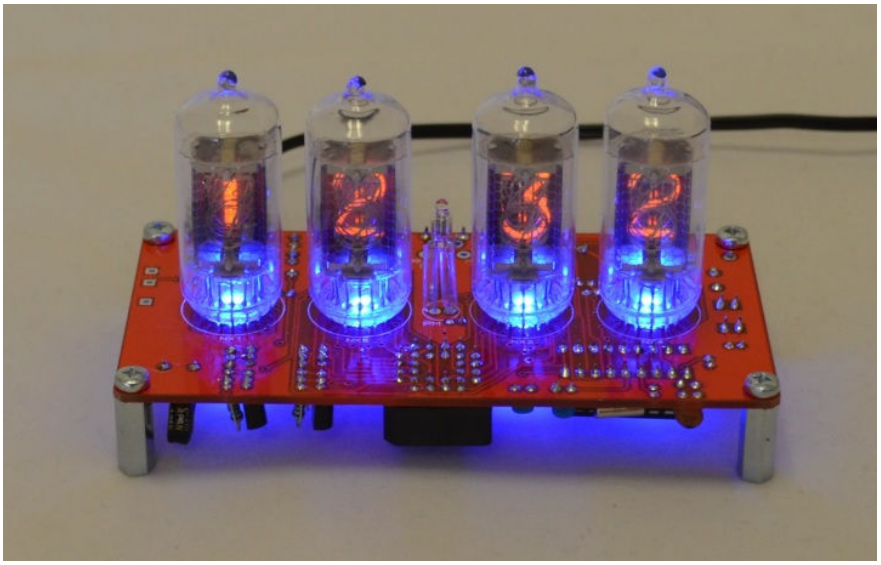
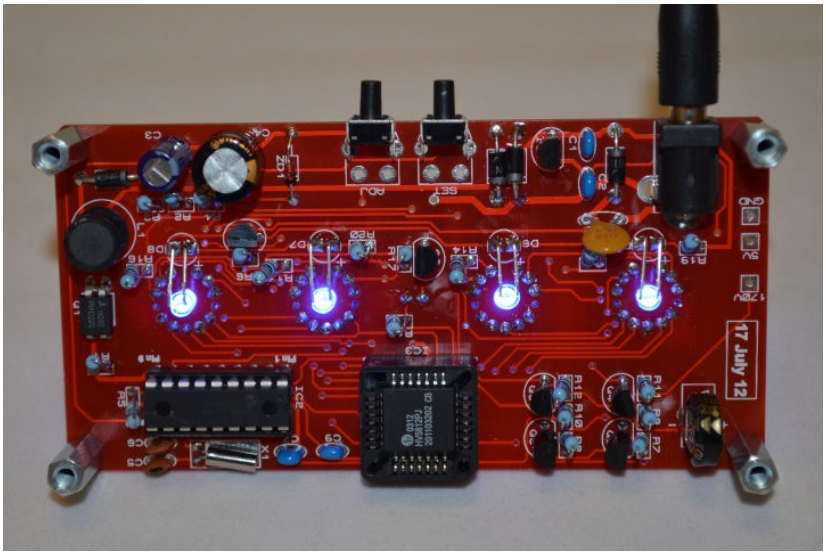
Assembly Instructions
And
User Guide

Nixie Clock Type 'Quattro'





REVISION HISTORY

Issue Number	Date	Reason for Issue
3	01 Nov 2018	New diode for D2, new ZD1
2	8 Sept 2012	Errors corrected
1	27 July 2012	New document

1.1 Nixie Quattro - Features

Nixie clock type 'Nixie Quattro' has the following features:

- Hours, Minutes and Seconds display
- 12 or 24 hour modes
- Uses a Quartz Crystal Oscillator as the timebase
- Programmable leading zero blanking
- Supercapacitor backup. Keeps time during short power outages
- Simple time setting using two buttons
- Programmable leading zero blanking
- Five programmable neon colon settings (Flashing AM/PM indication, illuminated AM/PM indication, both flashing, both on, both off)
- Seconds can be reset to zero to precisely the set time
- Programmable night mode - blanked or dimmed display to save tubes or prevent sleep disturbance.
- Separate modes for colon neons during night mode
- Standard, or scrollback display modes
- 'Slot Machine' Cathode poisoning prevention routine
- Not AC frequency dependent – works in all countries
- All user preferences stored to non-volatile memory

