



Australian Government

MEM29009 Prepare, configure and test collaborative robots for industrial operations

Release: 1

MEM29009 Prepare, configure and test collaborative robots for industrial operations

Modification History

Release 1. New unit.

Application

This unit defines the skills and knowledge required to prepare, configure and test collaborative robots for cooperative operations in a manufacturing, engineering or related environment, including a workplace implementing Industry 4.0 systems and processes.

Collaborative robots covered by this unit are robots that have been designed to assist humans in work processes and which have additional features associated with Industry 4.0, including machine learning capabilities, connectivity to other automation, industrial processes, and the cloud, and the ability to record, transmit, receive and process data. The unit does not apply to industrial robots that have additional 'collaborative' safety features installed, such as space monitoring that enforces stop or speed reduction when a person enters the robot shared space, but which do not have the other collaborative features mentioned above.

The unit includes workplace health and safety (WHS) considerations when using collaborative robots, collaborative robot sensors and networking, integration with other forms of automation and troubleshooting the configuration. The unit does not include electrical or mechanical repair and maintenance of collaborative robots.

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

Pre-requisite Unit

Nil

Competency Field

Applied technologies

Elements and Performance Criteria

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
1. Assess collaborative robot proposed workspaces	1.1 Identify features, specifications and system requirements of collaborative robots to be configured including level of incorporated human safety

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
	1.2 Identify workplace health and safety (WHS) procedures and risk control measures relevant to working with proposed collaborative robots 1.3 Review proposed human-collaborative robot shared spaces for suitability and safety and identify human and robot operation risk factors 1.4 Identify need for workspace modifications and follow procedures for ensuring modifications are made
2. Prepare to configure collaborative robots	2.1 Identify task requirements from documentation, work request or discussion with relevant personnel, and clarify where required 2.2 Source and interpret manufacturer's operating instructions, specifications, and engineering drawings for information relevant to collaborative robot tasks 2.3 Identify required materials, parts or components and calculate quantity requirements in accordance with specifications, drawings, job sheets or work instructions 2.4 Identify communication and networking requirements for workplace collaborative robots 2.5 Consult with appropriate personnel to ensure planned work is coordinated effectively with others
3. Configure collaborative robots for tasks or job runs	3.1 Follow WHS procedures and risk control measures associated with setting up collaborative robots 3.2 Train collaborative robot in accordance with manufacturer's instructions and job requirements 3.3 Test collaborative robot networking and data transfer performance is within specifications 3.4 Verify collaborative robot operates in accordance with manufacturer's instructions and job requirements
4. Work with collaborative robot on a test task or job run	4.1 Follow WHS procedures and risk control measures for working with and in proximity of collaborative robots 4.2 Work with collaborative robot to complete required task or job run 4.3 Evaluate collaborative robot performance against job requirements 4.4 Evaluate collaborative robot data transfer and connectivity during task or job run 4.5 Troubleshoot problems in operation and networking of the collaborative robot in accordance with manufacturer's operating

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Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
	instructions, job requirements and organisational procedures 4.6 Document troubleshooting procedures and outcomes and seek expert assistance where required
5. Complete and document work	5.1 Document task or job run outcomes according to organisation requirements 5.2 Clean and restore work area ready for further collaborative robot use

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.

Industry 4.0 related systems include one or more of the following:

- industrial internet of things (IIoT) devices
- collaborative robots
- networked and cloud connected traditional robots and other industrial automation
- networked and cloud connected supervisory control and data acquisition systems (SCADA)
- networked and cloud connected enterprise resource planning (ERP) systems
- networked and cloud connected CAD and CAM systems
- digital twins
- augmented and virtual reality systems
- networked and cloud connected CNC and additive manufacturing machines
- networked and cloud connected data storage and processing facilities

