Process Automation Engineer Degree Apprenticeship Standard

1. Context

The chemicals and process industry sector is wide ranging and diverse. It embraces many sub-sectors such as pharmaceuticals, bio-chemicals, speciality and fine chemicals, agrochemicals, heavy chemicals, minerals processing, cement, pulp and paper, power, oil and gas, nuclear processing, water, food and drink. The processes involved, which may be of a physical, chemical or biological nature, generally result in products in the form of a substance. Those processes are carried out using plant and equipment which are often of a large scale, extensive, highly integrated and invariably automated. The plant used is very different to the types of machinery found, for example, in the aerospace and manufacturing sectors where the products are typically components, parts and assemblies.

Automation of process plant is realised by Integrated Control and Safety Systems (ICSS) which are of a specialised nature, their design reflecting the complexity and risk of operations carried out. Process automation addresses not only the immediate objectives of maintaining control and safe operation of plant and equipment but also the wider issues of enterprise management such as process efficiency, plant utilisation, operations optimisation, product quality, inventory monitoring, utilities consumption and equipment diagnostics.

2. Occupation

Process automation lies very much at the interface between disciplines: chemical and electrical engineering, instrumentation and control, maths and computing, software and IT, business and management. To function effectively, process automation engineers require a breadth and depth of knowledge and knowhow across that spectrum. They are involved at all stages in the life cycle of an ICSS: feasibility, specification, design, development, acceptance, installation, commissioning, operation, maintenance and support. Typically, on a project basis, they may be involved in 'doing' the specifics of design, development, etc, or in the management thereof. Their work is subject to a variety of constraints: international and company standards, legal, contractual and commercial commitments, not to mention good practice.

The standard will apply to all apprentices in its entirety although the emphasis will vary for individuals according to which phases of the life cycle they are involved in and depending upon whether they are employed by system suppliers (the vendors), contractors (or system integrators) or end users (the operating companies).

3. Level This is a Level 7 apprenticeship standard.

4. Entry Requirements

Typically, the minimum academic qualification required of an apprentice is a Bachelor's degree (BEng or BSc) at 2.2 Hons standard, or equivalent, in chemical or electrical engineering or other appropriate discipline such as physics. Companies will set their own entry requirements in terms of experience.

5. Duration The duration will normally be five years.

6. Qualifications

The apprenticeship requires completion of an MSc degree in process automation worth 180 UK credits (90 ECTS credits). The MSc degree must be accredited by at least two relevant Professional Engineering Institutions (PEI), such as IChemE, IET and InstMC, for further learning to Master's level under the UK Standard for Professional Engineering Competence (UK-SPEC) for graduates with an accredited Bachelor's degree.

The Government requires that all apprentices hold Level 2 English and maths prior to the End-point Assessment (EPA).

7. Link to Progression and Professional Registration

The standard is aligned, as far as is practicable, with the requirements of UK-SPEC. Upon completion of the apprenticeship, an apprentice will i) be able to apply to become a Member of a relevant PEI, and ii) depending upon the level of experience gained and responsibility held, either wholly or partially satisfy the requirements for Chartered Engineer (CEng) status.

8. Review Date The standard will be reviewed after three years.

9 Knowledge, Skills and Behaviours

A competent apprentice will be able to demonstrate at the EPA all of the following attributes:

Knowledge: technical

a. knows the principles of design and operation of a variety of unit operations and the principal features of construction of related items of process plant.
b. understands a range of relevant strategies and techniques for the control of both batch and continuous plant, and the knowhow for translating them into designs.
c. knows about modern instrumentation for measurement of common process variables, actuation (valves & motors), signal transmission and protocols, intrinsic safety and segregation.
d. knows about modern control technology including hardware and infrastructure (power & air supply, trays & trunking, cabling and marshalling), and interfacing to third party equipment.
e. knows about with the topology (hardware, its organisation and layout), system software, communications and networks, and operator interface of at least one ICSS or equivalent.
f. is familiar with the essential functionality of the real-time languages, structures and tools provided for the development of application software for at least one ICCS or equivalent.
g. understands the organisation of alarm systems, the need for alarm management and the quantitative analysis and design of Safety Integrity Level (SIL) rated protection systems.
h. knows about the use of control systems as a platform for higher level tasks, such as optimisation and statistical process control, and of the database techniques (eg, querying and reporting) used for the integration of control and enterprise management systems.
i. is familiar with key international standards, codes of practice and industry guides, etc, and mandatory requirements, especially regarding protection systems, safety and human factors.

Knowledge: general

j. understands the life cycle of control systems in terms of feasibility, specification, design, development, acceptance, installation, commissioning, operation, maintenance and support.
k. appreciates the contractual nature of relationships between suppliers, contractors & end users.
l. knows about general management practice and, in particular, project management and software engineering methods.
m. appreciates the contribution of automation to improved safety, sustainability and reduced environmental impact of operations.

Skills: analytical and problem solving

n. able to analyse complex automation problems of a process nature, reducing them to their underlying issues, and can synthesise solutions subject to constraints.
o. able to develop, from first principles, qualitative and/or quantitative models and simulations of systems in terms of the functionality of their components and signals and can interpret their input-output relationships.
p. able to develop dynamic models based upon commercially available simulation packages.
q. able to adapt and apply control theory, related techniques, technology and knowhow to the solution of process automation problems, open ended or otherwise.

Skills: technical and commercial leadership

r. able to interpret requirements for automation and can articulate them in terms of user and functional design requirements, testing and acceptance specifications, and operating procedures.
s. able to translate those requirements into designs, especially of application software, and can realise them using the standard functionality of a proprietary ICSS or otherwise.
t. can manage automation projects in terms of the planning and deployment of human and physical resources for activities such as design, development, testing, documentation, etc.
u. able to handle the commercial and/or financial aspects of an automation project in terms of costs, resources, overheads, cash flow, margins, profit, etc.
v. can make judgements about and take responsibility for technical issues, such as operability, productivity, quality, reliability, safety, security, sustainability and viability, in an industrial context.

Behaviours: transferable skills

w. works independently, demonstrating self-discipline, self-motivation, self-sufficiency and self-development, requiring little supervision, if any.
x. works effectively and with enthusiasm as a member of one or more teams, interacting with and supporting other team members, whilst being committed to delivering on agreed targets for deliverables.
y. communicates effectively, especially in the written form, with other persons, technical or otherwise, using terminology correctly according to context.
z. accepts corporate beliefs and objectives and complies with company rules and guidelines, subject to the broader ethical responsibilities of a professional working in the industry.