

Set assignment

DRAFT

LEVEL 3 CAMBRIDGE ADVANCED NATIONAL (AAQ) IN

# ENGINEERING

**Extended Certificate H127**

For first teaching in 2025

**F134: Programmable electronics**

# Introduction

**This is Sample Assessment Material (SAM). It is an example set assignment that we publish alongside a new specification to help illustrate the intended style and structure of our set assignments.**

During the lifetime of the qualification, updates to the set assignment template may happen. We always recommend you look at the most recent set of past set assignments where available.

## Tell us what you think

Your feedback plays an important role in how we develop, market, support and resource qualifications now and into the future. Here at OCR, we want teachers and students to enjoy and get the best out of our qualifications and resources, but to do that we need honest opinions to tell us whether we're on the right track or not. That's where you come in.

You can email your thoughts to [ProductDevelopment@OCR.org.uk](mailto:ProductDevelopment@OCR.org.uk) or visit the [OCR feedback page](#) to learn more about how you can help us improve our qualifications.



Designed and tested with teachers and students



Helping young people develop an ethical view of the world



Equality, diversity, inclusion and belonging (EDIB) are part of everything we do

## Summary of updates

Date	Version	Page number	Summary of change
July 2023	1 DRAFT	All	Creation of document

# Teacher support

**We have a range of support services to help you at every stage, from preparation to delivery.**

Our teacher support is designed to make teaching our qualifications straightforward, whether you are an experienced teacher, new to teaching, new to OCR, or not a subject specialist of the qualification you are teaching.

We offer free access to services such as [Access to Scripts](#), [ExamBuilder](#) and [ActiveResults](#), and you'll find comprehensive teaching resources and a range of professional development courses on our teacher website, [Teach Cambridge](#).

Our [OCR subject advisors](#) provide support and information to centres, including:

- Specification and non-exam assessment advice
- Updates on resource developments and training opportunities
- Information on our subject networks giving an opportunity to share ideas and expertise.

## Further help and support

Visit our subject pages to find out more about the assessment and request trial access to [Teach Cambridge](#).

Not a registered or approved OCR centre? Discover the benefits of becoming one on the [OCR website](#).

Have more questions about teaching OCR qualifications? Explore our [Online Support Centre](#) or contact our [Customer Support team](#).

Contact details are available on the [final page](#) of the SAM.

## Work with us

As one of the major UK exam boards, OCR is responsible for creating and marking exams taken by over a million students each year. We work with over 10,000 professionals to create, check, mark and moderate our assessments.

If you would like to find out more about becoming an OCR examiner, please visit [our website](#) for more information.

# People and planet

**OCR is part of Cambridge University Press & Assessment, which has clear commitments to champion sustainability, diversity, trust and respect for our people and planet.**

We are committed to supporting a curriculum that helps young people develop an ethical view of the world. This enables them to take social responsibility, understand environmental issues and prepare them for the green jobs of the future.

Our equality, diversity, inclusion and belonging principles are that we:

- are respectful and considerate
- celebrate differences and promote positive attitudes to belonging
- include perspectives that reflect the diverse cultural and lifestyle backgrounds of our society
- challenge prejudicial views and unconscious biases
- promote a safe and supportive approach to learning
- are accessible and fair, creating positive experiences for all
- provide opportunities for everyone to perform at their best
- are contemporary, relevant and equip everyone to live and thrive in a global, diverse world
- create a shared sense of identity in a modern mixed society with one humanity.

**To learn more, including our work on accessibility in our assessment materials, visit our [People and planet page](#).**



Oxford Cambridge and RSA

# OCR-set Assignment

## Sample Assessment Material

OCR Level 3 Cambridge Advanced National (AAQ) in Engineering  
(Extended Certificate)

Unit F134: Programmable electronics

Scenario Title: Roadworks traffic light system

This is a sample OCR-set assignment which should only be used for practice.

This assignment **must not** be used for live assessment of students.

The live assignments will be available on our secure website, 'Teach Cambridge'.

