

Neonixie 4 Digit Nixie Clock Controller

Thank you for purchasing our 4 Digit Nixie Clock Controller. Our clock controller is user friendly and has many of the features most requested in a nixie clock:

- **12/24 Hour mode**
- **Digit cycling (slots) options.**
- **Cathode poisoning prevention routines.**
- **Power failure backup, using optional memory backup capacitor.**
- **PWM brightness control.**
- **Timed dimming of tubes.**
- **Software adjustable crystal.**

Assembly is easy; just follow the schematic on the back of this sheet. A separate sheet listing all user adjustable options is also provided. If you have any questions, please don't hesitate to contact us at nixietubes@neonixie.com

A user supplied backup capacitor (C2) can be optionally installed to provide backup in case of a power failure. A 1 farad capacitor will provide approximately 16 hours of backup time, a 0.33 farad approximately 5 hours.

OPERATION

Once powered up the clock will go through a short lamp test routine and will start with a time of 12:00 PM in 12 hour mode. The clock is adjusted using two buttons, Set and Advance.

SETTING THE TIME

Hold down the Set button for a few seconds, the hours or minutes will start to blink. You are now in the time set mode. Pressing the Set button chooses between hours and minutes. Pressing the Advance button will increment the hours or minutes. Holding down the Advance button will quickly advance the time.

When adjusting minutes, the clock will reset the seconds counter to 0 at each increment. Seconds are not reset when adjusting hours. The clock will return to normal operation if no buttons are pressed for a few seconds.

SETTING USER OPTIONS

Several user options are available. These options are stored in non-volatile EEPROM and will be maintained even after a power outage or long term storage of the clock.

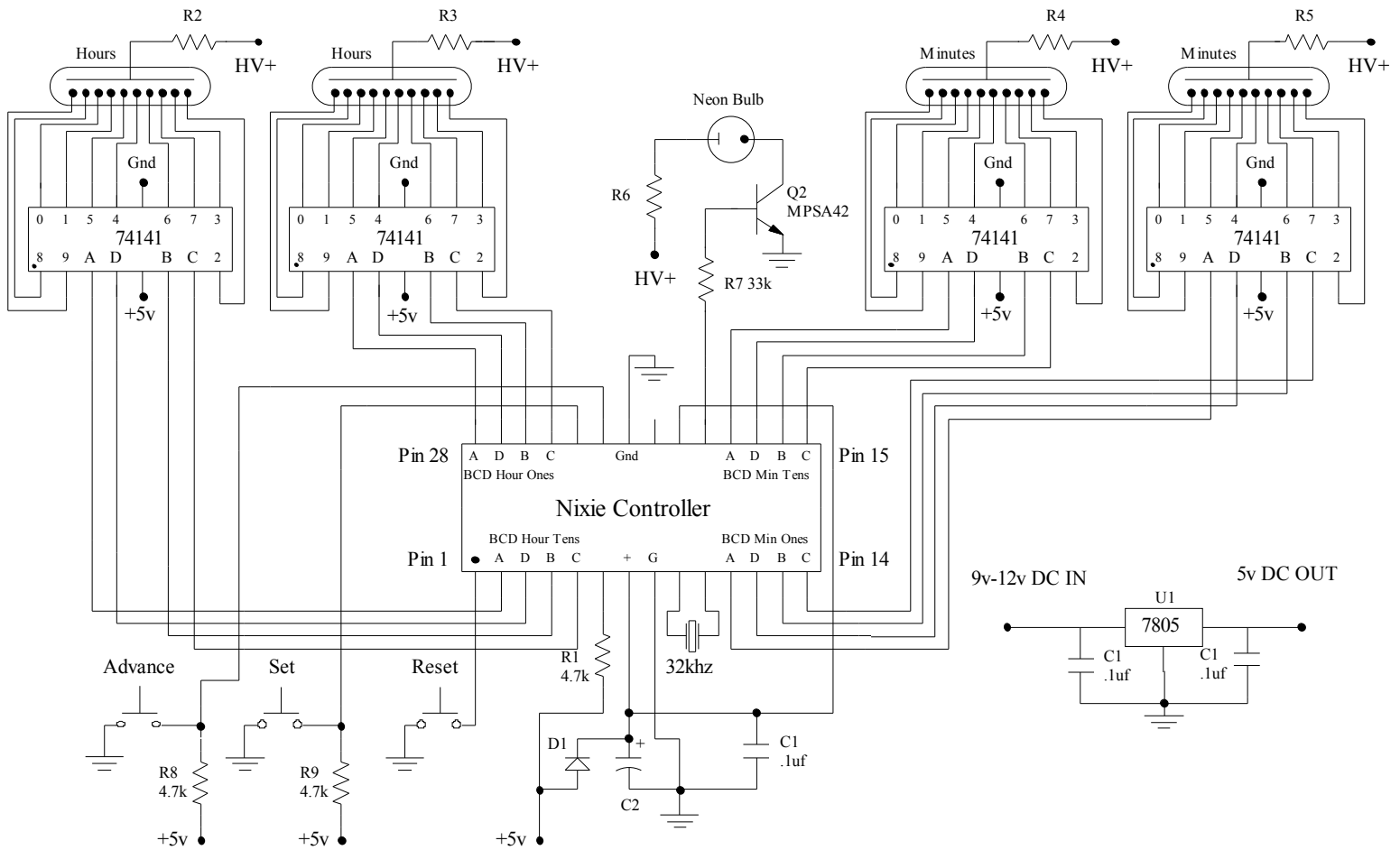
The clock options menu can be accessed by holding down both SET and ADVANCE buttons for a few seconds.

