

Cambridge **TECHNICALS LEVEL 3**

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# ***ENGINEERING***

**Unit 8**

**Electrical operations**

**Model assignment**

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Please note:

You can use this assignment to provide evidence for summative assessment, which is when the learner has completed their learning for this unit and is ready to be assessed against the grading criteria.

You can use this assignment as it is, or you can modify it or write your own; we give more information in this document under Guidance for tutors.

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# Guidance for tutors on using this assignment

## General

OCR Cambridge Technical model assignments are available to download from our website:

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

The purpose of this assignment is to provide a scenario and set of tasks that are typical of how electrical and electronic engineers would perform electrical operations to enable you to assess your learner against the requirements specified in the grading criteria. The scenario and its tasks are intended to give a work-relevant reason for applying the skills, knowledge and understanding needed to achieve the unit.

This assignment will not instruct learners how to meet the highest grade. Whether learners achieve a pass, merit or distinction will depend on what evidence they produce.

You can modify the scenario we provide in this assignment to make it more relevant to your local or regional needs. Please refer to the information under 'Modifying the model assignment' later in this section.

You don't have to use this assignment. You can use it as a guide to help you to design your own assignment, and we provide an assignment checking service. You'll find more information on these matters in section 8 of the qualification handbook.

In the tasks, we'll refer to the format of evidence. Learners are **not** required to follow that format **unless** we tell them otherwise.

It's essential that the work every learner produces is their own. Please make sure you read through the information we give on authenticity in section 8 of the qualification handbook and make sure that your learners and any staff involved in assessment understand how important authenticity is.

**We provide this assignment to be used for summative assessment. You must not use it for practice or for formative assessment.**

## Before using this assignment to carry out assessment

Learners will need to take part in a planned learning programme that covers the knowledge, understanding and skills of the unit.

When your learners are ready to be assessed, they must be provided with a copy of the following sections of this assignment:

- General information for learners
- Assignment for learners
- Evidence Checklist

They may carry out preparation prior to undertaking the tasks and there is no time limit for this.

## When completing the assignment

**You should use this assignment in conjunction with the unit specification and qualification handbook.**

**Please note** – if learners are completing this model assignment as part of the Extended Diploma qualification they will be required to complete the synoptic unit 25: Promoting continuous improvement. Before your learners complete this model assignment, you must refer to the specification and model assignment requirements for unit 25, so if applicable you can ensure learners gather the appropriate feedback on their own performance and performance of the system, process or artefact that they will produce in this model assignment.

## Resources to complete the tasks

There are resource requirements for this assignment. Every learner will need access to the following resources:

- In task 1, learners could require access to appropriate health and safety regulations, standards and codes of practice when dealing with electrical/electronic equipment this could be in the form of Health & Safety regulations or other appropriate literature that define safe working when working on electrical circuits.

A standard safe work method statement and risk assessment template, such as those on the HSE website or provided from employer partner, could be used.

- In task 2, for the first part learners will require access to suitable information and data to be able to investigate a range of different components as shown in the Unit Specification 1.1.

For the second part learners will require access to situations where they can determine resistor values by measurement, calculation and colour code for fixed, variable and resistive change resistor categories. This could include circuit diagrams, photographs or images of resistors and practical circuit set-up.

For the final part information and data is required to be able to analyse the operation and performance of electrical and electronic devices used as input devices, process devices and output devices, examples of which are shown in the Unit Specification 1.1.

- In task 3, for the first part learners will require access to technical data to investigate cable types and their applications as shown in Unit Specification 1.1.

In the second part, they will require access to scenarios from which they can calculate and select appropriate cable types and sizes. The scenarios must allow for applications that require different voltages and current flow. Learners should not carry out practical activities for scenarios that use high voltages – these should be undertaken through simulation.

In the third task access is required to information, data and suitable scenarios to enable learners to determine by calculation and then select types and ratings of fuses for a range of different applications.

For the final task learners will require access to information to be able to evaluate different methods of circuit protection, and their benefits as given in Unit Specification 1.2.

- In task 4 learners will require access to hand tools, specialist equipment, circuit diagrams, components and interconnecting wire etc. Please refer to Unit Specification LO3.1 to LO3.5 for full requirements.
- In task 5 learners will require access to:
  - electrical/electronic equipment with suitable pre-established faults
  - test equipment
  - manuals and data sheets.

