RAND WATER	RAND WATER AUTOMATION ASSET MANAGEMENT	
TITLE AUTOMATION STANDARD SPECIFICATION FOR SCADA - HARDWARE		DOC. NO: RW AAM 06000
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1. INTRODUCTION

1.1.1. The Employer has standardised on the Invensys Wonderware® suite of products for a complete and totally integrated SCADA solution.

1.1.2. This SCADA standard specification document aims to provide a complete set of guidelines and requirements for the design; supply; delivery; installation; configuration; testing; commissioning and putting into operation of the SCADA components/products.

1.1.3. The Contractor shall comply with these specifications and attain project objectives i.e. time, cost and quality.

1.1.4. This SCADA standard specification covers the minimum standards and guidelines applicable to the integrated SCADA automation system at all Rand Water stations and sites. The objective of this document is to prescribe the minimum requirements and framework when designing, procuring, developing, installing and commissioning a SCADA system in order to achieve uniformity, reduced engineering costs, reliability, system flexibility, maintainability and integration.

1.1.5. This document shall be used for all forms of tender, maintenance and for quality control purposes. Furthermore, this document focuses primarily on new SCADA work and less so for work involving SCADA modifications. The various components required to form a single integrated SCADA system are described in terms of Rand Water's requirements; included are hardware requirements (where possible) to support these software programs. The software programs and applications are described in terms of the desired outcomes and functionality for standardised objects.

1.1.6. This document, although a standard specification is also part of a contract and therefore describes the scope of work for a SCADA system when such a system is deliverable; is an inherent required; or forms part of the Scope of Work and/or Work Breakdown Structure in the main contract document. All criteria in this document shall be adhered to and exclusions shall be indicated in the main contract document.

2. REFERENCES AND APPLICABLE DOCUMENTATION

2.1.1. The Contractor shall refer to and comply with the requirements stipulated in the documents and references in the subsequent subsections.

2.2. Internal

2.2.1. The Contractor shall adhere to and comply with all requirements stated in the documents below.

Name	Description
RW AAS 00014	General Conditions

2.3. External

2.3.1. The Contractor shall adhere to the prescriptions in the referrals below.

Name	Source
ISA 88	-
ISA 95	-
Wonderware	www.wonderware.com

3. DEFINITION OF TERMS

3.1.1. The term "SCADA shall herein refer to the ArchestrA® based suite of products from Invensys Wonderware®. The term shall include HMI as far as possible.

3.1.2. The term "HMI" shall herein refer to a SCADA at an unmanned plant or site. The primary purpose of the HMI is to provide redundancy for maintenance and operational purposes when the SCADA is not functional due to technical difficulties or maintenance related tasks.

3.1.3. The term "manned plant" shall herein refer to a plant or site from where an operator manages a plant, site or station. If a plant is occupied for at least 8 hours each working day, then such a plant shall be deemed as manned.

3.1.4. The term "unmanned plant" shall herein refer to plants that are not considered or defined as manned plants. NB. The operator monitors such a plant from the HMI.

4. ABBREVIATIONS

Abbreviation	Description
CPU	Central Processing Unit
GUI	Graphical User Interface
GPRS	General Packet Radio Service
HMI	Human Machine Interface (local SCADA)
I/O	Input/Output
LAN	Local Area Network
Mbps	Mega Bits Per Second
PLC	Programmable Logic Controller
QMS	Quality Management System
SAN	Storage Area Network
SANS	South African National Standard
SCADA	Supervisory Control And Data Acquisition
SMS	Short Message Service
SQL	Sequential Query Language
WAN	Wide Area Network

Sorted Alphabetically

5. CONSTRAINTS

5.1.1. This standard specification shall be applied on a ***go forward basis*** and the Contractor shall not modify this standard specification without prior approval from the Automation Asset Manager (AAM).

5.1.2. The Employer reserves the right, on a case-by-case basis, to endorse retrofitting existing non-compliant PLC and/or SCADA systems with this standard specification.

6. CHANGE MANAGEMENT

6.1.1. This standard specification supersedes any previous revisions.

6.1.2. The Employer reserves the right to alter this standard specification without notification.

6.1.3. The Contractor shall report all conflicts, with due diligence, identified in this standard specification to the Engineer for consideration and modification.

6.1.4. The Contractor shall not modify, add or delete sections in this standard specification without prior written approval from the Chief Automation Engineer (CAE).

7. COMPLIANCE

7.1.1. The Contractor shall comply with all criteria and requirements contained in this SCADA standard specification and associated documents.

7.1.2. The Employer shall measure compliance against the requirements stipulated in each section as well as integration of the components.

8. PURPOSE

8.1.1. The objectives of the SCADA system are:

8.1.1.1. Develop a single SCADA system that provides a tool to manage development and implementation of standards throughout the various stations, sites and plants of the Employer.

8.1.1.2. Reduce the engineering costs and time associated with the implementation of a project involving a SCADA system.

8.1.1.3. Achieve and maintain a reliable and efficient SCADA system.

8.1.1.4. Ensure that decentralised monitoring and control is prevalent to reduce the risk of a total system failure at a particular station, site or plant.

8.1.1.5. Monitor and control all equipment and processes.

8.1.1.6. Receive and transmit all data and/or information in a controlled and optimal manner.

8.1.1.7. Integrate the SCADA system into the Employer's business system.

8.1.1.8. Allow identifiable external and indirect users of the SCADA system access to plant, site and station information on a monitoring basis only.

8.1.1.9. Allow identifiable users access to withdraw information and reports from the SCADA system for analyses, forecasting, faultfinding and other business related activities.

8.1.1.10. Transform all plant data into information and knowledge for decision-making purposes.

9. PRE-REQUISITES FOR TENDER

9.1.1. The following sections are considered material and essential for the successful design, supply, delivery, installation, testing, commissioning, maintenance and support of the SCADA system.

9.2. Accreditations

9.2.1. Contractor's SCADA Certificates

9.2.1.1. The Contractor or Subcontractor shall be an "ArchestrA Certified System Integrator".

9.2.1.2. Contractor's SCADA Developers

9.2.1.3. The Contractor or Subcontractor shall appoint a duly authorised ArchestrA Certified Developer as the lead engineer or project manager.

9.2.1.4. The lead engineer or project manager shall be in possession of a valid certificate or letter from the duly authorised manufacturer or distributor confirming that the lead engineer or project manager is suitably qualified and knowledgeable with regard to the SCADA.

9.3. Failure to Provide Proof of Accreditations

9.3.1. The Employer should reject the offer if the Contractor fails to submit valid proof of accreditations with the tender document.

9.4. SCADA Development Licenses

9.4.1. The Contractor or Subcontractor shall utilise its System Integrator licenses for SCADA configuration, development, testing and commissioning and the Employer shall not free issue any software development licenses.

10. GENERAL

10.1.1. The Contractor shall supply, deliver, install, configure, test and commission all components for new nodes and new components.

10.1.2. The Contractor shall install, reconfigure, test and commission all components for existing nodes and components.

10.1.3. The Contractor shall use discretion and distinguish requirements for new nodes from requirements for existing nodes.

