



HOW TO OPERATE YOUR ADVANCED 6 TUBE CLOCK

The clock uses the latest generation of our Nixie Clock electronics and is designed to be as simple to operate as possible, or allow you to delve into many layers of settings if you so wish.

There is a basic setting mode, and a more complex menu system. All settings are carried out with two buttons labelled on the rear of the clock 'H' for Hours and 'M' for Minutes.

First Start and self check

When you start the clock up the very first time, it will start in "Tube Test Mode". This mode is intended to let you see if all the tubes and the backlight are working correctly, by cycling through the digits 00:00:00 to 99:99:99 and varying the backlight LED colours.

Exit Tube Test mode:

Once you have seen that the tubes are okay, you can exit "Tube Test Mode" by pressing the 'H' push button when the display shows 88:88:88 and the clock will then display the software version number on the tubes and then revert to clock mode.

Basic Time Setting

To set the hours – press and hold the **‘H’** button until you see the Hours illuminated with a green flashing light. Release the **‘H’** button and then press it repeatedly to increment the hour or press the **‘M’** button to decrement the hour. Once you have the correct hour, just wait a few seconds for the flashing to stop and the set hour becomes active.

To set the Minutes – press and hold the **‘M’** button until you see the Minutes illuminated with a green flashing light. Release the **‘M’** button and then press it repeatedly to decrement the minute or press the **‘H’** button to increment the minute. Once you have the correct minute, just wait a few seconds for the flashing to stop and the set minute becomes active. Also note, the seconds will zero while you are setting the minutes.

That’s it – you now have the time set and if that’s all you wish from your clock you can disregard the rest of these instructions. It will accurately and reliably keep time for you.

Clock button functions and menu system

Normally the clock is in “Clock Mode” which will show the time. If you press a button for differing lengths, different things will happen.

“Brief Press” (less than 1 second): A temporary display will be shown for 10 seconds. This is useful if you want to know the date, for example. The options here are given in the section “Temporary Display Mode”

“Regular Press” (more than 1 second): If you press the **‘H’** button it will let you set the hours, if you press the **‘M’** button it will let you set the minutes for example as you’ve previously set.

“Dual Press” (Both buttons at once for more than 1 second) this will put the clock into it’s parameter setting mode. In this mode, the **‘H’** button advances the parameter and the **‘M’** button alters the value. The options here are given in the section “Parameter Setting Mode”

“Power up” (With the clock unplugged – Press and hold the ‘H’ button while you plug the clock in) This will effectively put the clock back to its factory settings and start up in “Tube Test Mode”

Temporary Display Mode

While the clock is normally in “Clock Mode” a brief press of the ‘H’ button will cycle through these pieces of information relating to the clock:

Mode	Description	Values
Date	Date. The current date will be shown in the date format you selected, if the date has been set	Example 17:06:21
LDR	Ambient Light Reading. If fitted, this shows the current ambient light reading from the LDR (light dependent resistor). It is a normalized value, and goes between 100 (dark) to 999 (bright). This controls the dimming of the tubes.	Example 09:99:00 100: darkest 999: brightest
Version	Display the software version number. The format will be “VV:vv:rr”, where major version is “VV”, minor version is “vv” and revision is “rr”	Example 01:23:00
IP part 1	If the WiFi module is installed you will see the first half of the clocks IP address here	Example: 19:21:68
IP part 2	2nd part of the IP address for the clock Example shown is 192.168.43.4	Example: 04:30:04
Mux Speed	This shows the refresh rate of the display. It varies a little based on the exact workload, but is usually about 150 impressions per second	Example: 00:00:95

Parameter Setting Mode

To enter setting mode, press both buttons together for more than 1 second (“dual press”). The “RGB back light” LEDs will turn blue, with the value to be altered indicated in green with the nixie tube flashing

Pressing and releasing the ‘H’ button advances the particular parameter, and briefly pressing the ‘M’ button changes the value of the parameter.

When you finish going through all the parameter numbers, the clock returns to normal time display mode.

To exit the setting mode before going through all the parameters, press and hold the ‘H’ button for more than 2 seconds (“long press”). The “RGB back light” LEDs will return back to their normal operation.

Alarm Clock function

If you have the alarm module installed, the clock is able to have an alarm time set. Once set the colons will do a ‘ double flash ‘ to indicate the alarm is active. When the alarm sounds, the clock will produce an alarm tone and flash the backlight alternate colours for 1 minute before automatically silencing. Pressing either the ‘H’ or ‘M’ button will also silence the alarm.

