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**REPUBLIC OF KENYA**

**NATIONAL OCCUPATIONAL STANDARDS**

**FOR**

**INSTRUMENTATION AND CONTROL TECHNICIAN**

**LEVEL 6**



TVET CDACC

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# OVERVIEW

Instrumentation and Control Level 6 consists of the following competencies:

**Core competencies**

1. Establish and optimize process control strategies
2. Install and service stand-alone controllers (sacs)
3. Install and service programmable logic controllers (plcs)
4. Install and service distributed control systems (dcss)
5. Install and service human machine interfaces (hmis)
6. Install and service supervisory control and data acquisition (scada) systems

# ESTABLISH AND OPTIMIZE PROCESS CONTROL STRATEGIES

**Unit Code:** *IAC020*

**Unit Standard Description**

This unit standard is intended for those who carry out instrumentation and control operations. It specifies the competencies required to: Develop; and Optimise process control strategies.

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| **Unit Standard Title**  | **Establish and optimize process control strategies**  |
| **Unit** **Scope/Range**  | This unit standard requires the establishment of process control strategies. It includes procedures for developing and controlling and optimizing control strategies. Performance of all elements must comply with all contractual agreement and/or manufacturers’ specifications, safe use of tools and materials, use of PPE, and relevant worksite, statutory, health, safety, and environment requirements, including e-waste disposal.  |
| **Element 1**  | **Develop process control strategies**  |
| **Range**  | Develop process control strategies include and not limited to identification of control strategy, control equipment, computers and software  |
| **Performance Criteria**  |
| 1.1. Job documentation and manufacturers’ specifications are read and interpreted according to work place procedures 1.2. Types of control strategy such as Proportional, Integral, Derivative (PID), feed forward/back, cascade, ratio, continuous, batch, single-loop and multi-loop are identified and described. 1.3. Process to be controlled is identified and explained according to workplace procedures 1.4. Control equipment characteristics and limitations are identified and their importance explained according to workplace procedures 1.5. Memory restrictions and number of input/output points are identified 1.6. Specialized equipment such as computers and software are used according to workplace procedures  |
| **Element 2**  | **Optimise process control strategies**  |
| **Range**  | Optimisation process control strategies include and is not limited to identification of configuration methods, control limits, computers, software and backup of documentation  |
| **Performance Criteria**  |
| 2.1. Configuration methods and requirements are identified 2.2. Specific control strategies and interaction of other processes are described 2.3. Control limits such as PID, alarm settings, and limits are described 2.4. Specialized equipment such as computers and software are used according to workplace procedures 2.5. Control strategy is programmed using configuration software and routines 2.6. End results are verified according to workplace procedures 2.7. Complete backup documentation is carried out according to workplace procedures.  |
| **Underpinning Knowledge**  |
| The individual needs to demonstrate knowledge of: * Process control strategies such as feed forward, cascade and ratio
* Controller functions such as direct/reverse action, auto/manual and split range
* Mathematical equations employed by strategies such as proportional-integral derivative (PID)
* Various process parameters to be controlled
* Control equipment characteristics and limitations
* Process control limitations
* Manufacturers’ equipment requirements
* Process requirements
* Configuration software
* Use of original software
* Manufacturers’ recommended configuration routines
* Interaction of other processes
* Failure modes
* Multi-variable control processes
* Tag descriptors and addressing
* Process and instrumentation diagram (P&ID) and Scientific Apparatus
* Makers Association (SAMA) drawings
* E-waste disposal
 |
| **Generic Skills**  |
| The individual needs to demonstrate ability related to: * Communication
* Team Work
* Problem solving
* Planning and Organising
* Self-management
* Safety awareness
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# INSTALL AND SERVICE STAND-ALONE CONTROLLERS (SACS)

**Unit Code:** *IAC021*

**Unit Standard Description**

This unit standard is intended for those who carry out instrumentation and control operations. It specifies the competencies required to: Install; Configure and Carry out maintenance, diagnostics and repairs on stand-alone controllers.

