PLC and RELAY CONNECTIONS

1 INTRODUCTION

In this work, a logic application (connections, hw configuration, program) is made that controls the motor through a relay. The relay will have to be used because the current drawn by the motor would overload the logic binary output. A relay is a type of electromechanical switch that can be controlled on/off at a relatively low current (power) but can control even a large current with its contacts. Figure 1 shows the principle of operation of the relay.

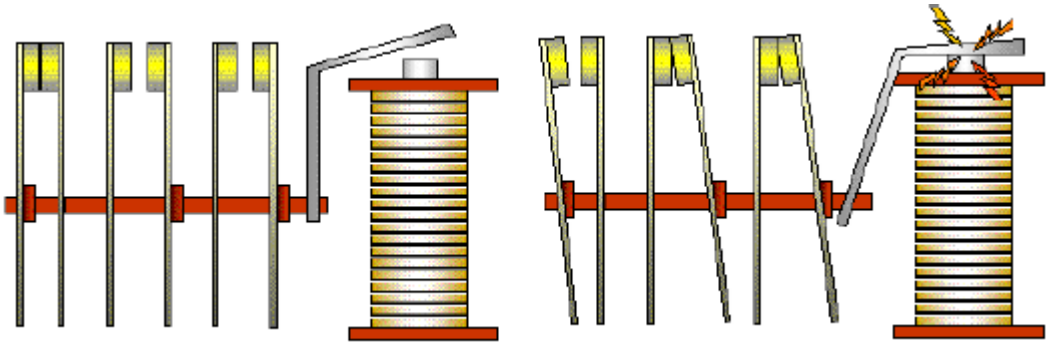

Figure 1 Principle of the relay

When the coil receives voltage from the outside (pictured right), a magnetic field is created that mechanically switches the state of the contacts. The contacts that were open close and the contacts that were closed open. Through these contacts goes the current of the controlled device. That is, the device controlled by the state of the contacts is either in operation or is not. The power passing through the contacts is usually significantly higher than what could be fed through logic. In addition, the voltage is typically other. Thus, the coil circuit and the contacts are not electrically connected but are galvanically separated. The only connection between the guiding power and the controlled power is mechanical. When the relay coil is energized, it is said that the relay is pulled. When the coil is de-energized, it is said to have been discharged.

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When the relay is connected to the binary output of programmable logic, the output of the logic (eg. Q124.0 true or false) controls the voltage in that channel and thus the relay either pulls or not. Figure 2 shows one example about device connections.

