

SQA Advanced Unit Specification

General information for centres

Unit title: High Level Language: External I/O Transfer

Unit code: HP43 48

Unit purpose: This Unit is designed to enable candidates to gain knowledge and understanding and apply a high level programming language solution to parallel and serial data transfer problems in an engineering environment. It is also intended, with the use of files, to introduce the principles of data logging. This Unit can, with the use of a cross compiler, be applied for the programming of microcontroller/microprocessor devices. The program can first be developed using high level language on the host computer (a PC) then cross compiled to the object code of the target system.

Outcome 1 introduces the principles of parallel data transfer with Outcome 2 concentrating on serial data transfer. Outcome 3 introduces the principles of file creation, reading and closing.

On completion of the Unit the candidate should be able to:

1. Write and test a high level language program to perform parallel data transfer.
2. Write and test a high level language program to perform serial data transfer.
3. Write and test a high level program that creates, reads and closes a file.

Credit value: 1 SQA Credit at SCQF level 8: (8 SCQF credit points at SCQF level 8*)

**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: Candidates should have a working knowledge and understanding of a high level programming language. This may be evidenced by the possession of the level 7 Unit High Level Engineering Software or other suitable Units.

Core skills: There may be opportunities to gather evidence towards Core Skills in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: This Unit was developed for the SQA Advanced Diploma in Electronics award. If the Unit is used in another group award(s) it is recommended that it should

SQA Advanced Unit Specification

be taught and assessed within the context of the particular group award(s) to which it contributes.

Assessment: It is recommended that this unit be assessed via a logbook and programming projects that cover the knowledge and skill presented in each Outcome.

It is recommended that assessments take the form of practical laboratory exercises followed by written reports. The practical exercises should be taken under controlled, supervised conditions. Centres should supply candidates with guidelines on the necessary standard of documentation. Candidates should submit written reports within 14 days of the practical work being completed.

Centres should take every reasonable effort to ensure that the reports are the candidates' own work. It may be possible to issue each candidate with a slightly different specification of equal complexity. Where there is a suspicion of copying or plagiarism, an appropriate strategy may be to interview candidates. A checklist should be used to record the candidate's oral response.

To reduce assessment, the programs developed in Outcomes 1 or 2 may be extended to include the file handling demanded by Outcome 3. Centres are recommended to develop appropriate checklists to support the assessment requirements for each of the knowledge and skills items. Centres are also recommended to produce a marking schedule based on the evidence requirements listed indicating clearly the required content of the report. Candidates who do not meet the standard should be obliged to correct and resubmit their work.

Unit specification: statement of standards

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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

Write and test a high level language program to perform parallel data transfer

Knowledge and/or skills

- ◆ Peripheral device set up
- ◆ Protocol for successful parallel data transfer
- ◆ High level programs involving parallel data transfer
- ◆ Program testing
- ◆ Program documentation

Evidence requirements

All parts of the knowledge and skills listed above shall be assessed. Evidence will be provided in the form of a written report.

A candidate's response can be judged satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the candidate is able to:

- ◆ select a suitable parallel transfer device for the task provided
- ◆ describe the required protocol for the selected parallel data transfer device
- ◆ describe the programming methodology required for successful parallel data transfer
- ◆ develop a high level program to successfully perform the parallel data transfer
- ◆ perform a test procedure that verifies successful parallel data transfer
- ◆ supply documentation for:
 - data transfer protocol
 - program listing
 - program description
 - testing procedures

There are no requirements for the candidates to write software from scratch during the assessment. They may be permitted to modify programs they have developed in tutorial exercises, or combine sections of code adapted from other programs.

SQA Advanced Unit Specification

Assessment guidelines

Centres are recommended to develop appropriate checklists to support the assessment requirements for each knowledge and skill item. Candidates who do not meet the standard should be required to correct and resubmit their work.

Outcome 2

Write and test a high level language program to perform serial data transfer

Knowledge and/or skills

- ◆ Set up procedure for serial transmission device
- ◆ Serial transmission protocol
- ◆ High-level programs for serial data transfer
- ◆ Program testing
- ◆ Program documentation

Evidence requirements

All parts of the knowledge and skills listed above shall be assessed. Evidence will be provided in the form of a written report.

A candidate's response can be judged satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the candidate is able to:

- ◆ describe the set up procedure for the specified serial data transmission device
- ◆ describe the protocol for a specified serial data transmission device
- ◆ describe the programming methodology required for the specified serial data transmission device
- ◆ develop a high level program to perform the serial data transfer
- ◆ perform a test procedure on the system
- ◆ supply documentation for:
 - program listing
 - program description
 - testing procedures

There are no requirements for the candidates to write software from scratch during the assessment. They may be permitted to modify programs they have developed in tutorial exercises, or combine sections of code adapted from other programs.

Assessment guidelines

Centres are recommended to develop appropriate checklists to support the assessment requirements for each knowledge and skill item. Candidates who do not meet the standard should be required to correct and resubmit their work.

Outcome 3

Write and test a high level program that creates, reads and closes a file

SQA Advanced Unit Specification

Knowledge and/or skills

- ◆ Creating a file
- ◆ Writing to a file
- ◆ Reading a file
- ◆ Closing a file
- ◆ Program test
- ◆ Program documentation

Evidence requirements

All parts of the knowledge and skills listed above shall be assessed. Evidence will be provided in the form of a written report.