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| **Unit Standard Title**  | **Install and service stand-alone controllers (SACs)**  |
| **Unit Scope**  | This unit standard requires the installation of stand-alone controllers. It includes procedures for fixing mounting, fitting stand-alone controllers, configuring, diagnosing, repairing, and maintaining, such as cleaning, lubricating, and tightening of loose parts. Performance of all elements must comply with all contractual agreement and/or manufacturers’ specifications, safe use of tools and materials, use of PPE, and relevant worksite, statutory, health, safety, and environment requirements, including e-waste disposal.  |
| **Element 1**  | **Install stand-alone controllers**  |
| **Range**  | Installation may include but is not limited to fixing mounting and fitting stand-alone  |
| **Performance Criteria**  |
| 1.1. Types of inputs and outputs are identified according to engineered designs 1.2. Environmental conditions such as extreme ambient temperature, cleanliness, or contamination are identified as per the workplace procedures 1.3. Controllers are selected according to application, process, and control strategy 1.4. The required power supply is selected according to workplace procedure. 1.5. Locations for controllers are determined according to workplace procedure 1.6. Controller is connected to the process system according to workplace procedure 1.7. Controllers are configured according to manufacturers’ specifications 1.8. Backup and documentation is completed according to workplace procedures  |
| **Element 2**  | **Configure stand-alone controllers**  |
| **Range**  | Configuring includes and is not limited to programming and customizing stand-alone controllers  |
| **Performance Criteria**  |
| 2.1. Configuration techniques applied to specific control strategies are identified 2.2. Specialized equipment such as computers and software are utilized according to workplace requirements 2.3. Controllers are configured using handheld programmers and computers according to workplace procedure 2.4. Control parameters and process limitations are identified according to workplace requirements 2.5. Equipment is isolated and make-safe procedures performed according to workplace procedure 2.6. Controllers are tuned to the process conditions according to manufacturers’ specifications  |

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| 2.7. Controllers are returned to service according to manufacturer’s specifications 2.8. Backup documentation is completed according to manufacturer’s specifications  |
| **Element 3**  | **Carry out maintenance, diagnostics and repairs on SACs**  |
| **Range**  | Maintenance includes and is not limited to cleaning, lubricating, and tightening of loose parts and calibrations  |
| **Performance Criteria**  |
|  3.1. Controller functions, process controls, and process control strategies are identified and explained  3.2. System diagnostics are performed according to workplace procedure  3.3. Equipment is isolated and make-safe procedures performed according to workplace procedure  3.4. Controller deviations, faults, and errors are identified according to workplace procedure  3.5. Process upset conditions and limitations are identified according to workplace procedure  3.6. Controller is removed and replaced according to workplace procedure 3.7. Controller parameters are tuned to varying process conditions according to manufacturers’ procedure and specifications  3.8. Software and firmware are updated/upgraded according to manufactures’ procedure  3.9. Controller is calibrated according to manufacturers’ specifications 3.10 Controller to process system is restored according to workplace procedure 3.11 Backup documentation completed according to workplace procedure  |

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| **Underpinning Knowledge**  |
| The individual needs to demonstrate knowledge of: * Types of SACs such as pneumatic and electronic
* Controller functions and modes such as direct/reverse action, auto/manual and PID
* Types of inputs and outputs such as pneumatic and electronic
* Connection methods
* Operation theory of SACs
* Operating parameters of SACs
* Installation conditions such as extreme ambient temperature, cleanliness and contamination  Configuration techniques of SACs
* Calibration techniques applied to specific control strategies
* Calibration and configuration tools such as pneumatic test equipment, handheld programmers and software
* Use of original software
* Desired process control and process control strategy, based on process limitations, requirements and engineered designs
* Tag descriptors and addressing
* Root cause diagnostics
* Repair/replacement methods
* Maintenance procedures, documentation and schedules
* E-waste disposal
 |
| **Generic Skills**  |
| The individual needs to demonstrate ability related to: * Communication
* Team Work
* Problem solving
* Planning and Organising
* Self-management
* Safety awareness
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# INSTALL AND SERVICE PROGRAMMABLE LOGIC CONTROLLERS (PLCS)

**Unit Code:** *IAC022*

**Unit Standard Description**

This unit standard is intended for those who carry out instrumentation and control operations. It specifies the competencies required to: Install; Configure; Perform maintenance and Repair programmable logic controllers (PLCs).

