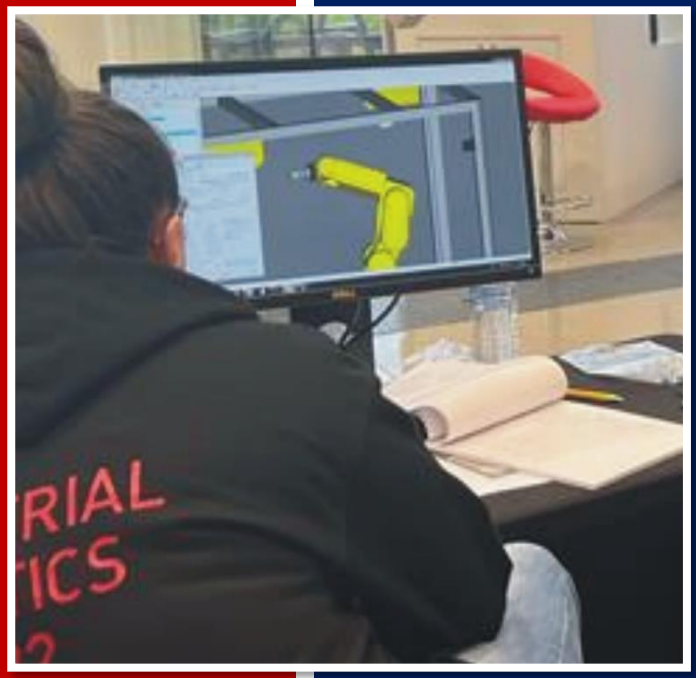
TECHNICAL HANDBOOK

INDUSTRIAL ROBOTICS



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Sponsors and Equipment Suppliers:

WorldSkills UK

WorldSkills UK is an independent charity and a partnership between employers, education, and governments. Together, they are raising standards in apprenticeships and technical education to enable more young people get the best start in work and life.

They are leading the charge to ensure that all young people have equal access to high quality apprenticeships and technical education, by:

- inspiring young people through their career advice resources, to choose excellence through apprenticeships and technical education as a prestigious career route on their path to reaching their potential, whatever their background.

- developing excellence in young people by testing and assessing their skills and knowledge against their peers through their national and international competitions programmes, improving their confidence and potential.

- innovating to mainstream global excellence to help improve the standard of teaching, training and assessment through international benchmarking to help young people, employers and the UK economy succeed.

They are also part of WorldSkills, a global movement supported by over 80 member countries, which celebrates young people achieving world-class standards in the biennial ‘skills Olympics.

This link can be used to access more information about WorldSkills UK and the work it undertakes.

Industrial Robotics Overview:

Industrial Robotics refers to the use of industrial robots in performing automated manufacturing tasks. It allows for outfitting and programming them to work in a wide variety of sectors to include assembly, foundry processes, handling, palletizing, finishing processes, welding to name a few.

Robot integrators need a wide range of skills, both practical and digital, to enable them to carry out roles in:

- robot implementation & design
- integration of peripheral equipment
- programming
- planning and documentation
- maintenance

Automation is a fast growing and innovative field of Engineering, spanning a number of industry sectors that value skills in problem solving, critical thinking and process optimization coupled with high standards and a good work ethic.

Industrial Robot Career Pathway

What is the job role?

The number of robots used in industry has increased rapidly, with an estimated 400,000 installed every year. A robot integrator ensures that they fit properly in the production process and so that they can perform complex and precise tasks, robots rely on skilled human resources to install and maintain them.

Robot Integrators must be able to assess the best type of robot for a particular application, which might include lifting, loading / unloading or welding, and then deciding where to place them. Other considerations include managing the flow of parts, developing and installing suitable programming, and the safety of the human workforce around them.

A Robot Integration technician will provide technical solutions to allow them to be integrated into the production process, from the preliminary assessment through to connecting them to power and other automated systems. They should be aware of the latest developments in manufacturing and control systems, including the multi-articulated arm, and the evolution of regulations for robotization.

