



**Australian Government**

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

# **MEM234010A Design microcontroller applications**

**Release: 1**

## **MEM234010A Design microcontroller applications**

### **Modification History**

New unit

### **Unit Descriptor**

This unit of competency covers the design of an automated device for a machine or equipment using a microcontroller. The automated device may use digital or analog input/output (I/O) and may involve feedback control. The microcontroller application may be an autonomous device or it may be integrated into a local area network (LAN) or distributed control system (DCS) using wired or wireless communications. It includes sustainability implications, occupational health and safety (OHS) and automation safety.

### **Application of the Unit**

This unit applies to the design of automated devices using microcontrollers across all forms of manufacturing and engineering. Design activities may also include reverse engineering, and design rectification or modifications of an existing design. The unit is suitable for automated device or systems designers and maintenance personnel, and those pursuing engineering or related qualifications and careers.

Prior experience in the application of basic computing, controllers, mathematics, electrical, electronic, and evaluation of microprocessor systems and safety procedures is required. Mechanical, fluid power, thermodynamic, manufacturing methods and processes experience 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 microcontroller application  |
|   |   | 1.2 | Determine technical, commercial and environmental parameters to the brief or contract   |
|   |   | 1.3 | Determine stakeholders to be consulted in design 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 and calculations   |
|   |   | 2.3 | Where appropriate, consider need for continuous improvement, constraints and contingency management, as part of concept proposal  |
|   |   | 2.4 | Generate a range of microcontroller application design options  |
|   |   | 2.5 | Check feasibility and evaluate solutions against design criteria ensuring conformity to OHS, regulatory, sustainability and environmental requirements                          |
|   |   | 2.6 | Prepare a device design proposal that includes appropriate consideration of results of feasibility study, required modelling and calculations, and any required expert opinions |
|   |   | 2.7 | Review concept proposal with client and select preferred solution   |

- 3 Design microcontrolled device
  - 3.1 Finalise selected device 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 application, including OHS, regulatory and risk management requirements
- interpreting parameters to the brief or contract
- researching latest trends and techniques in application of microcontrollers
- researching latest trends and techniques in reverse engineering
- investigating, 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 and evaluating a range of solutions for feasibility against design criteria
- evaluating solutions for feasibility against design criteria, including relevant engineering and financial calculations and 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 microcontroller application design methods
- research and investigations methods
- 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
- engineering design software options
- software simulation/validation processes
- documentation, drawings, specifications and instructions
- OHS and regulatory requirements, codes of practice, standards, risk minimisation and

registration requirements

- microcontroller software programming techniques
- control options
- device component options which may include microcontroller, user interfaces, HMIs and GUIs, software, data communications, telemetry, modems and networking topology, as appropriate
- specifications for I/O and I/O channels

## 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.

<p>Critical aspects for assessment and evidence required to demonstrate competency in this unit</p>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> <li>• interpret features and functions of the application and parameters to the brief or contract</li> <li>• determine sustainability, automation safety, OHS, regulatory and risk management</li> <li>• research and test system components</li> <li>• investigate and measure, model and calculate for options</li> <li>• generate and evaluate a range of solutions</li> <li>• design microcontrolled system solution</li> <li>• consider continuous improvement, constraint and contingency management requirements in design options, where this is appropriate to the application</li> <li>• select system components</li> <li>• prototype and systematically program and test system component function</li> <li>• ensure automation safety using appropriate licensed technical and professional assistance</li> <li>• communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design</li> <li>• document design with drawings, specifications and instructions.</li> </ul>
<p>Context of and specific resources for assessment</p>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability.</li> <li>• 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.</li> </ul>
<p>Method of assessment</p>	<ul style="list-style-type: none"> <li>• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.</li> <li>• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant</li> </ul>

	<p>contexts) together with application of underpinning knowledge.</p> <ul style="list-style-type: none"> <li>• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.</li> <li>• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.</li> <li>• 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.</li> <li>• Assessment may be in conjunction with assessment of other units of competency where required.</li> </ul>
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

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## Unit Sector(s)

Engineering practice

## Custom Content Section

Not applicable.