

Nixie Tube Thermometer



Introduction

I was browsing through the February 2011 edition of Elektor magazine when I saw this project using Nixie tubes (www.elektor.com/090784). The circuit is a mixture of the old and new.

Nixie tubes were around before the invention of much cheaper and more reliable LED's and seven segment displays. A nixie tube is usually used to display numerals. The glass tube contains a wire-mesh anode (+) and multiple cathodes(-), which are shaped like numerals. Applying power to one cathode makes it glow with an orange coloured discharge. The tube is filled with a gas at low pressure, usually neon. Nixie tubes were first produced in the 1950's and continued in production in Russia until the 1990's.

This project uses a DS1820 one-wire temperature sensor connected to an AT89C2051 microcontroller. The microcontroller processes the information from the sensor and drives the nixie tubes.

Features

Display range: 00 to 99 (Celsius or Fahrenheit)

Temperature sensor: Maxim-Dallas DS1820, accuracy 0.5 K

Power supply: AC power adaptor, 12 V to 15 V DC

Current consumption: 170 mA at 12 V

Tubes: Russian IN-16, 13-way solder connections

Microcontroller: Atmel AT89C2051 (this came ready-programmed)

Firmware: BASCOM (source and hex files available for free download)

Options:

- choice of Celsius or Fahrenheit display
- tube illumination
- LED trend (warmer/colder) indicators

Component List

Resistors

R1 = 4.7kOhm
R2,R3 = 220Ohm
R4,R5 = 22kOhm
R6 = 10kOhm
R7 = 1kOhm
R8 = 150Ohm
R9 = 820kOhm
R10 = 5.6kOhm

Capacitors

C1 = 10μF 63V, radial, 0.1 in. lead pitch
C2,C3,C5,C7,C8 = 100nF ceramic, 0.2.in. lead pitch
C4 = 10μF 250V, radial, 0.2 in. lead pitch
C6 = 470pF, 0.2 in. lead pitch
C9,C10 = 100μF 25V, radial, 0.1 in. lead pitch

Inductors

L1 = 330μH, 1A, axial, DxL = 11x32.5 mm max., e.g. Epcos B82500CA8 or Fastron 77 A-331 M-00

Semiconductors

D1,D3,D4 = LED, 3mm, blue
D2 = LED, 3 mm, red
D5 = 1N4004

D6 = BYV26 (e.g. Vishay)

T1 = IRF820 (Vishay, International Rectifier IRF820PBF)

IC1 = AT89C2051-24PU, programmed, Elektor (www.elektor.com/090784)

IC4 = DS18S20 (Maxim/Dallas)

IC5 = MC34063

IC6 = 7805 (TO220)

Miscellaneous

X1 = 12MHz resonator, 3-pin, e.g. AEL Crystals type C12M000000L003

JP1 = 2-pin pinheader, 0.1 in. lead pitch (optional jumper, see text)

