



Australian Government

MEM29005 Diagnose faults in digital control systems

Release: 1

MEM29005 Diagnose faults in digital control systems

Modification History

Release 1. New unit.

Application

This unit defines the skills and knowledge required to apply diagnostic procedures to existing digital control systems in order to correct faults and return the system to normal operation.

The unit includes preparing for and applying safe fault-finding processes and techniques, dealing with unexpected situations, and completing and documenting outcomes.

The unit applies to digital control systems that are part of, or have the potential to become, part of Industry 4.0 systems and processes in a manufacturing or engineering-related workplace or are part of a workplace that is connected to a manufacturing or engineering-related workplace supply chain.

The skills and knowledge described in this unit do not cover connecting, diagnosing or repairing power supplies above 50V ac or 120V dc or other electrical-related work requiring an electrical licence in any state or territory.

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. Prepare to diagnose digital control systems faults	1.1 Identify diagnostic procedures from control system supplier documentation, plant and process documentation, work request, or discussion with relevant personnel 1.2 Consult with appropriate personnel to ensure planned work is coordinated effectively with others and system downtime is minimised 1.3 Identify sources of materials and components in case replacements

Elements	Performance Criteria
Elements describe the essential outcomes.	Performance criteria describe the performance needed to demonstrate achievement of the element.
	are required as a result of fault diagnosis 1.4 Ensure appropriate tools and equipment for the digital control system are selected and serviceable
2. Apply diagnostic techniques to digital control systems	2.1 Apply relevant WHS and regulatory procedures and risk control measures associated with diagnostic procedures 2.2 Determine the need to observe, test or measure the system live and arrange access if required 2.3 Perform diagnostic processes and techniques efficiently to minimise disruption, wastage and downtime 2.4 Isolate control system circuits where required according to manufacturer's instructions and standard operating procedures (SOPs) 2.5 Check for faults in components in a systematic manner with reference to the required operating functions and parameters 2.6 Log faults according to SOPs
3. Provide solutions to digital control system faults and non-conformances	3.1 Apply safety and risk control measures and procedures to completing the diagnostic and repair activities 3.2 Repair or replace identified faulty components or materials 3.3 Identify programming related faults and arrange for reprogramming according to SOPs 3.4 Return digital control system to normal operation 3.5 Refer faults requiring additional expert assistance to manufacturer or other expert
4. Complete work and prepare report on diagnostic and repair activities	4.1 Monitor system after diagnostic and repair and confirm operation against specified parameters 4.2 Produce required documentation and reports in line with organisational policies and procedures

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 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 • 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 • regulations related to electrical work.
Components include one or more of the following:	• sensors • micro-electro-mechanical systems (mems) • wired and wireless (WiFi) network components • operational amplifiers • mechanical switches • analogue to digital and digital to analogue converters.
Diagnostic and repair activities include one or more of:	• monitoring live operation of an existing digital control system • alteration of the digital control system to comply with a specified function • tracing and correcting faults • repair or replacement of materials or components • programming or reprogramming the control system

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including arranging for expert programming where required.

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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 MEM29005 Diagnose faults in digital control systems

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Performance Evidence

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

- research supplier web sites and technical documentation for:
 - latest developments with digital control systems and their diagnostic procedures
 - information relevant to diagnostic procedures for specific digital control systems
- prepare and justify a plan for diagnosing faults for three different types of digital control system faults
- accurately identify and locate faults in at least three different types of digital control system faults
- use appropriate tools, testing equipment and software applications for diagnosing and rectifying faults on at least three digital control systems
- take accurate measurements during diagnostic procedures on digital control systems
- correct programming-related faults through basic reprogramming
- document and report diagnostic and repair outcomes
- document faults and prepare recommendations for expert assistance, upgrades, or other actions where fault is unable to be repaired immediately.

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:

- types and functions of digital control systems, including microcontroller-based applied digital control
- workplace health and safety (WHS) regulatory requirements relevant to troubleshooting digital control systems
- fault-finding principles in troubleshooting digital control systems
- common digital faults in digital control systems including faults in:
 - signals
 - numbering systems
 - combinational logic circuits
 - digital subsystem building blocks
- types, functions, operation and limitations of digital test equipment
- standards, codes and regulations relevant to troubleshooting digital control systems

- sensors including:
 - classification
 - characteristics
 - types
 - signal transmission including analog transmission and sensor digital conversion and transmission
- micro-electro-mechanical systems (MEMS)
- wireless sensor networking
- interfacing/signal conditioning
- balanced lines and noise reduction
- standard analog 20ma current loops for process control
- analogue to digital conversion process for digital control systems including:
 - signal generation through sensors
 - signal conditioning
 - signal amplification where needed
 - signal processing
- operational amplifiers
- digital to analogue conversion process and types of digital to analogue converters (DACs)
- voltage/current to frequency and frequency to voltage/current conversion
- mechanical switches.
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Assessment Conditions

- Assessors must:
 - have vocational competency in diagnosing faults in digital control systems 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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