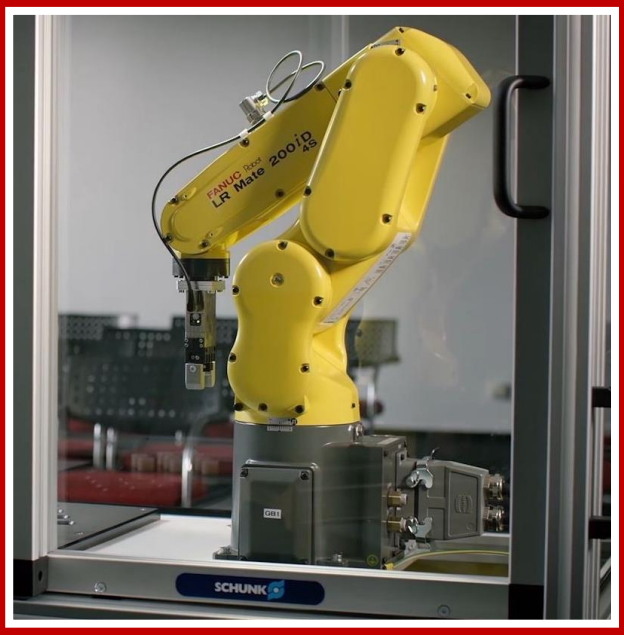
TECHNICAL HANDBOOK

INDUSTRIAL ROBOTICS



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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
- troubleshooting

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

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.

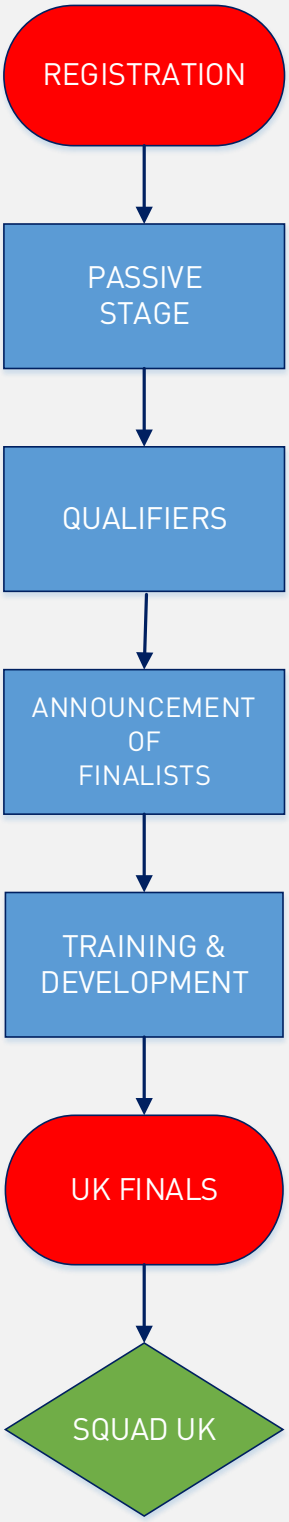
As an apprentice, you can expect to start your first year from around £12,000 per annum with a staged increase depending on performance and stage of training.

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 Stages - Quick View:



28th February – 1st April 2022
Register at:
https://www.worldskillsuk.org/competitions/industrial-robotics/

21st – 22nd April 2022
the first stage of competition is a Virtual task using FANUC's Robot Simulation Software

May / June 2022
Competitors will take part in qualifier round at our UK Office in Coventry. After some basic training on the robots you will complete a timed programming task.

6th / 7th July 2022
scores are quality assured and Finalists are announced

September / October 2022
preparing and practicing to compete in the National Finals

November 2022
the finalists come together to compete in the National Finals

December 2022
Competitors who are age eligible, and have achieved the benchmark score, will be invited to opt into Squad UK for the WorldSkills Lyon 2024 cycle

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.

