Technical Handbook
Mechatronics – 2026 Cycle

About WorldSkills UK

WorldSkills UK is a set of dynamic skills competitions for young people and adults, designed and delivered by industry experts annually in over 70 skills.

Many WorldSkills UK competitions lead into WorldSkills International competitions which are biennial global events.

For further details, please visit:
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ENGINEERING SKILLS FOR THE FUTURE

Mechatronics

Introduction

The aim of this manual is to help competitors prepare for the Mechatronics competition at regional and national level. We hope this will help competitors to perform to the best of their ability during the competitions. The guide contains general advice, technical tips and a more in-depth overview of the competition structure and its content. The teams are made up of **two competitors**.

Using the tips and advice throughout the guide will help you focus on the competition areas with a higher level of accuracy, read, look at and review tasks thoroughly before beginning and teach you to step back occasionally to see if you are achieving your goal.

Remember it's not a race, you are competing against a standard, a very high standard, but one that is achievable.

Competition Overview

This is a practical competition that will test your logic, design and fault-finding skills in a challenging environment.

To complete the tasks competitors are expected to apply their theoretical knowledge of fundamental principles, automation, pneumatic, electrical/electronic and PLC technologies.

The skills that are tested in the practical competition include:

- Designing, building, and testing pneumatic, electro-pneumatic circuits and PLC programmes for sequential and non-sequential tasks
- Mechanically assembling a given set of components, commission and optimise to a specification
- Electro-pneumatic circuit simulation and process visualisation
- Adding new functionality and operations to a given application
- Integrate distributed devices such as sensors and communication networks.

Stage 1 Registration and preparation

To compete in the competition, you must register using the WorldSkills UK website. You will then receive a confirmation of whether you have successfully registered. Mechatronics competition involves a team of two competitors. Whilst you wait to get to the next stage of the competition, you should do your best to prepare for the competition by looking at the **pre-competition activity task** made freely available to you on **our website**. While you will register your details individually, it is also very important at this stage to specify the same team name when registering so that you are allocated to the same team to avoid unnecessary delays.

Stage 2 Entry stage

Shortly after registering, the competition journey will begin with what is called an entry stage. This will be an online task in the form of a multiple-choice activity, exploring the competitor's fundamental knowledge and familiarity with pneumatics, electro-pneumatics and PLC programming. This activity is time limited to 1 hour and will take place soon after the registrations close. Each competitor will take part in the activity, but the individual marks will be combined to get a team mark. This is an important part of the competition journey as it gives the competitor an early taste of what knowledge is needed to be successful on the journey. Once everyone's scores have been totalled, competitor teams will be informed if they have progressed on to the next round, called the national qualifiers.

Stage 3 National Qualifiers

For competitors who have managed to progress from the entry stage, the next step is the national qualifiers. There will be a range of venues and dates that will be available to register. You will be allocated to your nearest host centre, subject to availability, however, we will do our best to ensure you can participate. National qualifiers are one-day activity, typically involving three main tasks. The top six scoring teams meeting the minimum threshold from the national qualifiers will then be invited to the next round, the National Finals.

Stage 4 WorldSkills UK National Finals

The top six (6) teams in the UK will be invited to compete in the UK National Final which is the pinnacle of the UK national competition cycle.

The finals are usually a large-scale event, and a chance to show off your skills, meet a number of industry professionals and other competitors taking part, as well as bring your family along to see you compete. The UK National Final is currently planned to take place, typically in mid-November, involving practical activities. This is typically a three-day event involving a day of setup and familiarisation followed by two days of competition activity.

Stage 5 WorldSkills UK International Competitions

Beyond the national finals, there are a host of opportunities for competitors. Eligible competitors who show the highest skills, passion, and drive from the national finals will be given the opportunity to compete to train for the EuroSkills and WorldSkills International competitions. The winners from national final competitions who are not eligible for international competitions may join the Skills Champions programme, which allows continued involvement, including the opportunity to work with WorldSkills UK and visit schools, colleges, and events to inspire the next generations.

Alternatively, if training is of interest to you, you could consider supporting WorldSkills UK with organising and training, and even helping to run the National Finals.

Core Competencies

Please note the following are core competencies for the full set of Mechatronics competitions, that competitors will be assessed on. Not all competencies are covered at all stages and levels.

