

RANGE TIMER

J.D. JARDINE

THE unit to be described here is a two range timer which is capable of generating either 0–10 sec or 0–100 sec variable timing periods depending on the range selected.

The construction and calibration of the unit is straight forward with its output voltage capable of driving either an l.e.d. or small reed relay for the duration of the set time period.

The timer was originally constructed for photographic use where its good repeatability ensured consistent results when multiple print processing; but with it being portable and reasonably small, it has found many other general purpose applications.

CIRCUIT DESCRIPTION

The complete circuit diagram of the Two Range Timer is shown in Fig. 1 with the range required being selected by S1.

If when S1 is in the position shown (0–100 second range) and S3 is pressed C1 is discharged and the timing period is initiated. After S3 has been released the output voltage of the comparator (IC1) is switched high and the relay energised.

IC2 which is connected as an integrator has its non-inverting input (pin 3) held positive by the potential divider

R2, VR3 and VR4 with respect to its inverting input (pin 2). This causes the output to IC2 to generate a positive going ramp waveform the slope of which is determined by C1, R1, VR3 and VR4. With IC2 acting as a constant current generator the slope of the ramp is linear.

This ramp voltage is applied to pin 2 of the voltage comparator (IC1) which compares it with a reference voltage set by VR1 and VR2. When the positive voltage on pin 2 reaches a level which is a few millivolts positive of pin 3 the output of IC2 is switched low and the relay de-energised.

TR1, R3 and D4 provide a stable 11.5V supply to the circuit and D1 eliminates the slight glow in the l.e.d. due to the saturation voltage of the i.c. when the unit has timed out.

CONSTRUCTION

In the prototype the components were soldered onto 0.1 in. Veroboard using the layout shown in Fig. 2. After soldering, the board and other components were fitted into 110mm dia. metal case which should be drilled or punched as shown in Fig. 3.

The layout of the components inside the case is shown in the photograph with the push button mounted on the lid.

The cursor which is made of Perspex can be bent by warming it over a hot soldering iron and gently bending it to

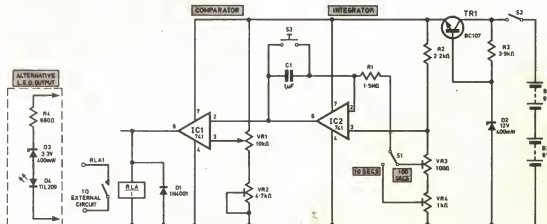


Fig. 1. Complete circuit diagram of the Two Range Timer

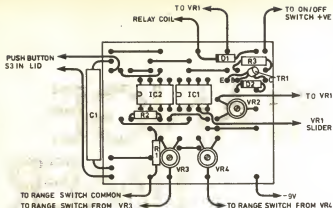


Fig. 2. Veroboard layout

shape. The index line should be scribed using a sharp knife and then the small knob should be fixed to the cursor using an epoxy adhesive.

The scale is thin white card, cut to the size shown and marked off with 100 two millimetre divisions and it is mounted on the case with its mid-way point opposite the centre

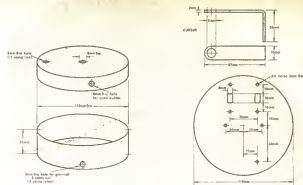


Fig. 3. Case drilling details

point of the potentiometers shaft rotation. Alternatively the scale can be left blank except for the 0 and 10 marks and calibrated as described in (b) (for more accurate time periods).

CALIBRATION

(a) Using a pre-marked scale.

- (1) Switch on and set the range switch to the 10 second range.
- (2) Set the cursor to 0 and push S3, and relay or i.e.d. should energise for a short while before dropping out; VR2 should then be adjusted so that when the button is pressed, the relay or i.e.d. is energised for as short a period as possible (less than 0.1 seconds).
- (3) Set the cursor to 10 and press the button; using a stop watch or clock, time the period before the relay or i.e.d. drops out.
- (4) Adjust VR4, press the button and re-time; adjust VR4 again if necessary. Repeat until a 10 second delay is obtained.
- (5) Switch to the 100 second range and repeat steps 3 and 4 using VR3.

(b) Using an unmarked scale.

Go through items 1, 2, 3, 4, 5 then select an intermediate time (on either range) and set the cursor somewhere near; push S3, time it through and thus adjust the cursor closer to the desired point. Repeat until the time period is exact and mark to scale, other times are obtained by the same method.

COMPONENTS . . .

Resistors

R1	1.5M Ω
R2	2.2k Ω
R3	3.9k Ω
*R4	680 Ω
All $\frac{1}{4}$ W 5% carbon	

Capacitors

C1	1 μ F polyester (C280 type)
----	---------------------------------

Potentiometers

VR1	10k Ω 0.25W linear
VR2	4.7k Ω
VR3	100 Ω
VR4	1k Ω

All horizontal sub-min presets except where stated

Semiconductors

D1	1N4001
D2	12V 400mW Zener
*D3	3.3V 400mW Zener
*D4	TIL 209 i.e.d.
TR1	BC107
IC1, IC2	741 op.amp. (2 off)

Switches

S1, S2	DPDT slide type (2 off)
S3	push to make (latching) switch

Miscellaneous

- *Reed relay R.S. type 348-986
- PP3 battery (2 off)
- 0.1" matrix Veroboard
- Clear Perspex
- Control knob
- Battery clips (2 off)
- 110mm dia. case
- *See Fig. 1.



OTHER RANGES

The timing range generated by the unit is a function of the value of VR3, VR4, C1 and R1.

Therefore to double the ranges (0 to 20 seconds 0 to 200 seconds) C1 could simply be doubled in value; although due to the new components tolerance a small recalibration may be required. ★