

Darkroom Timer

An Arduino Based Darkroom Clock and Enlarger Timer

Ver. 1.1.0

Changelog

Version control guideline (i.e. v1.0.1 / x.y.z)

Version control of timer is separated into Software and Hardware to allow changes independent of each other. All attempts should be made to avoid changes to the hardware where necessary as that may mean a complete change to the Arduino Sketch - resulting in incompatibilities in the future.

- x** – Hardware version which will track any changes to the physical equipment
- y** – Major software changes such as new functions or when significant code rewrites have taken place which impacts user experience/usability
- z** – Minor software changes such as bug fixes, code optimisation or other changes that does not add new functions or visible to the users

Version	Notes
1.0.1	Initial development, core functions development
1.0.2	Menu system/UI/UX revamp and standardisation. Memory utilisation optimisation including moving from local to global variables. Code clean-up.
1.1.0	Initial release

Introduction

Overview

Introduction

Traditionally film darkroom practitioners control their printing process through a simple process of calculating exposure times by means of linear multiplication. This usually equate to 2, 4, 6, 8 second exposures to get progressively denser/darker photos . The use of Exposure Stops for the calculation of exposure times however is deemed to be far superior in getting consistent print densities especially when complex exposure steps and controls are required. However this method requires significantly more complex calculation that the average person would be bothered with. (Further reading here <https://www.ephotozine.com/article/f-stop-printing-4638>)

This document is a summary of the exercise I took in the development of a Exposure Stop based enlarger timer after looking at available solutions online (open source and commercial) and the approach in developing my own solution.

My initial foray started from my need for a simple darkroom clock that just counts up to be used during my film and paper development processes. Using an Arduino Uno, LCD shield and buzzer I created a timer that counts and buzzes on every 50th second (to inform of the upcoming minute) and 60th second (to inform that one minute has passed). This function (and code) still exist in some form in this darkroom timer's code. It was around this time that I came across the work by William Brodie-Tyrrell and was my inspiration to expand my existing solution to include new functions such as the enlarger timer function. (<https://www.brodie-tyrrell.org/fstoptimer/>)

I hope that this solution will help any one out there who is also interested in using F-Stop technique in their darkroom but are looking for a **VERY** accessible solution; from purchasing the necessary parts to the ease of assembling, programming, and loading of updated “firmware” as and when available. Any amateur/beginner (photographer) programmer should also be able to easily understand the code and make customised solutions to shared with everyone else.

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Safety Warning

Note that this project involves mains rated electrical wiring and components (i.e. things that can kill or hurt you). If you are not competent and/or comfortable with dealing with electrical and electronic components/parts **DO PROCEED!** If you choose to use any part of the design, code or content, you acknowledge that you have absolved me from any physical, mental, material, and/or other types damages, losses and/or responsibilities now or in the future. You yourself are burdened with the responsibilities of checking and ensuring that everything is in good working order and choose to proceed with making this darkroom timer at your own risk and discretion.

Existing Solutions Comparison

Developer/Source	What I liked	What I didn't like
F Stop Timer Arduino based William Brodie-Tyrrell brodie-tyrrell.org/fstoptimer/	<ul style="list-style-type: none">• Arduino based• Foot switch• Rotary encoder• Ability to name and save data (but is quite complex)	<ul style="list-style-type: none">• Small 16x2 LCD which limited the flexibility of the user interface and hence making the UX complex• Codes that are far too advanced for my (limited) understanding to edit (such as utilizing a 20x4 LCD or adding functions)• Use of custom made PCB boards (cost and effort)• IMO a missed opportunity for not using a I2C connection for the LCD and save on the pins for other purposes
Homebrew f/stop timer Arduino based DonF photrio.com/forum/threads/homebrew-f-stop-timer.158118/	<ul style="list-style-type: none">• Arduino based• Foot switch• Dual buttons• Simpler code that I could understand and edit	<ul style="list-style-type: none">• Small 16x2 LCD which limited the flexibility of the user interface and hence making the UX complex• IMO a missed opportunity for not using a I2C connection for the LCD and save on the pins for other purposes
RH Design F-stop Timer Proprietary RH Designs rhdesigns.co.uk/darkroom/html/sto pclock_professional.html	<ul style="list-style-type: none">• Ready made solution• Well established solution	<ul style="list-style-type: none">• Expensive (GBP 300+)• Hard to find/source• Low possibility of firmware updates for new features• Very limited in terms of UI since the only displays are numerical only display
Maya Darkroom Timer Arduino based https://www.indiegogo.com/projects/maya-the-only-darkroom-timer-you-ll-ever-need#/	<ul style="list-style-type: none">• Arduino based• Well designed with modularity• User interface focused	<ul style="list-style-type: none">• Expensive (USD300+) on Kickstarter• Would have preferred a keypad for data entry

