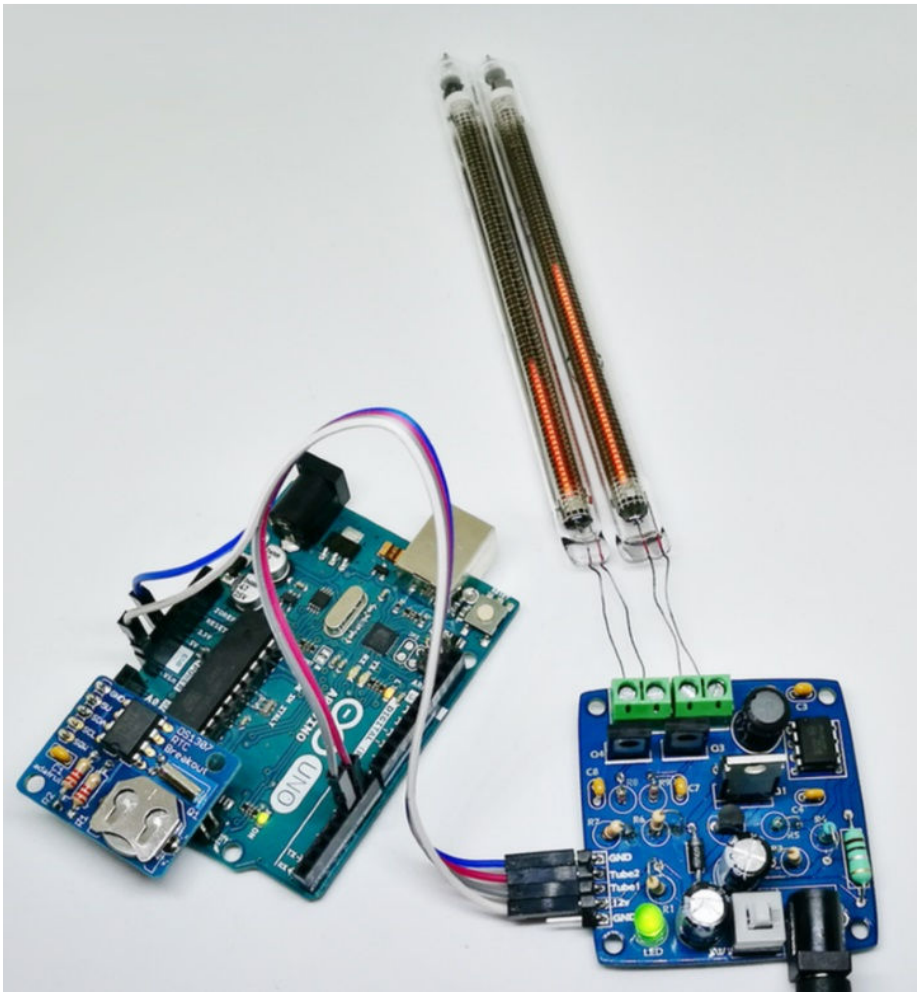
Assembly Instructions
And
User Guide

DuoDrive Nixie Bargraph Kit



REVISION HISTORY

Issue Number	Date	Reason for Issue
1	12 December 2017	New document

1. INTRODUCTION

1.1 About DuoDrive Nixie Bargraph Driver

IN-9 tubes are special type of 'Nixie Tube'. In fact, they are not really Nixie Tubes at all as they are not a numerical indicator. This simple kit allows easy control of 1 or 2 tubes, just by inputting a 0 to 5V analogue, or PWM signal for each tube.

1.2 SAFETY

DANGER: The PCB includes a switched-mode voltage booster circuit. This generates nominally 150 Volts DC. Assembly may only be undertaken by individuals who are suitably qualified and experienced in electronics assembly, and are familiar with safe procedures for working with high voltages. If in doubt, refer to a suitably qualified engineer before proceeding.

The voltages generated by this circuit can give a potentially LETHAL ELECTRIC SHOCK.

DISCLAIMER: This product is supplied as a kit of parts, intended only for suitably qualified electronic engineers, who are suitably qualified and experienced in electronics assembly, and are familiar with safe procedures for working with high voltages. The supplier, his agents or associates accept no liability for any damage, injury or death arising from the use of this kit of parts.

This is not a finished product, and the person assembling the kit is responsible for ensuring that the finished product complies with any applicable local regulations governing electrical equipment, eg. UL, CE, VDE.