10.1.4. The Contractor shall be responsible for identifying and distinguishing between new and existing components.

10.1.5. The Employer shall free issue all SCADA software runtime licenses prior to the Putting into Operation of the SCADA work in concern.

10.1.6. The Employer shall consider the highest computer specification, amongst the nodes in concern, as the intended requirement where and when a conflict arises and shall adopt a prudent stance on other matters that are in conflict.

10.1.7. The Contractor shall not hold the Employer liable for any costs and time arising from conflicts in this standard specification and its associated documents.

10.1.8. The Contractor should (shall) complete the QMS document for each SCADA component and should (shall) submit the respective documentation to the Engineer for approval.

10.1.9. The Contractor shall configure each SCADA node to automatically boot into the operating system environment without user intervention.

10.1.10. The Contractor shall configure each SCADA component to start up automatically when the operating system reboots and to re-establish all communications within 60 seconds when the network and devices return to a healthy state.

10.1.11. The Contractor shall not install "games" on new SCADA nodes and shall remove "games" on existing SCADA nodes, if applicable.

10.1.12. The Contractor shall obtain the approval of the Chief Automation Engineer (CAE) for additions, deletions and modifications to sections of this SCADA standard specification prior to implementation.

11. IDENTIFICATION OF COMPONENTS IN THE SCADA ENVIRONMENT

11.1. Primary Components

11.1.1. The following primary components form an integral part of the SCADA system:

Name	Abbreviation
Active Factory	AF
Automation Object Server	AOS
DT Analyst	DT
Enterprise Integration Application	EIA
Galaxy Repository	GR
Industrial Application Server	IAS
Information Server Portal	ISP
Production Event Module	PEM
QI Analyst	QI
SCADAlarm	SA
Wonderware Historian	WH

Sorted Alphabetically

11.2. Secondary Components

11.2.1. The following secondary components form an integral part of the SCADA system:

Name	Abbreviation
Alarm Database Manager	ADB
Data Acquisition Servers	DAS
Device Integration	DI
Input/Output Servers	IOS
Integrated Development Environment	IDE
InTouch	INT

Sorted Alphabetically

11.3. Tertiary Components

11.3.1. The following tertiary components are supplementary to the SCADA system:

Name	Abbreviation
Engineering Station	ES

Sorted Alphabetically

11.4. Components Excluded

11.4.1. The following components are excluded from further discussion in this SCADA standard specification and are excluded from the Scope of Work unless stated otherwise in the tender document. Hence all other components are included in the Scope of Work unless stated otherwise in the tender document:

11.4.1.1. Alarm Database Management.

11.4.1.2. DT Analyst.

11.4.1.3. Enterprise Integration Application.

11.4.1.4. Information Server Portal.

11.4.1.5. Production Event Module.

11.4.1.6. QI Analyst.

12. SOFTWARE PREREQUISITES FOR SCADA COMPONENTS

12.1.1. The Contractor shall put into operation the following for each SCADA component/node:

Item	Additional Information
Bootstrap	-
Platform	-
AppEngine	-
Symantec Anti-Virus Client Software	The Employer shall free issue this software

12.1.2. The Contractor shall provide the following information as part of the documentation for each item in 12 a above:

12.1.3. Serial number.

12.1.4. Version number.

12.1.5. Name of node.

13. INDUSTRIAL APPLICATION SERVER (IAS)

13.1.1. The Contractor shall refer to Galaxy Repository (GR).

14. GALAXY REPOSITORY (GR)

14.1.1. The Employer perceives that the Galaxy Repository (GR) and the Industrial Application Server (IAS) are closely linked and interrelated and therefore both components shall be discussed under this section as a single entity.

14.1.2. The Employer shall maintain and upgrade the hardware and software of the GR node.

14.1.3. The Contractor shall configure the single GR, based at the Employer's head office, via an IDE software program.

14.2. Computer Hardware Specifications

14.2.1. The Employer has installed the following hardware for the GR node:

Item	Specification
Model	HP ProLiant DL160 Gen 8 Server
Processors	Intel® Xeon® E5-2620 (2.0GHz/6-core/15MB/7.2GT-s QPI/95W, DDR3-1333, HT, Turbo2- 3/3/4/4/5/5)
Memory	HP SmartMemory 32 GB (4 x 8 GB) RDIMM
Hard Drive	Non-Hot Plug LFF SAS 1.2TB 2 x 600GB
Network	1Gb 361i Ethernet Adapter 2 Ports per controller

14.3. Software Specifications

14.3.1. The Employer has installed the following software for the GR node:

Item	Additional Information
Windows Server 2008	Service Pack 2
SCADA Software Prerequisites	-
IAS License	Version 3.0; 100 000 I/O
Microsoft SQL Server 2008	Service Pack 1
Integrated Development Environment	Arcestra2012 R2

15. SCADALARM (SA)

15.1.1. The Employer shall install SCADAlarm (SA) on each Wonderware Historian (WH) node.

15.1.2. The Contractor shall refer to Wonderware Historian (WH) for additional information.

15.2. Notification Criteria

15.2.1. The Contractor shall configure SA to transmit an SMS and an email upon activation of each medium and high priority alarm (See Alarms for further information).

15.2.2. The Contractor shall configure each alarm to automatically change priority to the next higher priority level if the alarm condition persists for a period longer than 30 days.

16. WONDERWARE HISTORIAN (WH)

16.1.1. The Employer shall maintain and upgrade each WH node.

16.2. Computer Hardware Specifications

16.2.1. Major WH Nodes

16.2.2. The Employer shall install at least one major WH node at each of the following sites:

16.2.2.1. Central Depot.

16.2.2.2. Vereeniging Pumping Station.

16.2.2.3. Zuikerbosch Pumping Station.

16.2.2.4. Zwartkopjies.

16.2.3. The Employer has installed the following hardware for each major WH node:

Item	Specification
Model	HP ProLiant DL160 Gen 8 Server
Processor 1 & 2	Intel® Xeon® E5-2620 (2.0GHz/6-core/15MB/7.2GT-s QPI/95W, DDR3-1333, HT, Turbo2- 3/3/4/4/5/5)
Memory	HP SmartMemory 32 GB (4 x 8 GB) RDIMM
Hard Drive	Non-Hot Plug LFF SAS 1.2TB 2 x 600GB
Network	1Gb 361i Ethernet Adapter 2 Ports per controller
Modem	ATI compliant

16.2.4. Minor WH Nodes

16.2.4.1. The Employer shall install at least one minor WH node at each of the following sites:

16.2.4.1.1. Panfontein Station.

16.2.4.1.2. Eikenhof Booster Station.

16.2.4.1.3. Palmiet Booster Station.

16.2.4.1.4. Mapleton Booster Station.

16.2.4.1.5. Daleside Booster Station

16.2.4.2. The Employer has installed the following hardware for each minor WH node:

Item	Specification
Model	HP ProLiant DL160 Gen 8 Server
Processor	Intel® Xeon® E5-2620 (2.0GHz/6-core/15MB/7.2GT-s QPI/95W, DDR3-1333, HT, Turbo2- 3/3/4/4/5/5)
Memory	HP SmartMemory 32 GB (4 x 8 GB) RDIMM
Hard Drive	Non-Hot Plug LFF SAS 1.2TB 2 x 600GB
Network	1Gb 361i Ethernet Adapter 2 Ports per controller
Modem	ATI compliant