1.3 SAFETY

DANGER: The clock pcb includes a switched-mode voltage booster circuit. This generates nominally 170 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. LIST OF COMPONENTS

2.1 Table of Components

Circuit Designation	Part Description
Resistors	
R1	4.7 KΩ, ¼ Watt
R2	390 KΩ, ¼ Watt
R3	4.7 KΩ, ¼ Watt
R4	390 KΩ, ¼ Watt
R5 - R8	4.7 KΩ, ¼ Watt
R9 - R12	390 KΩ, ¼ Watt
R13 – R17	10 KΩ, ¼ Watt
R18	390 KΩ, ¼ Watt
R19, R20	270 Ω, ¼ Watt
ZD1	300 KΩ, ¼ Watt
Capacitors	
C1, C2	100nF Ceramic
C3	1uF, 250V, Electrolytic
C4	470uF, 16-25V, Electrolytic
C5	15pF Ceramic
C6	33pF Ceramic
C7	100nF Ceramic
C8	0.1F
C9	100nF
Transistors	
Q1	IRFD220 MOSFET
Q2, Q3	MPSA42
Q4, Q5	MPSA92
Q6, Q7	MPSA42
Diodes	
D1, D3	1N5819
D2	1N4001
D4	UF4004
D5 - D8	3mm Blue LED
Integrated Circuits	
IC1	78L05 5V voltage regulator
IC2	PIC16F1827 8-bit microcontroller
IC3	HV5812
Miscellaneous	
L1	100uH inductor
PM	4mm wire ended neon lamp
SET, ADJ	Miniature push button
IC2 Socket	18 Way narrow IC socket for IC2
IC3 Socket	PLCC28 IC socket for IC3
FUSE	500mA fuse
Insulation	Clear insulation for PM neon
NX1 – NX4	Z5700M Nixie Tube
X1	32.768KHz watch crystal

2.2 Parts list / Packing Sheet

Part Description	Quantity
Resistors	
270 Ω, ¼ Watt	2
4.7 KΩ, ¼ Watt	6
10 KΩ, ¼ Watt	5
390 KΩ, ¼ Watt	7
300 KΩ, ¼ Watt	1
Capacitors	
33pF, Ceramic	1
15pF, Ceramic	1
100nF, Ceramic	4
1uF, 250V, Electrolytic	1
470uF, 16-25V, Electrolytic	1
0.1F	1
Transistors	
IRFD220 MOSFET	1
MPSA42	4
MPSA92	2
Diodes	
1N5819	2
1N4001	1
UF4004 fast recovery diode	1
3mm Blue LED	4
Integrated Circuits	
78L05 5V voltage regulator	1
PIC16F1827 8-bit microcontroller	1
HV5812	1
Miscellaneous	
100uH inductor	1
4mm wire ended neon lamp	1
Miniature push button	2
18 way narrow IC Socket for IC2	1
PLCC28 IC Socket for IC3	1
2.1mm PCB power socket	1
500mA fuse	1
Clear insulation for neons	1
32.768KHz watch crystal	1

Quick Assembly Guide

1.0 Low Voltage Components:

J1, Fuse, D1 - D3, C1, C2, IC1.
Test 5V test point for 5.4 - 5.7V.
If you do not get the correct voltage, do not continue. Stop and check your work, and email for support if necessary.

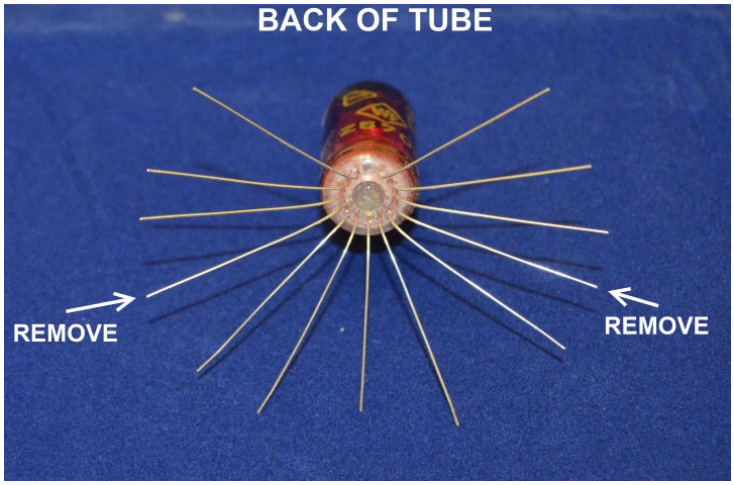
1.1 High Voltage Components:

