

Unusual Electronics

WARNING!

This unit generates a high voltage.

High voltages can cause serious injury or death!

Safe operation of this kit is the users' responsibility.

This information is provided 'as is'.

No responsibility is accepted for any damage, injury or death as a result of using this kit.

It must be properly en-cased to prevent contact with high voltages and kept out of reach of children.

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1. Reading the Time

The tubes show information in sequences of two digits at a time.

e.g. **Hours** – blank – **Minutes** – blank.... repeat

or: **Hours** – crossfade – **Minutes** – blank.... repeat (this is the default setting)

or: **Hours** – blank – **Minutes** – blank – **Seconds** (for several seconds) – blank....repeat

There are many other configuration options which allow you to change how the information is shown, display timing, special effects, tube LEDs colours etc.

You can configure the tube leds to show different colours for Hours, Minutes etc.

The default is Blue for Hours, Green for Minutes, Red for Seconds.

2. Controls

All settings are adjusted using two push-buttons.

The **SET** button is mainly used to access configuration options. Depending on how long it is held pressed (see section 5 for more info).

While in setup modes, pressing or holding-down the **UP** button will count-up through the allowed values for each option. (the increment speed increases as the button is held) In addition, the **UP** button can be pressed during normal time display to dim the display.

Whilst showing the time:

One short press (less than 2 seconds) of the **SET** button will show the date for the number of display cycles specified by option **23** (default=1 cycle).

Two short presses of the **SET** button (within 2 seconds) will switch to continuous temperature display. (Temperature will be shown in the format that you have chosen in the setup options **38-40**).

To exit from continuous temperature display, another short press of the **SET** button will briefly show the minimum & maximum temperatures since power-on, then return to the normal time display.

To reset the Maximum/Minimum temperature log:

Power-off or long press the set button whilst showing the temperature to reset the minimum & maximum temperature log. The tube LEDs will then flash **Cyan** twice.

See the following sections for a full description of the operation for each button.

3. Setting the Time

Press the **SET** button for about 2 seconds during time display. The display and LEDs will blank, Release the button when the LEDs glow **RED**. The hours digits begin to flash. (Hours are shown in 24 Hour time) Now pressing or holding-down the **UP** button will count-up the hours.

The next short press of the **SET** button will flash the minutes and the LEDs will glow **BLUE** As before, pressing the **UP** button counts up the minutes.

Another short press of the **SET** button will blank the tubes and the LEDs will glow **GREEN**. (When the button is released clock will resume showing the time. (If you have changed the time setting, the seconds will be zeroed as the button is released). (If no buttons are pressed for 3 minutes, it will exit back to time display).

4. Manually Dimming the display

While the clock is showing the time, the first short press of the **UP** button will show the current brightness level. Each successive short press of the **UP** button will dim the display in four steps, and then back to full brightness again. (The set brightness level is briefly shown on the second tube with each button press).

An automatic timed or light-level dim or display off can be configured – see the settings section. (Options **14 -18**)

5. Toggling the display

If the **UP** button is held pressed for 2 seconds or more while in time display mode, the display will toggle off/on.

This feature may be useful if you want to manually turn-off the display or override the timed or opto-dimming to turn-on the display.

The initial toggle is indicated by a short white flash of the LEDs.

When in this mode, the display will stay either on or off. (it completely overrides any timed or opto-dimming).

To return to normal mode, press the **UP** button again for 2 seconds, the LEDs will flash white twice and the display will toggle back to normal (timed and opto-dimming will now be enabled again).

6. Accessing the Configuration option mode

Whilst showing the time, enter the **configuration mode** as follows-

Press and hold-down the **SET** button for about 4 seconds. (until the LEDs glow **PURPLE**)

The display will now show a repeating sequence of the first configuration option (**01**) followed by the digits rapidly flashing the current value for that option. (**12 or 24**)

To change an option value, press the **UP** button (if held pressed it will auto-increment) To step-on to the next option, press the **SET** button briefly.

There are a total of 52 options , you can either step through each one sequentially as described above or press and hold the **SET** button again for two seconds (until the LEDs glow **GREEN**) to return to the normal clock time display.

(If no buttons are pressed for 3 minutes, it will automatically exit from configuration mode (any changes already made will be saved)).

