



Australian Government

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

Release: 2

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Modification History

		UEENEEI151A	Develop, enter and verify word and analogue control programs for programmable logic controllers	
Release	Action	Core/Elective	Details	Points
2	Editorial	N/A	Show full pre-req chain in the unit.	
2	Editorial	N/A	In Pre-requisites, delete “For the full prerequisite chain details for this unit please refer to Table 2 in Volume 1, Part 2”.	
2	Editorial	N/A	In Required Skills and Knowledge, insert topic numbering.	
2	Editorial	N/A	Replace “essential knowledge and associated skills” with “required skills and knowledge”.	

Unit Descriptor

Unit Descriptor

1) Scope:

1.1) Descriptor

This unit covers development, installation and testing of programs for an industrial system requiring advance control functions. It encompasses working safely, using structure logic, acceptable design techniques, applying knowledge of high level instructions, and documenting development and programming activities.

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.

Note:

1. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control, lifting equipment. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus, site rehabilitation.
2. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting and risk safety measures.

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

Unit Code	Unit Title
UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
UEENEEI150A	Develop, enter and verify discrete control programs for programmable

Prerequisite Unit(s) 4)

logic controllers

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 develop industrial control systems programs.	1.1 OHS procedures for a given work area are identified, obtained and understood through established routines and procedures.
	1.2 Established OHS risk control measures and procedures are followed in preparation for the work.
	1.3 Mode of operation of the control system is determined from job specifications of the process/plant/machine to be controlled, and through consultation with appropriate person(s).
	1.4 Equipment, software and testing devices needed to carry out the work are obtained and checked for correct operation and safety.
	1.5 Installation of programmable controller is checked for compliance with regulations and job specification.
2 Develop and enter and programs for industrial control systems.	2.1 Established OHS risk control measures and procedures for carrying out the work are followed.
	2.2 Control solutions are developed and documented based on the operational mode and using acceptable methods for designing control system that contain numeric variables and values.
	2.3 Developed control solution is entered using a personal computer and software applicable to the programmable controller.
	2.4 Programming elements are written and used to manipulate word data. (See Note 1)
	2.5 Program control values are assigned using applicable numbering systems and codes. (See Note 2)
	2.6 Programs are written to read and write analogue signals, both with and without.

ELEMENT

PERFORMANCE CRITERIA

- | | | |
|---|--|---|
| | 2.7 | Arithmetic functions are used to scale analogue inputs to a specified engineering span. |
| | 2.8 | Arithmetic functions are used to un-scale an engineering value to drive an analogue output. |
| | 2.9 | Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes. |
| 3 | Monitor, verify and document programming activities. | <p>3.1 Device operation is tested in strict accordance OHS requirements and procedures.</p> <p>3.2 Entered instructions and settings are tested as meeting those specified for the control mode requirements.</p> <p>3.3 Appropriate methods and tools are used to test and monitor control programs and operating faults, anomalies are identified and rectified. (See Note 3)</p> <p>3.4 OHS work completion risk control measures and procedures are followed.</p> <p>3.5 Control system specification and program are documented in accordance with established procedures.</p> |

Notes.

1. Example of programming elements are loading data from discrete input switches to an internal register; manipulating internal registers using arithmetic, logical and other functions; driving outputs from internal registers; utilizing thumbwheel switches and displays; manipulating double registers with mathematical operations; loading constants, variables and presets in and out of memory; using masking of registers to obtain desired data; using tables for the storage of data.

2. Examples are binary, integer, signed integer and REAL numbering systems and codes such as BCD or ASCII

ELEMENT

PERFORMANCE CRITERIA

3. Examples of control program testing and monitoring methods and tools are locating status bits (flags); examining and modifying watchdog timer; investigating the implications of rung positioning in relation to scan and interrogating error codes.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Evidence shall show that knowledge has been acquired of safe working practices and developing, entering and verifying programs for industrial control systems using high level instructions.

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

KS01-EI151A PLC analogue and word programming

Evidence shall show an understanding of PLC analogue and word programming to an extent indicated by the following aspects:

T1. Numbering systems and codes encompassing:

- Types of numbering systems
- Codes
- Application of Codes
- Conversion between codes and numbering systems

T2. Use PLC software encompassing:

- Install programming software
- Memory mapping
- Computer software
- Manufacturers' Instruction Manuals

T3. PLC Hardware encompassing:

- Selection
- Installation
- Configuration
- Signals
- Resolution

T4. Analogue Modules encompassing:

- Comparison of signals
- Resolution of analogue signals
- Connection of analogue field
- Programming
- Loop fault

T5. Data manipulation encompassing:

- IEC data types
- Word Structure
- Select Bits Transfer

REQUIRED SKILLS AND KNOWLEDGE

- Move
- Block Transfer
- Compare
- Block Compare
- And Words
- Mask
- Maths Function
- Scaling and Un-scaling
- Special registers
- Shift Register
- Multiplexing

T6 Sequencer encompassing:

- Application
- Event and Time Driven
- Programming Application

T7 Languages encompassing:

- Ladder
- CSF
- STL

T8 Diagnostic encompassing:

- Special Register
- Software Diagnostics
- Edits
- Rung Scan Faults

T9 Complex Industrial Process encompassing:

- Describe Process
- Write Program
- Edit Program
- Connect and Run Program
- Documentation

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 required 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, policies and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
 - Developing, entering and verifying programs for industrial control systems using instructions as described in 8) and including:
 - A Developing a control system to the required operating functions and parameters.
 - B Identifying non-compliance conditions of device installation.

- C Entering programming functions and parameters correctly.
- D Correcting programming anomalies.
- E Testing and verify device operation.
- F Documenting control system and programming clearly.
- G Dealing with unplanned events by drawing on required knowledge and skills to provide appropriate solutions incorporated in a holistic assessment with the above listed items.

Note:

Successful completion of relevant vendor training may be used to contribute to evidence on which competency is deemed. In these cases the alignment of outcomes of vendor training with performance criteria and critical aspects of evidence shall be clearly identified.

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 developing, entering and verifying programs for industrial control systems using high level instructions.

**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 required knowledge and skills described in this unit.

**Concurrent
assessment and
relationship with
other units**

9.5)

There are no concurrent assessment recommendations for this unit.

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 developing, entering and verifying word and analogue control programs for programmable logic controllers applied to representative range of at least five of the following:

- Hardware/Software configuration
- Number systems and converting between systems
- Basic diagnostics
- Binary word structure
- INT, DINT and REAL arithmetic operations
- Scaling and unscaling engineering units

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