16.3. Software Specifications

16.3.1. The Employer has installed the following software for each WH node (major and minor):

Item	Specification
Windows Server 2008	Service Pack 2
SCADA Software Prerequisites	-
Microsoft SQL Server 2008	Service Pack 1
Wonderware Historian	Version 11.0
Active Factory	Historian Client 10.0
SCADAlarm	Version 6.0

16.4. Minimum and General Trend Requirements

16.4.1. The Contractor shall historise, at a minimum and in general, the following:

Item	Requirements
AIN	Each Analog Input Object
AOT	Each Analog Output Object
DIN	Each Digital Input Object
DOT	Each Digital Output Object
-	At least one external I/O from each asset, field device etc.

17. DEVICE INTEGRATION (DI)

17.1.1. The Contractor shall refer to Automation Object Server (AOS).

18. DATA ACQUISITION SERVER (DAS)

18.1.1. The Contractor shall refer to Automation Object Server (AOS).

19. INPUT/OUTPUT SERVER (IOS)

19.1.1. The Contractor shall refer to Automation Object Server (AOS).

20. INTOUCH (InT)

20.1.1. The Contractor shall refer to Automation Object Server (AOS).

21. AUTOMATION OBJECT SERVER (AOS)

21.1.1. The Contractor shall put into operation at least one AOS at each unmanned plant.

21.1.2. The Contractor shall put into operation at least one two AOS at each manned plant, provided that the unmanned plant shall not be equipped with an AOS.

21.1.3. The Contractor shall put into operation additional AOS components as required in the tender document.

21.1.4. The Contractor shall put into operation the Device Integration (DI) and the AOS on the same node due to the close link and nature of operation between the DI and the AOS.

21.2. Computer Hardware Specifications

21.2.1. Manned Plant

21.2.1.1. The Contractor shall put into operation the following hardware for each AOS at each manned plant:

Item	Specification
Model	HP ProLiant DL160 Gen 8 Server
Processor	Intel® Xeon® E5-2620 (2.0GHz/6-core/15MB/7.2GT-s QPI/95W, DDR3-1333, HT, Turbo2- 3/3/4/4/5/5)
Memory	HP SmartMemory 32 GB (4 x 8 GB) RDIMM
Hard Drive	Non-Hot Plug LFF SAS 1.2TB 2 x 600GB
Network	1Gb 361i Ethernet Adapter 2 Ports per controller
Mouse	Hewlett Packard optical or USB mouse
Keyboard	Hewlett Packard keyboard
Mouse Pad	Hewlett Packard mouse pad
Monitor	Hewlett Packard L2065

21.3. Software Specifications

21.3.1.1. The Contractor shall put into operation the following for each AOS:

Item	Additional Information
Windows Server 2008 or Windows 7 Professional	Service Pack 2 or latest
SCADA Software Prerequisites	-
InTouch	Version 2012

21.4. Performance Configuration

21.4.1. The Contractor shall configure each AOS in a redundant manner if two AOS nodes are in close proximity.

21.4.2. The Contractor shall put into operation additional AOS(s) if the load of a single node exceeds the maximum threshold of 30% CPU usage, in which case the load shall be broken down into smaller parts and deployed to the additional AOS(s).

21.5. Criteria for an Additional AOS

21.5.1. The Contractor shall investigate the usage of an AOS firstly at a manned plant and only thereafter at an unmanned plant. The general rule is to consider the distance between the manned plant and the unmanned plant as well as the communication link between the two categories of plants. The second AOS(s) shall be considered if the straight-line distance between the manned and unmanned plant is greater than 100 meters, the two plants are not on the same site and if the Ethernet communication network between the manned plant and unmanned plant is less than 10 Mbps. The Contractor shall conclude the investigation prior to the submission of the tender document.

21.6. External I/O Communication

21.6.1. The Contractor shall put into operation each AOS and particularly the DI using one of the following secondary SCADA components based on the interface required to the PLC or field device:

21.6.1.1. Modicon Ethernet (MODTCP) DAS; Version 2.05.

21.6.1.2. Siemens S7 DAS; Version 2.05.

21.6.1.3. Wonderware OPC Link DAS; Version 2.05.

21.6.1.4. The Contractor shall configure each communication topic with two modes namely slow poll and fast poll and shall allocate the objects in the appropriate topic mode.

22. ACTIVE FACTORY (AF)

22.1.1. The Contractor shall put into operation system and operation reports. If the site is not equipped with a Wonderware Historian (WH) node then the Contractor shall prepare the reports at a WH or AF node designated by the Engineer.

22.1.2. The Contractor shall put into operation the report templates with provision for manually changing the dates and times.

22.1.3. The Contractor shall backup the templates to the Employer's software control program, VersionWorks®.

22.1.4. The Contractor shall refer to Wonderware Historian (WH) for the classification of variables that shall be historised.

23. INTEGRATED DEVELOPMENT ENVIRONMENT (IDE)

23.1.1. The Contractor shall refer to Engineering Station (ES).

24. ENGINEERING STATION (ES)

24.1.1. The Employer shall install Engineering Stations at the each site with at least one Wonderware Historian (WH) node. The Contractor shall refer to Wonderware Historian (WH) for the list and the location of each WH node.

24.1.2. The Contractor may utilise the Engineering Station for configuration, development, testing and commissioning.

24.1.3. The Employer reserves the right to allocate time slots to each Contractor for the usage of an Engineering Station (ES).

24.2. Computer Hardware Specifications

24.2.1. The Employer has installed the following hardware for each ES node:

Item	Specification
Model	B0F31EA HP 8300E CMT
Processor	Intel Core i5-3470
Memory	4GB DDR3 pc3-10600 RAM(2 DIMMS)
Hard Drive	500GB 7200RPM SATA Hard Drive

24.3. Software Specifications

24.3.1. The Employer has installed the following on each ES node:

Item	Additional Information
Windows7 Pro	64 bit
SCADA Software Prerequisites	
Active Factory Software Program	Historian Client 10.0
Active Factory License	Standalone (seat) license
Integrated Development Environment	-
PLC Software	Relevant PLC Software according to equipment on site