Core competencies and standards for WorldSkills UK Skills Competitions activities		Qualifier Stage	National Final	WSI Team UK
Standards	**Development of mechatronic systems** Knowledge and understanding: • designing, assembly and commissioning of a mechatronic system • understand the function, the application and the components of: – pneumatic systems – hydraulic systems – electric and electronic systems – drives – industrial robotic systems – PLC systems	Y	Y	Y
Competency	**Competitors shall be able to:** • carry out system design for a given industrial application • assemble a machine according to documentation • connect wires and tubes in the correct industrial way • install, setup and make necessary adjustments to the mechanical, electrical & sensor systems • commission a machine by auxiliary equipment and together with a PLC using their standards and their documentation.			
Standards	**Industrial controllers** Knowledge and understanding: • understand the function, the structure and the operating principles of PLCs • understand the structure and function of industrial controllers (PLCs) • understanding of the configuration of the industrial controller and how a software program relates to a machine action. • of industrial networks and bus systems	Y	Y	Y
Competency	**Competitors shall be able to:** • connect their own PLC to mechatronic systems • make the necessary configuration of the industrial controller • configure all aspects of their PLC as required and the associated control circuitry for correct operation. • Setup an industrial network/bus for communicating between industrial controllers and other distributed devices.			
Standards	**Software programming** Knowledge and understanding: • understanding of programming an industrial software system • understand how a software program relates to a machine actions	Y	Y	Y
Competency	**Competitors shall be able to:** • write programs to control a machine or a process, and visualise the process and operation using software • PLC programme, including digital and analogue signal processing and industrial field buses.			

Standards	**Design Circuits** Knowledge and understanding: • of the principles, applications and standards of circuits schematics • of the methods of designing and assembling electrical circuits in mechatronic systems.	**Y**	**Y**	**Y**
Competency	**Competitors shall be able to:** • read circuit schematics and design pneumatic and electrical systems. • design pneumatic and electropneumatic circuits with modern software tools.			
Standards	**Analytical Techniques** Knowledge and understanding: • knowledge of analytical fault finding and repairing.	**N**	**Y**	**Y**
Competency	**Competitors shall be able to:** • find different faults in an analytic way in a mechatronic system • repair components in short time. • demonstrate mastery of problem-solving techniques to ensure correct and safe machine operation. • optimise a mechatronic system consisting of different modules.			
Standards	**Mechanical and Electrical Design** Knowledge and understanding: • knowledge of designing and assembling mechanical systems including pneumatic systems, their standards and their documentation.	**N**	**Y**	**Y**
Competency	**Competitors shall be able to:** • design and assemble mechanical and electrical systems to a given specification.			

Schedule

Registration:	02 - 27 March 2026
Entry Stage:	20 – 22 April 2026
Results of Entry Stage:	01 May 2026
National Qualifiers***:**	Qualifier 1: 04 June 2026 – Festo, Northampton Qualifier 2: 05 June 2026 – Festo, Northampton
National Finalists Announced:	09 July 2026
National Finals:	17-20 November 2026, Swansea, South Wales.

**** - These are provisional qualifier dates and other venues and dates may be added following the Entry Stage.***

General Instructions

1. Entry stage will involve 1-hour multiple-choice test, aimed at testing fundamental knowledge in pneumatic and electro-pneumatic components and associated circuits and PLC programming. Competitor teams will be e-mailed a link to take the Entry Stage test during the above dates. Once you start the test, you must complete within an hour. Time taken will be recorded by the online system.
2. Maximum working time at National Qualifiers is 3 x 1-hour tasks. At the start of the competitions an allotted time will be allocated for work planning. This time is not part of the working time.
3. The National Final will typically consist of 5 tasks exploring different competencies tested over two days, requiring approx. 9-11 hours of total competition time.
4. All supplied equipment and materials must be accurately checked by the competitor upon commencing the competition.
5. All materials and equipment must be marked out/used in the most economical method.
6. Competitors will lose marks for any misplaced, lost, or spoiled materials and/or equipment, where this is the result of competitor error.
7. Competitors will lose marks for each minor breach of the Health & Safety rules. Where a competitor puts themselves or any other person at risk as a result of a Health & Safety breach, the task will be stopped. Where a task is stopped due to a Health & Safety risk, the judge will decide if the task can be continued safely.

