Pre-competition Activity
Automation Competition
Task Descriptions

TASK A: Pneumatic sequence

Weighting (points out of total): 30 / 100

Maximum time allowed, t max: 60 minutes

Problem:

Use Festo TP101 equipment set to design, assemble and commission a pneumatic circuit with the sequence of

$$\left[B+,\ 2s,\left(\begin{matrix}A+\\4.0bar\end{matrix}\right),\left(\begin{matrix}A-\\B-\end{matrix}\right)\right]$$

Circuit requirements:

1. Adjust the supply pressure to 5.0 bars.

2. Cylinders A and B are to be double acting cylinders with cushioned end stops.

3. The cycle is to be initiated by simultaneously pressing two normally closed 3/2 way valves configured using a dual pressure valve (AND).

4. Once the cycle is started it will complete one cycle and then come to rest.

5. Use appropriate sensors to ensure that cylinders A and B are in their retracted positions before the cycle can start. Note that there are two cylinder-attached proximity sensors and two roller lever valves available.

6. The choice of sensor types and location is to be determined by the teams.

7. Add speed control element to cylinder B to limit its forward speed while maintaining maximum force. Full forward stroke is to be achieved in 3.0
8. ±0.5 s.

9. The last step of the cycle includes both cylinders returning at the same time, however, Cylinder B is to retract fast through a quick exhaust valve.

10. Use a flow restrictor to starve cylinder A when it is moving forward. Add a gauge to observe the pressure slowly increasing in cylinder A to 4.0 bar.

11. The Cylinder A should have a pilot actuated and spring return 5/2 way valve and Cylinder B is to have a pilot actuated and pilot return 5/2 way valve.

TASK B: Electro-pneumatic (Hard-wired system)

Weighting (points out of total): 30/ 100

Maximum time allowed, t_{max}: 60 minutes

Problem:

Design, Assemble, and Commission the following sequence using hardwired electro- pneumatic elements.

$$[B+, A+, B-, A-]$$

Circuit requirements:

1. Use two momentary normally open switches and one of the relays provided to form a START/STOP latching circuit for step (3) above.

2. The sequence should only start if cylinder A and B are fully retracted. Use sensors to ensure this is the case.

3. Cylinder B is to be fitted with proximity sensors onto the cylinder and cylinder A's position is sensed by electrical limit switches (roller lever type).

4. Cylinder A is to be operated by a solenoid actuated, spring return 3/2 way directional control valve (DCV).

5. A 5/2 way double solenoid DCV is to be used for Cylinder B and the solenoids must be indirectly energised through relays.

6. Cylinder B must make a rapid return.

7. The cycle must self-repeat until interrupted by the STOP button.

WARNING: DO NOT POWER SOLENOID VALVES DIRECTLY WITH REED SWITCHES.

TASK C: Programming a sequence with a PLC

Weighting (points out of total): 40 / 100

Maximum time allowed, t_{max}: 60 minutes

Problem:

Use Festo TP101 and TP201 equipment set along with your PLC to design, assemble and commission an electro-pneumatic circuit with the following sequence:

$$\left[\begin{pmatrix} A+ \\ B+ \end{pmatrix}, 2s, A-, 2s, B-, 2s, (B+, B-)^2\right]$$

Circuit requirements:

1. Adjust the supply pressure to 6.0 bars.
2. Cylinders A and B are double acting cylinders with cushioned end stops.
3. The cycle is to be initiated by actuating a normally open momentary push-button switch (START). The cycle is not to self-repeat but must be able to start again by pressing the (START) button on demand, without resetting or reloading the programme to your PLC.
4. Use an appropriate solenoid actuated with spring return valve for Cylinder A and a double solenoid valve for Cylinder B.
5. Cylinder B solenoids are to be controlled indirectly using relay contacts.
6. Each cylinder is to have a sensor to detect its extended and retracted position. These can be any of the sensors available in the equipment set provided.

+++ END OF TASKS +++

Automation

Assessment Summary / Marking Criteria

Please note this is an **example** of how marks will be broadly awarded.

National Qualifiers (heats):

Criterion ID	Criterion Description	Max Marks
A	TASK 1: Pneumatic sequence	30
B	TASK 2: Electro-pneumatic (Hard-wired system)	30
C	TASK 3: PLC programming	40
	Total Marks	100

National Final:

Criterion ID	Criterion Description	Max Marks
A	TASK 1: Pneumatic sequence	15
B	TASK 2: Electro Pneumatics	15
C	TASK 3: Advanced Electro Pneumatics / Fault finding / circuit change	20
D	TASK 4: Electro Pneumatics + PLC Programming	25
E	TASK 5: Advanced drives + PLC Programming + OPC UA / Dashboards	25
	Total Marks	100