

**Sample assessment material**

**Cambridge National in**

# **Engineering Programmable Systems**

**Cambridge OCR Level 1/Level 2 Cambridge National in  
Engineering Programmable Systems**

**J824**

**R049: Developing programmable systems**

Version 5.0

[ocr.org.uk/cambridgenationals](http://ocr.org.uk/cambridgenationals)

## Introduction

**This is sample assessment material (SAM). It is an example Cambridge OCR-set assignment that we publish alongside a new specification to help illustrate the intended style and tasks of our set assignments.**

We also produce two further specific resources to support you with using this SAM:

- An assessment story where we explain the research we have undertaken during the development of the qualification and how consultation with teachers, students and schools has helped shape our assessment approach.
- A student guide to NEA assignments in which we provide a summary for your students of key points about their Cambridge OCR-set assignments, including the importance of avoiding plagiarism.

## Summary of updates

Section	Change	Version	Date
Tasks 1-3 You must/Advice sections	Updated to clarify what students are required to do and what is advisory for each task in the sample assignment.	5.0	June 2026

# Cambridge OCR-set Assignment

## Sample Assessment Material

Cambridge OCR Level 1/Level 2 Cambridge National in Engineering  
Programmable Systems Sample Set Assignment

Unit R049: Developing programmable systems

This is a sample 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 Cambridge OCR administrative codes associated with this unit are:**

- unit entry code                      R049
- certification code                    J824

**The regulated qualification number associated with this unit is:**

603/7088/9

**Duration: Approximately 10 - 12 hours**

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SAMPLE

# Information for teachers

## Using this assignment

### You **must**:

- familiarise yourself with the Assessment Guidance relating to the tasks. This is with the unit content in Section 4 of the [Specification](#).
- read and understand **all** the rules and guidance provided in Section 6 of the [Specification](#) **before** your students complete and you assess the set assignment.
- make sure that completion and assessment fully adhere to the rules and guidance provided in Section 6 of the [Specification](#).
- give students the [Engineering Programmable Systems Student guide to NEA assignments](#) before they start the assignment.
- allow students approximately 10-12 guided learning hours (GLH) to complete all tasks.
- complete the [Teacher Observation Record](#) provided on page 13 for Task 2. You **must** adhere to the [guidance](#) given on page 14 when completing it.

### You **must not**:

- change or modify this assignment in any way.

# Scenario for the assignment

## Automatic toothbrush timer

A toothbrush manufacturer wants to develop a simple automatic timer to sell with their toothbrushes to encourage people to clean their teeth for the correct amount of time. They want to do this using a programmable system.

The specification for the programmable system is shown below:

**Specification:**

- User sets required teeth cleaning time using an adjustable 'Set Time' control, from 1 to 3 minutes.
- User starts timer by pressing momentary 'Start Timer' button.
- An external 'Working' indicator light to show that the timer is working.
- A continuous sound is made when the set time period is over.
- After 10 seconds the sound and indicator turn off, and timer resets ready to be used again.

### **Important Advice:**

- Read through all the tasks before you start, so you know what needs to be completed for this assignment.
- Look at the marking criteria grids to see how the tasks will be marked. Your teacher can explain the marking criteria if you need help.
- You will need to use relevant skills/knowledge/understanding from other units you have studied in this qualification.
- You can use the test plan and record template provided for Task 3. Your teacher can give you a Word version to use.

# Your tasks and marking grids

## Task 1 – Planning the development of programmable systems

Topic Area 1 is assessed in this task.

Refer to the specification in the assignment scenario on page 4 for the automatic toothbrush timer.

You are to start by planning for the development of a programmable system to meet the specification.

You **must**:

- draw a block diagram to represent the system.
- determine and justify the hardware and software requirements for the programmable system. This must include the:
  - type of programmable device to be used.
  - programming language to be used, including method of downloading the program to the programmable device.
  - input and output devices required.

Total marks for Task 1: 15 marks

### Advice

- Use input, output and process blocks, signal arrows and feedback to draw your block diagram.
- Don't forget to include details of how the software will be downloaded to the programmable system.