Summary of Challenges and Objective

Challenges

- Ready made commercial solution on the market are expensive and/or not easily obtainable
- Customisation of existing DIY solutions are possible but mixed – most are firmware editable but could be difficult or could have the hardware configuration maximised
- Most DIY solutions require custom PCB or extensive soldering on prototyping PCB making it difficult for majority of people who may not have the access to a lot of the tools, skills or components

Objective

- Create a cheap Arduino based darkroom timer that covers all time based activities and processes
- Utilise “off-the-shelf” parts such as shields and breakout boards to eliminate custom PCBs and minimise individual component count
- Define a standard hardware system which can be utilised by any one to create their own custom firmware and share
- Updatable and modular code structure that can be easily debugged/modified without impacting other functions of the code
- Use of simple coding so any beginner C++/Arduino programmer can make changes (also an excuse due to my limited programming knowledge)
- Maximise hardware so that there is (preferably and hopefully) one hardware version with different firmware flavour by other others by:
 - Effective use of pins i.e. using I2C for the LCD
 - Maximise pin use for inputs such as switches, keypad and rotary switch
- A focus on UI/UX through larger screens (20x4 vs 16x2 LCD) so that users can be guided through the timer interface rather than reading the manual or having to remember all the steps/keys
- As cheap as possible – so that we can buy more film!

