SCQF level 5
Unit Specification

# Electronics: Circuit Simulation

## SCQF: level 5 (6 SCQF credit points)

## Unit code: JNR0 75

## Unit outline

The general aim of this Unit is to develop skills in the use of simulation software in the context of practical electronics. Learners will use software to assist in the design, construction and testing of electronic circuits.

Learners who complete this Unit will be able to:

1 Use software in the design of electronic systems
2 Use software in the construction and testing of electronic systems

This Unit is available as a free-standing Unit. The Unit Specification should be read in conjunction with the Unit Support Notes, which provides advice and guidance on delivery, assessment approaches and development of skills for learning, skills for life and skills for work. Exemplification of the standards in this Unit is given in the Unit Assessment Support.

## Recommended entry

Entry to this Unit is at the discretion of the centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

- Electronics: Circuit Simulation (National 4)
- Numeracy (National 4)

## 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. For further information, please refer to the Unit Support Notes.

# Standards

## Outcomes and assessment standards

### Outcome 1

The learner will:

1 **Use software in the design of electronic systems by:**

1.1 Simulating a range of electrical concepts
1.2 Simulating electronic systems
1.3 Investigating the behaviour of simulated circuits

### Outcome 2

The learner will:

2 Use software in the construction and testing of electronic systems by:

2.1 Creating circuit diagrams
2.2 Converting circuit diagrams to PCB layouts
2.3 Using simulations to assist testing of circuits

In this Unit, typical circuits could involve a power supply, multiple input devices, processing and more than one output device.

## Evidence Requirements for the Unit

Assessors should use their professional judgement, subject knowledge and experience, and understanding of their learners, to determine the most appropriate ways to generate evidence and the conditions and contexts in which they are used.

For this Unit, learners will be required to demonstrate the ability to use software in the design, construction and testing of electronic circuits. Evidence is most likely to be observational, obtained while the learner is carrying out appropriate practical tasks.

Exemplification of assessment is provided in the Unit Assessment Support. Advice and guidance on possible approaches to assessment is provided in the Unit Support Notes.

## Assessment standard thresholds

If a candidate successfully meets the requirements of the specified number of Assessment Standards they will be judged to have passed the Unit overall and no further re-assessment will be required.

The specific requirements for this Unit is as follows:

- 4 out of 6 Assessment Standards must be achieved.

It should be noted that there will still be the requirement for candidates to be given the opportunity to meet all Assessment Standards. The above threshold has been put in place to reduce the volume of re-assessment where that is required.

# Development of skills for learning, skills for life and skills for work

It is expected that learners will develop broad, generic skills through this Unit. The skills that learners will be expected to improve on and develop through the Unit are based on SQA's Skills Framework: Skills for Learning, Skills for Life and Skills for Work and drawn from the main skills areas listed below. These must be built into the Unit where there are appropriate opportunities.

**4 Employability, enterprise and citizenship**

4.2 Information and communication technology (ICT)

**5 Thinking skills**

5.2 Understanding
5.3 Applying

Amplification of these is given in SQA's Skills Framework: Skills for Learning, Skills for Life and Skills for Work. The level of these skills should be at the same SCQF level of the Unit and be consistent with the SCQF level descriptor. Further information on building in skills for learning, skills for life and skills for work is given in the Unit Support Notes.

# Appendix: Unit support notes

## Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing this Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- the *Unit Assessment Support packs*
- the *Unit Specification*

## Developing skills, knowledge and understanding

Teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

## Approaches to learning, teaching and assessment

The Unit is designed to provide flexibility and choice for both the learner and the teacher.

Learning and teaching activities should be designed to stimulate learners' interest, and to develop skills and knowledge to the standard required by the Outcomes and to the level defined by the associated Assessment Standards.

### Sequence of delivery

The sequence of delivery and the distribution of time is a matter of professional judgement and is at the discretion of the centre. Two main approaches are suggested, but other possibilities exist.

