



HM Government

T-LEVELS

T Level Technical Qualification in Design and Development for Engineering and Manufacturing

Electrical and Electronic Engineering Occupational Specialism (8714-322)

**Practical Assignment
SAMPLE Assessor Pack**

September 2025 Version 3.0

Version and date	Change detail	Section
1.0 September 2022	First Published Version	
2.0 February 2024	<p>Additional guidance on video requirements for Task 2</p> <p>Task 2 evidence detail updated</p> <p>Task specific guidance – overview</p> <p>Resources</p> <p>What must be produced for marking guidance</p>	<p>Task 2 – Video requirements</p> <p>Assessment theme: Manufacturing</p> <p>Minor amendment to wording.</p> <p>Task 4 – Resources</p> <p>Task 1 – What must be produced for marking guidance</p>
3.0 September 2025	<p>Refinement of layout and formatting</p> <p>Removal of duplicated guidance information</p>	<p>All</p> <p>1. Assessment</p> <p>2. Tasks</p>

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1. Assessment

The assessment for Electrical and Electronic Engineering Occupational Specialism component consists of a practical assignment that includes an assignment brief and then a number of tasks for the candidate to complete. Tasks are assessed by assessment themes that cover a range of knowledge and skills from the performance outcomes.

They are designed to allow judgement of the candidate to be made across different categories of performance.

The assessment for this component has been allocated a set number of marks against each assessment theme, based on weightings recommended by stakeholders of the qualification. This mark allocation remains the same for all versions of the assessments, ensuring consistency across assessment versions and over time.

The live Occupational Specialism assessment materials must be used in conjunction with the 'TQ Occupational Specialism assessment process guide', this is available on the T Levels [Resource Hub](#).

Performance outcomes

The weightings for each performance outcome will remain the same for every version of the practical assignment. This ensures the appropriate depth and breadth of knowledge and skills for each specialism can be reliably assessed in every version and meets the needs of industry while keeping comparability between each assessment over time.

Performance outcome	Typical knowledge and skills	Weighting
PO2 Analyse and interpret engineering and manufacturing requirements, systems, processes, technical drawings and specifications.	Analyse and interpret engineering and manufacturing requirements, systems, processes, technical drawings, diagrams and specifications.	16%
PO3 Evaluate systems, designs, components and processes, managing and integrating design information, proposals and specifications, to develop and improve electrical and electronic engineering and manufacturing proposals and solutions.	Evaluate systems, designs, components, sub-assemblies and processes, managing and integrating design information, proposals and specifications, to develop and improve electrical and electronic engineering and manufacturing proposals and solutions.	22%
PO4 Propose and design electrical and electronic engineering and manufacturing systems, products, components, processes and solutions, considering requirements, constraints and context.	Design and model electrical and electronic concepts, systems and circuitry. Use CAD software to produce diagrams, models and simulations. Use tools safely and effectively for specific purposes. Safely carry out engineering processes and activities.	23%
PO5 Collaborate to help manage, develop, test and quality assure electrical and electronic engineering and manufacturing design information, systems, processes and outcomes.	Work in accordance with professional standards, work-place policies, health and safety requirements and regulations. Complete detailed risk analysis. Respond to feedback from others to inform design decisions. Develop and test models and prototypes. Investigate and analyse test results and accurately report and respond to them.	26%
PO6 Communicate proposals, design information and solutions, producing, recording and explaining engineering and manufacturing representations, systems, processes, outcomes, specifications and technical drawings.	Use methods to communicate proposals, design ideas and solutions. Produce technical documentation using industry conventions.	13%

2.Task guidance

General task guidance

Read **ALL** information carefully before the assessment.

The following documents, available on the City & Guilds website, provide essential generic guidance for providers delivering T level Technical Qualifications (TQs) and **must** be referred to alongside this guidance:

- **T level Technical Qualifications – Teaching, Learning and Assessment Guide**
- **TQ Occupational Specialism Assessment Process Guide**

Ensure you are familiar with the following documentation before you undertake the assessment of candidates:

- Practical Observation (PO) template
- Peer review (PR) form (where applicable)
- Templates provided for tasks (where applicable)
- Marking grids

All work carried out should be to industry standards, undertaken in a safe manner and compliant with relevant regulations. If a candidate fails to carry out the activities in a safe manner, the assignment should be suspended until this aspect is corrected.

