

Smart Night Light User Manual 3rd October 2023 .....	1
1. Introduction .....	2
2. Specifications: .....	2
3. How does it work? .....	3
4. Control Interface.....	3
5. Initial Setup (Network Setup Mode).....	4
6. Arduino Sketch Installation .....	6
7. Trouble shooting.....	7
8. Other Info.....	8
9. The Control Screen .....	8
10. Schematic.....	10

## 1. Introduction

This device is a low energy brightness controlled Night Light using white light Emitting Diodes or small COB led panel. It plugs into a standard USB 5V outlet to avoid mains power safety issues. Various control functions are available through a web page control interface.

The Night Light includes a WiFi equipped Micro Computer (Micro).

Included is a 4 digit LED Clock display. This extra is optional and can be easily excluded from the Arduino Sketch.

The Night Light has no LDR to sense night time, Instead it uses Internet time and location to determine sunset to sunrise times. This means that it will work properly in locations such as dark interior passages.

It includes a beeper and Alarm option.

The unit is housed in a small 3D Printed enclosure that includes the male USB Connector.

## 2. Specifications:

- 5 White 5 mm LEDs or 3V COB LED Panel.
- Supply Voltage: 5V DC. Current less than 100mA. Indoor Use Only.
- WiFi: 2.4GHz only. WiFi On/Off control.
- Web Page Control Interface and Network Setup:
- 4 digit LED Clock display (using TM1637 I2C module)
- Adjustable Brightness.
- Default Brightness.
- Australian Capitals location settings
- Daylight Savings On/Off.
- Audible Alarm Setting On/Off and duration.
- Manual On/Off.
- Settable On/Off times or Sunset to Sunrise Control.

### 3. How does it work?

The Night Light is designed to operate in dark areas such as the passageway of new homes where traditional Night Lights may stay on all the time. The best feature is that the brightness can be varied to suit the location.

The heart of the unit is an ESP8266 ESP-01S Micro Computer module. It includes WiFi hardware and software so that a connection can be made to your local Network and also the Internet. A web server is created and the Night Light control web page can be accessed via a web browser on your smart device. A fixed local IP address is set on first boot to ensure the Night Light web page IP is always the same. The web server utilises web socket technology to continuously update the web page data values without page refresh.

The unit gets the current time from a Network Time Protocol service and uses a Library to calculate Sunrise and Sunset times for the specifically set Time Zone.

The main control loop constantly checks the time to determine whether the LED panel should be on or off as well as the alarm beeper.

PNP transistors buffer the Micro outputs for the buzzer and the LED panel. PNP connections ensure the micro GPIO pins are pulled high at boot.

The current time is shown on the 4 digit Led display using I2C (2 wire plus power plus ground).

The web page provides a number of options. Any changes to settings are saved to the Micro's File system.

A 5V USB plug pack provides power that is regulated to 3.3V for the micro using a three terminal AMS 1117 3.3V regulator module that has input and output capacitors installed. These 3 pin modules are cheap and reliable.

Using a 5V USB supply plug pack eliminates the safety issues associated with mains wiring.

### 4. Control Interface.

#### 1. Normal Mode.

In the normal mode, the Micro connects to your local WiFi network and starts a web server. The web page provides controls including brightness and On/Off times.

The Night Light will flash at 1 second intervals and show a counter on the Clock display during start up as it searches for the WiFi Network. Typically it will connect after about 5 seconds if the Network credentials are correct.

#### 2. Network Setup Mode.

In this mode, the WiFi settings can be set to your local WiFi network. Initially the unit will flash slowly with a count on the LED clock while looking for known WiFi Network. After a 15 seconds timeout, it will flash faster and commence Network Setup Mode.

## 5. Initial Setup (Network Setup Mode)

Initially , your WiFi settings must be entered. A Setup Web page must be accessed from the Night Light Unit.

WiFi Network Settings for Night Light:

Item	Current Value	New Value
WiFi Network Name:	unknown	<input type="text"/>
WiFi Network Password:	unknown	<input type="text"/>
Night Light IP Address:	10.0.0.60	<input type="text"/>
Router IP Address:	10.0.0.138	<input type="text"/>

Follow this Procedure for IOS devices. Search Internet for Android or Windows machines.

