

Design of the combinational logic circuit system for automatic control suction pump

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Abstract. In this paper, we analysis and designed an automatic control circuit, which is very important for vehicle permitted both automatically controlled and a single LED ,respectively. The results showed the functions that The suction pump works properly can be adjusted with automatic control circuit. An automatic control system that is controlled by one or more single - board computers.This upaper introduces the design process of combinational logic circuit , and the working principle of the system.

1. Introduction

Automatic control system of suction pump is practical use whatever. [1]With the development of our economy, urban and rural residents living standards has improved. Many families have installed a water tower pumping water. [2] When manual control pumping process, the operation is the intricacy of the work. [3] An automatic control system are key parts that protect suction pump from damage. [4]The combinational logic circuit has the advantages of simple structure, reliable operation, low cost and other characteristics.[5]

The system devices can perform a variety of control functions in electronic equipment. Design of combinational logic circuits is important.Determine the input and output. and then according to the output and the input of the logical relationship between the list of true value table. [6]The selection of device types. According to the requirements of decision and device functions. [7]For example, when the circuit design of MSI devices, for multi output functions, the decoder is convenient, and the single output function, then use the data selector is convenient. [8]According to the true value table type and selection logic device, write logic function expression. When using SSI integrated gate design, the logic function simplification and transformation as the most simple gate circuit corresponding. [9]Draw the logic circuit diagram according to the logic function expression and the selection of logic device.

2. Overall System Framework

2.1 operating principle

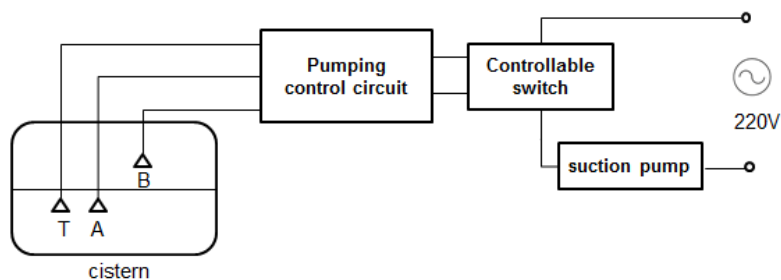


Fig. 1 Automatic control diagram of suction pump

2.2 Determine the logical function:

In many practical problems ,the circuit which the schematic was designed was used to determined the logic function .

Common output and input, output or another output to indicate their relationship between. Three detectors were placed in the cistern, the detection results as input variables, respectively A, B, T. And using controllable switch. The output variable or disconnected. Through the establishment of automatic controllable circuit, makes the whole circuit capable of automatic water supply when the level of water was lower.

2.3 Working Process

The first step to system modeling and control was input selection. When there was no water in the cistern, the circuit of three probes were not conduction. When A and B input was low, the output was high. Sensors and automatic control technology was an important link in achieving test.

Control switch started pumping motor with only the water level. When the water level was both higher than A and lower than B, the circuit of A and T conducted.

The principle is if the sensor pumping, the output high, go on with its work. When no pumping, the output low, had a rest. When the level was higher than B, the circuit system brought the pump to a rest. A single yellow LED1 shows that the power was switched on. The green LED2 shows there was water. And the red LED3 shows there was no water.

3. Circuit Design

The combinational logic circuit has the advantages of simple structure, reliable operation, low cost and other characteristics. Therefore, the electronic devices are widely applied in small and medium scale. For example: encoder, decoder, data selector and so on. According to the logic function, the process design of combinational logic circuit, draw the corresponding logic circuit. The working process of the front has a clear logic function circuit, and the input and output variables, we proceed to the next step, according to the logic function requirements, lists the truth table.