This assignment is designed to require the candidate to make use of their knowledge, understanding and the practical skills they have built up over the course of their learning to tackle tasks/problems/challenges. This approach to assessment emphasises to candidates the importance and applicability of the full range of their learning to practice in their industry area and supports them in learning to take responsibility for transferring their knowledge, understanding and skills to the practical situation, fostering independence, autonomy and confidence.

During the learning programme, it is expected that tutors will have taken the opportunity to set shorter, formative tasks that allow candidates to be supported to independently use the learning they have so far covered, drawing this together in a similar way, so they are familiar with the format, conditions and expectations of the assessment.

Candidates should be made aware during learning what the assessment themes are and how they are implemented in marking the assignment, so they will understand the level of performance that will achieve them high marks.

Candidates should not be entered for the assessment until the end of the course of learning for the qualification, so they are in a position to complete the assessment successfully.

Health and safety

Candidates must not be entered for assessment without being clear of the importance of working safely and having attended sufficient practical training to be able to work safely. The assessor must immediately stop an assessment if a candidate works unsafely. At the discretion of the assessor, depending on the severity of the incident, the candidate may be given a warning. If they continue to work unsafely, risking the safety of themselves or others however, their assessment must be ended, and they must retake the assessment in a future series after significant further training has taken place. Any warnings issued to a candidate must be considered as part of the marking process and recorded on the candidate record form (CRF). Any actions that have led to that warning must be detailed on the CRF so they can be considered along with the other evidence when applying the descriptors in the mark scheme.

Compliance with timings

Due to the nature of this assessment, the maximum time allowances provided must be adhered to. They refer directly to assessment time, not any additional setting up times the provider needs to create an appropriate assessment environment.

It is the provider's responsibility to plan sufficient assessment sessions as stated in each of the tasks, under the appropriate conditions, within the assessment window, to allow candidates reasonable time to complete the assessment tasks.

Where candidates are required to plan their work, they should have their plans confirmed for appropriateness in relation to the time allocated for each task, to ensure their planning has not left them with too short a time to complete the tasks safely. Any planning that is not appropriate must be recorded on the candidate record form (CRF) as part of the marking process.

Candidates should be allowed sufficient time to fully demonstrate the range of their skills, however this also needs to be reasonable and practicable. Candidates should be allowed to overrun their own planned timings in order for evidence of a range of their skills to be captured. If, however, the time required exceeds the maximum time allowance for the task, the provider must stop the assessment and base the marking on the evidence up to that point.

Assessor candidate ratios

Where the tutor/assessor is required to carry out observation of performance, detailed, descriptive notes must be recorded on the practical observation (PO) form provided. The provider has the flexibility to adapt the form to suit local requirements (e.g. to use electronic and hand-written formats) as long as this does not change or restrict the type of evidence collected.

The number of candidates an assessor will be able to observe at one time will vary depending on local conditions relating to:

- monitoring and maintaining safety during assessment
 - any specific hazards related to the task that pose a risk of harm in relation to the competence of the candidates
 - availability of supervisory staff to support the assessor
- the practicalities of collecting evidence
 - the complexity of evidence collection for the task
 - whether there are any peak times where there is a lot of evidence to collect that will need additional support or any that are quieter which may be eased through staggered starts etc
 - local conditions e.g.
 - layout of the assessment environment and sufficient assessor line of sight to task activity throughout the assessment period
 - amount of additional support available (e.g. to capture image/video evidence)
 - availability of suitable workspaces/bays or of shared resources and equipment.

Providers are advised to trial the planned arrangements during formative assessment, reviewing the quality of evidence captured and manageability. It is expected that for straight forward observations, with favourable local conditions and support, (and unless otherwise specified) no more than six candidates will be observed by a single assessor at one time, and the number will usually be fewer than this maximum. The key factors to consider are the logistics of collecting sufficient evidence and ability to remain working safely in the assessment environment.

A timetable of assessments and layout of the workspaces must be available for the moderator on request. This should detail:

- the candidates being assessed at each workstation,
- the assessor(s) and
- support staff present

Time

The time allocated for the completion of the tasks and production of evidence for this assessment is **34 hours**. Timings for completion of specific tasks are outlined below.

- Task 1 – 14 hours
- Task 2 – 13 hours
- Task 3 – 1 hour
- Task 4 – 6 hours.