7. The Configuration options mode list			
No.	Option	Detail (value in bold is the default)	Range
1	Show 12 or 24 Hour time		12 or 24
2	Year	2010 - 2099	10 - 99
3	Month		1 - 12
4	Day of month	Range depends on year & month	1 - Last
5	Crossfading level	0=disabled) 4=maximum 3=Default	0-4
6	Leading zero Hour blanking	0= disabled 1=left, 2=right tube	0 -2
7	AM/PM indicator	0=off, 1=PM , 2=AM	0-2
8	Time display options	0=random choice (1-5) for each cycle 1=hours/mins , 2=hours/mins/secs, 3=hours/mins with crossfade 4=hours/mins with slots effect, 5=hours/mins with flip effect	0-5
9	Time digits duration (x 0.1sec)	0.5 - 3 seconds. (0.8 seconds=default)	5-30
10	Digit gap duration (x 0.1sec)	0=no gap , 1=no gap with crossfade	0-20
11	End blank duration (x 0.1sec)	0 secs - 5 seconds (0.8 seconds=default)	0-50
12	Seconds display duration.	1 - 10 seconds (3 seconds=default)	1-10
13	Mains AC time sync	0=disabled, 1=auto , 2=Force 60hz	0-2
14	Timed brightness start hour	23=default (11pm)	0- 23
15	Timed brightness end hour	08=default (8am)	0-23
16	Timed brightness value	6=no timed dim , 0=turn off display	0-6
17	Light sensor autodim	0=disabled , 1=dimming only, 2=dimming & off, 3=on/off only	0-3
18	Light sensor threshold	25=default , (higher=dims in brighter light)	0-80
19	Date display every x cycles	0=disabled	0-60
20	Date duration (x 0.1sec)	0.5 - 3 seconds (0.8 seconds=default)	5-30
21	Date Visual effects	0=day only, 1=day & month, 2=day & month with crossfade , 3 = day with flip, 4 = day with slots effect.	0-4
22	Date format	0=UK (day,month), 1=US (month,day)	0 -1
23	Manual Date duration	0=Continuous, (1=Default)	0-5
24	Clock accuracy adjustment	0=no adjustment	0 -99
25	Clock accuracy ±	0=minus, 1=plus	0-1
26	DST zone presets	0=off ,1=UK, 2=EU, 3=US, 4=AUS, 5=NZ, 6=MEX, 7=Custom (see options 27-32)	0 -7

No.	Option	Detail (value in bold is the default)	Range
27	DST start month	DST start month	1-12
28	DST start Sunday	DST start Sunday (0=the last Sunday)	0-4
29	DST start Hour	DST start hour (midnight to 5am)	0-5
30	DST end month	DST end month	1-12
31	DST end Sunday	DST end Sunday (0=the last Sunday)	0-4
32	DST end Hour	DST end hour (midnight to 5am)	0-5
33	Digit cycling effect	0=randomly chosen effect	0-8
34	Digit cycling effect run-times	(0=Off) , 1=every five time cycles, 2=every ten cycles, 3=minute, 4=15mins, 5=30mins, 6=hour, 7=midnight for 5mins, 8=midnight for 59mins.	0-8
35	Digit cycling effect run speed	(8 is slow) 0= random speed	0 - 8
36	Digit cycling run duration	5 Seconds=default	2 - 30
37	Temperature every x cycles	0=disabled	0-60
38	Temperature duration (x0.1sec)	0.5 - 3 seconds (0.8 seconds=default)	5-50
39	Temperature Visual Effects	0=degrees only, 1=degrees and tenths 2=degrees & tenths with crossfade 3=degrees (flip) 4=degrees (slots)	0-4
40	Temperature mode	0=Centigrade , 1=Fahrenheit	0-1
41	Temperature offset adjustment	0=no adjustment (max \pm 1 degree C)	0-10
42	Temperature offset \pm	0=minus , 1=plus	0-1
43	LEDs Maximum brightness	0=leds off, 3=maximum	0-3
44	LEDs HOURS colour	0=off, 8=random 4=default (blue)	0-8
45	LEDs MINUTES colour	0=off, 8=random 2=default (green)	0-8
46	LEDs SECONDS colour	0=off, 8=random 1=default (red)	0-8
47	LEDs DATE colour	0=off , 8=random	0-8
48	LEDs Temperature colour	0=off , 8=random	0-8
49	LEDs EFFECTS colour	0=off , 8=random	0-8
50	LEDs while tubes blanked	0=off , 8=random	0-8
51	LEDs during timed/opto tubes-off	0=off , 8=random	0-8
52	LEDs glow effects during timed/opto off	0=off , 1 = Dim one colour, 2 = One colour fade/sec, 3 = Random colour fade/sec, 4 = Random colour fade/5 secs, 5 = Random colour fade/10 secs, 6 = Random colour fade random delay, 7 = Single colour flicker, 8 = options 1-7 at random, 9 = As option 8 except the random choice changes every minute.	0-9

