



## THEME Competence Matrix - Electrical Engineering/Electronics with Partial competences/ Learning outcomes



COMPETENCE AREAS	STEPS OF COMPETENCE DEVELOPMENT		
<b>1. Preparing, planning, mounting and installing electrical and/or electronic systems for buildings and industrial applications</b>	He/She is able to prepare and carry out simple electrical and electronic installations (e.g. cables, electrical outlets, connection and distribution systems, modular electronic components, computer components) as well as to carry out and check the necessary wirings and mountings.	He/She is able to plan, prepare and connect electrical and modular electronic installations. (e.g. energy supply in private and business premises, incl. lighting; alternating and three-phase current; electronic systems as units, wireless LAN, multimedia systems).  He/She is able to advise the customer and select the best implementation according to customer specifications.	He/She is able to plan complex electrical and/or electronically networked installations (e.g. systems of energy distribution, building management systems / KNX, regulation and monitoring systems, building access systems, RFID-systems etc.) and fully wire them.  He/She is able to configure service and diagnose the functionality of the installation according to customer requirements and for this purpose is able to use computer-assisted tools.
	<b>Partial competences/ Learning outcomes:</b>		
	He/She is able to control safety rules on the job site especially to avoid electrical shock.		
	He/She is able to select the equipment and tools necessary to fulfill simple installations.		
	He/She is able to process wiring of simple installations according to a given circuit diagram.		
	He/She is able to process mountings of simple devices according to a given circuit diagram.		
	He/She is able to check electrical installation by visual inspections.		
	He/She is able to undertake a basic functional test.		



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	<b>Partial competences/ Learning outcomes:</b>		
	<p>He/She is able to show an overview of the standard solutions in the field of work, to choose from standard circuits and to solve a specified problem.</p>		
	<p>He/She is able to organize the workload for simple electrical and/or modular electronic installations.</p>		
	<p>He/She is able to prepare and connect various kinds of devices in different situations and context.</p>		
	<p>He/She is able to communicate with and to capture the requirements or preferences of the customer.</p>		
	<p>He/She is able to explain different possible solutions to a customer and advise the customer on the best solution for the occurring problem.</p>		



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<b>1. Preparing, planning, mounting and installing electrical and/or electronic systems for buildings and industrial applications</b>	<p>He/She is able to prepare and carry out simple electrical and electronic installations (e.g. cables, electrical outlets, connection and distribution systems, modular electronic components, computer components) as well as to carry out and check the necessary wirings and mountings.</p>	<p>He/She is able to plan, prepare and connect electrical and modular electronic installations. (e.g. energy supply in private and business premises, incl. lighting; alternating and three-phase current; electronic systems as units, wireless LAN, multimedia systems).</p> <p>He/She is able to advise the customer and select the best implementation according to customer specifications.</p>	<p>He/She is able to plan complex electrical and/or electronically networked installations (e.g. systems of energy distribution, building management systems / KNX, regulation and monitoring systems, building access systems, RFID-systems etc.) and fully wire them.</p> <p>He/She is able to configure service and diagnose the functionality of the installation according to customer requirements and for this purpose is able to use computer-assisted tools.</p>
	<b>Partial competences/ Learning outcomes:</b>		
	He/She is able to get an overview of the project for electrical and electronic network installations to propose optimal solutions to the customer.		
	He/She is able to use project management tools.		
	He/She is able to project, install and test automation systems for residential and industrial installations with specific software.		
	He/She is able to interface with the data-base system using specific software.		
	He/She is able to diagnose problems of the system and suggest the most appropriate interventions (solutions).		
	He/She is able to fully wire up, plan and configure electronic and/or electrical network systems.		