General task requirements

- The assignment brief and any associated documents should be released to candidates at the start of the first scheduled task assessment. Candidates should be provided with 30 minutes of non-assessed time at the start of this session to read and review the brief, before being provided the first task. It must be made clear to candidates when the 30 minutes of non-assessed reading and review time starts and ends.
- Each task **must** only be released to candidates at the start of the scheduled assessment session for that individual task.
- Each task will provide details of what evidence must be submitted on the completion of the task. Additional evidence which must also be submitted will be detailed within the task.
- Candidates should be advised that approximate word counts, or page lengths have been given within the task guidance in order to act as a guide to support the completion of the tasks. These are provided as a guide only, and there will be no penalisation of marking based on if the word count or page length is above or below the indicative guidance provided.
- Candidates are not permitted to bring any existing notes or materials completed prior to the assessment into any of the assessment sessions.
- Candidates must be reminded that their work submitted, including drawings, sketches and calculations are legible and appropriately labelled with name and task, evidence can either be word processed or handwritten. Any electronic evidence produced must have a clear file name and easily identifiable to the task and candidate.
- Candidates are permitted to have copies of their final evidence from previous tasks in subsequent assessment sessions. The use of this evidence is solely to support candidates to refer to previous work. The purpose of only providing copies is to ensure that candidates are unable to rework any of their previous responses.
- When working under supervised conditions for longer sessions, breaks can be facilitated outside of the controlled conditions, ensuring the room is locked and all candidates have vacated once the break begins. All materials must be kept securely during the break.
- If the task completion runs over more than one session, candidates must be reminded that no assessment information can be shared or discussed with other candidates.
- Candidates must be made aware that plagiarism is not allowed.
- Candidates must be made aware of City & Guilds position on the use of Artificial Intelligence (AI) [Position Statement on AI | City & Guilds](#)
- Where evidence is created using software which has the potential for cloud-based retrieval or sharing this feature should be disabled where possible (e.g. in software settings or through restriction of internet connection). Where not possible, candidates must be reminded that the evidence submitted for the tasks can only be generated within the scheduled assessment times and also of the implications of sharing or plagiarising content from cloud-based content.
- After the production of evidence, both the assessor and candidate must sign declarations of authenticity.
- Where the candidate or assessor is unable to or does not confirm authenticity through signing a declaration form, the work will not be accepted and a mark of zero will be given. If any question of authenticity arises, the Provider may be contacted for justification of authentication

Task specific guidance

Each task should be administered separately and in order unless instructions state otherwise, and each task should be completed and submitted by all candidates before moving onto the next.

Where a candidate is required to update or refer to a document from a previous task, the document provided to them should be a copy of the original submitted evidence. This can be a hard copy or electronic. Candidates must not be permitted access to their original document from previous task, this is to prevent candidates reworking submitted evidence. Any annotations or amendments to the copy should be made in a different colour text or tracked electronically (e.g. tracked changes) for marking and moderation purposes and saved in a secure location with an appropriate file name.

Providers are not permitted to supply candidates with templates e.g. risk assessment for any task unless specified.

Task 1

Assessor guidance

- The physical modelling could use stripboard or an approach that does not require permanent fixings, such as breadboards or modular systems.
- The measurement of the system outputs could use basic electrical measurement equipment such as multimeters or logic probes, to verify if the design functions are being achieved.
- Evidence of the virtual modelling of the circuitry could be captured using annotated screen captures or printouts.
- Candidates must produce a design specification that builds on the design criteria for the circuitry, including any references to research used
- Candidates must generate a suitable design for the circuitry, including:
 - selection of appropriate sensors with justifications
 - calculations of the values required for successful operation, including the power required by the circuitry and the motors, timings and values for at least two different types of components
 - configuration of the circuitry including a circuit diagram and wiring diagram
 - printed circuitry board (PCB) layout for the circuitry
- Candidates must simulate the performance of the proposed design using CAD software
- Candidates must assemble a physical model of the circuitry and test its functionality
- Candidates must produce a bill of materials (BoM) listing all of the parts required in the final design proposal.

Evidence

- Design specification
- Design calculations, including all workings
- Justifications of design options for the sensors
- Circuit diagram and wiring diagram
- PCB layout
- Outcomes of the virtual modelling of the proposed circuit design, either as screen captures or printouts
- Record of outcome of testing the functionality of the physical model of the circuit and any changes if necessary
- Bill of materials
- Any notes produced of research undertaken including citation of sources and internet search history must be submitted to ensure the authenticity of evidence produced.