The Alarm will then automatically reset for the next day until you turn off the alarm function with parameter 11

Parameter	Description	Values
	<p>Clock mode. This is the normal mode and displays the time. It is the normal start up mode of the clock. If you do nothing. The clock is in this mode.</p> <p>In this mode a short press cycles through the values given in “Time Display Mode”, but always returns to the standard time display after 5 seconds.</p>	
<p>Time and Date Settings - When you press both ‘H’ and ‘M’ for more than 1 second, these are the first Parameters presented if there is no WiFi module fitted</p>		
Zero Seconds	<p>Zero Seconds. A brief press of the ‘M’ button will zero the seconds. If you wanted to synchronise the time for example</p>	00:00:XX
Press ‘H’ again	<p>Set Day. Each brief ‘M’ press will advance the day. The day roll over back to one after reaching the maximum number of days in the month.</p> <p>Depending on the date format you have set, this will be shown in day: month format, or month:day format.</p>	XX:00:00
Press ‘H’ again	<p>Set Month. Each brief ‘M’ press will advance the month. The month roll over back to zero after reaching 12.</p> <p>Depending on the date format you have set, this will be shown in day: month format, or month:day format.</p>	00:XX:00
Press ‘H’ again	<p>Set Year. Each brief ‘M’ press will advance the year. The year roll over back to 2015 after reaching 2099.</p>	00:00:XX

These initial operations are just for zeroing the seconds and setting the date, as such the parameter number is not shown on the first two tubes, just the value to be altered with the **'M'** button is illuminated flashing green. The basic time setting can also be done with just the **'H'** and **'M'** buttons as detailed in the 'Basic Time Setting' section.

The clock will not display the date by default, until a value has been set for it. Once a date has been set, the clock will then display the date once a minute. The next set of parameters just continue on, once you have set the year and they then relate to the functions of the clock that you can adjust and customise.

The 2 tubes on the left will now have green highlight, with the digits indicated flashing, to show you what the parameter number is as in the following table. Pressing the **'H'** button advances the parameter number, and pressing the **'M'** button changes the value of that specific parameter.

BASIC SETTINGS		
Parameter	Description	Values
07	12 or 24 hour time. The hours are displayed in 12 or 24 hour mode.	"1" = 12 hour "0" = 24 hour default: 0
08	Blank leading "0". Blank out the leading "0" from single digit hours.	"1" = blank "0" = don't blank default: 0
09	Scroll back. Use the scroll back (rapid count down) effect when changing from "9" to "0".	"1" = enable "0" = disable default: 1
10	Fade. Use cross digit fading.	"1" = enable "0" = disable default: 1

Parameter	Description	Values
11	Alarm Clock function. This will turn on the clocks alarm mode. Once the alarm is set, the colons will double flash to indicate alarm active. Once the alarm is sounding, pressing either 'H' or 'M' on the rear of the clock will silence the alarm until the next day.	"0" = disable "1" = enable Default: 0
12	Set alarm time Hour. This is where you set the hour for the time you want the alarm to sound, note it has to be in 24hr format	00 - 23 24 hour mode
13	Set alarm time Minutes. This is where you set the minutes for the time you want the alarm to sound. Used in conjunction with parameter 12	00-59
14	Date format. Set the format that the date is displayed in.	"0" = YY.MM.DD "1" = MM.DD.YY "2" = DD.MM.YY default: 2
15	<p>Display blanking. To preserve the tubes, you can set the display to be blanked or dimmed with parameter 22</p> <p>Options:</p> <ul style="list-style-type: none"> • "0" = "never": Don't use blanking. • "1" = "Weekends": Blank at weekends. • "2" = "Week days": Blank on week days. • "3" = "Always": Always use blanking. • "4" = "Hours": Blanks between the start and end hour every day. • "5" = "Hours or weekends": This blanks all day during the weekends and between the start and end hour every other day. • "6" = "Hours or week days": This blanks all day during the week days and between the start and end hour every other day. • "7" = "Hours on weekends": This blanks between the start and end hour on weekends. • "8" = "Hours on week days": This blanks between the start and end hour on week days. 	"0" = Don't blank "1" = Weekends "2" = Week days "3" = Always "4" = Hours "5" = H or weekends "6" = H or week days "7" = H on weekends "8" = H on week days default: 0

Parameter	Description	Values
16	Blanking Hour Start. Hour blanking will start at this hour, on the days set by the Display Blanking Mode. If the display blanking mode does not use hours, this setting is not shown.	Default: 00
17	Blanking Hour End. Hour blanking will end at this hour, on the days set by the Display Blanking Mode. If the display blanking mode does not use hours, this setting is not shown.	Default: 07
18	Anti Cathode Poisoning night suppression. The ACP which runs during the night lights the digits up at full brightness, and some people might find this disturbing. Using this setting, you can stop ACP happening when the display is fully dimmed (e.g. at night)	"1" = don't do ACP when dimmed "0" = do ACP always default: 1
19	Anti Cathode Poisoning Frequency. The ACP runs by default every 10 minutes, but this can be changed or turned off.	"0" = No ACP "1" = ACP every minute "2" = ACP every 10 mins "3" = ACP every hour default: 2
20	Colon operation. The Colons that flash between the digits can be set to work in different ways	"0" = Colons Off "1" = Slow flashing "2" = Fast flashing "3" = Constant on default: 1

