

SQA Advanced Unit Specification

General information for centres

Unit title: Fundamental Electronic Components, Devices and Applications

Unit code: HV2G 46

Unit purpose: This Unit has been designed to enable candidates to identify a wide range of electronic components and devices and explain the operation of both analogue and digital circuits. Candidates should also be provided with opportunities to conduct both static and dynamic tests on electronic circuits using appropriate electronic test equipment and report on the results.

The Unit may be studied by candidates with little or no previous knowledge of electronics but who wish to acquire a basic knowledge, understanding and skills of this subject (eg electricians, mechanical technicians etc). The Unit may also provide candidates with a basic course of study on which more advanced studies can be built.

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

- 1 Identify a range of electronic components and devices.
- 2 Describe applications of a range of electronic components and devices.
- 3 Apply electronic test equipment to verify electronic component and device applications.

Credit points and level: 1 SQA Credit at SCQF level 6: (8 SCQF credit points at SCQF level 6*).

**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: Entry to the Unit is at the discretion of the centre however candidates should have a basic knowledge and understanding of Electrical Principles. Possession of a basic knowledge and understanding may be evidenced by possession of the following SQA Advanced unit: Electrical Engineering Principles 1 (HV2F 46). A basic knowledge of electrical measurement and the use of electronic test instruments would be beneficial.

Core Skills: There are opportunities to develop the Core Skills of Written Communication and Critical Thinking at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

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Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Assessment: The assessment strategy for the Unit should be as follows:

The assessment for Outcomes 1 and 2 should be combined together into a single assessment paper taken at a single assessment event lasting two hours and carried out under supervised, controlled conditions. Candidates should not be allowed to bring any textbooks, handouts or notes to this assessment. Any relevant datasheets, etc, should form part of the assessment paper.

The assessment for Outcome 3 should consist of candidates carrying out two laboratory exercises, one on an analogue circuit and the other on a digital circuit and producing a report containing details of the two exercises.

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Unit specification: statement of standards

Unit title: Fundamental Electronic Components, Devices and Applications

Unit code: HV2G 46

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

Identify a range of electronic components and devices

Knowledge and/or skills

- ◆ Passive components
- ◆ Discrete active devices
- ◆ Integrated circuits

Outcome 2

Describe applications of a range of electronic components and devices

Knowledge and/or skills

- ◆ Passive components
- ◆ Discrete active devices
- ◆ Integrated circuits

Evidence Requirements

All knowledge and/or skills items in Outcomes 1 and 2 should be assessed.

A candidate's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing the candidate is able to for:

Outcome 1

Identify **one** passive component from each of the following lists:

Resistors — fixed, variable, thermistor or light sensitive
Capacitor — fixed, variable, electrolytic or non-electrolytic
Inductor — axial, radial or toroid

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Identify **one** discrete active device from each of the following lists:

Diodes — signal, zener, light emitting or photo
Transistors — bi-polar, field effect transistor
Power electronic devices — thyristor, diacs or triacs

Identify **one** integrated circuit device from each of the following lists:

Digital devices — Logic gates, MSI devices (eg bistable), LSI (eg counters, shift registers, A/D and D/A converter)
Analogue devices — operational amplifier, linear regulators, timers or waveform generator

Outcome 2

Describe **one** application from each of the following lists:

Resistors — current limiting, voltage division, line termination, temperature measurement or light sensing
Capacitors — energy storage, smoothing, tuning, coupling or de-coupling
Inductors — tuning, transformer or choke

Describe **one** application from each of the following lists:

Diodes — rectification, clipping/clamping, over-voltage protection, light emission or demodulation
Transistor — amplifier or switch
Power electronic devices — switch, light dimming, speed control or power supply

Describe **one** application from each of the following lists:

Digital devices — Logic gates, MSI devices (e.g. bistable), LSI (e.g. counters, shift registers, A/D and D/A converter)
Analogue devices – inverting or non-inverting operational amplifier circuit, summing amplifier or timer

The assessment for Outcomes 1 and 2 should be combined together to form one assessment paper which should be taken at a single assessment event, lasting two hours, and carried out under supervised, controlled conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring any textbooks, handouts or notes to the assessment. Any relevant datasheets, etc, will form part of the assessment paper.