See Unit Specification LO4.1 to LO4.4 for full details of requirements.

## Tutor information to support the tasks

Tutors should provide guidance in relation to performing practical operations safely and correctly.

In task 1, for P8 learners are not required to analyse specific documents **in detail** rather provide an overview of their purpose and key features. Tutors could adopt standard pro-forma for safe work method statements and risk assessments such as those available from the HSE website or from employer partners. For D2 learner are required to complete a detailed safe work method statement and risk assessment (including use of PPE). This could be performed through investigation of a physical situation or practical activity.

In task 2 for M1 learners will need to be able to measure resistance in a circuit using an ohmmeter (or multimeter on the ohms range).

Task 4 is highly practical in nature and is intended to be delivered practically. Tutors will need to ensure circuit diagram(s) are sufficiently detailed to allow learners to demonstrate appropriate use of different types of hand tools and different joining techniques as detailed in the unit specification for LO3. Tutors should supply individual witness statements to confirm how safe working has been followed.

Task 5 is also highly practical and is intended to be delivered practically. Standard forms of fault-finding pro-forma could also be introduced. Learners must be familiar with the correct and safe use of test equipment shown in Unit Specification 4.2. Tutors should supply individual witness statements to support evidence of fault-finding.

## Health and Safety and the use of resources

Health and safety will need to be considered should any of the tasks, or parts of the tasks be undertaken as practical activities. This should include appropriate risk assessments, safe working methods statements and the use of appropriate personal protective equipment (PPE). Learners should be encouraged to take part in assessing risk before conducting any practical activity.

## Time

You should plan for learners to have 14–19 hours to complete this assignment.

Learners must be allowed sufficient time to complete all the tasks. The amount of time may vary depending on the nature of the tasks and the ability of individual learners. To help with your planning, against each of the tasks we've given an indication of how long it should take.

Learners can produce evidence in several sessions.

## Format of evidence

Learners have to produce evidence that demonstrates how they have met the grading criteria. At the very least they must produce evidence that meets **all** of the pass criteria.

**Please make sure your learners realise that missing just one pass criterion means they will not pass the unit, even if they have successfully met the merit and distinction criteria.**

We don't have specific requirements for the format of evidence in this assignment. We've said what format the evidence could take for each task. For example, if we say 'You could include a report on ...', the evidence doesn't have to follow any specific reporting conventions. You can modify the format of the evidence, but you must make sure the format doesn't prevent the learner from accessing the grading criteria.

It's possible that certain formats for evidence can naturally cover several grading criteria and avoid the need for excessive amounts of evidence. For example, a report can be a good way to pull together evidence to meet several grading criteria.

For more guidance on generation and collection of evidence, please refer to the section 8 'Internal Assessment', in the qualification handbook.

## Group work

This assignment hasn't been written to include group work. If you plan to ask learners to work in a team to complete work for assessment, you need to determine at which point in an assessment task learners can work together.

You must be sure that each learner can produce evidence of their own contribution to each grading criterion. You can give constructive feedback to learners about working as a group and direct them on team working skills because evidence of team working skills is not required by the unit. See our information on authentication, including group work and feedback to learners, in section 8 of the qualification handbook.

If witness statements are used to support learners' evidence, you'll need to complete an individual statement for each learner.

## After completing the assignment

Once the learner has submitted their work to you to be assessed, you must judge or 'mark' the work against the grading criteria for the unit and identify one grade for the unit. For further information about assessment, please refer to section 8 of the qualification handbook.

Your assessment decisions must be quality assured across the cohort of learners in your centre who are being entered for the same unit. This must be done through an internal standardisation process. We give information on internal assessment and standardisation in the qualification handbook.

## Reworking the assignment

If you and the learner feel they've not performed at their best during the assessment, the learner can, at your discretion, improve their work and resubmit it to you for assessment. If a learner is working on improving their work before it is resubmitted, you and the learner must continue to make sure the work is the learner's own.