SPECIAL EFFECTS SETTINGS

Parameter	Description	Values
21	Use ambient light sensor If fitted. If you disable the sensor, the tubes will always work at maximum brightness.	"1" = enable "0" = disable default: 0

Parameter	Description	Values
22	Blank Mode. You can set the tubes, the LEDs or both the tubes and the LEDs to be blanked when in blanking mode.	"0" = tubes "1" = LEDs "2" = tubes and LEDs "3" = Dim tubes & LEDs default: 2
23	Fade Speed Slower. Each short press will make the fade speed between digits slower.	Default: 50 Max: 200 Min: 20
24	Fade Speed Faster. Each short press will make the fade speed between digits faster.	Default: 50 Max: 200 Min: 20
25	Scroll-back Speed Slower. Each short press will make the "scroll-back" speed slower.	Default: 4 Max: 40 Min: 1
26	Scroll-back Speed Faster. Each short press will make the "scroll-back" speed faster.	Default: 4 Max: 40 Min: 1
27	Date display You can have the date shown automatically once per minute for about 5 seconds	"1" = enable "0" = disable default: 1

RADAR SENSOR SETTINGS - Only applicable if radar sensor installed

Parameter	Description	Values
28	<p>Radar Timeout Longer. You can set the amount of time that the clock will wait before blanking the display, in seconds.</p> <p>This setting will be shown after you release the button. Only the setting number will be shown while you hold the button.</p>	Default: 300 Max: 3600 Min: 60
29	<p>Radar Timeout Shorter. You can set the amount of time that the clock will wait before blanking the display, in seconds.</p> <p>This setting will be shown after you release the button. Only the setting number will be shown while you hold the button.</p>	

Parameter	Description	Values
30	Radar Do Not Disturb Mode. If you set this setting, the Radar module will not interrupt the blanking period. If you leave this option unset, the Radar module will override the blanking times.	"1" = do not disturb "0" = normal default: 0

BACK LIGHT SETTINGS

Parameter	Description	Values
31	<p>Back Light Mode. This sets the mode of the back light.</p> <p>"Fixed" mode will show the back light colour according to the Red, Green and Blue channel intensities.</p> <p>"Pulse" will make the intensity of the back light "pulse", brightening for a second and then darkening for a second, but always respecting the relative intensities set by the Red, Green and Blue channel intensities.</p> <p>"Cycle" fades the back lighting randomly, and does not use the Red, Green and Blue channel intensities. These settings will be skipped if cycle mode is selected.</p> <p>"Colourtime" mode shows a different specific colour for each value shown on the digit, loosely following the rainbow.</p> <p>Options "0", "1", "2" and "6", do not dim with the Nixies. Options "3", "4", "5" and "7" do if the LDR is set to operate</p>	<p>"0" = Fixed "1" = Pulse "2" = Cycle "3" = Fixed/Dim "4" = Pulse/Dim "5" = Cycle/Dim "6" = "Colourtime" "7" = Colourtime/Dim default: 0</p>
32	<p>Red Channel Intensity. Sets the maximum intensity of the red channel back light. This will be dimmed according to the display dimming.</p> <p>If you are in cycle mode, this setting will be skipped.</p>	<p>Default: 15 Max: 15 Min: 0</p>
33	<p>Green Channel Intensity. Sets the maximum intensity of the green channel back light. This will be dimmed according to the display dimming.</p> <p>If you are in cycle mode, this setting will be skipped.</p>	<p>Default: 15 Max: 15 Min: 0</p>

Parameter	Description	Values
34	<p>Blue Channel Intensity. Sets the maximum intensity of the blue channel back light. This will be dimmed according to the display dimming.</p> <p>If you are in cycle mode, this setting will be skipped.</p>	<p>Default: 15 Max: 15 Min: 0</p>
35	<p>Cycle Speed. If you are in cycle mode, this controls the speed at which the colours cycle. The higher the number, the slower the colours will change.</p> <p>If you are not in cycle mode, this setting will be skipped.</p>	<p>Default: 10 Max: 64 Min: 4</p>

SPECIAL SETTINGS - these can adversely affect display operation, only adjust if requested.