### Delivering Outcomes 1 and 2 sequentially

It is possible to deliver the two Outcomes in sequence, with the transferable skills of Outcome 1 being used as a basis to develop further skills in Outcome 2.

### Useful resources

Before choosing and installing software, check that the relevant specification will be compatible with your current hardware.

### ECAD simulation packages

There are many electronic schematic editors and PCB layout packages available, many of them free. Many have simulation elements based on variations of SPICE and will deliver what the Unit requires. ECAD list is a website which contains links to over 60 packages of various types which you may investigate. The most consistent entry-level education package appears to be Yenka (formerly known as Crocodile Clips). This Scottish company specifically design with education in mind and their products are used widely in Scottish centres.

An example of useful software includes VeeCAD, a free-to-download stripboard layout package, which works in conjunction with TinyCAD, an open source electronic schematic editor. These may be used to assist in layout of circuits.

## Approaches to delivering and assessing each Outcome

The learner must demonstrate attainment of **all** of the Outcomes and their associated Assessment Standards. Assessment must be valid, reliable and fit for purpose.

SQA does not specify the methods of assessment to be used; teachers should determine the most appropriate method for their learners. In many cases, evidence (which may be oral or observational) will be gathered during normal classroom activities, rather than through formal assessment instruments.

Centres are expected to maintain a detailed record of evidence, including oral or observational evidence. Evidence in written or presentation format should be retained by the centre.

## Authentication of evidence

All evidence should be gathered under supervised conditions.

In order to ensure that the learner's work is their own, the following strategies are recommended:

- personal interviews with learners where teachers can ask additional questions about the completed work
- asking learners to do an oral presentation on their work
- ensuring learners are clear about acknowledging sources
- using checklists to record the authentication activity

Assessment evidence may be produced in a variety of formats including presentations, web pages, digital photographs, digital video, podcasts and blogs, and these can be stored by the learner (or teacher) within a proprietary e-portfolio, or simply by storing them in a secure folder. It should be noted that centres should verify that this evidence is indeed that of the learner and ensure that no credit is given for archive information without further analysis or comment by the student.

**Outcome 1**
The learner will:

**1 Use software in the design of electronic systems by:**

1.1 Simulating a range of electrical concepts
1.2 Simulating electronic systems
1.3 Investigating the behaviour of simulated circuits

**Notes on delivery of Outcome 1**
Typical circuits should involve a power supply, multiple input devices, processing and more than one output device.

Suitable circuits might include:

- resistive series circuits
- resistive parallel circuits
- circuits containing switches
- variable resistors and potential dividers
- potential dividers with sensors, using meters
- transistor switches
- output circuits — lights, motors, relays
- protection devices, fuses, diodes and resistors
- combinational logic plus output
- analogue input to digital logic
- digital logic to analogue output
- mini projects

This Outcome could be delivered by a series of teacher-led demonstrations followed by individual experiential learning, with learners making direct use of the simulation package(s). The demonstration materials should be available to students in either electronic or hard copy format to allow for direct differentiation based on ability and speed of progression. This material should include clear statements of the success criteria the teacher/lecturer assigns each activity to allow for the student's self-assessment as part of the process.

Typical software operations that will be developed in Outcome 1 are listed below:

- locating components in libraries
- placing components
- selecting/changing component values
- rotating components
- checking component polarity (if needed)
- adding ammeters in line with components
- adding voltmeters across components
- choosing meter ranges or selecting autorange
- adding wires to complete circuit
- adding text to annotate circuit
- saving and printing circuit diagram
- setting up on-screen oscilloscope, selecting probe points and capturing output
- collecting simulation readings/data by changing component states/values
- recording readings/data manually/electronically
- presenting readings/data in report form

The range of simulation skills listed should be available in most educational versions of current ECAD packages.

