Test Project

Task D1 – Automation in water and wastewater treatment plant

EduKit PA – 2 hours

Water Technology

Submitted by:

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Introduction

The EduKit PA system is a flexible and customizable learning platform that enables innovative experiments.

The following main components are provided for your task:

- EduKit PA Basic in a cardboard box
- EduKit PA Advanced in a Systainer
- Tools for this task
- Watering can
- Extension Kit EduKit PA WorldSkills 2026 Shanghai
- Tabletop power supply unit

Note: A range of sensors and actuators is provided. Use only the components required to fulfill this task.

Description of project and tasks

The task is to build a test bench using components from the EduKit PA Basic and EduKit PA Advanced systems to test a new component. The equipment proved to be excellent for this task, requiring only a few additional components to be acquired.

The engineering team has compiled preparatory technical documentation, including Piping and Instrumentation Diagram (P&ID), drawings, and simplified information on connecting the electrical components. Your task is to build and test this system to ensure that the newly selected components and the test bench are good to use.

Your task:

1. Preparation: Remove the station from the Systainer/box.
2. Assemble the station mechanically using the information provided.
3. Set up the station and test the new components to check the requirements and document the results.

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Instructions to the Competitor

1. **Preparation: Remove the station from the box and systainer.**

Note for all tasks:

- *Use only the pipes that were specified in the task. Minimize the use of new pipes and water as much as possible.*
- *Do not cut the electrical cables for the sensors and actuators, so they can be reused for other tasks.*
- *Pack all unused devices neatly in the Systainer from the EduKit PA Advanced package.*
- *Place all the unused components from EduKit PA Basic system to its cardboard box.*
- *Do not damage the box of the EduKit PA Basic system or any other boxes provided.*
- *Follow the guide and best practices for all steps, including pipe cutting, cable routing, and the use of cable holders.*

2. **Assemble the station using the information provided.**

- The Approximate mechanical drawing of the station, see (Figure 1).
- Piping and Instrumentation Diagram (P&ID), see (Figure 2).
- Assemble the ball valve according to the instructions (Figures 3-7) and separate assembly instructions.
- Layout of the pipe system (Figure 8). Build the pipe system and stabilize with a pipe holder (add space between the profile plate and the pipe) at the specified fixing points on the profile system.
- Note: *Only use components from the EduKit PA Extension Kit and the additional accessory bag, and additional pipes from the EduKit PA Basic system. Pipes that are already installed in the EduKit PA Basic must not be used and must be in their original condition at the end to enable quick reassembly, except for the pipe connection between the lower tank and the pump, which does not need to be changed for the test setup.*
- Install the manual control unit and pipe holder exactly as shown in Figure 9 on the lower tank of the EduKit PA Basic system.
- Set up the test bench on the new base plate as specified in Figure 10 and connect the new component in conjunction with the EduKit PA Basic system.
- **The areas to be evaluated are indicated** in Figure 10.
- Attach the equipotential bonding cable (PE) from the manual control unit to the specified position on the profile plate, as indicated in Figure 12.
- Label the components according to the P&ID (Figure 2).

3. **Additional information on the pneumatic system**

- Route the pneumatic hose from the pneumatic main inlet, via the pneumatic maintenance unit, to the pinch valve. Find installation positions on the profile system in Figure 10.

Safety note: Check whether the outlet of the pneumatic maintenance unit is closed before installing components or hoses. Before opening the maintenance unit, check that all pneumatic connections have been completed correctly!

4. **Additional information on the electrical system**

Note: For safety reasons, do not switch on the system during this part of the task, or while filling or emptying the station.
Only the equipotential bonding cable and the pump plug must be connected to the I/O board.

- The pump plug must be connected to the designated socket provided for the pump.

5. **Set up the station and test new component according to its functional requirements. Document the results of the testing process.**

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Assembly instructions and test report of the ball valves:

Name:	New Test bench	Order number:	WorldSkills 2026
No.	**Activity**	**Done**	**Note/observation/result**
1	Installation of the ball valve (1), mounting bracket (2), and rotary actuator (4). The slot on the top of the rotary actuator and the opening/bore of the ball valve must face the same direction; the brass band on the ball valve must be on the right-hand side. Use M5 x 16 screws (3). See Figure 4.	☐	
2	Install the push-in fitting (7) and exhaust-air throttle valves (6) on the underside of the solenoid valve (5). Insert the gaskets (if a gasket has a tab, insert it so that the tab points towards the “5/2” label on the edge). See Figure 5.	☐	
3	Place the pre-assembled solenoid valve (step 2) onto the mounting plate of the rotary actuator, rotating it so that the gaskets rest against the mounting plate (Caution: Make sure the gaskets do not slip out of position) Make sure that you align the coding pin in the correct position Figure 4 (10). Screw the solenoid valve to the mounting plate. See Figure 5.	☐	
4	Apply yellow and black markings to the position feedback (8), as shown in the Figure 6. Snap the round plate into the “housing” of the position feedback: the two protruding tabs on the plate and in the housing should be at a 90° angle to each other. See Figure 6.	☐	
5	Install the position feedback (8) so that the upper position mark (12) at the end points towards the electrical feedback (9) See Figure 6.	☐	
6	The fully assembled ball valve is shown in Figure 7.	☐	
Date and finish time	_____	**Test carried out by:**	Country: _____ Competitor: _____