Any feedback you give to the learner must not direct them on how to improve their work. You can identify what area of the work could be improved but you cannot give the learner any details about how they could improve it. You must follow the guidelines given in section 8 of the qualification handbook under 'Authenticity of learner work'.

## Modifying the model assignment

The tasks in this assignment allow learners access to the full range of grades detailed in the grading criteria of this unit.

If you modify this assignment you must not change the grading criteria provided in the tasks for the learner or in the evidence checklist. These grading criteria are taken from the unit.

You can modify the scenario to suit your local or regional needs and the tasks may be contextualised to match any changes you have made to the scenario. If you supply your own drawings to support a different scenario, these must be sufficiently detailed for learners to complete the tasks.

You can modify the type of evidence and the format it takes, unless we expressly state that evidence must take a specific format.

You must also make sure that you avoid discrimination, bias and stereotyping and support equality and diversity. For more information, please see the section 'Designing your own assignments for internally assessed units' in section 8 of the qualification handbook.

**If modifications are made to the model assignment, whether to the scenario alone, or to both the scenario and individual tasks, it's your responsibility to make sure that all grading criteria can still be met and that learners can access the full range of grades.**

If you're using this model assignment and delivering the Foundation Diploma, Diploma or Extended Diploma you have an opportunity to secure meaningful employer involvement by working with an employer to modify it.

# General information for learners

**Q** *What do I need to do to pass this assignment?*

**A** You need to produce evidence to meet the requirements of all the pass criteria for the unit this assignment relates to. If you miss just one pass criterion, you will not achieve this unit and will receive an unclassified result.

**Q** *What do I need to do if I want to get a merit or distinction for this assignment?*

**A** For a merit, you need to produce evidence to meet the requirements of **all** the pass criteria for the unit this assignment relates to **and** you need to produce evidence to meet **all** the merit criteria.

For a distinction, in addition to the above, you also need to meet **all** the distinction criteria for this unit.

**Q** *What help will I get?*

**A** Your tutor will support you when completing this assignment and will make sure that you know what resources or facilities you need and are allowed to use. We've given your tutor information about how much support they can give you.

**Q** *What if I don't understand something?*

**A** It's your responsibility to read the assignment carefully and make sure you understand what you need to do and what you should hand in. If you are not sure, check with your tutor.

**Q** *I've been told I must not plagiarise. What does this mean?*

**A** Plagiarism is when you take someone else's work and pass this off as your own, or if you fail to acknowledge sources properly. This includes information taken from the internet.

It's not just about presenting a whole copied assignment as your own; you will also be plagiarising if you use the ideas or words of others without acknowledgement, and this is why it's important to reference your work correctly (see Q&A below for more information on referencing).

Plagiarism has serious consequences; you could lose the grade for this unit or you may not be allowed to achieve the whole qualification.

**Always remember that the work you produce must be your own work. You will be asked to sign a declaration to say that it is.**

**Q** *What is referencing and where can I find out more information about it?*

**A** Referencing is the process of acknowledging the work of others. If you use someone else's words and ideas in your assignment, you must acknowledge it, and this is done through referencing.

You should think about why you want to use and reference other people's work. If you need to show your own knowledge or understanding about an aspect of subject content in your assignment, then just quoting and referencing someone else's work will not show that you know or understand it. Make sure it's clear in your work how you are using the material you have referenced **to inform** your thoughts, ideas or conclusions.

You can find more information about how to reference in *The OCR Guide to Referencing* available on our website: <http://www.ocr.org.uk/Images/168840-the-ocr-guide-to-referencing>.

**Q Can I work in a group?**

A Yes. However, if you work in a group at any stage, you must still produce work that shows your individual contribution. Your tutor can advise you how to do this.

**Q Does my work for each task need to be in a particular format?**

A You can present your work in a variety of ways – it can be handwritten, word-processed, on video or in digital media. What you choose should be appropriate to the task(s) and your tutor can advise you. There may be times when you need proof that you have completed the work yourself: for example, if you do something during work placement that you want to use as evidence, the tutor might ask the employer to provide a witness statement.