Each option is indicated by an option number displayed on the tens digit of the hours indicator, the left most nixie tube. Option number 10 and above are displayed on both hour tubes. The Set button is used to change option numbers, and the Advance button is used to alter the option.

You can clear the EEPROM to its factory defaults by resetting the clock while holding down both Set and Advance buttons. The clock will blink the display with all zeros to indicate the EEPROM is being reset.

For values with large ranges, the Advance button will alternate between incrementing and decrementing the value upon each press/release. Options with just a few values will increment on each press and upon reaching the last value will reset back to the first.

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Pin	Description	Notes
1	Reset	
2	BCD Hour Tens, A	
3	BCD Hour Tens, D	
4	BCD Hour Tens, B	
5	BCD Hour Tens, C	
6	Power Fail Resistor	REQUIRED
7	5v power	
8	Ground	
9	Crystal	32 kHz crystal
10	Crystal	32 kHz crystal
11	BCD MIN Ones, A	
12	BCD MIN Ones, D	
13	BCD MIN Ones, B	
14	BCD MIN Ones, C	

Pin	Description	Notes
15	BCD MIN Tens, C	
16	BCD MIN Tens, B	
17	BCD MIN Tens, D	
18	BCD MIN Tens, A	
19	Blinking Colon Drive	
20	5v power	
21	No Connection	
22	Ground	
23	Advance Switch	
24	Set Switch	
25	BCD Hour Ones, C	
26	BCD Hour Ones, B	
27	BCD Hour Ones, D	
28	BCD Hour Ones, A	

Construction Notes

- R1 (4.7K), the power fail detect resistor is required for operation, even if no backup capacitor is used.
- If a backup capacitor (C2) is not used, omit D1 and wire pin 7 (power) directly to 5v.
- If a backup capacitor is used (C2) we recommend a 1N5817 Schottky Diode for D1.
- Install decoupling capacitor C1 as close as possible to pin 7 (power).
- We recommend using a watch crystal with a 12.5pf load capacitance, solder directly to controller pins.
- High Voltage for most nixie tubes is 170-180volts. Adjust anode resistors to match your current requirements.
- Adjust anode resistor value (R6) for your particular neon bulb.

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USER OPTIONS

- **Option #1: 12/24 Hour mode.**

Press the Advance button to change between 12 (default) or 24 hour modes.

- **Option #2: Digit cycling.**

This option, in addition to providing an interesting display, is used to prevent cathode poisoning of digits not used in the normal operation of a clock. It will cycle all the digits at a predefined time.

The slot settings are an interesting digit cycle mode, similar to a slot machine. If enabled, the clock will cycle in this mode for the first 10 seconds of each minute. The stop sequence of the 'slot machine' can be controlled by Option #3.

0: No cycling takes place (Default value).

1: Cycles at midnight.

2: Cycles at the top of every hour.

3: Slots, every minute, random digit cycling

4: Slots, every minute, incremental digit cycling

- **Option #3: Slot Stop Setting**

This option controls the method of stopping the slot cycling if enabled.

1: Left to right (default).