Key Features/Functionalities

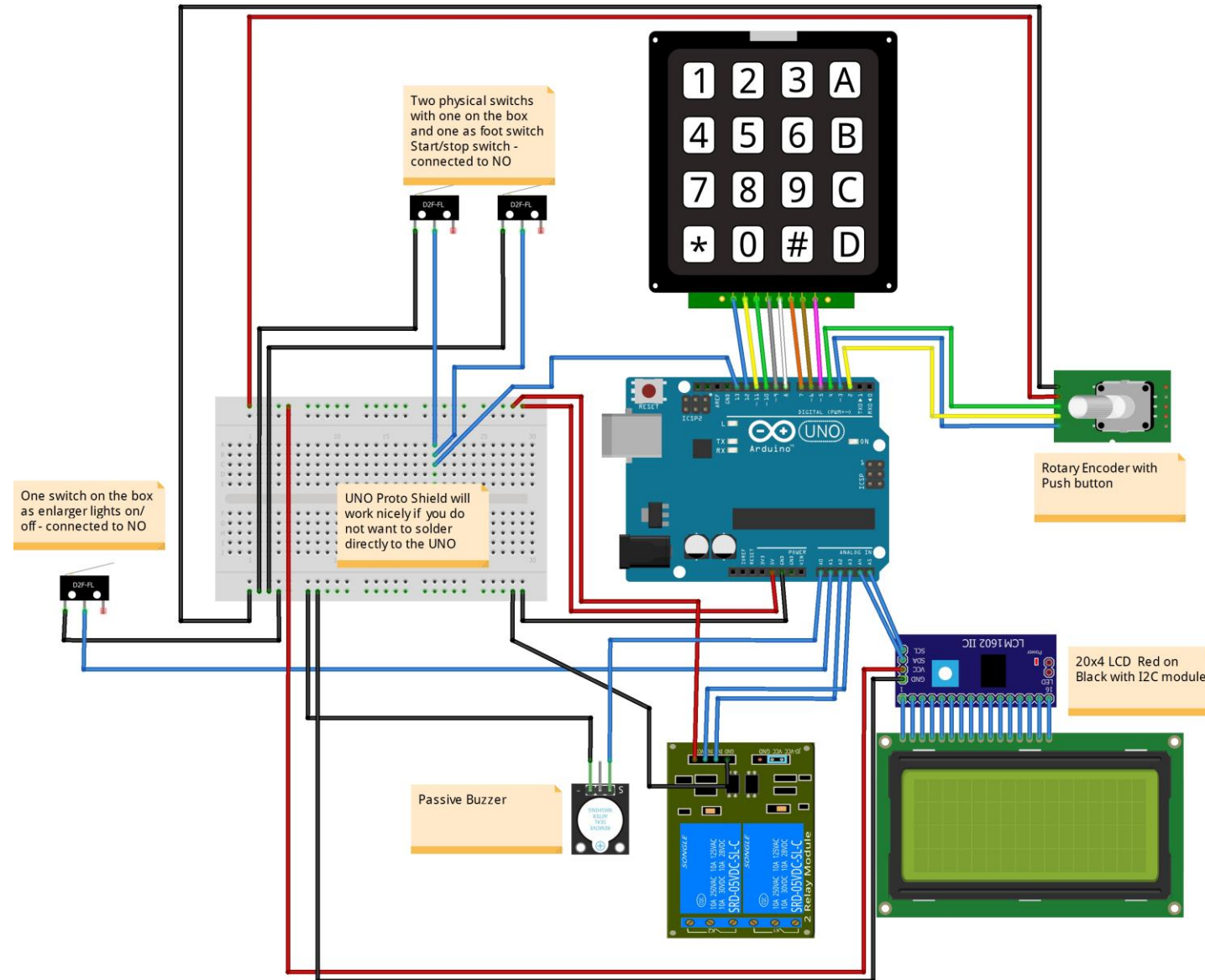
- All in one timer for the darkroom with a focus on F-stop based calculator for the enlarger timer function.
- Multiple input methods including a keypad, rotary dial with push button, dedicated button to enable enlarger focus and start/stop switch/foot switch.
- Large 20x4 LCD to allow greater space for user interface design
- Audio cue to allow users to focus on their activity (burn and dodge) while being aware of the time
- Foot switch to allow hand free operations especially if hands are positioned for burning and dodging
- Connections for mains powered safelight and enlargers up to 250v
- Key software modes/function:
 - Clock and Countdown timer function
 - Minute/seconds clock – Simple timers with audio cue at the minute and second mark respectively
 - Countdown timer – User imputable countdown timer up to 999 minutes
 - Test strip creation function
 - User selectable method for test strip creation (gradually open or gradually close test strip)
 - User definable base time (shown in stops and seconds), number of exposure steps (up to 9), and exposure stops between first and last steps (in stops)
 - Enlarger timer
 - User definable method for print creation (Addition mode; building up on continuous exposure - i.e. user have pre-calculated the exposure differences in zones and are expecting to expose base only on the differences OR Absolute mode; knowing all the different exposure zone values and letting the system calculate the right for each zone
 - User definable exposure (in steps) up to 0.01 difference, burn (additive) or dodge (subtraction), dry down factor in percentage up to 1% difference, and filter factor (i.e. when filter factor 4 or more is defined, the timer will automatically add the defined filter factor to the exposure).
-

Inputs/Output

Input/Keypad/Switch	Function	Description
Start Button/Foot Switch	Run/Execute programme	
Focus Button	Turn on/off enlarger/safelight	
Rotary dial	Menu select	Move menu selector up or down by turning clock or anti-clock wise
Rotary push button	Menu confirm	
Keypad 0 – 9	Data entry for numbers 0 to 9	
Keypad *	Decimal point	Not yet implemented as of SW v1.1.x
Keypad #	Confirm data entry	
Keypad A	Go/return to main menu	
Keypad B	Back/exit to previous screen	Back to previous screen
Keypad C	Confirm/proceed to next screen	Confirm configuration and proceed to next stage
Keypad D	Load/Save Data from/to EEPROM	Not yet implemented as of SW v1.1.x
USB port	Firmware update	

Outputs	Function	Description
20x4 LCD Screen	Main display screen	
Relay Connection #1	Power control for Enlarger lamp	
Relay Connection #2	Power control for Safelight	
Passive Buzzer	Provide audio cue	

Hardware Schematics (Version 1.x.x)



