SCQF level 6
Unit Specification

Electronics and Control

SCQF: level 6 (6 SCQF credit points)

Unit code: J29F 76

Unit outline

The general aim of this Unit is to develop a deep understanding of electronic control systems. Learners will investigate and explore engineering problems and design, simulate, construct, test and evaluate solutions.

Learners who complete this Unit will be able to:

1 Develop analogue electronic control systems
2 Develop digital electronic control systems
3 Develop programmable control systems for mechatronic systems

This Unit is available as a free-standing Unit. The Unit Specification should be read in conjunction with the *Unit Support Notes* which provide 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 *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 and Control (National 5)

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 Develop analogue electronic control systems by:

1.1 Designing and constructing circuits using sensor inputs and BJT drivers
1.2 Designing and constructing circuits using sensor inputs and MOSFET drivers
1.3 Designing and constructing operational amplifier circuits
1.4 Testing and evaluating analogue electronic solutions against a specification

Outcome 2

The learner will:

2 Develop digital electronic control systems by:

2.1 Designing and constructing complex combinational logic circuits
2.2 Describing logic functions using Boolean operators
2.3 Simplifying logic circuits using NAND equivalents
2.4 Testing and evaluating combinational logic circuits against a specification

Outcome 3

The learner will:

3 Develop programmable control systems for mechatronic systems by:

3.1 Designing and simulating high-level programs to monitor inputs and initiate digital outputs
3.2 Designing and simulating high-level programs to make decisions using arithmetic and logic functions
3.3 Testing and evaluating programs against a specification

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 technological skills, knowledge and understanding in the context of electronic control systems.

Evidence of Outcomes may be demonstrated by carrying out practical design and development tasks, supplemented by oral or written evidence of testing and evaluation. Evidence of Outcomes and Assessment Standards may be generated during one or more activities. Although learners are expected to develop a range of digital, analogue and programmable control systems, evidence is only required for one of each.

Exemplification of assessment is provided in *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:

- 8 out of 11 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 in this 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.

2 Numeracy

2.1 Number processes
2.3 Information handling

4 Employability, enterprise and citizenship

4.2 Information and communication technology (ICT)

5 Thinking skills

5.3 Applying
5.4 Analysing and evaluating

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

These support notes 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 specification*
- the *unit assessment support packs (UASP)*

Calculations	Manipulating and combining given formulae to obtain answers Solving structural problems using trigonometric functions and substitution in simultaneous equations
Analogue electronic control systems	Variable resistors, light and temperature sensors in voltage dividers Use of input transducer characteristics to design voltage dividers to meet specification Function and purpose of BJTs, 741ICs (building blocks) and op-amps (devices for amplifying voltage signals) Function of op-amp configurations: inverting, non-inverting, comparator, difference amplifier, summing amplifier, voltage followers Design of BJT circuit as a current amplifier Calculation of relationship between input and output voltages for different op-amp configurations Calculation of current gain (H_{FE}) of an npn transistor Function and purpose of MOSFETs using diagrams and characteristic graphs Design of MOSFET (n-channel enhancement mode) circuit as a voltage operated switch Calculation of transconductance in a MOSFET Comparison of two types of transistor in a given application

Digital electronic control systems	Digital electronic control: Logic functions: AND, OR, NOT, NAND, NOR, EOR and combinations Conversion to NAND equivalent Development of Boolean expressions from truth tables, logic diagrams or circuit specifications Construction of truth tables and logic diagrams from written specifications Programmable control: Controlling a motor using pulse width modulation Control routines with up to four inputs and four outputs, processing analogue inputs Use of infinite and finite loops and time delays Use of logic and arithmetic operations to make decisions

Administrative information

Published: July 2019 (version 4.0)

Superclass: XL

History of changes to National Unit Specification

Version	Description of change	Authorised by	Date
2.0	The word 'digital' removed from Assessment Standard 3.1	Qualifications Manager	August 2015
3.0	Level changed from Higher to SCQF level 6. Unit support notes added. Assessment standard threshold added.	Qualifications Manager	September 2018
4.0	Unit code updated	Qualifications Manager	July 2019