



Australian Government

Department of Education, Employment and Workplace Relations

MEM18060B Maintain, repair control instrumentation - single and multiple loop control systems

Release: 1

MEM18060B Maintain, repair control instrumentation - single and multiple loop control systems

Modification History

Not Applicable

Unit Descriptor

Unit descriptor	This unit covers determining control loop characteristics, monitoring and recording the operation of a control loop, localising the fault condition, and replacing or repairing the faulty condition.
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Application of the Unit

Application of the unit	This unit applies to split architecture single/multi loop control instrumentation that includes PLCs, distributed control systems (DCS) and computer-based systems. This unit also includes the basic adjustment of controller modes, checking of the loop operation, identification and fault finding of simple and multiple controller type controls schemes and the adjustment of controller modes. Where fault finding is required to electronic component level, Unit MEM18056B (Diagnose and repair analog equipment and components) and/or Unit MEM18065B (Diagnose and repair digital equipment and components) should also be selected. This unit has dual status and is to be regarded as both a Specialisation band A unit and Specialisation band B unit for progression to C5 (AQF level V). Band: A Unit Weight: 8
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Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units		
Path 1	MEM05001B	Perform manual soldering/desoldering - electrical/electronic components
	MEM09002B	Interpret technical drawing
	MEM12004B	Perform precision electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test, calibrate instrumentation systems and equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18057B	Maintain/service analog/digital electronic equipment
	MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements
Path 2	MEM09002B	Interpret technical drawing
	MEM12002B	Perform electrical/electronic measurement
	MEM12023A	Perform engineering measurements
	MEM18001C	Use hand tools
	MEM18002B	Use power tools/hand held operations
	MEM18054B	Fault find, test and calibrate instrumentation systems and

Prerequisite units		
		equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18062B	Install, maintain and calibrate instrumentation sensors, transmitters and final control elements
	MEM18064B	Maintain instrumentation system components

Employability Skills Information

Employability skills	This unit contains employability skills.
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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.
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Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1. Determine control loop operating characteristics	1.1. Engineering specifications, technical information and historical trends are examined for relevant data. 1.2. System specifications, operational data and other relevant data sources are examined, read, interpreted and relevant conclusions are noted. 1.3. Consultation with system operators and other relevant plant personnel is carried out, and relevant data is extracted and documented by appropriate means. 1.4. Using knowledge of all control loop device characteristics, controller mode principles and adjustment methods, operation of the system is observed. 1.5. Appropriate test equipment and testing procedures are used. 1.6. Fault finding and diagnostic techniques are utilised. 1.7. Relevant data is collected by appropriate means from all sources including maintenance records, fault indicators, charts, error codes operational symptoms, observation monitoring and consultation with appropriate personnel.
2. Monitor and record operation of a control loop	2.1. Pneumatic, electrical and electronic circuit diagrams are interpreted and understood. 2.2. Using knowledge of all control loop device characteristics, controller mode principles and calibration/adjustment methods, loop operation from the controller response to set point and manual output changes using correct test equipment, principles and procedures are check tested and monitored. 2.3. Software configuration data for digital control systems is interpreted. 2.4. Operational responses are monitored and recorded by appropriate means. 2.5. Fault finding and diagnostic techniques are utilised throughout checking and testing procedures including simple and multi-controller type control schemes. 2.6. Diagnostic results and conclusions are analysed against predetermined operational specifications.
3. Localise fault condition	3.1. Circuits are tested to the level necessary to identify and localise faults. 3.2. Drawings/diagrams and operational testing data are

ELEMENT	PERFORMANCE CRITERIA
	utilised in identifying and localising fault conditions. 3.3. Fault condition is localised and verified to major component level using appropriate test equipment, principles and procedures.

ELEMENT	PERFORMANCE CRITERIA
4. Replace or repair faulty condition	4.1. Components are dismantled for repair or replacement using appropriate tools, equipment and procedures. 4.2. Replaceable items are selected from manufacturers' catalogues, spare parts lists, or data sheets. 4.3. Serviceable items are repaired using correct principles, tools, equipment and procedures. 4.4. Repaired and replaceable items are reassembled using appropriate tools, equipment, techniques and procedures.
5. Calibrate and adjust control instrumentation	5.1. Panel mounted, split architecture single loop/multiple loop control instruments are calibrated and adjusted using correct calibration principles, equipment and methods for all devices according to manufacturers' instructions. 5.2. Adjust controller modes and actions are adjusted according to specifications. 5.3. Zero span and range checks are undertaken using correct and appropriate configuration. 5.4. Correct and appropriate procedures, techniques, tools and equipment are used to make final adjustments to control instrumentation to specifications.
6. Complete service reports and recommission	6.1. Service reports are completed to standard operating procedures. 6.2. Appropriate follow-up procedures are adopted. 6.3. Control instrumentation is recommissioned to standard operating procedures.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