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| **Unit Standard Title**  | **Install and service programmable logic controllers (PLCs)**  |
| **Unit Scope**  | This unit standard requires the installation of programmable logic controllers. It includes procedures for fixing mounting, fitting PLCs, configuring, repairing and maintaining, such as cleaning, lubricating, tightening of loose parts and replacing worn components. Performance of all elements must comply with all contractual agreement and/or manufacturers’ specifications, safe use of tools and materials, use of PPE, and relevant worksite, statutory, health, safety, and environment requirements, including e-waste disposal.  |
| **Element 1**  | **Install programmable logic controllers**  |
| **Range**  | Installation may include but is not limited to fixing mounting and fitting PLCs |
| **Performance Criteria**  |
| 1.1. Type of PLC, architecture, and capabilities are identified 1.2. PLC language to be used such as ladder, function block, sequential function chart, and script is identified 1.3. Environmental conditions such as heat, cleanliness and contamination are identified 1.4. PLC and components for the process are selected 1.5. Required power supply is selected according to workplace procedure 1.6. Locations for PLCs are determined according to workplace procedure 1.7. PLC and terminating I/O are connected according to manufacturers’ specifications 1.8. PLC is mounted according to manufacturers’ specifications. 1.9. Backup and documentation is done and completed according to workplace procedures  |
| **Element 2**  | **Configure PLCs**  |
| **Range**  | Configuring includes and is not limited to programming and customizing PLCs |
| **Performance Criteria**  |
| 2.1 PLC language such as ladder, function block, sequential function chart and script are identified 2.2 PLC programs and associate software such as word processors, spreadsheets, and databases are identified 2.3 Specialized equipment such as computers and software are used according to workplace procedure 2.4 PLCs are configured using programming/configuring software 2.5 Control parameters and process limitations are identified  |

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| 2.6 The controller is isolated from the process according to workplace procedure 2.7 Results are interpreted according to workplace procedure 2.8 Controller is returned to service according to workplace procedure 2.9 Tests carried out to verify the program according to manufacturers’ procedures and specifications. 2.10 Backup documentation completed according to workplace procedure  |
| **Element 3**  | **Perform maintenance and repair on PLCs**  |
| **Range**  | Maintenance includes and is not limited to cleaning, lubricating, tightening of loose parts and replacing worn components |
| **Performance Criteria**  |
|  3.1 Computer applications related to PLC functions are identified  3.2 Communication systems used by PLCs are identified  3.3 PLC language is identified and explained 3.4 Programming software, diagnostic tools and equipment are identified and used according to manufacturers’ specifications  3.5 Configuration parameters are identified according to workplace procedure  3.6 Software reports and documentation are interpreted to identify network programmes  3.7 I/Os are disabled or bypassed according to workplace procedure  3.8 Shut-down and start-up of PLCs is performed 3.10 Software and firmware is upgraded according to workplace procedure 3.11 Programme modifications are made according to workplace procedure 3.12 Components are removed and re-installed according to manufacturers’ procedure 3.13 Batteries, fans, and environmental filters are replaced according to workplace procedure 3.14 Programmes are backed-up and the backup documentation completed  |