Resources

- Access to internet
- Access to PCB software
- Access to appropriate CAD software suitable for circuit design and simulation
- Manufacturer's datasheets (for electronic components)
- Scientific calculator for design calculations
- Basic electronic components including: capacitors, resistors, sensor components, integrated and discrete components, cables, connectors and cable terminations
- Access to appropriate circuit modelling methods
- DC power supply unit.

Task 2

Assessor guidance

- Any appropriate method to manufacture the PCB is acceptable.
- As noted in the task guidance, if available candidates should be given access to a conveyor system to which they can attach their proposed system. If this is not available candidates will need to simulate the operation to evaluate the function.
- Work area must be representative of normal centre practice prior to any practical activities taking place for candidates to complete their work area preparation.
- Candidates must have access to appropriate materials, tools, equipment and machinery in order for them to manufacture their prototype.
- Candidates must produce risk assessments for the production of the PCB and the construction of the soldered prototype
- Candidates must produce the PCB for the design
- Candidates must build a soldered prototype working circuitry from your design
- Candidates must test the operation of the circuitry.

Evidence

- Risk assessments
- Test records for the results of testing the circuitry
- PCB
- Prototype.
- Assessor observation of:
 - the production of the PCB
 - building of the soldered prototype
 - testing of the circuitry.

To support the comments made within the Practical Observation the assessor must capture the following photographs and videos that must be submitted as supporting evidence for each candidate.

Photographic evidence which shows:

- unassembled PCB clearly showing the track layout
- back of the assembled PCB showing all soldered joints
- front of the assembled PCB showing positioning and fitting of components.

Video evidence which shows:

- functionality of the prototype (maximum of five minutes).

Resources

- Copies of completed documentation from Task 1
- PCB production facilities
- Basic electronic components including; capacitors, resistors, sensor components, integrated and discrete components, cables, connectors and cable terminations
- DC power supply unit
- Diagnostic equipment, including multimeters, logic probes etc
- Tools for the electronic assembly, for example: soldering iron, side cutters, snip nose pliers, wire strippers, stripboard cutter (if used), PCB/stripboard holder, solder extraction units (portable or fixed)

- If required, programmable system software and hardware upload facilities.

Task 3

Assessor guidance

Task 3 must take place in a single assessment session on the same day.

The assessor must ensure the following requirements are met:

- organise candidates into groups (recommend three candidates per group) for the discussions. Where this is not possible i.e. candidate absence group sizes may be flexed but should be closely monitored by the assessor to ensure a comparable experience is achieved for all candidates
- the task should be candidate led but the assessor may facilitate through prompting to support the level of engagement and feedback gained for candidates
- monitor timings as directed by the task
- the discussion takes place in an appropriate environment where candidates are unlikely to be disturbed
- check all completed peer review forms for appropriateness before sharing with the candidate whose evidence is being reviewed.

Evidence

- Feedback record form
- Peer review feedback form.

Resources

- Copies of completed documentation from Task 1
- Feedback record form
- Peer review feedback form(s).

Task 4

Assessor guidance

- Candidates must produce a virtual model of the design using appropriate software incorporating any changes they have decided to make in response to feedback or as a result of manufacturing and testing
- Candidates must produce a revision control document or report that is typically 500 words justifying why changes were made or not made as a result of the peer review feedback
- Candidates produce a report evaluating the proposed design. The report should typically be 800 words and must include:
 - an explanation of the test methods used, reasons for their use and their limitations
 - a summary of the capabilities of the circuitry
 - an evaluation of the fitness for purpose of the design proposal and its conformance to the design criteria and specification
 - the information necessary for a third party to implement the prototype
 - an outline of any additional factors that may need to be considered during the implementation, including:
 - cable types to be used to connect the sensors to the circuitry, if appropriate
 - health and safety considerations
 - applicable requirements from wiring regulations
 - any improvements or adaptations required to the prototype, including any reasoning and justifications if adaptations or improvements are not required.

Evidence

- Outcomes of virtual modelling
- Revision control document
- Evaluation and implementation report.

Resources

- Copies of completed documentation from Tasks 1 and 2
- Feedback record form and peer review form from Task 3.
- Internet access for research (e.g. costs, component data and production information)
- Manufacturer's datasheets (for materials and components)
- Wiring regulations.