**The OCR administrative codes linked to this unit are:**

- unit entry code      F134
- certification code    H127

**The regulated qualification number linked to this unit is:**

TBC

### Duration

About 20 hours of supervised time (GLH)  
(work that **must** be completed under teacher supervised conditions)

**All** this material **can** be photocopied. Any photocopying will be done under the terms of the Copyright Designs and Patents Act 1988 solely for the purposes of assessment.

# Contents

Information and instructions for Teachers .....	3
Using this assignment .....	3
Information for delivering tasks .....	4
Tasks for students and assessment criteria .....	5
Scenario .....	5
Task 1 .....	6
Task 2 .....	7
Task 3 .....	9
Task 4 .....	11
Appendix A .....	12
Teacher Observation Record Form .....	13
Guidance notes .....	14
Template for Task 3 .....	15
Test record sheet .....	15
NEA Command Words .....	16

# Information and instructions for Teachers

## Using this assignment

This assignment provides a scenario and set of related tasks that reflect how programmable systems engineers would design, develop, assemble and test a programmable system to meet a given scenario and specification.

The assignment:

- Is written so that students have the opportunity to meet the requirements of all assessment criteria for the unit.
- Will tell students if their evidence must be in a specific format. If the task does not specify a format, students can choose the format to use.
- **Must** be completed under teacher supervision. Any exceptions to this will be stated in the assessment guidance.

You **must**:

- Use an OCR-set assignment for summative assessment of students.
- Familiarise yourself with the assessment criteria and assessment guidance for the tasks. These are given at the end of each student task. They are also with the unit content in **Section 4** of the Specification.  
Assessment guidance is only given where additional information is needed. There might not be assessment guidance for each criterion.
- Make sure students understand that the assessment criteria and assessment guidance tell them in detail what they need to do in each task.
- Read and understand **all** the rules and guidance in **Section 6** of the Specification **before** your students start the set assignments.
- Make sure that your students complete the tasks and that you assess the task fully in line with the rules and guidance in **Section 6** of the Specification.
- Give your students the Engineering **Student guide to NEA assignments** **before** they start the assignments.
- Complete the **Teacher Observation Record** for **Task 2**. You **must** follow the guidance given when completing it.

You **must not**:

- Use live OCR-set assignments for practice or formative assessment. This sample assessment material **can** be used for practice or formative assessment.
- Use this sample assessment material for live assessment of students.
- Allow group work for **any** task in this assignment.
- Change any part of the OCR-set assignments or assessment criteria.

## Information for delivering tasks

Task	Requirements
Task 2	Access to appropriate virtual modelling and program simulation software is required.

**Pages 1-4** are for teachers only. Please do **not** give **Pages 1-4** to your students.

You can give **any** or **all** of the pages **that follow** to your students.



# Tasks for students and assessment criteria

## OCR Level 3 Cambridge Advanced National (AAQ) in Engineering (Extended Certificate)

### Unit F134: Programmable Electronics

#### Scenario Title: Roadwork traffic light system

#### Scenario

You are a junior programmable electronics engineer working for the local council.

The council are to complete roadworks which will require a temporary traffic light system to be put in place to ensure the safe movement of vehicles through the roadworks.

The system will have 2 sets of traffic lights, one at each end of the roadworks. The road is reduced to a single lane while the roadworks take place, so the sets of traffic lights need to let traffic through at one end and stop it at the other.

An example of a traffic light system is shown below.



## Task 1

### Investigating suitable microcontroller systems for a commercial application

Topic Area 1 is assessed in this task.

You have been asked to investigate different options for a suitable microcontroller system to use in a **commercial** roadwork traffic light system.

As it is a commercial application you should consider the most appropriate systems that are available.

You will not need to use this microcontroller system for your prototype so do not need to limit your investigation to what is available to use in your centre.

#### The task is:

To decide on a suitable microcontroller system for a commercial roadwork traffic light system.

Your evidence **must** include:

- A written report detailing your investigation and decisions.

