

Knowledge Organiser



Learners will explore and develop the design and manufacture of electronic printed circuit boards (PCBs). This unit does not cover the design of circuits.

Learning Aim A

Learners will provide a balanced evaluation of the design of at least two PCBs contained in different products. For example, learners could cover the complexity of the circuit, power requirements and physical factors, such as product size. They will also cover environmental conditions and manufacturing considerations, such as production quantity, manufacturing cost, and quality. Learners will suggest how the products might evolve for particular applications that require changes to the PCB technology/characteristics or due to advances in technology. Learners will refer to consumer trends and market forces and how they might influence the evolution of the electronic products and the impact of these on the electronics required.

Learning Aim B and C

Learners will include justifications for design decisions, records of identification of errors/defects and remedial action taken, and iterations of the circuit board to detail refinements that would improve its performance. For example:

- consideration of the intended application, such as the positioning of fixed components and points for mounting
- a name and other reference text will be included (if applicable)
- the soldering will be of an excellent quality, with no defects
- component density and grouping optimised.

Throughout the activity, learners will demonstrate relevant behaviours and general engineering skills to a professional standard. For example, all assignments will be completed on time, the practical activities will be planned out in advance and the finished PCB will fully meet the requirements of the client brief, hence demonstrating commercial awareness. The lessons learned report will present a good technical understanding of PCB design and safe manufacturing processes. Overall, the evidence will include a balanced view about the actions taken, and PCB design and manufacture, including health and safety compliance and technical engineering terms, which will have been used correctly.

Unit Overview

Electronic products are everywhere, from toasters to computer tablets, and at the heart of these devices are ever more complex electronic circuits. To make these products function as intended (reliably and safely), the circuits need to be connected effectively; and this is the job of a PCB.

As well as making all of the required electrical connections that join the components together, a PCB must also physically support the components. PCBs might also comprise some user controls or a display, and can be designed to help protect the circuit from excess heat or interference. In this unit, you will understand and explore the industrial processes involved in designing and manufacturing sustainable PCBs. You will gain an understanding of the different types of PCB and the design considerations for an electronic product or system. You will experiment with software

tools to design and simulate the PCB, before safely producing a PCB that you will then examine to assess its functionality and build quality. Finally, you will reflect on the skills and understanding you have acquired while designing and manufacturing a PCB, and the behaviours applied. It is the role of electronic design engineers to examine and analyse the diverse product and system requirements and then to develop effective, efficient and sustainable solutions, ensuring optimal performance. This unit will help to prepare you for employment and apprenticeships in electronic and electrical engineering and, in particular, electronic product design and manufacture. You may also be interested in this unit if you want to progress to higher education to study engineering

Learning Aims:

- A** Examine the design and manufacture of printed circuit boards that are widely used in industry
- B** Explore how computer software is used for schematic capture and simulation of an electronic circuit
- C** Develop safely a printed circuit board to solve an engineering problem
- D** Review the development of the printed circuit board and reflect on own performance.

Key Vocabulary

Transducers,
Microcontrollers,
Discrete Semi-conductors, Capacitors

Numeracy links:

electronics uses specific mathematics that is needed to calculate values such as voltage across different parts of a circuit

Work Related Learning:

Gaining knowledge in electronics that can be used in any electronics engineering role

SMSC and British Values

Understanding the importance that electronics has in solving critical issues in the world.

Learning Aim B

Learners will draw the circuit to a high standard following industry best practice. This will include a neat, well-organised and readable layout with sequential component labels. Components will be fully specified and connected accurately with efficient wiring. The positioning of power lines will be appropriate and labelling will have been used to identify the purpose of terminals or controls. Data will have been collated and well presented as a formal document, together with circuit schematics to generate a technical specification for the circuit. This will include a table of electrical values at key points in the circuit and/or at key stages in circuit operation. The AC circuit or AC element of a complex DC and AC circuit will include characteristic waveforms.