25. SITE SPECIFIC SCADA TOPOLOGY

25.1.1. The Contractor shall update and/or create specific drawings and documentation for the site(s) in concern.

26. TYPICAL SYSTEM TOPOLOGY

26.1.1. The following topology depicts a typical SCADA configuration and layout.

26.2. Legend

PLC

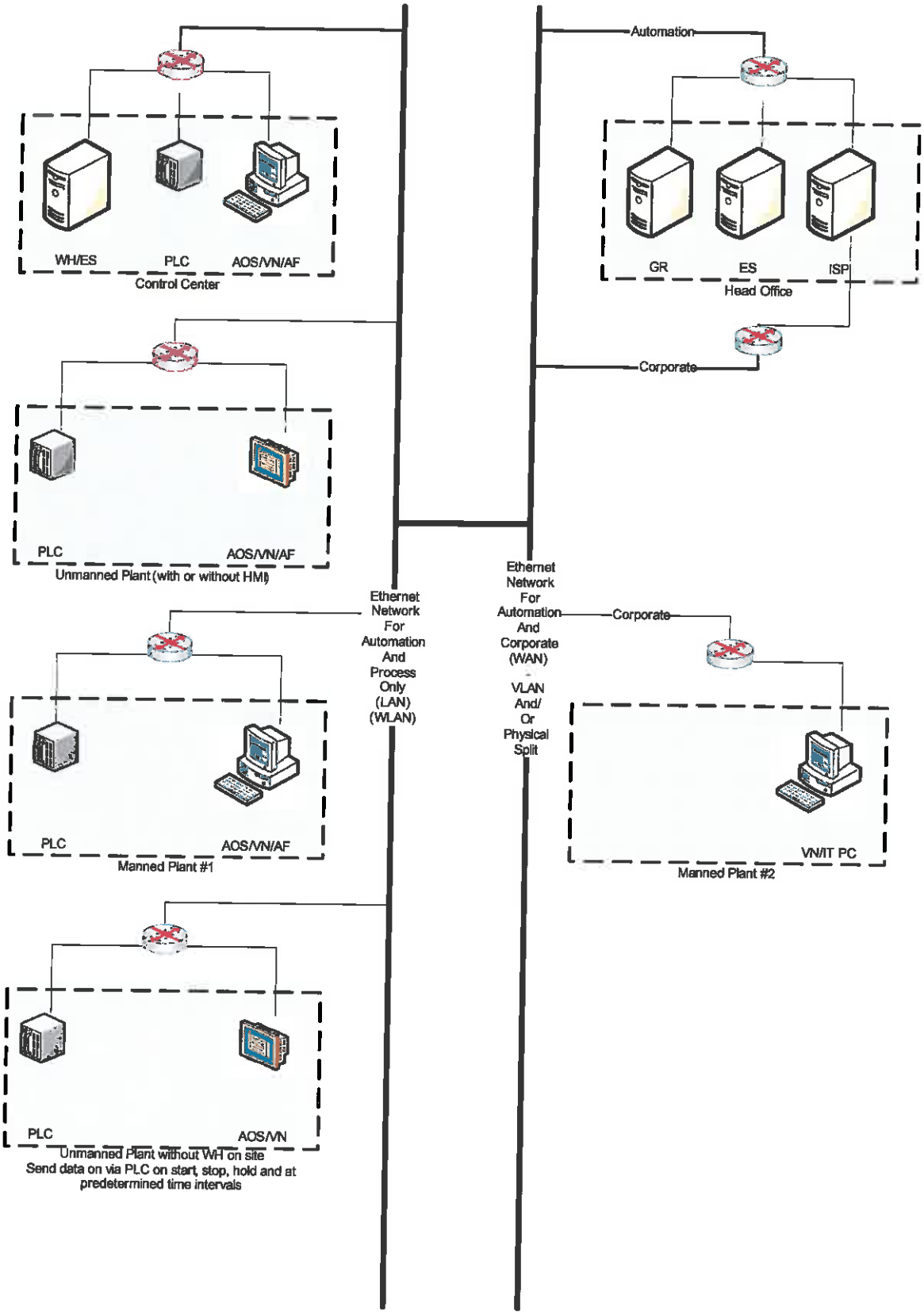
HMI (AOS at an unmanned plant)

Workstation (AOS/AF at a manned plant)

Server (WH, GR etc)

Network node (e.g. Ethernet Switch)

26.3. Typical System Topology



27. IDENTIFICATION OF FUNCTIONAL REQUIREMENTS IN THE SCADA ENVIRONMENT

27.1.1. The Contractor shall provide the specific data needed by the operational and maintenance staff in fulfilling real time responsibilities.

27.1.2. The Contractor shall put into operation the functionality based on the criteria and requirements stipulated in this standard specification.

27.1.3. The Contractor shall put into operation all functionality as detailed in the relevant sections and subsections below including the interdependence and integration with other sections contained in this SCADA standard specification, PLC standard specification and other associated and related documents.

27.2. Areas of Functionality

27.2.1. The following areas of functionality forms an integral part of the SCADA system and shall be included in the Scope of Work unless explicitly excluded from the tender document:

Name
Alarms
Colours (General)
Communications (IO Server/DAS/Top Server and Network)
Computers
Control Modules
Documentation
Equipment Modules
Events
General
Help Functionality
Miscellaneous
Modes of Operation
Navigation
Operation/Phase Modules
Operation Modes (Auto, Manual etc.)
Physical Model
Reports
Scripts
Security and Access Control

SQL Database
Tag Naming Convention
Text (General)
Trends
Windows/Mimics (General)

Sorted Alphabetically

28. PHYSICAL MODEL

28.1.1. The Contractor shall put into operation the physical model.

28.1.2. The Contractor shall refer to the hierarchical depiction of the physical model below.

28.1.3. The Contractor shall organise assets in a hierarchical fashion. In some cases, a grouping within one level may be incorporated into another grouping at that same level.

28.1.4. The physical model has eight levels.

28.1.5. The top layer shall always start with Rand Water as the enterprise.

28.1.6. The Contractor shall put into operation the four highest levels of the model to identify the location of each asset to the enterprise.

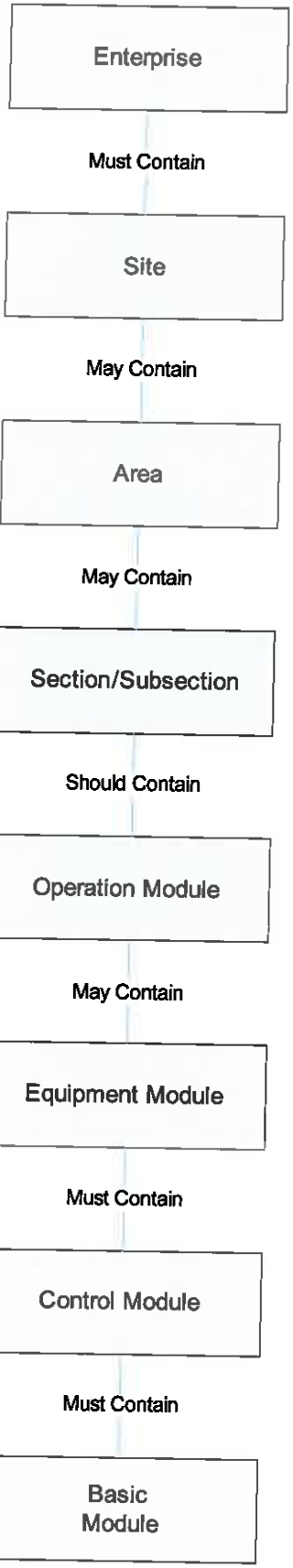
28.1.7. The Contractor shall put into operation the lowest four levels of this model.

