



Australian Government

MEM234011 Design programmable logic controller applications

Release: 1

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Modification History

Release 1. Supersedes and is equivalent to MEM234011A Design programmable logic controller applications.

Application

This unit of competency defines the skills and knowledge required to design an engineering application using a programmable logic controller (PLC). It includes consideration of sustainability implications, work health and safety (WHS) and automation safety.

The client may be internal or external to the designer's organisation.

The unit applies to the control of machines, equipment or processes that can have thermodynamic, hydrodynamic, fluid power or mechanical system elements using a PLC. Control functions can be digital and analog and can also include feedback. Network and remote control can also be used.

The unit is suitable for mechatronics and automated systems designers, systems maintenance, machine and process control, or computer-integrated manufacturing (CIM) designers. Design activities can also include reverse engineering and design rectification or modifications of an existing design.

Individuals completing this work either already have or are developing skills and experience in the evaluation of PLC systems, application of computing, controllers, mathematics, and basic electrical and electronics safety procedures.

Additionally, experience in mechanical, fluid power, thermodynamic, manufacturing methods and processes may be required by particular system designs.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

Nil

Competency Field

Engineering science

Elements and Performance Criteria

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>

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1. Clarify client brief or contract requirements	1.1 Establish the required features and functions of the application and establish control requirements in consultation with the client 1.2 Determine technical, commercial and environmental parameters of the brief or contract 1.3 Determine stakeholders to be consulted in the design and application process 1.4 Provide initial advice to client on the feasibility of the project
2. Prepare concept proposal	2.1 Carry out initial investigations and measurements 2.2 Carry out required modelling or simulations and calculations using appropriate software and validation techniques 2.3 Generate PLC application solutions that respond to the brief 2.4 Check feasibility and evaluate solutions against design criteria, ensuring conformity to WHS, regulatory, sustainability and environmental requirements 2.5 Prepare a PLC proposal that can include results of feasibility study, consideration of expert opinion, initial calculations and modelling, and the use of judgment and discretion 2.6 Review concept proposal with client and select preferred solution
3. Design PLC control application	3.1 Finalise selected control application design to meet design brief 3.2 Provide documentation, drawings, specifications and instructions 3.3 Consult with client and stakeholders to obtain sign-off on design 3.4 Monitor installation and commissioning with stakeholders, and make any necessary modifications

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.	
Parameters of the brief include:	• design of new equipment or fault analysis, rectification or modification to an existing design • determination of the degree of innovation and creativity expected by the client • design process limits and budgets • product cost limits and budgets • performance specifications • equipment availability, capacities and restrictions • specified administrative, communication and approval procedures • other special features and limits in the design brief.
PLC solutions include:	• input/output (I/O) capacity • I/O module types: • discrete • special • signal conditioning • interface requirements • control functions • system integration • communication protocols • automation safety • network topology • programming languages.
Applications include:	• control of machines, equipment or processes that can have thermodynamic, hydrodynamic, fluid power or mechanical system elements • control functions: • digital • analog • feedback loops • communications networks and remote control.
WHS, regulatory, sustainability and environmental issues include:	• WHS acts and regulations and relevant standards • industry codes of practice • risk assessments • registration requirements • safe work practices • minimising ecological and environmental footprint of process, plant and product

	• maximising economic benefit of process plant and product to the organisation and the community • minimising the negative WHS impact on employees, community and customer • state and territory regulatory requirements.
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Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM234011A Design programmable logic controller applications.

Links

Companion Volume Implementation Guides are available on VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b7050d37-5fd0-4740-8f7d-3b7a49c10bb2>

Assessment Requirements for MEM234011 Design programmable logic controller applications

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include:

- interpreting features and functions of the application and parameters of the brief or contract
- determining sustainability, automation safety, work health and safety (WHS), regulatory and risk management requirements
- researching latest trends and techniques in application of programmable logic controllers (PLCs), PLC functions and programming options, and in reverse engineering
- investigating, measuring, modelling and calculating for options
- investigating faults in existing designs and produce solutions
- generating and evaluating solutions
- designing PLC system solution on at least two occasions
- implementing systems thinking, continuous improvement and constraint and contingency management
- prototyping and systematically programming and testing actuators and interfaces, input sensors and/or transducers, communications and network connections, human machine interfaces (HMIs) and graphical user interfaces (GUIs)
- selecting actuators, interfaces, microcontroller, sensors and/or transducers, signal conditioning, HMIs, communication and network software and connections, on at least two occasions
- ensuring automation safety using appropriate licensed technical and professional assistance
- communicating, negotiating and reviewing with stakeholders and client throughout the process to obtain agreement on proposal and sign-off on design
- documenting design with drawings, specifications and instructions.

Note: Where a volume and/or frequency is not specified, demonstration must be provided at least once.

Knowledge Evidence

Evidence required to demonstrate the required knowledge for this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include knowledge of:

- contemporary engineering PLC application design methods
- automation fundamentals, including mechanical, electrical, electronic and information technologies, sensors and transducers, controllers, interfacing and signal conditioning, networking, software, data sharing and control functions
- features and capability of plant, equipment, controllers, software, network and communication systems
- WHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
- processes for investigation, developing options, modelling and calculating, generating solutions, completing feasibility and evaluation studies, and preparing proposals
- use of techniques for:
 - continuous improvement
 - problem-solving and decision-making
 - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis
- communications and control systems standards, protocols and programming
- system logic as flow charts and state diagrams
- specifications for inputs/outputs (I/O).

Assessment Conditions

- Assessors must:
 - have vocational competency in designing programmable logic controller applications at least to the level being assessed with relevant industry knowledge and experience
 - satisfy the assessor requirements in the *Standards for Registered Training Organisations 2015 or its replacement* and comply with the *National Vocational Education and Training Regulator Act 2011*, its replacement or equivalent legislation covering VET regulation in a non-referring state/territory as the case requires.
- Where possible assessment must occur in operational workplace situations. Where this is not possible or where personal safety or environmental damage are limiting factors, assessment must occur in a sufficiently rigorous simulated environment that reflects realistic operational workplace conditions that cover all aspects of workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.
- Conditions for assessment must include access to all tools, equipment, materials and documentation required including relevant workplace procedures, product and manufacturing specifications.
- Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.
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