1. Using your smart device, open Settings, WiFi.
2. Record (exactly) the currently connected Network Name. Also record the Password for your network. To find the password, Tap on the "i" Icon (information) to the right of the currently connected network Name then tap on the password dots, press Touch ID to view password (if you have touch ID enabled)

Record the Network Name here: \_\_\_\_\_

Record the Network Password here: \_\_\_\_\_

3. Scroll up (or Tap on the "i" Icon (information) to the right of the currently connected network Name if still at the Network name screen)
4. Find the group that is labelled IPV4 ADDRESS and Record (exactly) the numbers alongside of the item Labelled "Router" (The IPV4 numbers will be something like 192.168.0.1 or similar) Note that this is alongside the item "Router" and not alongside the item "IP Address".

Record the Router numbers (Router IP Address) here: \_\_\_\_\_

5. Choose an IP address for your Night Light.

This will be the local Network IP address that you will use to access the Night Light Web Page.

Use the first three number groups of the Router number as recorded earlier plus a last number that will be unique on your network. Choose a last number that is far away

from the Router last number address group and is easy to remember but must be less than 254. Choose a number distant to avoid picking a number that is already in use by another device on your network.

For example, if the Router number is 192.168.0.1 then choose a number such as 192.168.0.200 or 192.168.0.88 for the Night Light IP Address.

For example, if the Router number is 10.0.0.138 then choose a number such as 10.0.0.200 or 10.0.0.77 for the Night Light IP Address.

Record the Night Light IP Address here: \_\_\_\_\_

6. Plug the Night Light into a 5V USB plug Pack and turn on.
7. Wait until the Night Light flashes slowly then quickly.
8. On your smart device go back to WiFi settings and look for a new Network Name of **NightLight**
9. Tap on the Night Light Network Name and enter a password of: **password**
10. To access the Night Light setup page, when connected, open the smart device web browser then tap and enter the following IP address in the browser address/search bar. **192.168.4.1:85** then press Enter or Go on your Key Pad. (must be exact including the dots and the colon). A setup web page should load.
11. Enter the Network Name (exactly) as recorded earlier in the appropriate Text Box and press Enter or Go on your Key Pad. The values you enter should appear in the current Value Field.
12. Enter your Network Password (exactly ) as recorded earlier in the Password Text Box and press Enter or Go on your key Pad.
13. Enter the Night Light IP Address as recorded earlier .
14. Enter the Router IP Address as recorded earlier.
15. If all the entries are correct (Shown to the right of the Text Boxes then press Re-Boot Micro Button on the web page. If successful the Night Light should re-boot and start to slow flash while searching for a Network Connection.
16. When the Night Light stops Flashing, Open WiFi settings on your smart device and connect to your normal Wi Fi Network. (the network recorded above)
17. To open the Night Light control web page, open a browser and enter the Night Light IP address in the browser address bar as per the previously entered IP Address (must be exact with dots). Now add a colon and the numbers 85 to the end then press enter or Go.

For example if your Night Light IP Address is 192.168.0.200 then you would enter 192.168.0.200:85 to open the Night Light Web Page.

All ways use this address to access the Night Light control page. Add this site to your favourites or tool bar for easy access.

## 6. Arduino Sketch Installation

\*\*\*\*\*

### **IMPORTANT BEFORE PROGRAMMING YOUR ESP8266**

Note that the UART TX and RX pins are used for I2C communication between the micro and the LED display. This means that the Serial monitor cannot be used. **When programming, with the programmer connected but not powered up, GPIO 0 must be pulled low before powering up.** This means that the micro will be in download mode ready to accept the software update. If this routine is not followed and the micro is running, the Tx and RX pins are set to outputs that could possibly be damaged by the Serial programmer or the Micro if the connected device has a low impedance pull up or pull down. Either follow this routine or before programming, install 390R resistors between the Programmer TX to Micro RX and the Programmer Rx to Micro Tx.

Simply put:

Connect the Serial programmer to the ESP8266 while powered down. Then place the Micro into download mode by pulling GPIO 0 low and holding it low while then powering up the ESP8266. After programming, do not reset while power is on. Unplug the ESP8266 and install it into the Night Light circuit before powering up again.

