LED matrix clock

Written by Hans Summers
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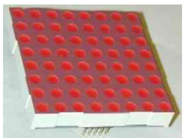
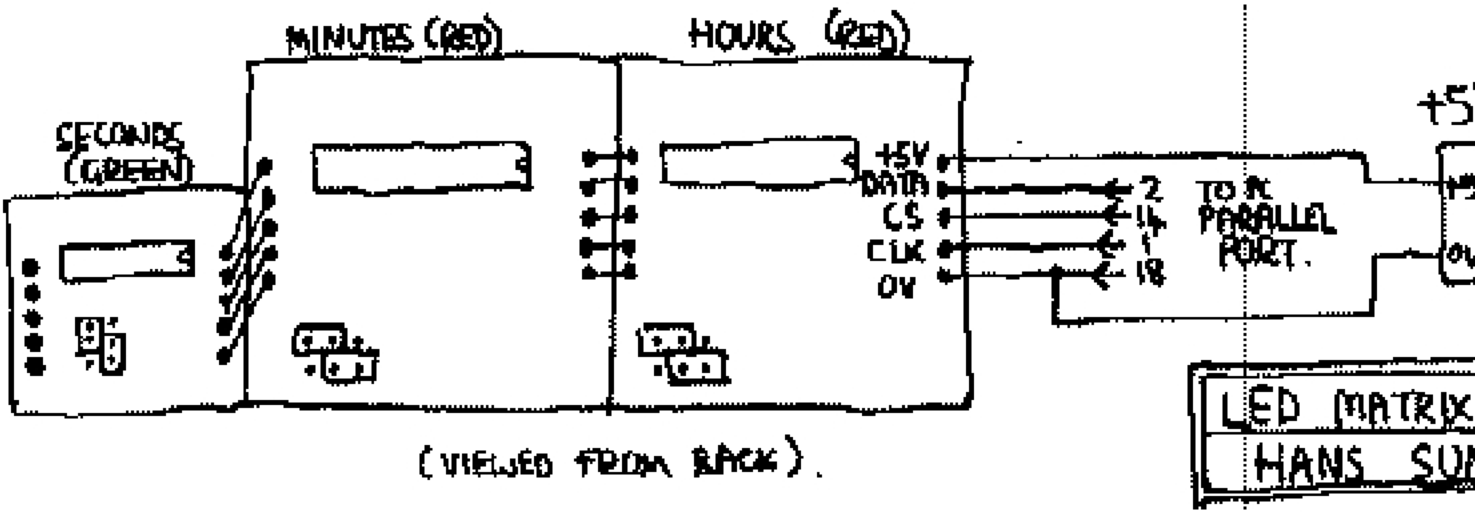
This LED Matrix Clock is a feasibility study for a much larger project I built for my employer. The intention was to pro B64CDM8/B48CDM8 8x8 5mm mys
Nexus Machines
MAX7219
{gallery}matrix/clock12{/gallery}

LED Matrix Modules



The Nexus Machines modules used are an assembly having 64 LED's (8x8 matrix) set in moulded plastic, with a PCB mounted on the back containing a Maxim MAX7219 display driver chip. For evaluation purposes we purchased 2 of the large modules (B64CDM8-R , 60mm square) with Red LED's, and one of the medium-sized modules (B48CDM8-G , 38mm square) with Green LED's. I could have made an LED display matrix using discrete LED's, however for the size of the future project the assembly and connection of so many discrete LED's, not to mention electronics for driving them, would be formiddable. The modules have 5 connection pins on either side and the moulded cases have slots to enable stacking. In this way it is easy to cascade several modules to create a much larger matrix. The modules are available from RS components (stock number 321-0991), or more cheaply from Farnell (stock number 301-4058), or EVEN more cheaply (in large quantities) direct from Nexus Machines themselves.



