

**Course outline: 312 Control Circuits G109A**  
**UEENEEG109A - Develop and connect electrical control circuits**

<b>Qualification:</b>	Certificate III in Electrotechnology Electrician - UEE30811
<b>Applicable to:</b>	Learners, industry/employers, governments, community and Global Energy Training Solutions as the provider
<b>Unit of competency:</b>	Accessible from: <a href="http://training.gov.au/Training/Details/UEENEEG109A">http://training.gov.au/Training/Details/UEENEEG109A</a>
<b>Related policies:</b>	<p>Policy &amp; Procedure 1 – Enrolment Policy</p> <p>Policy &amp; Procedure 2 – Credit Transfer &amp; Recognition of Prior Learning</p> <p>Policy &amp; Procedure 3 – Learner Support</p> <p>Policy &amp; Procedure 4 – Assessment</p> <p>Policy &amp; Procedure 5 – Academic Misconduct</p> <p>Policy &amp; Procedure 6 – Alcohol &amp; Other Drugs</p> <p>Policy &amp; Procedure 7 – Access, Equity &amp; Diversity</p> <p>Policy &amp; Procedure 8 – Vulnerable People</p> <p>Policy &amp; Procedure 9 – Work, Health &amp; Safety</p> <p>Policy &amp; Procedure 10 – Incident, Injury &amp; Rehabilitation</p> <p>Policy &amp; Procedure 11 – Competency, &amp; Qualification Assessment Decisions</p> <p>Policy &amp; Procedure 12 – Complaints &amp; Appeals</p> <p>Policy &amp; Procedure 13 – Privacy</p> <p>Policy &amp; Procedure 14 – Fees</p> <p>Policy &amp; Procedure 15 – Industry &amp; Employer Engagement</p> <p>Policy &amp; Procedure 16 – Trainers &amp; Assessors</p> <p>Policy &amp; Procedure 17 – Administration &amp; Other Staff</p> <p>Policy &amp; Procedure 18 – Quality Assurance</p> <p>Policy &amp; Procedure 19 – Business &amp; Financial Risk Management</p> <p>Policy &amp; Procedure 20 – Changes to Qualifications or Business</p> <p>Policy &amp; Procedure 21 – Conflict of Interest</p> <p>Policy &amp; Procedure 22 – Records Management</p> <p>Policy &amp; Procedure 23 – Marketing &amp; Advertising</p>
<b>Monitor and review:</b>	Policy & Procedure 18 – Quality Assurance
<b>Responsibility:</b>	Ben Murphy – as Proprietor
<b>Questions/queries:</b>	Feedback and suggestions welcomed: <a href="mailto:office@gets.com.au">office@gets.com.au</a> (+61) 02 6262 0077

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### 1. Material requirements

- AS/NZS 3000:2007 incorporating amendment 1 and 2
- Scientific calculator, ruler, pens and pencils
- Note book
- Hand tools
- Covered footwear
- Internet access (provided)

### 2. Session summaries

Day 1		
Required Skills and Knowledge	T1	<p>Basic relay circuits encompassing:</p> <ul style="list-style-type: none"> <li>• Identification of given circuit diagrams (schematic) symbols and explain the operation of the components represented</li> <li>• labelling wires and terminal (numbering systems)</li> <li>• control relay - operating principles, basic contact configurations and identification and common applications</li> <li>• push button - switching configurations and common applications</li> <li>• selecting pushbuttons/pilot lamps from manufacturer's catalogues for specific applications</li> <li>• development of simple stop-start relay circuit that incorporates pilot lights and latching circuit.</li> <li>• connection and testing of control circuits</li> </ul>
	T2	<p>Relay circuits and drawing conventions encompassing:</p> <ul style="list-style-type: none"> <li>• circuit diagram drawing conventions</li> <li>• selecting relays from manufacturers' catalogue for specified applications</li> <li>• circuit development of electrical control circuit in accordance with a written description (specification) and list the sequence of operation of the circuit</li> <li>• connecting simple electrical control circuit from circuit diagrams</li> <li>• applying safe working practices when testing an electrical control circuit</li> </ul>

Day 2		
Required	T3	Remote STOP-START control and electrical interlocking encompassing:

Skills and Knowledge	<ul style="list-style-type: none"> <li>• operation of local and remote start-stop control of relays</li> <li>• operation of an electrically interlocked relay circuit</li> <li>• development of a relay circuit incorporating local and remote start and stop buttons and electrical interlocking.</li> <li>• connecting electrical circuits with local and remote start-stop control and with electrical interlocking.</li> <li>• applying circuit checking and testing techniques to an electrical control circuit.</li> </ul> <p>T4 Time delay relays encompassing:</p> <ul style="list-style-type: none"> <li>• timers - operating principles, basic contact configurations and identification and common applications</li> <li>• selecting timers for specified functions from manufactures' catalogues</li> <li>• development of timer controlled circuits from a written description and list the sequence of circuit operation</li> <li>• connecting a timer controlled circuit using a circuit diagram as a guide.</li> <li>• timer circuit checking and testing procedures.</li> </ul>
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### Day 3

Required Skills and Knowledge	<p>T5 Circuits using contactors encompassing:</p> <ul style="list-style-type: none"> <li>• contactors - operating principles, basic contact configurations and identification and common applications</li> <li>• thermal overloads - operating principles, basic contact configurations and identification and common applications</li> <li>• circuit diagram symbols</li> <li>• circuit development using a contactor</li> <li>• using contactors for motor control.</li> <li>• compliance requirements for devices for isolating circuits.</li> </ul> <p>T6 Jogging and interlocking encompassing:</p> <ul style="list-style-type: none"> <li>• purpose and application of jogging control of motors</li> <li>• operation of motor control using start, stop and jog buttons</li> <li>• purpose and application of electrical/mechanical interlocking</li> <li>• developing a multiple motor starting circuit from a description of the circuit operation including jog and interlock functions.</li> <li>• selecting circuit components using manufacturers' catalogues for appropriate duty ratings</li> <li>• connecting and testing a multiple motor starting circuit which incorporates start, stop and jog control.</li> </ul>
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### Day 4

Required Skills and Knowledge	<p>T7 Control devices encompassing:</p> <ul style="list-style-type: none"> <li>• common control devices used in automatic control circuits: limit switches, proximity switches, photoelectric cells, pressure switches, float switches, light sensors and temperature sensors</li> <li>• basic operating principles of common control devices</li> <li>• advantages and disadvantages of common control devices</li> <li>• applications for common control devices</li> <li>• selecting control devices using manufacturers' catalogues for specified applications</li> <li>• connection of control devices into control circuits</li> </ul>
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### Day 5

Required Skills and Knowledge	<p>T8 Programmable relays encompassing:</p> <ul style="list-style-type: none"> <li>• programmable relays - advantages over electromagnetic relay circuit control.</li> <li>• typical applications of programmable relays.</li> </ul>
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	<ul style="list-style-type: none"> <li>• block diagram representation and basic operating principles</li> <li>• input and output parameters, listing, connections and output types.</li> <li>• connecting input and output devices to a programmable relay using a diagram</li> <li>• basic programming of ladder circuits consisting of inputs, outputs i.e. stop-start circuit</li> <li>• using the monitoring facility of the programmable relay to verify each ladder circuit operation.</li> <li>• programming timers and using the monitoring facility of the programmable relay to check the values of the timer</li> <li>• external devices</li> <li>• implications of programming normally closed field devices</li> <li>• conversion of control circuits</li> <li>• installation of programmable control relays</li> <li>• common faults and their symptoms</li> </ul>
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### Day 6

Required Skills and Knowledge	<p>T9 Three-phase induction motor starters encompassing:</p> <ul style="list-style-type: none"> <li>• reasons for limiting the starting current of large motors.</li> <li>• requirements of the wiring rules (AS/NZS 3000) and the local supply authority service rules, with regard to starting and control of induction motors.</li> <li>• DOL starter operating principles, applications and circuits</li> <li>• electronic (soft) starter operating principles, applications and circuits</li> <li>• connecting a DOL motor starter and testing the operation of the power and control circuits</li> </ul> <p>installation of DOL and soft starters</p> <p>T10 Three-phase induction motor starters- reduced voltage encompassing:</p> <ul style="list-style-type: none"> <li>• star-delta starter operating principles and circuits</li> <li>• primary resistance starter operating principles and circuits</li> <li>• auto-transformer starter operating principles and circuits</li> <li>• secondary resistance starter operating principles and circuits</li> <li>• common applications for each starter type</li> <li>• comparison of motor starters basic characteristics</li> <li>• selecting the most suitable motor starter for a given situation</li> <li>• connecting motor starter power and control circuits for correct operation</li> <li>• measuring starting current and torque of selected motor starters</li> <li>• installation of reduced voltage starters</li> </ul>
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### Day 7