28.1.8. The operation/phase and equipment levels are unique to the work in concern and thus embedded in the PLC or field device. The Contractor shall put into operation the SCADA to mimic the structure of the PLC for alarming, trending and information purposes.

28.1.9. The Contractor shall configure the physical model to locate and describe the physical assets of the Employer in terms of sites, plants, sections, operations (process cells), phases (units), equipment modules, and control modules.

28.1.10. The lowest level of this model refer to specific data types such at Boolean, Real, String Integer etc.

28.1.11. The Contractor shall obtain written approval of acceptance for the physical model design from the Chief Automation Engineer (CAE) prior to further configuration, software development and implementation.


Enterprise
Must Contain
Site
May Contain
Area
May Contain
Section/Subsection
Should Contain
Operation Module
May Contain
Equipment Module
Must Contain
Control Module
Must Contain
Basic Module

28.2. Enterprise Level

28.2.1. The Employer has established the enterprise level as Rand Water and the abbreviation is RW.

28.3. Site Level

28.3.1. The Contractor shall put into operation the site level and adhere to the naming convention and abbreviations tabulated below.

28.3.2. The Contractor shall put into operation each site level based on organisational or business criteria as opposed to technical criteria.

28.3.3. The Contractor shall inform the Employer of sites not tabulated below. The Contractor shall create the new site ensuring that the number of characters does not exceed four including numerical placeholders, as the site name shall form part of the tag naming convention.

28.3.4. The Contractor shall obtain the approval of the Chief Automation Engineer (CAE) for additions and modifications to the table of sites prior to implementation.

28.3.5. The Contractor may utilise the area level to provide information pertaining to a site asset that is not unique to a particular site and the asset is shared or interconnected by two or more locations.

28.3.6. The Contractor shall adhere to the list of applicable sites (not exhausted yet) as tabulated below:

Site	Abbreviation
Airfield Reservoir	AF
Amanzimtoti (previously Houtkop)	AM
Barrage	BA
Bethal Reservoir	BE
Bronberg Reservoir	BB
Bloemendal Booster Station	BD
Benoni Reservoir	BE
Brakfontein Reservoir	BF
Buffelshoek Reservoir	BH
Blyvooruitzicht Reservoir	BU
Barnardvlei Reservoir	BV
Central Depot Bulk Water Services	CD
Consumer Meters (various locations)	CM
Daleside Booster Station	DS
Driefontein Reservoir	DF
Eikenhof Pumping Station	EK

Ennerdale Reservoir	EN
Esselen Park	EP
Forest Hill Reservoir	FH
Germiston Reservoir	GM
Heilbron Reservoir	HB
Hartbeeshoek Reservoir	HH
Klipriviersberg Reservoir	KB
Krugersdorp Reservoir	KD
Klipfontein Reservoir	KF
Libanon Pumping Station	LB
Libanon Reservoir	LN
Leeuwpoort Reservoir	LP
Langerand Reservoir	LR
Lethabo Pumping Station	LT
Meyersdal Reservoir	MD
Meyers Hill Reservoir	MH
Mapleton Pumping Station	MP
Meredale Reservoir	MR
Modder East Reservoir	ME
North Ridge Reservoir	NR
Panfontein Station	PF
Palmiet Pumping Station	PM
Pipelines (various locations and interconnecting)	P
Roodepoort Pumping Station	RP
Rietvlei (Head Office)	RV
Sasolburg Pumping Station	SB
Selcourt Reservoir	SC
Townlands	TL
Trichard	TR
Vaal Dam Reservoir	VD
Vlakfontein Reservoir	VF
Vereeniging Purification Station	VG
Wildebeesfontein Reservoir	WF

Witpoortjie Reservoir	WP
Weltevreden Reservoir	WT
Waterval Reservoir	WV
Zuikerbosch Purification Station – Works Area 1	ZB1
Zuikerbosch Purification Station – Works Area 2	ZB2
Zwartkopjes Booster Station	ZK
Zuurbekom	ZU

Sorted Alphabetically

28.4. Area Level

28.4.1. The Contractor shall put into operation the area level and adhere to the naming convention and abbreviations tabulated below.

28.4.2. The Contractor shall put into operation the boundaries of an area based on physical structures and particular types of systems at a particular site. The term area refers to plants and/or major processes.

28.4.3. The Contractor shall put into operation an area provided the area is contained or in close proximity to a site.

28.4.4. The Contractor shall inform the Employer of areas not tabulated below. The Contractor shall create the new area ensuring that the number of characters does not exceed five including numerical placeholders, as the area name shall form part of the tag naming convention.

28.4.5. The Contractor shall obtain the approval of the Chief Automation Engineer (CAE) for additions and modifications to the table of areas prior to implementation.

28.4.6. The Contractor shall adhere to the list of applicable areas (not exhausted yet) as tabulated below:

Area/Plant	**Abbreviation**
Ammonia Plant	AM
Boiler House	BL
Carbonation Bay	CB
Canal	CN
Chlorine Plant	CL
Condition Bay	CD
Crusher House	CR
Desludging Bridge	DB
Engine Room	ER
Ferric Plant	FE
Filter House	FH

Flocculator	FC
Flouride Plant	FL
Forebay	FB
Kiln	KL
Lime Plant	LM
Preconditioning Bay	PC
Poly Plant	PO
Primary Sedimentation	PS
Recovered Wash Water	RW
Reservoir	RS
Secondary Sedimentation	SS
Sedimentation Tank	ST
Silica Plant	SI
Slaker House	SL
Sludge Plant	SD
Sodium Hypochlorite Plant	SO
Sump	SU
System	SY
Tippler Plant	TP
Tunnel	TN
Water Quality Kiosk	WQ
Well	WL

Sorted Alphabetically

28.5. Section/Sub Section Level

28.5.1. The Contractor shall put into operation the section/subsection level and adhere to the naming convention and abbreviations tabulated below.

28.5.2. The Contractor shall put into operation the boundaries of a section/subsection based on physical structures and particular types of systems in a particular area.

28.5.3. The Contractor shall put into operation a section/subsection provided the section/subsection is contained or in close proximity to an area.

28.5.4. The Contractor shall inform the Employer of sections/subsections not tabulated below. The Contractor shall create the new section/subsection ensuring that the number of characters does not exceed five including numerical placeholders, as the section/subsection name shall form part of the tag naming convention.

28.5.5. The Contractor shall obtain the approval of the Chief Automation Engineer (CAE) for additions and modifications to the table of sections/subsections prior to implementation.

28.5.5.1. The Contractor shall adhere to the list of applicable sections/subsections (not exhausted yet) as tabulated below:

Section/Subsection	Abbreviation
Auxiliary Equipment or Section	AUX
Air Section	AIR
Drum Section	DRM
Evaporator Section	EVP
Dosing Section	DOS
Dosing Plants – Primary Section	PRI
Dosing Plants – Secondary Section	SEC
Pump Set	PS
Switchgear Section	SG

Sorted Alphabetically

28.6. Operation/Phase Level

28.6.1. The operation level consists of distinct operations e.g. pump set operation, desludging etc. and is typically linked to an area. The operation module consists of the total plant control and monitoring features such as plant start, plant stop, plant running etc. and to this end is standardised as an object in the SCADA system.