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| **Underpinning Knowledge**  |
| The individual needs to demonstrate knowledge of: * Types of PLCs supplied by various manufacturers and the differences in their architecture and capabilities
* Programming software and version compatibility
* Languages such as ladder, function block, sequential function chart and script
* Types of components such as power supply, processor, memory and I/O
* Grounding methods
* Digital, discrete and analog signals
* Compatibility with other process control systems
* Communication networks and protocols
* Installation conditions such as heat, cleanliness and contamination
* Manufacturers’ specifications and recommendations
* Associated software such as word processors, spreadsheets and databases
* Tag descriptors and addressing
* Configuration parameters
* Programming standards
* Alarm priorities
* Access and security levels
* Licensing and service contract requirements
* Controlled process
* Interaction with process
* Effects of maintenance actions or errors
* Communication systems used by PLCs
* Software and hardware limitations
* Use of original software
* Obsolescence issues
* Service bulletins and alerts
* Cause and effects of forcing and bypassing I/Os
* Data types such as binary, integer and floating point
* Hot standby and redundancy applications
* Working offline and online
* Maintenance procedures, documentation and schedules
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| * Repair/replacement methods
* Root cause diagnostics
* E-waste disposal
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| **Generic Skills**  |
| The individual needs to demonstrate ability related to: * Communication
* Team Work
* Problem solving
* Planning and Organising
* Self-management
* Safety awareness
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# INSTALL AND SERVICE DISTRIBUTED CONTROL SYSTEMS (DCSS)

**Unit Code:** *IAC023*

**Unit Standard Description**

This unit standard is intended for those who carry out instrumentation and control operations. It specifies the competencies required to: Install; Configure; Perform maintenance, diagnose and Repair on distributed control systems DCSs.

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| **Unit Standard Title**  | **Install and service distributed control systems (DCSs)**  |
| **Unit Scope**  | This unit standard requires the installation of distributed control systems. It includes procedures for mounting, configuring, maintaining, diagnosing, and repairing. Performance of all elements must comply with all contractual agreement and/or manufacturers’ specifications, safe use of tools and materials, use of PPE, and relevant worksite, statutory, health, safety, and environment requirements, including e-waste disposal.  |
| **Element 1**  | **Install distributed control systems (DCSs)**  |
| **Range**  | Mounting includes and is not limited to hanging, fixing and fitting distributed control systems |
| **Performance Criteria**  |
| 1.1. Types of DCS, architectures, and capabilities are identified 1.2. DCS language such as ladder, function block, and script is identified 1.3. DCS components such as power supply, processor, memory, and I/O are identified 1.4. Required power supply and grounding methods are selected 1.5. Digital, discrete, or analog signals are identified and explained 1.6. Compatibility with other process control systems is identified and explained 1.7. Environmental conditions such as heat, cleanliness, or contamination are described 1.8. Installation details of DCS components such as cabinets, operator stations, and servers is confirmed 1.9. DCS components such as I/O cards and power supplies are mounted according to workplace procedure 1.10. 1.10 Wiring and network to DCS are connected according to workplace procedure  |
| **Element 2**  | **Configure DCSs**  |
| **Range**  | Configuring includes and is not limited to programming and customizing DCSs  |
| **Performance Criteria**  |
| 2.1 DCS programs and associated software are identified are described 2.2 DCSs language such as ladder, function block, and script are identified and explained 2.3 Operating software is updated according to workplace procedure 2.4 DCS configuration is created and validated according to rack and cabinet layout 2.5 DCS is programmed to include comments and displays according to workplace procedure 2.6 External communication configured with other systems and devices according to manufacturers’ procedure 2.7 Configurations are backed-up and restored according to workplace procedure  |