C3, C4, R1- R4, D4, L1, ZD1, Q1, IC2 / IC2 socket.
The two joined pins on Q1 face the inductor.
Test HV Point for 168 - 172V.
If you do not get the correct voltage, do not continue. Stop and check your work, and email for support if necessary.

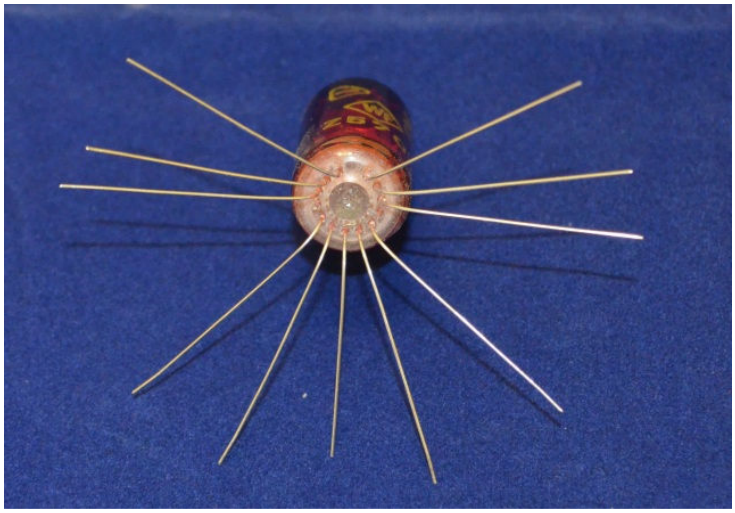
1.2 All remaining components except Tubes and LEDs

1.3 Z570M, Z573M, ZM1080, ZM1082, GN9A Nixie Tubes.

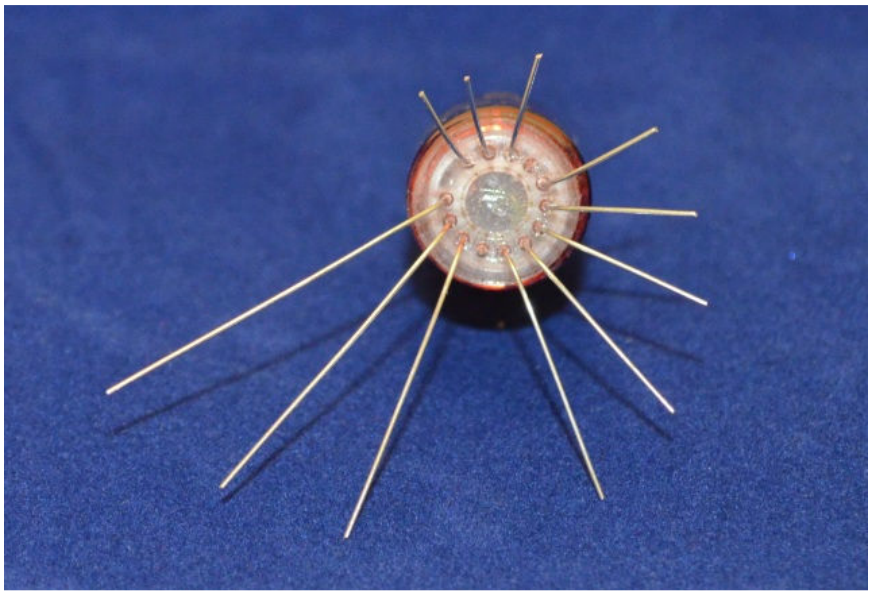
It is necessary to clip off two of the Z570M and equivalent tube leads: Clip off the two leads as shown below:



This is how the tube will look after removing the leads:



To facilitate easy insertion of the flying leads into the PCB holes, it helps enormously to trim the remaining flying leads with a pair of scissors as shown below. Start at one of the leads at the back of the tube.
Then, working around the tube, cut each sucessive lead approx 2mm shorter than the previous one. This will allow you to feed each lead in in turn.