2. TOOLS AND EQUIPMENT REQUIRED

2.1 Tools required to assemble the PCB.

The following tools will be required to assemble the PCB:

- Soldering iron with a small tip (1-2 mm).
- Wire cutters to trim the excess component leads after soldering. (TIP: A small pair of nail clippers works very well for this function).
- Wire strippers (TIP: A small pair of scissors is quite suitable).
- Multimeter for voltage tests and for identifying the resistors.

2.2 Materials you will need.

Solder – lead / tin solder is highly recommended. **USE LEAD/ TIN SOLDER!**.

Lead free solder, as now required to be used in commercial products in Europe, has a much higher melting point and can be very hard to work with.

Desoldering wick (braid) can be useful if you accidentally create solder bridges between adjacent solder joints.

2.3 Other items you will need.

The clock kit does not include a power adapter.

The following type of adapter should be obtained and used with the kit:

Output 12V DC regulated, minimum power output capability of 500 mA

Output plug: 2.1mm pin, centre positive.

A suitable adapter is shown below:

3. LIST OF COMPONENTS

3.1 Table of Electronic Components

Circuit Designation	Part Description
Resistors	
R1	10 KΩ, ¼ Watt
R2	0.1 Ω, ¼ Watt
R3	1 KΩ, ¼ Watt
R4	510 KΩ, ¼ Watt
R5	4.3 KΩ, ¼ Watt
R6, R7	10 KΩ, ¼ Watt
R8, R9	220 Ω, ¼ Watt
Capacitors	
C1	470 uF
C2, C3	100 nF
C4	1 nF
C5	10uF
C7, C8	100 nF
Transistors	
Q1	IRF640
Q2	BC516 or BC560
Q3, Q4	MJE340
Diodes	
D1	SB140
D2	UF4007
Integrated Circuit	
U1	MC34063
Miscellaneous	
L1	470uH inductor
SW1	Push Button Switch
LED	5mm LED
DC Connector	2.1mm DC Connector
Pin Header	5 Way pin header
Screw Terminals	2 X 2 way screw terminals

It is recommended that the kit is checked against the list above, to ensure all parts are present before commencing assembly. Don't be alarmed if there are some extra components, as some component bags are shared between different kit types.

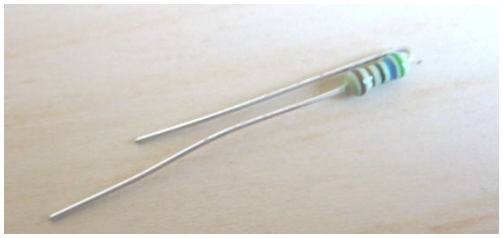
4. ASSEMBLY OF THE TUBE PCB

DUE TO PRODUCT DEVELOPMENT AND IMPROVEMENTS, YOUR PCB MAY NOT LOOK EXACTLY LIKE THE ONE PICTURED.

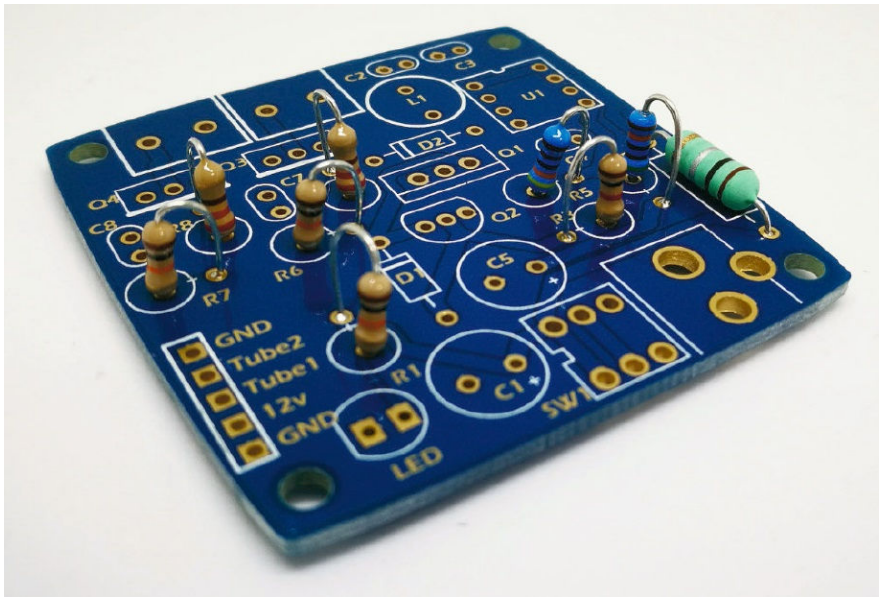
Proceed according to the tube type you will use with your kit.