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| 2.8 DCSs control of the process is determined according to workplace procedure 2.9 Backup documentation is completed according to workplace procedure  |
| **Element 3**  | **Perform maintenance, diagnosis and repairs on DCSs**  |
| **Range**  | Maintenance include and is not limited to making maintenance plans or charts, documents, device cleaning, programming, program modifications and testing Trouble shooting, fault identification and documentation. Fault diagnosis, problem fixing, testing, commissioning and job documentation and recommendations  |
| **Performance Criteria**  |
|  3.1 Computer programs and software related to DCS functions are identified and explained  3.2 DCS language such as function block and script are described  3.3 Program and configuration are backed-up and restored according to workplace procedure  3.4 I/Os are forced, disabled, and bypassed according to workplace procedure  3.5 DCS components are shut down and started up according to workplace procedure  3.6 Software and firmware are upgraded according to workplace procedure  3.7 Program modifications is conducted according to workplace procedure 3.8 Devices removed and re-installed according to manufacturers’ specifications. 3.9 Backup batteries are replaced according to workplace procedure 3.10 Fans and environmental filters are cleaned according to workplace procedure 3.11 Backup documentation is completed according to workplace procedure  |
| **Underpinning Knowledge**  |
| The individual needs to demonstrate knowledge of: * Types of DCSs supplied by various manufacturers and the differences in their architecture and capabilities
* Programming software and version compatibility
* Languages such as ladder, function block, sequential function chart and script
* Types of components such as power supply, processor, memory and I/O
* Grounding methods
* Digital, discrete and analog signals
* Compatibility with other process control systems
* Communication networks and protocols
* Installation conditions such as heat, cleanliness and contamination
* Manufacturers’ specifications and recommendations
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| * Associated software such as word processors, spreadsheets and databases
* Tag descriptors and addressing
* Configuration parameters
* Programming standards
* Alarm priorities
* Access and security levels
* Licensing and service contract requirements
* Controlled process
* Interaction with process
* Effects of maintenance actions or errors
* Communication systems used by DCSs
* Software and hardware limitations
* Use of original software
* Obsolescence issues
* Service bulletins and alerts
* Cause and effects of forcing and bypassing I/Os
* Data types such as binary, integer and floating point
* Hot standby and redundancy applications
* Working offline and online
* Maintenance procedures, documentation and schedules
* Repair/replacement methods
* Root cause diagnostics
* E-waste disposal
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| **Generic Skills**  |
| The individual needs to demonstrate ability related to: * Communication
* Team Work
* Problem solving
* Planning and Organising
* Self-management
* Safety awareness
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# INSTALL AND SERVICE HUMAN MACHINE INTERFACES (HMIS)

**Unit Code:** *IAC024*

**Unit Standard Description**

This unit standard is intended for those who carry out instrumentation and control operations. It specifies the competencies required to: Install; Configure; Perform maintenance, Diagnose and Repair human machine interfaces (HMIs).

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|  **Unit Standard Title**  | **Install and service human machine interfaces (HMIs)**  |
| **Unit Scope**  | This unit standard requires the installation of human machine interfaces. It includes procedures for fixing mountings, configuring, diagnosing, repairing, and maintaining, such as cleaning, lubricating, tightening of loose parts and replacing worn components. Performance of all elements must comply with all contractual agreement and/or manufacturers’ specifications, safe use of tools and materials, use of PPE, and relevant worksite, statutory, health, safety, and environment requirements, including e-waste disposal.  |
| **Element 1**  | **Install human machine interfaces (HMIs)**  |
| **Range**  | Installation may include but is not limited to fixing mounting and fitting HMIs systems  |
| **Performance Criteria**  |
| 1.1 Types of HMI software, hardware, design, and capabilities are identified 1.2 Data types such as Boolean, integer, and floating point are identified and explained 1.3 Compatibility with other process control systems are determined 1.4 Communication networks and protocols are identified and described 1.5 Environmental conditions such as heat, cleanliness, and contamination are identified and explained 1.6 HMI software and operator interface equipment are selected according to workplace procedure 1.7 Software is installed according to manufacturers specifications 1.8 Communication links are connected according to manufacturers’ specifications 1.9 HMI is secured by screwing or bolting according to manufacturers’ specifications  |
| **Element 2**  | **Configure human machine interfaces (HMIs)**  |
| **Range**  | Configuring includes and is not limited to programming and customizing HMIs.  |
| **Performance Criteria**  |
| 2.1 HMI programs and associated software are selected according to applications 2.2 Data types and addressing scheme are selected according to manufacturers’ specifications 2.3 Programming software and firmware is updated according to manufacturers’ specifications 2.4 Operator displays are generated according to manufacturers’ specifications 2.5 HMI configuration and displays are validated according to manufacturers’ specifications 2.6 External communication is configured according to manufacturers’ specifications 2.7 Configurations are backed-up and restored according to manufacturers’ specifications  |

