



Australian Government

UEENEEI148A Solve problems in single phase electronic power control circuits

Release: 2

UEENEEI148A Solve problems in single phase electronic power control circuits

Modification History

		UEENEEI148A	Solve problems in single phase electronic power control circuits	
Release	Action	Core/Elective	Details	Points
2	Editorial	N/A	Show full pre-req chain in the unit.	
2	Editorial	N/A	In Pre-requisites, delete “For the full prerequisite chain details for this unit please refer to Table 2 in Volume 1, Part 2”.	
2	Editorial	N/A	Replace “essential knowledge and associated skills” with “required skills and knowledge”.	

Unit Descriptor

Unit Descriptor

1) Scope:

1.1) Descriptor

This unit covers solving problems with electronic aspects of single phase power control devices and circuits. The unit encompasses safe working practices, interpreting diagrams, applying knowledge of electronic power control devices and their application, using effective problem solving techniques, safety and functional testing and reporting work activities and outcomes.

Note.

Typical single phase electronic power control problems are those encountered in meeting performance requirements and compliance standards, revising control operating parameters and dealing with control malfunctions.

Application of the Unit

Application of the Unit 2)

This unit is intended to apply to any recognised development program that leads to the acquisition of a formal award at AQF level 4 or higher.

Licensing/Regulatory Information

License to practice 3)

The skills and knowledge described in this unit require a license to practice in the workplace for work involving direct access to plant and equipment connected to installation wiring at voltage above 50 V a.c. or 120 V d.c. However other conditions may apply in some jurisdictions subject to regulations related to electrical work. Practice in the workplace and during training is also subject to regulations directly related to occupational health and safety and where applicable contracts of training such as apprenticeships.

Note:

1. Compliance with permits may be required in various jurisdictions and typically relates to the operation of plant, machinery and equipment such as elevating work platforms, powder operated fixing tools, power operated tools, vehicles, road signage and traffic control, lifting equipment and the like. Permits may also be required for some work environments such as confined spaces, working aloft, near live electrical apparatus and site rehabilitation.
2. Compliance may be required in various jurisdictions relating to currency in First Aid, confined space, lifting and risk safety measures.

Pre-Requisites

Prerequisite Unit(s) **4)**

Competencies **4.1)**

Granting of competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

Where pre-requisite pathways have been identified. All competencies in the Common Unit Group must be have been completed plus all the competencies in one (1) of the identified Pathway Unit Group(s):

Electrotechnology

Electronics and Communications

Electrical

Instrumentation and control

Common Unit Group

Unit Code	Unit Title
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UEENEEE101A	Apply Occupational Health and Safety regulations, codes and practices in the workplace
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UEENEEE104A	Solve problems in d.c. Circuits
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Electrotechnology Pathway Group

Unit Code	Unit Title
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UEENEEH102A	Repair basic electronic apparatus faults by replacement of components
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UEENEEH139A	Troubleshoot basic amplifier circuits
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UEENEEH169A	Solve problems in basic electronic circuits
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Electronics and Communications Pathway Group

Unit Code	Unit Title
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UEENEEH102A	Repair basic electronic apparatus faults by replacement of components
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UEENEEH114A	Solve problems in frequency dependent
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Prerequisite Unit(s) 4)

circuits

UEENEEH139A Troubleshoot basic amplifier circuits

Electrical Pathway Group

Unit Code Unit Title

UEENEEE105A Fix and secure electrotechnology equipment

UEENEEE107A Use drawings, diagrams, schedules, standards, codes and specifications

UEENEEG006A Solve problems in single and three phase low voltage machines

UEENEEG033A Solve problems in single and three phase electrical apparatus and circuits

UEENEEG063A Arrange circuits, control and protection for general electrical installations

UEENEEG101A Solve problems in electromagnetic devices and related circuits

UEENEEG102A Solve problems in low voltage a.c. circuits

UEENEEG106A Terminate cables, cords and accessories for low voltage circuits

Instrumentation and Control Pathway Group

Unit Code Unit Title

UEENEEE107A Use drawings, diagrams, schedules, standards, codes and specifications