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<b>2. Inspecting, maintaining and servicing electrical and/or electronic systems and machinery</b>	<p>He/She is able to carry out basic and scheduled maintenance tasks, inspections and checks at electrical and/or electronic equipment according to maintenance schedules and predefined instructions (e.g. checking voltage tolerances, changing wearing parts in industrial plants, switching and control systems, electrical machinery, computer systems).</p> <p>He/She is able to use the measuring and testing tools necessary for it.</p>	<p>He/She is able to carry out and document preventative maintenance and alignment tasks at electrical and/or electronic industrial appliances and systems according to established methods of the quality assurance (e.g. continuous monitoring of a CNC machine tool).</p>	<p>He/She is able to analyse and determine availability and condition of electrical and/or electronic systems.</p> <p>He/She is able to analyse influencing factors on reliability and performance of electrical/electronic systems and find causes of malfunctions (e.g. leakage current analysis, power factor correction, EMC analysis).</p>	<p>He/She is able to develop and document maintenance and inspection methods for electrical/electronic systems based on production and service process analysis as well as on quality management and customer requirements.</p> <p>He/She is able to develop related maintenance, inspection and quality assurance plans (e.g. optimizing MTBF of a production line, planning reserve power supply).</p>
	<b>Partial competences/ Learning outcomes:</b>			
	<p>He/She is able to carry out the standard maintenance tasks required for a device.</p>			
	<p>He/She is able to show the benefits of a proper maintenance.</p>			
	<p>He/She is able to document the results in existing maintenance plans.</p>			
	<p>He/She is able to detect worn parts and to replace them.</p>			
	<p>He/She is able to use basic measuring and testing tools.</p>			



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	<b>Partial competences/ Learning outcomes:</b>			
	He/She is able to carry out the preventative maintenance tasks.			
	He/She is able to fulfill the required quality standards.			
	He/She is able to use document tools for the preventative maintenance tasks.			
	He/She is able to adjust parameters of electrical and or electronic industrial appliance systems for proper function of devices.			
	He/She is able to apply corrective action according to the results of measurement tools.			



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	<b>Partial competences/ Learning outcomes:</b>			
	<p>He/She is able to use proper tools to analyse and determine availability of electrical/electronic systems.</p>			
	<p>He/She is able to estimate lifetime and/or downtime of electrical/electronic devices.</p>			
	<p>He/She is able to analyse existing electrical/electronic systems, to find causes of malfunctions and determine availability and condition of the system.</p>			
	<p>He/She is able to point out influencing factors on the reliability of electrical/electronic systems.</p>			
	<p>He/She is able to distinguish which parameters should be adjusted according to the influencing factors on the reliability of electrical/electronic systems.</p>			



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	<b>Partial competences/ Learning outcomes: not covered by consortium</b>			



## THEME Competence Matrix - Electrical Engineering/Electronics with Partial competences/ Learning outcomes



<b>3. Setting up, putting into operation and adjusting electrical and/or electronic systems</b>	He/She is able to set up, adjust and put into operation electrical and/or electronic systems (e.g. allocating frequency channels for a TV set, basic settings of a frequency converter or a thermo relay for a motor) following customer requirements and instructions from the technical documentation.	He/She is able to obtain and set system test parameters for set up and operation of electrical and electronic systems, select and carry out test procedures for installation and adjustment (e.g. adjusting interfaces in multimedia system, sensitivity setting of alarm equipment, elevator control unit).	He/She is able to select, set up and adjust electrical and/or electronic systems and their control units including accompanying sensors and actuators according to requirement analysis (e.g. energy supply systems, drive systems, electrical machinery, radio relay systems).
	<b>Partial competences/ Learning outcomes:</b>		
	He/She is able to capture the basic requirements or preferences of the customer and carry them out according to common technical standards.		
	He/She is able to explain different possible solutions to a customer.		
	He/She is able to advise the customer on the best solution for the occurring problem.		
	He/She is able to use the instruction from the technical documentation for the setup, adjusting and put into operation.		
	He/She is able to select the equipment, tools and measurement instruments needed to fulfill the setup, adjusting and put into operation of the system.		
	He/She is able to setup, put into operation and adjust in a structured way.		





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	<b>Partial competences/ Learning outcomes:</b>		
	<p>He/She is able to define the system's required measurement performances.</p>		
	<p>He/She is able to select the appropriate equipment based on the specifications, the defined system measurement performance according to common technical standards.</p>		
	<p>He/She is able to setup and verify the test system.</p>		
	<p>He/She is able to measure\obtain the system parameters during setup and operation.</p>		
	<p>He/She is able to verify system performance overtime and define a time schedule for parameter testing according to common technical standards.</p>		
	<p>He/She is able to fill out any required compliance form.</p>		



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	<b>Partial competences/ Learning outcomes:</b>		
	He/She is able to select electrical and/or electronic systems and their control units according to requirement analysis.		
	He/She is able to select sensors and actuators according to requirement analysis.		
	He/She is able to set up electrical and/or electronic systems and their control units according to requirement analysis.		
	He/She is able to setup sensors and actuators according to requirement analysis.		
	He/She is able to adjust electrical and/or electronic systems and their control units according to requirement analysis.		
	He/She is able to adjust sensors and actuators according to requirement analysis.		