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Test report

Name:	Sample station	Order number:	WorldSkills 2026
No.	**Activity**	**Done**	**Note/observation/result**
1	Connect the electrical power cable from the manual control unit to the power supply unit. Make sure that the power supply unit is "off".	☐	
2	Close the valves VV5, VV3.	☐	
3	Fill 2.5 L water into the tank VE1.	☐	
4	Switch the power supply unit "on".	☐	
	Check the function of the ball valve. (Figure 11)	☐	
5	Setup the pneumatic maintenance unit so that the ball valve still switches reliably, while applying as little pressure as possible to the compressed-air line. Also note down the air pressure value on the pneumatic maintenance unit.	☐	_____ bar
	Note: The recorded values must always correspond to the test sequence: Set the valves, then switch on the pump, then record the measured value when it is stable.		
	Test No.1 - Setup Typ1 **Read the values at FI 106:**		
10	How much flow is obtained through only the manual valve VV1?	☐	_____ L/h
11	How much flow is obtained through only the ball valve VV2?	☐	_____ L/h
12	How much flow is obtained through the manual valve VV1 and ball valve VV2?	☐	_____ L/h
	Test No. 2 - Setup Typ2: **Read the values at FI 106:** **Install the additional component (non-return valve and pipe with 105mm +/-2mm) see PI diagram Figure 2.**		
20	How much flow is obtained through only the manual valve VV1?	☐	_____ L/h
21	How much flow is obtained through only the ball valve VV2?	☐	_____ L/h
22	How much flow is obtained through the manual valve VV1 and ball valve VV2?	☐	_____ L/h
	Additional Points:		

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30	To save water, use as little as possible throughout the entire test and setup. You have an initial allowance of 5 Liters of water. If additional water is needed, notify the observer.	☐	End check: 2.5 L in the VE1 _____ L in the watering can
Date and finish time	_____	**Test carried out by:**	Country: _____ Competitor: _____

To continue.

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Figure 1. Approximate design of the new EduKit PA layout.

Figure 2. P&ID of the test system Typ 1 and Typ 2 (Install for setup Typ 2).

Figure 3. Overview of the components used for the ball valve.

1: Ball valve; 2: Mounting bracket; 3: Screws; 4: Rotary actuator; 5: Solenoid valve; 6: Exhaust air throttle valves; 7: Push-in fitting; 8 Position feedback; 9: Electrical feedback.

Figure 4. Ball valve - 10: Coding pin.

Figure 5. Ball valve - 11: Seal/ Gasket.

Figure 6. Position feedback - 12: Top position marker.

Figure 7. Fully assembled ball valve.

Figure 8. Layout of the new pipe system.

Figure 9. Manual control unit and pipe holder - mounting information.

Figure 10. 1: Pipe holder; 2: cable holder; 3: Pneumatic unit - Manometer face to the front; 4: Pneumatic ball valve.

Figure 11. Pneumatic ball valve - manual switch open/closed.

Figure 12. Position of the equipotential bonding cable.