### Topic Area 1: Planning the development of programmable systems

MB1: 1-2 marks	MB2: 3-4 marks	MB3: 5-6 marks
Draws a block diagram with <b>limited</b> accuracy for a programmable system.	Draws a block diagram with <b>partial</b> accuracy for a programmable system.	Draws a <b>fully</b> accurate block diagram for a programmable system.
MB1: 1-3 marks	MB2: 4-6 marks	MB3: 7-9 marks
Provides a <b>basic</b> justification of the hardware and software requirements to satisfy the programmable system problem.	Provides an <b>adequate</b> justification of the hardware and software requirements to satisfy the programmable system problem.	Provides a <b>comprehensive</b> justification of the hardware and software requirements to satisfy the programmable system problem.

If your work does not meet any Mark Band 1 criteria, you will be awarded zero marks for this task.

## Task 2 – Develop programmable systems

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Topic Area 2 is assessed in this task.

You are to assemble and program your programmable system planned in Task 1 to meet the requirement of the specification.

You **must**:

- select and use appropriate connection methods. Physically connect chosen input and output devices to the programmable system safely. There is no need to build any circuitry.
- produce a suitable program for the system, selecting the most appropriate programming functions.
- simulate the operation of the program, making corrections as appropriate based on this simulation.
- safely download the program to the programmable system.
- use annotated photos or a video to show step by step how the input and output devices were connected safely to the programmable system.
- use annotated screen shots to show step by step how you have produced and simulated the program for the system.
- ask your teacher to complete a Teacher Observation Record for this task.

Total marks for Task 2: 27 marks

### Advice

- Don't forget to show how the final program was downloaded ready for testing.

**Topic Area 2: Develop programmable systems**

<b>MB1: 1-2 marks</b>	<b>MB2: 3-4 marks</b>	<b>MB3: 5-6 marks</b>
<p><b>Few</b> appropriate connection methods selected.</p> <p><b>Dependent</b> upon assistance to physically connect input and output devices to a programmable system safely.</p>	<p><b>Some</b> appropriate connection methods selected.</p> <p><b>Assisted</b> to physically connect input and output devices to a programmable system safely.</p>	<p><b>Fully</b> appropriate connection methods selected.</p> <p>Works <b>independently</b> to physically connect input and output devices to a programmable system safely</p>
<b>MB1: 1-3 marks</b>	<b>MB2: 4-6 marks</b>	<b>MB3: 7-9 marks</b>
<p>Produces a program that solves <b>few</b> aspects of the programmable system problem.</p> <p>Selects <b>few</b> appropriate programming functions.</p>	<p>Produces a program that solves <b>some</b> aspects of the programmable system problem.</p> <p>Selects <b>some</b> appropriate programming functions.</p>	<p>Produces a program that solves <b>all</b> aspects of the programmable system problem.</p> <p>Selects <b>wholly</b> appropriate programming functions.</p>
<b>MB1: 1-4 marks</b>	<b>MB2: 5-8 marks</b>	<b>MB3: 9-12 marks</b>
<p>Undertakes <b>limited</b> simulation of the program to ensure its functionality.</p> <p><b>Dependent</b> upon assistance to make any necessary corrections.</p>	<p>Undertakes <b>adequate</b> simulation of the program to ensure its functionality.</p> <p><b>Assisted</b> to make any necessary corrections.</p>	<p>Undertakes <b>comprehensive</b> simulation of the program to ensure its functionality.</p> <p>Works <b>independently</b> to make any necessary corrections.</p>

If your work does not meet any Mark Band 1 criteria, you will be awarded zero marks for this task.

## Task 3 – Test programmable systems

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Topic Area 3 is assessed in this task.

Finally, you are required to test the programmable system.

You **must**:

- complete a test plan of how you will test that the system meets the specification. You should include:
  - the requirements of the system
  - test methods to be used
  - expected outcomes of the testing.
- visually and functionally test your system against the test plan and record your results.
- produce a final evaluation based on the results of your testing, including:
  - the effectiveness of the program compared to the specification
  - the operational performance of the system hardware
  - any improvements or changes you would make.
- use annotated photos or a video to show testing of the programmable system.

Total marks for Task 3: 18 marks

### Advice

- You can use the template we provide on page 15 for your test plan and record.
- Make sure that your test plan covers all of the criteria in the specification for the programmable system.
- Don't forget to record the results of each test. Use this to evaluate system performance and make suggestions for improvements or changes.

