



Australian Government

Department of Education, Employment and Workplace Relations

MEM18067B Tune control loops - multi controller or multi element systems

Release: 2

MEM18067B Tune control loops - multi controller or multi element systems

Modification History

Single band identifier removed to clarify dual status

Unit Descriptor

Unit descriptor	This unit covers determining and recording control loop characteristics, tuning control loops and completing service records.
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Application of the Unit

Application of the unit	This unit applies to pneumatic, analog and digital electronic test and recording equipment for the monitoring and adjustment of control loop tuning - the recording of control loop responses in open and closed loop modes. Included is the application of step response - open loop tuning calculations and closed loop ultimate sensitivity trials to achieve specified loop characteristics in conformance to operational specifications. Where fault finding is required to electronic component level, Unit MEM18056B (Diagnose and repair analog equipment and components) should also be selected. Band: 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). Unit Weight: 6
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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 and calibrate instrumentation systems and equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18057B	Maintain/service analog/digital electronic equipment
	MEM18060B	Maintain, repair control instrumentation - single and multiple loop control systems
	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

Prerequisite units		
		operations
	MEM18054B	Fault find, test and calibrate instrumentation systems and equipment
	MEM18055B	Dismantle, replace and assemble engineering components
	MEM18060B	Maintain, repair control instrumentation - single and multiple loop control systems
	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 characteristics	1.1.Engineering specifications, technical information and historical process, records and trends are examined for relevant data. 1.2.Consultation with system operators and other relevant plant personnel is carried out, and relevant data is extracted and documented to standard operating procedures. 1.3.Programmed maintenance/service reports are read and relevant data noted. 1.4.Data is analysed and control loop characteristics are ascertained.
2. Record control loop responses	2.1.Using chart recorders and data loggers, control loop responses are recorded in open and closed loop mode. 2.2.Unit is tested for tuning using appropriate diagnostic techniques. 2.3.Diagnostic results are analysed against specifications.
3. Tune control loops	3.1.Using knowledge of control loop device characteristics, controller mode principles and adjustment methods, tuning operations are performed using correct and appropriate techniques, procedures and equipment. 3.2.Recording equipment used for monitoring and adjustment of control loop components during controller tuning operations is corrected and tested. 3.3.Step response - open loop tuning calculations are applied to achieve specified loop characteristics. 3.4.Closed loop tuning methods using ultimate sensitivity and systematic trials are used to achieve specified loop characteristics. 3.5.Correct sequence of tuning is used on multi controllers and/or multi element systems to achieve specified characteristics. 3.6.Control loops are tuned to optimum mode settings utilising correct and appropriate techniques, tools, test equipment and procedures.
4. Complete service reports	4.1.Service reports are completed to standard operating procedures. 4.2.Appropriate follow up procedures are adopted. 4.3.Process control loop is recommissioned to specifications.

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:

- calculating control loop characteristics
- 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 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
- determining corrective action and interpreting trends from operational data
- testing/monitoring the control loop for correct operation
- monitoring and recording operational responses of the control system/loop
- 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
- implementing diagnostic techniques and procedures
- tuning the control loop
- completing all necessary reports including appropriate follow up procedures
- commissioning the control system

Required knowledge

Look for evidence that confirms knowledge of:

- proportional integral differential (PID) control loops tuning/calibration techniques

REQUIRED SKILLS AND KNOWLEDGE

- 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 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 tune control loops - multi controller or multi element 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 tuning control loops - multi controller or multi element 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, standards, manuals and reference materials.

EVIDENCE GUIDE**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 process

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

Test equipment

Pneumatic, analogue and digital electronic test equipment for the monitoring and adjustment of control loop tuning

Unit Sector(s)**Unit sector****Co-requisite units****Co-requisite units**

Competency field

Competency field	Maintenance and diagnostics
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