Look for evidence that confirms skills in:

- obtaining and interpreting relevant engineering specifications, technical information, software data, diagrams and drawings, historical records and documents pertaining to the system components and operational data
- consulting system operators and other relevant plant personnel with respect to the

REQUIRED SKILLS AND KNOWLEDGE

- control loop characteristics
- confirming function/malfunction of the system and/or its components
- checking operational characteristics of control devices, signal conversion instruments and final control elements for conformance to specification
- identifying faults/defects in control system components
- locating/reading in-built fault indicators and error codes
- obtaining relevant pneumatic, electrical and electronic circuit diagrams
- testing and monitoring the control loop for correct operation
- monitoring and recording responses of the control system
- using appropriate fault-finding and diagnostic techniques and procedures throughout the monitoring and testing process
- comparing collected data with the operational specifications of the control system
- marking components for repair or replacement
- dismantling/disassembling serviceable items
- setting up appropriate test and calibration equipment
- setting and adjusting the controller modes
- checking the control instrumentation for correct zero, span and range
- adjusting the control system as required
- completing all necessary reports including appropriate follow-up procedures
- commissioning the control system
- interpreting trends from operational data
- interpreting information from in-built devices
- calculating control loop characteristics

Required knowledge

Look for evidence that confirms knowledge of:

- mathematical computations including algebra, exponentials and logarithms, equations, graphs, charts, vectors, complex numbers, Boolean algebra
- relevant data, including information from in-built devices on the control loop characteristics
- specifications of each system component
- control programming
- SCADA systems, programmable logic controller systems (PLC) distributive control systems (DCS) and computer-based systems
- procedures for documenting/reporting information
- signal transmission including the principles of operation of the final control element, procedures for calibrating and adjusting the control system
- correct function of the circuits and components within the control loop
- calibration and adjustment methods for the control loop devices
- configuration of the digital control system software
- operational responses and procedures for monitoring and recording test and

REQUIRED SKILLS AND KNOWLEDGE

- operational data
- fault-finding and diagnostic techniques throughout the monitoring and testing process
- deviations/variations from specification
- procedures for documenting control system tests and analysis
- hazards associated with testing circuits
- procedures for isolating and testing the control system and its components
- procedures for verifying apparent faults in circuits and/or control system components
- procedures for marking components for repair or replacement including procedures for dismantling/ disassembling components for repair or replacement
- correct maintenance procedures for serviceable item(s)
- procedures for assembling repaired and/or replacement items
- procedures and equipment necessary for the calibration of control system components
- adjustments which affect the calibration to control system components
- controller modes and actions
- procedures for checking control instruments for zero, span and range
- procedures for making final adjustments to ensure all control system components conform to specification
- reporting/recording requirements associated with the commissioning of the control system
- follow-up actions to be undertaken after maintaining/repairing control system instrumentation
- procedures for commissioning the control system
- safe work practices and procedures

Evidence Guide

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 maintain, repair control instrumentation - single and multiple loop control systems. Competency in this unit cannot be claimed until all prerequisites have been satisfied.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

Assessors must be satisfied that the candidate can competently and consistently perform all elements of the unit as specified by the criteria, including required knowledge, and be capable of applying the competency in new and different situations and contexts.

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, that is the candidate is not in productive work, then an appropriate simulation 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. The assessment environment should not disadvantage the candidate.

This unit could be assessed in conjunction with any other units addressing the safety, quality, communication, materials handling, recording and reporting associated with maintaining, repairing control instrumentation - single and multiple loop control systems, or other units requiring the exercise of the skills and knowledge covered by this unit.

Method of assessment

Assessors should gather a range of evidence that is valid, sufficient, current and authentic. Evidence can be gathered through a variety of ways including direct observation, supervisor's reports, project work, samples and questioning. Questioning techniques should not require language, literacy and numeracy skills beyond those required in this unit of competency. The candidate must have access to all tools, equipment, materials and documentation required. The candidate must be permitted to refer to any relevant workplace procedures, product and manufacturing specifications, codes,

EVIDENCE GUIDE	
	standards, manuals and reference materials.
Guidance information for assessment	

Range Statement

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.	
Historical trends	SCADA, charts, chart recorders and data loggers, equipment condition monitoring etc.
Control loop	An opened and closed loop system includes final control elements, process measuring devices, converters, controllers, process signals and the like
Major components can include	Transducers, power supplies, removable circuit boards, sensor units and other like components

Unit Sector(s)

Unit sector	
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Co-requisite units

Co-requisite units	

Competency field

Competency field	Maintenance and diagnostics
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