SQA Advanced Unit Specification

General information for centres

Unit title: Distributed Control Systems

Unit code: HV63 47

Unit purpose: This Unit is designed to enable candidates to gain knowledge and understanding and apply Distributed Control Systems (DCS) in Industrial Measurement and Control Engineering. On completion of the Unit candidates should be able to:

1 Explain the concept of DCS.
2 Apply the construction and operation of a DCS controller.
3 Apply field interfaces and networks.
4 Explain operator interfaces.
5 Explain reporting systems.
6 Apply maintenance considerations.
7 Apply DCS applications and implementation.
8 Apply future DCSs.

Credit points and level: 2 SQA Credit at SCQF level 7: (16 SCQF credit points at SCQF level 7*)

**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: Access to this Unit will be at the discretion of the centre and the following recommendations are for guidance only. Candidates should have a basic knowledge of industrial measurement and control engineering. This may be evidenced by the possession of Higher Process Measurement or Higher Process Control or NQ Units in Measurement and Control or NC Measurement and Control or NC Multidisciplinary Engineering.

Core Skills: There are opportunities to develop the Core Skill(s) of Written Communication (Writing), Written Communication (Reading), Using Information Technology, Working with Others and Problem Solving (Critical Thinking) at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

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: It is recommended that the Outcomes be assessed separately by a one hour assessment each. The assessment papers could be composed of a suitable balance of short answer

questions, restricted responses and structured questions. Assessments should be conducted under controlled supervised conditions. It should be noted that candidates must achieve all the minimum evidence specified for each Outcome to pass the Unit.

Unit specification: statement of standards

Unit title: Distributed Control Systems

Unit code: HV63 47

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

Explain the concept of DCS

Knowledge and/or skills

- DCS layout in terms of communication paths and signal levels
- Highway based systems, communications controller and highway redundancy
- Distributed system from field devices to commercial data processing
- Component parts and their respective functions/specifications
- High/low level systems

Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis and be presented in response to specific questions. Each candidate will need to demonstrate that he/she can answer correctly questions based on a sample of the items shown above. In any assessment of this Outcome four out of five knowledge and/or skills should be sampled.

In order to ensure candidates will not be able to foresee the items in which they will be questioned on a different sample of four knowledge and skills is to be used each time the Outcome is assessed. Candidates must provide a satisfactory response to all four knowledge and/or skills. When sampling takes place a candidate response can be judged satisfactory where evidence is provided is sufficient to meet the requirement for each item by showing that the candidate is able to:

- explain with the aid of a sketch an annotated diagram of a DCS layout showing the communication paths and signal levels
- explain highway based systems, highway redundancy, communication controllers and the structure of data and command words on the highway
- explain the distributed system from field devices to commercial data processing
- explain the component part of a DCS and their functions specifications
- explain high/low level system

Evidence should be generated through assessment undertaken in controlled supervised conditions.

Assessment guidelines

Assessment should be conducted under closed-book conditions and as such candidates should not be allowed to bring any textbooks or handouts to the assessment.

Questions used to check candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

It is recommended that the Outcome be assessed by a one hour assessment.

Outcome 2

Apply the construction and operation of a DCS controller

Knowledge and/or skills

- Control modes; manual, automatic and cascade
- Mode attribute; operate and programme
- Structure of a DCS controller
- Tracking, initialisation, past mode recall and alarms
- Advance multifunction controller functions and configuration words
- Diagnostic methods used in multifunction controllers
- Primary and reserve controllers and the use of uninterrupted automatic control
- Configuration to meet loop detail specification for feedback, feedforward, cascade, ratio systems and digital point input/output
- Security levels

Evidence Requirements

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis and be presented in response to specific questions. Each candidate will need to demonstrate that he/she can answer correctly questions based on a sample of the knowledge and/or skills shown above. In any assessment of this Outcome seven out of nine knowledge and/or skills then should be sampled.