Make sure you check the wording in each task carefully. For each task, we'll tell you if your evidence has to be in a specific format:

- If we say use the word '**must**', for example 'You must produce a report' or 'Your evidence/work must include a diagram', then you must produce the work in the stated format.
- If we use the word '**could**', for example 'You could include sketches of your ideas' or 'You could do this by annotating your diagram', this means that you are not required to follow the format we have given, but you must make sure that the work you do produce allows you to demonstrate the requirements of the grading criteria.

If you are unsure about what evidence you need, please ask your tutor.

**Q Can I ask my tutor for feedback on my work?**

A Yes, but they can't give you detailed feedback.

We have given your tutor instructions on what kind of feedback they can give you. For example, they are **not** allowed to tell you exactly what to do to make your work better, but they **can** remind you about what they've taught you and you can use this additional learning to try and improve your work independently. They can say what they've noticed might be wrong with your work, for example if your work is descriptive where an evaluation is required, but your tutor can't tell you specifically what you need to do to change it from a description to an evaluation – you will need to work out what you need to do and then do it for yourself.

**Q When I have finished, what do I need to do?**

A If you have included the personal details (such as name, address or date of birth) of someone other than yourself in your work, this must be blanked out (anonymised) – your tutor will tell you how to do this. You don't need to do this for information contained in references.

You can complete the evidence checklist to show your tutor where they can find the evidence for each grading criterion in your work.

You should make sure your work is labelled, titled and in the correct order for assessing.

Hand in the work that you've completed for each task to your tutor. They might ask to see your draft work, so please keep your draft work in a safe place.

**Q How will my work be assessed?**

A Your work will be marked by someone in your centre who has been authorised to do so. They will use the information in the grading criteria to decide which grade your work meets. The grading criteria are detailed in each unit and are also given in the tasks within this assignment. Please ask your tutor if you are unsure what the grading criteria are for this assignment.

# Assignment for learners

## Unit 8: Electrical operations

### Scenario

Common electrical and electronic components include resistors, capacitors, switches and more complex electronic devices such as diodes, transistors, semiconductors and integrated circuits. These components function together to make working electrical and electronic circuits and systems.

Cables are used to connect components and systems together, and are available in a range of styles, types and connections. The correct cable type, size and connection must be selected for a particular application.

Fuses and other devices provide circuit protection. Similarly these devices are available in a range of types and ratings, and must be appropriately selected.

It is vitally important to work safely with electricity – and within prescribed rules, regulations, standards and codes of practice.

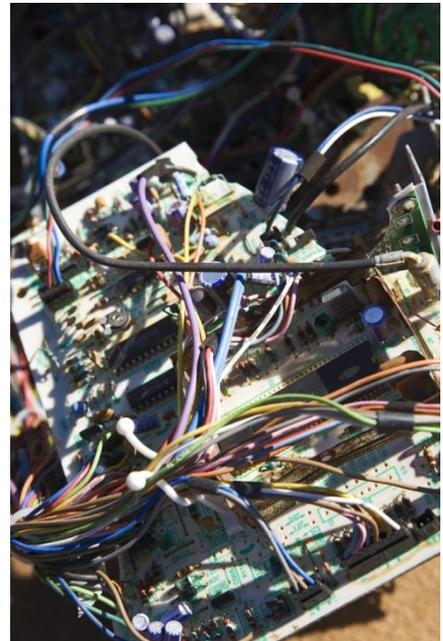
The efficient and effective construction of electrical and electronic circuits requires a range of skills and techniques – including the use of tools and processes.

Fault finding is the process of checking the correct operation of electrical/electronic circuits, finding and rectifying any faults. It involves a number of recognised techniques, and the use of test equipment.

In this assignment you will use a range of different skills and techniques required in order to be able to safely construct and test electrical and electronic circuits.

These skills will include being able to recognise and specify electrical and electronic components and devices, and being able to read and interpret circuit diagrams.

You will demonstrate the importance of working safely to prescribed rules and regulations and show how you can use test equipment and fault finding methods to check for correct operation.



## Task 1: Working safely with electricity

(This task should take between 2 and 3 hours.)

**Learning Outcome 2:** 'Be able to work safely with electricity' is assessed in this task.

Your first task is to produce a report on the purpose and key features of relevant health and safety regulations, standards and codes of practice.