**Topic Area 3: Test programmable systems**

<b>MB1: 1-2 marks</b>	<b>MB2: 3-4 marks</b>	<b>MB3: 5-6 marks</b>
<p>Produces a <b>basic</b> test plan to enable functionality of the programmable system to be tested.</p> <p><b>Superficially</b> records outcomes of testing against the test plan</p>	<p>Produces an <b>adequate</b> test plan to enable functionality of the programmable system to be tested.</p> <p><b>Adequately</b> records outcomes of testing against the test plan</p>	<p>Produces a <b>comprehensive</b> test plan to enable functionality of the programmable system to be tested.</p> <p><b>Clearly</b> records outcomes of testing against the test plan</p>
<b>MB1: 1-4 marks</b>	<b>MB2: 5-8 marks</b>	<b>MB3: 9-12 marks</b>
<p>Undertakes <b>basic</b> visual and functional testing of the programmable system.</p> <p>Undertakes a <b>basic</b> evaluation of the programmable system based on testing.</p>	<p>Undertakes <b>adequate</b> visual and functional testing of the programmable system, recording outcomes against the test plan.</p> <p>Undertakes an <b>adequate</b> evaluation of the programmable system based on testing.</p>	<p>Undertakes <b>comprehensive</b> visual and functional testing of the programmable system, recording outcomes against the test plan.</p> <p>Undertakes a <b>comprehensive</b> evaluation of the programmable system based on testing.</p>

If your work does not meet any Mark Band 1 criteria, you will be awarded zero marks for this task.

# Marking criteria words

The tables below show the descriptor words that will be used in the NEA Marking Criteria grids. They explain the type of evidence that you should expect to see to meet each descriptor word.

## Mark Band (MB1) Words:

Word	Meaning
<b>Basic</b>	<ul style="list-style-type: none"> <li>• Work includes the minimum required. It is a starting point but is simplistic and not developed.</li> <li>• Understanding and skills are applied in a way that partly achieves the wanted or intended result, but it would not be useable without further input or work.</li> </ul>
<b>Brief/Briefly</b>	<ul style="list-style-type: none"> <li>• Work includes a small number of relevant facts or concepts but lacks detail, contextualisation or examples.</li> </ul>
<b>Dependent</b>	<ul style="list-style-type: none"> <li>• The student can perform a task when given regular assistance or help</li> </ul>
<b>Few</b>	<ul style="list-style-type: none"> <li>• Work produced is restricted or narrow. It includes less than half of the information or examples expected for a full response.</li> </ul>
<b>Inefficient</b>	<ul style="list-style-type: none"> <li>• Outputs are produced but with great expense or effort because of poor organisation or design and not making the best use of available resources.</li> </ul>
<b>Limited</b>	<ul style="list-style-type: none"> <li>• Work produced is restricted in range or scope and includes only some of the information required. It evidences partial rather than full understanding.</li> <li>• Work produced is a starting point rather than a developed process, concept or output.</li> </ul>
<b>Minimal</b>	<ul style="list-style-type: none"> <li>• Includes very little in amount or quantity required.</li> </ul>
<b>Simple</b>	<ul style="list-style-type: none"> <li>• Includes a small number of relevant parts, which are not related to each other.</li> </ul>
<b>Superficial</b>	<ul style="list-style-type: none"> <li>• Work completed lacks depth and detail.</li> </ul>

**Mark Band (MB2) Words:**

Word	Meaning
<b>Adequate(ly)</b>	<ul style="list-style-type: none"> <li>• Work includes the appropriate number of relevant facts or concepts but does not include the full detail, contextualisation or examples.</li> </ul>
<b>Assisted</b>	<ul style="list-style-type: none"> <li>• The student can perform a task with occasional assistance or help.</li> </ul>
<b>Part(ly)/Partial</b>	<ul style="list-style-type: none"> <li>• To some extent but not completely.</li> <li>• Work produced is inclusive in range and scope. It evidences a mainly developed application of understanding, performance or output needed.</li> <li>• Work produced results in a process, concept or output that would be useable for its purpose.</li> </ul>
<b>Some</b>	<ul style="list-style-type: none"> <li>• Work produced is inclusive but not fully comprehensive. It includes over half the information or examples expected for a full response.</li> </ul>
<b>Sound</b>	<ul style="list-style-type: none"> <li>• Valid, logical, shows the student has secured most of the relevant understanding, but points or performance are not fully developed.</li> <li>• Applies understanding and skills to produce the wanted or intended result in a way that would be useable.</li> </ul>

