# COMPUTERSIED ELECTRONIC LOCK


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Electronic lock systems are commonly used in hotels, motels, cruise ships and ferries where rooms are rented to guests for a short period of time and a high level of security is required. These offer several advantages over mechanical locks such as better access control by providing multiple access codes as well as dedicated time zones. In particular, electronic lock systems have revolutionised the hospitality industry by offering a safe and efficient way of controlling the access to the devices in hotel rooms.

The electronic lock system is controlled by a computer system. Typically, it consists of a key generating station, which is located at the check-in counter or front desk of the hotel, and an electronic lock, which is mounted at the door of a room and provides access to the room. Upon checking in at the front desk of the hotel and being assigned a room, a customer is given the electronic key corresponding to the electronic lock securing access to his room. The electronic lock may perform processing upon user input before causing the locking mechanism to activate or deactivate. Such processing allows more sophisticated functionality than the aforementioned mechanical locks.


*Fig. 2: Control panel screen for switching the device either 'on' or 'off'*

Electronic locks provide for increased security as the lock can be reprogrammed to reject the keys that it would previously accept. Also, these don't use a mechanical key that can be easily duplicated.

## Parallel port

The parallel port or line printer terminal (LPT) is a 25-pin, D-type connector (DB25) found at the back of your PC. It comprises three different ports, namely, data port, control port and status port. In

