Practice Problem (Industrial Control and Supervisory Systems)

Mixing plant with two stirrers

Easy Control (EC4P-200) compact PLC is required to control two stirrers that operate together in a mixing tank. Both stirrers can rotate in the same or opposite direction.

Main switch S1 is used to switch the system on or off.

When switched off (S1 = OFF) you can use S2 to set the rotation direction (same or opposite). S4 switch (S1 = OFF) is used for selection of one-cycle or five-cycle operation. If the system is switched on (S1 = ON), the rotation direction and cycle numbers can no longer be changed and you can start the system via the Start pushbutton S3.

In the case of emergency the operator can switch off the setup by S5 emergency-stop pushbutton.

The mixing plant can not be started up if tank cover is opened (S6 limit switch).

Stirring stage 1 starts after 2 seconds. After a period (t_1) of 5 seconds the stirrer stops for 2 seconds to stir in the reverse direction (same or opposite) for a further 10 seconds (t_2). This means: S1 Switch off – S2 Set rotation direction – S4 Set number of cycles – S6 Close tank cover – S1 restart and – S3 Start pushbutton.

The motors are 3-phase asynchronous electrical motors. Their start is provided by star-delta motor switching. Star-delta switching time is 10 s. Counting of mixing times (t_1, t_2) is started after delta-contactors are energized. PLC implements both motor shaft rotation change and star-delta motor switching.

Both motors are protected against overload via motor-protective circuit-breakers which are connected to the PLC inputs. Developed PLC program should provide handling of their auxiliary contacts.

Compose PLC configuration and IO list.

Use CoDeSys for solution of this automation problem. Use different **programming languages** (IL, ST, LD, FBD, SFC) and various **POU**s (Program Organization Units: programs, function blocks, functions).

Practice Problem (Technical Drawing)

Design electrical wiring for *mixing plant with two stirrers*.

Problems to solve:

1. Design the electric power supply for motor and control circuits!
2. Solve the star-delta motor switching and motor shaft direction change!
3. Design power circuit for this problem!
4. Design 24 V DC control circuit for the same problem!
5. Solve overloading and short-circuit protection for the motor and other electrical components!
6. Choose proper electrical components!
7. Assign articles to all electric components (at least to one complex and three simple components)!
8. Draw electric circuit diagrams in EPLAN!
9. Generate the following sheets: title, table of contents, PLC overview, summarized parts list!