In this assignment you will be undertaking practical work which will involve you investigating low voltage circuits. To prepare for this practical work, your second task is to research and identify the hazards and risks associated with working on electrical systems and when working on live equipment.

Your third task is to compare techniques to identify potential electrical hazards including reasons for their use. You could also produce a detailed safe working method statement and risk assessment (including identification of appropriate PPE) for the investigating and testing of the electrical components, devices and circuits within this assignment.

Pass	Merit	Distinction
P8: Know the purpose and key features of relevant health and safety regulations, standards and codes of practice.	M3: Compare techniques to identify potential electrical hazards including reasons for their use.	D2: Produce a detailed safe working method statement and risk assessment (including identification of appropriate PPE).
P9: Identify hazards and risks associated with working on electrical systems.		
P10: Identify risks associated with working on live equipment.		
<b>Evidence</b>		
Evidence could be in the form of:		
<ul style="list-style-type: none"> <li>A report including a safe working method statement and risk assessment.</li> </ul>		

## Task 2: Electronic components

(This task should take between 2 and 3 hours.)

Part of **Learning Outcome 1**: 'Understand operating and performance characteristics of electrical and electronic components and devices' is assessed in this task. Also see Task 3.

Your first task is to investigate features and applications of components in each of the following categories by referring to manufacturers and suppliers technical data:

- Resistors
- Capacitors
- Switches
- Electronic devices (i.e. input, output and process devices).

Your second task is to determine resistor values by measurement, calculation and colour code for fixed value resistors.

Your third task is to analyse the operation and performance characteristics of electrical and electronic input, process and output devices using appropriate data.

Pass	Merit	Distinction
P1: Use technical data to identify different resistor types and their applications.	M1: Determine a wide range of resistor values by measurement, calculation and colour code.	
P3: Use technical data to identify different capacitor types and their applications.	M2: Analyse the operation and performance characteristics of a diverse range of electrical and electronic devices using appropriate data.	
P4: Use technical data to identify different switches and their applications.		
P5: Use technical and manufacturers' data to identify a different input, output and process electronic devices and their applications.		
<b>Evidence</b>		
Evidence could be in the form of:		
<ul style="list-style-type: none"> <li>• A report or presentation that includes all calculations.</li> <li>• You could also include evidence in the form of annotated diagrams and/or photographs showing the tasks you have performed.</li> </ul>		

## Task 3: Cables, fuses and circuit protection

(This task should take between 2 and 3 hours.)

Part of **Learning Outcome 1**: 'Understand operating and performance characteristics of electrical and electronic components and devices' is assessed in this task. Also see Task 2.

Your first task is to investigate features and applications of different cable types by referring to manufacturers and suppliers technical data.

Your second task is to calculate cable size and select appropriate cables for a range of voltage and current applications.

Your third task is to calculate and select appropriate fuse types and ratings for a range of applications.

Your final task is to evaluate methods and benefits of circuit protection.

Pass	Merit	Distinction
P2: Use technical data to identify different cable types and their applications.		D1: Evaluate methods and benefits of circuit protection.
P6: Calculate cable size and select appropriate cables for a range of voltage and current applications.		
P7: Calculate and select appropriate fuse types and ratings for a range of applications.		
<b>Evidence</b>		
Evidence could be in the form of: <ul style="list-style-type: none"><li>• A report or presentation including all calculations.</li><li>• You could also include evidence in the form of annotated diagrams and/or photographs showing the tasks you have performed.</li></ul>		

## Task 4: Constructing electrical and electronic circuits

(This task should take between 4 and 5 hours.)

**Learning Outcome 3:** 'Be able to construct electrical and electronic circuits' is assessed in this task.

Your task is to construct circuit(s) by interpreting circuit diagram(s). You need to demonstrate that you can correctly and safely use different hand tools and appropriate joining techniques during the construction.

The circuit(s) you construct must demonstrate the appropriate use of different types of hand tools and different joining techniques.

Pass	Merit	Distinction
P11: Use hand tools safely to construct a circuit.	M4: Construct circuits and electrical/electronic assemblies using appropriate joining techniques from circuit diagrams.	
P12: Interpret a circuit diagram in order to construct a circuit.		
<b>Evidence</b>		
Evidence could be in the form of:		
<ul style="list-style-type: none"><li>A written portfolio of evidence including annotated photographic evidence showing you using hand tools and demonstrating joining techniques during circuit construction. You should include annotated circuit diagrams.</li><li>Your tutor must supply a witness statement to support your evidence for safe working.</li></ul>		

## Task 5: Fault finding electrical equipment

(This task should take between 4 and 5 hours.)