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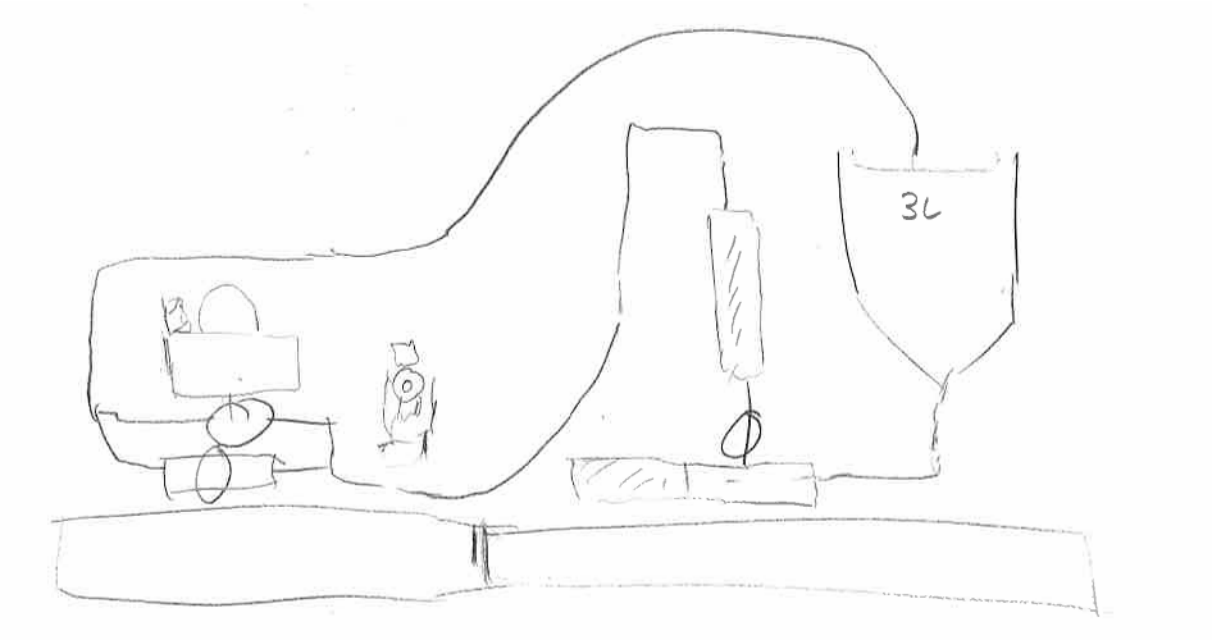


Figure 1. Approximate design of the new EduKit PA layout.

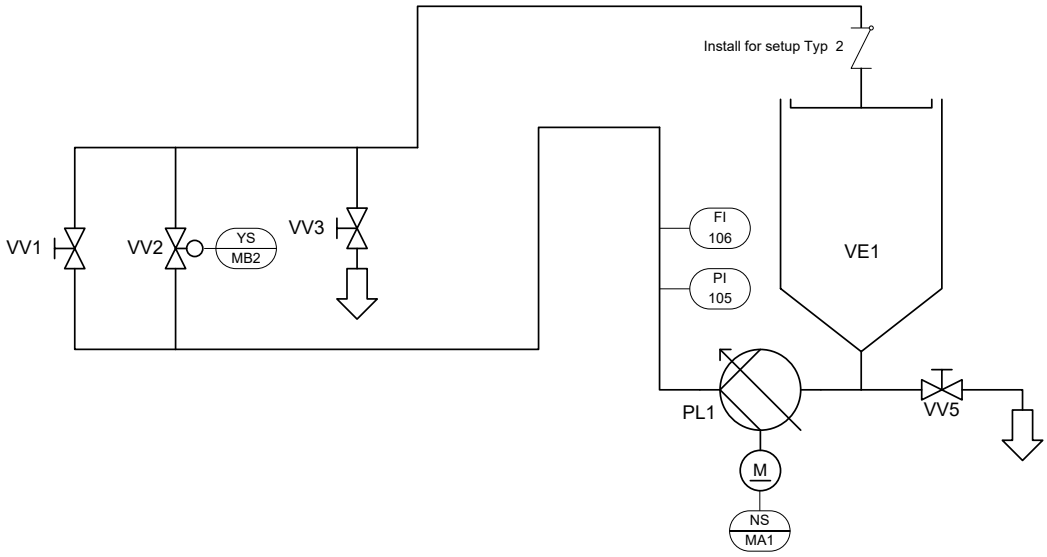


Figure 2. P&ID of the test system Typ 1 and Typ 2 (Install for setup Typ 2).

