Australian Government

Department of Education, Employment and Workplace Relations

UEENEEI154A Design and use advanced programming tools PC networks and HMI Interfacing

Release: 1

INDUSTRY SKILLS COUNCILS
Creating Australia's Future

UEENEEI154A Design and use advanced programming tools PC networks and HMI Interfacing

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor	**1) Scope:**
	1.1) Descriptor
	This unit covers the design of computer application for control processes. It encompasses apply knowledge of control devices, control systems, programmable logic controllers, supervisory control and data acquisition systems and control programming methods, developing alternative design schemes based on design brief, customer relations and documenting designs.

Application of the Unit

Application of the Unit	**2)**
	This unit is intended to augment formally-acquired competencies. It is suitable for employment-based programs under an approved contract of training. It applies to any formal recognition for this standard at the aligned AQF 6 level.

Licensing/Regulatory Information

License to practice	**3)**
	The skills and knowledge described in this unit do not require a license to practice in the workplace. However, practice in this unit is subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.

Pre-Requisites

Prerequisite Unit(s)	**4)**

Competencies	**4.1)**

Granting competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

UEENEEI151A	Develop, enter and verify word and analog control programs for programmable logic controllers.

For the full prerequisite chain details for this unit please refer to Table 2 in Volume 1, Part 2

Literacy and numeracy skills	**4.2)**

Participants are best equipped to achieve competency in this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 'Literacy and Numeracy'

Reading	5	Writing	5	Numeracy	5

Employability Skills Information

Employability Skills	**5)**

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a competency standard unit

Performance Criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the Evidence Guide.

Elements and Performance Criteria

ELEMENT		PERFORMANCE CRITERIA	
1	Prepare to design engineering computer applications.	1.1	OHS processes and procedures for a given work area are identified, obtained and understood.
		1.2	Established OHS risk control measures and procedures are followed in preparation for the work.
		1.3	The extent of the proposed control system is determined from the design brief or in consultation with appropriate person(s).
		1.4	Design development work is planned to meet scheduled timelines in consultation with others involved on the work site.
2	Develop engineering computer applications design.	2.1	Knowledge of control devices, control systems and control programming methods are applied to the design.
		2.2	Alternative concepts for the design are tested based on the requirements outlined in the design brief. (Note)
		2.3	Safety, functional and budget considerations are incorporated in the design.
		2.4	System design draft is checked for compliance with the design brief and regulatory requirements.
		2.5	System design is documented for submission to appropriate person(s) for approval.
		2.6	Solutions to unplanned situation are provided consistent with organisation's

ELEMENT	PERFORMANCE CRITERIA	
		policy.
3 Obtain approval for engineering computer applications design.	3.1	System design is presented and explained to client representative and/or other relevant person(s).
	3.2	Requests for alterations to the design are negotiated with relevant person(s) within the constraints of organisation's policy.
	3.3	Final design is documented and approval obtained from appropriate person(s).
	3.4	Quality of work is monitored against personal performance agreement and/or established organisational or professional standards.

Note.
Design concepts should be tested by real or virtual prototyping where it cannot be shown easily by other means that particular aspects of the design meet specified requirements

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

8) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and designing a computer based control system.

All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

KS01-EI154A   PLC system applications

Evidence shall show an understanding of PLC system applications to an extent indicated by the following aspects:

a) Alternative/enhancing programming methods

b) System diagnostics techniques.

c) Control loops encompassing:

Regulated loop control

Proportional / integral /derivative (PID) control

Applications of PID control

Methods used to achieve PID control using a PLC

d) Specialist instructions - interrupt driven applications, high speed counters, positional encoders

e) Communications methods and requirements encompassing:

Common protocols and interface standards

Requirements when networking/interfacing PLC's

Communication mediums

Network types and topologies

Hierarchal networks

Peer to peer networks

Handshaking

Open architecture communications

Remote I/O

f) Intelligent terminals/graphic interfaces installation and communication requirements

a) Data link layer encompassing:

Device types

Bus arbitration

Device initialisation

Synchronous / Asynchronous messaging.

Time management

Link active scheduler specific functions

b) Bus monitor encompassing:

capturing

filtering

c) Fieldbus message specification encompassing:

Virtual field device

Object dictionary

Communicate objectives

REQUIRED SKILLS AND KNOWLEDGE

Communicate services
d) High speed Ethernet encompassing:
Protocols
FDA agents
Messaging
Sessions
Time synchronisation
Redundancy

Evidence Guide

EVIDENCE GUIDE

9) This provides essential advice for assessment of the unit and must be read in conjunction with the performance criteria and the range statement of the unit and the Training Package Assessment Guidelines.
The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all parts of this unit and performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment	**9.1)**
	Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the industry-preferred model for apprenticeships. However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accordance with industry and regulatory policy.
	Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.
	The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries

risk in deeming a person competent. Sources of evidence need to be 'rich' in nature to minimise error in judgment.

Activities associated with normal everyday work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practised. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

Critical aspects of evidence required to demonstrate competency in this unit	**9.2)**

Before the critical aspects of evidence are considered all prerequisites shall be met.

Evidence for competence in this unit shall be considered holistically. Each element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines – UEE11'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
  - Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement
  - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
  - Demonstrate an understanding of the essential knowledge and associated skills as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing requirements.
  - Demonstrate an appropriate level of skills enabling employment
  - Conduct work observing the relevant Anti Discrimination legislation, regulations, polices and workplace procedures

- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Design a PLC computer based control system as described in 8) and including:

A	Develop and test PLC code using advanced programming tools
B	Program and test a continuous control loop (such as PID) using a PLC.
C	Configure and test a PLC network enabling data to be shared between PLC's.
D	Configure and test a field bus style network (remote I/O)
E	Configure a HMI using software applicable to the PLC available.
F	Dealing with unplanned events by drawing on essential knowledge and skills to provide appropriate solutions incorporated in a holistic assessment with the above listed items.

Context of and specific resources for assessment	**9.3)**

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed in this unit.

These should be used in the formal learning/assessment environment.
Note:
Where simulation is considered a suitable strategy for assessment, conditions for assessment must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.
The resources used for assessment should reflect current industry practices in relation to design a computer based control system.

Method of assessment	**9.4)**
	This unit shall be assessed by methods given in Volume 1, Part 3 'Assessment Guidelines'. Note: Competent performance with inherent safe working practices is expected in the Industry to which this unit applies. This requires assessment in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.
Concurrent assessment and relationship with other units	**9.5)**
	For optimisation of training and assessment effort, competency development in this unit may be arranged concurrently with unit: UEENEEE01 1C Manage risk in electrotechnology activities

Range Statement

RANGE STATEMENT

10) This relates to the unit as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.
This unit shall be demonstrated in relation to designing a computer based control system incorporating at least five interacting subsystems modes.

- Configure and test a PLC Peer to Peer network
- Configure and test a PLC Hierarchical network
- Configure and test a PLC field bus style network
- Develop PLC code using a structured text programming tool
- Develop PLC code using a sequential function chart programming tool
- Design a simple HMI interface using a typical touch screen device
- Use system diagnostics to fault find hardware/software issues
- Program and test a PID functional control/program block

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

Unit Sector(s)

Not applicable.

Competency Field

Competency Field   11)

Instrumentation and Control