Competition equipment needed at National Qualifiers

1. Competition equipment is typically based on the Festo Technology Packages using electro-pneumatic components. There will also be a simpler build task for a modular production system. Equipment needed for the tasks will provided by the organisers with the exception of the programming device.
2. All competitor teams will need to bring their own PLC and programming equipment and the necessary software.
3. While it is not necessary, competitors may bring their own tools, writing pads or boards.
4. PLCs will need to have minimum of:
   - 16 x Digital inputs – 24V DC
   - 16 x Digital outputs – 24V DC
   - 4 x IO-Link Master – this can be integrated with your PLC or can be used as an add on external device, connected to your PLC using Profinet or similar. The IO-Link master should have either open ended screw/push fit terminals or as M12, Female, IO-Link **Class B** connectors.
5. Integration of the competitors PLC is typically achieved by the use Syslink cables or directly with 4mm shrouded leads. If competitor's PLC only has hardwired connections, then it would be helpful to inform the organisers so adequate provision to connect the PLC to the rest of the equipment can be made.
6. If your PLC will be using Syslink cables to connect to the rest of the equipment, it would be helpful to bring your own Universal Connection units. Otherwise, it would be helpful to inform the organisers to ensure this is provided.

Competition equipment needed at National Finals

1. Once progressed to the National Finals, competitors will need to bring along their preferred PLC with the relevant programming software and associated equipment.
2. PLC specification will need to have:
   - 16 x Digital inputs – 24V DC
   - 16 x Digital outputs – 24V DC
   - 4 x IO-Link Master – this can be integrated with your PLC or can be used as an add on external device, connected to your PLC using Profinet or similar. The IO-Link master should have either open ended screw/push fit terminals or as M12, Female, IO-Link **Class B** connectors.
3. Competitor teams are strongly advised to make themselves familiar with installing IODD (IO-Link Device Description) files to their programming software. During the tasks, you will be issued with various IO-Link devices to integrated into your setup along with associated data files.
4. Full set of tools needed will be made available for all competitor teams but they are also entitled to bring their own equipment and tools.

Practice

There are a number of past competition test pieces available to download from the WorldSkills UK website. This is labelled the ***pre-competition activity***.

Please ensure you make full use of these resources in preparing to attend the qualifiers and national finals.

> A wise man can learn more from a foolish question than a fool can learn from a wise answer.
>
> **Bruce Lee**

Judges Top Tips

The following eight aspects are neither exhaustive nor prescriptive and not a 'magic' formula to success. However, these are tips based on being involved with competitions for many years and we hope these will help you in future competition participation.

1. **Pressure.** You will be nervous, but you will need to keep nerves under control and not let the pressure overtake you. But managed pressure can be good, increasing energy and performance potential.

   How to handle nerves;

   a. Listen to the Judge's brief and ask questions – what sort of questions depends on you, i.e. repeating an aspect of their brief; gives you a chance to understand more.
   b. Importantly, understand at what point your allotted time actually starts, i.e. normally after the Judge's brief.
   c. Read your competitors' brief; everything you need to know for the task is in that brief. Allow yourself 2 to 3 minutes to read it. Read it at least twice as your first reading will be too fast.
   d. Take a deep breath and start the task. You are against the clock and so you will need to work with focus.

e. Task going wrong? Take a moment, think. If necessary, quickly re-read that part of the instructions and then refocus. You may need to move on from that particular aspect of the task.

2. **Time Management.** The tasks are all against the clock. So once you have had your task brief and know how long you have, then quickly plan your workload. Section the aspects of the task into time blocks.
3. **Remember,** it is a competition and so practically everything you do within the task is marked and worth points; so focus on gathering points. Leave some time to put tools away at the end (that is worth points), clean up the working area (again, worth points). If you are stuck on a particular aspect then accept you may or may not get points for that particular part and in order to move onto the next part of the task, ask the Judge for assistance. Remember, there are other points to be earned.
4. **Think outside of the task.** Where are the Risk Assessments? If using any POL, where is the COSHH? If in doubt, then ask the Judge where these items are. Remember, you have a limited time to display your technical skill to the Judge and so you must be smart with your actions and work levels.
5. **Practice before the competition** at working under pressure and with someone watching you; perhaps your works' supervisor or college lecturer. Get them to be super critical on your work quality, methods of work and approach.
6. **Understand the advantage of selecting the right tool for the job.**
7. **Sleep.** Get plenty of sleep the night before. If offered, take advantage of accommodation for the night before the competition. Resist the temptation to consume alcohol the night before and have a good breakfast on the day of the competition; these actions will assist in preparing your mind and body.
8. **Arithmetic.** Practice mental arithmetic. It will sharpen your mind. Perhaps try Sudoku; aim to achieve at least medium level (start at mild or easy). Do mental arithmetic whenever the opportunity arises, e.g. just filled your car or motorbike, how many litres did you put in the tank. Mentally (without the aid of calculator convert Litres to Imperial Gallons - divide Litres by 4.5 to give Imperial Gallons or multiply Litres by 0.22). Understand the relationship between imperial and metric. Remember some datums.
e.g. 25.4mm to 1 inch and so, 12.7mm is ½ inch and 6.35mm is ¼ inch. 1 Imperial Gallon is 4.5 Litres (to 1 decimal place - it is actually 1 Imperial Gallon = 4.5461 Litres).