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	• networked and cloud connected edge devices • other networked and cloud connected digital devices and systems relevant to the workplace
WHS procedures and risk control measures include one or more of the following:	• personal protective equipment (PPE) • job safety analysis (JSA) worksheets • material safety data sheet (MSDS) • safety equipment and devices • safety signs /symbols
Collaborative robots may be mobile or fixed and includes one or more of the following hardware components:	• sensors • networking onboard devices • human–machine interfaces • electrical, hydraulic and pneumatic actuators and servos • motors • vision systems • end effectors • switches and emergency stops • guarding • locomotion components for mobile robots
Features, specifications and system requirements include one or more of the following:	• components • capabilities • speed • reach • load restrictions • movements • applications • required operating conditions • limitations • justification • safety features
Network connections include one or more of the following:	• WiFi • local area network (LAN) • cloud • edge computers and gateways • supervisory control and data acquisition (SCADA) and other data sharing and reporting systems • WiFi or wired direct connections to other automation

Unit Mapping Information

No equivalent unit

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 MEM29009 Prepare, configure and test collaborative robots for industrial operations

Modification History

Not applicable.

Performance Evidence

There must be evidence the candidate has demonstrated the ability to:

- research latest technology developments in regard to collaborative robots within own area of responsibility
- assess at least two proposed workspaces for suitability for collaborative robot operations
- establish the hardware features, specifications and system requirements of at least two collaborative robots
- select and prepare materials and components to set up a collaborative robot for at least two separate required tasks
- configure a collaborative robot for at least two tasks or job runs including:
 - establishing safety and other limits appropriate to the task, space and manufacturer's instructions
 - preparing materials and space for collaborative robot tasks
 - programming robot movements,
 - configuring machine vision and other sensors
 - establishing required robot data reporting and PLC and networking interfaces
- troubleshoot faults in collaborative robot configuration and operation
- troubleshoot collaborative robot onboard data processing, file transfer, and network connections
- apply safety practices while configuring and working with collaborative robot
- report on work completion in the required format.

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

Knowledge Evidence

There must be evidence the candidate has knowledge of:

- shared space risks for collaborative robot operations including:
 - uneven floor surfaces for mobile collaborative robots
 - routing or guarding to ensure employees and others cannot intrude into the shared space outside of collaborative robot safety sensing limits
 - electrical interference hazards
 - fail-safe space assessment in the event of robot fault or stoppage
 - other shared space risks unique to the workplace

- features of robots that make the robot collaborative including features associated with:
 - collaborative arm robots
 - track/transverse movement robots
 - mobile robots
- collaborative robot hardware components and features including:
 - sensors
 - onboard networking devices
 - human–machine interfaces
 - electrical, hydraulic and pneumatic actuators and servos
 - motors
 - vision systems
 - end effectors
 - switches and emergency stops,
 - contamination protection and guarding
 - power supply and cables
- typical functions, operations and limitations of different collaborative robots including:
 - vision system principles
 - robot mechanics
 - data acquisition, processing and transfer
- interfacing of collaborative robots with humans including:
 - safety features including sensors, protective stops, guarding and insulation, and fail-safe processes
 - manual programming/teaching, e.g., how collaborative robots interact with manufacturing execution system (MES)
- workplace safety requirements and work health and safety (WHS) legislation relevant to the working environment and the task being undertaken
- standards, codes and regulations relevant to working with collaborative robots and the activities being undertaken
- manufacturer’s specifications, workplace procedures and other relevant technical information relating to working with collaborative robots
- differences between collaborative robots and traditional industrial robots
- uses of collaborative robots in the manufacturing sector
- machine learning in relation to collaborative robots
- troubleshooting processes and techniques relevant to collaborative robots
- techniques used for training a collaborative robot through guided movements and task demonstration
- operating within own scope of role and when to seek assistance, including input, or hand off to others when working with collaborative robots.
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Assessment Conditions

- Assessors must:
 - have vocational competency in preparing, configuring and testing collaborative robots for industrial operations 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.
- There must be 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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