8. Some Configuration options explained

Option 1 - 12 or 24 hour time selection

You can choose to display the time in 12 or 24 hour mode.
(Note. It always uses 24 hour mode when in time setup.)

Options 2 to 4 – Date settings.

The date settings are saved to memory and also retained while running on battery backup.

Option 5 - Crossfading level

The digits can be set to gently fade between numbers instead of change abruptly.
A setting of 3 gives a nice effect. (0 = no crossfade)
(The crossfade effect looks best with the display at full brightness).

Options 6 to 12 – Time display settings

These settings determine how the time is displayed. You can choose to include Seconds, suppress the hours leading zero, adjust how long each part of the sequence lasts or select special effects such as a rolling “slot machine” display for the minutes.

Option 13 - Mains AC time sync.

If you power the clock with a 9-12 volt AC supply, you can use the mains frequency for timekeeping instead of the crystal oscillator.

(In some countries, the mains frequency timekeeping is very accurate.)

If power fails, the clock will use the crystal until power resumes.

(Note. The USA is considering a one year experiment to allow the mains frequency to vary)

Options 14 to 18 – Timed and Light sensor dimming.

Dimming or turning-off the tubes when not needed helps to make them last longer.

You can set it to occur between set hours or by room light level or both.

Option **18** sets the brightness threshold for dimming the display, if set to a high value the display may start to dim even in a bright room.

When the tubes are completely off, their high voltage supply also turns off to save power.

A short press of either button, will turn the tubes back on again for 1 minute.

Timed brightness settings take priority over light sensor dimming.

When using the timed brightness feature, you can either set the hours range for when you want to dim or turn-off the display e.g. set option **16** to 0 or 1 or **OR** you can set the hours range to be when you want to override the opto-dim feature by setting option **16** to 5 and it will then only allow opto-dimming outside of that time range.

Options 19 to 22 – Date display options.

These control how many time sequence cycles to count before showing the date, how the date is shown, day only or day and month, any special effects and UK or US date format if set to show days and months.

Options 23 – Manual Date display duration.

One short press (less than 2 seconds) of the **SET** button will show the date for the number of display cycles specified by this option.

If this option is set to 0, it will show the date continuously until the **SET** button is pressed again.

Options 24 & 25 – Clock timekeeping accuracy adjustment.

Without adjustment the clock should be accurate to within about ± 1.7 seconds per day.

To adjust, first set the time against a very accurate clock such as a time signal.

After ten days compare the number of seconds error.

e.g. if the clock was 12 seconds slow, set option **24** to 12 and set option **25** to 1 (plus).

(You may subsequently need to make further small adjustments because the accuracy depends on temperature and ageing of the timekeeping crystal).

(These settings have no effect if the clock is using mains AC for timekeeping or during any power failure.)

Options 26 – DST (Daylight Savings Time).

If enabled here, the clock will automatically adjust the hour at the start and end of Daylight Savings Time (**DST**). Pre-sets can be set here for: UK (1), Europe,(2) USA,(3)

Australia(4), New Zealand(5) and Mexico(6).

If there isn't a pre-set for your country or the DST rules change, set this option to 7 and use options 27-32 to define the DST rule.

Options 27 to 32 – Manual DST rule definition.

If option 26 doesn't have a DST pre-set for your country, you can define your own.

(Option 26 must first be set to "7" for Manual DST rule definition)

The latest worldwide DST rules can be found at:

www.webexhibits.org/daylightsaving/g.html

Options **28 & 31** specify the start/end Sunday in the month (1 - 4 = first to fourth)

If DST changes on the **LAST** Sunday, set this option to **0** and it will automatically adjust for months that have 4 or 5 Sundays.

(The current firmware only changes DST on a Sunday (most countries currently use this day)

Options 33 to 36 – Digit cycling effects.

Nixie tube life can be prolonged by regularly cycling through all of the digits.

