MEM23117A Evaluate microcontroller applications

Release: 1

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Modification History

Release 1 - New unit.   Replaces MEM23082A, but not equivalent.

Unit Descriptor

This unit of competency covers the evaluation of automated devices, machines and processes controlled by microprocessors. This includes integration of input devices/sensors, output devices/actuators, controllers, interfacing and signal conditioning, human-machine interfaces (HMIs), networking options, data and communications protocols software, and programming of microcontrollers and automation safety. Analog interfacing is included but not proportional integral derivative (PID) interfacing.

Application of the Unit

This unit applies to the evaluation of microcontrollers and their use in automated devices, machines and engineering processes. It is suitable for people working as automation, mechatronics or maintenance technicians or for those pursuing qualifications or careers in those disciplines.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

MEM23004A	Apply technical mathematics
MEM23111A	Select electrical equipment and components for engineering applications
MEM23112A	Investigate electrical and electronic controllers in engineering applications

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.

Elements and Performance Criteria

1	Determine scope of evaluation	1.1	Confirm and apply safe electrical working practice
		1.2	Review the currents and voltages present in the microcontroller applications and check for regulatory requirements and dangerous high currents and voltages, including effects on humans and on application equipment and components
		1.3	Identify work health and safety (WHS) and regulatory requirements with particular emphasis on automation safety, codes of practice, standards, risk management and organisational procedures
		1.4	Identify software techniques and graphics required for evaluation
		1.5	Identify stakeholders to be consulted on evaluation tasks
		1.6	Identify sources of technical and professional assistance
		1.7	Investigate sustainability implications of microcontroller applications
2	Establish existing features of microprocessor applications	2.1	Review the functions and features of devices, machines and processes controlled by microprocessors
		2.2	Identify features and functions of microprocessor devices and components
		2.3	Review microprocessor programming and functions
		2.4	Identify system integrating principles and techniques,

			signal conditioning and power interfacing
		2.5	Identify networking and system supervision, data acquisition and systems control options
3	Evaluate microcontroller applications	3.1	Determine suitability of components of application, including sensor/transducers, microcontroller and output devices, signal conditioning and interfacing used by applications
		3.2	Assess scope and suitability of microcontroller functions, software and programming to applications
		3.3	Assess suitability of network, system control and data acquisition (SCADA) options, communications protocols, standards and network topologies, HMIs and graphical user interfaces (GUIs) used by applications
		3.4	Review application for compliance with WHS and regulatory requirements, codes of practice, standards and risk management procedures
4	Report results	4.1	Record results of scoping, principles and techniques identification, and evaluation of applications
		4.2	Provide documentation, such as layouts, programs, flow charts, state diagrams and files

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

Required skills include:

- identifying features and functions of microcontroller systems, including:
  - components
  - system integrating principles and techniques
  - signal conditioning and power interfacing
  - networking and system supervision, data acquisition and systems control options
- ensuring safe electrical working practice, including use of licensed personnel
- investigating sustainability implications of microcontroller applications
- evaluating safety, condition, efficiency and functionality of microcontrollers and their applications, including
- components of applications
- controller functions and programming, network, SCADA, communications protocols, standards and network topologies
- HMIs and GUIs
- compliance with WHS and regulatory requirements
- applying WHS, regulatory and automation safety requirements, risk management and organisational procedures
- reporting and documenting results of scoping, principles and techniques identification, and evaluation of applications, layouts, programs and flow charts or state diagrams

Required knowledge

Required knowledge includes:

- features of a range of microcontrollers and related control system component applications used in engineering environments
- compliance requirements of WHS, regulations, codes of practice, standards and risk assessment
- effects of electricity on humans, dangerous high currents and voltages and automated systems, and regulatory requirements related to extra low, low and high voltage applications
- hardware functions, options and integration with microprocessor applications
- input devices/sensors, output devices/actuators, controller, interfacing and signal conditioning, communications, HMIs, GUIs, and networking options for devices
- appropriate use of microprocessor related terminology
- microcontroller features and function, including:

- volatile and non-volitile memory and data storage
- one-time programmable and reprogrammable microcontrollers
- typical microcontroller architecture characteristics
- central processing unit (CPU) functions
- interrupt structures
- Input/Output (I/O) functions
- timers and clocks
- logic
- programming methods and techniques

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.

Overview of assessment	A person who demonstrates competency in this unit must be able to evaluate microprocessor devices, machines and processes for safety, economy and fitness for purpose.
Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: • identify and assess compliance with WHS and regulatory requirements, and risk management procedures • review dangers and effects of electricity on humans • identify microprocessor related systems and components, integrating principles and techniques • assess suitability of programming • investigate sustainability implications of microprocessor related applications • assess and apply basic electrical and electronic, control principles, controller programming principles and techniques, software basic analysis, and graphics skills and techniques • evaluate components of applications against application specifications for safety, economy and fitness for purpose • report and document results.
Context of and specific resources for assessment	• 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, 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. • Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. • 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.
Method of assessment	• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package. • Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.

	- Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure correct interpretation and application. - Assessment may be applied under project-related conditions (real or simulated) and require evidence of process. - Assessment must confirm a reasonable inference that competency is not only able to be satisfied under the particular circumstance, but is able to be transferred to other circumstances. - Assessment may be in conjunction with assessment of other units of competency where required.
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

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Microcontroller	Microcontrollers are typically an integrated circuit consisting of a CPU combined with support functions, such as a crystal oscillator, timers, watchdog timer, serial and optional analog I/O. A limited amount of read/write memory on the chip along with program memory in the form of reprogrammable flash or 'one-time programmable' ROM
Microcontroller applications	Microcontroller applications are found in most industries. Typical applications include: - motor controllers - fault detectors - power controllers - communications - security systems - machine and process automation - automotive and transport applications - domestic appliances - medical equipment

Standards and codes	Standards, codes and protocols refer to all relevant Australian and international standards, codes and protocols applicable to microprocessor related tasks
Appropriate technical and professional assistance	Appropriate technical and professional assistance may include: • technical support and advice relating to elements which have intrinsic dangers, such as: • high pressure • energised fluid vessels • high temperatures and heat energy capacity • wiring with high current control voltages above extra low voltage • professional support for technologies may include: • specialist electric motor drives and controllers • specialist materials, plastics, metal alloys and nano materials • special processes, foundry, alloy welding, heat treatment, sealing and fastening
WHS, regulatory requirements and enterprise procedures	WHS, regulatory requirements and enterprise procedures may include: • WHS Acts and regulations • relevant standards • codes of practice from Australian and overseas engineering and technical associations and societies • risk assessments • registration requirements • safe work practices • state and territory regulatory requirements
Automation safety	Automation safety refers to the reliance on emergency stop, failsafe design, redundancy, system interlocks and data integrity. Standards apply to general plant design and use as well as the functional safety of safety-related electrical, electronic and programmable electronic control systems.
Network topologies	Network topologies include: • daisy-chain, star, ring, branch, linear and tree • wired and wireless options
Software for microcontroller applications	Software for microcontroller applications may include: • integrated development environment software which may include programmer, editor, assembler, compiler, linker, simulator and emulator • HMI software

	• network software • modem software
Sustainability	Sustainability is used to mean the entire sustainable performance of the organisation/plant, including: • meeting all regulatory requirements • conforming to all industry covenants, protocols and best practice guides • minimising ecological and environmental footprint of process, plant and product • maximising economic benefit of process plant and product to the organisation and the community • minimising the negative WHS impact on employees, community and customer

Unit Sector(s)

Competency field

Unit sector   Engineering science

Custom Content Section

Not applicable.

Manufacturing Skills Australia