# Factsheet Electrical Instalation sector



SHIFTVET

Digital Transformation for Wood and Furniture VET

SHIFTVET
Digital Transformation for Wood and Furniture VET

## Content

1. Description of the VET Programme ..... 3
2. Potential Subjects for Transfer ..... 3
3. Transferable ShiftVET Exercises ..... 5
4. Example of application in the New Sector ..... 6
5. Required Adjustments ..... 7
6. Conclusions ..... 8

Industry / VET Sector Analysed: Electrical Installation, Industrial Automation, and Electronics.

VET programme(s) analysed:

Advanced Technician in Electrotechnical and Automated Systems (EQF Level 5).

# 1. Description of the VET Programme

What should be included?

The professional profile for this programme involves designing, installing, and maintaining electrical systems in buildings and industrial environments. Students focus on Industrial Automation, Domotics (Smart Homes), and Renewable Energy. Typical practical activities include assembling electrical distribution boards, wiring complex sensor networks, and programming PLC (Programmable Logic Controller) systems to automate machinery (EQF Level 5).

# 2. Potential Subjects for Transfer

What should be included?

| Subject / Module | Applicable Technology | Relevant ShiftVET Exercise | Transfer potential |
|---|---|---|---|
| Domotics and Smart Homes | 3D Printing | Exercise 1: Custom Enclosures for PLC and Sensors | High |
| Electrical Installations | 3D Printing | Modular Cable Management Clips and DIN-rail Mounts | High |
| Industrial Maintenance | 3D Printing | Production of Obsolete Insulating Handles and Covers | High |
| Industrial Maintenance | 3D Scanning | Exercise 2: Digitising Legacy Cabinets | Medium/High |
| Automation and Robotics | 3D Scanning | Reverse Engineering Specialised Connectors | Medium |
| Project Design & Planning | 3D Scanning | Site Mapping for Panel Fit Verification | High |
| Switchgear Assembly | CNC Machining | Exercise 3: Automated Panel & Gland Milling | High |
| Power Distribution Systems | CNC Machining | Machining Custom Copper Busbars | High |
| Control Circuitry | CNC Machining | Prototyping Printed Circuit Boards (PCBs) | Medium/High |

Technologies:

- 3D Printing (Additive Manufacturing): In the electrical sector, this technology replaces the "structural wood connectors" from Exercise 1 with functional, non-conductive components. Students focus on tolerance management (0.2–0.5 mm) to ensure that custom-printed enclosures or cable clips fit standard industrial rails and electrical components perfectly.
- 3D Scanning (Digital Metrology): Building on the "seat surface reconstruction" methodology of Exercise 2, students apply scanning to reverse engineer legacy hardware or map existing physical installations. This is vital for ensuring that new electrical assemblies fit into restricted physical spaces without requiring manual measurement corrections.
- CNC Machining (Subtractive Manufacturing): Transitioning from the "decorative drawer carving" of Exercise 3, the focus shifts to the precise automation of technical materials. Electrical students use CNC workflows to mill PVC or aluminium panels for switchgear assembly, ensuring that holes for displays and cable glands are cut with industrial accuracy and safety.

# 3. Transferable ShiftVET Exercises

What should be included?

| ShiftVET Exercise | Technology | Transferability (High / Medium / Low) |
|---|---|---|
| Exercise 1: Structural connectors | 3D Printing | High |
| Exercise 2: Surface reverse engineering | 3D Scanning | Medium / High |
| Exercise 3: CNC programming for a drawer front | CNC Machining | High |

The transfer of these exercises to the electrical sector is highly feasible because they allow for the integration of mechanical design with electrical functionality, a growing requirement in Industry 4.0.

- **3D Printing (Exercise 1):** The parametric design methodology and tolerance management (0.2–0.5 mm) are directly applicable to the creation of bespoke insulating components. Instead of timber connectors, students print custom PLC enclosures or sensor mounts, ensuring they fit perfectly onto standard industrial DIN rails.
- **3D Scanning (Exercise 2):** The "mesh-to-surface" workflow is fundamental for retrofitting old installations. It allows students to digitise obsolete electrical cabinets or discontinued connectors for which no original plans exist, facilitating their replication or the planning of new component layouts in restricted spaces.
- **CNC Machining (Exercise 3):** This exercise is critical for the automation of switchgear assembly. Students transfer their learning from wood milling to the precise machining of PVC or aluminium panels and copper busbars. This replaces slow and potentially hazardous manual drilling with a digital workflow that improves both safety and industrial finish quality.