2: Right to left.

3: All at once.

4: Random.

- **Option #4: Default brightness.**

This controls the default brightness of the clock.

10 to 100% in 10 percent increments (default 100%).

- **Option #5: Timed Dimming, Brightness.**

This is the brightness level that is used for timed dimming. This is used in conjunction with option 6 and 7 to control timed dimming of the tubes.

0 to 100 %, 0% will turn off tubes (default 50%).

- **Option #6: Timed Dimming, Start Hour.**

This is used to control the start hour of the timed dim.

0-23, 24 hour time format (default 0).

- **Option #7: Timed Dimming, Duration.**

This option specifies the number of hours the timed dimming will be in effect.

0-24 (default 0).

- **Option #8: Cathode Poisoning Prevention.**

Used to turn on and off the Cathode Poisoning Prevention option of the clock, used in conjunction with options 9 and 10.

0: Disable (default).

1: Enable.

2: Enable, override brightness setting, run at 100%

3: Enable, override brightness setting, run at 50%

- **Option #9: Cathode Poisoning Prevention, Start Hour.**

Specifies the start hour of the Cathode Poisoning Prevention feature.

0-23, in 24 hour time format (default 3).

- **Option #10: Cathode Poisoning Prevention, Duration.**

Specifies the duration in hours for the Cathode Poisoning Prevention feature.

1-24 hours (default 1).

● **Option #11: Software time correction.**

This option can have a value from -99 to +99. Negative values are indicated by lighting the center colon indicator. Use the Advance button to adjust this value.

-99 to +99 (default +14)

NOTES ON SOFTWARE TIME CORRECTION

The software time correction value entered by the user refers to the number of seconds per week of correction. For example, if the clock is slow 14 seconds per week, a value of +14 entered into the software correction option will compensate for this drift.

Software time correction is preferred over physically adjusting the crystals load capacitance, since adjustment can be done with no tools by the end user. Software time correction also allows the user to easily compensate for crystal aging and for adjusting the clock for accuracy in different temperature environments.

When taking measurements to find the proper correction value, remember that average temperature plays a large role in the clocks accuracy. A clock corrected to operate precisely at an average temperature of 50 degrees, will drift slightly if operated at 80 degrees, and vice-versa.

When taking time readings for software correction, be sure to use an accurate source. Accurate sources include an atomic clock that has recently synced, a PC that is synced to a time server, or a GPS receiver. The controller is shipped with a default value of +14 seconds.

Once software adjusted, and kept in a controlled environment with minimal temperature drifts, such as an air conditioned or heated home, accuracies of greater than 1 second per week can be achieved.

NOTES ON DISPLAY PRECEDENCE

Since many display options can be enabled simultaneously by the user, the display must give precedence to certain options to prevent conflicts. Listed below is the display precedence, from highest to lowest.

- Time Setting menu, or Options menu.
- Cathode Poisoning Prevention, with brightness override
- Timed Dimming of Display
- Cathode Poisoning Prevention, no brightness override
- Digit Cycling (slots, etc).

Example 1: If you have set the timed dim to turn off all tubes, you can still access the options menu to modify options, even when the tubes are off, since the options menu has a higher precedence for display.

Example 2: Digit cycling and Cathode Poisoning Prevention are both turned on, the Cathode Poisoning Prevention will get precedence once it's run time is reached, and will override the digit cycling.

NOTES ON CATHODE POISONING AND PREVENTION

Cathode poisoning occurs when inactive cathodes in the nixie tube get coated with material released or sputtered from the active cathodes. Cathode poisoning shows up as dark or dim spots in the effected digit. Most all nixie tubes are vulnerable to this effect in various degrees.

Clocks are especially vulnerable to cathode poisoning because the tens tube of the hour and minute do not utilize all digits during normal operation. If precautions are not taken, you can expect to see cathode poisoning in unused digits in several weeks to a few months of clock operation. Cathode poisoning is not a defect in the nixie tube.

To prevent this from occurring, you have several options. The Digit cycling mode of this clock, namely the 'slots' option which runs every minute, should be able to prevent most all cathode poisoning.

If you do not wish to utilize the slots cycling, or the tubes require more cycling, a more aggressive cathode poisoning prevention method is provided that will cycle digits for a chosen amount of hours per day.

This option also has a full brightness override, which should be able to recover tubes that are already effected by light cathode poisoning.