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| 2.8 Commissioning of HMI is done according to manufacturers’ specifications 2.9 Complete backup and documentation is carried out according to workplace procedures  |
| **Element 3**  | **Perform maintenance, diagnosis and repairs on HMIs**  |
| **Range**  | Maintenance includes and is not limited to cleaning, lubricating, tightening of loose parts and replacing worn components |
| **Performance Criteria**  |
|  3.1 General trouble shooting on HMIs is carried out according to manufacturers’ specifications  3.2 HMI programs and associated software are diagnosed according to manufacturers’ specifications  3.3 HMI programs and associated software identified and selected  3.4 Programming software and firmware updated according to manufacturers’ specifications  3.5 Faulty operator displays are diagnosed according to manufacturers’ specifications  3.6 HMI configuration and displays validated according to manufacturers’ specifications  3.7 External communication is re-configured according to manufacturers’ specifications  3.8 HMI commissioned according to manufacturers’ specifications  3.9 Backup documentation completed according to workplace procedures  |
| **Underpinning Knowledge**  |
| The individual needs to demonstrate knowledge of: * Types of HMIs supplied by various manufacturers and the differences in their architecture and capabilities
* Programming software and version compatibility
* Languages such as ladder, function block, sequential function chart and script
* Types of components such as power supply, processor, memory and I/O
* Grounding methods
* Digital, discrete and analog signals
* Compatibility with other process control systems
* Communication networks and protocols
* Installation conditions such as heat, cleanliness and contamination
* Manufacturers’ specifications and recommendations
* Associated software such as word processors, spreadsheets and databases
* Tag descriptors and addressing
* Configuration parameters
* Programming standards
 |
| * Use of original software
* Alarm priorities
* Access and security levels
* Licensing and service contract requirements
* Controlled process
* Interaction with process
* Effects of maintenance actions or errors
* Communication systems used by HMIs
* Software and hardware limitations
* Obsolescence issues
* Service bulletins and alerts
* Cause and effects of forcing and bypassing I/Os
* Data types such as binary, integer and floating point
* Hot standby and redundancy applications
* Working offline and online
* Maintenance procedures, documentation and schedules
* Repair/replacement methods
* Root cause diagnostics
* E-waste disposal
 |
| **Generic Skills**  |
| The individual needs to demonstrate ability related to: * Communication
* Team Work
* Problem solving
* Planning and Organising
* Self-management
* Safety awareness
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# INSTALL AND SERVICE SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEMS

**Unit Code:** *IAC025*

**Unit Standard Description**

This unit standard is intended for those who carry out instrumentation and control operations. It specifies the competencies required to: Install; Configure; Maintain and Repair Supervisory Control and Data Acquisition (SCADA systems).