Typical routes into this type of role include:

- through a related university course
- an apprenticeship
- working towards this role

Career pathway (continued)

General Working Hours and Salary range:

In the UK working hours are generally between 37-40 hours per week, Monday to Friday, though this can vary to include shift work and overtime.

As an apprentice, you can expect to start your first year from around £12,000 per annum with a staged increase depending on performance and stage of training.

Once qualified you could expect to start on around £24,000 per annum, often with the additional benefits of company pension, holiday entitlement and private healthcare schemes. There is normally an element of travel and overtime expected within the role to sites around the UK and abroad.

Future job roles:

These would include progression into roles such as Service Engineer, Project Engineer, Project Management, System Designer, Electrical Engineer or Design Engineer.

WorldSkills UK Competition Cycle:

27th February – 24th March 2023
Register at:
https://www.worldskillsuk.org/competitions/industrial-robotics/

April 2023
the first stage of competition is a Virtual task using FANUC's Robot Simulation Software

May / June 2023
Competitors will take part in qualifier round at a number of sites in the UK. After some basic training on the robots you will complete a timed programming task.

July 2023
scores are quality assured and Finalists are announced

September / October 2023
preparing and practicing to compete in the National Finals

November 2023
the finalists come together to compete in the National Finals

December 2023
Competitors who are age eligible, and have achieved the benchmark score, will be invited to opt into Squad UK for their chance to represent the UK at the next International WorldSkills Competition

IMPORTANT - Competition Hardware Requirement:

Industrial Robotics is team event open to teams of no more than two people. The first stages of this year's competition have been designed for remote completion and submission. As part of this, you will need to install software onto a suitable device.

Please be aware of the minimum system requirements, listed below, to ensure successful installation and use of this software.

- Operating System
  - Windows 10 (32-bit and 64-bit)
  - Windows 8.1 (32-bit and 64-bit)
  - Windows 7 (32-bit and 64-bit)
    (Windows 64-bit version recommended)
- Processor
  - Type: AMD Athlon 64 3200+, Pentium IV 2.4 GHz (Core (TM) 2 Quad or higher recommended)
  - Speed: 2.4 GHz
- System Memory
  - 1 GB (4GB recommended)
- Video Card
  - RAM: 512 MB
  - Resolution: 1280x1024
  - Colour Depth: 24-bit colour
  - Hardware Features: OpenGL Hardware Support
- Free Hard disk space
  - 4 GB
- Additional Hardware
  - Ethernet, DVD 32x, Mouse

You must also ensure that you have Administration rights on the PC you are installing the software on.

Competition Entry Criteria:

- **This is a team activity (teams of two)**
- There is no limit to the number of teams permitted to enter this competition per organisation
- **Competitors must have access to I.T equipment capable of running FANUC Roboguide software (minimum requirement is listed on previous page)**
- Teams must be available for the final stage of the competition at the National Finals in mid November 2023.
- **Competitors should be within a year of completion of a relevant Level 3 Apprenticeship and /or hold qualifications in an Engineering based subject to a minimum of a Level 3 or equivalent. Additionally, applicants must not have been employed within the industry of the chosen skill for more than three years prior to registration, not including the period of an apprenticeship.**

The competition has been designed to accommodate a participants from different levels and is accessible to people with little to no knowledge of robotic systems as well as those with a robotics background. Tasks have been designed to stretch and challenge competitors and incorporate the range of skills necessary to operate in a Robotic Engineering environment.

Participants will be asked to complete the first Entry task online using virtual simulation software. The qualifier stage will be held at a number of venues around the UK.

Successful participants will then be invited to take part in the National finals working and programming with real FANUC robots.

Competition Timetable:

Registration:

Once you have completed your registration, and accepted all terms and conditions, you will be sent a copy of the FANUC Roboguide Simulation software for you to install and familiarise yourself with prior to the release of the Entry Stage task in April.

Online training for Registered Teams will be offered via Microsoft Teams towards the end of April. They will be approximately 2 hrs long and recorded for future reference or to be worked through at a time to suit your timetable. Exact dates TBC

Entry Stage:

The Entry stage will be a remote assessment in which you must complete work in your own time and submit this for judging.