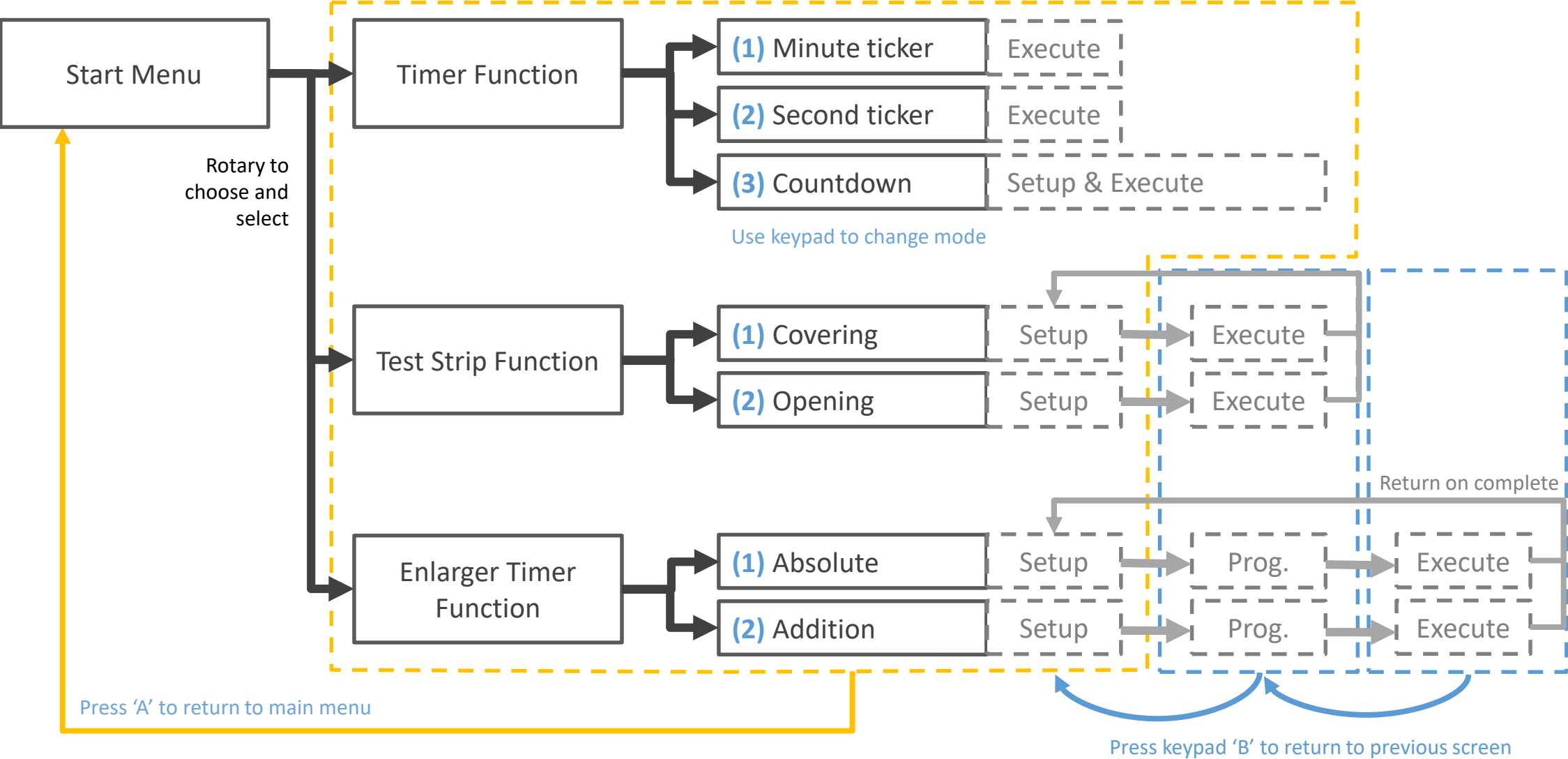
Hardware Bill of Material

Part	Qty	Remarks
Arduino Uno	1	Any Arduino Uno compatible boards are acceptable. If your boards come with Dupond headers and THT holds it will allow you to solder directly on to the board.
4x4 Keypad	1	
Momentary Foot Pedal Switch	1	Single Pole, Single Throw/Normally Open switch
Momentary Push Button	2	Single Pole, Single Throw/Normally Open switch
20x4 LCD with I2C pack	1	Preferably Red on Black otherwise White on Black 5V
Passive 5V Buzzer	1	Active Buzzer is possible but multitoned audio is not possible. Substitution with Active Buzzer have not been tested
Rotary Encoder with push button	1	Examples include common KY040 Rotary Encoder
2 Channel 5V Relay	1	Optionally 2x 1 Channel 5V Relay. Either should be rated for 240V with sufficient amperage for your enlarger/safelight
5v Switching Power Supply	1	Optionally you can use any 5V power supply such as USB charger powered through the USB connection
Arduino Uno Prototype Shield	1	Optional – just makes soldering easier and less risky as you can mess it up without destroying the board
Rubylith	1	Sufficient to cover the LCD screen to prevent any unsafe light coming off the LCD from fogging your paper (I use regular red coloured plastic sheets which seems to work for me unless I leave the print paper directly on the LCD)
Electric Box	1	Big enough to put everything in
Tools		Dremel, screws/drivers, stand-offs etc to put it all together

Detailed Functional Design

Timer Functions

UI Menu Flow



Functional Description – Minute and Second Ticker

Description

The Minute and Second tickers are essentially similar functions in that they count the time that has passed since it has started. The only difference between them are:

- a) Minute Ticker –
 - i. Two short buzzes on start
 - ii. One short buzz once every 50th second (i.e. 50second, 1min and 50 seconds, 2min and 50 seconds, etc.) to inform of the approaching minute mark. In general I use the 50seconds mark to start pouring chemical out of the development tank and start pouring in the next chemical at the one minute mark.
 - iii. Two short buzzes every minute/60 seconds. This works well when your chemical reaction timings are to the minutes (i.e. development - 5 minutes, stop bath – 1 minute, fix – 2 minutes, etc).

- a) Second Ticker – Second ticker simply buzzes at every second much like a metronome at 60 beats per minute.