Use the assessment criteria below to tell you what you need to do in more detail.

Pass	Merit	Distinction
<b>P1: Analyse</b> appropriate microcontroller types and casings for the commercial application.	<b>M1: Justify</b> the selection of a suitable microcontroller type, casing, system and programming language.	<b>D1: Explain</b> how the selected microcontroller type, casing, system and programming language could be future proofed against new requirements.
<b>P2: Analyse</b> appropriate microcontroller systems and programming languages for the commercial application.		

## Task 2

### Design and assemble a prototype programmable microcontroller system

Topic Areas 2 and 3 are assessed in this task.

You have been asked to develop a prototype roadwork traffic light system that will control the sequence and timing of two traffic lights.

The prototype system must meet the **specification requirements given in Appendix A** and use a microcontroller system. Your design will need to consider what devices and components to use, any testing, simulation and/or modelling that will be used and safe working practices.

As this is a prototype system it does not require the use of actual traffic lights or vehicles.

You do **not** need to use the same microcontroller system selected in task 1.

#### The task is:

To design and assemble a **prototype** roadwork traffic light system using a microcontroller system that meets the specification requirements (Appendix A).

Your evidence **must** include:

- An outline program design and a hardware schematic/circuit diagram of the prototype system.
- A teacher observation record detailing the assembly methods used and adherence to safe working practices. This should be completed by your teacher and signed by you and your teacher.
- Annotated screenshots and/or photographs showing the model or simulations.
- Annotated photographs showing the safe assembly of the hardware for the system.
- Any other supporting written evidence.

Use the assessment criteria below to tell you what you need to do in more detail.

Pass	Merit	Distinction
<b>P3: Select</b> input and output devices and other components for a prototype microcontroller system that meet the specification requirements.	<b>M2: Explain</b> how the devices and other components provide an appropriate user interface to meet the specification requirements.	<b>D2: Justify</b> the selection of input devices, output devices and other components to meet the specification requirements.
<b>P4: Produce</b> an outline program design using a block diagram or flowchart for the prototype showing the main inputs, processes and outputs.	<b>M3: Produce</b> a model or simulate element(s) of the microcontroller system in operation; making improvements and/or repairs as required.	

<b>P5: Produce</b> an appropriate hardware schematic/circuit diagram of the prototype system.		
<b>P6: Assemble</b> the hardware devices safely for the prototype.		
<b>P7 Explain</b> how the prototype will be tested to ensure the specification requirements are met.		

### Assessment Guidance

This assessment guidance gives you information to meet the assessment criteria. There might not be additional assessment guidance for each criterion. It is only given where it is needed. You must read this guidance before you complete your evidence.

Assessment Criteria	Assessment guidance
All	<ul style="list-style-type: none"> <li>The system to be assembled is a low voltage prototype that must meet the requirements of a given brief and specification. Only the input and output devices as listed in the unit content need to be used. For example, for a traffic light system a set of coloured LEDs should be used rather than a set of actual traffic lights.</li> <li>Component data sheets and library codes may be used when completing the assessment. Access to appropriate virtual modelling and program simulation software is required.</li> </ul>
P7	<ul style="list-style-type: none"> <li>The test record sheet template provided can be used to show how the prototype will be tested, as well as for recording the results of testing.</li> </ul>
M3	<ul style="list-style-type: none"> <li>The production of a model or simulation of elements of the microcontroller system in operation is required, with any necessary improvements made. As a minimum this must involve showing the program being simulated, with the operational outcomes of the main parts of the code clearly shown. If no improvements are necessary (i.e. the program works first time) then this needs to be explained, with a justification as to why no improvements are required.</li> </ul>

### Task 3

#### Programming and testing a programmable microcontroller system

Topic Areas 3 and 4 are assessed in this task.

Using the design documentation from Task 2, you can now program and test your prototype system.

#### The task is:

To produce, compile and download a suitable program and test the function of the fully assembled and programmed prototype microcontroller system against the specification requirements (Appendix A).