In order to ensure candidates will not be able to foresee the items on which they will be questioned a different sample of seven knowledge and/or skills is to be used each time the Outcome is assessed. Candidates must provide a satisfactory response to all seven items.

When sampling takes place a candidate response can be judged satisfactory where evidence provided is sufficient to meet the requirements of each item by showing that the candidate is able to:

- explain manual, automatic and cascade control modes
- explain operate and program mode attributes
- explain the structure of a DCS controller
- explain tracking, initialisation, past mode recall and alarms
- apply advanced multifunction controllers and their configuration words
- explain diagnostic methods used in multifunction controllers
- explain primary and reserve controllers and the use of uninterrupted automatic control
- apply configuration to meet loop detail specification for feedback, feed forward, cascade, ratio systems and digital point input/outputs
- explain security levels of operation

Evidence should be generated through assessment undertaken in controlled supervised conditions.

Assessment guidelines

Assessment should be conducted under closed-book conditions and as such candidates should not be allowed to bring any text books or handouts to the assessment.

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer questions, restricted response and structured questions.

It is recommended that the Outcome be assessed by a one hour assessment.

Outcome 3

Apply field interfaces and networks

Knowledge and/or skills

- Input/output interface types (analogue/digital/pulse)
- Multiplexing/de-multiplexing of process values and data/signal processing/interface from field devices
- Hazardous area installations
- Use of local area network communications, network types and specifications, low and high level systems
- Ethernet/Fieldbus types, LANS, topology, gateways, routers and Ethernet switches
- Hart/Fieldbus protocols and physical layer
- Integration of Fieldbus systems

Evidence Requirements

Evidence for the knowledge and skills in this Outcome will be provided on a sample basis and be presented in response to specific questions. Each candidate will need to demonstrate that he/she can answer correctly questions based on a sample of the knowledge and/or skills shown above. In any assessment of this Outcome five out of seven knowledge and/or skills should be sampled. In order to ensure candidates will not be able to foresee the items on which they will be questioned a different sample of five knowledge and/or skills is to be used each time the Outcome is assessed. Candidates must provide a satisfactory response to all five knowledge and/or skills.

When sampling takes place a candidate response can be judged satisfactory where evidence provided is sufficient to meet the requirements of each knowledge and/or skill by showing that the candidate is able to:

- explain the input/output interface types
- explain multiplexing/de-multiplexing of process value inputs and data/signal/processing from field devices
- explain hazardous area installations
- apply local area network communications, network types and specifications, low and high level systems
- apply Ethernet/Fieldbuses and LANs, topology, gateways, routers and Ethernet switches
- apply Hart and Fieldbus protocols and physical layers
- apply Fieldbus integration to distributed control systems

Evidence should be generated through assessment undertaken in controlled conditions.

Assessment guidelines

Assessment should be conducted under closed-book conditions and as such candidates should not be allowed to bring any textbooks or handouts to the assessment.

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer questions, restricted response questions and structured questions.

It is recommended that the Outcome be assessed by a one hour assessment.

Outcome 4

Explain operator interfaces

Knowledge and/or skills

- Operator interface and associated hardware
- Ergonomic considerations
- Multiple operator stations
- Highway and media connections

Evidence Requirements

Evidence of knowledge and/or skills in this Outcome will be provided on a sample basis and be presented in response to specific questions. Each candidate will need to demonstrate that he/she can answer correctly questions based on a sample of the knowledge and/or skills shown above. In any assessment of the Outcome three out of four knowledge and/skills items should be sampled. In order to ensure candidates will not be able to foresee the items which they will be questioned on a different sample of three knowledge and/or skill items is to be used each time the Outcome is assessed. Candidates must provide a satisfactory response to all three items. When sampling takes place a candidate response can be judged satisfactory where evidence provided is sufficient to meet the requirements of each item by showing that the candidate is able to:

- explain an operator interface and its associated hardware
- explain ergonomic considerations
- explain multiple operator stations and their use
- explain highway and media connections

Evidence should be generated through assessment undertaken in controlled conditions.