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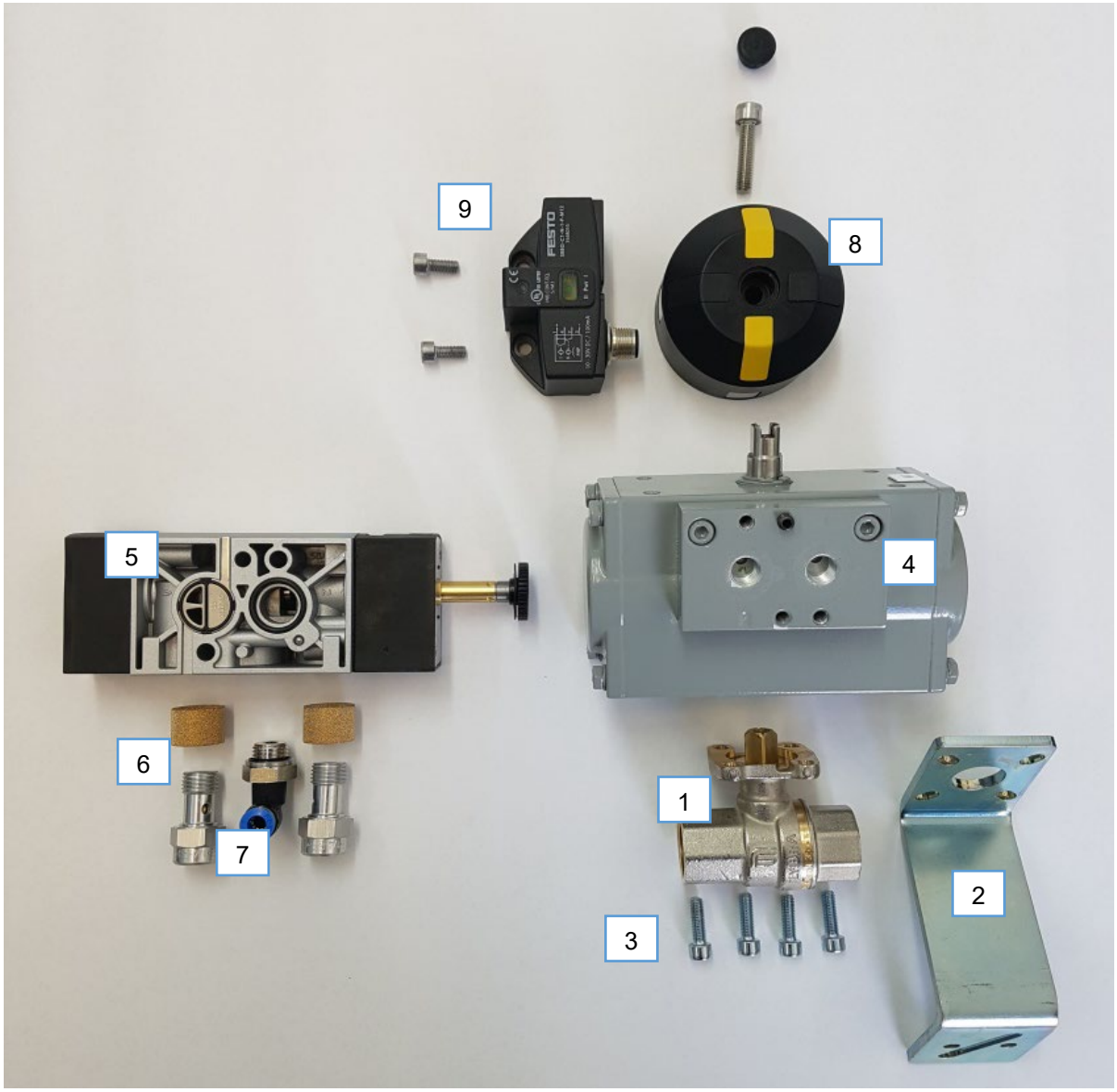


Figure 3. Overview of the components used for the ball valve.
1: Ball valve; 2: Mounting bracket; 3: Screws; 4: Rotary actuator; 5: Solenoid valve; 6: Exhaust air throttle valves; 7: Push-in fitting; 8 Position feedback; 9: Electrical feedback.

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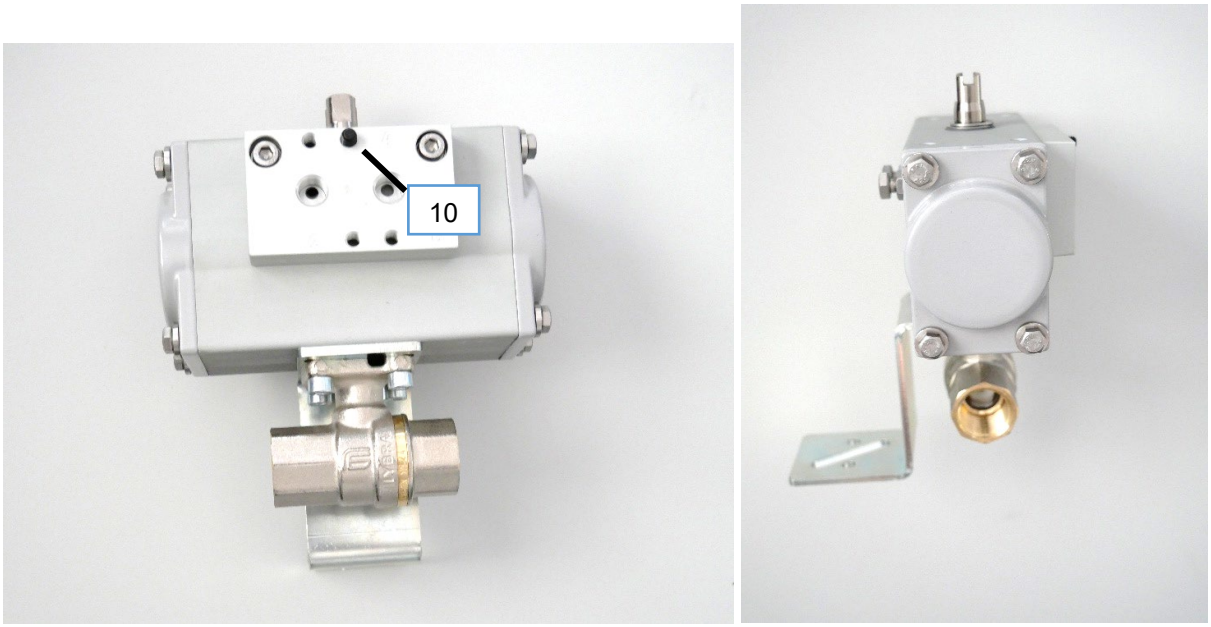