Technical Guidance

Technical guidance for each specific task and / or tooling will be given at the competition.

Task Breakdown

The following is an example of the marking criteria for the National Qualifier.

Criteria	Task	Mark
A	TASK 1: Simple build and test	**50**
B	TASK 2: System integration task	**50**
	Total Marks	**100%**

Health & Safety

During the competition as in any work or educational facility you have a duty to protect yourself and those around you.

As an Organising Partner, our delivery partners have a responsibility to protect you and keep you informed about health & safety procedures and practices including;

- making the competition area safe and without risks to health
- ensure plant and machinery are safe and that safe systems of work are set and followed
- ensure hazardous articles and substances are moved, stored and used safely
- provide adequate welfare facilities
- give instruction, information, supervision and where applicable training necessary to maintain health and safety.

As a competitor you have a legal duty to:

- take reasonable care for your own health & safety and that of others who may be affected by what you do or do not do
- cooperate with the Organising Partner and/or their appointed delivery team on health and safety matters
- correctly use work/competition items provided, including personal protective equipment, in accordance with instructions and/or training given
- not interfere with or misuse anything provided for your health, safety or welfare

In particular:

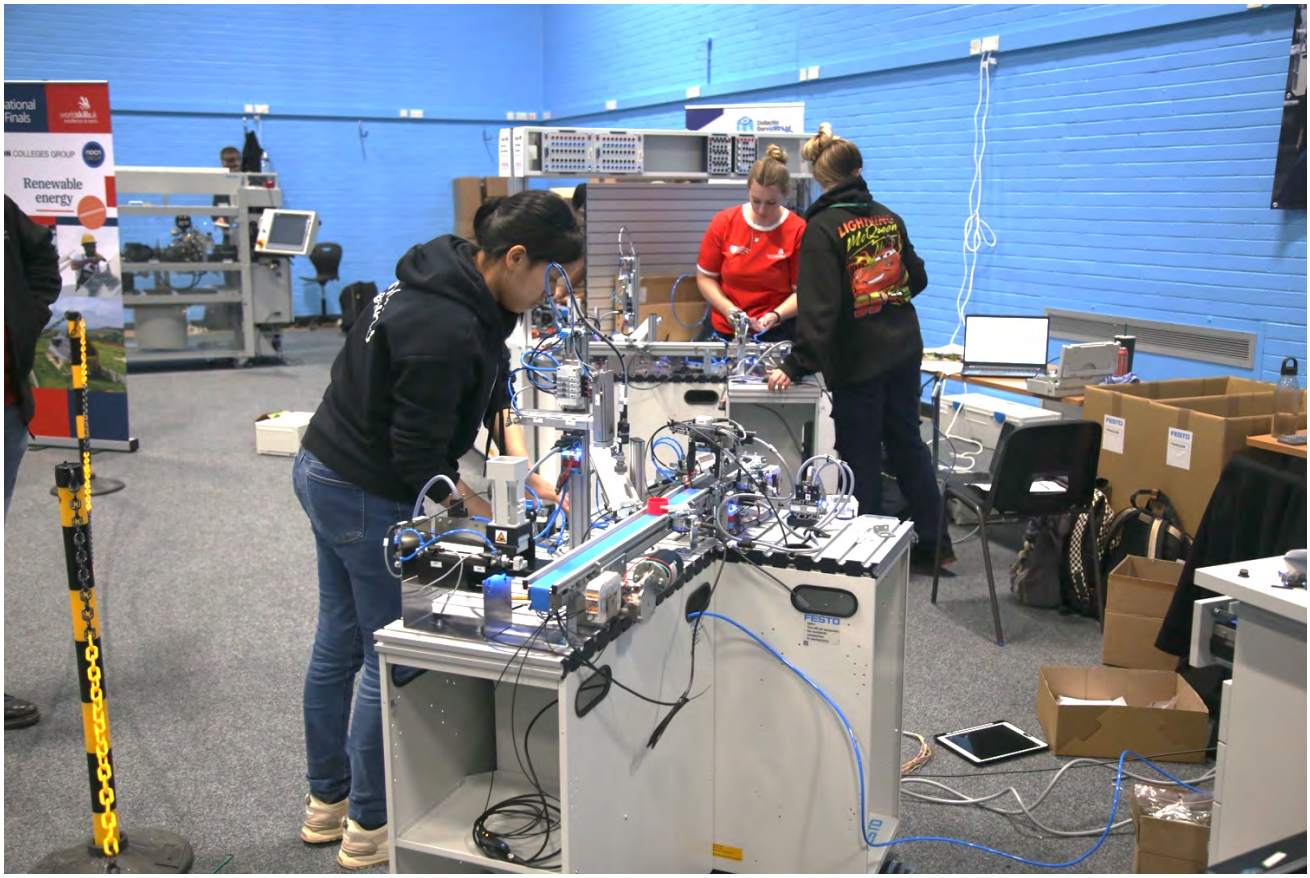
- all health and safety regulations, including protection standards, specified by the competition hosts and delivery team, must be followed exactly. Any defect in machines or equipment must be reported immediately.
- safety goggles must be used in all material-removing operations.
- shoes and clothing must comply with health and safety regulations.