**Learning Outcome 4:** 'Be able to fault find in electrical and electronic equipment' is assessed in this task.

Your first task is to perform electrical and electronic fault finding through the interpretation of manuals and data sheets and the comparison of expected values. As well as demonstrating the use of appropriate test equipment and performing a visual inspection to locate an electrical fault.

Your next task is to produce a fault-finding plan and systematic troubleshooting plan to identify and confirm faults.

Your final task is to demonstrate that you can use a variety of fault finding procedures and test equipment to establish faults in electrical equipment.

Pass	Merit	Distinction
P13: Use test equipment on electronic equipment in order to undertake electrical fault finding.	M5: Produced a fault-finding plan and systematic troubleshooting plan for an electrical or electronic system.	D3: Use a variety of fault-finding procedures and test equipment to establish faults in electrical equipment.
P14: Interpret manuals, data sheets and expected values in order to undertake electrical fault finding.		
P15: Carry out visual inspection to locate an electrical fault.		
<b>Evidence</b>		
Evidence could be in the form of: <ul style="list-style-type: none"> <li>• A written portfolio of evidence including annotated photographic evidence showing you undertaking activities.</li> <li>• Your tutor must supply a witness statement to support your evidence of fault-finding.</li> </ul>		

# Evidence Checklist

## OCR Level 3 Cambridge Technicals in Engineering Unit 8: Electrical operations

LEARNER NAME:

For Pass have you: (as a minimum you have to show you can meet every pass criterion to complete the unit)	Where can your tutor find the evidence? Give page no(s)/digital timings, etc.
Used technical data to identify different resistor types and their applications (P1)	
Used technical data to identify different cable types and their applications (P2)	
Used technical data to identify different capacitor types and their applications (P3)	
Used technical data to identify different switches and their applications (P4)	
Used technical and manufacturers' data to identify a different input, output and process electronic devices and their applications (P5)	
Calculated cable size and selected appropriate cables for a range of voltage and current applications (P6)	
Calculated and selected appropriate fuse types and ratings for a range of applications (P7)	
Known the purpose and key features of relevant health and safety regulations, standards and codes of practice (P8)	
Identified hazards and risks associated with working on electrical systems (P9)	
Identified risks associated with working on live equipment (P10)	
Used hand tools safely to construct a circuit (P11)	
Interpreted a circuit diagram in order to construct a circuit (P12)	
Used test equipment on electronic equipment in order to undertake electrical fault finding (P13)	
Interpreted manuals, data sheets and expected values in order to undertake electrical fault finding (P14)	
Carried out visual inspection to locate an electrical fault (P15)	

<b>For Merit have you:</b>	<b>Where can your tutor find the evidence? Give page no(s)/digital timings, etc.</b>
Determined a wide range of resistor values by measurement, calculation and colour code (M1)	
Analysed the operation and performance characteristics of a diverse range of electrical and electronic devices using appropriate data (M2)	
Compared techniques to identify potential electrical hazards including reasons for their use (M3)	
Constructed circuits and electrical/electronic assemblies using appropriate joining techniques from circuit diagrams (M4)	
Produced a fault-finding plan and systematic troubleshooting plan for an electrical or electronic system (M5)	

<b>For Distinction have you:</b>	<b>Where can your tutor find the evidence? Give page no(s)/digital timings, etc.</b>
Evaluated methods and benefits of circuit protection (D1)	
Produced a detailed safe working method statement and risk assessment (including identification of appropriate PPE) (D2)	
Used a variety of fault finding procedures and test equipment to establish faults in electrical equipment (D3)	

To find out more

**[ocr.org.uk/engineering](http://ocr.org.uk/engineering)**

or call our Customer Contact Centre on **02476 851509**

Alternatively, you can email us on **[vocational.qualifications@ocr.org.uk](mailto:vocational.qualifications@ocr.org.uk)**



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