Figure 4. Ball valve - 10: Coding pin.



Figure 5. Ball valve - 11: Seal/ Gasket.

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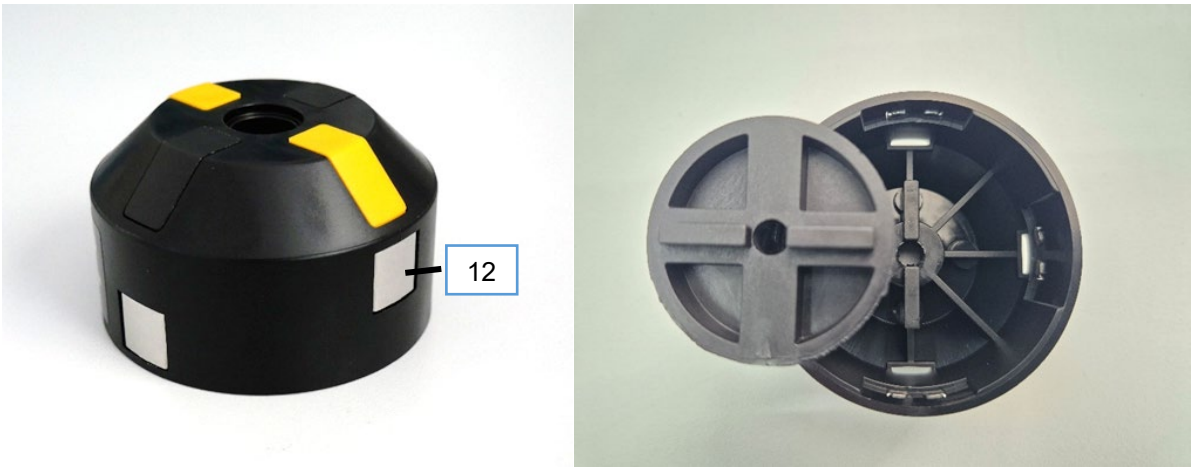


Figure 6. Position feedback - 12: Top position marker.



Figure 7. Fully assembled ball valve.