**Mark Band (MB3) Words:**

<b>Word</b>	<b>Meaning</b>
<b>Accurate(ly)</b>	<ul style="list-style-type: none"> <li>Acting or performing with care and precision.</li> <li>Correct in all details.</li> </ul>
<b>All</b>	<ul style="list-style-type: none"> <li>Work produced is fully comprehensive and wide-ranging. It includes almost all, or all the information or examples expected for a full response.</li> </ul>
<b>Clear(ly)</b>	<ul style="list-style-type: none"> <li>Focused and accurately expressed, without ambiguity.</li> </ul>
<b>Complex</b>	<ul style="list-style-type: none"> <li>Includes many relevant parts, all of which relate to each other logically.</li> </ul>
<b>Comprehensive(ly)</b>	<ul style="list-style-type: none"> <li>The work produced is complete and includes everything required to show depth and breadth of understanding.</li> <li>Applies the understanding and skills needed to successfully produce the wanted or intended result in a way that would be fully fit-for-purpose.</li> </ul>
<b>Consistent(ly)</b>	<ul style="list-style-type: none"> <li>A level of performance which does not vary in quality over time.</li> </ul>
<b>Critical</b>	<ul style="list-style-type: none"> <li>Objective analysis and evaluation in order to form: a judgement, evaluation of the evidence or effective trouble shooting/fault finding.</li> </ul>
<b>Detailed</b>	<ul style="list-style-type: none"> <li>Gives point by point consideration of all the key information.</li> </ul>
<b>Effective</b>	<ul style="list-style-type: none"> <li>Applies the skills required to the task and is successful in producing the desired or intended result.</li> <li>The work produced is effective in relation to a brief.</li> </ul>
<b>Efficient</b>	<ul style="list-style-type: none"> <li>Able to produce results or outputs with the minimum expense or effort, because of good organisation or design and making the best use of available resources.</li> </ul>
<b>Full(y)</b>	<ul style="list-style-type: none"> <li>Work produced is comprehensive in range and scope. It evidences a fully developed application of understanding, performance or output needed.</li> <li>Work produced results in a process, concept or output that would be fully fit-for-purpose.</li> </ul>
<b>Independent(ly)</b>	<ul style="list-style-type: none"> <li>The student can perform a task without assistance or reliance on others</li> </ul>
<b>Justify/Justified</b>	<ul style="list-style-type: none"> <li>The reasons for doing something are explained in full.</li> </ul>
<b>Most(ly)</b>	<ul style="list-style-type: none"> <li>Includes nearly all of what is expected to be included.</li> </ul>
<b>Wide (ranging)</b>	<ul style="list-style-type: none"> <li>Includes many relevant details, examples or contexts; all of which are fully detailed, contextualised or exemplified.</li> </ul>

# Teacher Observation Record

Please read the **guidance notes** on the following page before completing this form.

<b>Student name:</b>	
<b>Qualification:</b>	Cambridge OCR Level 1/Level 2 Cambridge National in Engineering Programmable Systems
<b>Unit number and title:</b>	Unit number: R049
	Unit title: Developing programmable systems
<b>Activity observed:</b>	Task title: Develop programmable systems
	Task number: 2
<b>Date activity completed:</b>	
<b>Additional evidence attached:</b>	

<b>TEACHER SECTION:</b>	
<p><b>How did the student complete the activity?</b> Your response must provide details of what the student did and how this relates to the relevant marking criteria.</p>	
<b>STUDENT SECTION:</b>	
I agree with my teacher's description of how I completed this activity.	Yes <input type="checkbox"/>
Additional student comments:	
<b>Student signature</b>	<b>Date:</b> (DD/MM/YYYY)
<b>Teacher name:</b>	
<b>Teacher signature:</b>	<b>Date:</b> (DD/MM/YYYY)

# Teacher observation record guidance notes

The class teacher and student being observed are responsible for completing this form.

The Teacher Observation Record is used by the teacher to detail their observation of a student completing an activity. In order to provide sufficient evidence, the completed form must give contextualised details of what the student did and how this relates to the marking criteria. Simply providing statements from the marking criteria is not acceptable. The evidence provided must be individual to the student.

The Teacher Observation Record is also used to show that the student agrees with the teacher's assessment of this activity.

The information given by the teacher must be shared with the student for the student to agree, or otherwise. If the student does not agree with the teacher's comments and links to the marking criteria, they must have the chance to talk about these further with the teacher to reach an agreed outcome **before** the work is submitted for moderation.

Both the teacher and student must sign and date the form to provide evidence of this agreement.