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<b>4. Designing, modifying and adapting wirings and circuit boards for electrical and/or electronic systems including their interfaces</b>	He/She is able to modify, plan and build up simple electrical/electronic circuits according to standards and guidelines (e.g. wiring for rooms, connection diagram of basic motor circuits, simple operational amplifier applications, small programmable control units).	He/She is able to modify, plan and build up standard electrical/electronic appliances according to customer requirements and official regulations (e.g. fire-warning devices, layouts for electrical/electronic wirings with the help of CAD programmes, energy supply in private and business premises).	He/She is able to design, build up and improve electrical/electronic applications and its interfaces according to emc standards and confirming test (e.g. electronic control circuits and equipment, microcontroller applications, PLC and related software).  He/She is able to do this in cooperation with experts working in interdisciplinary teams.	He/She is able to design, build up and configure devices and facilities, units for process control systems including related programming and considering complex system requirements (e.g. controlled drive systems, process monitoring, automated production line, real time microcontroller applications for car control, GSM data transmission for monitoring and remote control).
	<b>Partial competences/ Learning outcomes:</b>			
	He/She is able to analyze existing simple electrical/electronic circuits.			
	He/She is able to carry out small changes in existing simple electrical/electronic circuits according to technical standards.			
	He/She is able to select common components to realize the functionality of simple electrical/electronic circuits.			
	He/She is able to draw simple designs of electrical/electronic circuits.			
	He/She is able to carry out the appropriate method or process to create the electrical/electronic circuits.			



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<b>4. Designing, modifying and adapting wirings and circuit boards for electrical and/or electronic systems including their interfaces</b>	He/She is able to modify, plan and build up simple electrical/electronic circuits according to standards and guidelines (e.g. wiring for rooms, connection diagram of basic motor circuits, simple operational amplifier applications, small programmable control units).	He/She is able to modify, plan and build up standard electrical/electronic appliances according to customer requirements and official regulations (e.g. fire-warning devices, layouts for electrical/electronic wirings with the help of CAD programmes, energy supply in private and business premises).	He/She is able to design, build up and improve electrical/electronic applications and its interfaces according to emc standards and confirming test (e.g. electronic control circuits and equipment, microcontroller applications, PLC and related software).  He/She is able to do this in cooperation with experts working in interdisciplinary teams.	He/She is able to design, build up and configure devices and facilities, units for process control systems including related programming and considering complex system requirements (e.g. controlled drive systems, process monitoring, automated production line, real time microcontroller applications for car control, GSM data transmission for monitoring and remote control).
	<b>Partial competences/ Learning outcomes:</b>			
	He/She is able to analyze existing standard electrical/electronic appliances.			
	He/She is able to carry out changes in existing standard electrical/electronic appliances according to customer requirements and technical standards.			
	He/She is able to select common components to realize the functionality of electrical/electronic appliances.			
	He/She is able to draw standard designs by using CAD of electrical/electronic appliances.			
	He/She is able to carry out the appropriate method or process to create the electrical/electronic appliances.			



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	<b>Partial competences/ Learning outcomes: not covered by consortium</b>			



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<b>5. Developing custom designed electrical and/or electronic projects</b>	He/She is able to develop and propose solutions for simple electrical/electronic system based on customer requirements (e.g. lighting installations, power supply unit, basic automation and control systems).	He/She is able to design electrical/electronic systems (e.g. PLC program for industrial applications, microcontroller application, ensuring expansion capability) and provide the necessary documentation (operational, maintenance, safety instructions, function, integration and acceptance tests).	He/She is able to develop technical solutions for electrical and/or electronic systems and applications (e.g. microcontroller board for heating and air condition, RFID access system, new production line...) and provide appropriate documentation and customer training.
	<b>Partial competences/ Learning outcomes:</b>		
	He/She is able to select simple electrical/electronic components, devices and/or systems according to client preferences.		
	He/She is able to customize a simple electrical/electronic system according to client preferences.		
	He/She is able to develop customized solutions for simple electrical/electronic system based on customer requirements.		
	He/She is able to explain solutions for simple electrical/electronic systems to a customer based on a client's criteria.		
	He/She is able to realize the whole process of designing, building and implementing on simple electrical/electronic systems.		



