MEM234011A Design programmable logic controller applications

Release: 1

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Modification History

New unit

Unit Descriptor

This unit of competency covers the design of an engineering application using a programmable logic controller (PLC). It includes sustainability implications, occupational health and safety (OHS) and automation safety.

Application of the Unit

This unit applies to the control of machines, equipment or processes that may have thermodynamic, hydrodynamic, fluid power or mechanical system elements using a PLC. Control functions may be digital and analog and may include feedback. Network and remote control may 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 may also include reverse engineering, and design rectification or modifications of an existing design.

Prior experience in the evaluation of PLC systems, application of computing, controllers, mathematics, and basic electrical and electronics safety procedures is required. Additionally, experience in mechanical, fluid power, thermodynamic, manufacturing methods and processes may be required by particular system designs.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

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. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

1	Clarify client brief or contract requirements	1.1	Establish, in consultation with the client, the required features and functions of the application and establish control requirements
		1.2	Determine technical, commercial and environmental parameters to 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 a range of PLC application solutions
		2.4	Check feasibility and evaluate solutions against design criteria ensuring conformity to OHS, regulatory, sustainability and environmental requirements
		2.5	Prepare a PLC proposal that may 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
		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, when required, and make any necessary modifications

Required Skills and Knowledge

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

Required skills

Required skills include:

- determining the features and functions of the PLC application, including OHS, regulatory and risk management requirements
- interpreting parameters to the brief or contract
- researching latest trends and techniques in application of PLCs, PLC functions and programming options
- researching latest trends and techniques in reverse engineering
- investigating and measuring, modelling and calculating for options
- investigating faults in existing designs and arriving at solutions
- prototyping and systematically programming and testing actuators and interfaces, input sensor/transducers, communications and network connections, human machine interfaces (HMIs) and graphical user interfaces (GUIs)
- generating a range of solutions and evaluating them for feasibility against design criteria, engineering practice and financial analysis
- selecting actuators, interfaces, microcontroller, sensor/transducers, signal conditioning, HMIs, communication and network software and connections, if required
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design
- documenting design with drawings, specifications and instructions

Required knowledge

Required knowledge includes:

- contemporary engineering PLC application design methods
- automation fundamentals, including mechanical, electrical, electronic and information technologies, sensor/transducers, controllers, interfacing and signal conditioning, networking (if required), software, data sharing and control functions
- features and capability of plant, equipment, controllers, software, network and communication systems
- OHS and regulatory requirements, codes of practice, standards, risk management and registration requirements
- processes for investigation, developing options, modelling and calculating, generating a range of 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)

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.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: • interpret features and functions of the application and parameters to the brief or contract • determine sustainability, automation safety, OHS, regulatory and risk management • research and test system components • investigate and measure, model and calculate for options • generate and evaluate a range of solutions • design PLC system solution • implement systems thinking, continuous improvement and constraint and contingency management • select system components • prototype and systematically program and test system component function • ensure automation safety, using appropriate licensed technical and professional assistance • communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design • document design with drawings, specifications and instructions.
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, that is, the candidate is not in productive work, 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 its 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 able not only 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.

Client	Client may be:
	• internal or external to the designer's organisation
Parameters to the brief	The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include:
	• 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	PLC solutions may include consideration of:
	
	• 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	Applications may include:
	
	• control of machines, equipment or processes that may have thermodynamic, hydrodynamic, fluid power or mechanical system elements
	• control functions:
	   • digital
	   • analog
	   • feedback loops
	• communications networks and remote control

OHS, regulatory, sustainability and environmental issues	OHS, regulatory, sustainability and environmental issues may include: • OHS Acts and regulations • 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 OHS impact on employees, community and customer • state and territory regulatory requirements

Unit Sector(s)

Manufacturing Skills Australia

Engineering practice

Custom Content Section

Not applicable.