Assessment guidelines

Assessment should be conducted under closed-book conditions and as such candidates should not be allowed to bring any textbooks or handouts into the assessment.

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer questions, restricted response and structured questions.

It is recommended that the Outcome be assessed by a one hour assessment.

Outcome 5

Explain reporting systems

Knowledge and/or skills

- Data point ownership
- Alarms — generation, reporting, acceptance and time stamped
- Alarms — configuration of priority action, setting and suppression
- Types of logs and reports, configurable on DCS
- Cross screen invocation and user defined keys

Evidence Requirements

Evidence of knowledge and skills in the Outcome will be provided on a sample basis and be presented in response to specific questions on the knowledge and/or skills shown above.

In any assessment of this Outcome four out of five knowledge and/or skill items should be sampled. In order to ensure candidates will not be able to foresee the items on which they will be questioned a different sample of four knowledge and/or skills is to be used each time the Outcome is assessed. Candidates must provide a satisfactory response to all four items. When sampling takes place a candidate response can be judged satisfactory when evidence provided is sufficient to meet the requirements of each item by ensuring the candidate is able to:

- explain data point ownership
- explain generation, reporting, acceptance and time stamped alarms
- explain configuration of priority action, setting and suppression of process value alarms
- explain different types of logs and reports configurable on a distributed system database
- explain cross screen invocation and user defined keys

Evidence should be generated through assessment undertaken in controlled supervised conditions.

Assessment guidelines

Assessment should be conducted under closed-book conditions and as such candidates should not bring any textbooks or handouts into the assessment.

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer questions, restricted response and structured questions.

It is recommended that the Outcome be assessed by a one hour assessment.

Outcome 6

Apply maintenance considerations

Knowledge and/or skills

- Hardware reliability — mean time between failures, mean time to repair and availability
- Diagnostic and maintenance routines — self diagnostics, module start-up and failure messages
- Requirements of uninterruptible power supplies (UPS) and their application
- Recovery of DCS after power outage

Evidence Requirements

Evidence for the knowledge and skills in this Outcome will be provided on a sample basis and be presented in response to specific questions. Each candidate will need to demonstrate that he/she can answer questions based on a sample of the knowledge and/or skills shown above. In any assessment of the Outcome three out of four knowledge and/or skills items should be sampled. In order to ensure candidates will not be able to foresee the items on which they will be questioned a different sample of three knowledge and/or skills items is to be used each time the Outcome is assessed. Candidates must provide a satisfactory response to all three items. When sampling takes place a candidate response can be judged satisfactory where evidence provided is sufficient to meet the requirements of each item by showing that the candidate is able to:

- apply reliability techniques to DCS hardware
- explain self diagnostics and maintenance routines to start-up and failure messages
- apply UPS in DCS
- explain how a DCS is recovered after a power outage

Evidence should be generated through assessment undertaken under controlled supervised conditions.

Assessment guidelines

Assessment should be conducted under closed-book conditions and as such candidates should not be allowed to bring any textbooks or handouts to the assessment.

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer question, restricted response questions and structured questions.

It is recommended that the Outcome be assessed by a one hour assessment.

Outcome 7

Apply DCS applications and implementation

Knowledge and/or skills

- Examples of process control — from highway level, main computer level and mainframe computer level
- DCS in different control environments — paper/pulp, boiler controls, petro/chemical and gas processing
- System strategy and automation plan — architecture, vendor, system requirements and system integrator and toolkit
- Project implementation phases — requirements definition, design, implementation, testing and start-up, continuous improvement decommissioning
- Process life cycle versus system life cycle

Evidence Requirements

Evidence of knowledge and/or skills in this Outcome will be provided on a sample basis and be presented in response to specific questions. Each candidate will need to demonstrate that he/she can answer correctly questions based on a sample of the items shown above. In any assessment of this Outcome four out of five knowledge and/or skills should be sampled.