# 4. Example of application in the New Sector

To successfully transfer the ShiftVET learning outcomes to the electrical installation and Smart Home sector, several adaptations are required to ensure that the technologies are applied to the specific needs of electrical systems rather than furniture production.

Firstly, the materials must be adapted to suit electrical applications. Instead of using wood and wood-based products, students should work with electrically insulating polymers for 3D printing, such as PETG or ABS, which are suitable for manufacturing protective enclosures for electronic devices. Likewise, CNC machining activities should use aluminium or rigid PVC sheets, as these materials are commonly employed in electrical distribution boards because they provide mechanical strength, durability, and compliance with electrical safety requirements.

Secondly, the learning objectives should focus on the design and manufacture of functional electrical components. Rather than producing decorative or structural wooden elements, students should learn how to design customised enclosures that protect electrical equipment, provide adequate ventilation to prevent overheating, ensure correct positioning of electronic devices, and facilitate safe installation and maintenance. They should also understand how digital manufacturing technologies contribute to precision and efficiency in Smart Home installations.

The practical activities should also be adapted to reflect real industrial scenarios. For example, instead of machining decorative wooden panels, students could manufacture customised covers for electrical distribution boards, mounting plates for smart controllers, or support structures for sensors and communication devices. Similarly, 3D printing exercises should concentrate on producing functional electrical enclosures designed from the digital models obtained through 3D scanning.

Finally, the assessment criteria should evaluate not only the quality and dimensional accuracy of the manufactured parts but also their suitability for electrical installations. Particular attention should be given to the correct fitting of electrical components, compliance with basic electrical safety requirements, the functionality of the finished products, and the effective integration of the three digital manufacturing technologies throughout the design and production process.

# 5. Required Adjustments

What should be included?

- To successfully transfer the ShiftVET learning outcomes to the electrical installation and Smart Home sector, several adaptations are required to ensure that the technologies are applied to the specific needs of electrical systems rather than furniture production.
- Firstly, the materials must be adapted to suit electrical applications. Instead of using wood and wood-based products, students should work with electrically insulating polymers for 3D printing, such as PETG or ABS, which are suitable for manufacturing protective enclosures for electronic devices. Likewise, CNC machining activities should use aluminium or rigid PVC sheets, as these materials are commonly employed in electrical distribution boards because they provide mechanical strength, durability, and compliance with electrical safety requirements.
- Secondly, the learning objectives should focus on the design and manufacture of functional electrical components. Rather than producing decorative or structural wooden elements, students should learn how to design customised enclosures that protect electrical equipment, provide adequate ventilation to prevent overheating, ensure correct positioning of electronic devices, and facilitate safe installation and maintenance. They should also understand how digital manufacturing technologies contribute to precision and efficiency in Smart Home installations.
- The practical activities should also be adapted to reflect real industrial scenarios. For example, instead of machining decorative wooden panels, students could manufacture customised covers for electrical distribution boards, mounting plates for smart controllers, or support structures for sensors and communication devices. Similarly, 3D printing exercises should concentrate on producing functional electrical enclosures designed from the digital models obtained through 3D scanning.
- Finally, the assessment criteria should evaluate not only the quality and dimensional accuracy of the manufactured parts but also their suitability for electrical installations. Attention should be given to the correct fitting of electrical components, compliance with basic electrical safety requirements, the functionality of the finished products, and the effective integration of the three digital manufacturing technologies throughout the design and production process.

# 6. Conclusions

The implementation of the ShiftVET learning outcomes within the electrical installation sector is both feasible and highly beneficial. The combination of 3D scanning, 3D printing, and CNC machining provides students with practical digital manufacturing skills that are increasingly demanded in modern electrical and smart building industries.
Overall, integrating these technologies into vocational training promotes innovation, improves manufacturing accuracy, reduces production time, and better prepares future electrical technicians for the growing digitalisation of the construction and electrical industries.

Summary
Overall Transferability Assessment
**x** High
☐ Medium
☐ Low
Main technology with transfer potential
**x** 3D Printing
☐ 3D Scanning
☐ CNC Machining
☐ Combination of technologies
Main transferable exercise
Exercise 3 (CNC Machining).



# SHIFTVET



Co-funded by
the European Union

Co-funded by the European Union. Views and opinions expressed are, however, those of the author(s) only and do not necessarily reflect those of the European Union or the Spanish Service for the Internationalisation of Education (SEPIE). Neither the European Union nor the granting authority can be held responsible for them.