WATCHMAN WATCHER

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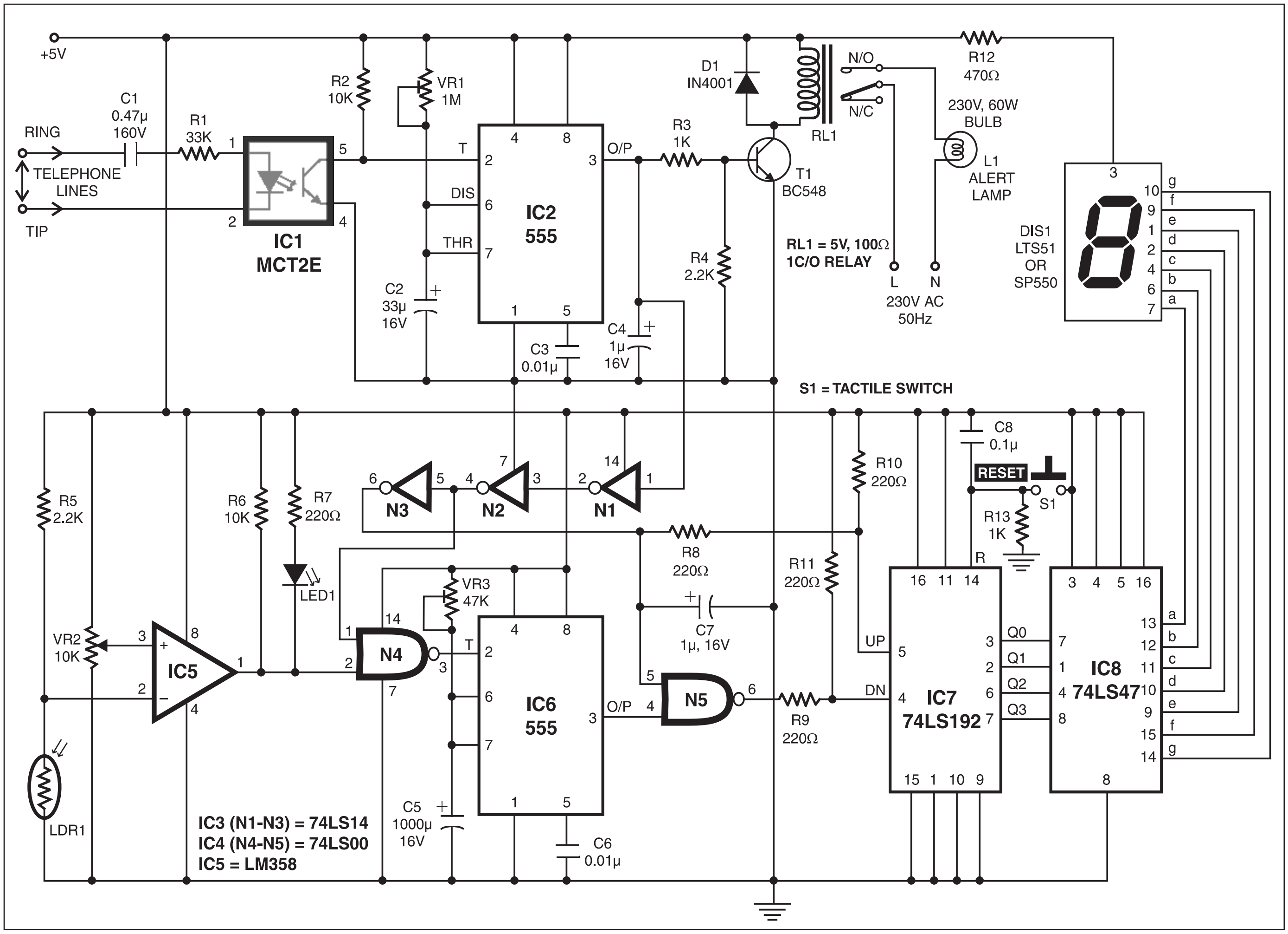
Here is a circuit that can be used in offices, stores, warehouses, etc during night to check whether the watchman of your establishment is on duty. For operation, it uses an existing telephone (e.g. in office or store) closest to the watchman's post. The watchman is given an audio alert signal by just ringing the office/store telephone once (minimum) from your residence or any other place, preferably using your mobile phone. The ring is detected by the given circuit and the watchman is also given a visual alert signal by a glowing lamp. The lamp remains 'on' for a duration of nearly 60 seconds soon after the ringtone. The watchman is given an instruction to register his presence by simply pointing his torch-light beam towards a wall-mounted LDR sensor unit (without lifting the handset off-cradle of the ringing telephone). This is to be done within the time period during which the alert lamp glows. If he fails to do it within the permissible time, the circuit registers his absence by incrementing a count. If he does, the count remains unaltered.

