Australian Government

MEM23112A Investigate electrical and electronic controllers in engineering applications

Release: 1

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

MEM23112A Investigate electrical and electronic controllers in engineering applications

Modification History

Release 1 - New unit. Replaces MEM23051A, but not equivalent.

Unit Descriptor

This unit of competency covers investigation of new or existing controllers for suitability in automated systems used in engineering applications. The unit includes the application of fundamental controller programming techniques and control system power supply requirements, basic programmable logic controller (PLC), microcontroller and system control and data acquisition (SCADA) applications.

Application of the Unit

The unit applies to controllers used in automated systems in industry. Typical applications of the unit include assessing the ongoing suitability of existing controllers, programming of PLCs, adjustments to controllers for new equipment or products, and condition monitoring. It is suitable for people working as automation or mechatronics technicians and for people using the services of electrical and control systems technicians. It is suitable for those pursuing careers and qualifications in mechatronic or automated system design and maintenance.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23111A	Select electrical equipment and components for engineering applications

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element.

Elements and Performance Criteria

1	Determine scope of electro and controller operation	1.1	Assess current or proposed controller context for electrical and automation safety and risks
		1.2	Identify potential or actual dangerous high currents and voltages and check for regulatory compliance requirements related to extra low, low and high voltage applications
		1.3	Identify work health and safety (WHS) and regulatory requirements with particular emphasis on automation safety, codes of practice, standards, risk management and organisational procedures
		1.4	Identify stakeholders to be consulted on investigation task
		1.5	Investigate software and software techniques required for basic analysis and graphics required for controller investigation task
		1.6	Ensure appropriate support, including licensed electrical, technical and professional assistance is available
2	Review functions and features needed in controller application	2.1	Use analytical and graphical software, as required, to review controller application and function
		2.2	Validate software results
		2.3	Undertake instrument readings, as required

3	Program controllers and SCADA applications for required functions	3.1	Program controller as required for required sequencing and actuations for applications
		3.2	Develop simple SCADA applications for required interactions with inputs and outputs of controllers
4	Report results	4.1	Record outcomes of investigation, evaluation and application
		4.2	Provide documentation, such as calculations, diagrams, programs and files

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

Required skills include:

- identifying parameters and context of tasks, WHS, regulatory requirements, risk management and organisational procedures
- reviewing effects of electricity on humans, dangerous high currents and voltages and automated systems, regulatory requirements related to extra low, low and high voltage applications, and relating these to electrical and electronic applications in engineering
- reviewing sustainability implications of functions and features of devices, machines, controllers, interfaces, signal conditioning and networks programming and interfacing of PLCs, including sequencing two or more actuations with start, stop and actuation motion confirmation signals
- ensuring safe electrical working practice, including use of licensed personnel
- describeing information flow and control as a flowchart
- reporting and documenting results of investigation, evaluation and application, calculations, diagrams, programs and files

Required knowledge

Required knowledge includes:

- the effects of electricity on humans
- electrical laws:
  - Ohm's law
  - Kirchhoff's voltage and current laws
  - analogies with hydraulics, pressure drop and continuity
- automated systems and mechatronic devices (Note: This unit does not include design or modification of interfacing with these devices)
- common software requirements of control systems, including SCADA, distributed control systems (DCS) and programming
- PLC and microcontroller basic programming functions
- SCADA, including basic editing and programming techniques
- documentation techniques, circuit diagrams, programs and applications
- specifications for hardware applicable to controller techniques in engineering

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Overview of assessment	A person who demonstrates competency in this unit must be able to apply controller principles to ensure safe practice, assist with systems development, component selection and maintenance and broadly evaluate electrical, electronic and controller features and functions. This includes working individually and as part of a team and recognising and complying with normal control procedures on engineering projects.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: • identify and apply WHS, regulatory and risk management procedures • review dangers and effects of electricity on humans • identify effects and dangers of electricity, automated systems and specialist requirements, such as licensing related to technical work • confirm personal functions and responsibilities and that of team and support functional group • review sustainability implications, functions and features of controllers and related devices, machines and systems • assess and apply basic electrical and electronic control principles, controller programming principles and techniques to simple machine control functions • ensure safe electrical working practice • ensure clear and logical process of analysis • report and document results.
Context of and specific resources for assessment	• This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. • Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.

	• Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.
Method of assessment	• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package. • Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge. • Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application. • Assessment may be applied under project-related conditions (real or simulated) and require evidence of process. • Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances. • Assessment may be in conjunction with assessment of other units of competency where required.
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Controllers	Controllers may be: • PLCs • microcontrollers • DCS • SCADA • other systems and equipment, including proprietary equipment

Controller tasks	Controller tasks covered by this unit include, but are not limited to: • determining WHS, regulatory, risk management and automation safety requirements • programming and interfacing a PLC capable of sequencing two or more actuations with start, stop and actuation motion confirmation signals • developing a simple SCADA application capable of interacting with inputs and outputs of PLCs and/or microcontrollers
Automation safety	Automation safety refers to the reliance on emergency stop, failsafe design, redundancy, interlocks and data integrity

Appropriate licensed trade, technical and professional assistance	Appropriate licensed trade, technical and professional assistance may include:
	• availability of licensed electrical tradespersons for work covered by electrical licensing regulations
	• technical support and advice relating to elements which have intrinsic dangers, such as:
	  • 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 may include:
	  • specialist electric motor drives and controllers
	  • specialist materials, plastics, metal alloys and nano materials
	  • special processes, foundry, alloy welding, heat treatment, sealing and fastening

WHS, regulatory requirements and enterprise procedures	WHS, regulatory requirements and enterprise procedures may include: • WHS Acts and regulations • 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 applying to electrical work

Sustainability	Sustainability is used to mean the entire sustainable performance of the organisation/plant, including: • 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
Standards and codes	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular task

Unit Sector(s)

Competency field

Unit sector Engineering science

Custom Content Section

Not applicable.