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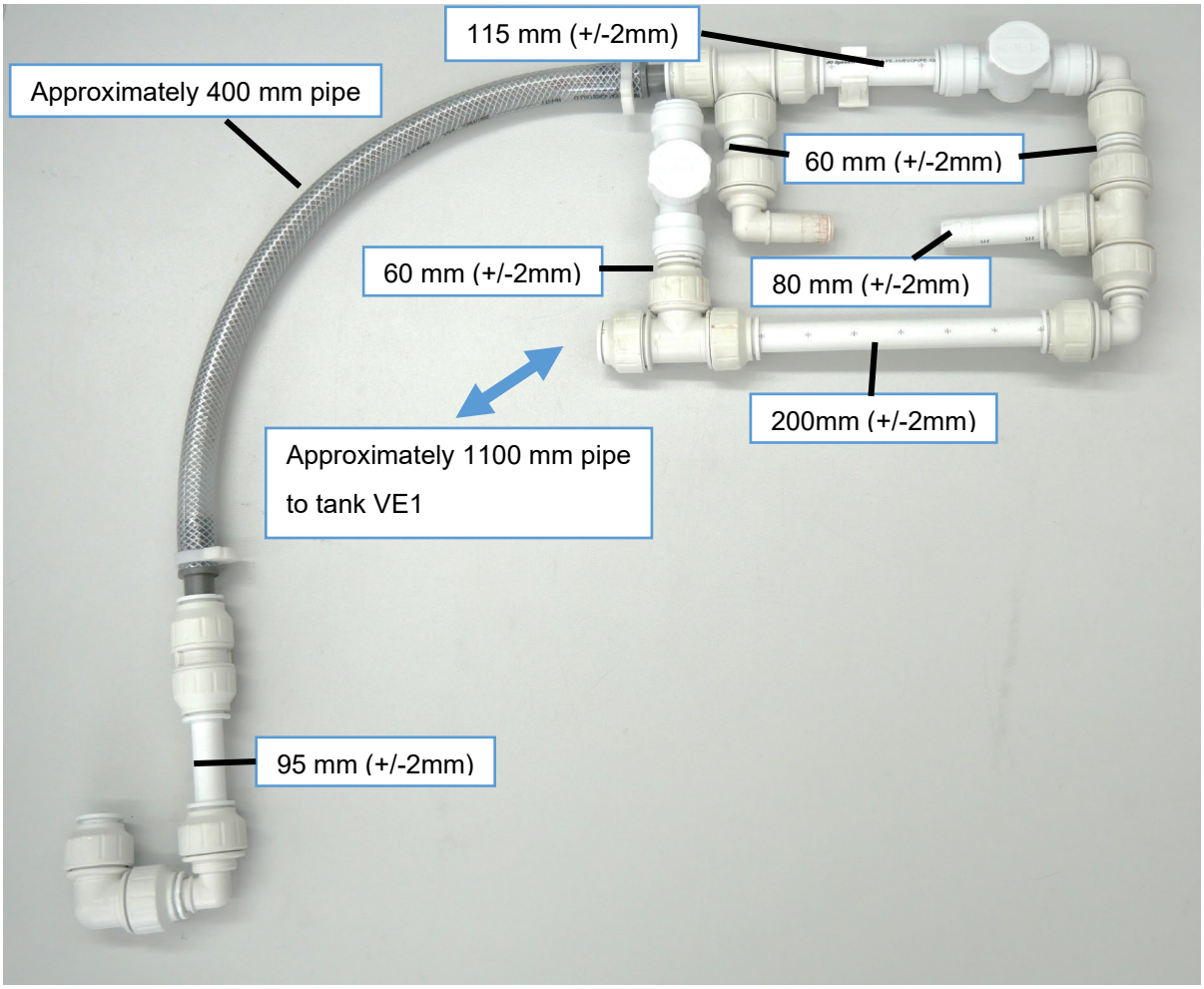


Figure 8. Layout of the new pipe system.

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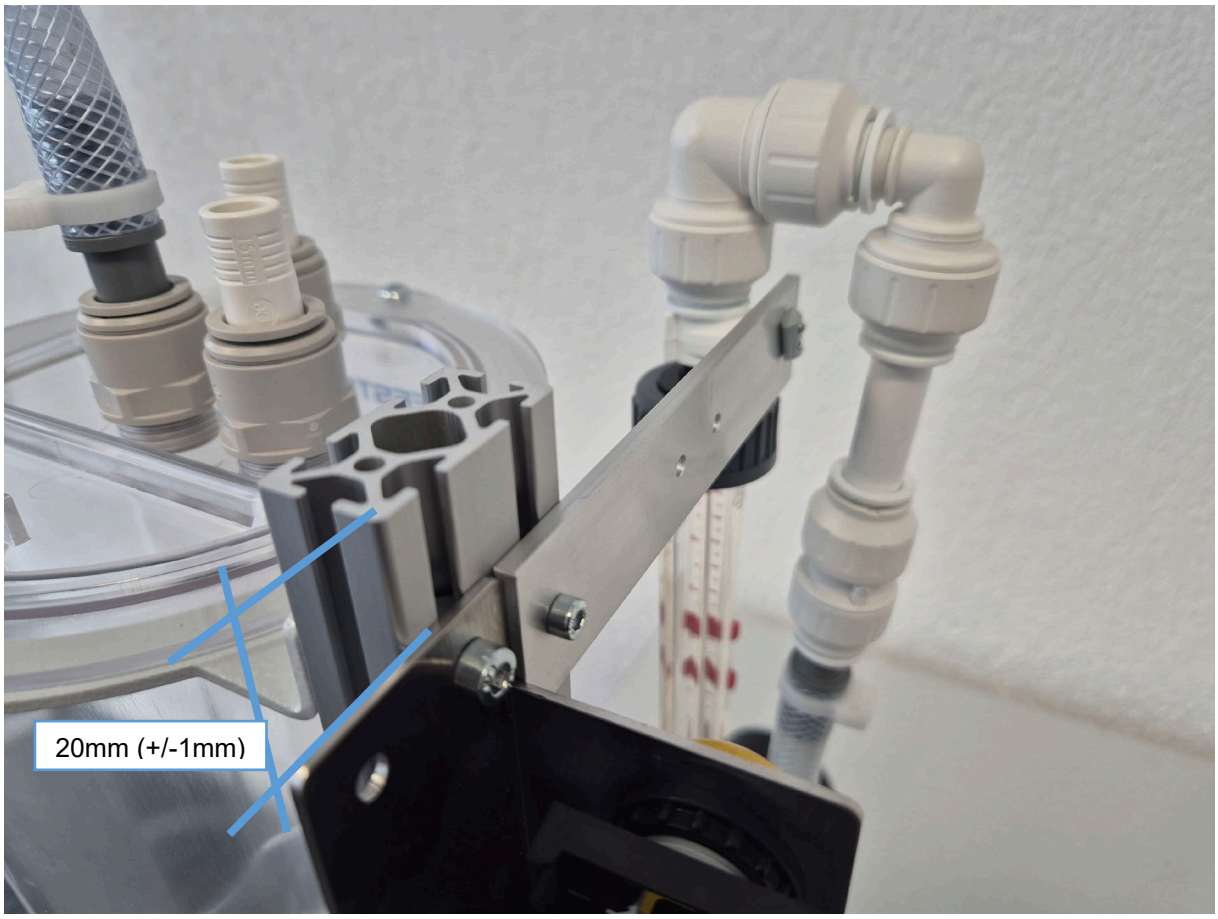