Now you can insert and solder in the tube. Its best to have the tube approx 5mm from the PCB, so you are not soldering too close to the glass-to-metal seal.

1.4 D5 - D8

Note these LEDs are polarised – the longer lead goes in the hole marked +.

2. HOW TO OPERATE THE CLOCK

The twp buttons have the following functions:
SET:
Set time and date;
Enter configuration menu;
ADJ: Adjust: time, adjust configuration values.

Entering configuration mode:
The principal settings of the clock are stored in flash memory – your preferred configuration is stored even after powering off the clock for extended periods. To access the configuration mode press and hold the 'SET' button. After 2 seconds the seconds will display. Continue holding the button a further 2 seconds until the clock displays in this format: 01-XX. XX is the software verson. eg. 12 means version 1.2

In configuration mode the hours digits diplay the current parameter being adjusted, and the minutes digits display the current value stored against the parameter.
For each parameter, and referring to the table below, scroll through the range of possible values by pressing the 'ADJ' button. When the desired value has been reached, move on to the next parameter by pressing the 'SET' button. When the last parameter has been set, pressing 'SET' one more time will revert the clock back to time display mode. The first parameter (0) cannot be changed as it is the software revision number. It will show for several seconds and then move to parameter 1.

In all correspondence on support issues, please quote the board type, revision date and software version.

Parameter	Description	Values
0	Software revision	10 = version 1.0, 11 = version 1.1 etc
1	12 / 24 Hr mode	0 – 12 Hr (default) 1 – 24 Hr
2	Leading zero blanking eg. *0*1:54:32	0 – leading zero blanked (default) 1 – leading zero displayed
3	Night Mode start hour	0 - 23
4	Night Mode end hour	0 - 23
5	Night Mode	0 – Tubes off 1 – Dimmed display (default)
6	PM neon mode	0 – AM/PM Indication, flashing 1 – AM/PM Indication, illuminated 2 – Flashing (default) 3 – Illuminated 4 – Off
7	PM neon during night dimmed mode [1]	0 – AM/PM Indication, flashing 1 – AM/PM Indication, illuminated 2 – Flashing 3 – Illuminated (default) 4 – Off
8	LED Tube Lighting Brightness	0 - 9 (default 9)
9	LED Tube Lighting Brightness (Night Mode)	0 - 9 (default 3)
10	Reserved – leave as 0	0
11	Reserved – leave as 0	0
12	Slots Mode[2]	0 – Slots disabled 1 – Slots every minute 2 - Slots every 10 minutes (default) 3 - Slots every hour 4 – Slots at midnight
13	Display Mode	0 – Standard change of digits 1 – Cross-fading digits with scrollback effect (default)
14	Seconds display each minute	0 – Off 1 – On (default)[3]
15	Night Mode Override Period	0 – 50 (default 0 gives 15 seconds override)[4]
15	Restore default settings	0 – Keep user settings 1 – Restore original default settings[5]

Notes:

1. Night time neon mode is active when night mode is set to dim. During night time blanking the tubes AND PM neon are disabled.
2. Visual effect / cathode poisoning prevention – all digits on all tubes are cycled for 10 seconds. Not active during night blanking or dimmed modes.
3. Seconds will be displayed each minute between 55 and 59 seconds past the minute.
4. Press 'SET' briefly during Night Mode to show time for prescribed period.
5. Set this parameter to '1' to restore original default settings. Internal operations will then load all the original settings and restore the value to '0'

Setting the Time and Date:
From time display mode, press and hold 'SET' button for 2 seconds until the seconds digits are displayed
Press the 'ADJ' button to reset seconds to zero.

Briefly Press 'SET' again and the minutes will be highlighted
Press the 'ADJ' button to set the minutes.