3. Marking

Guidance on marking

Please refer to the **TQ Occupational Specialism Assessment process guide** document for further information on gathering evidence suitable for marking and moderation, and on using the marking grid and forms.

The Candidate Record Form (CRF) is used to record:

- details of any guidance or the level of prompting the candidate has received during the assessment period
- rough notes bringing together relevant evidence from across tasks during marking
- summary justifications when holistically coming to an overall judgement of the mark for each performance objective and overall
- if an assessment has to be stopped on the grounds of Health and Safety or if a candidate has been working in an unsafe manner.

The Practical Observation form (PO) is used to record:

- descriptive information and evidence of candidate performance during an observation.

4. Marking grid

There is a marking grid for each assessment theme that must be assessed as part of this occupational specialism assessment. The individual statements within the band descriptors should be treated together to make one whole descriptor and not separately.

Assessment theme – Health and Safety

Guidance for assessors

The following evidence from Task 1, 2 and Task 4 should be used to assess performance against this assessment theme.

Task 1

- Design specification.

Task 2

- Risk assessment
- Assessor observations:
 - production of the PCB
 - building of the soldered prototype
 - testing of the circuitry.

Task 4

- Evaluation and implementation report.

Additional supporting evidence

Photographic and/or video evidence requirements are stated in the specific task guidance for each task within this assessor pack.

<p>Note: where there is insufficient evidence to award a mark, a zero mark must be given</p>	<p>Band 1 descriptor</p>	<p>Band 2 descriptor</p>	<p>Band 3 descriptor</p>	<p>Total marks per sub assessment theme</p>	<p>Total marks per assessment theme</p>
	<p>Indicative content:</p> <p>Completion of a comprehensive risk assessment, including:</p> <ul style="list-style-type: none"> • identification of risks and hazards that if not controlled could cause injury to themselves or others, that may include: <ul style="list-style-type: none"> ○ low risk – slips, trips and falls ○ medium risk – working in high temperatures (burns and scaling), flying debris, personal injury from use of tools ○ high risk – chemicals, electric shock • analysis of risk with appropriate mitigation and control measures prepared against hazards for planned tasks, including PPE, correct handling of power sources, extraction, isolation, measures to ensure safety when soldering • assessment of risk as part of planning and preparing for manufacturing and testing activities, including health and safety preparatory checks on tools and equipment and the work area. <p>Manufacture and testing of prototype:</p> <ul style="list-style-type: none"> • correct preparation of tools, prototype manufacture and assembly equipment and PPE for the proposed design • work area to be kept tidy throughout the tasks • wearing the correct PPE at all times, as identified in their risk assessment • following safe work practices throughout the manufacture, development and testing of the prototype e.g. safe use of tools and equipment e.g. soldering equipment, PCB production equipment, wire cutters. <p>Completion of a design specification for the system to include consideration to:</p> <ul style="list-style-type: none"> • safe use of power supplies • safe production and manufacture of the PCB • safe construction and assembly of the PCB • testing requirements to ensure safe operation • health and safety legislations and regulations and local workplace procedures (use of tools and equipment, measurement, IET wiring regulations). <p>Completion of an evaluation and implementation report to consideration of:</p> <ul style="list-style-type: none"> • health and safety legislations and regulations e.g. wiring regulations • wider implications of both the construction and operation of the system e.g. environmental considerations, capabilities of human operators, ergonomics • measures required to work on components, systems, wiring and cables 				

	<ul style="list-style-type: none"> location in which activity is carried out. 				
Marks per band	1-4	5-8	9-12	N/A	12
	<p>Risk assessment covers the majority of risk factors and some control measures have been identified. Likelihood or severity has been considered for some risks and hazards. Risk mitigation methods are limited.</p>	<p>Risk assessment covers a good range of risk factors, including risk control measures identified for most of the potential risks and hazards. Likelihood and severity have been considered for most risks and hazards. Risk mitigation methods have been identified for some of the potential risks, but not all.</p>	<p>Risk assessment is detailed and clearly identifies all of the associated risk factors, risk control measures and have been clearly identified for all potential risks and hazards. Likelihood and severity have been considered for all risks and hazards. Risk mitigation methods are detailed and have been clearly identified for all potential risks.</p>		
	<p>Health and safety is followed during preparation and throughout the tasks so that all work is completed safely. Some risks and hazards that occur during the tasks are mitigated against as they arise.</p>	<p>Health and safety is followed during preparation and throughout tasks and all work completed safely. Most risks and hazards that occur during the tasks are correctly mitigated against as they arise.</p>	<p>Health and safety is followed during preparation and throughout tasks and all work completed safely. All risks and hazards that occur during the tasks are correctly mitigated against as they arise.</p>		
	<p>Minimal health and safety considerations have been included as part of the design and evaluation/ implementation.</p>	<p>A good range of health and safety considerations have been included as part of the design and evaluation/ implementation.</p>	<p>A comprehensive range of health and safety considerations have been considered as part of the design and evaluation/ implementation.</p>		

