Achievement Standard

Subject Reference	Digital Technologies 3.49
Title	Implement complex techniques in constructing a specified complex electronic and embedded system

Level	3	**Credits**	4	**Assessment**	Internal
Subfield	Technology				
Domain	Digital Technologies				
Status	Registered	**Status date**	4 December 2012		
Planned review date	31 December 2019	**Date version published**	17 November 2016		

This achievement standard involves implementing complex techniques in constructing a specified complex electronic and embedded system.

Achievement Criteria

Achievement	Achievement with Merit	Achievement with Excellence
• Implement complex techniques in constructing a specified complex electronic and embedded system.	• Skilfully implement complex techniques in constructing a specified complex electronic and embedded system.	• Efficiently implement complex techniques in constructing a specified complex electronic and embedded system.

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 at Work Act 2015.

This standard is also derived from *Te Marautanga o Aotearoa*. For details of *Te Marautanga o Aotearoa* achievement objectives to which this standard relates, see the Papa Whakaako for the relevant learning area.

2 *Implement complex techniques in constructing a specified complex electronic and embedded system* involves:

- using Printed Circuit Board (PCB) Computer Aided Design (CAD) software to develop a PCB layout that will preserve signal integrity
- constructing, testing, analysing, and modifying functional circuits on PCBs
- writing and debugging software that can manage a complex electronic and embedded system
- analysing and managing signal and data parameters.

Skilfully implement complex techniques in constructing a specified complex electronic and embedded system involves:

- constructing, testing, analysing and modifying reliable circuits on PCB, with improved track layout and soldering
- writing, debugging and annotating readily understandable software that can manage a complex electronic and embedded system
- analysing and improved management of signal and data parameters.

Efficiently implement complex techniques in constructing a specified complex electronic and embedded system involves:

- constructing, testing, analysing and modifying reliable functional circuits on PCB, with substantially improved track layout and soldering
- writing, debugging and modifying well-structured, clearly annotated, and readily understandable embedded software
- analysing and effectively managing signal and data parameters.

3 *Electronic and embedded system* describes hardware (components and combinations of components) and software contained within physical components, and therefore subject to reactive, real-time, and physical size constraints.

4 *Specified complex electronic and embedded system* refers to an electronic and embedded system with specifications that define the functional qualities required of the system. The specifications must be of sufficient rigour to allow the student to meet the standard. They will be developed by the assessor in negotiation with the student. Specifications for this achievement standard will require sophisticated data processing and relate to the development of a system consisting of several subsystems.

5 *Complex techniques* may include but are not limited to:

- laying out and constructing complex functional circuits on PCBs which reflect good practice, using CAD software and manufacturing systems e.g. photo resist or engraving machines
- soldering of high quality joints on closely spaced pads, which may be for surface mount components
- calculations involving Ohm's Law, $P = I^2R$, $\tau = RC$, gain, pulse-width, baud rates
- writing of complex embedded software which reflects good practice
- fault finding using visual inspection and suitable test equipment e.g. multimeter, oscilloscope etc to test signal parameters e.g. voltage, current, frequency etc at indicated points
- developing testing and debugging strategies for embedded software to ensure they work properly
- noise reduction and filtering techniques

- employing safe workshop practice.

6 Practical contexts suitable for this achievement standard may include but are not limited to:
- environmental monitoring and control with multiple sensors and outputs
- robotics
- more complex elevator and traffic light scenarios
- railway control systems.

7 Conditions of Assessment related to this achievement standard can be found at http://ncea.tki.org.nz/Resources-for-aligned-standards/Technology/Level-3-Technology.

Replacement Information
This achievement standard replaced unit standard 13396.

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