K1 = 2-way PCB screw terminal, lead pitch 5mm

V1,V2 = Nixie tube type IN-16

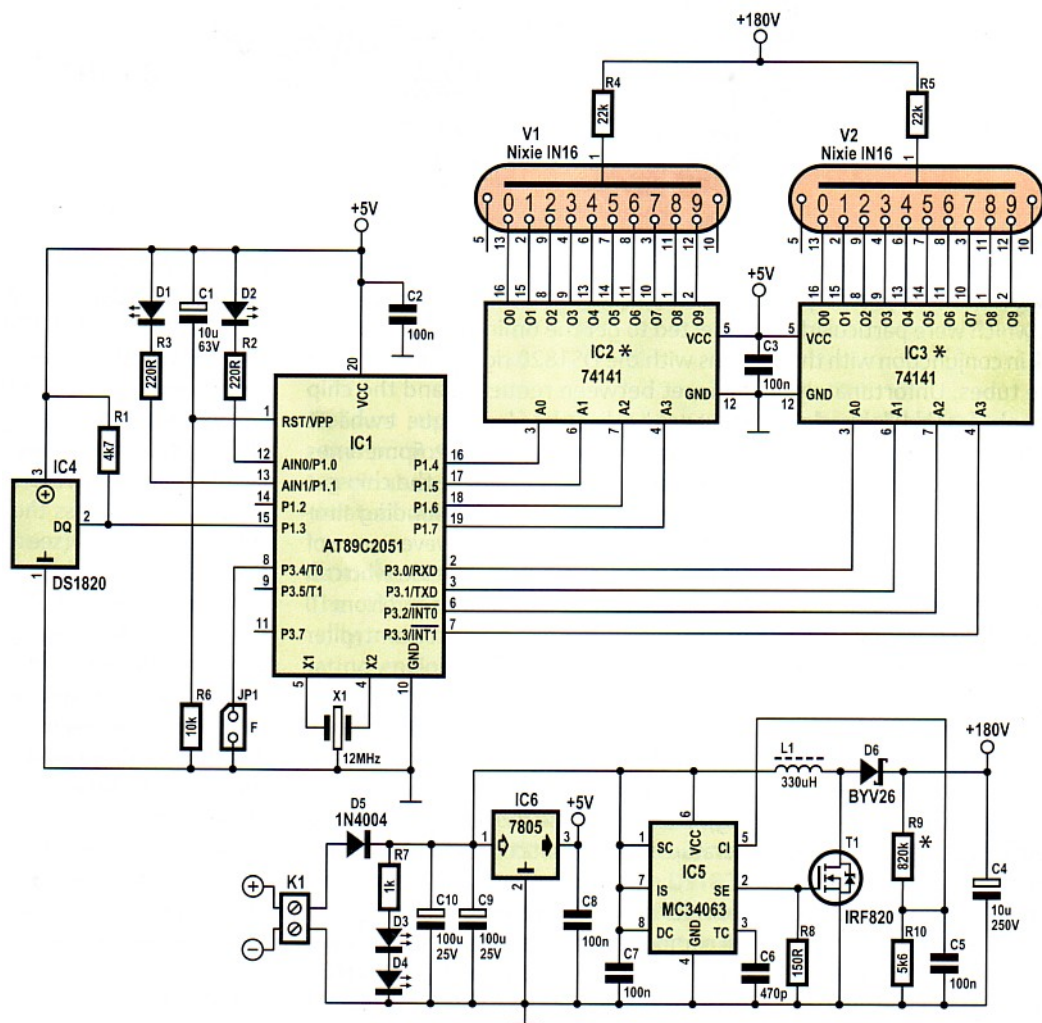
Most of the components above were easy to find. The components in red/italic were supplied by Farnell Components (<http://uk.farnell.com>) see below

Part No	Order Code	Description
IC4	9724761	MAXIM INTEGRATED PRODUCTS DS18S20
X1	1448128	AEL CRYSTALS RESONATOR, ZTT, 12MHZ
L1	976453	EPCOS INDUCTOR, AXIAL, 330UH
D6	1075759	VISHAY BYV26C DIODE, SOFT, 1A
T1	8648514	IRF820PBF MOSFET, N, 500V, 2.5A, TO-220
IC5	1077180	MC34063ABN DC/DC CONTROLLER

The Nixie tubes can be found on www.ebay.co.uk. Search for IN-16 nixie tubes.

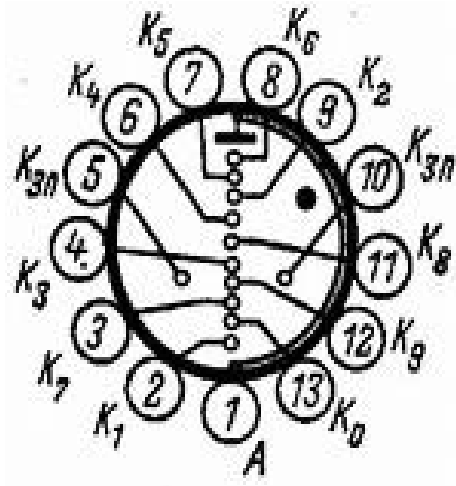
A PCB for the project can be supplied by Elektor as well as a pre-programmed AT89C2051 micorcontroller, see the link above.

Circuit Diagram



IC2 and IC3 are BCD to DECIMAL decoder ICs with high voltage transistor outputs, especially designed to drive Nixie tubes. 74141 IC's are hard to get now , but they can be substituted using Russian IC's which are pin compatible (K155ID1) and relatively cheap.

1N-16 Nixie Tube Pin Identification



- Pin 1, Anode
- Pin 2, K1
- Pin 3, K7
- Pin 4, K3
- Pin 5, LHDP
- Pin 6, K4
- Pin 7, K5
- Pin 8, K6
- Pin 9, K2
- Pin 10, RHDP
- Pin 11, K8
- Pin 12, K9



The Anode (pin 1) has white insulation inside, and can be found at the back of the tube when the digits are facing you.