Achievement Standard

Subject Reference	Digital Technologies 3.47				
Title	Demonstrate understanding of complex concepts used in the design and construction of electronic environments				
Level	3	**Credits**	4	**Assessment**	External
Subfield	Technology				
Domain	Digital Technologies				
Status	Registered	**Status date**	4 December 2012		
Planned review date	31 December 2016	**Date version published**	12 December 2013		

This achievement standard involves demonstrating understanding of complex concepts used in the design and construction of electronic environments.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
• Demonstrate understanding of complex concepts used in the design and construction of electronic environments.	• Demonstrate in-depth understanding of complex concepts used in the design and construction of electronic environments.	• Demonstrate comprehensive understanding of complex concepts used in the design and construction of electronic environments.

Explanatory Notes

1 This achievement standard is derived from Level 8 of the Technology learning area in *The New Zealand Curriculum*, Learning Media, Ministry of Education, 2007; and is related to the material in the *Teaching and Learning Guide for Technology*, Ministry of Education at http://seniorsecondary.tki.org.nz.

Further information can be found at http://www.technology.tki.org.nz/.

Appropriate reference information is available in *Safety and Technology Education: A Guidance Manual for New Zealand Schools,* Ministry of Education at http://technology.tki.org.nz/Curriculum-support/Safety-and-Technology-Education, and the Health and Safety in Employment Act 1992.

2 *Demonstrate understanding of complex concepts used in the design and construction of electronic environments* involves:
- describing complex software concepts eg describing software flags used to show conditions within a program, such as indicating the status of a model train on a track
- describing microcontrollers and other complex hardware concepts eg describing various feedback techniques in op-amp circuits.

Demonstrate in-depth understanding of complex concepts used in the design and construction of electronic environments involves:
- explaining complex software concepts eg explaining how interrupts are used to suspend usual program flow, such as when a second model train enters the same section of track as the first train
- explaining microcontrollers and other complex hardware concepts eg explaining how signals can be mixed such as audio in a summing op-amp circuit.

Demonstrate comprehensive understanding of complex concepts used in the design and construction of electronic environments involves:
- discussing complex software concepts eg discussing why flags are selected for a program, such as when handling requests from multiple sources in a model train system
- discussing microcontrollers and other complex hardware concepts eg discussing why multiple stages of amplification rather than a single stage is more appropriate for a pressure sensor design.

3 *Electronic environments* refer to a functional combination of hardware and embedded software.

4 Complex software concepts include a selection from:
- structuring complex programs logically
- analogue to digital and digital to analogue conversion
- flags
- counters
- interrupts
- bitwise logic (ie bitwise AND and OR statements)
- idea of serial data transmission, baud rate using wires, Infra Red (IR), radio
- Universal Serial Bus (USB)/Ethernet/Wireless Fidelity (WiFi) interfaces.

5 Complex hardware concepts include microcontrollers and a selection from:
- effects of component tolerance in a circuit
- effects of capacitor-resistor timing and idea of a time constant
- system amplification
- noise reduction and filtering
- photodiode circuits
- Liquid Crystal Display (LCD) displays
- DC motor interface, either transistor or H-bridge with speed control
- Op-amps (various purposes)
- variable voltage regulators
- Field Effect Transistors (FETs)
- special function ICs eg 555 timer, 556 vco, DDS function generators

- multiple sensors (typically some of the following: Hall effect sensor, strain gauge, pressure sensor, proximity sensors)
- multiple actuators (typically some of the following: relay, DC motor, solenoid, servo, stepper)
- CRYSTAL oscillators
- RF circuits.

6 Assessment Specifications for this achievement standard can be accessed through the Technology Resources page found at http://www.nzqa.govt.nz/qualifications-standards/qualifications/ncea/subjects/.

Replacement Information
This achievement standard replaced AS90680.

Quality Assurance

1 Providers and Industry Training Organisations must have been granted consent to assess by NZQA before they can register credits from assessment against achievement standards.

2 Organisations with consent to assess and Industry Training Organisations assessing against achievement standards must engage with the moderation system that applies to those achievement standards.

Consent and Moderation Requirements (CMR) reference 0233