\*\*\*\*\*

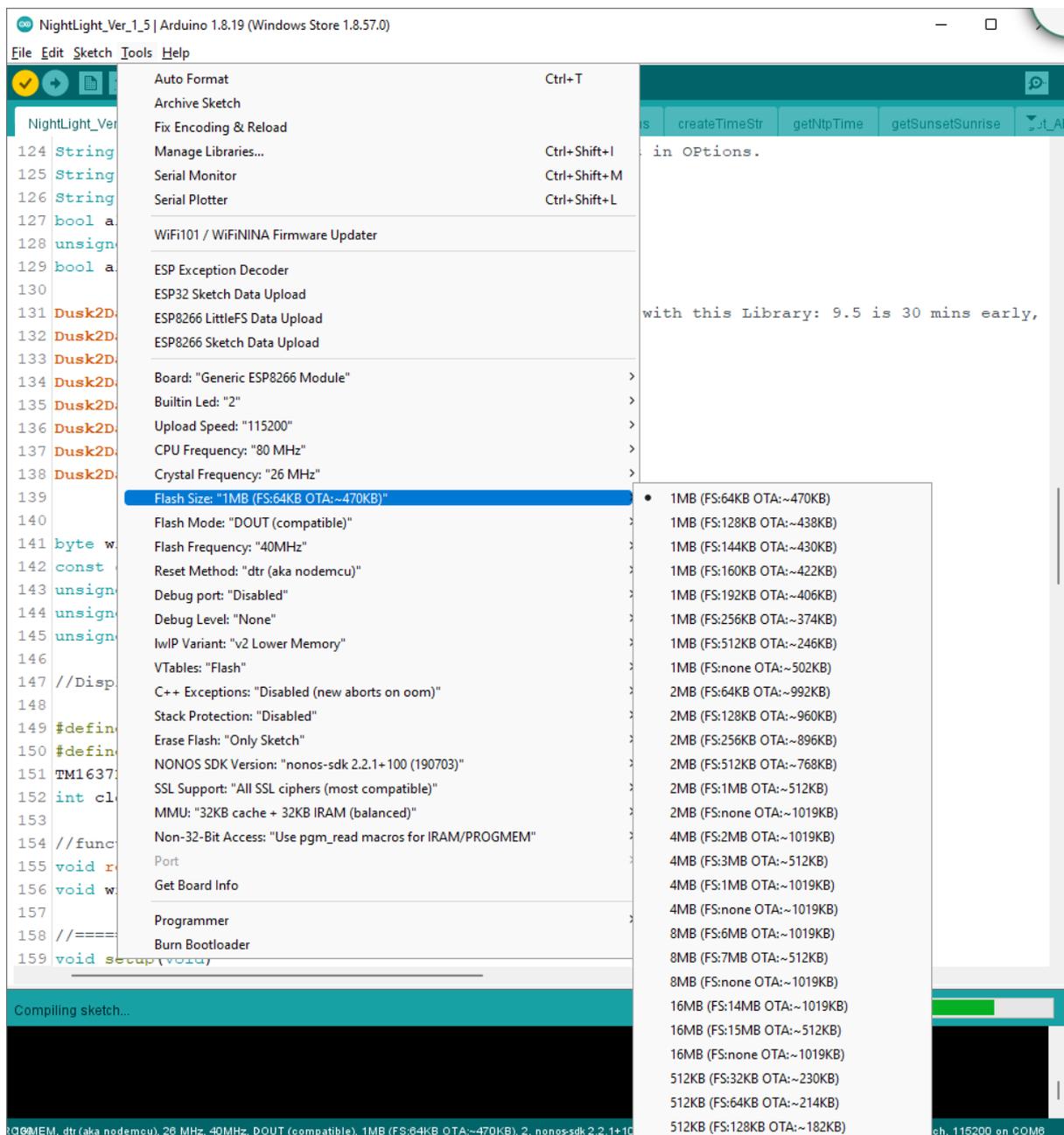
To install the software, create a NightLight\_Ver\_1\_5 folder in your Arduino sketch files location. (Location is found in the Arduino IDE File Menu/Preferences. Unzip the NightLight.zip file into this folder.

Open the Arduino IDE and File/Open menu navigate to and then open the NightLight\_Ver\_1\_5.ino file. All of the sketch files should be seen along the tabs in the Arduino IDE. To access files that are not shown on the tabs, use the drop down arrow just under the Serial Monitor Hour Glass Icon to the top right of the Arduino IDE screen.

At the top of the sketch you should see the additional Arduino Libraries that need to be installed and where to look on GitHub or elsewhere.

Find each library and download each as a ZIP file then install them using the Arduino IDE menu Sketch/Include Library/Add .ZIP Library.

From the Tools/Board menu Select ESP8266 Boards then Generic ESP8266. ( My ESP Boards version was ESP8266 Boards(3.1.2).



## 7. Trouble shooting

The most common problems are:

### Software will not compile or upload.

- Check correct board selected.
- Check micro is power up.
- Check Serial Port exists and is ticked in Tools/Port.
- Check all libraries are installed. (Look for library errors in compile messages)

### Web page inaccessible or Clock not updating.

- Check that the Night light WiFi Network Name and Password are correct.
- Check that the Night light setup IP addresses are correct.