UEENEEE119A Solve problems in multiple path extra low voltage (ELV) a.c. circuits

UEENEEI101A Use instrumentation drawings, specification, standards and equipment manuals

UEENEEI102A Solve problems in pressure measurement components and systems

Prerequisite Unit(s) 4)

UEENEEI103A	Solve problems in density/level measurement components and systems
UEENEEI104A	Solve problems in flow measurement components and systems
UEENEEI105A	Solve problems in temperature measurement components and systems
UEENEEI106A	Set up and adjust PID control loops
UEENEEI110A	Set up and adjust advanced PID process control loops
UEENEEI112A	Verify compliance and functionality of instrumentation and control installations
UEENEEI113A	Setup and configure Human-Machine Interface (HMI) and industrial networks

Literacy and numeracy skills 4.2)

Participants are best equipped to achieve competency in this unit if they have reading, writing and numeracy skills indicated by the following scales. Description of each scale is given in Volume 2, Part 3 'Literacy and Numeracy'

Reading	4	Writing	4	Numeracy	4
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Employability Skills Information**Employability Skills 5)**

This unit contains Employability Skills

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged

Employability Skills**5)**

will assist in identifying Employability Skill requirements.

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a competency standard unit

Performance Criteria describe the required performance needed to demonstrate achievement of the element.
Assessment of performance is to be consistent with the Evidence Guide.

Elements and Performance Criteria**ELEMENT****PERFORMANCE CRITERIA**

1 Prepare to solve problems in single phase electronic power control systems.	1.1	OHS processes and procedures for a given work area are identified, obtained and understood.
	1.2	Established OHS risk control measures and procedures are followed in preparation for the work.
	1.3	The extent of single phase electronic power control problem is determined from performance specifications and situation reports and in consultations with relevant persons.
	1.4	Activities are planned to meet scheduled timelines in consultation with others involved in the work.
	1.5	Tools, equipment and testing devices needed for the work are obtained in accordance with established procedures and checked for correct operation and safety.
2 Solve problems in single phase electronic power control systems.	2.1	OHS risk control measures and procedures for carrying out the work are followed.
	2.2	Knowledge of single phase electronic power control device and circuit operation, characteristics and applications are applied to developing solutions to control problems.

ELEMENT	PERFORMANCE CRITERIA
3 Test and document solutions to single phase electronic power control.	2.3 Parameters, specifications and performance requirements in relation to each single phase electronic power control problem are obtained in accordance with established procedures.
	2.4 Approaches to resolving single phase electronic power control problems are evaluated to provide most effective solutions.
	2.5 Methods for dealing with unexpected situations are selected on the basis of safety and specified work outcomes.
	2.6 Problems are solved efficiently without waste of materials or damage to apparatus and the surrounding environment or services and using sustainable energy practices.
	3.1 OHS risk control measures and procedures for carrying out the work are followed.
	3.2 Solutions to single phase electronic power control problems are tested to determine their effectiveness and modified where necessary.
	3.3 Adopted solutions are documented including instruction for their implementation that incorporates risk control measure to be followed. (See Note)
	3.4 Justification for solutions used to solve single phase electronic power control problems are documented in accordance with established procedures.

Note:

A license to practice in the workplace is required for work involving direct access to plant and equipment connected to installation wiring at voltages above 50 V a.c. or 120 V d.c.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

8) This describes the required skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired of safe working practices and solve problems in single phase electronic power control systems.