Up to nine separate alert rings are considered here. The count displayed is the number of times the watchman failed to register his presence. The mobile phone records the called number and call time, and it can be used with the displayed count to get the timing details.

The telephone lines (TIP and RING) in the circuit are connected across optocoupler MCT2E (IC1) through a resistor-capacitor (R1-C1) combination. The diode in the optocoupler conducts only during ring pulses. The collector of the optocoupler transistor is normally off and a 5V signal is available here. This signal is connected to the trigger input of IC 555 (IC2) configured in monostable mode. The time constant of IC2 is set to nearly one minute (1.1RxC). Its output pin 3 is low during normal mode of operation and the relay is de-energised.



When the phone rings, the internal transistor of the optocoupler conducts to cause a high-to-low transition at trigger pin 2 of monostable IC2. Timer IC2 gets triggered on this trailing edge to energise

Mode-Select Table of 74LS192

MRpin 14	PL pin 11	UPpin5	DNpin4	Mode
H	X	X	X	Reset
L	L	X	X	Preset
L	H	H	H	No change
L	H	_⌐	H	Count up
L	H	H	_⌐	Count down

Note: X = Don't care

relay RL1. This relay is used to switch on alert lamp L1. The circuit doesn't respond to additional trigger inputs for the set duration of the monostable. The caller may cut the phone call after hearing ringback tone from the called phone.

The sensor circuit formed using LDR1 activates another monostable 555 (IC6). LDR1 has a resistance of 2.2 kilo-ohms in daylight, which drops below 50 ohms when torchlight beam falls on it. (An LDR of nearly 2cm diameter has been used in this circuit.) Comparator LM358 (IC5) compares the level set at pin 3 (nearly 1V, set using a 10k pot) with the level at pin 2.

When no light is falling on LDR1, its voltage is above 1V and IC5 has a low output at its pin 1. When light is falling on LDR1, its voltage drops below 1V and IC5 output at its pin 1 becomes high. This low-to-high transition is NANDed with the output of monostable IC2 (via inverters gates N1 and N2) to form the trigger signal for monostable IC6. So the trigger input is normally high, which falls when torchlight beam is focused on LDR1. It returns to high state when torchlight is switched off. So the torch is used as a remote for triggering monostable IC6 and this triggering is enabled only when alert lamp L1 is 'on.'

Monostable IC6 has a time constant of nearly one minute (1.1RxC). It is used to form a down clock signal for 4-bit up-/down-counter 74LS192 (IC7). Counter IC7 has two separate clocks for up and down counts (refer to the table). For correct counting, it needs one clock line to be high during high-to-low transition of the other clock line. Otherwise, it counts erratically.

To operate counter IC7, the voltage levels and timings of the two clock inputs (up and down) are to be properly adjusted. Both trigger inputs, i.e. up and down clocks, are asynchronous.

The output of monostable IC2 is filtered using capacitor C4 to remove unwanted transitions and inverted using Schmitt trigger inverter 74LS14 (IC3). This forms a signal with correct rising and falling edges. The inverted signal from pin 6 of gate N3 is used as the up clock.

Counter 74LS192 (IC7) is reset to zero state by making its reset pin 14 high through reset switch S1. The 7-segment, common-anode display DIS1 is driven through IC 74LS47 (IC8). When the phone rings, count '1' is displayed after nearly one minute. This happens if the watchman fails to focus the torchlight beam on LDR1.

If LDR1 receives light from the torch of the watchman within the allowed time period, the down clock remains high until the up clock is high. The counter counts up and then down, so, in effect, the count remains unchanged.

All components, except LDR1, are kept in a sealed cabinet with locking arrangement. Only LDR1 is wall-mounted and visible outside. This is done to avoid manual resetting of the counter. The circuit is to be powered by a battery to avoid resetting of the count during power failure.

The working procedure can be summarised as follows:

1. Initially, when the power supply is switched on, power-on-reset components C8 and R13 reset counter IC7 and the display shows '0.'
2. Now dial the telephone number (where parallel system is installed) from outside or from your mobile. For the first ring, relay RL1 energises and alert lamp L1 glows.
3. When alert lamp L1 is off, the counter is incremented by '1.'
4. If the watchman focuses the torchlight beam on LDR1 within the glowing time of alert lamp L1, the counter first counts up and then counts down and finally the display shows 0. This indicates that the watchman is present.
5. If the watchman focuses the torchlight beam on LDR1 after alert lamp L1 goes off, up-counting takes place and the display shows '1.' This indicates that the watchman is absent.