

Title	Demonstrate knowledge of safety and compliance for industrial measurement and control systems		
Level	5	Credits	10

Purpose	<p>This unit standard is intended for use in the training and assessment of industrial measurement and control.</p> <p>People credited with this unit standard are able to:</p> <ul style="list-style-type: none"> – demonstrate knowledge of the legal requirements for the design and operation of instrumentation and control systems; – demonstrate knowledge of the layers of protection in safety related instrumentation and control systems; – interpret documentation used to define safety related instrumentation systems; – describe important factors used in the design of safety related instrumentation systems; – describe processes for working on safety related instrumentation and control systems, including documentation; and – describe procedures for work involving temporary overriding, disabling, or forcing of safety related systems and the justification, risks, and requirements of such actions.
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Classification	Industrial Measurement and Control > Industrial Measurement and Control - Theory
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Available grade	Achieved
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Guidance Information

- 1 This unit standard has been designed for learning and assessment off-job.
- 2 References
 Construction Contracts Act 2002
 Electricity Act 1992;
 Hazardous Substances and New Organisms Act 1996;
 Health and Safety at Work Act 2015, and associated regulations;
 Electricity (Safety) Regulations 2010;
 ANSI/ISA-84.00.01-2004 Part 1 (IEC 61511-1 Mod) *Functional Safety: Safety Instrumented Systems for the Process Industry Sector – Part 1: Framework, Definitions, System, Hardware and Software Requirements*;
 ANSI/ISA-84.00.01-2004 Part 2 (IEC 61511-2 Mod) *Functional Safety: Safety Instrumented Systems for the Process Industry Sector – Part 2: Guidelines for the Application of ANSI/ISA-84.00.01-2004 Part 1 (IEC 61511-1 Mod) – Informative*;

ANSI/ISA-84.00.01-2004 Part 3 (IEC 61511-3 Mod) *Functional Safety: Safety Instrumented Systems for the Process Industry Sector – Part 3: Guidance for the Determination of the Required Safety Integrity Levels – Informative*; *Approved Code of Practice for the Prevention, Detection and Control of Fire and Explosion in New Zealand Dairy Industry Spray Drying Plant*, <https://worksafe.govt.nz/>;

Drinking-water Standards for New Zealand 2005 (Revised 2008) ISBN numbers: 978-0-478-31809-8 (Print), 978-0-478-31810-4 (Online);

IEC 61131-3 *Programmable controllers – Part 3: Programming languages*;

IEC 61508-4 *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 4: Definitions and abbreviations*;

Health and Safety at Work (Major Hazard Facilities) Regulations 2016;

Approved Code of Practice for the Design, Safe Operation, Maintenance and Servicing of Boilers, <https://worksafe.govt.nz/>;

and all subsequent amendments and replacements.

3 Definitions

ALARP – as low as reasonably practicable.

HAZOP – Hazard and Operability.

Industry practice – those practices that competent practitioners within the industry recognise as current industry best practice.

SIL – safety integrity level.

- 4 Diagram formats referred to in this unit standard are as defined in IEC 61131-3 *Programmable controllers – Part 3: Programming languages*. These formats are used because they provide a common basis to define terms, and are not intended to restrict use of other terms which are specific to a particular equipment supplier or vendor.

- 5 Terminology used is as defined in IEC 61508-4 *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 4: Definitions and abbreviations*.

6 Range

- a The candidate is required to be able to relate activities included in this unit standard to the provisions of the Health and Safety at Work Act 2015 as requested by the assessor.
- b All activities and evidence presented for all outcomes and performance criteria in this unit standard must be in accordance with legislation, policies, procedures, ethical codes and standards, industry practice; and where appropriate, manufacturers' instructions, specifications, and data sheets.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of the legal requirements for the design and operation of instrumentation and control systems.

Performance criteria

- 1.1 The duties of parties under the Health and Safety at Work Act 2015 and associated regulations are described.
- Range parties – employers, employees, designers, manufacturers, suppliers, installers;
duties – hazard identification and control, documentation, safe working practices.
- 1.2 Requirements of other legislation as they relate to industrial measurement and control are identified.
- Range may include but is not limited to – Electricity Act 1992, Electricity Regulations 2010; Hazardous Substances and New Organisms Act 1996; Construction Contracts Act 2002; and any associated regulations; evidence of two is required.
- 1.3 The purpose of Approved Codes of Practice and recognised standards is described as they relate to industrial measurement and control.
- Range may include but is not limited to – Approved Code of Practice for the Design, Safe Operation, Maintenance and Servicing of Boilers; Approved Code of Practice for the Prevention, Detection and Control of Fire and Explosion in New Zealand Dairy Industry Spray Drying Plant; Drinking-water Standards for New Zealand; evidence of two is required.