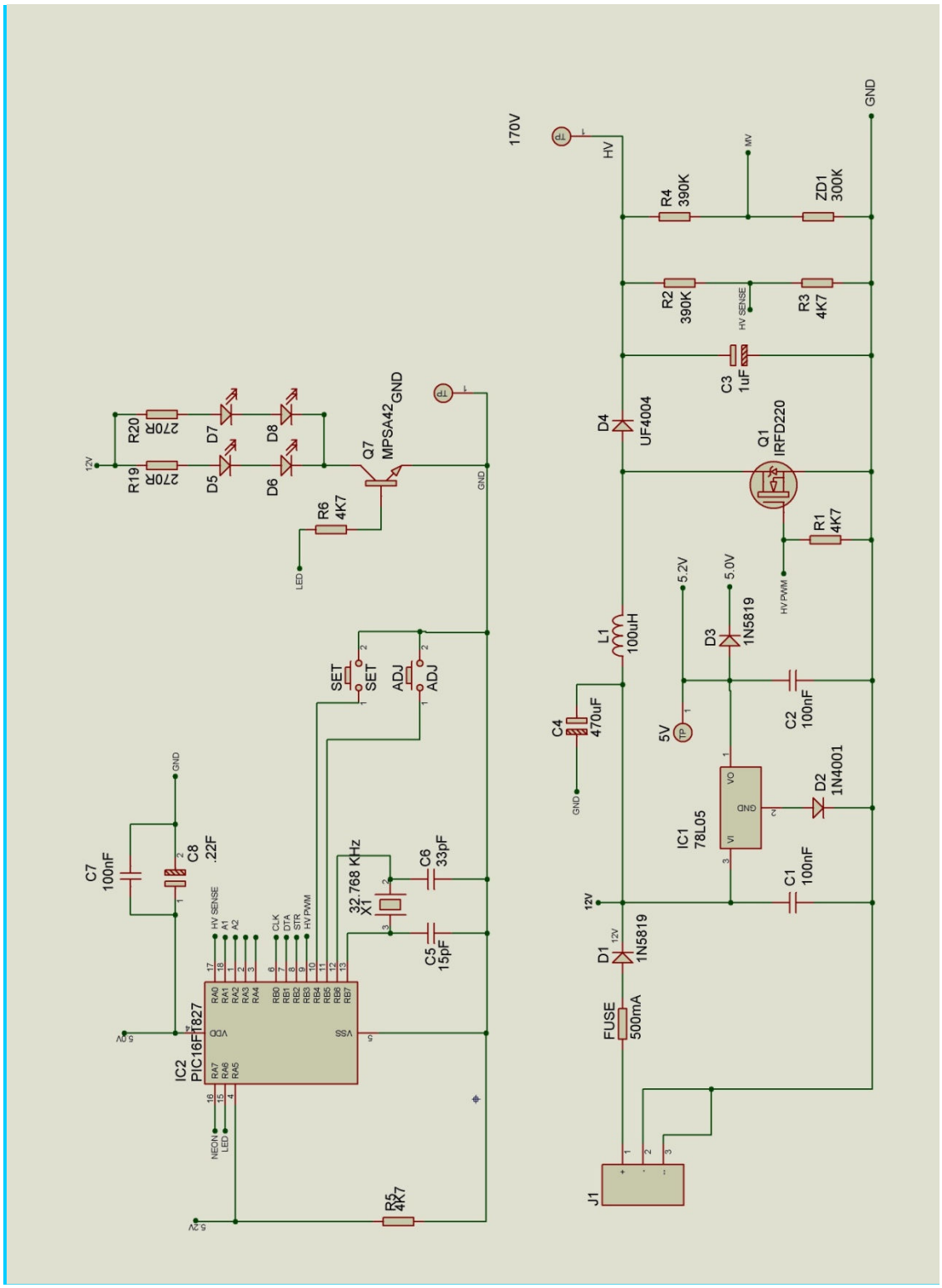
Briefly Press 'SET' again and the hours will be highlighted.
Press the 'ADJ' button to set the hours.