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| **Unit Standard Title**  | **Install and service Supervisory Control and Data Acquisition (SCADA) systems**  |
| **Unit Scope**  | This unit standard requires the installation of Supervisory Control and Data Acquisition systems. It includes procedures for fixing mounting, configuring, maintaining and repairing, such as cleaning, lubricating, tightening of loose parts and replacing worn components. Performance of all elements must comply with all contractual agreement and/or manufacturers’ specifications, safe use of tools and materials, use of PPE, and relevant worksite, statutory, health, safety, and environment requirements, including e-waste disposal.  |
| **Element 1**  | **Install SCADA systems**  |
| **Range**  | Installation may include but is not limited to fixing mounting and fitting SCADA systems  |
| **Performance Criteria**  |
| 1.1 SCADA equipment are selected according to engineered designs, application, control strategy and workplace standards 1.2 Tools and equipment to be used are selected 1.3 SCADA components are mounted according to drawings and workplace practices 1.4 Wiring and network to SCADA equipment according to manufacturers’ recommendations and engineered designs such as schematics are mounted 1.5 Wireless transmission are tested and mounted according to workplace procedure 1.6 Other systems and processes are installed to avoid interference according to workplace procedure  |
| **Element 2**  | **Configure SCADA systems**  |
| **Range**  | Configuring includes and is not limited to programming and customizing SCADA systems  |
| **Performance Criteria**  |
| 2.1 Computer programs and software related to SCADA functions are identified 2.2 SCADA language such as function block and script are identified 2.3 Program and configuration are backed-up and restored according to manufacturers’ specifications 2.4 I/Os are forced, disabled, and bypassed according to manufacturers’ specifications 2.5 SCADA components are shut down and started up according to workplace procedures 2.6 Software and firmware are upgraded according to manufacturers’ specifications 2.7 Program modifications are carried out according to manufacturers’ specifications 2.8 Devices are removed and re-installed according to manufacturers’ specifications  |

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| 2.9 Backup batteries are replaced according to manufacturers’ specifications 2.10 Fans and environmental filters are cleaned according to manufacturers’ specifications 2.11Backup documentation is completed according to workplace procedures  |
| **Element 3**  | **Maintain and repair SCADA systems**  |
| **Range**  | Maintenance includes and is not limited to cleaning, lubricating, tightening of loose parts and replacing worn components  |
| **Performance Criteria**  |
|  3.10 Computer programs and software related to SCADA functions are identified  3.11 SCADA language such as function block and script are identified  3.12 Program and configuration are backed-up and restored according to manufacturers’ specifications  3.13 I/Os are forced, disabled, and bypassed according to manufacturers’ specifications  3.14 SCADA components are shut down and started up according to workplace procedures  3.15 Software and firmware are upgraded according to manufacturers’ specifications  3.16 Program modifications are carried out according to manufacturers’ specifications  3.17 Devices are removed and re-installed according to manufacturers’ specifications  3.18 Backup batteries are replaced according to manufacturers’ specifications 3.10 Fans and environmental filters are cleaned according to manufacturers’ specifications 3.11 Backup documentation is completed according to workplace procedures  |
| **Underpinning Knowledge**  |
| The individual needs to demonstrate knowledge of: * Types of SCADA systems supplied by various manufacturers and the differences in their architecture and capabilities
* Programming software and version compatibility
* Languages such as ladder, function block, sequential function chart and script
* Types of components such as power supply, processor, memory and I/O
* Grounding methods
* Digital, discrete and analog signals
* Compatibility with other process control systems
* Communication networks and protocols
* Installation conditions such as heat, cleanliness and contamination
* Manufacturers’ specifications and recommendations
* Associated software such as word processors, spreadsheets and databases
* Tag descriptors and addressing
 |
| * Configuration parameters
* Programming standards
* Alarm priorities
* Access and security levels
* Licensing and service contract requirements
* Controlled process
* Interaction with process
* Effects of maintenance actions or errors
* Communication systems used by SCADA systems
* Software and hardware limitations
* Use of original sofware
* Obsolescence issues
* Service bulletins and alerts
* Cause and effects of forcing and bypassing I/Os
* Data types such as binary, integer and floating point
* Hot standby and redundancy applications
* Working offline and online
* Maintenance procedures, documentation and schedules
* Repair/replacement methods
* Root cause diagnostics
* E-waste disposal
 |
| **Generic Skills**  |
| The individual needs to demonstrate ability related to: * Communication
* Team Work
* Problem solving
* Planning and Organising
* Self-management
* Safety awareness
 |