Your evidence **must** include:

- A screenshot or printout of the completed microcontroller program code.
- Annotated screenshots showing any simulation completed.
- Annotated screenshots showing the compilation and downloading of the program onto a microcontroller.
- A completed test record showing the tests completed, the outcome of the tests and whether any corrective actions were taken.

Use the assessment criteria below to tell you what you need to do in more detail.

Pass	Merit	Distinction
<b>P8: Produce</b> the program code for the prototype using constructs.	<b>M4: Use</b> appropriate annotation of the program code to communicate how the program works.	<b>D3: Produce</b> code which is well organised, efficient and correctly uses appropriate constructs.
	<b>M5: Simulate</b> the hardware and program code in operation, correcting logical and syntax errors.	
<b>P9: Compile</b> and download the program code onto a microcontroller.		
<b>P10: Complete</b> visual inspection and functional testing of the prototype system in operation.		<b>D4: Complete</b> integrated testing of the hardware and program code, repairing errors in the microcontroller system.

### Assessment Guidance

This assessment guidance gives you information to meet the assessment criteria. There might not be additional assessment guidance for each criterion. It is only given where it is needed. You must read this guidance before you complete your evidence.

Assessment Criteria	Assessment guidance
All	<ul style="list-style-type: none"><li>Microcontroller programs must be written using an appropriate text-based language. Aim for no more than 100 lines of code as a guide, although programs that are longer than this will not be penalised.</li></ul>
M4	<ul style="list-style-type: none"><li>The purpose of the annotation is to demonstrate understanding of the key parts of the program code and constructs that have been used, and to allow a competent third party to amend/maintain the code.</li></ul>

#### Advice:

- You can use the Test Record Sheet template provided to record your test results.

## Task 4

### Demonstrate the prototype microcontroller system in operation

Topic Areas 3 and 4 are assessed in this task.

You can now show your prototype microcontroller system in operation and judge its success against the specification requirements (Appendix A).

#### The task is:

To demonstrate your prototype microcontroller system in operation against the specification requirements.

Your evidence **must** include:

- An audio-visual recording of your prototype microcontroller system in operation with a voice-over and/or written notes.

Use the assessment criteria below to tell you what you need to do in more detail.

Pass	Merit	Distinction
<b>P11: Demonstrate</b> how the operation of the prototype microcontroller system meets the <b>minimum requirements</b> of the specification.	<b>M6: Demonstrate</b> how the operation of the prototype microcontroller system meets the <b>additional requirements</b> of the specification.	<b>D5: Conclude</b> how well the microcontroller system in operation meets all the requirements of the specification.

#### Assessment Guidance

This assessment guidance gives you information to meet the assessment criteria. There might not be additional assessment guidance for each criterion. It is only given where it is needed. You must read this guidance before you complete your evidence.

Assessment Criteria	Assessment guidance
P11/M6	<ul style="list-style-type: none"> <li>• The audio-visual recording only needs to be long enough to show the system working. The maximum recommended length of the audio-visual recording is 3-5 minutes.</li> </ul>

# Appendix A

## Specification requirements

As a minimum the prototype traffic light system **must**:

- Have two traffic lights; Set A and Set B, one at each end of the roadworks. Each set has individual lights coloured red, amber and green.
- In normal operation, cycle through the following 8 step sequence automatically and continuously:

Sequence step		1	2	3	4	5	6	7	8
Set A	Red	● R	● R	● R	● R	● R	● R	○	○
	Amber	○	○	○	○	○	● A	○	● A
	Green	○	○	○	○	○	○	● G	○
Set B	Red	● R	● R	○	○	● R	● R	● R	● R
	Amber	○	● A	○	● A	○	○	○	○
	Green	○	○	● G	○	○	○	○	○
Time (Seconds)		30	2	30	2	30	2	30	2

The lights have the following meaning in the sequence:

- Red means that vehicles must not proceed through the roadworks
- Red and amber means that the lights are changing, but the red light rule applies
- Green means that the vehicles can move through the roadworks
- Amber means that the lights are changing, and a vehicle should not proceed through the roadworks unless it cannot stop safely.