Executing Mode

- At any point press the Start Button or stepping on the Foot Switch to start the timer
- At any point when the Timer is running, press the Start Button or stepping on the Foot Switch to stop the timer
- At any point when the Timer has stopped running, pressing the Start Button or stepping on the Foot Switch resets the timer

Functional Description – Countdown Timer

Description

The Countdown timer allows a user to define a set time in minutes up to 999 minutes (16 hours 39 minutes) for which the timer will count down to zero. The timer would buzz at:

- 10 minutes remaining once
- 1 minutes remaining at every second
- 0 minutes perpetual buzz until stopped

Executing Mode

- Using rotary dial, move the cursor to row 2 (Min Count) and key in countdown time in minutes
- At any point press the Start Button or stepping on the Foot Switch to start the countdown
- At any point when the Timer is running, press the Start Button or stepping on the Foot Switch to stop the countdown
- At any point when the Timer has stopped running, pressing the Start Button or stepping on the Foot Switch resets the countdown

Detailed Functional Design

Test Strip Function

Functional Description – Test Strip (Cover and Open)

Description

The Test Strip Cover and Open functions are essentially similar functions in that they are designed to help users create test scripts for the purpose of determining the right exposure for printing. The only difference between the two is:

- a) Cover mode - the print paper is fully exposed in the first exposure is covered gradually for each step.
- a) Open mode - the print paper is mostly covered and gradually opened and exposed for each subsequent step.

Executing Mode

- The mode starts with a setup page where the user can select the mode (Cover or Open) and enter the relevant printing requirements.
- Press “C” to Confirm that the right mode and printing requirements have been inputted and enter “Execution” mode
- Press and release the Start Button or on the Foot Switch to start exposing the first test strip “step”. The enlarger will turn on and safelight turn off based on the calculated time.
- Open or close the next segment of the test strip. Press and release the Start Button or on the Foot Switch to start exposing the next test strip “step”. Repeat until all “steps” have been exposed and the timer returns to the setup menu.