Figure 9. Manual control unit and pipe holder - mounting information.

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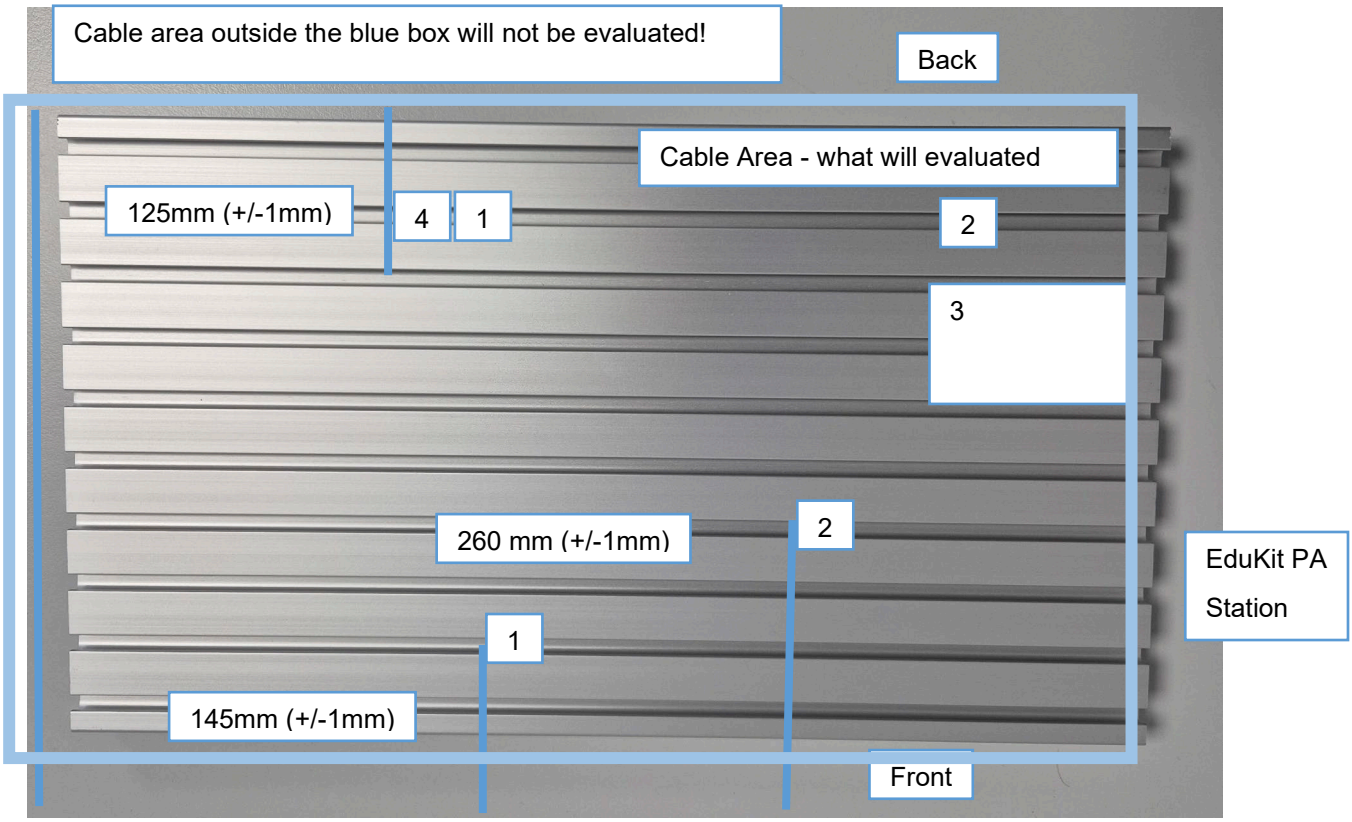