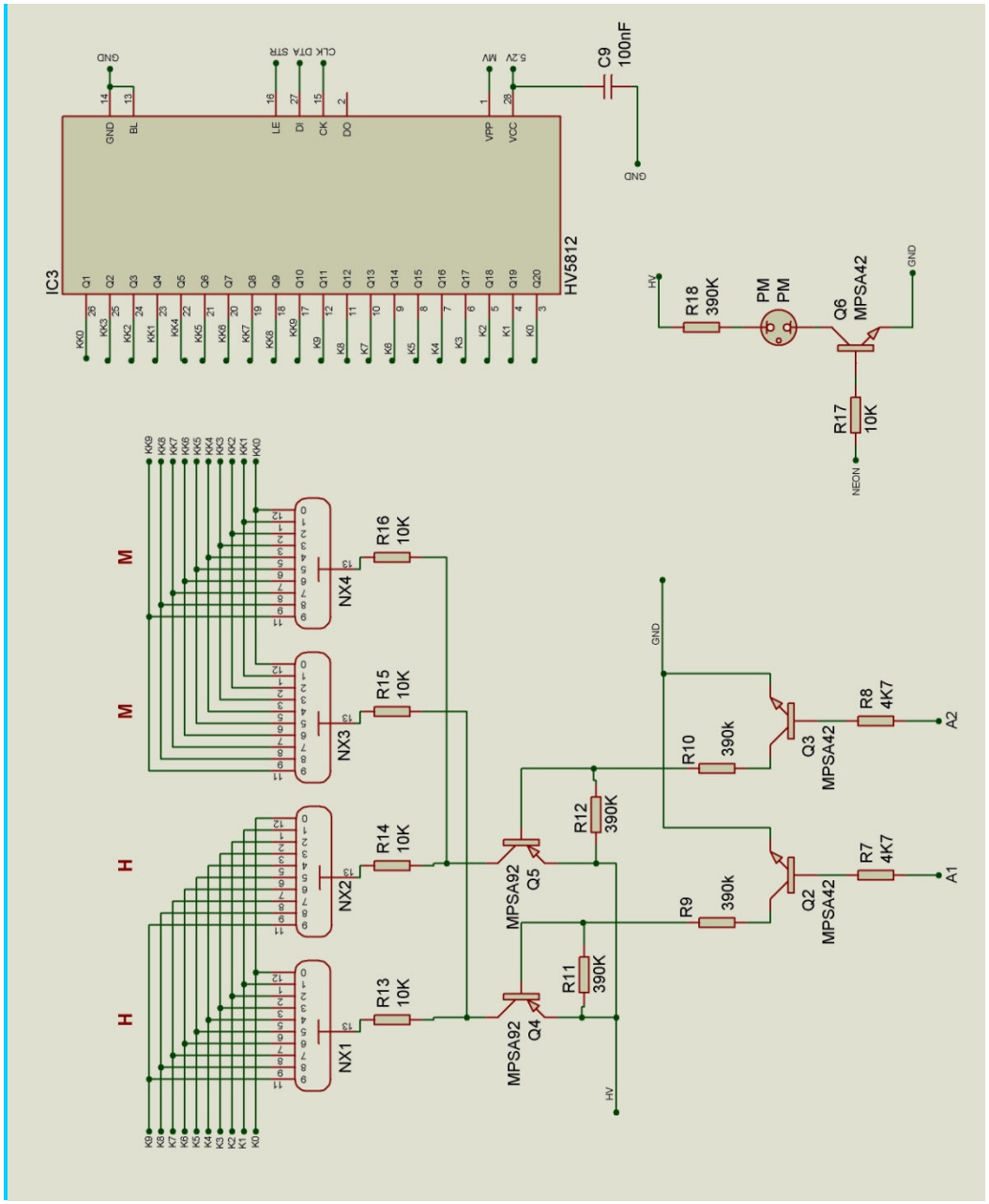
Finally, briefly Press 'SET' again to revert to normal clock operation.

Auto Date Display:
Setting parameter (14) to '1' will enable auto display of date between 55 and 59 seconds past each minute.

Night Blanking Override:
During programmed night blanking, the blanking may be overridden to see the time by briefly pressing the 'SET' button. Tubes will remain lit for the period defined in parameter (15).

3. CIRCUIT DIAGRAM




IC3
HV5812
C9
100nF
GND
R18
390K
PM
PM
Q6
MPSA42
R17
10K
NEON
HV
M
M
H
H
NX4
NX3
NX2
NX1
R16
10K
R15
10K
R14
10K
R13
10K
R12
390K
R11
390K
R10
390k
R9
390k
Q5
MPSA92
Q4
MPSA92
Q3
MPSA42
Q2
MPSA42
R8
4K7
R7
4K7
A2
A1