The task will be released to all entrants at 9am on the first day (exact date TBC) with a deadline for submitting it electronically, on the same day, by 5pm.

You will be notified of your results by the end of May and if you have achieved a high enough score to move forward, you will be invited to visit one of the venues around the UK to take part in the National Qualifier Stage.

Further online training will be offered via Microsoft Teams to all teams moving on to the Qualifier stage. They will be approximately 2 hrs long and recorded for future reference or to be worked through at a time to suit your timetable. Training will be held in early June with exact dates to be confirmed.

National Qualifier Stage:

Exact locations for the Qualifiers will be confirmed once the registration period has closed with the aim of holding them at locations in Scotland, Wales, Ireland, and England to minimise the disruption and travel for competitors.

They will be held as single day events with the first few hours giving the opportunity to learn basic programming skills and how to work safely with Industrial Robots.

After the basic training teams will be given their Qualifying Task that will need to be completed by the end of the day and submitted for marking. Each team will be assigned a robot cell to complete the Qualifying task using the skills you have learnt during the earlier training.

We will not only be assessing your task submission but also looking at how well you work as a team, listen to instructions, and implement your learning.

Results from the Qualifying stage will be given early July after which FANUC will be offering all successful teams the opportunity for some Hands-On training.
The location for this has yet to be confirmed though it is likely to be either at out offices in Coventry or a venue near your team similar to the Qualifier stage.
Training will look at improving your programming knowledge and skills both offline and in real world using the FANUC education cells that will be used in the UK Finals in November.

Worldskills UK Finals

This year we will be inviting the top five teams from the Qualifying stage to go through to the UK Finals which will be held in one venue in mid November 2023. The competition will be designed to further test your knowledge and skills with virtual and real-world programming using FANUC Robots.

The task will include elements of practical design, CAD modelling and assembly of hardware alongside robot programming in both real world and virtually.

Entry Stage Structure:

Designed as an introduction to using FANUC's Roboguide simulation software the task will be undertaken remotely and take, ideally, between 1-2 hours to complete. We will be looking for teams who can demonstrate the ability to:

- Follow instructions and procedures
- Communicate ideas and information
- Pay attention to detail
- Work effectively together in a team

This is a team skill and with only one entry submission per team. The competition task will be released at 9.00 am the first day with entries being submitted electronically to: RSI@fanuc.co.uk by 5.00 pm on the same day. Links will be sent out in advance of the submission deadline for you to upload your entry to the FANUC site.

National Qualifier Stage Structure:

This task will build on the skills gained in the entry stage and translate them into programming in real world, using FANUC robots, during one of our day long Qualifier stages being held around the country.

There will be the chance for both members of the team to get hands-on experience with the robots before working together to produce your final submission. For the marking we will be looking for teams who can demonstrate the ability to:

- Collect and utilise information
- Work effectively together in a team
- Follow work instructions and procedures
- Communicate ideas and information
- Produce a successful robot programme to industry best practice.

This is a team skill and with only one entry submission per team. The competition task will be given to the teams after a short safety introduction and basic programming training. Submissions for the Qualifier stage will be made at the end of that day.

Exact dates will be communicated to successful teams from the Entry stage, along with instructions on how to find us and details on your next steps. The Qualifier stage will be held in May / June 2023 at various venues.

Training and Development:

Following the release of results for the qualifier stage in early July 2023 the five finalist teams will be given the opportunity to attend training events. This will give successful teams a chance to work with FANUC robot engineers and learn the basic Health & Safety considerations when working with industrial robots.

Teams will also be able to ask questions regarding industry best practice for producing operating programs and allow them to explore the options and technology in-built to the robot controller in preparation for the final.

The exact details of how and where the training will be delivered is to be confirmed but it will look to cover topics like:

- Working safely with industrial robots
- Advanced options
- iRVision set-up and operation
- Industry best practice
- Program layout & optimization
- Offline simulation
- FANUC Modeler

WorldSkills UK Finals – Industrial Robotics task breakdown:

The Industrial Robotics Skills competition will be judged by a panel of robotics engineers & specialists.

