Automatic Tank Filling Cum Pump House System

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Here is a simple circuit which can be used for controlling the water level in both the single tank or the combined overhead/sump tank systems automatically. It switches on the motor pump when the water level in the overhead tank falls to a pre-set minimum level (P1) and switches off the pump when the water level reaches the maximum pre-set level (P2) in the overhead tank. It automatically switches off the motor when the sump runs dry or the motor fails or the pump is unable to pump the water from the sump. This unit gives one visible indication for motor running and another indication for pump failure (or dried up sump) for attending to its failure.

This unit can be powered from the domestic AC mains and consumes very little power. A 4-core cable (three for probes and one for earth wire), is to be drawn from the unit to the overhead tank. Two CMOS CD4011 ICs (quad 2-input NAND gates) are used.

Circuit details

Those who want the motor to switch 'on' or 'off' on the

[redacted] work as telecommunication inspectors in the Microwave [redacted], Secunderabad

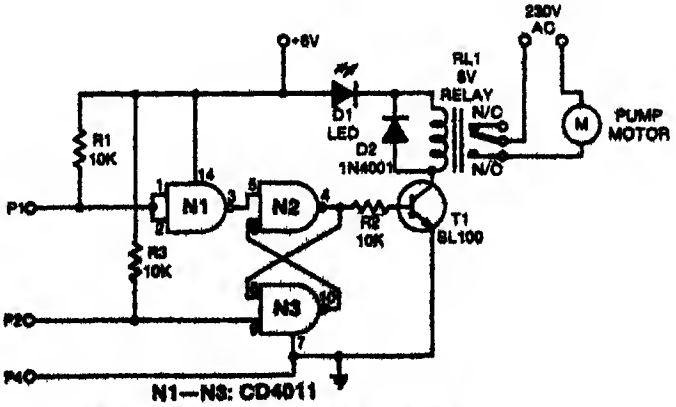

Fig. 1: Simple automatic tank filling system.

PARTS LIST

Semiconductors:

IC1	— CD4011 2-input quad NAND gate
T1	— SL100 npn transistor
D1	— 5mm light-emitting diode
D2	— 1N4001 rectifier diode

Resistors:

R1-R3	— 10-kilohm, ¼-watt carbon

Miscellaneous:

RL1	— 6 volt, 500-ohm relay
	— General-purpose board, flexible wire, brass rods, red connectors, LED holders, enclosure etc.)

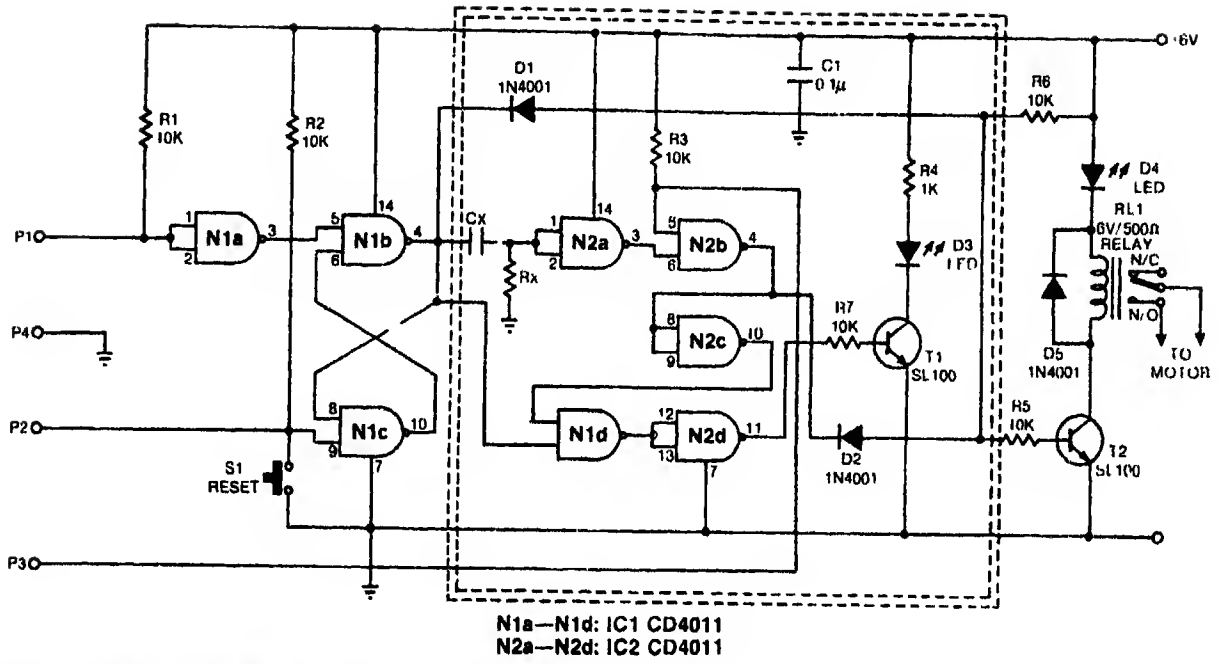

Fig. 2: Automatic tank filling system with pump failure indication.