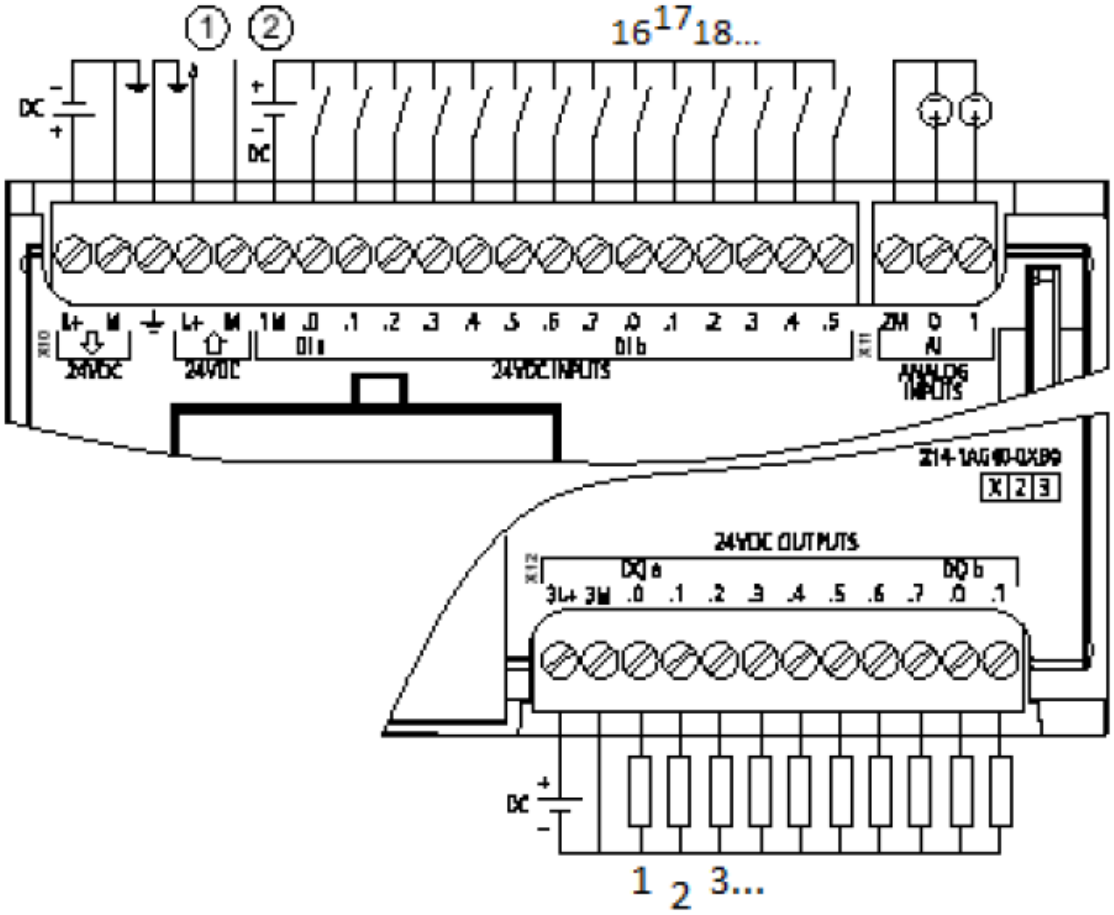

Figure 2 Connecting example

At the top, the connection of inputs with logic (14 separate binary inputs) is shown. In them, a voltage of +24 VDC is applied to the field (for example, to the sensor / switch). If the contact in the field is closed, the voltage can be used on a channel-by-channel basis whether the contact connected to that channel was open or closed (volt-

age at the logic connector indicates that the contact was closed). Closed contact can indicate for example, that some valve is closed.

As for the outputs that appear at the bottom (10 pieces of binary outputs), the operation, is slightly different. In them, the supply voltage is connected to the card terminal 3L+, the division of which by channels is handled inside the board. When the output is turned on, the corresponding output terminal is energized. At other times, the output terminal is de-energized. When a relay coil is connected to the terminal, the relay pulls and connects the device connected to it to the voltage (usually 230 / 400 VAC). The relay coil terminals are typically marked A1 and A2. A1 is the terminal to which the voltage is connected and zero is connected to A2.

2 INFORMATION ABOUT THE WORKSTATION

The programmable logic at the base is a Siemens S7 1214C. It has an integrated Profinet interface, as well as binary inputs and outputs. The lamp is controlled by a relay, which is connected to the binary output of logic. The status of the relay (coil energized or not) is read to the logic so that in the program it can be concluded whether the control is successful or not. Figure 3 is presenting the general layout of the components needed in work. If there are not all the components available, you can borrow from other tables. This work is meant to be done in the lab DP66 table next to hallway (near window to hallway), Figure 4.

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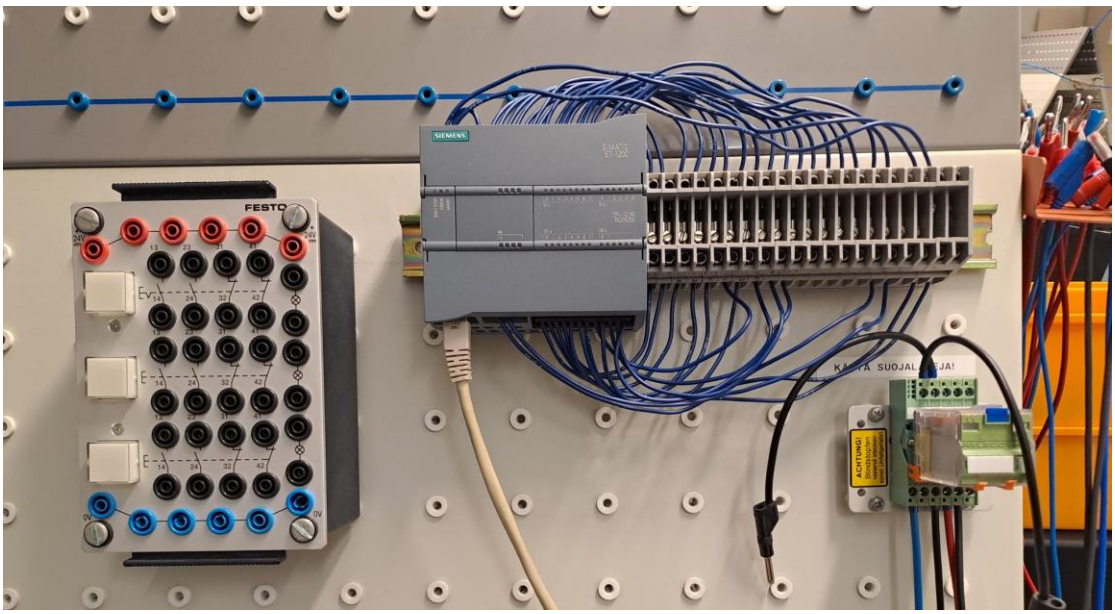