The judges' decisions will be independently moderated, and quality assured before being confirmed at the closing ceremony where the results are announced. The judges are briefed on assessment procedures prior to the competition.

Judges are looking for technical competency but are also briefed to look for excellence amongst competitors and will therefore take into account skills such as time management, working under pressure and communication skills. All marking is objective and based on agreed criteria.

Building on the skills gained in the first two stages there will be elements of offline programming, CAD, and documentation with one additional part – competitors will get to put their work into practice, in real world, with the FANUC robots.

The robot cells feature one of the latest robots in the FANUC family inside a purpose-built cell. Competitors will be expected to install additional hardware then connect and configure it to work as part of the robot's program.

Roboguide will still play an integral part in the design and optimisation of the cell layout and work as a digital twin to form part of the final submission. As with previous stages, an amount of documentation may also be required as part of the final entry.

Judges will also be looking for other skills expected of a successful team such as:

- Time Management
- Performance when working under pressure
- Communication skills
- Collecting and utilising information
- Planning and organising work activities
- Teamwork
- Problems solving
- Effective use of individual's skill set within the team.

All competitors will receive feedback after the competition on their performance.

For teams that complete the main task with sufficient time there will be a further extension task that can be undertaken.

This will make use of some of the additional systems that form part of the robot cell and work to further to enhance the process and complexity of the automated system in carrying out the main task. It will also form part of the overall marking scheme weightings for the competition.

Details of the extension task, as well as all the information necessary to enable competitors to complete the main task, will be given to all teams for two hours of planning and discussion prior to the start of the competition.

Marking and Assessment – UK Finals:

The competition marking structure is comprised of two main parts to enable both competitors to contribute towards the final entry submission.
One part concentrates on the CAD design, roboguide and documentation aspect whilst the other focuses on the real-world programming element. Both parts are required for a successful competition entry.
The extension task enables competitors to add to their score and further demonstrate their technical abilities and skills.

Judges are primarily looking for technical competency but will also be briefed to look for excellence amongst competitors and will therefore take into account skills such as:

- Quality and attention to detail
- Following H&S guidelines for automation work areas

- Communicating ideas and information
- Organisation and preparing technical reports
- Use of available technologies
- Problem solving

All task marking is objective and based on agreed criteria with overall weightings as detailed below:

CAD design & solid modelling	20%
Implementing technical data	5%
Planning & organising work activities	5%
Documenting & recording technical data	10%
Programming & optimization	45%
iRVision	15%

All equipment, tools, and specific safety equipment for use in the UK Final will be supplied to the competitors and no additional documentation or devices will be allowed during the competition phase. If supplied, all competitors are required to wear any competitor work wear during the competition days. Please bring your own safety shoes. (Without your safety shoes you may not be able to take part in the competition due to health and safety regulations).

Any team that is invited to the final who have any special equipment requirements must notify the competition organisers prior to attending so that they can assess your request and make any adjustments to the equipment supplied accordingly.

What to expect at the UK finals:

The competition is structured to run over a week in mid-November:

- The first day will be used for registration, orientation, equipment check and to cover the Health & Safety considerations that arise when working with industrial robots.
  This will be followed by getting you all settled into your accommodation and a Welcome meal in the evening to give teams a chance to get to know each other and meet the judges in an informal atmosphere.

- The next three days are for the competition itself. Marking is done at specific times throughout with milestones clearly set for competitors to keep them on track. Final submission of the team's entry, including any specified documentation, simulations, or data, will be at the end of the third day.

- There may be an additional day for competitors to showcase their knowledge and skills without the pressure of competition. There will, hopefully, be the opportunity for competitors to become a trainer for the day and invite visitors to 'have a go' on the competition stand programming and operating the FANUC robots.