Assessment theme – Design and Planning

Guidance for assessors

The following evidence from Task 1 should be used to assess performance against this assessment theme.

Task 1

- Design specification
- Design calculations
- Evaluation of design options for the sensors
- Bill of materials
- Circuit diagram and wiring diagram
- PCB layout
- Outcomes of the virtual modelling of the proposed circuit design, either as screen captures or printouts.

Task 4

- Outcomes of virtual modelling.

Note: where there is insufficient evidence to award a mark, a zero mark must be given	Band 1 descriptor	Band 2 descriptor	Band 3 descriptor	Total marks per sub assessment themes	Total marks for assessment theme
	<p>Indicative content:</p> <p>Documents</p> <ul style="list-style-type: none"> • Analysis and interpretation of design criteria • The appropriate selection of technology, input, process and output components, tools and equipment <ul style="list-style-type: none"> ○ Technologies and components: potential dividers, 4000 series logic, 74 series logic, PAL, FPGA, PID controller, PLC, microcontroller or alternatives ○ Input devices: SPST switch on/off, infrared sensors, ultrasonic sensors, LDR, microswitches, pressure sensors or alternatives ○ Output devices: lamps, light emitting diodes, buzzers, bells, loudspeakers, motors and servo motors • The appropriate selection of materials and components and sub-systems required to meet the design criteria and specification with justifications for the selections 				

	<ul style="list-style-type: none"> • Accuracy and precision of sensors • Sustainability considerations and requirements e.g. use of renewable energy, safe disposal of components, designing for recycling and re-use, circular economy • The type, size and quantity of materials and components required to complete the tasks to ensure the highest quality, which shows no evidence of damage to components, sensors and wiring etc • Considerations relating to the design of the PCB (track and pad layouts, track thickness, grounding considerations, decoupling) • Design calculations e.g. calculate required resistor and capacitor values, potential divider voltages, output voltages, power supplies • Scientific principles e.g. Ohms Law, Watts Law, voltage, current, resistance, capacitance, power. <p>Drawings and diagrams</p> <ul style="list-style-type: none"> • Engineering diagrams and representations (wiring diagrams, block diagrams, circuit diagrams, schematics, PCB layouts) • Block diagrams include signal flow and feedback loop for sensor control • Wiring diagrams include type of wire, connection types, physical layout of sub--systems and grounding • Schematics including correct abbreviations and symbols for on/off switch, sensors detecting the dimensions of each box, holding area sensor (e.g infrared sensor), LED or lamp for the visual indicator and buzzer or speaker for the audible sound output • PCB layouts include all pads, tracks and components arranged in an efficient manner with little wasted board space • Industry standard conventions, symbols, abbreviations, references and annotations. <p>Virtual modelling</p> <ul style="list-style-type: none"> • Use of virtual modelling tools or CAD to simulate function of circuit including on/off switch, sensors, visual indicator and sound output device • Use of virtual modelling tools or CAD to simulate function of PCB including all input, process and output devices. 				
Marks per band	1-4	5-8	9-12	12	33
Documents	Specification is brief with minor inaccuracies in technical knowledge. Most points have been analysed, considered and elaborated on.	Specification is clear with minor inaccuracies in technical knowledge. All points have been analysed, considered and most have been elaborated on.	Specification is detailed and thorough with accurate technical knowledge throughout. All points have been analysed, considered and elaborated on.		
	Some key materials and quantities to meet the brief have been identified.	Most key materials, quantities required to meet the brief have been identified.	All materials and quantities required to meet the brief have been identified.		
	No reasoning provided to justify choices made for selection of	Some reasoning provided to justify choices made for	Clear and detailed reasoning provided to justify choices		