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Assessment guidelines

The assessment paper should be composed of an appropriate balance of short answer, restricted response and structured questions. In Outcome 1 passive components and active and integrated devices can be presented in the form of photographs, diagrams, circuit symbols or device code or a combination of these for candidates to identify. In Outcome 2 every attempt should be made to integrate applications wherever possible (eg an amplifier circuit with a current limiting resistor and coupling capacitor).

Outcome 3

Apply electronic test equipment to verify electronic component and device applications

Knowledge and/or skills

- ◆ Electronic circuits
- ◆ Electronic test equipment
- ◆ Test procedures

Evidence Requirements

All knowledge and/or skills items in Outcome 3 should be assessed.

The assessment for this Outcome must comprise of two laboratory exercise, one on an analogue circuit and the other on a digital circuit, conducted under supervised conditions. For each circuit candidates should be provided with a pre-constructed circuit, a circuit specification and relevant datasheets. Candidates should draw layout and circuit diagrams, select appropriate test equipment and perform suitable tests to prove the functionality of the circuit by carrying out static and dynamic tests.

Candidate evidence should be presented in the form of a report which, for each circuit, must include the following details:

- ◆ completed and accurate layout and circuit diagrams
- ◆ a correct component list
- ◆ accurate test results proving the functionality of the circuit
- ◆ a list of the test equipment used
- ◆ accurate conclusions developed from a comparison of expected and actual results

Candidates should complete the report in their own time. Centres should make every reasonable effort to ensure the report is the candidate's own work.

Where copying or plagiarism is suspected candidates may be interviewed to check their knowledge and understanding of the subject matter. A checklist should be used to record oral evidence of the candidate's knowledge and understanding.

Assessment guidelines

Circuits that may be used for the laboratory exercise may include the following: a two stage transistor amplifier; inverting or non-inverting amplifier, summing amplifier circuit, combinational logic circuit, synchronous or asynchronous counter. The laboratory exercise on each circuit should up to two hours to complete.

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Administrative Information

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Unit title:	Fundamental Electronics Components, Devices and Applications
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Version	Description of change	Date

Source: SQA

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Unit specification: support notes

Unit title: Fundamental Electronic Components, Devices and Applications

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

The Unit has been written in order to allow candidates to develop knowledge, understanding and skills in the following areas:

- 1 Identifying a range of electronic components and devices.
- 2 Describing applications of a range of electronic components and devices.
- 3 Applying electronic test equipment to verify electronic component and device applications.

This Unit has been developed for the SQA Advanced Certificate in Engineering Practice awards. The Unit is a 1-credit unit at SCQF Level 6.

In designing this Unit the Unit writers have identified the range of topics expected to be covered by lecturers. The writers have also given recommendations as to how much time should be allocated to each Outcome. This has been done to help lecturers to decide the depth of treatment which should be given to each topic within an Outcome. Whilst it is not mandatory for centres to use this list of topics it is strongly recommended that they do so to ensure candidates have adequate knowledge and skills needed by many electronic and electrical employers.

A list of topics is given below. Lecturers are advised to study this list of topics so that they can get a clear indication of the standard of achievement expected of candidates in this Unit.

1 Identify a range of electronic components and devices (8 hours)

- ◆ Resistors (fixed, variable, thermistors, light sensitive).
- ◆ Capacitors (fixed, variable, electrolytic, non-electrolytic).
- ◆ Inductors (axial, radial, toroid).
- ◆ Diodes (signal, zener, light emitting, photo).
- ◆ Transistors (bi-polar or field effect).
- ◆ Power electronic devices (thyristors, diacs, triacs).
- ◆ Integrated Circuits: digital devices and analogue devices

2 Describing applications of a range of electronic components and devices (12 hours)

- ◆ Resistors (current limiting, voltage division, line termination, temperature measuring, light sensing)
- ◆ Capacitors (energy storage, smoothing, tuning, coupling and de-coupling).
- ◆ Inductors (tuning, transformers, chokes)
- ◆ Diodes (rectification, clamping/clipping, over-voltage protection, light emission, demodulation)