Table 1 Function Table

Table 2 Truth Table

Probe A	Probe B	Q _n	Q _{n+1}	A	B	Q _n	Q _{n+1}
No water	No water	No pumping	Pump	0	0	0	1
No water	No water	Pump	Pump	0	0	1	1
Water	No water	Pump	Pump	1	0	1	1
Water	No water	No pumping	No pumping	1	0	0	0
Water	Water	No pumping	No pumping	1	1	0	0
Water	Water	Pump	No pumping	1	1	1	0
No water	Water	—	—	0	1	—	—

The logical expression:

(1)

$$\begin{aligned}
 Q_{n+1} &= \overline{A}B\overline{Q}_n + \overline{A}BQ_n + AB\overline{Q}_n \\
 &= \overline{A}B(\overline{Q}_n + Q_n) + AB\overline{Q}_n \\
 &= \overline{A}B + AB\overline{Q}_n \\
 &= \overline{A}B + \overline{A}B\overline{Q}_n \\
 Q_{n+1} &= \overline{B}A\overline{Q}_n
 \end{aligned}$$

According to the logical expression, draw the logic diagram

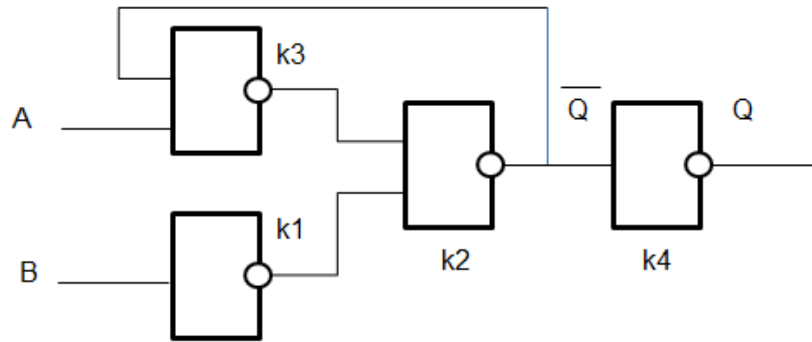


Fig. 2 Logic circuit diagram

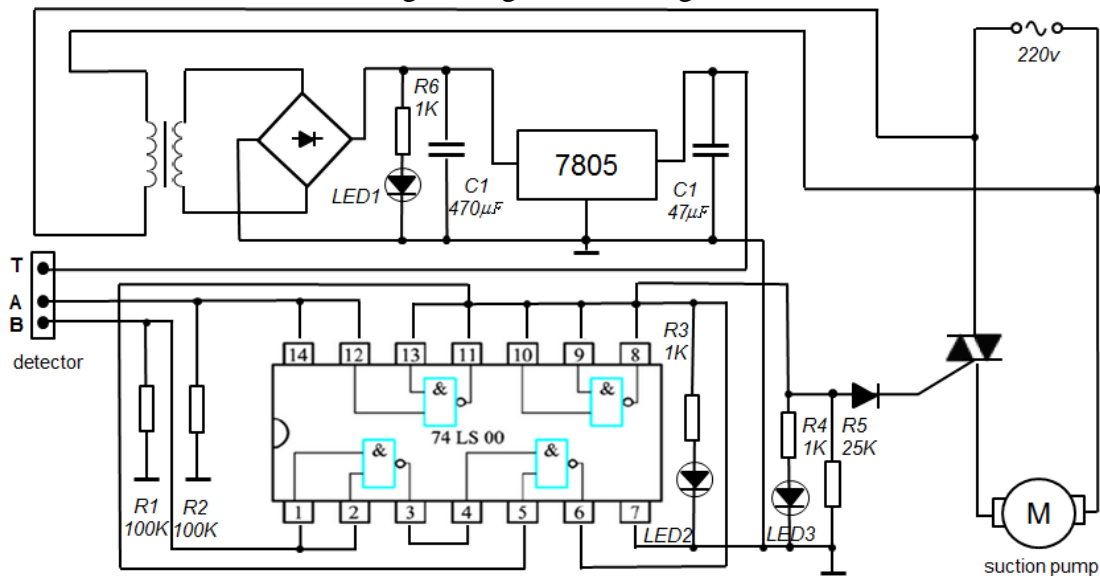


Fig. 3 Principle of operation

According to the verification of the actual circuit, the design of the control circuit is able to complete its logic function.

4. Summary

The main function of the system is to automatically detect the water level and pumping function. When the water level is too low, circuit, water pump automatic pumping; when the water level is too high, the circuit breaker, the pump automatically stops pumping. In order to facilitate the observation, each functional circuit series LED. system with different colors through a combination of logic circuits to realize the automatic control function.

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