



Australian Government

MEM23116 Evaluate programmable logic controller and related control system component applications

Release: 1

MEM23116 Evaluate programmable logic controller and related control system component applications

Modification History

Release 1. Supersedes and is equivalent to MEM23116A Evaluate programmable logic controller and related control system component applications.

Application

This unit of competency defines the skills and knowledge required to evaluate automated devices, machines and processes controlled by programmable logic controllers (PLCs). It includes basic PLC architecture, associated control system components and programming techniques, work health and safety (WHS) compliance requirements, risk management, automation safety, networking for data sharing and remote control, and broad implications of wiring rules.

This unit applies to evaluations of PLCs and their use in engineering applications. The evaluation can be undertaken as part of a PLC selection process or to assess PLC and control system condition or efficiency.

It is suitable for people working as automation, mechatronics or maintenance technicians or for those pursuing qualifications or careers in those disciplines.

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

Pre-requisite Unit

MEM23004 Apply technical mathematics

MEM23111 Select electrical equipment and components for engineering applications

MEM23112 Investigate electrical and electronic controllers in engineering applications

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>
1. Determine scope of evaluation	1.1 Confirm and apply safe electrical working practice 1.2 Review the currents and voltages present in the PLC applications

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
	and check for regulatory requirements and dangerous high currents and voltages, including effects on humans and on application equipment and components 1.3 Identify WHS and regulatory requirements codes of practice, standards, risk management and organisational procedure, including those for automation safety 1.4 Determine requirement for PLC and related control system components 1.5 Ensure appropriate support, including licensed electrical, technical and professional assistance, is available 1.6 Determine software and software techniques for analysis and graphics required by the evaluation task 1.7 Identify stakeholders to be consulted on evaluation 1.8 Investigate sustainability implications of PLC applications
2. Establish existing features of PLC applications	2.1 Review the functions and features of devices, machines and processes controlled by PLCs 2.2 Identify features and functions of PLC systems and components 2.3 Review PLC programming and functions 2.4 Identify system integrating principles and techniques, signal conditioning and power interfacing 2.5 Identify networking and system supervision, data acquisition and supervisory control options
3. Evaluate PLC applications	3.1 Determine suitability of components of application including sensor or transducers, PLC and output devices, signal conditioning and interfacing 3.2 Establish suitability of controller functions, PLC software and programming 3.3 Determine suitability of network, supervisory control and data acquisition (SCADA) communications protocols, standards and network topologies, human-machine interfaces (HMIs) and graphical user interfaces (GUIs) used by applications 3.4 Evaluate compliance of application with WHS and regulatory requirements, codes of practice, standards and risk management procedures

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
4. Report results	4.1 Record results of evaluation in accordance with procedures 4.2 Provide documentation including layouts, programs and flow charts or state diagrams and files

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.

PLC applications include:	• motor controllers, fault detectors and power controllers • multi-axis machine control • process automation • packaging, for shrink-wrapping, labelling and palletising • utilities, for water and effluent treatment • industrial distributed control system • amusement rides • agricultural machine and irrigation controllers • military and aerospace automation (except aircraft systems) • mineral and chemical, and petroleum processing.
PLC software and programming language includes:	• ladder diagram (LD) - graphical • function block diagram (FBD) - graphical • structured text (ST) - textual • instruction list (IL) - textual • sequential function chart (SFC) - elements to organise programs for sequential and parallel control processing. Note: PLC programming language standards can comply with IEC

	61131-3 or other standards.
Appropriate technical and professional assistance includes:	- technical support and advice relating to elements which have intrinsic dangers including: - high pressure - energised fluid vessels - high temperatures and heat energy capacity - wiring with high current control voltages above extra low voltage - professional support for technologies include: - specialised electric motor drives and controllers - specialised materials, plastics, metal alloys and nano materials - special processes, foundry, alloy welding, heat treatment, sealing and fastening.
WHS, regulatory requirements and organisational procedures include:	- WHS acts, regulations and relevant standards - codes of practice from Australian and overseas engineering and technical associations and societies - risk assessments - registration requirements - safe work practices - state and territory regulatory requirements.
Automation safety includes:	- emergency stop - failsafe design - redundancy - interlocks - data integrity.
Data and communications protocols and standards include:	- layered communications and networking protocols including Open Systems Interconnection (OSI Model) – seven layers - TCP/IP Internet Protocol Suite {Transmission Control Protocol (TCP) and the Internet Protocol (IP)} – four or five layers - IEEE 802 Wireless PAN, LAN, MAN and WPAN standards - interface standards, including RS232 and RS485, Fieldbus, Modbus and DNP3.0.
Network topologies include:	- daisy-chain - star - ring - branch - linear - tree - wired and wireless options.
Sustainability includes:	- meeting all regulatory requirements - conforming to all industry covenants, protocols and best practice

	guides • 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.
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Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM23116A Evaluate programmable logic controller and related control system component applications.

Links

Companion Volume implementation guides are found in VETNet -

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

Assessment Requirements for MEM23116 Evaluate programmable logic controller and related control system component 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:

- identifying and assessing compliance with work health and safety (WHS) and regulatory requirements, and risk management procedures
- reviewing dangers and effects of electricity on humans
- identifying programmable logic controllers (PLC) related systems and components, integrating principles and techniques
- assessing suitability of programming
- investigating sustainability implications of PLC applications
- assessing and applying basic electrical and electronic control principles, controller programming principles and techniques, software basic analysis and graphics skills and techniques on at least two occasions
- evaluating components of applications against application specifications for safety, economy and fitness for purpose on at least two occasions
- reporting and documenting results of evaluation, including layouts, programs and flow charts or state diagrams and files.

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:

- features of PLC and related control system component applications used in engineering environments
- effects of electricity on humans, dangerous high currents and voltages and automated systems, regulatory requirements related to extra low, low and high voltage applications
- relevant compliance requirements of WHS, regulations, codes of practice, standards, and risk assessment requirements for integrated manufacturing systems with emphasis on automation safety
- appropriate technical and professional assistance
- PLC software and programming language

- hardware functions, options and integration into plc and related control systems
- input devices and sensors
- output devices/actuators
- PLCs
- interfacing and signal conditioning
- data and communications protocols and standards
- communications and networking options for devices
- HMIs and GUIs
- PLC architecture
- input/output (I/O) functions and arrangements
- typical input signals and sensor and transducers
- shielding and twisted pairing for noise mitigation
- calibration techniques
- reading of discrete levels from analog input data (other analog I/O functions not required by this unit)
- input signal conditioning

digitally driven output devices and interface requirements power supply programming techniques and options.

Assessment Conditions

- Assessors must:
 - have vocational competency in evaluating programmable logic controller and related control system component 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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