



Australian Government

MEM23126 Evaluate industrial robotic applications

Release: 1

MEM23126 Evaluate industrial robotic applications

Modification History

Release 1. Supersedes and is equivalent to MEM23126A Evaluate industrial robotic applications.

Application

This unit of competency defines the skills and knowledge required to evaluate industrial and mobile robotic devices or systems for commercial, industrial, machine and process automation in engineering and related applications. It includes loading and positioning capability, accuracy, repeatability, communications requirements, networks and protocols, and effectiveness of integration into automation systems, along with evaluation of standard industrial robot types, mobile robots and other automated elements.

Robotic devices or systems are mechanical, programmable self-controlling machines used widely in engineering and related applications where location, work environment, costs, accuracy, quality, repeatability and reliability dictate their use in preference to human or other machines. The robot can be networked to serve an automated environment.

It is suitable for people working as automation or robotics technicians or paraprofessionals and draftspersons, and for those pursuing related technical qualifications and careers.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

MEM23004 Apply technical mathematics

MEM23111 Select electrical equipment and components for engineering applications

MEM23112 Investigate electrical and electronic controllers in engineering applications

MEM23116 Evaluate programmable logic controller and related control system component applications

MEM23117 Evaluate microcontroller applications

Competency Field

Engineering science

Elements and Performance Criteria

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>

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1. Establish scope of robotics evaluation	1.1 Determine parameters and context of robotics applications to be evaluated 1.2 Identify stakeholders to be consulted on evaluation 1.3 Identify software requirements used in the robotic applications 1.4 Identify relevant compliance requirements of work health and safety (WHS) and regulatory requirements, codes of practice, standards and risk assessment requirements for robotic applications and automation safety 1.5 Ensure appropriate support, including licensed electrical, technical and professional assistance, is available 1.6 Investigate sustainability implications of robotic applications
2. Confirm existing features of robotics applications	2.1 Review features and functions of robotic applications and classify industrial robotic devices 2.2 Review robots and robotic elements 2.3 Identify robotic principles and techniques required to evaluate and optimise the processes 2.4 Identify appropriate analysis techniques, software and software validation techniques
3. Evaluate robotic applications	3.1 Assess robotic hardware, sensors or transducers, signal conditioning, controllers, power interfaces, actuators and interface with the end effectors 3.2 Assess motion analysis, load capability, accuracy, precision and repeatability 3.3 Assess system integration, networks, data sharing, control and human machine interfaces (HMIs) 3.4 Assess software and programming techniques for controllers, distributed control system (DCS), supervisory control and data acquisition (SCADA) and system simulation 3.5 Assess compliance of robot and system with WHS and regulatory requirements, codes of practice, standards and risk management requirements 3.6 Apply mock-up and prototyping techniques for robot and subsystem testing 3.7 Assess sustainability implications of robotic application

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
4. Report results	4.1 Record results of evaluation 4.2 Provide documentation that includes required calculations, specifications, diagrams, computer programs and files, and mock-ups or prototypes

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

Industrial robotic applications include one or more of the following:	• palletising and depalletising robots • welding and cutting robots • packaging robots • transfer robots • interactive remote surgery robots • interactive nuclear fuel cell robots.
Mobile robotic applications include:	• military robots, including land mine detection and improvised explosive demolition • police bomb detection robots • automated guidance vehicles.
Reviewing features and functions of robotic applications include:	• assessment by analysis of specifications and drawings • 'reverse engineering' of robotic applications • performance analysis using simulation and dynamic performance software • motion control but does not require validation of dynamic stability which is included in other units and dependant on solution of differential equations.
Sensor and actuator	• signal conditioning techniques and analog to digital converter

interfacing techniques include the use of:	(ADC) power interfacing and digital to analog converter (DAC) and pulse-width modulation (PWM).
Controller programming techniques for motion control and load handling include:	'teach' mode or coordinate and path programming - use of variable velocity algorithms - provision for input variables including: - contact - proximity - measured distance or load and vision - pressure - temperature - open and closed loop actuator control.
Sustainability includes:	- 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.
Analysis includes:	- static and dynamic analysis of loads - the stresses and deformations resulting - graphical and mathematical methods and software options.
WHS, regulatory requirements and organisational procedures include:	- WHS acts, regulations and 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 refers to use of general and specific safety features and includes:	- emergency stop - failsafe design - redundancy - interlocks - guarding data integrity - general plant design and use - functional safety of safety-related electrical, electronic and programmable electronic control systems.
Appropriate technical and professional assistance	- licensed electrical tradespersons - technical support and advice relating to elements which have intrinsic dangers

includes:	• professional support for technologies.
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Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM23126A Evaluate industrial robotic applications.