28.6.2. The phase level consists of distinct sub-operations e.g. shut off procedure in a chlorine dosing operation, transfer of desludging bridge from one tank to another etc. This level is unique to the work in concern but may be typical of phases at similar plants or areas.

28.6.3. The Contractor shall refer to Operation/Phase Modules.

28.7. Equipment Level

28.7.1. The equipment level consists of a functional group of basic and control equipment that in combination can carry out a finite number of specific minor processing activities. An equipment module typically consists of control modules and basic modules. The equipment level consists of a group of sensors, control, and monitoring equipment that performs a finite task e.g. duty/standby pumps on a single bench for redundancy, pumps at desludging bridge, proximity switches on the rails of a desludging bridge. This level is unique to the work in concern but may be typical of equipment at similar plants or areas.

28.7.2. The Contractor shall refer to Equipment Modules.

28.8. Control Level

28.8.1. The control level consists of individual sensors, control and monitoring equipment that can carry out basic control. A control module is typically sensors, actuators, motors, variable speed drives, uninterruptible power supplies, PLC modules, computers etc. that, from the viewpoint of control, is operated as a single entity. This level forms a significant part of standardisation that shall be frequently used.

28.8.2. The Contractor shall refer to Control Modules.

28.9. Basic Level

28.9.1. The basic level consists of data types and is the lowest level in the physical model. The basic modules are Boolean, Integer, Real etc. This level is usually predefined in all software programs.

28.9.2. The Contractor shall refer to Basic Modules.

29. OPERATION/PHASE MODULES

29.1.1. The Contractor shall put into operation the operation/phase level.

29.1.2. The operation module applies to control and monitoring of an entire operation and the operation is usually linked to an area. Phase modules are similar to operation modules but apply to levels lower than the operation module where distinct and independent operations are executed at a given section/subsection. The operation/phase module has distinct attributes, modes, transitions, states and messages.

29.1.3. The Contractor shall comply with the Employer's tag naming convention.

29.1.4. Each operation module shall be addressed using the abbreviation OM.

29.1.5. Each phase module shall be addressed using the abbreviation PM.

29.2. Input/Outputs

29.2.1. The Contractor shall configure user initiated commands as set/reset actions from the SCADA.

29.2.2. The Contractor shall put into operation the following I/O for each operation/phase module and only one transition may be active at any given time. A state shall include transitions:

State
Default
Error Message
Interlock
Start-up Interlock
Process Interlock
Safety Interlock
Other Interlock
Ready
Initiate
Initiating
Initiated
Failed to Initiate
Start
Starting
Running/Healthy
Failed to Start
Stop
Stopping
Stopped
Failed to Stop
Hold
Holding
Held
Failed to Hold
Go To
Going To
Gone To

Failed to Go To
Return to Normal Operation
Returning to normal operation
Returned to normal operation
Failed to return to normal operation
Acknowledge
Acknowledging
Acknowledged
Failed to Acknowledge
Emergency Stop
Emergency In Progress
Emergency Stopped
Emergency Stop Failure
Mode (See mode of operations below)
Prompt Message

29.3. Definition of States

29.3.1. Default

29.3.1.1. The Contractor shall put into operation the operation/phase module.

29.3.1.2. The operation/phase module shall on its first scan or upon recovery of a major failure return to the default state.

29.3.1.3. All respective phase and equipment modules shall be reset when the operation module is in the defaul state.

29.3.2. Interlocks

29.3.2.1. The Contractor shall put into operation interlocks for each operation/phase module.

29.3.2.2. The Contractor shall distinguish between start-up, process, safety and other interlocks.

29.3.2.3. The interlocks shall be considered active when a positive or high signal is received from the field device. An active interlock shall prevent start-up or continued operation of a plant.

29.3.2.4. The start-up interlock shall only prevent the initial starting of an operation/phase. This interlock shall not be monitored while the operation is active.

29.3.2.5. The process interlocks refer to interlocks that the operator may bypass.

29.3.2.6. The safety interlocks shall not be bypassed by the user.

29.3.2.7. The Contractor shall classify all other types of interlocks excluding start-up, process and safety as other interlocks.

29.3.2.8. Interlocks shall be displayed in an 8 x 1 array, at a minimum, and the interlocks shall be positioned in a logical sequence to facilitate corrective action.

29.3.3. Ready

29.3.3.1. The Ready state is achieved when all devices are healthy, no errors are present or imminent, no interlocks are preventing operation of any field device and the system is in a safe state and ready for operation.

29.3.3.2. The Contractor shall put into operation the ready state in line with the functionality of the entire system and external logic contained in the PLC or field device.

29.3.4. Initiate

29.3.4.1. The Contractor shall put into operation the initiate functionality for each operation/phase module.

29.3.4.2. The initiate command is required to begin execution of the logic contained in the operation/phase module. The activation of this command is subject to the duly authorised user being logged on the SCADA system.

29.3.4.3. The activation of the initiate command from the SCADA shall cause a transition from the ready state to the initiating state. This state shall be determined by the SCADA.

29.3.4.4. The initiated state shall be confirmed by the PLC or field device.

29.3.4.5. The failed to initiate state shall be activated if the user adjustable time has elapsed and the initiated state has not been confirmed by the PLC or field device.

29.3.4.6. The timer shall be deactivated when the initiated state is active and activated when the initiate command is initiated.

29.3.4.7. The field devices should be controlled and placed in a ready to operate mode by the PLC or control system upon activation of the initiate command.

29.3.5. Start

29.3.5.1. The Contractor shall put into operation the start functionality for each operation/phase module.

29.3.5.2. The activation of the start command from the SCADA may only be activated if the operation/phase module is in the initiated state and the duly authorised user is logged on the SCADA system.

29.3.5.3. The start command shall cause a transition from the ready state to the starting state. This state shall be determined by the SCADA.

29.3.5.4. The started/running state shall be confirmed by the PLC or field device.

29.3.5.5. The failed to start/run state shall be activated if the user adjustable time has elapsed and the start/running state has not been confirmed by the PLC.

29.3.5.6. The timer shall be deactivated when the started/running state is active and activated when the start command is initiated.

29.3.5.7. The field devices should be controlled and placed in a running mode by the PLC or control system upon activation of the start command.

29.3.6. Stop

29.3.6.1. The Contractor shall put into operation the stop functionality for each operation/phase module.

29.3.6.2. The activation of the stop command from the SCADA may only be activated if the operation/phase module is in the started/running state and the duly authorised user is logged on the SCADA system.

29.3.6.3. The stop command shall cause a transition from the running state to the stopping state. This state shall be determined by the SCADA.