	materials.	selection of materials.	made for selection of materials.		
	Some design calculations are accurate. Some correct methodology applied.	Most design calculations are accurate. Most correct methodology applied.	All design calculations are accurate. Methodology correctly applied throughout and reference to industry standards annotated.		
Marks per band	1-4	5-8	9-12	12	
Drawings and diagrams	Drawings/diagrams are produced using some correct conventions.	Drawings/diagrams are produced using most correct conventions.	Drawings/diagrams produced with fully compliant and correct conventions.		
	Drawings/diagrams are clear and contain some of the appropriate information needed in order for a third party to reproduce them.	Drawings/diagrams are clear and contain most of the appropriate information needed in order for a third party to reproduce them.	Drawings/diagrams are clear and well presented and contain all of the appropriate information needed in order for a third party to reproduce them.		
	Sketches include brief annotations and some relevant information.	Sketches are clearly annotated and contain most relevant information.	Sketches are annotated in detail and contain all relevant information.		
Marks per band	1-3	4-6	7-9	9	
Virtual modelling	Use of virtual modelling tools is basic .	Use of virtual modelling tools is good .	Use of virtual modelling tools is comprehensive .		
	Virtual model(s) is functional and meets some of the requirements of the design criteria.	Virtual model(s) is functional meets most of the requirements of the design criteria.	Virtual model(s) is functional meets all requirements of the design criteria, including any changes or modifications if required.		

Assessment theme – Manufacturing

Guidance for assessors

The following evidence from Tasks 1 and 2 should be used to assess performance against this assessment theme.

Task 1

- Records of the results of testing the model of the circuit.

Task 2

- Test records for the results of testing the circuitry
- Assessor observations:
 - production of the PCB
 - building of the soldered prototype
 - testing of the circuitry.

Additional supporting evidence

Photographic and/or video evidence requirements are stated in the specific task guidance for each task within this assessor pack.

Note: where there is insufficient evidence to award a mark, a zero mark must be given	Band 1 descriptor	Band 2 descriptor	Band 3 descriptor	Total marks per sub assessment theme	Total marks for assessment theme
	<p>Indicative content:</p> <p>Developing the prototype/model</p> <ul style="list-style-type: none"> The appropriate selection and use of components, tools, equipment and processes for PCB production and assembly Hand skills e.g. wiring, soldering of components to PCB, fitting input, process and output devices Soldering and assembling a prototype Use of equipment to manufacture and produce a PCB e.g. etching, milling. Measuring and cutting of components, materials, wiring and cables using appropriate tools and equipment Soldered joints are correctly formed and dry joints avoided, use of strain holes for soldered wiring connections, sockets used to avoid heat damage to ICs when soldering, screw connections are tightened, correctly matched crimps and wires, 				

	no exposed wiring or connections, appropriate colour coding of wiring used, appropriate circuit protection methods used, microcontroller programming is fully tested where relevant.				
	Tests from the range below <ul style="list-style-type: none"> • Use of electrical measurement and test equipment (e.g. multimeter, oscilloscope, logic probe) to measure input and output signal parameters for both the full circuit and individual switches, sensors, processes sub-systems and output devices (e.g., voltage, current, resistance and characteristic of signal waveforms) • Use of manual and automated testing processes, such as functional testing and visual inspection, to test against each point of the design criteria listed in the brief. E.g. using a range of different box sizes and weights to check that the system responds as required to each one by directing them down the appropriate chute. 				
Marks per band	1-3	4-6	7-9	9	27
Prototype/ model	The prototype/model is mainly appropriate but may require some modifications.	The prototype/model is mainly appropriate but may require some minor modifications.	The prototype/model is functional without modification .		
	The prototype/model meets some of the requirements of the design criteria.	The prototype/model meets most of the requirements of the design criteria.	The prototype/model meets all of the requirements of the design criteria.		
Marks per band	1-2	3-4	5-6	6	
Developing	The soldering is adequate for functionality.	The soldering is of a good standard for functionality.	The soldering is neat and tidy and carried out to a high standard.		
	Selection of tools, equipment and processes is not always appropriate to the task.	Selection of tools, equipment and processes is mostly appropriate to the task.	Selection of tools, equipment and processes is always appropriate to the task.		
	Use of tools, equipment and processes is basic , resulting in a finish that is of poor quality .	Use of tools, equipment and processes is good resulting in a finish that is of adequate quality .	Use of tools, equipment and processes is excellent , resulting in a finish that is of high-quality .		
Marks per band	1-4	5-8	9-12	12	

