



National Unit Specification: general information

UNIT Engineering: Fault Finding in Measurement and Control
(SCQF level 6)

CODE F5KN 12

SUMMARY

This Unit can be delivered as part of a National Qualification Group Award but can also be taken as a free-standing Unit.

This Unit is designed to enable candidates to develop knowledge and understanding of fault finding in measurement and process control used in industry. It will develop knowledge and understanding of fault finding techniques in measurement and control systems and develop a practical ability to fault find.

OUTCOMES

- 1 Use and interpret a schematic drawing of a measurement and control system.
- 2 Apply methods of fault finding.
- 3 Apply fault finding to measurement and control system elements.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following, or equivalent:

- ◆ Standard Grade Mathematics — General/Credit Level
- ◆ Standard Grade Technological Studies and/or Science subjects — General/Credit Level

Administrative Information

Superclass: VE

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National Unit Specification: general information (cont)

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CREDIT VALUE

1 credit at SCQF level 6 (6 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 Access 1 to Doctorates.*

CORE SKILLS

There is no automatic certification of Core Skills in this Unit.

This Unit provides opportunities for candidates to develop aspects of the following Core Skills:

Problem Solving (SCQF level 6)
Numeracy (SCQF level 6)

These opportunities are highlighted in the Support Notes of this Unit Specification.

National Unit Specification: statement of standards

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Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

Use and interpret a schematic drawing of a measurement and control system.

Performance Criteria

- (a) The interpretation of the given drawing is correct with respect to identification of the purpose of the measurement and control system.
- (b) The interpretation of the given drawing is correct with respect to identification of process control elements.
- (c) The interpretation of the given drawing is correct with respect to identification of supply lines, signal lines and direction of information flow.
- (d) The given system is drawn in block diagram form, showing control elements in the correct sequence with signal ranges and direction of signal shown.

OUTCOME 2

Apply methods of fault finding.

Performance Criteria

- (a) The random method to fault finding is correctly applied.
- (b) The start/finish method to fault finding is correctly applied.
- (c) The half split method to fault finding is correctly applied.

OUTCOME 3

Apply fault finding to measurement and control system elements.

Performance Criteria

- (a) Fault finding to measurement elements is correctly applied.
- (b) Fault finding to control elements is correctly applied.

National Unit Specification: statement of standards (cont)

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EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

Written and/or oral evidence is required which demonstrates that the candidate has achieved Outcome 1 to the standard specified in the Outcome and Performance Criteria.

The assessment will be closed-book and should last approximately 1 hour.

Performance and written and/or oral evidence is required which demonstrates that the candidate has achieved Outcome 2 to the standard specified in the Outcome and Performance Criteria. A report on the methods of fault finding must be provided and will be obtained under open-book conditions. An assessor observation/checklist should record the fault finding procedures and last approximately 1 hour.

Performance evidence and written and/or oral evidence is required which demonstrates that the candidate has achieved Outcome 3 to the standard specified in the Outcome and Performance Criteria. A report on the methods of fault finding must be provided and obtained under open-book conditions. An assessor observation/checklist should record the correct application of fault finding techniques and last approximately 1 hour.

National Unit Specification: support notes

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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 is an optional Unit within the National Certificate in Measurement and Control Engineering, but can also be delivered on a free-standing basis.

Safety regulations and safe working practices and procedures should be observed at all times.

Computer simulation can be used where appropriate in a supporting role.

The range of topics that will be covered in the delivery of the Unit will be as follows:

Outcome 1

- ◆ Appropriate graphical symbols for: transducers, controllers, recorders, indicators, control valves, actuators, convertors, switches, motors, interlocks, heaters, pumps, airlines (supply and signal), hydraulic lines (supply and signal) and electrical lines (supply and signal)
- ◆ Appropriate standards
- ◆ Block diagram representation of primary and secondary measuring elements
- ◆ Controllers (including comparators and gain elements)
- ◆ Control elements
- ◆ Process lines
- ◆ Signal lines and signal directions, types and levels of signal
- ◆ Physical models could include, interface units, process pressure, level, temperature and flow transmitters, controllers and control valves and interconnections

Outcome 2

- ◆ Flowcharting and manufacturers' 'Troubleshooting Guides'
- ◆ Control systems or simulations, which can be deliberately faulted
- ◆ Random, half split and start/finish methods of fault finding

Outcome 3

- ◆ Control elements which can be deliberately faulted, eg controller, sensor/transmitter
- ◆ Process elements which can be deliberately faulted, eg blocked pipes
- ◆ Random, half split and start/finish methods of fault finding
- ◆ Diagnostic abilities of smart instruments

National Unit Specification: support notes (cont)

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GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

This Unit should be delivered in a way that includes a mixture of lecturer led and candidate-centred activities.

In this Unit the Outcomes should be delivered in order.

The use of ICT (Information and Communication Technology) should be used to support the delivery of this Unit. This could take the form of candidates researching different types of fault finding techniques. Candidates should download manufacturers' manuals and troubleshooting information from the internet.

This Unit requires access to a measurement and control engineering laboratory with a range of process control systems and test equipment. Demonstrations and laboratory exercises can be used to improve the candidates understanding of fault finding in process control. This will help to relate theory to practice.

The aim of this Unit is to help the candidate to develop sound fault finding techniques. To this end practical examples should be used whenever possible. A comprehensive range of industrial instrumentation related to process control is essential.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Elements of the Core Skill of *Problem Solving*, that is, critical thinking, planning, organising, reviewing and evaluating, will be naturally developed and enhanced as candidates apply methods of fault finding to measurement and control system elements. Undertaking and completing the practical work successfully will involve taking account of a complex range of factors including safety issues. Fault finding principles have to be applied and reported efficiently and accurately. Discussing, practising and evaluating the process in a laboratory environment should be routine during formative work.

Candidates have to interpret a schematic drawing and draw a given system in block diagram form. Formative practical activities should be designed to develop accuracy and confidence in handling graphic and numerical concepts in an engineering context. *Numeracy* skills will be naturally enhanced, with a focus on the practical application of sequence and directional data.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by information and communications technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

National Unit Specification: support notes (cont)

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The candidate should be given a process plant drawing (P & ID – process and instrument drawing) which includes the BS symbols for process control elements, supply lines and signal lines. The candidate will be required to produce an appropriate block diagram for the loop, which will include the sequence of the blocks and signal ranges. Elements should be clearly labelled.

Achievement of this Unit requires the Evidence Requirements for each Outcome to be met. A candidate who does not initially achieve the specified standard can have a further opportunity, attempting only the Outcome(s) not previously achieved.

Outcome 1 should be assessed by a 1 hour closed-book test which consists of a series of short answer, restricted response and structured questions.

Outcome 2 should be assessed by practical exercises that involve fault finding using random, half split and start/finish techniques. An observation checklist should be used to record candidate performance. The assessment also requires the production of a suitable report containing the test data and its interpretation.

Outcome 3 should be assessed by practical exercises that involve fault finding using appropriate techniques selected by the candidate. An observation checklist should be used to record candidate performance. The assessment also requires the production of a suitable report containing the test data and its interpretation.

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).