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- ◆ Transistors (amplifiers and switches)
- ◆ Power electronic devices (switches, speed control, light dimming, use in power supplies)
- ◆ Integrated Circuits: digital devices (Logic gates, MSI devices (eg bistable), LSI (eg counters, shift registers, A/D and D/A converter) and analogue devices (inverting or non-inverting operational amplifier circuit, summing amplifier or timer)

Assessment of Outcomes 1 and 2 — two hours

3 Applying electronic test equipment to verify electronic component and device applications — (18 hours which includes time for assessment of Outcome 3)

- ◆ Electronic circuits: schematic and circuit diagram conventions, circuit boards and interconnections, device data sheets
- ◆ Electronic Test Equipment: multimeters, logic probes & testers, power supplies, signal generators and oscilloscopes
- ◆ Test procedures: static testing (to check for circuit continuity, short circuits, dc bias levels, etc.) and dynamic testing (to check circuit functionality)

Guidance on the delivery and assessment of this Unit

This Unit has been designed to incorporate sufficient time to allow lecturers to teach all of the electronic subjects contained in the Unit. There is also sufficient time for candidates to practice what they have learnt through appropriate formative assessment and practical laboratory and computer simulation exercises. With regard to computer simulation and laboratory work there are software packages available which can be used to illustrate the operation of different electronic components and circuits and it is certainly recommended that lecturers use such packages to consolidate learning. However, it is also important that candidates get exposure to practical electronic devices and circuits so that they get a realistic sense of the types of devices and circuits that are used in industrial and commercial applications. It is also recommended that the candidates obtain experience of electronic construction techniques and using test equipment such as oscilloscope, oscillators, logic testers and multi-meters prior to doing the electronic laboratory exercises.

The Core Skill component of Written Communication may be further developed while candidates are writing their report for Outcome 3. The Critical Thinking Core Skill component may be developed in formative exercises involving electronic problems and in laboratory work and computer simulation.

Information on Evidence requirements and Assessment guidelines is given after Outcomes 2 and 3 in the SQA Advanced Unit specification: statement of standards section. The written assessment should be taken after Outcomes 1 and 2 have been completed while the practical laboratory exercises can be done during the delivery of Outcome 3.

Opportunities for developing Core Skills

There are opportunities to develop the Core Skills of Written Communication and Critical Thinking at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

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Open learning

This Unit could be delivered by distance learning, which may incorporate some degree of on-line support. However, with regards to assessment, planning would be required by the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangements would be required to be put in place to ensure that assessment paper covering Outcomes 1 and 2 was conducted under controlled, supervised conditions. To keep administrative arrangements to a minimum, it is recommended that for distance learning candidates the assessment paper is taken at a single assessment event.

The centre would also be required to arrange for the electronic laboratory exercise to be undertaken under controlled, supervised conditions. Arrangement should also be put in place to allow distance learning candidates to access practical electronic laboratories and computer simulation software so that they can obtain a high quality learning experience whilst completing this Unit.

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

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General information for candidates

Unit title: Fundamental Electronic Components, Devices and Applications

The Unit has been developed to allow you to develop a basic knowledge, understanding and skills in electronics.

During the Unit you will learn to identify a wide range of electronic components and devices and you will also study some applications of these components and devices in a range of analogue and digital electronic circuits. You will also develop the skills to use a range of electronic test equipment to undertake both static and dynamic tests on electronic circuits.

This Unit will normally be delivered by a combination of lectures, tutorial exercises, practical work and/or computer simulation. The tutorial exercises will be designed to develop your knowledge, skills and confidence in solving simple electronic problems. Practical work is particularly important as it will allow you to learn important electronic skills such as interpreting circuit/wiring diagrams, wiring up and using electronic test equipment. Please ask your lecturer what practical work you will do in this Unit.

The assessment of this Unit is in the following two parts: a closed book two hour assessment paper covering Outcomes 1 and 2 and two laboratory exercises covering Outcome 3.