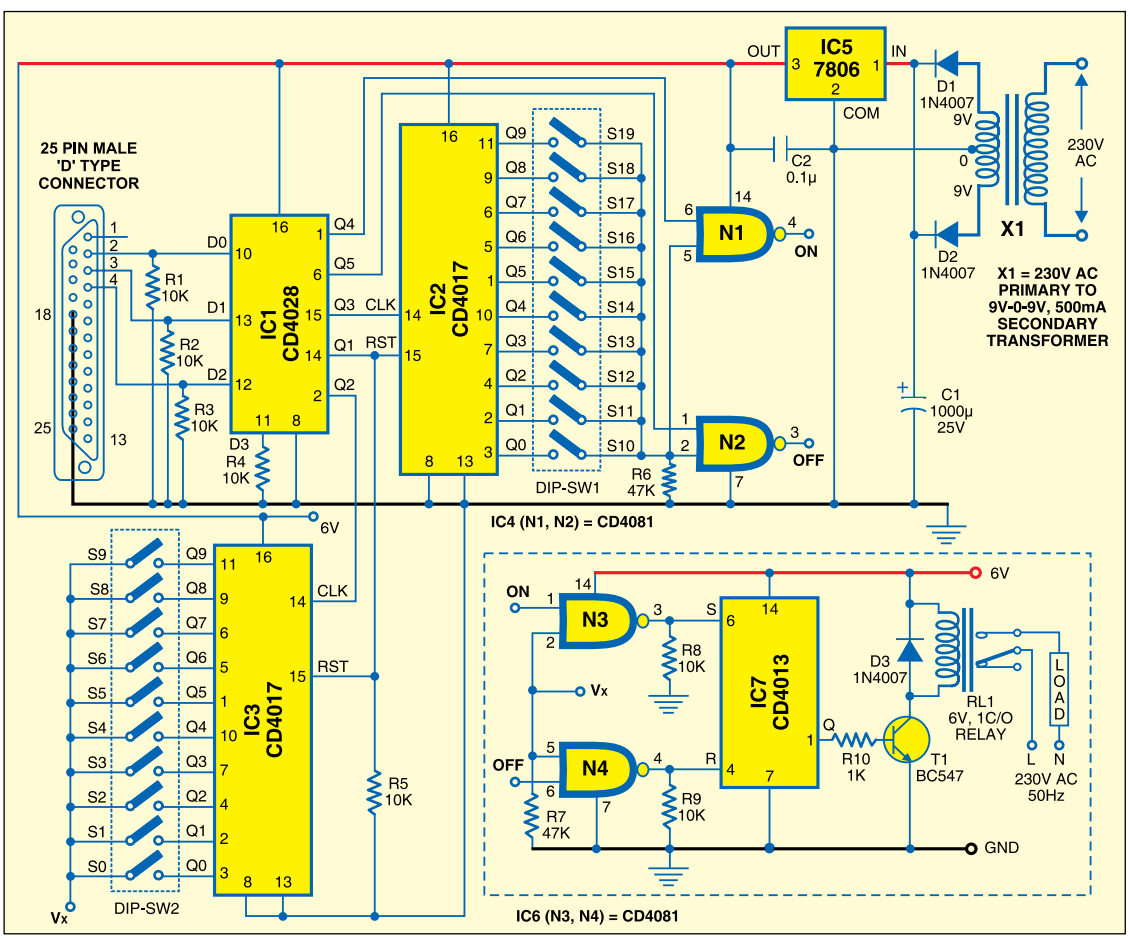


*Fig. 1: Circuit diagram of computerised electronic lock*

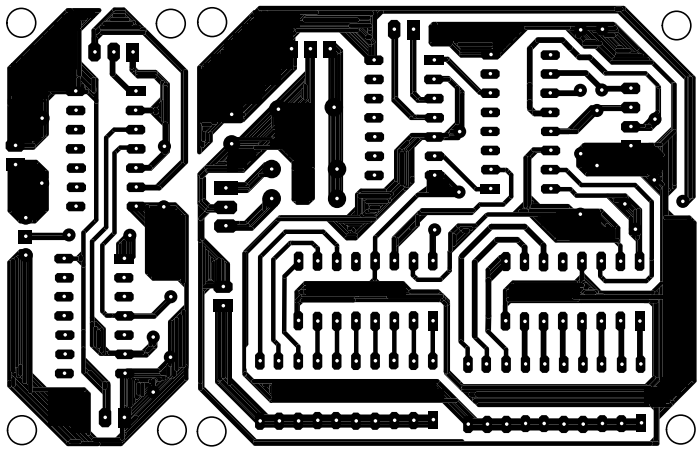

*Fig. 3: Actual-size, single-side PCB for the computersied electronic lock*

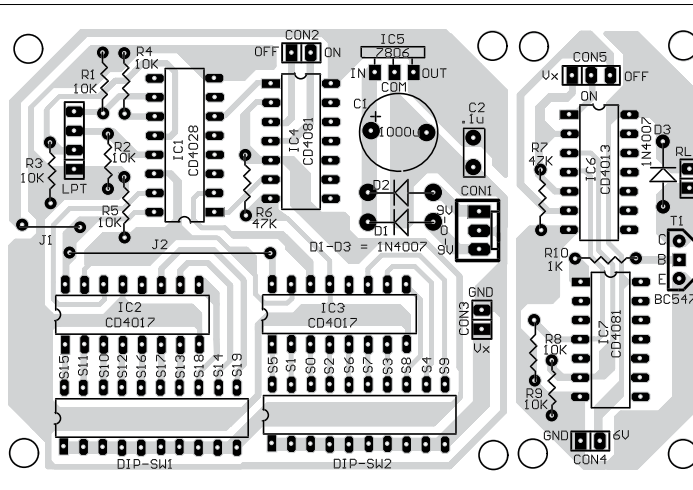


*Fig. 4: Component layout for the PCB*

order to access any port, you should have its port address. The addresses of data port, status port and control port are '0×378', '0×378+1' and '0×378+2,' respectively. Here we have used two data lines along with signal ground for controlling the direction of motor rotation.

## Circuit description

Fig. 1 shows the circuit of the computerised electronic lock. It comprises BCD-to-decimal decoder CD4028, decade counter CD4017, AND gate CD4081, flip-flop CD4013 and a few discrete components.

BCD-to-decimal decoder CD4028 (IC1) consists of four inputs, decoding logic gates and ten output buffers. A BCD code applied to its input pins (D0 through D4) results in a high level at the selected 1-of-10 decimal decoded outputs. Pins D0 through D4 of CD4028 are pulled low through resistors R1 through R4 and receive inputs from the parallel port. Data pins D0 through D2 of the parallel port control the locking and unlocking processes.

The CD4017 is 5-stage divide-by-10 counter with ten decoded outputs and a carry-out bit. These counters are cleared to their zero count by a high on their reset pin 15, which is provided by Q1 output of decoder CD4028.