All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

KS01-EI148 Single phase electronic power control circuit

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Evidence shall show an understanding of single phase electronic power control circuit to an extent indicated by the following aspects:

REQUIRED SKILLS AND KNOWLEDGE

- T1. Introduction to Power Control:
- Advantages and benefits of power control
 - Need for power control and typical applications
 - Power control methods
 - Types of solid state switches
 - Block diagram of a power converter
 - Power control terminology
 - Modes of operation.
- T2. Single Phase Power Rectifiers:
- Single Phase Rectifier Circuit Configurations
 - Resistive/Inductive Loads
 - Output Voltages/Waveforms
 - Ripple Voltage/Frequency
 - Peak Reverse Voltages
 - Free Wheeling Diodes
- T3. Silicon Controlled Rectifiers (SCRs):
- Construction and Symbol
 - Basic Operating Principles
 - Characteristics
 - Gate Requirements
 - Commutation
 - Electrical Ratings
 - Testing SCRs
 - Applications.
- T4. Triacs and Gate Turn Off (GTO) Thyristors:
- Triac Construction and Symbol
 - Triac Basic Operating Principles
 - Triac Characteristics
 - Triac Triggering Modes
 - Triac Electrical Ratings
 - Triac Testing
 - GTO Construction and Symbol
 - GTO Basic Operating Principles
 - GTO Characteristics
 - GTO Electrical Ratings
 - Applications for Triac and GTOs

REQUIRED SKILLS AND KNOWLEDGE

- T5. Power Transistors (BJTs):
- BJT Construction and Symbol
 - BJT Basic Operating Principles
 - BJT Characteristics
 - BJT Electrical Ratings
 - BJT Testing
 - Applications for BJTs
- T6. Power Field Effect Transistors (FET):
- Types of FETs used for power control
 - Power FETs Construction and Symbol
 - FET Basic Operating Principles and Characteristics
 - IGBT Basic Operating Principles and Characteristics
 - Power FET Electrical Ratings
 - Power FET Testing
 - Applications for Power FETs
- T7. Triggering Devices Diac:
- construction and symbol
 - operating principles
 - breakover voltage.
 - Unijunction transistors (UJTs)
 - construction and symbol
 - operating principles
 - intrinsic standoff ratio and peak point voltage
- T8. Programmable Unijunction Transistors (PUTs):
- construction and symbol
 - operating principles
 - programmable standoff ratio
 - peak point voltage
- T9. Triggering Circuits:
- R-C Time Constant Circuits
 - Diac Trigger Circuit Operation
 - UJT Relaxation Oscillator Circuit Operation
 - PUT Relaxation Oscillator Circuit
- T10. Half Wave Controlled Rectification:
- Phase shift control

REQUIRED SKILLS AND KNOWLEDGE

- Controlled rectifiers
- Controlled rectifier power output control
- Single Phase Half-Wave Controlled Rectifier
- Circuit configuration
- circuit operation
- waveforms
- load voltage
- applications and limitations
- Problems Associated with Phase Shift Control

T11. Full Wave Controlled Bridge Rectification:

- Single phase full-wave controlled bridge rectifier circuit
- Output voltage
- Output waveforms
- Applications and limitations
- Advantages and disadvantages

T12. Fully Controlled Bridge Rectification:

- Single phase fully controlled rectifier bridge circuit
- Output voltage
- Output waveforms
- Applications and limitations
- Advantages and disadvantages

T13. Single-Phase a.c. Voltage Control:

- Phase control of a.c. power
- Circuit configurations - half and full control circuits
- Triggering circuits
- Circuit performance and operation on resistive and inductive loads
- Output voltage and waveform, determination of output voltage using circuit characteristics
- Range of control with inductive loads
- Triggering problems associated with inductive loads.
- Applications and limitations

T14. Zero Voltage Switching (ZVS):

- Operating principles
- Circuit configuration – including trigger circuits
- Circuit operation and waveforms – resistive loads only

REQUIRED SKILLS AND KNOWLEDGE

- Relationship between load power and conduction time
- Solid state relays; types and ratings
- Applications and limitations

T15. Fault Finding of Power Control Circuits:

- Fault finding procedures
- Typical faults – power and trigger circuits
- Characteristics displayed by common faults
- Comparison of test data with expected data (voltage/current waveforms)
- Location and replacement of faulty components

Evidence Guide

EVIDENCE GUIDE

9) The evidence guide provides advice on assessment and must be read in conjunction with the Performance Criteria, Required Skills and Knowledge, the Range Statement and the Assessment Guidelines for this Training Package. .