## 8. Other Info

If the Unit cannot find the saved WiFi network (For example after a power failure, the unit will re-boot but the router may not start up the Wi Fi signal for some time), it will then switch temporarily into setup mode, wait a short time and then retry to connect to the saved network. This procedure will continue forever until the WiFi Network becomes available or new settings are applied. Thus the unit recovers after power failure and can also be relocated to another WiFi location.

If the Wi Fi Network Off in 30 minutes option is selected, the micro will disconnect from the WiFi 30 minutes later. This saves power but the web page will be inaccessible until the unit is power is cycled. Also, to keep the clock accurate, the unit will connect to WiFi for 30 minutes duration at 4:30pm each day.

All settings are saved to the Micro's internal File system. (using LittleFS Library)

## 9. The Control Screen

In Normal Mode, the unit should operate automatically and the control web page can be accessed via your smart device using the WiFi network and IP address setup in the initial Network Setup Section.

### Features:

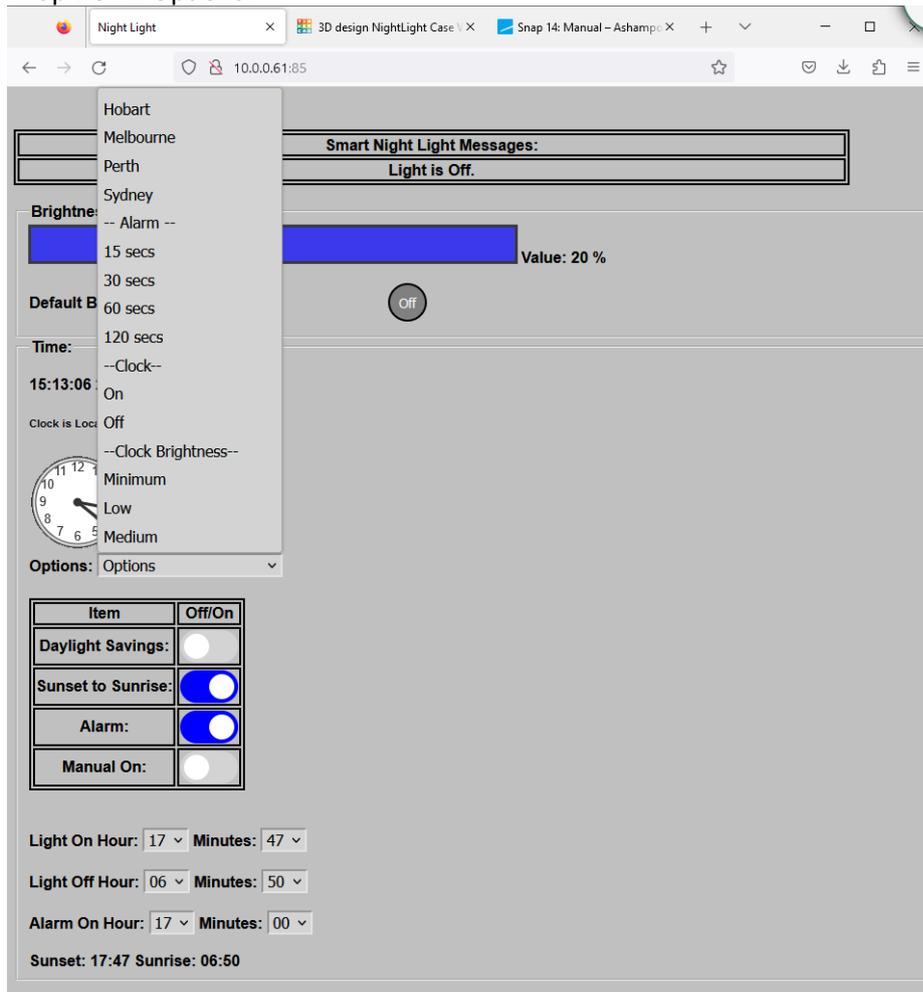
- **Smart Night Light Messages:** This is where feedback messages appear when status or controls change.
- **Brightness:** This is a slider that changes the brightness from 0% to 100%.
- **Default Brightness:** A drop Down List to select the Brightness when powered up. Setting saved to file.
- **Light On/Off Indicator:**
- **Current Time, Date and Location:**
- **Clock Face:** Is current computer Time and not location time.
- **Options:** This is a drop down list box to change the location, the alarm run duration, clock on/Off, clock brightness, resetting the Micro, resetting the WiFi Network and showing the Software Version.
- **Toggle Switches:** For Daylight Savings, Sunset to Sunrise On/Off (over-rides manual settings) ,alarm On/Off and Manual On. Alarm will start at the Alarm on Set time. The alarm will sound a buzzer and flash the Night Light on and off every second.
- **On and Off Hours and Minutes:** Drop down list selection boxes.
- **Alarm On Hours and Minutes:** Drop down list selection boxes.
- **Sunset and Sunrise Times:** Shown for current location.