4.1 Resistors

Forget about the resistor colour chart, and use a multimeter to identify the resistors. It is a more reliable method.
To save space, most of the resistors are mounted vertically. Bend one lead cleanly 180 degrees at the body as shown:

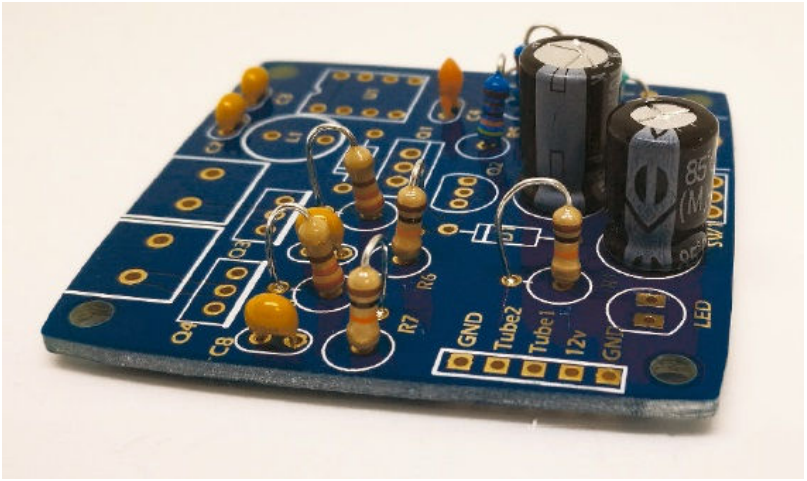


Then feed the leads into the PCB, with the body of the resistor central to the circle marked at each resistor location.



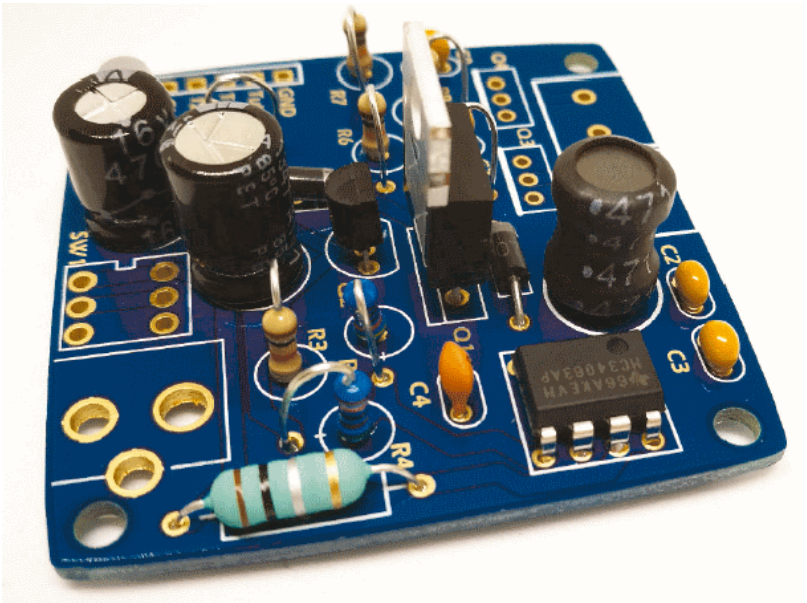
4.2 Capacitors

C1 and C5 are polarised components. The longest lead goes in the hole marked +.