In order to ensure candidates will not be able to foresee the knowledge and/or skills on which they will be questioned a different sample of four knowledge and/or skill is to be used each time the Outcome is assessed. Candidates must provide a satisfactory response to all four items. When

sampling takes place a candidate response can be judged satisfactory when evidence provided is sufficient to meet the requirements of each item by showing that the candidate is able to:

- interpret process control applications from highway level, main computer and mainframe computer
- apply DCS to different control environments and process control applications
- explain a system strategy in terms of architecture, vendor, system requirements, system integration and toolkits available
- apply project implementation to a DCS application
- explain process life cycle versus system life cycle

Evidence should be generated through assessment undertaken in controlled supervised conditions.

Assessment guidelines

Assessment should be conducted under closed-book conditions and as such candidates should not be allowed to bring any textbooks or handouts to the assessment.

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer questions, restricted response questions and structured questions.

It is recommended that the Outcome be assessed by a one hour assessment.

Outcome 8

Apply future DCS

Knowledge and/or skills

- Open systems — choice of hardware/software and communication systems
- OPC – Data transfer between different vendor systems
- Industrial communications — Fieldbus and Ethernet standards needed for intrinsic safety
- Safety and shutdown systems — TMR systems and safety functions to DCS
- Embedding of EN 61511 and EN 61508
- Integration with business systems — E commerce for process control systems, web browser and applications

Evidence Requirements

Evidence for the knowledge and skills in this Outcome will be provided on a sample basis and be presented in response to specific questions each candidate will need to demonstrate that he/she can answer correctly questions based on a sample of the items shown above.

In any assessment of this Outcome four out of six knowledge and/or skills should be sampled. In order to ensure candidates will not be able to foresee the items on which they will be questioned a different sample of four knowledge and/or skill is to be used each time the Outcome is assessed. Candidates must provide a satisfactory response to all four knowledge and/or skills. When sampling takes place a candidate response can be judged satisfactory where evidence provided is sufficient to meet the requirements of each item by showing the candidate is able to:

- explain open systems and select appropriate hardware/software and communication systems
- apply OPC to transfer data from different vendor systems
- apply industrial communications via Fieldbus/Ethernet to meet intrinsic safety standards
- apply TMR systems and safety systems to DCS shutdowns
- explain the embedding of EN61511 and EN61508 to DCS

- explain integration with business systems in application of process control

Evidence should be generated through assessment undertaken in controlled supervised conditions.

Assessment guidelines

Assessment should be conducted under closed-book conditions and as such candidates should not be allowed to bring textbooks or handbooks to the assessment.

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer questions, restricted response questions and structured questions.

It is recommended that the Outcome be assessed by a one hour assessment.

Administrative information

Unit code: HV63 47

Unit title: Distributed Control Systems

Superclass category: VG

Original date of publication: November 2017

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History of Changes:

Version	Description of change	Date

Source: SQA

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

Unit specification: support notes

Unit title: Distributed Control Systems

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 80 hours.

Guidance on the content and context for this Unit

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

1 The concept of DCS.
2 Multifunction controllers used in DCS.
3 The application of interfaces and networks used in DCS.
4 The operator interface and its use.
5 The reporting methods used in DCS.
6 The application of maintenance and diagnostic techniques.
7 The application and implementation of DCS to process controls.
8 The application of future DCS.

This Unit is at SCQF level 7 and has been devised as a mandatory Unit in the SQA Advanced Certificate in Measurement and Control Engineering Awards. However this does not preclude the use of this Unit in other awards where designers feel this to be appropriate.

In designing this Unit, the Unit writer has identified the range of topics that they would expect to be covered by lecturers. The writer has also given recommendations as to how much time should be spent on each Outcome. This has been done to assist lecturers to decide what depth of treatment should be given to the topics attached to each Outcome. While it is not mandatory for centres to use this list of topics, it is recommended that they do so since the assessment exemplar pack for this Unit is based on the knowledge and/or skills and list of topics in each of the Outcomes.