The Evidence Guide forms an integral part of this unit. It must be used in conjunction with all parts of the unit and performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment 9.1)

Longitudinal competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the Industry-preferred model for apprenticeships. However, where summative (or final) assessment is used it must include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accord with industry and regulatory policy.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place,

access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Sources of evidence need to be 'rich' in nature to minimise error in judgment.

Activities associated with normal everyday work influence decisions about how/how much the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practised. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included for Assessors in the Assessment Guidelines of this Training Package.

**Critical aspects
of evidence
required to
demonstrate
competency in
this unit**

9.2)

Before the critical aspects of evidence are considered all prerequisites shall be met.

Evidence for competence in this unit shall be considered holistically. Each Element and associated performance criteria shall be demonstrated on at least two occasions in accordance with the 'Assessment Guidelines – UEE11'. Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:
 - Implement Occupational Health and Safety workplace procedures and practices, including the use of risk control measures as specified in the performance criteria and range statement
 - Apply sustainable energy principles and practices as specified in the performance criteria and range statement
 - Demonstrate an understanding of the required skills and knowledge as described in this unit. It may be required by some jurisdictions that RTOs provide a percentile graded result for the purpose of regulatory or licensing

requirements.

- Demonstrate an appropriate level of skills enabling employment
- Conduct work observing the relevant Anti Discrimination legislation, regulations, policies and workplace procedures
- Demonstrated consistent performance across a representative range of contexts from the prescribed items below:
 - Solve problems in single phase electronic power control systems as described in 8) and including:

- A Understanding the extent of the single phase electronic power control problem.
- B Obtaining electronic device and circuit parameters, specifications and performance requirements appropriate to each problem.
- C Testing and solutions to single phase electronic power control problems.
- D Documenting justification of solutions implemented in accordance with established procedures.
- E Dealing with unplanned events by drawing on required skills and knowledge to provide appropriate solutions incorporated in a holistic assessment with the above listed items.

Note:

Successful completion of relevant vendor training may be used to contribute to evidence on which competency is deemed. In these cases the alignment of outcomes of vendor training with performance criteria and critical aspects of evidence shall be clearly identified.

Context of and specific resources for assessment **9.3)**

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed by this

unit.

These should be part of the formal learning/assessment environment.

Note:

Where simulation is considered a suitable strategy for assessment, conditions must be authentic and as far as possible reproduce and replicate the workplace and be consistent with the approved industry simulation policy.

The resources used for assessment should reflect current industry practices in relation to providing solutions to single phase electronic power control problems.

Method of assessment

9.4)

This unit shall be assessed by methods given in Volume 1, Part 3 'Assessment Guidelines'.

Note:

Competent performance with inherent safe working practices is expected in the industry to which this unit applies. This requires that the specified required skills and knowledge are assessed in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the required skills and knowledge described in this unit.

Concurrent assessment and relationship with other units

9.5)

For optimisation of training and assessment effort, competency development in this unit may be arranged concurrently with unit:

UEENEEH11 Troubleshoot amplifiers in an electronic apparatus
3A

OR

UEENEEI124 Fault find and repair analogue circuits and
A components in electronic control systems

The critical aspects of occupational health and safety covered in unit UEENEEE101A and other discipline specific occupational

health and safety units shall be incorporated in relation to this unit.

Range Statement

RANGE STATEMENT

10) This relates to the unit as a whole providing the range of contexts and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

This unit shall be demonstrated in relation to solve problems in at least four single phase electronic power control systems

Note.

Typical single phase electronic power control problems are those encountered in meeting performance requirements and compliance standards, revising control operating parameters and dealing with control malfunctions.

Generic terms used throughout this Vocational Standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms that apply are given in Volume 2, Part 2.1.

Unit Sector(s)

Not applicable.

Competency Field

Competency Field **11)**

Instrumentation and Control