It can also create some nice effects!

Option 34 determines how often the effects run. Set it to 7 or 8 if an extra long run is ever needed due to some digits beginning to fade.

Options 37 to 42 – Temperature display settings.

Temperature can be shown periodically in a similar way as the date is. It can show degrees only or degrees and tenths and has also effects such as “slots”.

The DS18B20 sensor is factory calibrated to be within ± 0.5 Degrees C.

Options **41** & **42** allow fine tuning of it's accuracy if needed.

(Pressing the set button twice during time display can also be used to constantly show the temperature)

Options 43 to 50 – LEDs settings.

You can choose the colour of the LEDs for the information being shown.

0=off 1=red 2=green 3=orange 4=blue 5=purple 6=cyan 7=white
8=choose colour randomly.

Options 51 & 52– LED settings when tubes are off.

If the tubes are completely off (during timed or opto off) the LEDs colour can be chosen by option **51** as above. (they are off by default)

Option **52** enables some simple LED effects such as flickering, fading to run during this time.

Setting it to **1** provides a very dim glow.

7 does a candle-like flicker.

8 chooses settings 1-7 at random each time the display turns off.

9 randomly changes the setting choice every minute.

9. Accessing the Special Configuration option mode

The second configuration option mode contains settings that are usually less frequently needed to be adjusted.

Press and hold-down the **SET** button during power-on.

The LEDs will glow GREEN, then show the first configurable option (90) as before.

To change an option, follow the same procedure as with the main configuration options.

No.	Option	Detail (value in bold is the default)	Range
90	HV voltage adjust ±	0=Minus 1=Plus	0 -1
91	HV voltage offset	Allows adjustment in 1.24v increments	0 - 20
92	HV load monitor sensitivity	0=default , 1=low sensitivity, 2= HV load monitor off	0 - 2
93	Show firmware version	(not adjustable by user)	0-99
94	Reset all settings to defaults	1=Reset to defaults (factory reset)	0 -1

10. The Special Configuration options explained.

Option 90, 91 - HV voltage adjustments.

The HV voltage should already be around 180 Volts and does not have to be precise.

If you wish to fine-adjust the voltage, you will need to first carefully measure the voltage on pin 1 of the pcb connector.

Set option 90 to increment either minus or plus, then adjust option 91.

The voltage can then be checked again on pin 1 of the pcb connector.

Option 92 - HV load monitor sensitivity.

By default, the HV generator checks for overload and shuts-down if detected.

You can reduce the sensitivity if you are using larger Nixie tubes.

Option 93 – Show firmware version.

Use this option to view the firmware revision. The firmware is not user-upgradable.

Any firmware updates can only be obtained by purchasing a new PIC chip from us.

Option 94 – Reset to defaults.

You can use this to reset everything back to the initial default settings – all user settings will be lost.

11. Specifications

Power supply adapter requirements:

A 9 – 12 Volts AC or DC power adapter (wall-wart) rated at 300 – 500mA .

Power consumption:

Measured with a 12V DC regulated supply: approx 155mA (1.9 Watts) **maximum** with both tubes and LEDs on.

Approx 16mA (0.2 Watts) with all tubes, LEDs and HV off. (Timed/Opto off mode).

(Actual total power consumption when using a mains adapter (wall-wart) may be higher depending on it's efficiency and your mains supply voltage.)

Dimensions:

PCB only - 64mm X 45mm X 1.6mm (2.52" X 1.77" X 0.06") (PCB has rounded corners)
Height (including tubes) approx 76mm (3")

Timekeeping Accuracy:

Unadjusted crystal accuracy is within ± 20 ppm. (about ± 1.7 seconds per 24 hours)
(Crystal frequency will drift with temperature changes and crystal ageing)

Software adjustments can be made to compensate for up to ± 5 seconds per day in 0.1 second per day increments (i.e. Approx ± 50 ppm in 1ppm increments) while the clock is continuously powered.

Temperature Display:

0 - 125°C (the unadjusted accuracy is $\pm 0.5^\circ\text{C}$ between 0 - 85°C)
The displayable Fahrenheit range is 32 - 199°F

Weight: (no case)

Approx 76 Grams (2.7oz)

12. Feedback

We welcome your comments and suggestions. If there is a feature you particularly like or dislike, or you have any feature requests:

Please email using the contact form on the website: unusualelectronics.co.uk