Additional requirements of the prototype roadwork traffic light system include:

- A user-friendly interface that allows the traffic light sequence to be stopped safely and the timing of the traffic lights changed. For example, the traffic light sequence may need to be stopped to allow a maintenance or emergency vehicle to pass safely through the roadworks as a priority.
- A method of resetting/restarting the prototype traffic light system safely.

As a prototype system it does not require the use of actual traffic lights or vehicles.

You do **not** need to use the same microcontroller system selected in task 1.



# Teacher Observation Record Form

Use this form to record what is observed.

Read the **guidance notes** below the form **before** you complete the form.

## OCR Level 3 Cambridge Advanced National (AAQ) in Engineering (Extended Certificate)

Unit number:	F134
Unit title:	Programmable Electronics
Task number:	2
Task title:	Design and assemble a programmable microcontroller system

Student's name:	
Date the activity was completed:	

What extra evidence is attached to the form?	
--	--

The **teacher** fills in this section:

What Assessment Criteria does this activity relate to?	
How does the activity meet the requirements of the Assessment Criteria? You <b>must</b> describe:	
<ol style="list-style-type: none"> <li>1. what the student did</li> <li>2. how it relates to the relevant Assessment Criteria</li> </ol>	
Teacher's name:	
Teacher's signature:	
Date:	

The **student** fills in this section:

I agree with my teacher's description of how I completed this activity		Yes <input type="checkbox"/>
Use this space to make any extra comments.		
Student's signature:		
Date:		

## Guidance notes

**Both** the teacher **and** the student are responsible for completing this form.

The **teacher must**:

- use the form to describe in detail what they observed the student doing.
- give contextualised details of what the student did and how this relates to the Assessment Criteria.
- say how well the activity was completed in relation to the Assessment Criteria with reasons.
- share what they have written with the student and offer the opportunity to discuss if the student disagrees with what is written.
- reach agreement with the student before the work is submitted for moderation.
- sign and date the form as evidence of agreement.

The **student must**:

- reach agreement with the teacher before the work is submitted for moderation.
- use the form to show that they agree with the teacher's record of the activity observed
- sign and date the form as evidence of agreement.

The form **must**:

- be accompanied by extra evidence, as required by the task.
- provide evidence that is individual to the student.

The form **must not**:

- contain a simple repeat of the Assessment Criteria.
- contain just a list of skills.
- be completed by anyone other than the teacher observing the activity and the student completing the activity.
- be written by the student for the teacher to sign.
- be used to evidence achievement of a whole unit or task in isolation.

# Template for Task 3

## Test record sheet

<b>Specification requirement</b>	<b>Test method(s) used</b>	<b>Results of testing</b>

# NEA Command Words

The table below shows the command words that may be used in the NEA assignments and/or assessment criteria.