Calculations Implemented – Test Strip (Cover)

Test Strip function uses the following formula (simplified) to determine the exposure. This example assumes the user inputs:

- a) Base time/time for which the first strip will expose for – *8 seconds/3 EV*
- b) Number of steps/number of strips to be exposed – *5 steps*
- c) Number of stops/stops between the first strip and last strip – *2 EV*

Cover mode (n is the strip number starting from the first strip or n=1). In cover mode the print paper fully exposed in the first exposure is covered gradually for each step.

$$\text{Stops between steps}(d) = \frac{c}{b - 1}$$

$$\text{Exposure stop per strip} = a + (d * (n - 1))$$

Results are

Step	Step 1 (n=1)	Step 2 (n=2)	Step 3 (n=3)	Step 4 (n=4)	Step 5 (n=5)
Total Exposure stops (EV)	3	+0.5 (3.5)	+0.5 (4.0)	+0.5 (4.5)	+0.5 (5.0)
Exposure time (secs)	8	+3.31	+4.69	+6.62	+9.38
Total Exposure time (secs)	8	11.31	16	22.62	32

Calculations Implemented – Test Strip (Open)

Test Strip function uses the following formula (simplified) to determine the exposure. This example assumes the user inputs:

- a) Base time/time for which the first strip will expose for – *8 seconds/3 EV*
- b) Number of steps/number of strips to be exposed – *5 steps*
- c) Number of stops/stops between the first strip and last strip – *2 EV*

Open mode (n is the strip number starting from the first strip or n=1). In open mode the print paper is fully covered and gradually opened and exposed for each step.

$$\text{Stops between steps}(d) = \frac{c}{b - 1}$$

$$\text{Exposure stop per strip} = (a + c) - (d * (n - 1))$$

Results are

Step	Step 1 (n=1)	Step 2 (n=2)	Step 3 (n=3)	Step 4 (n=4)	Step 5 (n=5)
Total Exposure stops (EV)	5.0	4.5	4.0	3.5	3
Exposure time (secs)	9.38	+6.62	+4.69	+3.31	+8.00
Total Exposure time (secs)	32	22.62	16	11.31	8

Detailed Functional Design

Enlarger Timer Function

Functional Description – Absolute and Addition

Description

Enlarger timer functions are purely for the purpose of controlling the On/Off sequencing of enlarger when printing. Absolute and Addition modes both use the F stop method of calculating exposures based on exponential of 2 (2^x where x equals to the relative enlarger exposure stops). These two modes allow for the user to define:

- Up to 25 exposure “zones” with different exposure stops/duration for printing
- Dry down in percentage to discount from the exposure value
- Filter factor to be applied when contrast filters with rating of 4 or more is used
- For each “zone” to define if a burn or dodge action is to be taken
- For each “zone” to define the contrast filter to be used

Otherwise these two modes only differ based on assumed methods in which a printer may execute his workflow

Absolute mode

For a given print, the printer knows the *Absolute* exposure values in which he/she wants to print for each “zone” of the picture.

Addition mode

In this mode it is assumed that the printer knows or has calculated the relative density increase/decrease he/she wishes to print for. In this case the printer keys in the known exposure values for each step in the sequence.

Functional Description – Absolute and Addition

Executing Mode

- Timers can be started by pressing the Start Button or stepping on the Foot Switch.
- Second press stops the timers.
- Third press resets the timer to 0 and the timer is ready to restart from 0.

Notes

1. The general assumption is that during printing the 1st “zone” must be defined as “burn” in the printing programme mounting as the base exposure for the print.
2. During printing “burn” adds density/exposure time to a give “zone” while “dodge” adds density/exposure time (aka “burns”) to all other area of the print except the area of the print being “dodged”

Calculations Implemented – Absolute Mode

Enlarger Mode – Absolute utilises the following logic and formula in calculating the final exposure times. This example assumes the following print configuration has been entered on the:

Setup Screen

- a. Absolute mode
- b. 5 zones
- c. 8% Dry Down
- d. 2.0x Filter (*factor for filter grade*) >4

Programming Screen

Step	Step 1 (n=1)	Step 2 (n=2)	Step 3 (n=3)	Step 4 (n=4)	Step 5 (n=5)
Mode	Burn	Burn	Dodge	Dodge	Burn
Stops (seconds equivalent)	4.50 (22.63")	3.50 (11.31")	2.00 (4.00")	1.25 (2.38")	4.09 (17.03")
Filter Grade	No Filter	00	2.0	2.0	4.0

The following calculations are then carried out to determine the final exposure sequence

- 1. Total up all the dodge time defined (Step 3 and Step 4) i.e. 6.38"
- 2. If the step is a Burn mode, minus the Total Dodge Time. If the step is a Dodge mode ignore this step

