



Australian Government

Department of Education, Employment and Workplace Relations

UEENEEI150A Develop, enter and verify discrete control programs for programmable controllers

Release: 1

UEENEEI150A Develop, enter and verify discrete control programs for programmable controllers

Modification History

Not applicable.

Unit Descriptor

Unit Descriptor

1) Scope:

1.1) Descriptor

This unit covers development, installation and testing of programs for programmable controllers (PLC) for a system requiring discrete control functions. It encompasses working safely, applying knowledge of control systems, control system development methods, using ladder diagrams/statement list/function block diagram instruction sets, following written instructions and documenting program development and testing 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 competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

UEENEEE1 Apply Occupational Health Safety
01A regulations, codes and practices in the
workplace

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 4 Writing 4 Numeracy 4

Employability Skills Information

Employability Skills 5)

The required outcomes described in this unit of

Employability Skills

5)

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 enter and verify program.	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 Safety hazards that have not previously been identified are reported and advice on risk control measures is sought from the work supervisor.
	1.4 Control system scenario is determined from job specifications of the process/plant/machine to be controlled, and through consultation with appropriate person(s).
	1.5 Equipment, software and testing devices needed to carry out the work are obtained and checked for correct operation and safety.
	1.6 Installation of programmable controller is checked for compliance with regulations and

ELEMENT	PERFORMANCE CRITERIA
	job specification.
2 Develop control system and enter and test program.	2.1 Established OHS risk control measures and procedures for carrying out the work are followed.
	2.2 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.
	2.3 Control solutions are developed and documented based on the specified control mode and using acceptable methods for designing control systems.
	2.4 Developed control system is converted to an appropriate form, such as flow, state and ladder diagrams(See Note 1)
	2.5 Program is entered into the programmable control using a personal computer and appropriate software.
	2.6 Entered instructions and settings are tested as meeting those specified in by the control system scenario.
	2.7 Appropriate methods and tools are used to test control systems and operating faults and anomalies are identified and rectified. (See Note 2)
	2.8 Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.
3 Verify, document and report programming activities.	3.1 OHS work completion risk control measures and procedures are followed.
	3.2 Program is transferred from a programmable controller to an external medium for storage. (See Note 3)
	3.3 Control system specification and program are documented in accordance with established procedures.

ELEMENT

PERFORMANCE CRITERIA

- 3.4 Work completion is reported and appropriate personnel notified in accordance with established procedures.

Note.

1. Example of control functions are derived timers (off delay, self resetting, constant duty cycle), reversible counters, cascading timers, cascading counters, combining timers and counters, internal relays/flags/markers, latching relays (set/reset), jump instructions, master control instructions, bit shift registers, scan time considerations, one shot, retentive (power fail) functions, simple step sequence instructions
2. Examples of control system testing methods and tools are monitor mode as an aid to fault finding, inbuilt hardware/software diagnostics and use of error codes.
3. Examples of storage mediums are IC storage, hard disks, servers.

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 developing, entering and verifying discrete control programs for programmable logic controllers.

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

- **KS01-EI150A Programmable controller**
- Evidence shall show an understanding of programmable controller to an extent indicated by the following aspects:
 - T1. PLC Introduction encompassing:
 - Evolution of the programmable controller and applications
 - Relay control, static logic control and programmable control
 - Programmable controller block diagram (Inputs and Outputs)
 - Programmable controller advantages
 - Programmable controller symbols
 - Programmable controller functions
 - Numbering systems start-up procedures
 - Programming inputs and outputs
 - Operation of programmable controller inputs
 - PLC operation: scan cycle
 - Basic programming
 - T2. Types of PC programs encompassing:
 - Ladder diagrams
 - Basic Programming
 - Program modification
 - Ladder diagram development
 - Connecting the programmable controller.
 - T3. Programming Timers encompassing:
 - Purpose of timers
 - Timer instructions
 - On-delay timer instruction
 - Off-delay timer instruction
 - Programming timers
 - Retentive and non-retentive timers
 - Cascading timers
 - The self-resetting timer
 - Monitoring timers
 - Circuit conversion

REQUIRED SKILLS AND KNOWLEDGE

- T4. Programming Counters encompassing:
 - Counter instructions
 - Retentive and non-retentive counter
 - Programming counters
 - Up/down counters
 - Self resetting counter
 - Cascading counters
 - Circuit conversion
- T5. Program Storage encompassing:
 - PLC terms
 - Memory
 - Using the PROM pack
 - Printing ladder diagrams
- T6. PLC Input and Output Modules encompassing:
 - Purpose of modules
 - PLC input modules: dry contact input modules; AC input modules, DC input modules; Analog input modules
 - Output modules: relay output; Triac output; transistor output; analog output modules
- T7. PLC Installation Requirements encompassing:
 - Installation precaution
 - Safety systems
 - AS/NZS requirements
 - Mounting the PLC
 - Installation documentation
 - Routing signal and power cables
 - Locating PLCs and I/O
 - Earthing Requirements
- T8. Master Control encompassing:
 - Master control relay
 - Master control relay ladder diagram
 - Programming master control relays
- T9. Jump Function encompassing:
 - Jump function
 - Jump function ladder diagram
 - Programming jump functions
- T10. The Shift Register encompassing:
 - Purpose of Registers
 - The shift register
 - Shift register operation
 - Clock input

REQUIRED SKILLS AND KNOWLEDGE

- Shift register requirements
- Programming shift registers
- T11. The Step Sequencer encompassing:
 - Step Sequencers
 - Step sequencer operation
 - Clock input
 - Step Sequencer requirements
 - Programming step sequencer
- T12. PLC Diagnostics and Fault Finding encompassing:
 - PLC Fault Finding
 - Controller Status
 - I/O Faults
 - Program Faults

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 – 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, policies and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
 - Develop, enter and verify programs for programmable controllers as described in 8) and including:

- A Developing a control system solution to the required operating functions and parameters.
- B Identifying non-compliance conditions of device installation.
- C Converting control system to a PLC program.
- D Entering programming functions and parameters correctly.
- E Transferring programs to a PLC.
- F Correcting programming anomalies.
- G Testing and verify control system operation.
- H Transferring program to external storage.
- I Documenting control system and programming clearly.
- J 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.

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 programmable logic controllers using ladder instrument set.

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)

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 programs for programmable logic controllers. The program shall include at least five of the following functions/controls:

- Derived timers (off delay)
- Self resetting
- Constant duty cycle
- Reversible counters
- Cascading timers
- Cascading counters
- Combining timers and counters
- Internal relays/flags/markers
- Latching relays (set/reset)
- Jump instructions
- Master control instructions
- Bit shift registers
- Scan time considerations
- One shot
- Retentive (power fail) functions
- Simple step sequence instructions

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