Command Word	Meaning
<b>Adapt</b>	<ul style="list-style-type: none"> <li>Change to make suitable for a new use or purpose</li> </ul>
<b>Analyse</b>	<ul style="list-style-type: none"> <li>Separate or break down information into parts and identify their characteristics or elements</li> <li>Explain the pros and cons of a topic or argument and make reasoned comments</li> <li>Explain the impacts of actions using a logical chain of reasoning</li> </ul>
<b>Assess</b>	<ul style="list-style-type: none"> <li>Offer a reasoned judgement of the standard or quality of situations or skills. The reasoned judgement is informed by relevant facts</li> </ul>
<b>Calculate</b>	<ul style="list-style-type: none"> <li>Get a numerical answer, showing how it has been worked out</li> </ul>
<b>Classify</b>	<ul style="list-style-type: none"> <li>Arrange in categories according to shared qualities or characteristics</li> </ul>
<b>Compare</b>	<ul style="list-style-type: none"> <li>Give an account of the similarities and differences between two or more items, situations or actions</li> </ul>
<b>Conclude</b>	<ul style="list-style-type: none"> <li>Judge or decide something</li> </ul>
<b>Describe</b>	<ul style="list-style-type: none"> <li>Give an account that includes all the relevant characteristics, qualities, or events</li> </ul>
<b>Discuss</b> (how/whether/etc)	<ul style="list-style-type: none"> <li>Present, analyse and evaluate relevant points (for example, for/against an argument) to make a reasoned judgement</li> </ul>
<b>Evaluate</b>	<ul style="list-style-type: none"> <li>Make a reasoned qualitative judgement considering different factors and using available knowledge/experience</li> </ul>
<b>Examine</b>	<ul style="list-style-type: none"> <li>To look at, inspect, or scrutinise carefully, or in detail</li> </ul>
<b>Explain</b>	<ul style="list-style-type: none"> <li>Give reasons for and/or causes of something</li> <li>Make something clear by describing and/or giving information</li> </ul>
<b>Interpret</b>	<ul style="list-style-type: none"> <li>Translate information into recognisable form</li> <li>Convey one's understanding to others, e.g. in a performance</li> </ul>
<b>Investigate</b>	<ul style="list-style-type: none"> <li>Inquire into (a situation or problem)</li> </ul>
<b>Justify</b>	<ul style="list-style-type: none"> <li>Give valid reasons for offering an opinion or reaching a conclusion</li> </ul>
<b>Research</b>	<ul style="list-style-type: none"> <li>Do detailed study in order to discover (new) information or reach a (new) understanding</li> </ul>
<b>Summarise</b>	<ul style="list-style-type: none"> <li>Express the most important facts or ideas about something in a short and clear form</li> </ul>

We might also use other command words but these will be:

- commonly used words whose meaning will be made clear from the context in which they are used (e.g. create, improve, plan)
- subject specific words drawn from the unit content.

OCR would like to acknowledge the following: Page 5 *Traffic Lights at Road Works stock photo* – *Gannet77/Gettyimages.com*

Sample

# Examine *with us*

- Build confidence supporting your students with assessment
- Enhance subject knowledge
- Great for professional development





Join our team: [ocr.org.uk/assessor](https://ocr.org.uk/assessor)

**OCR**  
Oxford Cambridge and RSA

These are draft documents and some aspects may not be fully accessible. If you have any problems with the accessibility of this format, please [contact us](#).

**Contact the team at:**

-  **01223 553998**
-  **[support@ocr.org.uk](mailto:support@ocr.org.uk)**
-  **[ocr.org.uk](http://ocr.org.uk)**
-  **[facebook.com/ocrexams](https://facebook.com/ocrexams)**
-  **[twitter.com/ocrexams](https://twitter.com/ocrexams)**
-  **[instagram.com/ocrexaminations](https://instagram.com/ocrexaminations)**
-  **[linkedin.com/company/ocr](https://linkedin.com/company/ocr)**
-  **[youtube.com/ocrexams](https://youtube.com/ocrexams)**

To stay up to date with all the relevant news about our qualifications, register for email updates at **[ocr.org.uk/updates](http://ocr.org.uk/updates)**

Visit our Online Support Centre at **[support.ocr.org.uk](http://support.ocr.org.uk)**



OCR is part of Cambridge University Press & Assessment, a department of the University of Cambridge.

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored. ©OCR 2023 Oxford Cambridge and RSA Examinations is a Company Limited by Guarantee. Registered in England. Registered office The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA. Registered company number 3484466. OCR is an exempt charity.

OCR operates academic and vocational qualifications regulated by Ofqual, Qualifications Wales and CCEA as listed in their qualifications registers including A Levels, GCSEs, Cambridge Technicals and Cambridge Nationals.

Cambridge University Press & Assessment is committed to making our documents accessible in accordance with the WCAG 2.1 Standard. We're always looking to improve the accessibility of our documents. If you find any problems or you think we're not meeting accessibility requirements, please [contact us](#).

OCR acknowledges the use of the icons by appleuzr, sourced from gettyimages.co.uk.