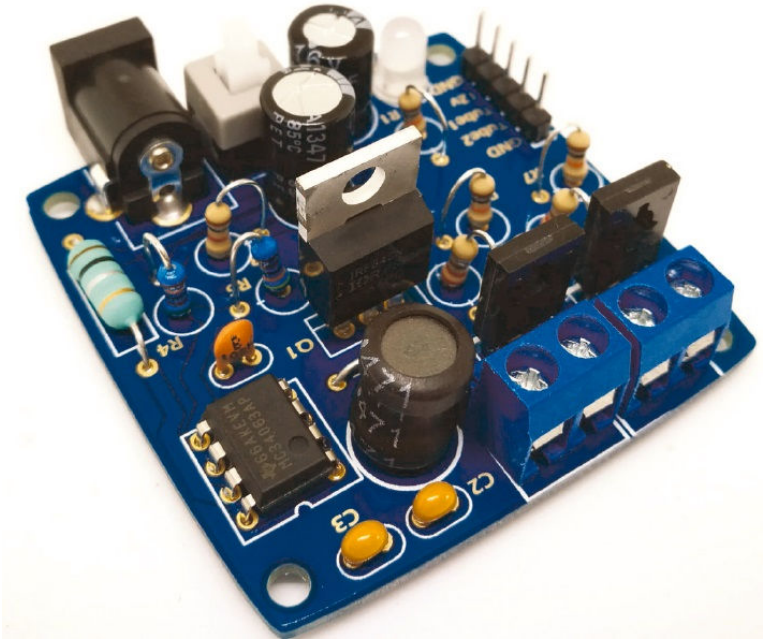
4.3 D1 (SB140)
D2 (UF4007)
Q1 (IRF640)
Q2 (BC516 or BC560)
U1 (MC34063)

All these components are polarised. The white band on the diodes should match the white band on the PCB.



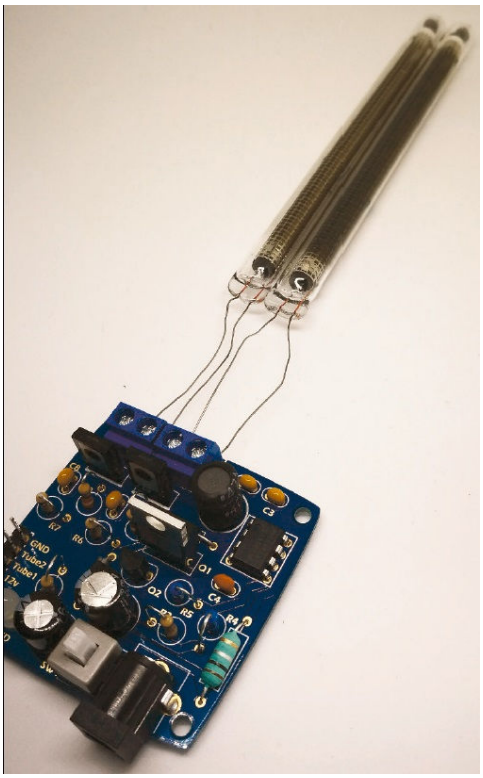
4.4 Q3, Q4 (MJE340)
LED
Screw terminals
Switch
5 Way header
DC Socket

Take care that the flat edge of the LED matches the flat marking on the PCB



5. HOW TO USE THE MODULE

The Nixie tubes will only work in one polarity. With the front of the tube upward from the table insert the wires and screw into place.



If you apply power at this point you will not see the tubes light up, however, there WILL be high voltage on your board, so you must be very careful not to touch the board.

In order to see the tubes glow you will need to connect an Arduino, microcontroller, Raspberry Pi etc to the Tube1 and Tube2 inputs on the PCB.

A very simple test is to connect these to two Arduino pins, connect the ground pin to the ground on the Arduino and use digitalWrite to set them high. This will set both Tube1 and Tube2 to 5v, and the tubes will light up to their maximum height.

Note that on the first use of the tubes, they may not fully light as they need to be 'burned in'. Leave them on until the glow creeps up to the end of the tube.

Once your tubes are burnt in, you are ready to try something more interesting. On our downloads page are a couple of example Arduino sketches to help you get going.

When you look at these sketches you will see that they do not use the default PWM function, They in fact use the PWM frequency library. This is for an important reason. Unlike an LED, which can react extremely quickly to changes, the Neon glow discharge inside a Nixie tube behaves quite differently. Making sudden changes can cause the bottom of the plasma to no longer be locked to the bottom of the tube, and instead, float in the middle. This is very undesirable. So in order to avoid this, the PWM signal is filtered before the controlling transistor. This low pass filter smoothes the PWM signal but also limits how quickly changes to the tube height can be made. The standard Arduino PWM function uses a very slow frequency of 500Hz. Using a low pass filter for such a low frequency means it is also difficult to make quick changes to the tube height. For this reason, we have opted to use the PWM frequency library, this allows us to use a much higher PWM frequencies.

11. CIRCUIT DIAGRAM