A list of topics for each Outcome is given below lecturers are advised to study this list in conjunction with the assessment exemplar pack so that they can get a clear indication of the standards of achievement expected of this Unit.

1 Explain the concept of DCS (8 hours)

- There are various DCS architectures on the market and different offerings from various vendors should be considered.
- The dominant systems are typically Delta V, Honeywell PlantScape and Foxboro I/A. A comparison should be made of these system architectures.
- The comparison should include high speed Ethernet and Fieldbus systems along with analogue I/O.
- Candidates should be aware of the signal levels/rates at the various high/low levels of communications along with the control of the communications between the various levels.
- Support for fibre optic and wireless architecture for additional configuration options and flexibility should be included.

2 Analyse the construction and operation of a DCS controller (18 hours)

- Refer to basic and advanced controllers for continuous, batch and discrete operation.
- Block diagram of micro-processor based controller.
- Control modes — manual, automatic, cascade or back-up cascade.
- Control mode attributes — operator, program or none.
- Typical mode structure of a DCS controller.
- Process value tracking in various control modes.
- Initialisation in control slots for cascade control. (PV initialisation and control initialisation).
- Past mode recall and alarm settings (PV and error, rate of change of PV and error).

Control algorithms	**Function supported**
Data acquisition	PV source (auto, manual)
Flow compensation	PV clamping
High/low average selector	PV filter (single lag)
Middle of 3 selector	EU conversion and extended range
Summer	PV value status and propagation
Totaliser and general linearisation	PV alarming, bad PV, PV high/low PV HIHI/LOLO, PV rate of change, PV significant change
Variable dead time with lead/lag	
PID Control PID with feed forward control PID with position control PID with external reset Proportional control	Manual, automatic Cascade and back-up cascade Mode attributes – operator and program Normal mode Remote cascade, remote request and remote.
Ratio Control Ramp soak Auto/manual selection Incremental summer Switch Override selector	Configurable by slot Initialisation Wind up protection Fixed or auto ratio and bias Override propagation External mode switch Safety shutdown Target value processing or set point ramping Alarms PV source, PV alarming Mode shed or bad PV Limits outputs, set point, ratio and bias

Control algorithms	Function supported
Logic Block	Boolean logic functions Delay ON/OFF Pulse Watch dog timer Switch Flip, flop Check for Bad

User programme points — control programs can access the DCS controller database, accessing all analogue inputs/outputs, digital inputs/outputs, array points, logic block status, alarm states and failure states, numeric variables and flags. Control programs also support communications with the operator and can send and receive data from other controllers on the data highway or control network.

Control equations used to generate the control algorithms eg PID with bus and ratio.

Use of configuration words to create loop documentation for standard process control loops eg feedback, feedforward, cascade and ratio. Analogue inputs, digital input/output eg pump stop/start or solenoid valve open/close.

Primary and reserve controllers and explain the operation of uninterruptible automatic control should the primary controller fault for any reason.

Explanation of the uninterrupted automatic control sequence.

Security systems and access to controller detail and configuration ie view only, operator level, supervision level and engineer level.

3 Apply field interfaces and networks (10 hours)

- Compare input and output signal types.
- Explain multiplexing process and interfaces with field devices.
- Hazardous area installations for analogue and digital signals.
- Communications — suplex, half duplex and full duplex methods.
- Synchronous and Asynchronous systems and error detection.
- Balanced and unbalanced transmission lines.
- Major elements of EIA-232 and EIA 485, EIA 422, interface standards.
- 2- wire multidrop.
- Modbus protocol and functions.
- Hart protocol and functions.
- Local area network topology — star/ring token passing.
- Ethernet types. High speed Ethernets.
- Network interconnections - repeaters, routers and gateways. TCP/IP protocols.
- Fieldbus- Overview of types, performance, physical layer, attenuation, power supply for Fieldbus network. Signal type and cable application layer.