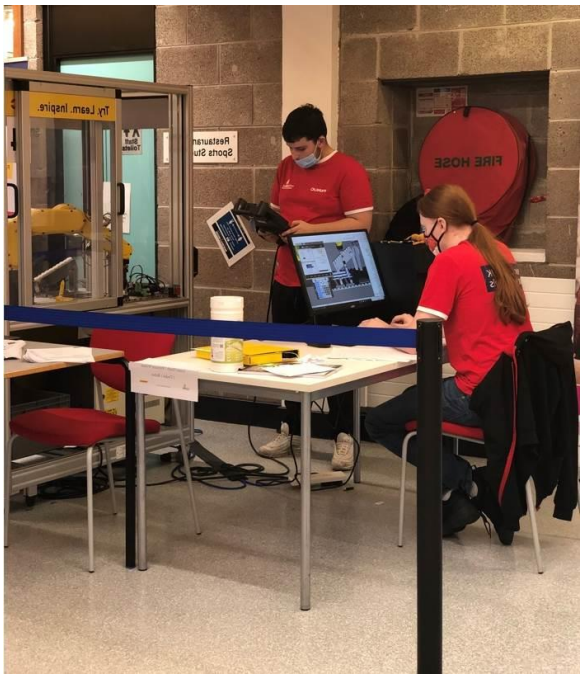
- Operating System
  - Windows 10 (32-bit and 64-bit)
  - Windows 8.1 (32-bit and 64-bit)
  - Windows 7 (32-bit and 64-bit)
    (Windows 64-bit version recommended)
- Processor
  - Type: AMD Athlon 64 3200+, Pentium IV 2.4 GHz (Core(TM) 2 Quad or higher recommended)
  - Speed: 2.4 GHz
- System Memory
  - 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 November 2022.
- **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 range of participants with little to no knowledge of robotic systems, to robotics engineers. Stretch and challenge tasks have been incorporated to maximise a range of skills necessary to operate in a range of robotic engineering environments. Participants will be asked to complete two tasks using virtual simulation software to include design, assembly and offline programming. Successful participants will then be invited to take part in the National finals working and programming with real FANUC robots.



Competition Structure:

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 Passive Stage task on the 21st April.

Passive Stage:

Following on from closure of the registration period the passive stage task will be released to all entrants on the Thursday 21st April at 9am with a deadline for submitting it electronically by 5pm on Friday 22nd April. You will be given your results on Friday 7th May and, if you have achieved a high enough score to move forward, you will be invited to visit our offices in Coventry to take part in the National Qualifier Stage.

National Qualifier Stage:

The Qualifiers will be held at our offices in Coventry in as a one day event with the day being split into two sessions. In the morning session teams will have the oppourtunity to learn basic programming skills and how to work safely with Industrial Robots. Before breaking for lunch teams will be given the Qualifying Task that needs to be completed during the afternoon session.

After lunch your team will be assigned a robot cell to complete the Qualifying task using the skills you have learnt during the morning session.

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

Worldskills UK Finals

If your team is successful in the first stages and go through to the UK Finals these will be held in November 2022. They will 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.

Passive Stage:

Designed as a basic introduction to using FANUC 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 on the 21st April with entries being submitted electronically to: RSI@fanuc.co.uk by 5.00 pm on the 22nd

National Qualifier Stage:

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

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 during the morning session at our offices in May / June with entries being submitted at 5pm that day.

Exact dates will be communicated to successful teams from the passive stage,
along with instructions on how to find us and details on your next steps.
The Qualifier stage will be held in May / June 2022 in Coventry.

Training and Development:

Following the release of results for the qualifier stage in early July 2022 the six 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 training will be in the form of one day events held in the Training Academy at our FANUC UK head office in Coventry and will look to cover:

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

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 robots 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
- Team work
- 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 additonal 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 early November:

- The first day will be used for familiarisation, training, equipment check and to cover the Health & Safety considerations that arise when working with industrial robots. Details of the competition task, and the extension task, will be given to teams for two hours of planning and discussion before the end of the day. Any notes or information generated during this time will remain in the competition area until the following day.

- The next three days, are for the competition itself. Submission of the team's entry, including any specified documentation 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 Live National Finals is in its self 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.

Additionally there is the facility, within Roboguide, 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 second time that the UK has looked to enter the robot systems integration skill internationally. Training managers will be onsite during the 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!