Step	Step 1 (n=1)	Step 2 (n=2)	Step 3 (n=3)	Step 4 (n=4)	Step 5 (n=5)
Mode	Burn	Burn	Dodge	Dodge	Burn
Stops (seconds equivalent)	4.50 (22.63")	3.50 (11.31")	2.00 (4.00")	1.25 (2.38")	4.09 (17.03")
Filter Grade	No Filter	00	2.0	2.0	4.0
Minus Total Dodge time if Burn Mode	16.25"	4.39"	4.00"	2.38"	10.65"

Calculations Implemented – Absolute Mode

3. The next step then doubles the timing if the filter defined for that step is grade 4.0 or more (assuming and per Ilford's instructions when using ILFORD MULTIGRADE FILTERS). The factor to be applied is as defined in the Setup Menu. If the filter is less than grade 4.0 there is no changes to the calculated timing.

Step	Step 1 (n=1)	Step 2 (n=2)	Step 3 (n=3)	Step 4 (n=4)	Step 5 (n=5)
Mode	Burn	Burn	Dodge	Dodge	Burn
Stops (seconds equivalent)	4.50 (22.63")	3.50 (11.31")	2.00 (4.00")	1.25 (2.38")	4.09 (17.03")
Filter Grade	No Filter	00	2.0	2.0	4.0
Minus Total Dodge time if Burn Mode	16.25"	4.39"	4.00"	2.38"	10.65"
Apply Filter Factor (New Time)	No (16.25")	No (4.39")	No (4.00")	No (2.38")	Yes (21.30")

4. The last step applies the Dry Down factor by reducing/discounting the timing by the percentage defined in the Setup Menu. This is done for ALL steps irrespective.

Step	Step 1 (n=1)	Step 2 (n=2)	Step 3 (n=3)	Step 4 (n=4)	Step 5 (n=5)
Mode	Burn	Burn	Dodge	Dodge	Burn
Stops (seconds equivalent)	4.50 (22.63")	3.50 (11.31")	2.00 (4.00")	1.25 (2.38")	4.09 (17.03")
Filter Grade	No Filter	00	2.0	2.0	4.0
Minus Total Dodge time if Burn Mode	16.25"	4.93"	4.00"	2.38"	10.65"
Apply Filter Factor (New Time)	No (16.25")	No (4.93")	No (4.00")	No (2.38")	Yes (21.30")
Dry Down Applied	14.95"	4.54"	3.68"	2.19"	19.60"

Calculations Implemented – Addition Mode

Enlarger Mode – Addition utilises the following logic and formula in calculating the final exposure times. This example assumes the following print configuration has been entered on the:

Setup Screen

- a. Absolute mode
- b. 5 zones
- c. 8% Dry Down
- d. 2.0x Filter (*factor for filter grade*) >4

Programming Screen

Step	Step 1 (n=1)	Step 2 (n=2)	Step 3 (n=3)	Step 4 (n=4)	Step 5 (n=5)
Mode	Burn	Burn	Dodge	Dodge	Burn
Stops (seconds equivalent)	4.50 (22.63")	3.50 (11.31")	2.00 (4.00")	1.25 (2.38")	4.09 (17.03")
Filter Grade	No Filter	00	2.0	2.0	4.0

The following calculations are then carried out to determine the final exposure sequence

- 1. Unlike the Absolute Mode, Addition Mode DOES NOT Total up all the dodge time defined (Step 3 and Step 4) i.e. 6.38"
- 2. Unlike the Absolute Mode, Addition Mode DOES NOT minus the Total Dodge Time. The mode ignore this step all together

Step	Step 1 (n=1)	Step 2 (n=2)	Step 3 (n=3)	Step 4 (n=4)	Step 5 (n=5)
Mode	Burn	Burn	Dodge	Dodge	Burn
Stops (seconds equivalent)	4.50 (22.63")	3.50 (11.31")	2.00 (4.00")	1.25 (2.38")	4.09 (17.03")
Filter Grade	No Filter	00	2.0	2.0	4.0
Addition Mode Timing	22.63"	11.31"	4.00"	2.38"	17.03"

Calculations Implemented – Addition Mode

3. The next step then doubles the timing if the filter defined for that step is grade 4.0 or more (assuming and per Ilford's instructions when using ILFORD MULTIGRADE FILTERS). The factor to be applied is as defined in the Setup Menu. If the filter is less than grade 4.0 there is no changes to the calculated timing.