Outcome 2

Demonstrate knowledge of the layers of protection in safety related instrumentation and control systems.

Performance criteria

- 2.1 The role of regulatory control systems in plant protection is described.
- 2.2 The role of manual operator response to alarms as part of plant protection is described.
- 2.3 The roles of other technology safety related systems and external risk reduction facilities are explained.
- Range may include but is not limited to – safety and relief valves, mechanical overspeed trips, fire walls, bunds; evidence of two is required.

- 2.4 The use of safety related instrumentation systems to reduce risk is described in terms of the type and level of risk.

Range risk, tolerable risk, residual risk, ALARP.

- 2.5 Terms used to describe safety related instrumentation systems are explained.

Range terms – detected, revealed, or overt failures; undetected, unrevealed, or covert failures; SIL, diversity, failure on demand, redundancy, common mode failure.

Outcome 3

Interpret documentation used to define safety related instrumentation systems.

Performance criteria

- 3.1 Safety functions required for a safety related instrumentation system are identified from documented codes of practice and safety analysis.

- 3.2 Actions arising from a hazardous event in a safety related instrumentation system are described with reference to diagrams and documents.

Range may include but is not limited to – cause and effect matrix, logic diagrams, function descriptors; evidence of two is required.

- 3.3 The possible causes of a safety related instrumentation system outcome are explained with reference to diagrams.

Range diagrams – cause and effect matrix, logic diagrams, flow charts, sequential function charts.

- 3.4 The sequence of operation of a safety related instrumentation system is described with reference to diagrams.

Range diagrams – sequential function charts, flow charts.

Outcome 4

Describe important factors used in the design of safety related instrumentation systems.

Performance criteria

- 4.1 The use of redundancy to improve the integrity of safety related instrumentation systems is described.

Range one out of two, two out of two, two out of three, diagnostics.

- 4.2 Applications of failure modes are described with examples.

Range fail open, fail closed, fail locked.

4.3 Sources of common mode failures are described.

Range power supply, sensor location, actuating element, specification, changes to operating conditions.

4.4 Techniques for verifying the operation of safety related instrumentation systems are described.

Range watchdog timer, use of analogue sensor.

Outcome 5

Describe processes for working on safety related instrumentation and control systems, including documentation.

Performance criteria

5.1 The purpose of a formal review process is explained with reference to the Health and Safety at Work Act 2015.

5.2 The purpose and methods of review processes applicable to changes to safety related instrumentation systems are described.

Range may include but is not limited to – review processes, HAZOP study, fault tree, cause and effect diagram, failure modes, effects analysis; evidence of two processes is required.

Outcome 6

Describe procedures for work involving the temporary overriding, disabling, or forcing of safety related systems and the justification, risks, and requirements of such actions.

Performance criteria

6.1 Risks associated with temporary disabling, overriding, or forcing signals in safety related systems are described.

Range reduction in protection, requirement for increased operator vigilance.

6.2 Requirements for formal review, control, and justification of work involving the by-passing of safety related systems are explained and procedures described.

Range requirements – overriding, justification, disabling or forcing, equivalent safety is achieved by other methods, minimise time, method used is suitable; procedures – register, reporting and approval levels, operator acknowledgement.

- 6.3 Methods and potential consequences of temporary overriding, disabling, or forcing signals are described and their advantages and disadvantages are explained.

Range jumper wires, provision made during design, automatic expiry time.

- 6.4 Procedures for installation and removal of overriding, disabling, or forcing signals are explained.

Range operator notification, work permits, installation and removal records.

This unit standard is expiring. Assessment against the standard must take place by the last date for assessment set out below.

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	28 August 2002	31 December 2013
Review	2	21 August 2009	31 December 2027
Rollover and Revision	3	28 June 2018	31 December 2027
Review	4	30 January 2025	31 December 2027

Consent and Moderation Requirements (CMR) reference

0003

This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.