



**Australian Government**

**Department of Education, Employment and Workplace Relations**

# **UEENEED150A Develop industrial control programs for microcomputer equipped devices**

Release: 1

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### **Modification History**

Not applicable.

### **Unit Descriptor**

#### **Unit Descriptor**

#### **1) Scope:**

##### **1.1) Descriptor**

This unit covers development of hardware and programs to control external devices using microcomputers as apply to engineering product development work. It encompasses working safely, following design brief, applying knowledge of microcomputer architecture, constructing prototype devices, programming using assembler or 'C' programming language, testing device operation and documenting development work.

Note:

This unit applies to all aspects of Electrotechnology – engineering applications only. For general competencies related to Information Technologies refer to the latest endorsed IT Training Package.

### **Application of the Unit**

#### **Application of the Unit 2)**

This unit applies to any recognised development program that leads to the acquisition of a formal award at AQF level 5 or higher.

### **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

**License to practice**

3)

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

**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 control programs for microcomputer equipped devices.	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 development work is determined from design brief and in consultation with relevant persons.
	1.4 Development work is planned to meet scheduled timelines in consultation with others involved on the work site.
	1.5 Appropriate development tools and software are selected based on specified requirements and performance standards.
	1.6 Materials and devices/components required for the work are selected on compatibility of specifications with control requirements and project budget constraints.
	1.7 Strategies are implemented to ensure development work is carried out efficiently.
2 Develop control programs.	2.1 OHS risk control measures and procedures for carrying out the work are followed.
	2.2 Knowledge of computer-equipped devices and systems and compliance standards are applied to the design.

<b>ELEMENT</b>	<b>PERFORMANCE CRITERIA</b>
	2.3 Alternative arrangements for the development are considered based on the requirements outlined in the design brief.
	2.4 Safety, functional and budget considerations are incorporated in the design.
	2.5 Prototype devices and circuits are constructed and tested for compliance with the design brief and regulatory requirements.
	2.6 Knowledge of programming language code, functions and features in current use are applied to developing control programs.
	2.7 Prototype malfunctions are rectified and re-tested to ensure effective operation of design.
	2.8 Program development is documented for submission to appropriate person(s) for approval
	2.9 Approaches to issues/problems are analysed to provide most effective solutions.
	2.10 Quality of work is monitored against personal performance agreement and/or established organisational or professional standards.
3 Test, evaluate, implement and document control programs.	3.1 Testing and procedures are developed to evaluate control program.
	3.2 Problems and bugs in program are identified and rectified to ensure specifications are met.
	3.3 Intermediate and final work reports are written in accordance with professional standards and presented to appropriate person(s).

## 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 control programs for microcomputer equipped devices.

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

#### **KS01-ED150A                      Microprocessor/microcontroller assembler language programming**

Evidence shall show an understanding of microcontroller control system programming methods, microprocessor assembly language, high-level language programming as it is applied to engineering applications to an extent indicated by the following aspects:

T1     Programming terms

T2     Language levels and their features

T3     Language simulators and emulators

T4     Language programming basics encompassing:

- Programming input/output functions
- Timing loops

T5     CPU Architecture

- registers.
- instruction set considerations, common and advanced instructions.
- addressing modes supported: direct, indirect, indexed etc.
- software interrupts and system calls.

T6     Processor And System Support

- instruction pre-fetch pipeline.
- system timer chip, function and programming.
- hardware interrupts programming considerations.
- DMA devices and support.
- co-processors and bus interface.

T7     Modular Programming

- separately compiled and linked assembly language modules.
- library modules.
- macros.

T8     Documentation And Debugging

- system specification and documentation
- debugging and tracing program execution

T9     Complex data types and structures encompassing:

- Pointers/references
- arrays and strings

## REQUIRED SKILLS AND KNOWLEDGE

- user-defined data types

T10 Interfacing high-level languages to assembler encompassing:

- in-line assembly.
- bit manipulation
- IO port addressing

T11 Interrupt Service Routines

## 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, policies and workplace procedures



- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
  - Develop control programs for microcomputer equipped devices as described in 8) and including:
    - A Determining the extent of development work requirements.
    - B Identifying the appropriate development tools and software.
    - C Selecting devices/components compatibility with control requirements and project budget constraints.
    - D Developing control program within the safety and functional requirements and budget limitations.
    - E Documenting and presenting program development effectively.
    - F Successfully negotiating program alteration requests.
    - G Obtaining approval for final program developed.
    - H 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 developing control programs for microcomputer equipped devices.

**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 control programs for microcomputer equipped devices with at least five interacting functions and using a programming language currently used in industry.

Note.

Although 'C' and assembler languages are preferred, other relevant language in current industry use may be used.

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)**  
   Computer Systems