Circuit Diagram

Because all the hard work is taken care of my the MAX7219 on the PCB of the modules, the amount of wiring required is minimal! This diagram shows the connections between modules, and the pin numbers on the standard 25-pin PC parallel port connector. I am using a packaged power supply, which is capable of supplying +5V at the required 1A current (maximum current per module with all LED's on at maximum brightness is specified as 330mA). This diagram also shows the configuration of the jumpers on the modules, which determine which direction the data flows between cascaded modules. This configuration is the reverse of the default factory setting.

Construction

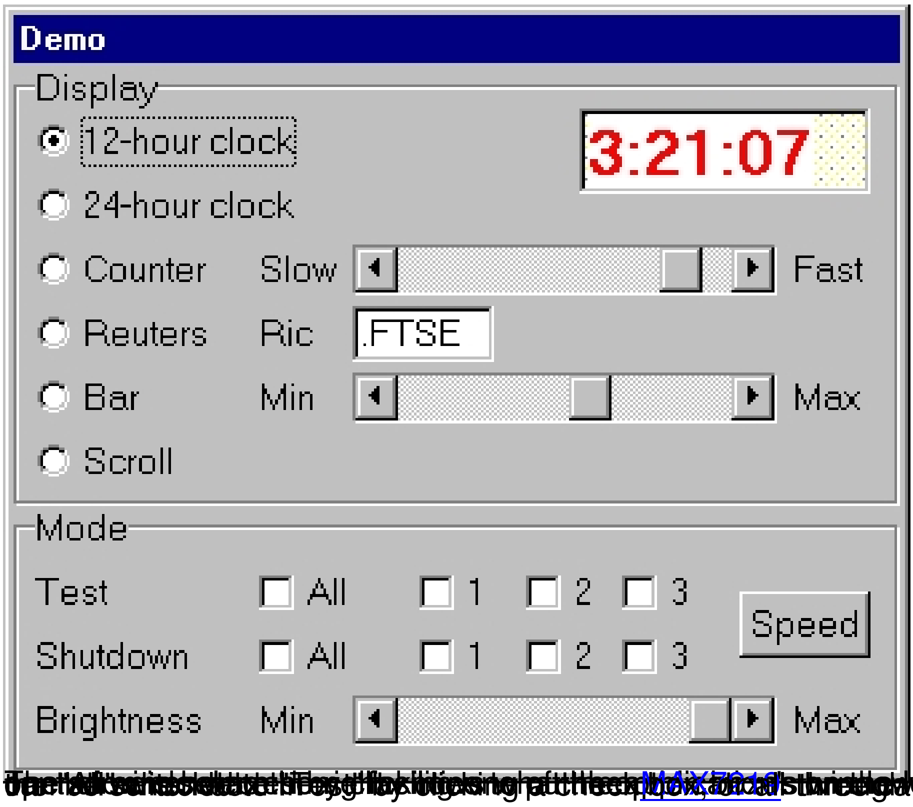
The three modules are glued to a small piece of pine wood left over from my Nixie Clock . The front panel is a neutral display filter from RS components (stock number 588-746). A red display filter would have given higher brightness for the red modules but blocked the green modules completely. The display filter is sawn to size using a hacksaw and there is plenty left over from the 220mm x 130mm sheet to cut triangular side-pieces to bracket the front panel rigidly to the base. For this simple demonstration project no proper enclosure is used. Connections to the computer parallel port are via a 5-way ribbon cable, glued to the wooden base to prevent strain on the solder connections. The modules are wired together in series, in the opposite direction to the default configuration of the modules, which means the blue direction jumpers must be reversed.

{gallery}matrix/back{/gallery}

Software

Controlling the PC parallel port on Windows NT isn't easy because they have protected the parallel port. Fortunately I found a shareware library TVicHW32 which takes care of all the Windows NT unpleasantness and allows direct access to the PC hardware under Windows 95/98/Me/NT/2000/XP. My demo application drives one data pin of the parallel port, and two of the control pins, to behave like a serial SPI interface.