Schmitt trigger action in the clock input circuit provides pulse a shaping

**PARTS LIST**

*Semiconductors:*

| | |
|---|---|
| IC1 | - CD4028 BCD-to-decimal decoder |
| IC2, IC3 | - CD4017 decade counter |
| IC4, IC6 | - CD4081 AND gate |
| IC5 | - 7806, 6V regulator |
| IC7 | - CD4013 flip-flop |
| T1 | - BC547 npn transistor |
| D1-D3 | - 1N4007 rectifier diode |

*Resistors (all ¼-watt, ±5% carbon unless stated otherwise):*

| | |
|---|---|
| R1-R5, R8, R9 | - 10-kilo-ohm |
| R6, R7 | - 47-kilo-ohm |
| R10 | - 1-kilo-ohm |

*Capacitors:*

| | |
|---|---|
| C1 | - 1000µF, 25V electrolytic |
| C2 | - 0.1µF ceramic disk |

*Miscellaneous:*

| | |
|---|---|
| X1 | - 230V primary to 9V-0-9V, 500mA secondary transformer |
| RL1 | - 6V, 1C/O relay |
| DIP-SW1, DIP-SW2 | - 8-way DIP switch |

that allows unlimited clock input pulse rise and fall times. Q2 and Q3 outputs of CD4028 provide positive-edge clock pulse to IC3 and IC2, respectively. Both of these counters advance on the positive edge of the clock signal when strobe pin 13 is in the logical '0' state. Q4 and Q5 outputs of CD4028 control the lock 'on' and 'off' function with the help of AND gate CD4081.

Q0 through Q9 outputs of decade counter CD4017 are used for selection of the device with the help of DIP switches DIP-SW1 and DIP-SW2. Q0 through Q9 outputs of IC2 are used for device selection in decade from 10 through 90 (10, 20, 30, ..., 70, 80, 90), respectively, with the help of DIP-SW1. Q0 through Q9 outputs of IC3 are used for device selection from 0 to 9, respectively, with the help of DIP-SW2.

Lock circuit (shown inside the dotted line) is built around flip-flop CD4013, two AND gates, transistor and relay RL1. If AND gate N3 inputs Vx and ON are high, its output sets flip-flop CD4013. The high output of the flip-flop drives the transistor into saturation and relay RL1 energises to turn the device 'on.' If AND gate N4 inputs Vx and OFF are high, its output resets flip-flop CD4013. As a result,

relay RL1 de-energises to turn the device 'off.'

The 230V, 50Hz AC mains is stepped down by transformer X1 to deliver a secondary output of 9V-0-9V, 500mA. The transformer output is rectified by a full-wave rectifier comprising D1 and D2, filtered by capacitor C1 and regulated by IC 7806 (IC5), which provides a 6V DC output. Capacitor C2 provide further filtering.

## Construction

An actual-size, single-side PCB for the computerised electronic lock is shown in Fig. 3 and its component layout in Fig. 4. Assemble the circuit on a printed circuit board (PCB) to minimise time and assembly errors. Carefully mount the components and double-check for any overlooked error. On the PCB, provide connectors for 'on,' 'off' and 'Vx' points. The clock circuit is separate for every device, and fitted along with the device.

If you want to switch on any device, say, device No. 13, connect the clock circuit to 'on,' 'off' and 'Vx' points and close switch S11 of DIP-SW1 and switch S2 of DIP-SW2. Now log into the software and enter the device No. (13) in the device number box and click 'on' button. The flip-flop is set and relay RL1 energises to activate the device.

## Software

The source program for the electronic lock is written in C++ and compiled using Turbo C++. It is well commented and easy to understand.

When you click 'celock.exe,' a screen pops up that prompts you to enter the password. Type the password as 'lock' and press 'enter' from the keyboard. The main screen appears. Click the control panel button to get the control panel screen shown in Fig. 2. Now you can control a device by entering the device number and clicking 'on' or 'off.'

In 'select all' mode, you can control up to 20 devices through this program. The number of devices to be controlled can be set only from the program.

In 'group' mode, you can create groups of different devices (like a group of device numbers 2, 4, 5 and 8). For every group, one .dat file is created with the group name. Inside the .dat file, the device number ends with '-1.' You can add up to 99 devices to a single group.

***EFY note.*** All the relevant files of this project have been included in this month's EFY-CD.