Step	Step 1 (n=1)	Step 2 (n=2)	Step 3 (n=3)	Step 4 (n=4)	Step 5 (n=5)
Mode	Burn	Burn	Dodge	Dodge	Burn
Stops (seconds equivalent)	4.50 (22.63")	3.50 (11.31")	2.00 (4.00")	1.25 (2.38")	4.09 (17.03")
Filter Grade	No Filter	00	2.0	2.0	4.0
Addition Mode Timing	22.63"	11.31"	4.00"	2.38"	17.03"
Apply Filter Factor (New Time)	No (22.63")	No (11.31")	No (4.00")	No (2.38")	Yes (34.06")

4. The last step applies the Dry Down factor by reducing/discounting the timing by the percentage defined in the Setup Menu. This is done for ALL steps irrespective.

Step	Step 1 (n=1)	Step 2 (n=2)	Step 3 (n=3)	Step 4 (n=4)	Step 5 (n=5)
Mode	Burn	Burn	Dodge	Dodge	Burn
Stops (seconds equivalent)	4.50 (22.63")	3.50 (11.31")	2.00 (4.00")	1.25 (2.38")	4.09 (17.03")
Filter Grade	No Filter	00	2.0	2.0	4.0
Minus Total Dodge time if Burn Mode	16.25"	4.93"	4.00"	2.38"	10.65"
Apply Filter Factor (New Time)	No (22.63")	No (11.31")	No (4.00")	No (2.38")	Yes (34.06")
Dry Down Applied	20.82"	10.41"	3.68"	2.19"	31.34"

Enlarger Time Mode Notes

General Notes

- 1. All data inputted is kept in memory while the unit is powered – meaning you can switch between Absolute and Addition Modes seamlessly as the unit will recalculate when entering “Execution” mode.
- 2. Multigrade Filters are defined into three categories in this programme and can be inputted using the following keys when in Programming Screen’s filter row

Filter Grade	No Filter	00 Filter	0 Filter	0.5 to 5.0 Filter
Input required	Anything more than 5.0	0	Between 0.1 and 0.4	0.5 to 5.0
Example Key press required	“6”, “0” (i.e. 6.0) “#” (to confirm)	“0” (i.e. 0) “#” (to confirm)	“0”, “2” (i.e. 0.2) “#” (to confirm)	“5”, “0” (i.e. 5.0) “#” (to confirm)

Absolute Mode

- 1. For any given printing sequence the Total Dodge Time should never be more than any single Burn step. If for any reason you need to program a Burn sequence that is equal to or less than the Total Dodge Time, you have to use the Addition Mode instead.

Appendix

Known Bugs

Description	Status	Status/remarks
Filter factor in enlarger timer function does not allocate for ‘No filter’, 00, 0 and ½ to 5 grade filters. Challenge in capturing all permutation of the filter grades.	Medium Closed	For grade 00 filter key in ‘0’, ‘0’, ‘#’, while for grade between ½ to 5 key in ‘0’, ‘5’, ‘#’ and ‘5’, ‘0’, ‘#’ respectively. For no filter key in anything more than 5 (i.e. ‘5’, ‘5’, ‘#’) and the timer will default to “No Filter”
Enlarger Mode (Absolute) does not warn or display correctly the timing for a given step in a sequence when the Dodge time is more than one or more Burn steps.	Low	

Functionalities Wish List

Functionalities Wish List

- Ability to save all data for later retrieval/load on reboot (EEPROM saving) - **HIGH**
- Ability to change data inputted whole stock due to changes in lens aperture and/or raising/lowering of enlarger head, changes different paper types or whole stock shifting of programmed exposure (i.e. 0.33 or 0.66 stops down/up from current exposure setting) – **HIGH**
- Additional enlarger function for simple time based enlarger printing (i.e. Viponel S15 timer) - **MEDIUM**
- Clipping warning for areas which will experience over exposure (total black) or under exposure (total white) during enlarger functions – **LOW**
- Use of rotary for inputting data. E.g. turning it will increase/decrease minutes in count down function, or change EV value in enlarger timer function - **LOW**
- Better way of inputting data through keypad - **LOW**
 - Immediate visibility of entered number rather than the current implementation where value is visible only AFTER confirming data
 - Ability to define decimal point during data entry

End of Document