4 Explain operation interfaces (6 hours)

- Operator interface and hardware layout.
- Interface with data highway, VDU, keyboard, printers and media connections.
- Multiple operator stations — large plant application.
- Interface displays — details of group, schematic, detail, configuration and trend displays.

5 Explain Reporting Systems (6 hours)

- Operation of advanced DCS using multi-screen displays, cross screen invocation and linking.
- Alarm reporting, generation and acceptance. Alarm setting and suppression.
- Types of logs and reports configurable on DCS.

6 Apply maintenance considerations (12 hours)

- Maintenance requirement of the system and system elements.
- Dependability, availability, hardware reliability, fault tolerance and maintainability.
- Requirements for inbuilt diagnostic and maintenance routines — self diagnostics, module start-up testing subroutines, failure messages.
- System maintenance diagnostic routines.
- Requirement for installation of UPS system.
- Recovery of DCS power outage — typical recovery procedure.
- History storage module, start-up of operator station, highway gateway/control network interfacing module and controllers.

7 Apply DCS applications and implementations (12 hours)

- Use of DCS for the control of the following processes, pulping, bleaching, evaporation and recovery boiler, refinery/distillation, thermal cracking, crude oil, hydrocracker, offshore production, gas plants and liquid natural gas.
- Strategy and automation plan — architecture, vendor, system requirement.
- Hardware, software, connectivity, networks evaluation and scoring, system integration and toolkits.
- Implementation — P & IDs, testing start-up, installation and commissioning of equipment, manual control checks, automatic control checks.

8 Apply future DCS (8 hours)

- Open systems — use of OPC, use of industrial communications, safety and shut down Systems. Tighter integration with business systems and the supply chain.
- E-commerce solutions intranet/internet.
- Relationship between IEC 61511 and IEC 61508. These standards address safe instrumentated systems in the process industries. The safe system includes all components and subsystems necessary to carry out the safe instrumentated functions from sensors to the final element.

It is recommended that the Outcomes be assessed separately by a one hour assessment each, ie eight one hour assessments.

Assessments should be conducted under controlled supervised conditions.

Guidance on the delivery and assessment of this Unit

This Unit is a mandatory Unit in the SQA Advanced Certificate/Diploma in Measurement and Control Engineering Group Award and is designed to provide the candidate with technical knowledge and skills for the occupational area.

It is recommended that this Unit is delivered towards the end of the Group Award. By this time the candidate should have a good appreciation of the main types of workplace environment in which they will be working. Assessments should be held in controlled conditions and candidates may not bring textbooks, handouts or any material prepared by themselves.

Opportunities for developing Core Skills

There are opportunities to develop the Core Skills of Written Communication (Writing), Written Communication (Reading), Using Information Technology, Working with Others and Problem Solving (Critical Thinking) at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Open learning

The Unit could be delivered by distance learning. However it would require planning by the centre to ensure the sufficiency and authenticity of candidate evidence. Arrangements would have to be made to ensure that a single integrated assessment of all eight Outcomes is delivered in a supervised environment under controlled conditions.

To keep the administrative burden to a minimum, it is recommended that a single assessment based on a case study is used for open and distance learning candidates.

For information on open learning arrangements, please refer to *SQA guide assessment and quality assurance of open and distance learning (A1030, Feb 2001).*

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.

General information for candidates

Unit title: Distributed Control Systems

This Unit has been designed to provide you with the knowledge, understanding and skills associated with distributed control systems, networks and interface Units which are the basis of all modern process control.

The early part of the Unit deals with the elements of distributed control, the controller functions and their application to process control and complex control loops.

The rest of the Unit deals with field interfaces and networks, operator interfaces, reporting systems and the application and implementation of Distributed Control Systems to process plant.

The Unit will also enable you to analyse problems and apply a distributed control system to practical process control and how a distributed system is interfaced with field devices and process plant.

By the end of the Unit you will be able to understand how a distributed control system operates and is set up to control and monitor a process plant. Application of plant networks, highways and Fieldbus technology is also included.

The assessments can be carried out on an Outcome by Outcome basis.