Testing	Some understanding shown through selection of tests, some appropriate tests carried out in order to check the prototype/model meets the design criteria.	Good understanding shown through selection of tests, most appropriate tests carried out in order to check the prototype/model meets the design criteria.	Comprehensive understanding shown through selection of tests, all appropriate tests carried out in order to check the prototype/model meets the design criteria.		
	The model/prototype has been tested against some of the design criteria and meets some of the requirements.	The model/prototype has been tested against most of the design criteria and meets most of the requirements.	The model/prototype has been tested against all of the design criteria and meets all of the requirements.		
	Selection and use of testing and measurement equipment is mostly appropriate and carried out with some errors in accuracy.	Selection and use of testing and measurement equipment is mostly appropriate and carried out accurately .	Selection and use of testing and measurement equipment is always appropriate to the task and carried out with a high degree of accuracy.		

Assessment theme – Reports

Guidance for assessors

The following evidence from Tasks 1, 2, 3 and 4 should be used to assess performance against this assessment theme.

Task 1

- Records of the results of testing the model of the circuit.

Task 2

- Test records for the results of testing the circuitry.

Task 3 – for consideration only

- Candidate notes on the candidate feedback record form
- Peer review feedback form.

Task 4

- Evaluation and implementation report
- Revision control document
- Outcomes of virtual modelling.

Note: where there is insufficient evidence to award a mark, a zero mark must be given	Band 1 descriptor	Band 2 descriptor	Band 3 descriptor	Total marks per sub assessment theme	Total marks for assessment theme
	Indicative content: Implementation Completion of an evaluation and implementation report to include: <ul style="list-style-type: none"> • use of wiring, circuitry and components • wiring regulations BS7671 (IET) or relevant wireless connection regulations • any adaptations/modifications and improvements with justifications • justifications where no adaptations/modifications are required • revision control document with justifications 				

	<ul style="list-style-type: none"> conformance to design requirements and functionality commissioning procedures, siting of switches, sensors, output devices and circuitry compliance to legal standards. <p>Records/reports</p> <ul style="list-style-type: none"> Completion of test records and reports/results, including function, performance testing, relevance and any limitations or challenges to methods used Descriptions of methods and processes Consideration of accuracy and sources of any errors Use of technical language and terminology. 				
Marks per band	1-4	5-8	9-12	12	18
Implementation	Contains some basic information, some minor details missing that could impact on a third party familiar with the design being able to reproduce it.	Contains good information that would allow a third party that is familiar with the design to reproduce it.	Contains detailed information that would allow a third party to reproduce it.		
	Evaluation of the design is basic and identifies a brief list of improvements with no justification .	Evaluation of the design is good and identifies a range of improvements with some justification .	Evaluation of the design is thorough and identifies a comprehensive range of improvements with clear and detailed justification .		
	Where no improvements or adaptations are needed, this is supported with brief reasoning and justifications to why.	Where no improvements or adaptations are needed, this is supported with good reasoning and justifications to why.	Where no improvements or adaptations are needed, this is supported with detailed and thorough reasoning and justifications to why.		
	Changes or no changes to the design as a result of manufacturing, testing or feedback are not always suitable and lack reasoning .	Changes or no changes to the design as a result of manufacturing, testing or feedback are suitable with some reasoning .	Changes or no changes to the design as a result of manufacturing, testing or feedback are suitable with detailed reasoning .		
Marks per band	1-3	4-6	7-9	6	

Records/reports	Reports are partially completed brief in content with some incorrect technical and industry terminology.	Reports are completed in a clear format with only minor details missing. Content and technical and industry terminology is mostly accurate.	Reports are detailed and accurate with correct technical and industry terminology throughout .		
	Test records include some of the appropriate information.	Test records include most of the appropriate information.	Test records are detailed and include all appropriate information.		
	Some inaccuracies in recording of test outputs and measurements.	Some minor inaccuracies in recording of test outputs and measurements.	All test outputs and measurements are accurate.		

6. Links to Maths, English and Digital Skills

The table below indicates where each of the General Maths, English and Digital Competencies have been integrated into the assignment tasks.

Task	Skills
1	EC1, EC2, EC3, MC2, MC8, MC10, DC1, DC2
2	EC1, EC3, MC1, MC10
3	EC1, EC2, EC3, EC4, EC6, MC2
4	EC1, EC2, EC3, EC4, MC10, DC1, DC2

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