Conclusion

Remember, the competition will be designed to take you out of your comfort zone but the tasks will be achievable. There will be a lot of 'self-pressure'. You need to learn how to control this and focus on the task in hand.

Once a task is complete, you cannot change the outcome good or bad, start the next task afresh and with positivity.

Drink plenty of water throughout the competition, staying hydrated will help with your concentration, focus and will reduce stress and headaches.


Renewable
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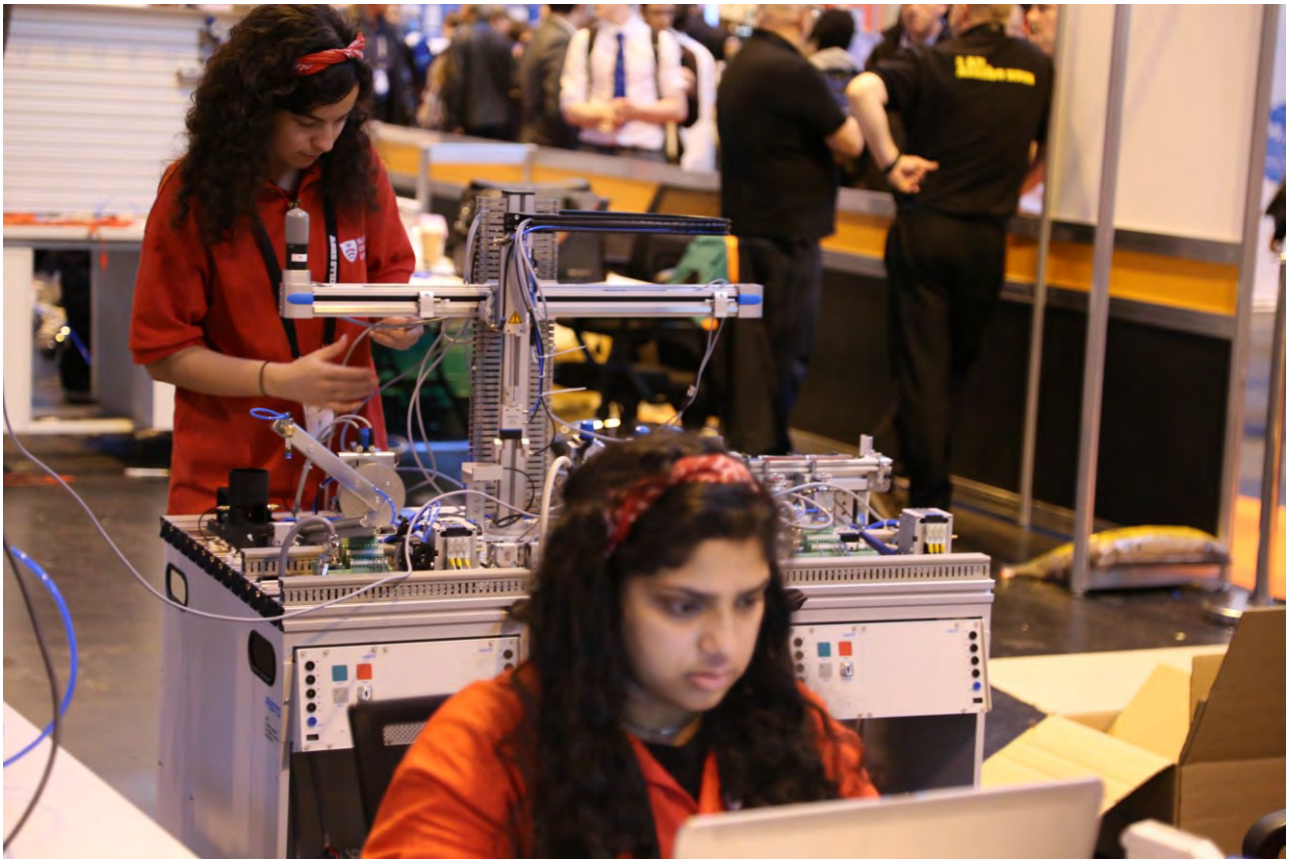