Links

Companion Volume implementation guides are found in VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b7050d37-5fd0-4740-8f7d-3b7a49c10bb2>

Assessment Requirements for MEM23126 Evaluate industrial robotic applications

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include:

- identifying work health and safety (WHS), regulatory and risk management compliance requirements, including those related to automation safety
- investigating sustainability implications of robotic applications
- identifying, reviewing and classifying features and functions of robotic applications and robotic devices, robotic principles and techniques, analysis techniques and software
- evaluating robotic hardware
- evaluating robotic motion, load capability, accuracy, precision, efficiency and repeatability on at least two occasions
- evaluating system integration, networking, data sharing, control and human machine interfaces, software and programming, supervisory control and data acquisition (SCADA) or distributed control system (DCS), and system simulation
- applying mock-up or prototyping and virtual techniques for robot and subsystem testing on at least two occasions
- reporting and documenting processes and results of evaluation, including calculations, specifications, diagrams, computer programs and files, and mock-ups or prototypes.

Note: Where a volume and/or frequency is not specified, demonstration must be provided at least once.

Knowledge Evidence

Evidence required to demonstrate the required knowledge for this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include knowledge of:

- compliance requirements of WHS and regulatory requirements, codes of practice, standards and risk management requirements for robotic applications
- classifications and applications of industrial and mobile robotic devices or systems
- features, mechanisms and components of robots
- advantages and disadvantages of different types of actuators for engineering applications
- types of actuator power interfaces
- end effectors and their applications
- robot sensors including:
 - contact, proximity and interrupted beam

- distance sensing
- pressure and temperature
- relative and absolute encoders
- vision and smart cameras
- sensor interface/transducer signal conditioning techniques and analog to digital converter (ADC)
- online and offline programming methods
- mechanical, fluid power, electrical, electronic, programming, communications and networking principles and techniques related to robotics
- role of kinematic and kinetic analysis of robot mechanisms
- analysis of motions, loads, accuracy, precision and repeatability
- situations requiring licensed trade, technical or professional assistance including actuator power interfacing
- interfaces for sensors and actuators, including the use of signal conditioning techniques and ADC, power interfacing and digital to analog converter (DAC), and pulse-width modulation (PWM)
- programming techniques for motion control and load handling with specialist input including vision systems, proximity and distance measurement inputs, and variable velocity control which may be implemented using packaged routines
- automation safety in systems and programs including appropriate use of emergency stop, failsafe design, redundancy, interlocks, guarding and data integrity
- system integration of sensing, control, end effectors and actuators, data requirements, network topology and communication protocols required
- software for simulation, motion analysis, control, digital to analogue converter (DAC) and SCADA
- sustainability implications of industrial robotics.
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Assessment Conditions

- Assessors must:
 - have vocational competency in evaluating industrial robotic applications at least to the level being assessed with relevant industry knowledge and experience
 - satisfy the assessor requirements in the *Standards for Registered Training Organisations 2015 or its replacement* and comply with the *National Vocational Education and Training Regulator Act 2011*, its replacement or equivalent legislation covering VET regulation in a non-referring state/territory as the case requires.
- Where possible assessment must occur in operational workplace situations. Where this is not possible or where personal safety or environmental damage are limiting factors, assessment must occur in a sufficiently rigorous simulated environment that reflects realistic operational workplace conditions that cover all aspects of workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.

- Conditions for assessment must include access to all tools, equipment, materials and documentation required including relevant workplace procedures, product and manufacturing specifications.
- Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.
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