A candidate's response can be judged satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the candidate is able to:

- ◆ create a file
- ◆ write data to this file
- ◆ close the file after writing
- ◆ read the file
- ◆ close the file after reading
- ◆ perform a test procedure on the system
- ◆ supply documentation to include:
 - program listing
 - program description.
 - testing procedures.

Assessment guidelines

Centres are recommended to develop appropriate checklists to support the assessment requirements for each knowledge and skill item. Candidates who do not meet the standard should be required to correct and resubmit their work. Centres may wish to combine this assessment with one or both of the other Outcomes.

SQA Advanced Unit Specification

Administrative information

Unit code:	HP43 48
Unit title:	High Level Language: External I/O Transfer
Superclass category:	CB
Date of publication:	August 2017
Version:	01
Source:	SQA

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SQA Advanced Unit Specification

Unit specification: support notes

Unit title: High Level Language: External I/O Transfer

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

1. Write and test a high level language program to perform parallel data transfer. (12 hours)
 2. Write and test a high level language program to perform serial data transfer (18 hours)
 3. Write and test a high level program that creates, reads and closes a file. (10 hours)
- The subject times indicated are based on Unit duration of 40 hours

This Unit has been designed to develop successfully candidates' ability to apply the techniques of high level programming to engineering applications and in particular parallel and serial data transfer and file handling. This Unit follows on from the SQA Advanced Unit High Level Engineering software.

Candidates are required to demonstrate the ability to access hardware directly through a high level language, rather than being supplied with program procedures.

The program design methodology has not been specified and has been left to the discretion of the centre. However to preserve a logical and clear programming style it is recommended that a modular approach with top down stepwise refinement be adopted.

Emphasis should be placed on applying the high level language to the data transfer technology and file handling, with the language constructs taken as being assessed in the level 7 Unit, High Level Engineering Software. However centres are urged to promote good programming design and style.

In Outcome 1 parallel data transfer devices could be analogue to digital converters, a digital to analogue converter where the data transfer protocols are transfer with handshaking and free running data transfer.

In Outcome 2 the serial data transfer device could be a UART where the set up procedure would require setting the baud rate, the number of start and stop bits, parity etc.

In Outcome 3 the files types could be text or binary.

It is also recommended that in Outcome 3, centres involve their candidates in data analysis. For example:

- ◆ finding average, maximum and minimum values
- ◆ using sort routines
- ◆ recording reading that lie outside a specified data range

Guidance on the delivery and assessment of this Unit

This Unit was developed as one of four SQA Advanced Diploma options and is at SCQF level 8. Access to the Unit should be limited to candidates who have elected to complete the option High Level Engineering Software or who can otherwise demonstrate high level programming skills, for example by industrial experience or by completion of a Unit from earlier engineering frameworks.

In designing this Unit, the Unit writers have identified the range of topics they would expect to be covered by lecturers. The writers have also given recommendations as to how much time should be spent on each Outcome. This has been done to help lecturers to decide what depth of treatment should be given to the topics attached to each of the Outcomes. Whilst it is not mandatory for centres to use this list of topics it is strongly recommended that they do so to ensure continuity of teaching and learning across the programming Units and because the assessment exemplar pack for this Unit is based on the knowledge and/or skills and list of topics in each of the Outcomes.

This Unit does not include specifications of the serial and parallel data transfer devices. This is left to the discretion of the centres. It is appreciated that centres will have access to a variety of hardware such as personal computers data transfer device hardware, all which may be used by this Unit. There is also the possibility that technology will change throughout the lifetime of this Unit, hence it would be unwise to restrict centres to particular types of data transfer systems.

Open learning

Given the practical nature of this Unit it is unlikely that it will be suitable for distance learning.

For information on normal open learning arrangements, please refer to the SQA guide *Assessment and Quality of Open and Distance Learning* (SQA 2000).

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: High Level Language: External I/O Transfer

This Unit is intended to further develop the candidate's high-level software skills and apply them to serial and data transfer applications. Opportunities, depending on available equipment, should offer experience in using different modes of parallel data transfer and protocols for serial data transfer. Again depending on available equipment and time experience in cross compilation may be gained. For example, the target system may be a microcontroller such as a PIC. This device has a C compiler. Using the host computer, the program can be developed in C then cross-compiled to generate the code used by the PIC. If the Units on assembly language are also studied, this will equip the candidate with a wide range of software skills to solve complex engineering problems in the most efficient way. This Unit will also instruct the candidate in the design of test and debug strategies.

The candidate's performance will be assessed by a series of laboratory practical exercises where the lecturer will update a checklist to ensure that all parts of the assessment are correctly completed. The candidate may also be required to submit to a brief oral examination to ensure the work submitted is genuine and test the candidate's understanding of the exercise material.

The centre where you are studying may chose to combine parts of this Unit with the level 7 Unit, High Level Engineering Software. This will have the benefit of reducing the amount of assessment undertaken. It will be the responsibility of the centre to ensure that all parts of the syllabus are still covered