CLOK

CLOK is a novel electromechanical clock that displays the time over a 12-hour period with a resolution of 2½ minutes. Coloured dots provide a simple visual indication of the current time.

Construction

First fit and solder the resistors (R1 to R3) and trim their legs. Identify the resistors by the coloured stripes on the body.

Next fit the chip sockets (IC1 to IC9) matching the notch in the socket against the notch in the symbol on the board. Care should be taken when soldering these components to avoid solder bridges between the pins. It is not recommended that the chips are soldered directly to the board.

Fit and solder the capacitors, paying attention to the polarity of the electrolytics (C4, C5 and C6) (negative is marked by a stripe on the side of the body). The ceramic capacitors (C1, C2 and C3) can be fitted either way around.

Bend the legs of the regulator (REG) at right angles and solder it such that the metal heatsink is flat on the board and the side with the writing is facing upwards. Solder the LED matching the shorter leg (also flat on the rim) to the hole with the line.

Solder the pushbuttons (S1 and S2).

Solder the crystal (XTAL) and the power socket (POWER).

Don't fit the chips into their sockets until you have thoroughly checked your construction. Check that all the components have been inserted correctly and that there are no dry joints and no solder bridges between pins. Then match the small notch in each chip to the notch in its socket.

Connect a mains power supply (6V to 9V regulated dc, 1A, centre +) to the power socket. (Note that the board draws too much current for sustained battery power.) A 9V power supply is the recommended voltage to use although a 6V supply also seems to work reliably. A 12V supply is not recommended because the voltage regulator will become too hot.

The software includes a power-on self-test. The LED should flash twice if the board is functioning correctly.

Now that basic testing of the board is complete the flip-dots can be soldered. They should be soldered one set at a time and tested before proceeding to the next set. The power-on sequence tests each dot in turn by flipping it between its two states.

The orientation of the flip-dots is important. This is indicated by small bumps on one side and small hollows on the other which matches the symbol on the board. **Double check that the orientation is correct before soldering.**

Also check that the flip-dots are level, square with the board and all at the same height. It is not recommended that the excess legs of the flip-dots are trimmed.

Flip-dots are somewhat delicate and the coloured surfaces can be easily scratched so take care during assembly. In general try to avoid touching the surface of the discs with your fingers.

If a disc should become dislodged from its mounting it can be, with care, restored. The two small pins on the disc fit into two holes in the housing.

The corners of the board are drilled with 5mm holes which can be used for mounting. It can be mounted on a wooden board using standoffs, or mounted within a case to protect the mechanism from dust.

How to Use

The two pushbuttons are used to set the current time. The left-hand button increments the hours and the right-hand button increments the minutes.

The current hour is indicated by the first flip-dot that is 'on' (coloured face upwards) moving clockwise with reference to the numbers around the outside of the board. The current minute is indicated by the total number of flip-dots that are on. For example, quarter past the hour is indicated by 6 dots and half past by 12 dots.

Since 6 dots represent 15 minutes the resolution of the clock is 2½ minutes per dot.

Pressing both pushbuttons together changes the mode. The mode is indicated by one to three flashes of the LED.

Mode #1 is the quietest mode. The flip-dots only change at the end of each 2½ minute time period.

In mode #2 the four outer flip-dots (which are not used to indicate hours or minutes) produce a pleasing 'tick tock' sound like a traditional mechanical clock.

Mode #3 is the same as mode #2 with the addition of a short animation on the hour change.

Calibration

If the left-hand pushbutton is held down while power is applied to the board, then a calibration mode is entered. This mode allows the accuracy of the clock to be adjusted via a calibration offset.

The left-hand button increments the calibration offset while the right-hand button decrements it. The range of the offset is -12 to +12. Each adjustment is equivalent to approximately 1 second per day.

Positive offsets speed *CLOK* up and negative offsets slow *CLOK* down.

The current offset is displayed by a single flipped dot or no flipped dots if the offset is zero.

Pressing both pushbuttons together exits calibration mode and stores the calibration offset in non-volatile memory.

Component List

Resistors

R1	47k (yellow, purple, orange, gold)
R2	470R (yellow, purple, brown, gold)
R3	1R (brown, black, gold, gold)

Capacitors

C1, C2	22pF ceramic (brown, marked '22')
C3	100nF ceramic (brown, marked ‘104’)
C4	47uF electrolytic 105° (blue or black)
C5	100uF electrolytic 105° (blue or black)
C6	10uF electrolytic 105° (blue or black)

Semiconductors

REG	LM2940 LDO 5V 1A regulator (black/silver)
LED	red
IC1	PIC18F14K50 microcontroller (B21X) + 20-pin socket
IC2 - IC9	L293D H-bridge driver + 16-pin socket

Miscellaneous

DOTS1 - DOTS4	flip-dots 0.53"
XTAL	20MHz low-profile crystal 10ppm
S1, S2	miniature tactile pushbutton
POWER	2.1mm dc power socket

PCB