**Notes on assessment of Outcome 1**
The teacher should maintain an observational record for each learner's work. This should be supplemented by each learner building up a portfolio of completed simulations. This could include saved electronic and printed circuit diagrams of a selection of suitable circuits. Each item should be labelled with the circuit name, learner's name and date of production. The completed portfolio must include examples of work sufficient to demonstrate full coverage of the Outcome and Assessment Standards. Although learners are expected to simulate and investigate many circuits, portfolio evidence is only required of one circuit for each Assessment Standard.

**Outcome 2**
The learner will:

**2 Use software in the construction and testing of electronic systems by:**

2.1 Creating circuit diagrams
2.2 Converting circuit diagrams to PCB layouts
2.3 Using simulations to assist testing of circuits

**Notes on delivery of Outcome 2**
Typical circuits should involve a power supply, multiple input devices, processing and more than one output device (see list for Outcome 1).

This Outcome could be delivered by a series of teacher-led demonstrations followed by individual experiential learning, with learners making direct use of the simulation package/packages. The demonstration materials should be available to students in either electronic or hard copy format to allow for direct differentiation based on ability and speed of progression. This material should include clear statements of the success criteria the teacher/lecturer assigns each activity to allow for the student's self-assessment as part of the process.

Additional operations which will be developed for Outcome 2 are listed below:

- export drawing for other uses
- transfer drawing to PCB tools software
- place components on PCB manually
- add manual tracks (simple circuit only)
- use automatic layout and track tools
- add text to PCB
- generate PCB masks
- export machining file (if available)
- print PCB masks

**Notes on assessment of Outcome 2**
The teacher should maintain an observational record for each learner's work.

This should be supplemented by each learner building up a portfolio of completed simulations. This could include printouts of PCB layouts and PCB masks of a selection of suitable circuits. Each item should be labelled with the circuit name, learner's name and date of production. The completed portfolio must include examples of work sufficient to demonstrate full coverage of the Outcome and Assessment Standards. Although learners are expected to simulate and investigate many circuits, portfolio evidence is only required of one circuit for each Assessment Standard.

# Developing skills for learning, skills for life and skills for work

Learners are expected to develop broad generic skills as an integral part of their learning experience. The Unit Specification lists the skills for learning, skills for life and skills for work that learners should develop through this Unit. These are based on SQA's Skills Framework: Skills for Learning, Skills for Life and Skills for Work and must be built into the Unit where there are appropriate opportunities. The level of these skills will be appropriate to the level of the Unit.

The table below suggests opportunities to develop these skills during this Unit.

| Skill | Opportunity to develop skill |
|---|---|
| **4 Employability, enterprise and citizenship** | |
| 4.2 Information and communication technology (ICT) | Using simulation software in the design of circuits<br><br>Using software to create layouts<br><br>Using simulation software to test circuits |
| **5 Thinking skills** | |
| 5.2 Understanding | Developing skills in using software packages<br><br>Interpreting the results of testing circuits using simulation packages |
| 5.3 Applying | Applying output of simulations to the design, construction and testing of real circuits |

The Unit may also provide opportunities to develop or consolidate other skills for life, learning and work, including:

- Reading and writing
- Number processes and information handling
- Working with others
- Enterprise and citizenship
- Evaluating

## Combining assessment within Units

It may be possible to develop learning/assessment activities which provide evidence that learners have achieved the standards for more than one Outcome within the Unit, thereby reducing the assessment burden on learners. Combining assessment of Outcomes (or parts of Outcomes) in this way is perfectly acceptable, but needs to be carefully managed to ensure that all Assessment Standards and Outcomes for the Unit are covered.

# Administrative information

**Published:** January 2026 (version 3.0)

## History of changes to National Unit Specification

| Version | Description of change | Date |
|---|---|---|
| 2.0 | Unit code updated. | July 2019 |
| 3.0 | We have added unit support notes.<br><br>We have removed 'Practical' from the unit name and changed the unit code.<br><br>**What you need to do differently**<br>There is no impact on teaching, learning or assessment, however, you must use the new code for entries. | January 2026 |
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