A 24x8 array isn't very much to display 6 digits of a clock on (including seconds). To demonstrate different fonts I prepared three different sets of numbers (pictured right), of different widths. They are on 8x8, 5x8 and 4x8 grids respectively. For 6 digits of a clock the 4x8 font is needed. However if you make it a 12-hour clock rather than 24-hour, then you can take advantage of the fact that the leftermost digit is only ever blank or a 1, and a 1 can be made very narrow. So I set up a mode having 5x8 digits for the hours and minutes, and 4x8 for the seconds. I also created a 3-digit counter mode to show off the large 8x8 grid font. A Reuters quote mode (in the smallest font) shows a real time stock quote from Reuters (this is a feasability study for a financial application, after all!). A bar mode uses a scroll bar on the screen to light up a horizontal bar. Finally there is a "Scroll" mode, which displays each of the 5 display modes for 3 seconds, then smoothly scrolls off in the vertical direction and scrolls in the next demo mode.



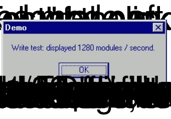
- ● 12-hour clock
- ○ 24-hour clock
- ○ Counter
- ○ Reuters
- ○ Bar
- ○ Scroll

3:21:07

Ric: .FTSE

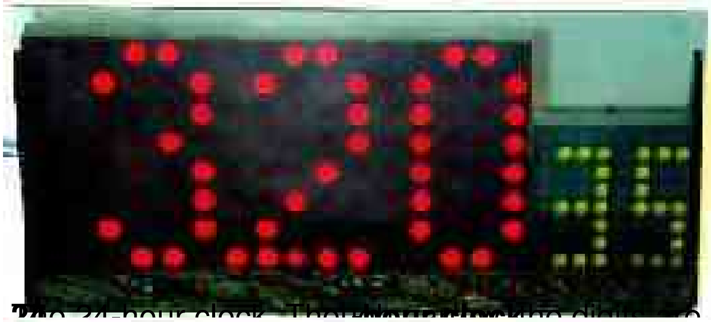
Test	☐ All	☐ 1	☐ 2	☐ 3
Shutdown	☐ All	☐ 1	☐ 2	☐ 3

[illegible] MAX7219 [illegible]

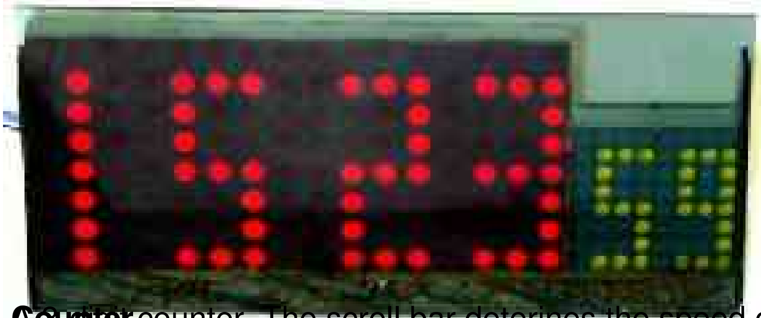


Write test: displayed 1280 modules / second.

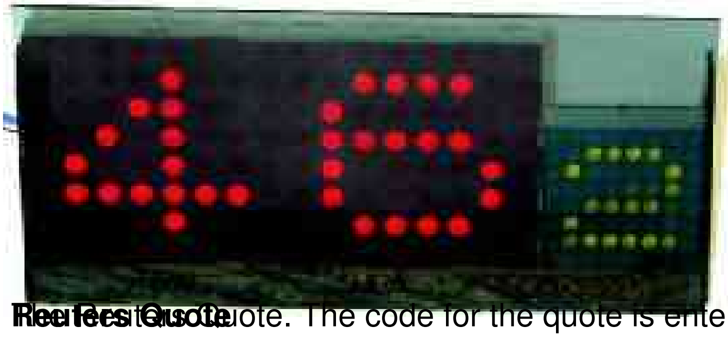
[illegible] 0-hours c



[illegible] perfectly readable. In fact, some argue that they are m



[illegible] of the count. Incidentally, the font used for these dig



[illegible] Quote. The code for the quote is entered in the "Ric" box. The display shows the UK's FTS

Bar

A plain bar, just to illustrate what the block-lit matrix will look like. The size of the bar is set by a scroll ba