Required Skills and Knowledge	<p>T11 Three-phase induction motor reversal and braking encompassing:</p> <ul style="list-style-type: none"> <li>• reversing operating principles and control circuits</li> <li>• plug braking operating principles and circuits</li> <li>• dynamic braking operating principles and circuits</li> <li>• regenerative braking operating principles and circuits</li> <li>• eddy current brakes operating principles and circuits</li> <li>• mechanical brakes operating principles and circuits</li> <li>• comparison of the difference braking methods used.</li> <li>• typical applications for each braking method.</li> <li>• connecting a circuit with a braking feature to operate a three-phase motor.</li> <li>• installation of motor braking control circuits</li> </ul> <p>T12 Three-phase induction motor speed control encompassing:</p> <ul style="list-style-type: none"> <li>• pole changing operating principles and circuits</li> <li>• variable frequency drives operating principles and circuits</li> <li>• slip-ring motors operating principles and circuits</li> </ul>
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	<ul style="list-style-type: none"> <li>• installation of motor speed controllers.</li> </ul>
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### 3. Elements and Performance Criteria

Elements and Performance Criteria require practice and demonstration in the work place.

Element	Performance Criteria	Work Performance
1:Develop and prepare to connect electrical control circuits.	1.1 OHS procedures for a given work area are identified, obtained and understood.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	1.2 Established OHS risk control measures and procedures in preparation for the work are followed.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	1.3 Safety hazards, which have not previously been identified, are noted and established risk control measures are implemented.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	1.4 Control scenarios are determined from discussions with appropriate person(s) and documented in accordance with established procedures.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	1.5 Agreement for the control scenarios is sought from appropriate person(s) and documented in accordance with established procedures.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	1.6 Schematic arrangement of control circuits that complies with agreed scenarios is documented in accordance with established procedures.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	1.7 Materials needed to connect control circuits are obtained in accordance with established procedures and checked against job requirements.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	1.8 Tools, equipment and testing devices needed to connect control circuits are obtained in accordance with established procedures and checked for correct operation and safety.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	1.9 Preparatory work is checked to ensure no damage has occurred and complies with requirements.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
2:Connect and test electrical control circuits.	2.1 OHS risk control measures and procedures for carrying out the work are followed.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	2.2 The need to test or measure live is determined in strict accordance with OHS requirements and when necessary conducted within established safety procedures.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	2.3 Circuits/machines/plant are checked as being isolated where necessary in strict accordance OHS requirements and procedures.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	2.4 Control circuit components are connected to comply with the agreed control scenario.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	2.5 Control circuit operation is tested for agreed functionality and in strict accordance with OHS requirements and established safety procedures.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed

	2.6	Non-compliant control functions are rectified to comply with the agreed control scenario.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	2.7	Unexpected situations are dealt with safely and with the approval of an authorised person.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	2.8	Control circuits are connected and tested efficiently without unnecessary waste of materials or damage to apparatus, circuits, the surrounding environment or services and using sustainable energy practice.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
3:Completion and document circuit development activities.	3.1	OHS work completion risk control measures and procedures are followed.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	3.2	Work site is cleaned and made safe in accordance with established procedures.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed
	3.3	'As-connected' control circuits are documented using standard drawing conventions and an appropriate person or persons notified in accordance with established procedures.	<input type="checkbox"/> Satisfactory <input type="checkbox"/> Needs improvement <input type="checkbox"/> Not performed

#### 4. Assessments

Assessment	When	Satisfactory mark/outcome
Theory assessment 1	Day 7	70%
Practical assessment 1	Day 7	100%
Practical assessment 2	Day 5	100%
Practical assessment 3	Day 3	100%
Workplace Observation	After theory and practical assessments	Must be valid, sufficient, authentic and current
Employer Competency report		
Structured workplace experience interview		
Note: Once all theory, practical and on-site assessments are complete, competency assessment decisions can be made in conjunction with the learner, employer and registered training organisation.		

#### 5. Version control

Version	Date of release	Author	Authorised by	Position	Rational for change
V1	5/10/2015	Ben Murphy	Ben Murphy	Proprietor	Initial release
V2	7/2/2017	Ben Murphy	Ben Murphy	Proprietor	Added Elements and Performance Criteria