PARTS LIST

Semiconductors:	
IC1, IC2	CD4011 2-input quad NAND gate
T1, T2	SL100 npn transistor
D1, D2	1N4001 rectifier diode
D3, D4	5mm light-emitting diode
Resistors:	
R1-R7	10-kilohm, ¼-watt carbon
Rx	See text
Capacitors:	
C1	0.1μF ceramic disc
Cx	See text
Miscellaneous:	
RL1	6-volt, 500-ohm SPDT relay
	General-purpose board, brass rods, rod connectors, flexible wire, LED holders, enclosure etc.

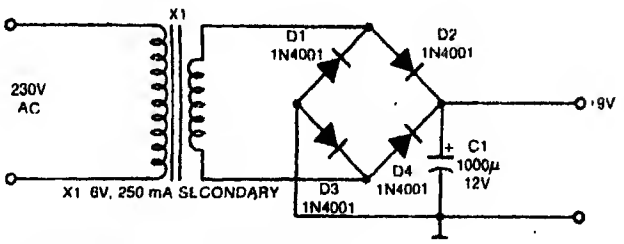

Fig. 3: Power supply for the circuit.

PARTS LIST

Semiconductors:	
D1-D4	1N4001 rectifier diode
Capacitor:	
C1	100μF, 12V electrolytic
Miscellaneous:	
X1	6V, 250mA transformer
	Flexible wire, mains cord, strip board, battery connectors, metal enclosure etc.

basis of the water level in the overhead tank irrespective of the water level condition in the sump or whether the pump is able to suck the water from the sump or not, the circuit given in Fig. 1 is sufficient. When the water level in the overhead tank goes below probe P1, P1 becomes 'high' making the output of gate N1a low, which in turn makes the output of gate N2 (flip-flop) high. This sequence enables the transistor to conduct and operate the relay. The relay operation extends supply to the motor and water starts filling in the tank. As soon as the water touches probe P2, P2 becomes 'low'. This resets the flip-flop which de-energises the relay and stops the motor. It remains in the same state till the water level goes below P1.

For those who want to stop the motor if there is no water in the sump or the pump is not able to pump the water up, and want to get an indication or alarm to attend to the failure, the circuit given in Fig. 2 will be useful. Only the circuit in the dotted portion is the improvement on the earlier circuit and hence the working of the circuit outside the dotted portion is same as before. The output of gate N1b, in addition to driving the motor also triggers the monostable. The period ($T = 1.4\ R_x\ C_x$ sec) of the monostable is set according to the time taken by the pump to start filling the tank, once the supply to the motor is 'on'. If the period is double that time, it is better.

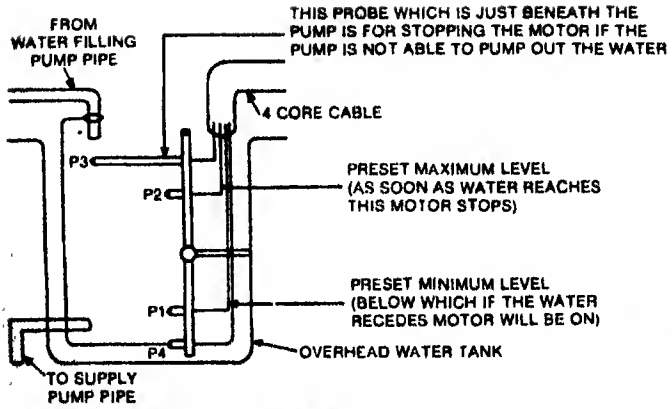

Fig. 4: Internal tank wiring system.

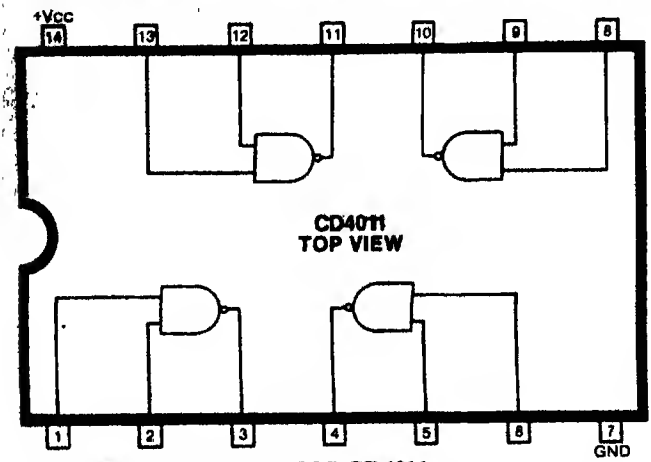

Fig. 5: Pin configuration of IC CD4011.

After this period, the output of the monostable becomes high. Even at that instant, if the water does not come out of the pump because there is no water in the sump or the motor fails, probe P3, which is just beneath the mouth of the filling pump at the overhead tank, remains high, turning the output of gate N2b low and, turns the diode NAND gate low thus turning off the relay and the supply to the motor. The output of gate N2d drives the red LED, indicating this failure. This red LED remains lit and the supply to the motor remains cut as long as the circuit is not reset manually after attending to the failure.

The total cost of the circuit is around Rs 60. This circuit has been tried with good results. A switch can also be provided across the relay contacts which is normally 'off' and can be switched 'on' during an emergency.

Lab Note: To maintain proper sensitivity in the circuit, the gap of the sensor probes (P1-P4) should be maintained at 1.5 mm for unfiltered water coming from the sump. But for filtered water, if the relay operation is not proper, increase the value of R1 and R3 to 1 Meg and use brass type sensing probes. □