SQA Advanced Unit Specification

General information for centres

Unit title: Electronic Construction Skills

Unit code: HP3K 47

Unit purpose: This Unit introduces the candidate to electronic components and their circuit symbols as used in analogue and digital circuit diagrams. It provides opportunities for the candidate to simulate ac and dc circuits and to test their function by means of simulated test equipment. It allows the exploration of circuit construction techniques and enables the candidate to use some of the techniques to build and test ac and dc circuits. The ultimate purpose of the Unit to is to develop the candidates' skills of simulating, building and testing circuits.

On completion of this Unit the candidate should be able to:

1. Interpret and use electronic component symbols in circuit diagrams
2. Simulate and test electronic circuits
3. Apply circuit construction techniques
4. Construct and test circuits on suitable media

Credit value: 1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from National 1 to Doctorates.*

Recommended prior knowledge and skills: Candidates should have some prior knowledge of electronic components, their symbols and circuit diagrams. They also should have basic skill in the use of a PC and application packages. They should also have used basic electronic test equipment. This may be evidenced by the possession of a Higher Electronics (C027 12), Intermediate II Electronic and Electrical Fundamentals (C025 11) or the following National Qualification Units: Introduction to Electronic Test Equipment and Measurement (E9S9 11), Electronic Components and Circuit Assembly Techniques (E9S6 11), Fault Diagnosis on Basic Electronic Circuits (EE9K 12).

Core skills: There may be opportunities to gather evidence towards Core Skills in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: This Unit is developed for the SQA Advanced Certificate/Diploma in Electronics. If the Unit is used in another group award(s) it is recommended that it be taught and assessed in the context of that particular group award.

Assessment: The assessment for this Unit will test the skills developed by this Unit which includes:

- component recognition, symbol recognition, circuit drawing and reading
- simulation of dc and ac circuits
- construction of dc and ac circuits

The assessment strategy requires the candidate to demonstrate skills in the following areas: recognition and use of common component and instrument symbols; creation and interpretation of schematic diagrams; simulation, construction and testing of electronic circuits. For candidates following the SQA Advanced Certificate/Diploma in Electronics course, circuits on which assessments are based can be selected from those studied in the Unit Analogue Electronic Principles and Combinational Logic.

Outcome 1 is concerned with the knowledge and skills associated with symbols and schematic diagrams. As candidates continue to develop these throughout the delivery of the Unit it is recommended that the assessment for this Outcome takes place towards the end of the Unit.

The schedule of assessment would be:

Outcome 2
Outcome 3
Outcome 4
Outcome 1

Unit specification: statement of standards

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The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Interpret and use electronic component symbols in circuit diagrams

Knowledge and/or skills

- Identifies standard (IEC and ANSI) circuit symbols for resistors, capacitors, inductors, diodes, transistors, integrated circuits, transformers, transducers and connectors
- Identifies standard (IEC and ANSI) circuit symbols for voltmeters, ammeters, ohm meters, direct and alternating power supplies, signal generators and oscilloscopes
- Draws standard circuit symbols for resistors, capacitors, inductors, diodes, transistors, integrated circuits, transformers, transducers and connectors
- Draws standard circuit symbols for voltmeters, ammeters, ohm meters, direct and alternating power supplies, signal generators and oscilloscopes

Evidence requirements

The candidate must be able to select appropriate components from a given circuit diagram similarly given a physical circuit must be able to draw the circuit diagram. In both contexts a range of components must be correctly selected and their symbols accurately drawn. Circuit diagrams must include a range of components, interconnections, power rails and input/output terminals.

Assessment guidelines

The candidate should be presented with a circuit diagram containing a minimum of twenty components and a range of at least twenty different components from which appropriate items have to be selected to match the circuit requirements.

The candidate should be presented with a physical circuit containing at least eight components from which an accurate circuit diagram should be drawn showing appropriate component symbols, component designators, interconnections and input/output terminals.

A centre should produce an appropriate checklist(s) to support the assessment on this Outcome.

Outcome 2

Simulate and test electronic circuits

Knowledge and/or skills

- Simulates passive circuits
- Simulates active linear circuits
- Simulates combinational logic circuits containing gates and input and output devices

Evidence requirements

The candidate simulates circuits with appropriate software to check their function and measure their parameters. The simulated circuits with their test results and parameter measurements are stored and printed.

Assessment guidelines

The candidate should be presented with diagrams of practical circuits with a minimum of eight components, or logic functions, which have to be simulated. A list of measurements required for the circuits should be provided. The circuits should be developed in the simulator and measurements made. The simulated circuits and test results should be stored and printed out.

A centre should produce an appropriate checklist(s) to support the assessment of this Outcome.

Outcome 3

Apply circuit construction techniques

Knowledge and/or skills

- Applies circuit construction techniques safely
- Strips and prepares solid conductor and stranded conductor wire
- Solders wires and connectors.
- Forms and solders component leads
- Assembles circuit boards
- Crimps terminals to stranded conductor wire
- Describes the difference between surface mount and through-hole technology components and their assembly methods

Evidence requirements

The candidate manufactures a circuit with a minimum of eight components using wire stripping and preparation, component preparation, soldering and crimping.
The candidate performs research and provides diagrammatic and descriptive evidence describing the difference between surface mount and through-hole technology.