Figure 3 Components needed in the work

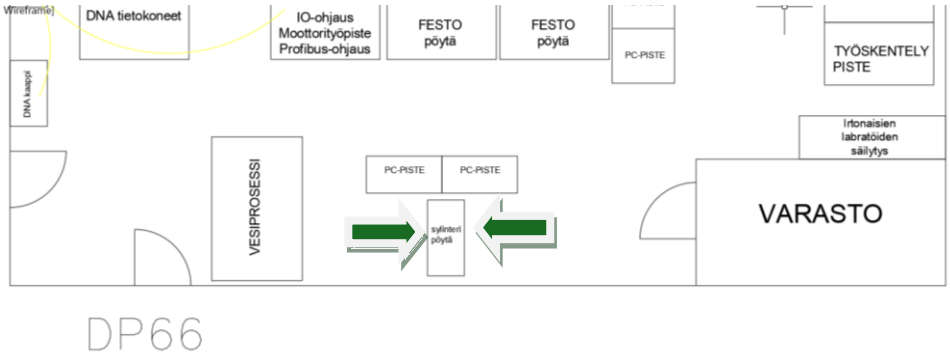

Figure 4 Location of the working point (two similar places)

3 SAFETY

Care should be taken when working with electrical appliances at the workstation. In any case, therefore, it is NOT allowed to go into connections other than 24 VDC. Note you can make a short circuit also using that voltage. For that reason, be careful in making lengthen for wires. Note there is protected wires and not protected available.

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When connecting them together, make sure you make it like shown in right side of Figure 5.

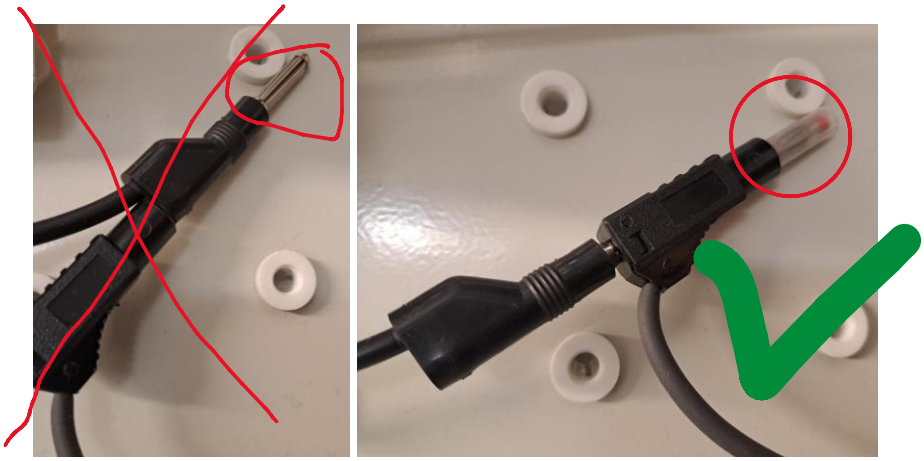

Figure 5 Wrong and right way to connect two wires (metal in the socket has to be covered)

4 TASK

1. Open TIA Portal V16 and create a new project. Please add the CPU as a new device. Pay attention to the correct CPU type (the exact type can be found in small print on the CPU) and the right FW (Firmware). FW should be labeled / taped into CPU.

2. Make a simple program where push button lights three lamps (the I/O address table is given in Table 1). There is one input for push button and another for feed back signal, which indicates the relay is on. One output controls all lamps via relay (when relay is on, all lamps are lighting). Program is simple: when push buttons is pressed, all lamps are lighting. When button is not pressed, lamps are off. If the relay is not on when button is pressed, the alarm signal is activated. Alarm signal is active also if

relay is on without pressing the push button. In this case alarm doesn’t need acknowledge -signal. Use reasonable structure in program, symbols and comments.

Table 1. I/O's addresses

ADDRESS	EXPLANATION
I0.0	”Start” switch input
I1.0	Feedback from contactor
Q0.0	Output for lamp
Q0.1	Output for alarm signal

3. Make the necessary connections for the work. Use wires with sockets. You don’t need any tools making connections. Connect the relay coil to the output channel (Q0.0) and the feedback contact to the input (I1.0). Find out the correct connector numbers using Figures 2 and 6. The addresses depend on the hardware settings, and it is worth making sure that for digital outputs and inputs 'I address' 0... 1 and 'Q address' 0... 1 are also addressed in the program. Figure 6 shows the terminal numbers of the relay to be used. The relay and its base have different numbers, both of which are shown in the attached figure.

Figure 6 terminals of relay and its base

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4. Load the program into logic and test the operation of the program in monitoring mode:

- All three lamps are lighting when Start switch (I0.0) is pressed. Lights don't light when button is not pressed.

- If you loosen a relay from base, the alarm should be triggered when you press the button (and lights are off)

- Connect the relay to base. If you force the control on (press blue button in relay without pressing push button connected to PLC), the alarm should be triggered.

5. When the application is ready and tested, introduce the whole system and operation in short video. There has to be an identification in the video (tell who you are / show your face / show the username in computer) and short intro about the system. No explanation is needed, the function of the system is enough. Return a link to video into Moodle. Check there is user rights enough in sharing so the video can be seen.