Digital Stop Clock has LED readout

Most of us wishing to time an event would use a stop-watch, but for a partially sighted person this can be difficult or impossible. Here is one straightforward solution to the problem which readers may find interesting.

by DENYS CHAMPION*

The need arose for an event timer (period timer, or stop-clock, call it what you will) for visually handicapped telephone switchboard operators to time STD calls. The Royal Blind Society of New South Wales trains these operators, helps them to find employment and supplies them at subsidised prices with technical aids to help them in daily living and in the work situation.

Many visually handicapped people are also colour blind, generally to red, so the Society was looking for an event timer with a large green display, a timing period of 30 minutes or better in minutes and seconds, with facilities to "hold" the display at the end of the time period and for resetting to zero.

A search of the market did not find any suitable timer; in fact, event timers of any sort other than stop watches are difficult to find, so it was decided to design a digital event timer to meet the need. Again, none of the readily available clock modules met all the requirements in this case and only one integrated circuit clock chip was found which has a reset pin allowing all the on-chip counters to be reset to zero, as required in a stop-clock.

So it was decided to build a stop-clock using TTL ICs and separate green LED displays, as depicted in the complete circuit diagram.

The power supply is similar to that used in the Mini Frequency Meter published in "Electronics Australia" for May 1978 (File 7/F/22) and gives a regulated supply at 5V and an unregulated supply for the clock timing circuit. The output of the two diodes in the clock timing circuit consists of a series of pulses at twice the mains frequency, or 100Hz. These pulses are taken to a voltage divider consisting of a 390 ohm and an 820 ohm resistor in series. The junction gives a voltage suitable to drive a Schmitt trigger.

To filter any spikes coming in from the supply mains and to protect the Schmitt trigger, a .01uF capacitor and a zener diode are shunted across the 820 ohm resistor and a small signal diode is added between the input to the Schmitt trigger and the supply rail. The 100Hz square wave output from the Schmitt trigger is divided by each 7490 decade counter so that the output of the first 7490 is 10Hz and that of the second, 1Hz.

The 7492 is a divide-by-12 counter necessary to give a count of one minute every time the seconds count reaches 60 and resets to zero, and this is followed by a further 7490 to give a count of tens of minutes. Note that the connections to the 7492 are different from those on the 7490s. Each counter (except the first two) drives a 7475 which is a 4-bit latch, required to provide the hold facility. In the hold-mode, the display is held for as long as required, but the clock continues to run and if the hold switch is returned to the run position the display will "jump" forward to show the total elapsed time since the clock started from zero.

However, if the reset switch is operated while the display is on "hold" the clock will reset to zero, but the display will still be held until the hold switch is returned to "run".

Each 7475 drives a 7447 BCD to 7-segment decoder/driver which converts the binary coded decimal input to an out-

We estimate that the current cost of parts for this project is approximately

$50

This includes sales tax.

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put suitable for driving the seven segment LED displays.

The writer used 12.7mm green displays available from Radio Despatch Service, 869 George St, Sydney and so far these have proved to be very satisfactory for visually handicapped persons. Of course any other size or colour display can be used where green is not required, as long as they are the common-anode type.

There is no decimal point connection on SEL 620 displays (why I don't know because the decimal point can be plainly seen in the moulding), so that if you require a decimal point a separate LED indicator must be placed between the seconds and minutes displays.

PARTS LIST

1 transformer, A&R 2155 or similar
4 SEL620 green LED displays
1 clock case
1 DPDT switch
1 SPDT switch
1 Heatsink for 7805 voltage regulator
Vero board, screws and nuts, hook-up wire, etc.

SEMICONDUCTORS
5 1N4002 rectifier diodes
1 4.7V zener diode
1 IN 4148 diode
1 7805 voltage regulator
1 74C14 Schmitt trigger
5 7490 decade counters
1 7492 divide-by-12 counter
4 7475 4 bit latches
4 7447 BCD-to-7-segment decoder/drivers

CAPACITORS
1 2200uF/16VW electrolytic
1 0.47uF metallised polyester (greencap)
1 0.22uF greencap
1 0.01uF greencap

RESISTORS (¼ or ½W)
2 × 1k; 1 × 820 ohms, 1 × 390 ohms,
28 × 150 ohms

As the clock depends entirely on supply mains frequency which constantly drifts about the mean of 50Hz, the clock accuracy is of the order of 0.5%, which is of course more than adequate for the purpose for which it was designed.

If fractional second display is required, the first two 7490 ICs can be connected to their own displays in a similar manner to the remainder of the clock, but if such accuracy is required it would be better to design a precision time base.

Although designed for telephone switchboard operators the prototype digital event timer is in fact now being used very successfully by a visually handicapped technician for program timing in an audio-visual recording studio.