Assessment guidelines

The circuit construction skills should be assessed by the manufacture of circuits using wire stripping and preparation, component lead forming, soldering and crimping in a through-hole environment.

A brief report should be written by candidates to provide diagrammatic and descriptive evidence that they understand the difference between surface mount and through-hole technology.

A centre should produce an appropriate checklist(s) to support the assessment of this Outcome.

Outcome 4

Construct and test circuits on suitable media

Knowledge and/or skills

- Selects components by type and parameter for a given circuit
- Designs component layouts for given circuits to be constructed on suitable media
- Constructs circuits containing passive and active linear components on suitable media
- Tests circuits containing passive and active components constructed on suitable media
- Constructs combinational logic circuits containing gates and input and output devices on suitable media. Tests combinational logic circuits containing gates and input and output devices constructed on suitable media

Evidence requirements

The candidate manufactures one functional circuit built on suitable media with documentary evidence of circuit test results.

Assessment guidelines

The candidate should be provided with a circuit diagram from which a prototype layout is designed, built and tested. Appropriate parameter measurements are made and recorded.

A centre should produce an appropriate checklist(s) to support the assessment of this Outcome.

Administrative information

Unit code: HP3K 47

Unit title: Electronic Construction Skills

Superclass category: XL

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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

Unit specification: support notes

Unit title: Electronic Construction Skills

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

This single credit Unit at level 7 is part of the Principles and Technology core of the SQA Advanced Diploma in Electronics and an optional Unit in the SQA Advanced Certificate in Electronics. It may be helpful to deliver it in conjunction with the single credit level 7 Unit Electronic Testing Skills.

SAFETY: No explicit statement of safety is made in this Unit, however it is expected that centres will ensure that candidates are provided with safe working conditions and that they themselves adhere to the centre's own safety requirements.

There are four main skill aspects of the Unit. The first is circuit symbol recognition and the use of symbols in circuit diagrams and the selection of components. The second are the skills required to simulate and test circuits using software. The third are the skills required to manufacture circuits using manual construction methods. The fourth is the conversion of a schematic diagram into a prototype board layout and the construction and test of this circuit. This is to include component selection by type, relevant parameter and ratings.

This Unit replaces the SQA Advanced Unit Electronic Construction Skills (D4H4 04) and while it has many similarities the simulation of circuits and surface mount technology have been added. There is increased emphasis on the integration of the various skills. The older Unit's contents have been revised to include the testing of simulated circuits in response to the increased use and availability of circuit simulation and other similar CAD packages. It is intended that the candidate should gain experience in testing circuits in both simulated and actual circuit environments and, therefore, gain experience of the advantages and limitations of each method.

Guidance on the delivery and assessment of this Unit

It is recommended that this Unit be introduced in the early stages of SQA Advanced Certificate and SQA Advanced Diploma courses as it is very practical and develops:

- schematic symbol and circuit reading skills
- component recognition skills
- circuit manufacturing skills
- circuit simulation skills
- testing skills

Many of these find application in other parts of the course when performing laboratory work. In addition, they introduce most of the basic electronic concepts such as voltage and resistance

from a practical viewpoint. These provide a foundation for further study of electronics in a principles or circuit application context.

Centres should be able to align the delivery of this Unit with the Unit Electronic Testing Skills if this suits the selected programme. Circuits utilised should be selected from those which are used elsewhere in the SQA Advanced Certificate/Diploma in Electronics framework if that is the programme being followed. Candidates on other programmes should be provided with types of electronic circuit common to that programme.

It would also be helpful to use this Unit as the foundation for Electronic Fault Finding (HP3L 48) if this was included in the course.

Open learning

Due to the high practical content of this Unit it is unsuitable for open or distance learning.

For information on normal open learning arrangements, please refer to the SQA guide *Assessment and Quality of Open and Distance Learning* (SQA 2000).

Special needs

This Unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering special alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, 2001).

General information for candidates

Unit title: Electronic Construction Skills

This Unit has been designed to allow you to gain knowledge of a range of practical electronic skills which include:

- reading and drawing electronic component circuit symbols and diagrams
- selecting and using electronic components
- computer simulation and testing of ac and dc circuits
- constructing and testing ac and dc circuits

These skills will be utilised in other parts of the course you are following and are likely to prove useful in many forms of employment.

The early part of the Unit deals with component symbols and the reading and creation of schematic diagrams. It is important for you to recognise symbols and be able to interpret the interconnections between them in electronic circuits.

As the Unit develops you will use computer software to simulate common electronic circuits, this will help you analyse their operation.

The latter part of the Unit involves the layout and construction of physical circuits using hand tools and soldering equipment. The vast majority of electronic circuits contain many soldered joints and you will be given the opportunity to develop some of the skills necessary to construct and repair such circuits.

You will be assessed on your knowledge and application of schematic symbols, component selection, circuit simulation, construction and testing. It is likely that the centre where you will study the Unit will arrange three practical assignments and one written assessment covering symbol recognition.