Gate control System

GATE CONTROL SYSTEM

Safety pressure bar

Indicator lamp

Control access gate: Rempart High school
The entrance to a company's premises is often closed with a gate. The gate is only opened to let vehicles in and out. The gate is controlled by the porter.

1. Requirements for a gate control system

- The gate is opened and closed by means of pushbuttons in the gatehouse. The porter can monitor the operation of the gate at the same time.
- The gate is normally fully opened or fully closed. The gate motion can be interrupted at any time.
- An indicator lamp is switched on five seconds before the gate starts moving and when the gate is in motion.
- A safety pressure bar prevents harm to persons and objects from getting trapped or damaged when the gate is closing.
Various control systems are used to operate automatic gates. The circuit diagram below shows one of these options. The high current circuit supply a three phases induction motor.

- K1 auxiliary relay OPEN
- K3 auxiliary relay CLOSE
- K2 timer contactor relay
- K4 timer contactor relay
- K5 contactor relay high current OPEN
- K6 contactor relay high current CLOSE
- S0 (break contact) STOP pushbutton
- S1 (make contact) OPEN pushbutton
- S2 (make contact) CLOSE pushbutton
- S3 (break contact) Position sensor OPEN
- S4 (break contact) Position sensor CLOSED
- S5 (break contact) Safety bar

Control access gate: Rempart High school
New Solution:
The company in charge of the gate control access asks you to propose a new version of this system. The new specifications are:

- The automation will be controlled by a Millenium PLC
- A safety LV command
- All drawing should be provided with the gate (high current and low current circuit)
- A diagram should explain the automation program
- A 24VDC motor controls the gate.
- You have to provide technical arguments to the commercial department for this new version.

New material:
- K1 contactor relay OPEN
- K2 contactor relay CLOSE
- S0 STOP pushbutton (NO and NC contact)
- S1 OPEN pushbutton (NO and NC contact)
- S2 CLOSE pushbutton (NO and NC contact)
- S3 Position sensor OPEN (NO and NC contact)
- S4 Position sensor CLOSED (NO and NC contact)
- S5 Safety bar (NO contact)
• Work and questions

a. You should study the previous system automation and provide a diagram which explain the process by a GRAFCET (SFC) AND/OR a diagram (algorithm, chronogram, organigram)

b. Define the input and the output variables

c. Propose a theoretical solution with a GRAFCET OR/AND logic circuit for the new version.

d. Program the PLC and test your solution with the testing model.

e. Draw the circuit high current and LV circuit.

f. Expose the advantages and disadvantages of this new technologic solution.
b. Define the input and the output variables

<table>
<thead>
<tr>
<th>input</th>
<th>output</th>
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<tbody>
<tr>
<td>S0</td>
<td>H1</td>
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<tr>
<td>S1</td>
<td>K1</td>
</tr>
<tr>
<td>S2</td>
<td>K2</td>
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<td>S3</td>
<td></td>
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<td>S4</td>
<td></td>
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<tr>
<td>S5</td>
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</tbody>
</table>

| variables | |
|-----------||
| I1        | I1 |
| I2        | I2 |
| I3        | I3 |
| I4        | I4 |
| I5        | I5 |
| I6        | I6 |

Control access gate: Rempart High school
a. Analyse of the first solution: Time diagram
c. Theoretical solution with a logic circuit

SECOND SOLUTION

According to the previous solution, I found this logic equation:

To Open: \[ K_1 = (S_1 + M_1) \cdot (S_0 + S_3) \cdot S_3 \cdot T_1 \]

To Close: \[ K_2 = (S_2 + M_2) \cdot (S_3 + S_4 + S_5) \cdot S_4 \cdot T_2 \]

For the light: \[ L = (S_1 + M_1) \cdot (S_0 + S_3) \cdot \overline{S_3}. \]

Or: \[ L = (S_2 + M_2) \cdot (S_3 + S_4 + S_5) \cdot S_4 \]
Syteme function

To open I push S1, the light switches on. After five seconds the motor K1 runs and to stop this motor, I push S0 or the gate touches the break contact S3.

To close I push S2, the light switches on. After five seconds the motor K2 runs and to stop this motor, I push S0 or the gate touches the break contact S4 or the safety bar S5.

c. Theoretical solution with a logic circuit
d. Logical solution on Crouzet

New system: Logical diagram

\[ A = (S1 + M1). (S0 + S3) \]
\[ B = (S2 + M2). (S0 + S4 + S5) \]
c'. GRAFCET (SFC) solution

NEW MATERIAL

K1: Contactor relay OPEN
K2: Contactor relay CLOSE
S0: Stop pushbutton (NO and NC contact)
S1: Open pushbutton (NO and NC contact)
S2: CLOSE pushbutton (NO and NC contact)
S3: Position sensor OPEN (NO and NC contact)
S4: Position sensor Close (NO and NC contact)
S5: Safety bar (NO contact)
L: Lamp

Control access gate: Rempart High school
d'. SFC solution with Crouzet

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e. Electric schema
f. Advantages and disadvantages

- **Advantages:**
  - This automate is less expensive because several materials have been taken out to make the wiring easier.
  - With less materials the wiring will be easier.
  - With the program we can change variable (timer, input, output...).

- **Disadvantages:**
  - We have to know the Crouzet software.
  - Problems for the maintenance in the future.

- **Conclusion:**
  With this new solution there are more advantages than disadvantages. The wiring is easier and faster with P.L.C.
No future without

.......automation control

END

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