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<b>5. Developing custom designed electrical and/or electronic projects</b>	<p>He/She is able to develop and propose solutions for simple electrical/electronic system based on customer requirements (e.g. lighting installations, power supply unit, basic automation and control systems).</p>	<p>He/She is able to design electrical/electronic systems (e.g. PLC program for industrial applications, microcontroller application, ensuring expansion capability) and provide the necessary documentation (operational, maintenance, safety instructions, function, integration and acceptance tests).</p>	<p>He/She is able to develop technical solutions for electrical and/or electronic systems and applications (e.g. microcontroller board for heating and air condition, RFID access system, new production line...) and provide appropriate documentation and customer training.</p>
	<b>Partial competences/ Learning outcomes: not covered by consortium</b>		
<b>6. Supervising and supporting work and business processes including quality management</b>	<p>He/She is able to check process steps in the production with suitable process tools (e.g. PPS, ERP, MRP) and carry out quality controls.</p>	<p>He/She is able to evaluate results of the process monitoring with software tools and determine quality assurance actions (work, production and time schedules).</p>	<p>He/She is able to develop controlling methods in the production (PPS, MRP, ERP) and in process planning/control and supervision (CAP) and implement these with the help of software supported systems.</p>
	<b>Partial competences/ Learning outcomes: not covered by consortium</b>		



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<b>7. Installing, configuring modifying and testing of application software for set-up and operation of electrical and/or electronic systems</b>	He/She is able to install programmes for hardware and software environments and carry out simple configuration tasks as well as updates (e.g. starter software, graphical programming for measurement and automation).	He/She is able to select hardware and software for production systems following the business requirements and test programmes.	He/She is able to integrate hardware and software into existing system environments and use simulation and diagnostic programmes (e.g. implement and adapt a driver for a CAD/CAM interface).	He/She is able to combine hardware and software to networked system environments and carry out network specific checks of all signals and adapt by means of software (e.g. OPC-Server, process control system).
	<b>Partial competences/ Learning outcomes:</b>			
	He/She is able to establish connections between hardware devices.			
	He/She is able to install operating systems and application software.			
	He/She is able to carry out basic virus checks.			
He/She is able to carry out simple configuration tasks necessary to adapt software and/or hardware environments for specific needs.				





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	<b>Partial competences/ Learning outcomes:</b>			
	He/She is able to analyze the requirements of production systems.			
	He/She is able to take into account the business requirements concerning the choice of hardware and software.			
	He/She is able to take into account the test programs concerning the choice of hardware and software.			
	He/She is able to choose the appropriate hardware and software for a specific production system.			



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	<b>Partial competences/ Learning outcomes: not covered by consortium</b>			



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<b>8. Diagnosing and repairing of electrical/electronic systems and equipment</b>	He/She is able to carry out standardized test procedures and diagnostic methods using wiring diagrams and test tools and carry out simple repairs at electrical/electronic systems (e.g. power measurement, level measurement).	He/She is able to use testing and diagnostic tools as well as expert systems for the fault diagnosis at electrical/electronic systems up to the component level and carry out the necessary repairs (e.g. software control test, spectrum analyser).	He/She is able to select and use diagnostic methods for complex electrical/ electronic systems and carry out preventative measures for the avoidance of disturbances and malfunctions in arrangement with customers (e.g. detection of bit error rate, overvoltage protection analyse).	He/She is able to carry out system analyses (FMEA, FTA etc.) of electrical/ electronic systems, determine error types and develop suitable diagnosis and repair methods.
	<b>Partial competences/ Learning outcomes:</b>			
	He/She is able to analyze the existing installations with help of wiring diagrams.			
	He/She is able to process functional tests by using standardized test procedures.			
	He/She is able to carry out measurements for fault finding and select the appropriate measurements method for fault finding.			
	He/She is able to choose appropriate repair method depending on the results of the measurements.			
	He/She is able to perform simple repairs on electrical and or electronic systems.			



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