



National Unit Specification: general information

UNIT Engineering: Distributed Control Systems (SCQF level 6)

CODE F5KM 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 suitable for candidates studying the subject for the first time and could act as a basis for progression to employment and/or further study.

This Unit is designed to enable candidates to develop knowledge and understanding of Distributed Control Systems (DCS) and Supervisory Control and Data Acquisition (SCADA), the structure and plant interfacing of DCS and SCADA and a user knowledge of such systems with highways and local area networks as used to monitor and control physical variables in process industries.

OUTCOMES

- 1 Investigate the operation of process system monitoring and data acquisition.
- 2 Investigate the structure and operation of distributed control systems.
- 3 Investigate how process measurement and control is achieved with a data highway and Local Area Network (LAN).

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 at General/Credit Level

Administrative Information

Superclass: VE

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National Unit Specification: general information (cont)

UNIT Engineering: Distributed Control Systems (SCQF level 6)

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:

Numeracy (SCQF level 6)

Information Technology (SCQF level 6)

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

National Unit Specification: statement of standards

UNIT Engineering: Distributed Control Systems (SCQF level 6)

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

Investigate the operation of process system monitoring and data acquisition.

Performance Criteria

- (a) Types of data signals in process measurement and control are correctly investigated.
- (b) Methods of signal conversion and multiplexing and de-multiplexing are correctly investigated.
- (c) Methods of remote communication are correctly explained.

OUTCOME 2

Investigate the structure and operation of distributed control systems.

Performance Criteria

- (a) The development of a distributed control system is correctly investigated.
- (b) The structure of distributed control systems from field device level to management level are correctly explained.
- (c) The operation of a distributed control system is correctly explained.

OUTCOME 3

Investigate how process measurement and control is achieved with a data highway and Local Area Network (LAN).

Performance Criteria

- (a) The data highway and its communications are correctly investigated.
- (b) Communication methods between the data highway and LAN are correctly investigated.
- (c) The operation of a data highway and LAN in process measurement and control are correctly explained.

National Unit Specification: statement of standards (cont)

UNIT Engineering: Distributed Control Systems (SCQF level 6)

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 all Outcomes to the standard specified in the Outcomes and Performance Criteria.

The evidence for Outcome 1, Outcome 2 and Outcome 3 will be obtained in a combined assessment under closed-book supervised conditions and will last approximately 1 hour and 30 minutes.

The Assessment Support Pack for this Unit provides sample assessment material. Centres wishing to develop their own assessments should refer to the Assessment Support Pack to ensure a comparable standard.

National Unit Specification: support notes

UNIT Engineering: Distributed Control Systems (SCQF level 6)

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 a restricted core Unit within the National Certificate in Measurement and Control Engineering, but is also suitable for candidates wishing to study the Unit on a free-standing basis.

This Unit has been written in order to allow candidates to develop knowledge, understanding and skills of Distributed Control Systems and should be delivered with the support of a measurement and control engineering laboratory and/or a process plant installation.

Outcome 1

- ◆ Signals — mV, mA, volt, Ohm, pulse and frequency
- ◆ Signal conversion/conditioning — analogue to digital conversion, digital to analogue conversion, multiplexing, de-multiplexing, linearisation of millivolt and milliamp signals
- ◆ Communications — analogue/digital/optical/radio/microwave

Outcome 2

- ◆ Development — analogue single loop to direct digital control to DCS (including auto manual changeovers, remote setpoints, modes of operation and data logging)
- ◆ DCS structure — field device level, controller level, management level, communication methods and devices linking the levels
- ◆ Screen displays — trends, alarms, group, schematic, detail
- ◆ Alarm types — absolute, rate of change, deviation
- ◆ Alarm priority — emergency, high, low

Outcome 3

- ◆ Highway — word length and baud rate, data and command words
- ◆ Communication methods — gateway units
- ◆ Operating stations — master and slave

National Unit Specification: support notes (cont)

UNIT Engineering: Distributed Control Systems (SCQF level 6)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

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 DCS and SCADA systems as used in process measurement and control on the internet.

This Unit ideally requires access to a measurement and control engineering laboratory with typical DCS and SCADA equipment. Demonstrations and laboratory exercises can be used to improve the candidates understanding of these systems and their application in process measurement and control which will help relate theory to practice.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Candidates perform a series of complex calculations and measurements as they demonstrate knowledge and understanding of systems and their application in process measurement and control. *Numeracy* skills will be naturally enhanced, with the focus throughout on practical interpretation and use of number and graphics. Formative activities could be designed to develop accuracy and confidence in handling numerical information in an engineering context.

Candidates investigate the achievement of process measurement and control with a data highway and Local Area Network (LAN) as the Unit is undertaken. Access to on-line information on different types of DCS and SCADA systems would support development of current knowledge and understanding. Individual research on control systems, methods and related issues should be encouraged. Practical technology skills should include awareness of security, safety and consideration for other users.

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)*.

Achievement of this Unit requires the Evidence Requirements of each Outcome to be met.

Outcome 1, Outcome 2 and Outcome 3 could be assessed by an integrated 1 hour 30 minute closed-book test, which consists of a series of short answer, restricted response and structured questions.

National Unit Specification: support notes (cont)

UNIT Engineering: Distributed Control Systems (SCQF level 6)

The assessment should test the candidates knowledge and understanding of process control and data acquisition systems in the form of; interfacing and sampling of plant measurement and control devices with a distributed control system, the structure of various types of distributed control systems, their operating stations, the structure and communications of highways and local area networks.

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).