Additional evidence of the student completing the activity must also be provided with the form. The types of additional evidence that are acceptable are detailed in Task 2.

## Teacher observation records must:

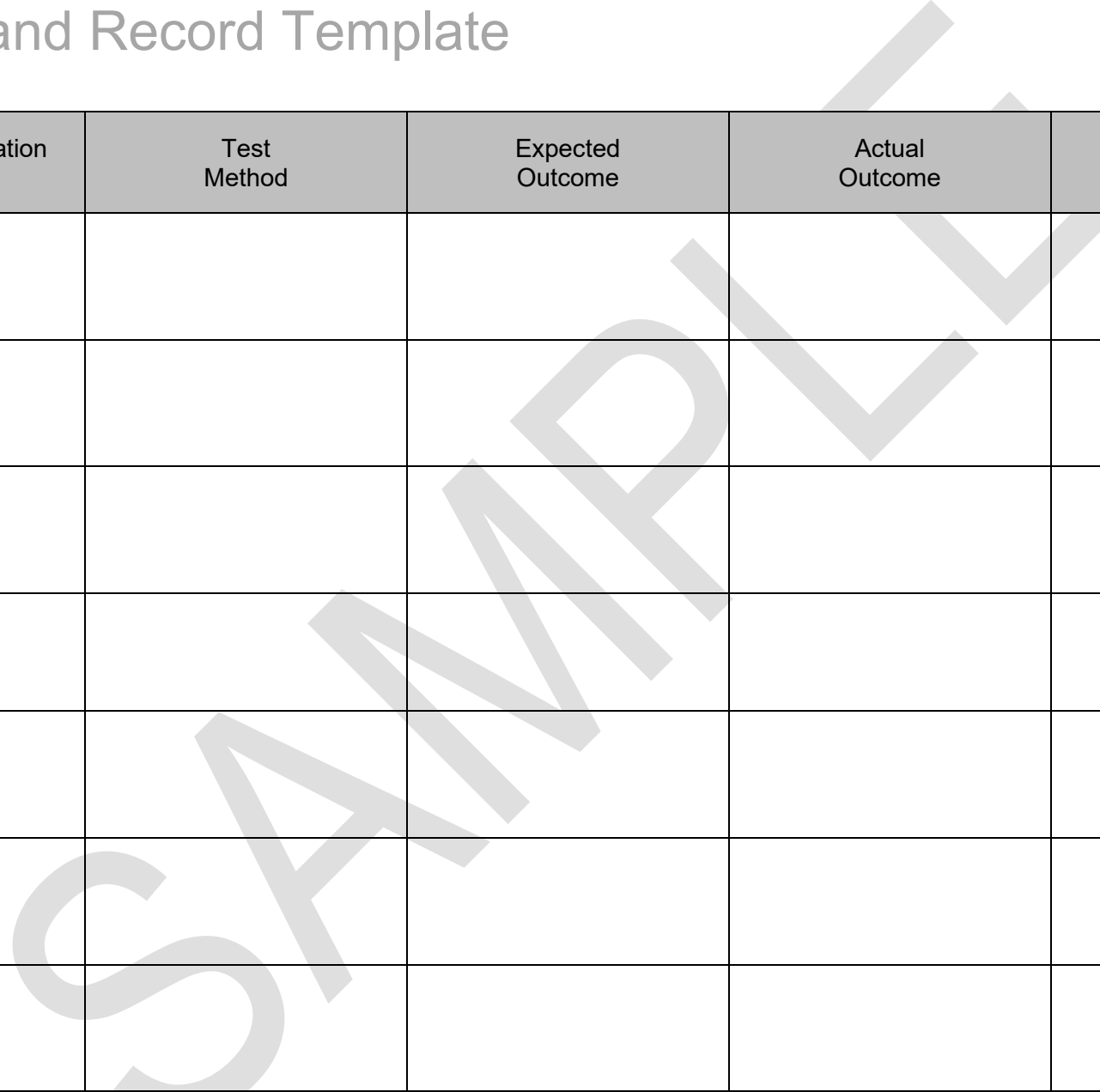
- describe what the teacher observed the student doing
- include how well the activity was completed and the reasons for this evaluation
- include confirmation from the student that they agree with the comments and reasons
- be accompanied by additional evidence as required in Task 2

## Teacher observation records must not:

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

# Test Plan and Record Template

Systems Specification Criteria	Test Method	Expected Outcome	Actual Outcome	Actions based on Outcome



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