29.3.6.4. The stopped state shall be confirmed by the PLC or field device.

29.3.6.5. The failed to stop state shall be activated if the user adjustable time has elapsed and the stopped state has not been confirmed by the PLC or field device.

29.3.6.6. The timer shall be deactivated when the stopped state is active and activated when the stop command is initiated.

29.3.6.7. The field devices should be controlled and placed in a stop mode by the PLC or control system upon activation of the stop command. This is a sequential and logical stop sequence activated by the control system.

29.3.7. Emergency Stop

29.3.7.1. The Contractor shall put into operation the emergency stop functionality for each operation/phase module.

29.3.7.2. The activation of the emergency stop command from the SCADA may only be activated if the operation/phase module is in the started/running state and the duly authorised user is logged on the SCADA system.

29.3.7.3. The emergency stop command shall cause a transition from the running state to the emergency stopping state. This state shall be determined by the SCADA.

29.3.7.4. The emergency stopped state shall be confirmed by the PLC or field device.

29.3.7.5. The failed to complete emergency stop state shall be activated if the user adjustable time has elapsed and the emergency stopped state has not been confirmed by the PLC or field device.

29.3.7.6. The timer shall be deactivated when the emergency stopped state is active and activated when the emergency stop command is initiated.

29.3.7.7. The field devices should be controlled and placed in an emergency stop mode by the PLC or control system upon activation of the emergency stop command. This is not a sequential and logical stop sequence activated by the control system rather an immediate placement of all equipment and modules into a safe state.

29.3.8. Acknowledge

29.3.8.1. The Contractor shall put into operation the acknowledge functionality for each operation/phase module.

29.3.8.2. The activation of the acknowledge command from the SCADA may only be activated if an error is present or alarms condition exists and the duly authorised user is logged on the SCADA system.

29.3.8.3. The acknowledge command shall cause a transition from the acknowledge state to the acknowledging state. This state shall be determined by the SCADA.

29.3.8.4. The acknowledged state shall be confirmed by the PLC or field device.

29.3.8.5. The failed to acknowledge state shall be activated if the user adjustable time has elapsed and the acknowledged state has not been confirmed by the PLC or field device.

29.3.8.6. The timer shall be deactivated when the acknowledged state is active and activated when the acknowledge command is initiated.

29.3.8.7. The field devices should be acknowledged and thereafter controlled and placed in the required mode of operation as determined by the PLC or control system.

29.3.9. Prompt Messages

29.3.9.1. The Contractor shall put into operation prompt messages for each operation/phase module.

29.3.9.2. Prompt messages shall be displayed in a 2 x 1 array and the prompts shall be positioned in a logical sequence to facilitate user action.

29.4. Advanced/abnormal Operation

29.4.1. Errors

29.4.1.1. The Contractor shall put into operation error messages for each operation/phase module.

29.4.1.2. Error messages shall be displayed in an 8 x 1 array and the errors shall be positioned in a logical sequence to facilitate corrective action promptly.

29.4.1.3. Error messages shall be described in layman's terms to assist operators with the correct interpretation of the message and cause of the error.

29.4.2. Hold

29.4.2.1. The Contractor shall put into operation the hold functionality for each operation/phase module.

29.4.2.2. The activation of the hold command from the SCADA may only be activated if the operation/phase module is in the started/running state and the duly authorised user is logged on the SCADA system.

29.4.2.3. The hold command shall cause a transition from the running state to the holding state. This state shall be determined by the SCADA.

29.4.2.4. The held state shall be confirmed by the PLC or field device.

29.4.2.5. The failed to hold state shall be activated if the user adjustable time has elapsed and the held state has not been confirmed by the PLC or field device.

29.4.2.6. The timer shall be deactivated when the held state is active and activated when the hold command is initiated.

29.4.2.7. The field devices should be controlled and placed in a hold mode by the PLC or control system upon activation of the hold command.

29.4.3. Return to Normal Operation

29.4.3.1. The Contractor shall put into operation the return to normal operation functionality for each operation/phase module.

29.4.3.2. The activation of the return to normal operation command from the SCADA may only be activated if the operation/phase module is in the held state and the duly authorised user is logged on the SCADA system.

29.4.3.3. The return to normal operation command shall cause a transition from the held state to the returning to normal operation state. This state shall be determined by the SCADA.

29.4.3.4. The returned to normal state shall be confirmed by the PLC or field device.

29.4.3.5. The failed to return to normal state shall be activated if the user adjustable time has elapsed and the returned to normal state has not been confirmed by the PLC or field device.

29.4.3.6. The timer shall be deactivated when the returned to normal state is active and activated when the returned to normal command is initiated.

29.4.3.7. The field devices should be controlled and placed in a normal mode by the PLC or control system.

29.4.4. Go to

29.4.4.1. The Contractor shall put into operation the go to functionality for each operation/phase module.

29.4.4.2. The activation of the go to command from the SCADA may only be activated if the duly authorised user is logged on the SCADA system. This command is reserved for site system administrators only.

29.4.4.3. The go to command shall cause a transition from the last known state to the going to state. This state shall be determined by the SCADA.

29.4.4.4. The gone to state shall be confirmed by the PLC or field device.

29.4.4.5. The failed to go to state shall be activated if the user adjustable time has elapsed and the gone to state has not been confirmed by the PLC or field device.

29.4.4.6. The timer shall be deactivated when the gone to state is active and activated when the go to command is initiated.

29.4.4.7. The field devices should be controlled and placed in the correct mode/state by the PLC or control system.

30. EQUIPMENT MODULES

30.1.1. The Contractor shall put into operation the equipment level for the work in concern.

30.1.2. The Contractor shall obtain written approval from the Chief Automation Engineer (CAE) prior to implementation of each equipment module.

31. CONTROL MODULES

31.1.1. A control module is typically a collection of sensors, actuators etc. that, from a control point of view, is operated as a single entity. Control modules contain the basic control and monitors I/O, interlocks, modes and commands. Based on these inputs these modules set outputs and statuses/alarms for further manipulation by the PLC code and the SCADA.

31.1.2. Control modules may have several variations to compensate for the differences in configuration and technology. In addition, control modules may incorporate particular types of sensors and devices that are similar for purposes of control, monitoring or data collection. The list of applicable control modules for the control level (not exhausted yet) is tabulated below:

31.1.3. The Contractor shall put into operation a control module for each field device and asset.

31.1.4. The Contractor shall refer to the relevant section for each control module.

31.1.5. The Contractor shall adhere to the requirements in the subsequent sections for each type of object and shall utilise the software object developed on the SCADA system.

31.1.6. The Contractor shall obtain written permission from the Chief Automation Engineer regarding the allocation of devices to its respective classification type.