Competition Rules:

Conduct for competitors during live competitions:

- It is the competitor's responsibility to arrive on time at the event each day, late arrivals may be excluded from the competition.
- Competitors will start and finish tasks as instructed by the judges or Competition team.
- Equipment, tools, and specific safety equipment will be supplied; however, competitors are required to wear any competitor work wear supplied. Please bring your own safety shoes. (Without your safety shoes you may not be able to take part in the competition due to health and safety regulations).
- Any competitor who wishes to leave the area during the competition must seek the permission of the competition organisers or lead judge.
- If there is a power stoppage, breakdown of machinery or accident, the competitors must act according to the instructions of the competition organisers.
- Competitors are expected to comply with the host venue rules and regulations.
- No competitors will be allowed to bring their own mobile phones, laptops, or other devices with them into the competition, any competitor found in breach of this will automatically disqualify both themselves and their team from the competition.
- At the end of each day of competition, all documentation and equipment for each team will be secured within the workcell or competition area to prevent tampering or loss.
- Any special equipment requirements must be agreed with by the competition organisers prior to attending the competition. If you do not follow this stipulation, the organisers reserve the right to refuse its use during the competition.
- The competition area is a working environment and competitors are expected to conduct themselves accordingly.
- Please report and problems or damage to equipment as soon as possible to the competition organisers so that they can carry out any repairs or replacements required – it will only harm your ability to produce a final entry submission for the competition.

Judges Top Tips:

- **Preparation and Practice**
  A successful competitor you need to be confident, calm, and self-assured when competing. Prepare by practicing your skills and techniques to ensure you get the required standard/results you want without any surprises.
- **Time Management**
  Learn to manage your time effectively when completing tasks by working smart not fast!
  The tasks have allocated times, so practice working to time and under pressure to perfect your timing. If you run out of time in the competition you will lose marks.
- **Planning**
  Make your own plans for how to complete each task, work methodically and even write it down to help you prepare.
- **Organised**
  Make sure you are organised, make sure all stages of a task are completed.
  Organise all of your equipment and materials for the task.
- **Health & Safely**
  In any engineering environment Health & Safety is very important, make sure you use the appropriate PPE for the task and work safely.
- **Clean and Tidy**
  Keep your working area as tidy as you can be more efficient in a tidy work area. Make sure that when you present your work to the judges it is clean and ready for final judging.
- **Understanding**
  Read the task brief thoroughly and make sure you understand what you need to do.
  Do not be afraid to ask questions, remember there is only one silly question…the one you don't ask!
- **Don't Worry**
  If a part of a task hasn't gone as well as you might have wanted don't worry or dwell on it, just draw a line under that and get on with the next task. Always focus on the marks you can gain not what you might have lost.
- **Enjoy**
  To get to the WorldSkills UK National Qualifiers or the WorldSkills UK National Finals is in itself a massive achievement that you should be extremely proud of - make the most of the whole WorldSkills UK/IR Skills Competitions process and enjoy it!
- **Ask**
  If you are invited to the UK Finals and able to take advantage of the Training Day with some of the FANUC engineers, make a list of questions and be sure to ask them on the day! Find out what is meant by industry best practice, safety around robots & process optimisation to make sure you are as prepared as possible to compete in November.

Digital Resources:

If you don't have access to CAD software, such as Solidworks or ProEngineer, a good alternative would be to visit the AutoDesk website and take a look at their Fusion360 software, most of their software is free to download and use for students and educators

https://www.autodesk.co.uk/

Most of them have in-built tutorials that you can use to practice your modelling skills before the release of the competition tasks.

FANUC Modeler is a function that can be installed within Roboguide. The software gives you the ability to create parts and models that can then be used in your simulations.

To use this function when you first install the Roboguide software you would need to check the 'Modeler' option plug-in.

Beyond the UK Finals:

The RSI Skills Competition National finals also form part of the selection process for WorldSkills International competitions. This year will be the third time that the UK has looked to enter the robot systems integration skill internationally. Training managers will be onsite during the Finals competition, monitoring the performance of those who are age eligible and who show the highest skills, passion, and drive to compete and could be invited to form part of the UK Squad.

Further details of the international competitions, including eligibility criteria and other opportunities you can get involved with, can be found on the WorldSkills International website www.worldskills.org.

You will be notified if you are age eligible following the UK Finals.

Those who are not eligible for WorldSkills competitions may join the 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.

Get inspired and become a part of Team UK today!