Parameter	Description	Values
36	<p>Increase Minimum dim. This setting allows you to increase the minimum brightness you want to have when the clock is fully dimmed.</p>	<p>Default: 200 Max: 500 Min: 100</p>
37	<p>Decrease Minimum dim. This setting allows you to decrease the minimum brightness you want to have when the clock is fully dimmed.</p>	<p>Default: 200 Max: 500 Min: 100</p>
38	<p>WiFi Discoverable. If the WiFi module is installed, and you want to make it visible again to reconfigure, then set this parameter to 1 to then reset the WiFi configuration.</p>	<p>“1” = enable “0” = disable default: 0</p>
39	<p>Reserved. This is basically a spare setting for future functions that currently doesn't do anything.</p>	

INFORMATION SETTINGS - only shows a value, cannot be altered

Parameter	Description	Values
40	<p>Digit Test. Will roll through all the digits on all locations to check that the display is healthy</p>	

Display Blanking Mode

During display blanking mode the tubes will be off or dimmed depending on the display blanking settings, but the colons will continue to run so you know the clock is still running.

You can configure the display to blank at weekends, during week days, always or never (the default). Also you are able to define hours during which to blank. For example I have a setting saying that the clock is blanked on weekdays between 7am and 4 pm, while I am out at work. At weekends, the display runs all the time.

You are also able to override the blanking. Press the **'H'** button while the clock is blanked, and the display will come on again. Pressing the button will display the time for about a minute (60 seconds, but the display is only blanked on the minute change).

If you press the **'H'** button multiple times within 5 seconds, the blanking will stay off for longer periods:

- 1 Press: 10 seconds
- 2 Presses: 1 hour
- 3 Presses: 4 hours

Radar Motion Detector Blanking

If you have a Radar motion detector installed, you can have the clock blank while there is no motion near it, and have it turn on only when someone is near the clock to see it. This saves power and greatly extends tube life, especially if the clock is in a location such as a bedroom.

If the clock has the blanking set, then parameter 30 (do not disturb) will override the motion detection, so if you get up in the middle of the night, the clock will not come to life when it detects motion

Factory Reset

To reset the clock back to initial settings, hold down the ‘H’ button while powering on. The LEDs will rapidly flash some colours to signal that the reset has been done.

Everything will be reset back to the factory default state, and the clock will go back to “Tube Test Mode”.

SPECIFICATIONS

- Latest technology, highly reliable surface mount construction, low power consumption.
- Long tube life: Anti Cathode Poisoning (ACP) and configurable blanking with optional Radar sensor makes sure that the tubes will stay healthy for many years with no intervention from you.
- The direct drive display and automatic dimming used in this design greatly extends the life of the tubes. Some other designs run the tubes too “hard”, and this causes a rapid degradation in the useful life of the tube.
- All settings are stored in non-volatile memory. Once they are set, they are remembered forever, or until you change them again.
- RGB back lighting allows you to set the colour of the back lighting to practically any colour you desire.
- Ambient light sensing if fitted, with automatic tube dimming, which sets the tube and LED brightness according to the light conditions. This also increases tube life.
- Absolutely silent operation. Some Nixie clocks emit an irritating “buzz” or “hiss” which is especially annoying if you keep the clock in a bedroom.
- Automatic week day or weekend blanking, extends the life of tubes even further
- Optional Alarm clock mode and optional WiFi connectivity for time update and setting.
- Automatic time of day blanking, can blank between a start hour and an end hour, on week days, weekends or every day

- Configurable suppression of Anti Cathode Poisoning when the clock is fully dimmed. In the middle of the night, all the digits lighting up at full brightness could be disturbing. You can choose to stop ACP when the clock is fully dimmed
- Highly accurate using separate RTC (Real time clock) module
- Battery backed, temperature compensated, high accuracy clock. The accuracy is Accuracy $\pm 2\text{ppm}$ from 0°C to $+40^{\circ}\text{C}$. (Maximum 1 minute per year).
- The battery life should be 3 years in normal use.
- Retains the date and time even when turned off (not just for a few minutes, but for as long as the battery lasts)
- Leap Year Compensation Valid Up to the year 2100

The Clock is based on the Arduino platform, and is a result of a collaboration between Bad Dog Designs, and Ian Sparkes from Nixieclocks.biz who made this possible!

Maintenance:

The Nixie tubes are good for approximately 20 years, some versions of clock will have tubes that can be unplugged and swapped, other clocks will have tubes that will need to be returned to the workshop to be replaced. There is no real maintenance that is required other than periodic dusting or polishing of the case.

Warranty:

All clocks and tubes come with a year's warranty from purchase date as standard. Tube failures are rare, even though the tubes are some 40 years old before they are used by us to make into a clock.



Bad Dog Designs Nixie Clocks Ltd

Unit 2
Pillaton Hall Farm
Pillaton
Penkridge
Staffordshire ST19 5RZ

Telephone: +44 (0)1543 732 734

Email Address: paul@bad-dog-designs.co.uk