### Options:

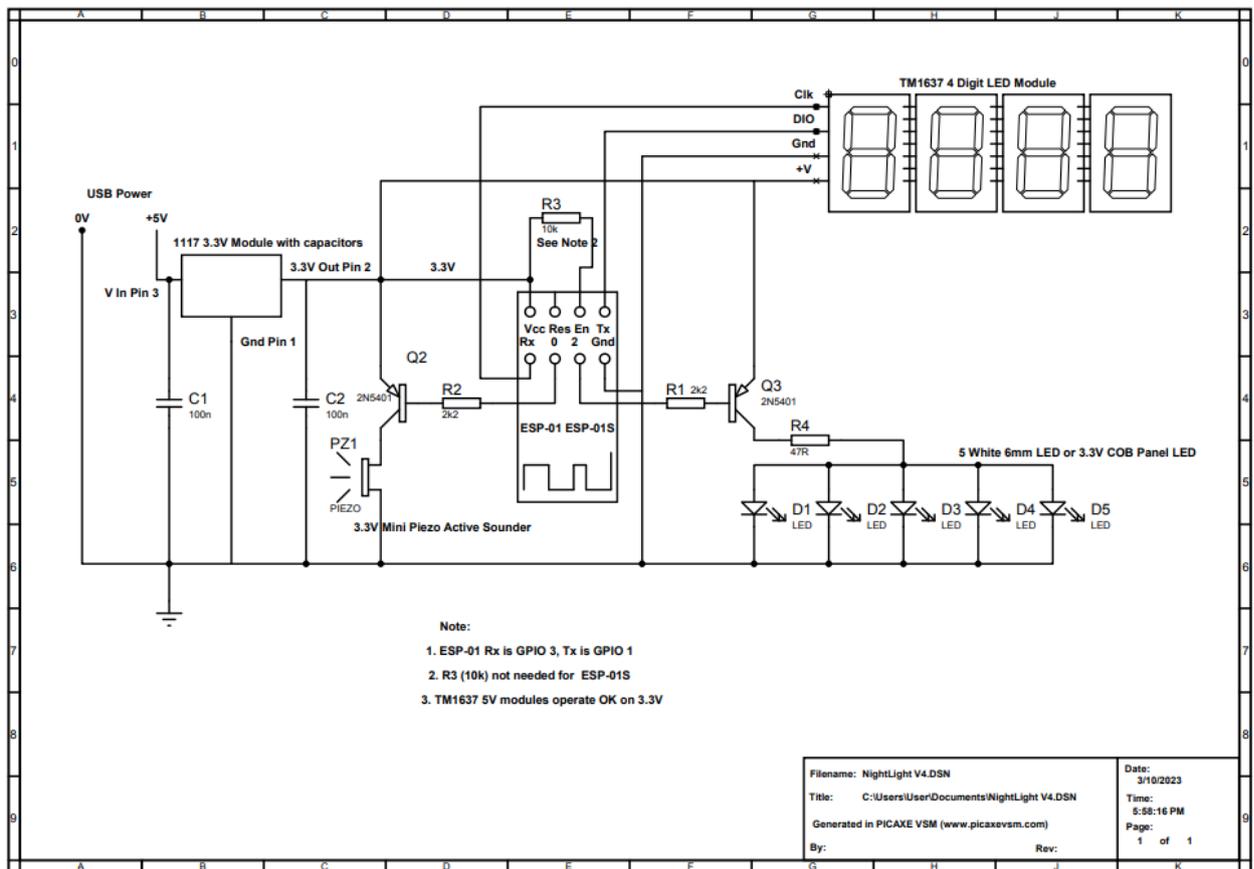
A drop down list box provides the following Options:

- **Location Selection** (Capital Cities. Other locations can be added with Lat,Long in sketch.)
- **Alarm duration.**
- **Clock On/Off.**
- **Clock Brightness.**
- **WiFi On/Off.** If Off, WiFi turns off after 30 minutes.
- **Show Software Version.**
- **Micro Re-boot.**
- **Network Reset.** Use this to check the Network Settings.

Drop Down Options:

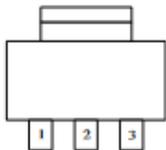


## 10. Schematic



### AMS1117-3.3

SOT-223 Top View



1- Ground/Adjust  
 2-  $V_{OUT}$   
 3-  $V_{IN}$

### 2N5401

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter

