3 FLOOR LIFT

LadderSchedule

Simplified Version Report

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PLC

The automaton used in the project is a Siemens S7 1200 that uses the ladder diagram programming language.

Relay

We use 24Vdc relays.

Relay Base

It is an auxiliary component of the relay. Its function is to fix the relay and provide the electrical connections so that it fulfills its functions.

Limit Sensors

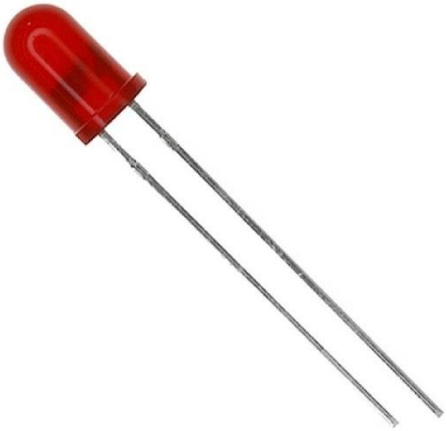
Its function is to indicate that a certain piece of equipment (in this case the elevator car) has reached the end of its range of motion.

Pressure Button

ON-OFF button, to select the floor in the elevator.

Leds

Current elevator floor signage.



Power Supply

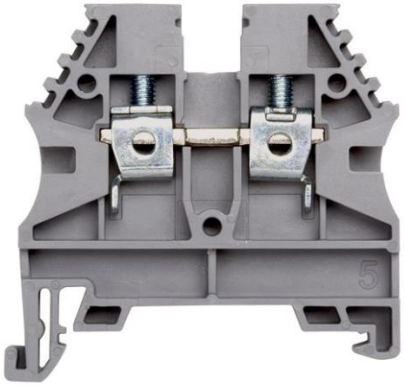
24V DC power supply.

Circuito Breaker

Electrical protection

Borne

Mechanical wire connection device.



Lift structure

Metal structure with wheels to aid displacement.

Electric scheme

The wiring diagram can be found in the project files.

- 1st page - Power circuit.

The power circuit provides the various voltage values (AC and DC) and consists of the power supply and protections (circuit breakers).

- 2nd page - Installation electrification scheme (command and signaling circuits).

A control voltage (D4 - 24 VDC) is provided in electrical devices (limit switches and pushbuttons), when actuated manually or mechanically they give commands / signals to the installation, starting / completing electrical circuits.

- 3rd page - Scheme of automaton entries.

The automaton provides the voltage (24 VDC) that are inserted into potential-free contacts in relays of the installation, when they operate they introduce a polarity / information of the installation in the automaton.

- 4th page - Diagram of the automata outputs.

The automaton provides the voltage (24 VDC), depending on its programming and installation (floor location, call, etc.), this activates an output. This output feeds a relay, which will give order to the installation.

- 5th page - Scheme of signs.

A control voltage (D4 - 24 VDC) is made available in potential-free contacts in the installation relays, which when operating, introduce a polarity in the signals, giving information / signaling of the installation status.

- 6th page - Engine power scheme.

A voltage (D5 - 24 VDC) is provided in potential-free contacts on the two relays (KS and KD) of the installation. NOTE: in the KS (upward) and KD (downward) relays, the polarities have been inverted to reverse the motor rotation.

Schedule

Software used

Initially, I started to develop programming in LogixPro, a Ladder programming language software, because it was the software that I was most familiar with. While developing the programming, I learned to work on the Portal TIA V14 software, which is Siemens software to program many of its automata, namely the one I used, the Siemens S7 1200. When I became familiar with the Portal TIA V14, I continued development of programming on this platform.

First version of programming

The first version was developed in LogixPro, using basic concepts learned in the Automation and Computers classes. This version consisted of having a line for each output, and creating several “and” and “or” on each of those lines. The error of this version appeared when a request was made to move to the 1st floor, the central floor, as the interlocking systems would crash and the engine would never stop.

Second version of programming

This version has 8 states, which are: start; system reset; floor selection; called RC floor; called floor 1; called 2nd floor; down / up engine; and floor signage. I will now explain each one of them:

- 1st state (Start), this state is activated as soon as the elevator receives energy and its function is to create a bit in memory so that it can activate the next state.

- 2nd state (system reset), this state is responsible for the elevator always having a reference floor. When it starts it will evaluate whether the elevator is on the ground floor or not (using the limit sensor on the ground floor), if the elevator is not on that floor it will order the engine to go down, this order will be interrupted when the elevator reaches the ground floor. If the elevator is already on the ground floor or has already descended there, it will activate the third state, floor selection. This state is very important, because if there is a power cut while it is in motion it will stop at a place, for the automaton, unknown (since it only recognizes the places where the limit sensors are), and when it returned the energy he would not know in which direction he would have to move, so this state makes the energy return as soon as he moves to the ground floor, thus making sure that there is always a reference floor.

- 3rd state (floor selection), this state is responsible for responding to the elevator's call requests. When you start, the first status, start, resets immediately and the Move RC / Call Floor RC, Move P1 / Call Floor 1 and Move P2 / Call Floor 2. After all resets, you will wait for the signal of one of the call buttons (ground floor, floor 1 or floor 2). When one of the buttons is activated it assesses whether the elevator is not on that floor and if the state corresponding to the floor called is not active, if the elevator is already on the floor selected by the button it does nothing.

- 4th state (called RC floor), this state is activated by the third party when someone clicks the call button on the ground floor and it is not there. When activated it will reset the third state. After that, it will evaluate if the elevator is on the 1st floor or on the 2nd floor and if it is on one of these floors, it will activate the state 7 in the down memory, which will activate the motor in the downward rotation until reaching the limit sensor of the ground level. floor. When the elevator reaches the ground floor, it will reset the down and up state, and activate the third state, the floor selection state.

- 5th state (called floor 1), this state is also activated by the third, but when someone clicks on the floor 1 and the elevator is not on that same floor. When active, it will reset the third state and will evaluate the position where it is, either on the ground floor or on the 2nd floor. If it is on the ground floor, it will activate state 7 in the rising memory, which will activate the motor in the upward rotation until reaching the floor 1 limit switch. If it is on level 2, it will activate state 7 in the down memory, which will activate the motor in the downward rotation until it reaches the level 1 limit switch. When the elevator reaches floor 1, it will reset the descending and rising state, and activate the third state, the floor selection state.

- 6th state (called floor 2), this state is activated by the third party when someone clicks the call button on floor 2 and the elevator is not on that same floor. When activated it will reset the third state. After that, it will evaluate if the elevator is on the 1st floor or on the ground floor and if it is on one of these floors it will activate the status 7 in the climb memory, which will activate the motor in the uphill rotation until reaching the end of stroke sensor. floor 2. When the elevator reaches level 2, it will reset the descending and rising state, and activate the third state, the floor selection state.

- 7th state (motor down / up), this state is responsible for the movement of the motor. It is activated by states 4, 5 and 6, when the memory variables activate up or down. This state also has a security system, the so-called “open door” system, which makes the elevator only move when the door is closed.

- 8th state (floor signaling), this state is responsible for signaling the floor on which the elevator meets. For example, when the ground floor limit switch is active, it will activate the RC Position memory variable and reset the Position P1 and Position P2 memory variables. In turn, the RC Position memory variable will activate the RC Signaling physical output. The operation is the same for the three floors, when the floor 1 limit switch is active, it will activate the memory variable Position P1 and reset the memory variables Position RC and Position P2, in turn this memory variable Position P1 will activate the physical output Signaling P1. And when the floor 2 limit switch is active, it will activate the memory variable Position P2 and reset the memory variables Position RC and Position P1, in turn this memory variable Position P2 will activate the physical output Signaling P2.

How to establish communication between the automaton and the computer

The first step is to change the IPv4 of the computer's network card to a fixed IP. In this case I changed it to 192.168.0.50.

Then I opened the TIA Portal v14 software (automaton programming software) and opened the programming block that I wanted to download to the automaton. I clicked on “add new device” and chose the version of my automaton, in this case it was CPU 1214C AC / DC, 6ES7 214-1BG40-0XB0, v. 4.0.

The third step was to change the automaton's IP to a different one from the computer, in this case I used 192.168.0.25.

The next step was to go to the menu bar and enter Online / Go Online. I chose the model of my network card and clicked start search (this with the automaton connected to the computer). After waiting about 30 seconds the communication was already made.

The last step was to download the lines of code to the automaton, for that I went to the Online / Download to Device menu and the transfer started automatically.