Figure 10. 1: Pipe holder; 2: cable holder - pneumatic; 3: Pneumatic unit - Manometer faces to the front; 4: Pneumatic ball valve.

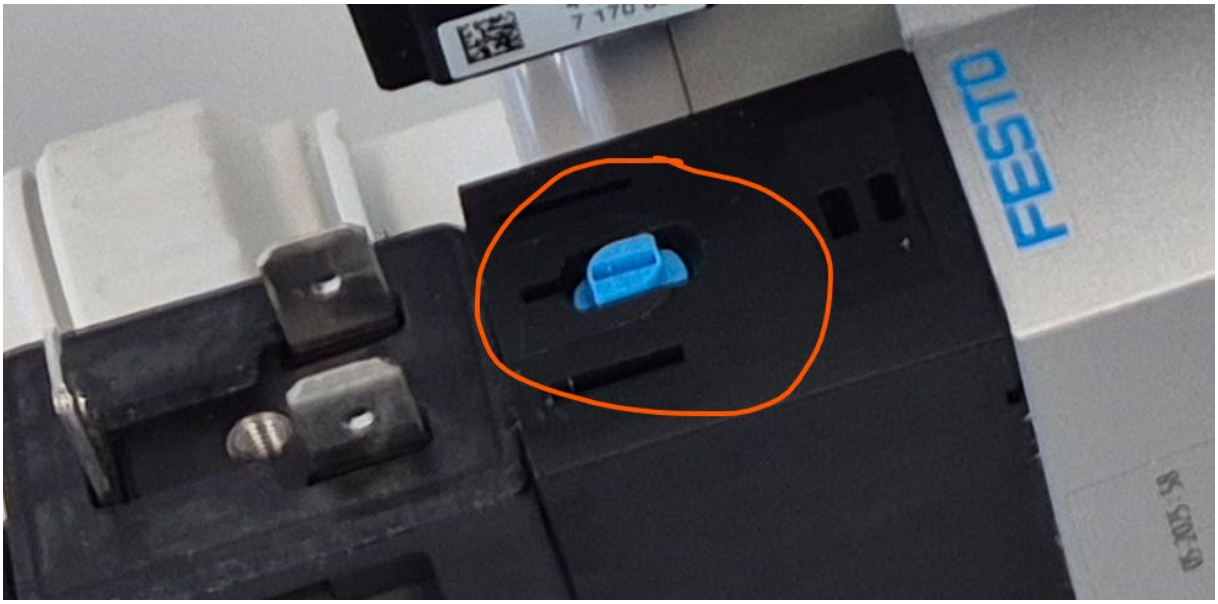


Figure 11. Pneumatic ball valve - manual switch open/closed.

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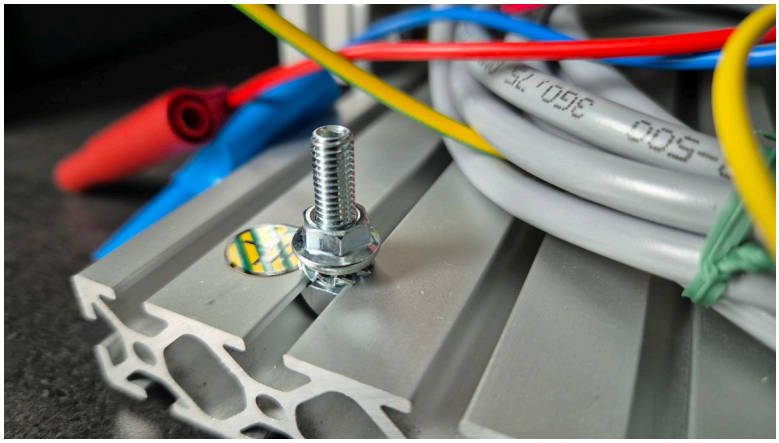


Figure 12. Position of the equipotential bonding cable.

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Task Forms

Country: _____ Competitor: _____

Marking Scheme

The task evaluation will be made according to the Competition Information System (CIS) of Water Technology 2026.

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