128"	256"	2
3	1/4	1/2	1 sec	2"	4"	8"	15"	30"	64"	128"	3
4	1/8	1/4	1/2	1 sec	2"	4"	8"	15"	30"	64"	4
5	1/15	1/8	1/4	1/2	1 sec	2"	4"	8"	15"	30"	5
6	1/30	1/15	1/8	1/4	1/2	1 sec	2"	4"	8"	15"	6
7	1/60	1/30	1/15	1/8	1/4	1/2	1 sec	2"	4"	8"	7
8	1/125	1/60	1/30	1/15	1/8	1/4	1/2	1 sec	2"	4"	8
9	1/250	1/125	1/60	1/30	1/15	1/8	1/4	1/2	1 sec	2"	9
10	1/500	1/250	1/125	1/60	1/30	1/15	1/8	1/4	1/2	1 sec	10
11	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	1/8	1/4	1/2	11
12	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	1/8	1/4	12
13	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	1/8	13
14	1/8000	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	1/15	14
15		1/8000	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60	1/30	15
16			1/8000	1/4000	1/2000	1/1000	1/500	1/250	1/125	1/60	16
17				1/8000	1/4000	1/2000	1/1000	1/500	1/250	1/125	17
18					1/8000	1/4000	1/2000	1/1000	1/500	1/250	18
19						1/8000	1/4000	1/2000	1/1000	1/500	19
20							1/8000	1/4000	1/2000	1/1000	20
EV	f/1.4	f/2	f/2.8	f/4	f/5.6	f/8	f/11	f/16	f/22	f/32	EV