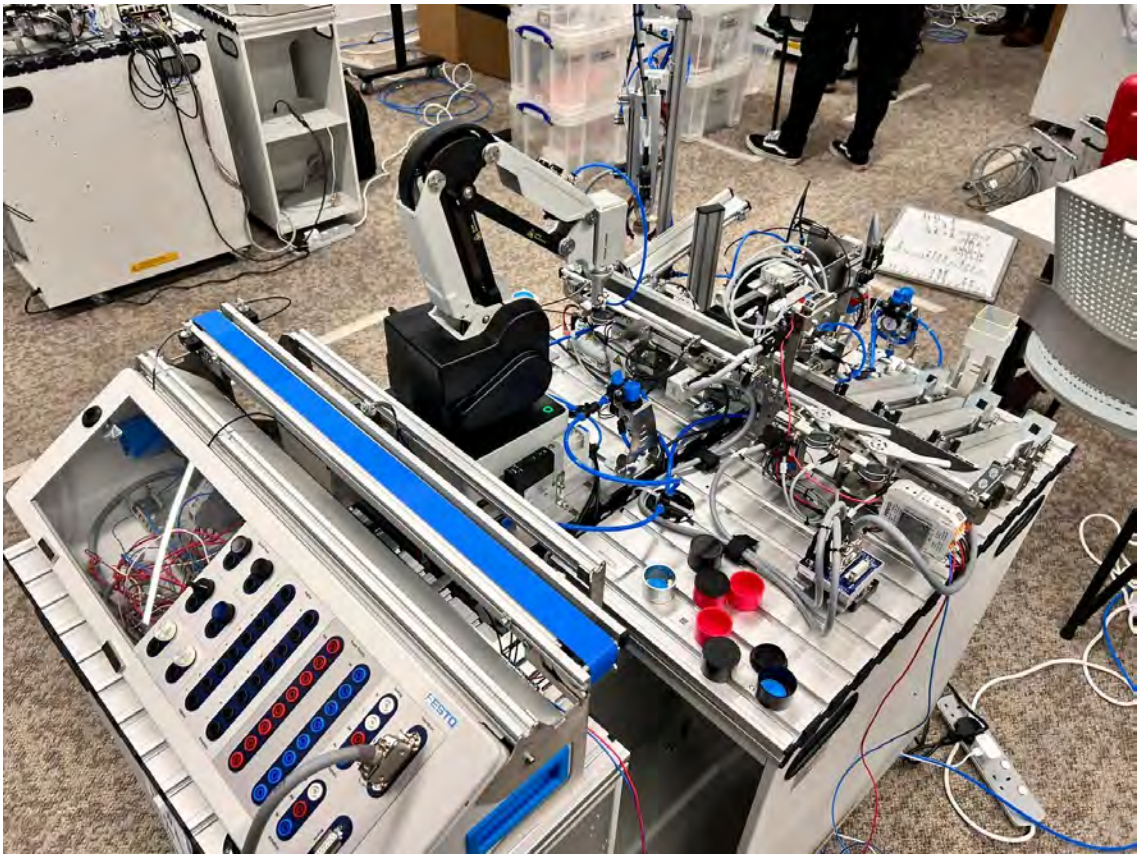
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We wish you the best of luck in your competition journey,
and would like to leave you with the following quote:

> Life is a series of experiences, each one of which makes us bigger, even though sometimes it is hard to realise this. For the world was built to develop character, and we must learn that the setbacks and grieves which we endure help us in our marching onward.
>
> **Henry Ford**