31.1.7. Each end device, node and intermediary device shall be monitored if available or deducible.

Control Module Template	Description
RW_ANALOG_INPUT	-
RW_ANALOG_OUTPUT	-
RW_DIGITAL_INPUT	-
RW_DIGITAL_OUTPUT	-
RW_COMPUTER	Any computer node
RW_GATEWAY	Any gateway
RW_MODEM	Any Modem
RW_MOTOR	-
RW_PID	Proportional, Integral and Derivative Controller
RW_PUMP	-
RW_SWITCH	Ethernet Switch
RW_TOTALISER	-
RW_UPS	Uninterruptible Power Supply
RW_VALVE	Any open/close valve
RW_VSD	Variable Speed Drive

Sorted Alphabetically

32. RW_Analog_input (AI)

32.1. General

32.1.1. The Contractor shall put into operation an analog input for each asset classified as an analog input device.

32.2. Analog Input Devices

32.2.1. The following devices are classified as analog input.

Measurement
Ampmeter
Chlorine
Conductivity
Density
Energy/Electrical Meter
Flouride
Flow
Level Transmitters
Mass
Position/Displacement
pH
Pressure Transmitters
Speed
Temperature Transmitter
Turbidity
Vibration
Voltmeter
Volume

32.3. PLC Attributes

32.3.1. Each analog input device shall have the following I/O and attributes:

Attribute	Comment	
Ack	Acknowledge all alarms	Bit
DisAlm	En/Disable alarms	Bit
HiHi	High-high alarm set point	Real
HiHiEn	High-high alarm set point Dis/Enable	Bit
HiHiAck	High-high alarm acknowledged	Bit
HiHiTmr	High-high alarm set point timer	Timer
HiHiAlm	High-high alarm state	Bit
Deadband	High-high alarm deadband	Real
Hi	High alarm set point (Refer to HiHi for a complete list of attributes)	
Lo	Low alarm set point (Refer to HiHi for a complete list of attributes)	
LoLo	Low-low alarm set point (Refer to HiHi for a complete list of attributes)	
RoC	Rate of change alarm set point (Refer to HiHi for a complete list of attributes)	
NoC	No change alarm set point (Refer to HiHi for a complete list of attributes)	
Mode	See modes of operation	
Auto	Auto mode	
Manual	Manual mode	
Maintenance	Maintenance mode	
Name	Name of asset	
Description	Description of asset	
WKS	WKS number of asset	
Help	Help file/path to file for the asset	
PV	Process variable or engineering value (scaled)	
Addr	Source address	
Damp	Damping Factor	
EngMax	Maximum engineering value	
EngMin	Minimum engineering value	
EngUnits	Engineering units	
ManPV	Manual/Manipulated process variable	

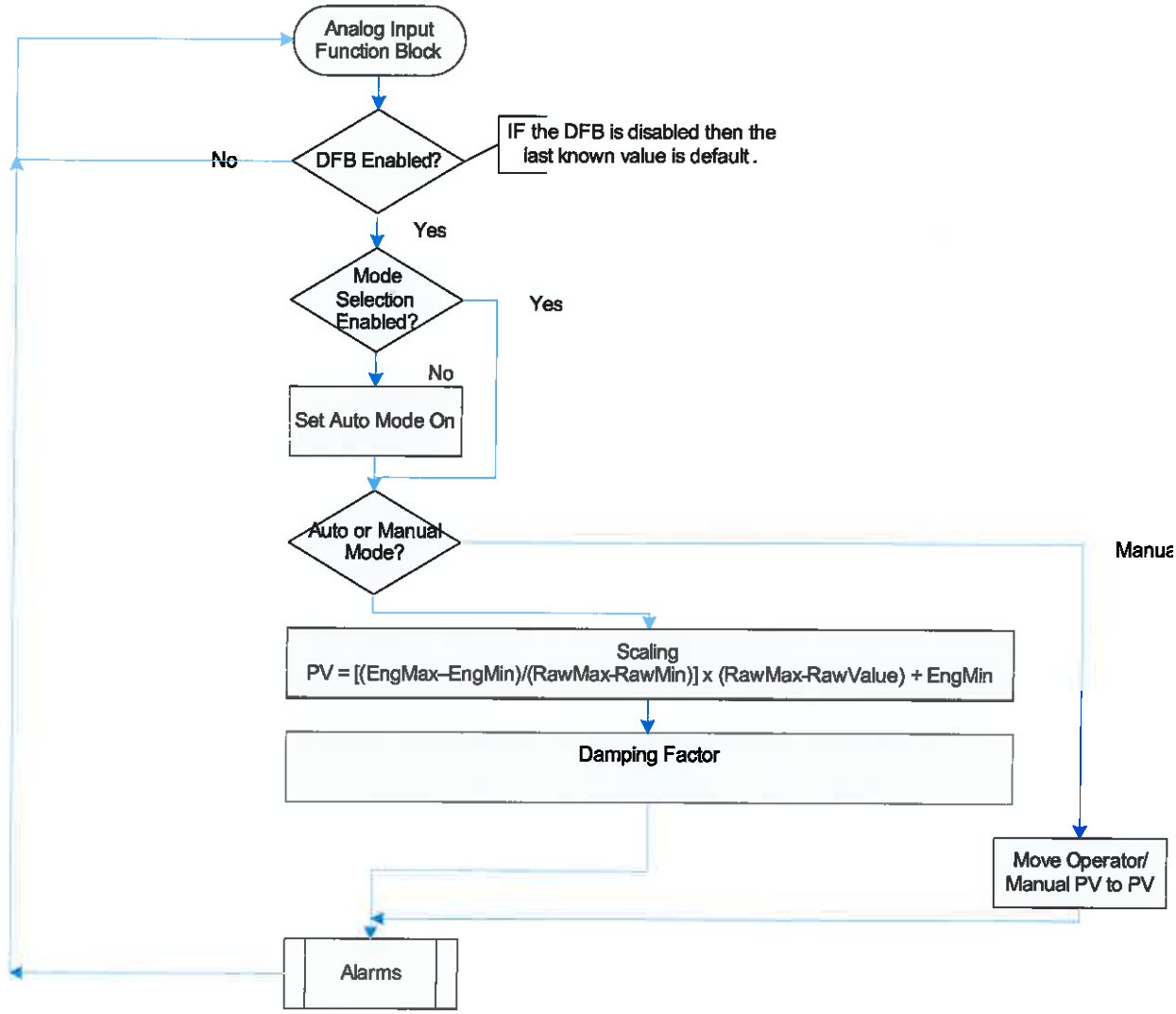
Slope	Positive or Negative sloping PV.	
RawVal	Raw value from field device (no scaling)	
RawMax	Maximum raw value from field device	
RawMin	Minimum raw value from field device	
Quality	Quality of raw value	
BadData	Data received is unreliable and probably requires calibration	
Comms	Communication Alarm	
Maintenance	Maintenance required for asset	
Unknown	Data is completely invalid and unreliable.	
Target	Target set point	
MinDev	Minor deviation alarm set point	
MaxDev	Major deviation alarm set point	
Statistics	Statistical Information	
Availability	Availability of device (total time minus time in maintenance state)	
Avg	Average value	
Installed	Date of installation or operation	
Max	Maximum value	
Min	Minimum value	
Reliability	Reliability (% derived from MTBF)	
Replace	Date of replacement	
Rst	Reset statistical information	
Sdev	Standard deviation	

Sorted Alphabetically

32.4. PLC Functionality

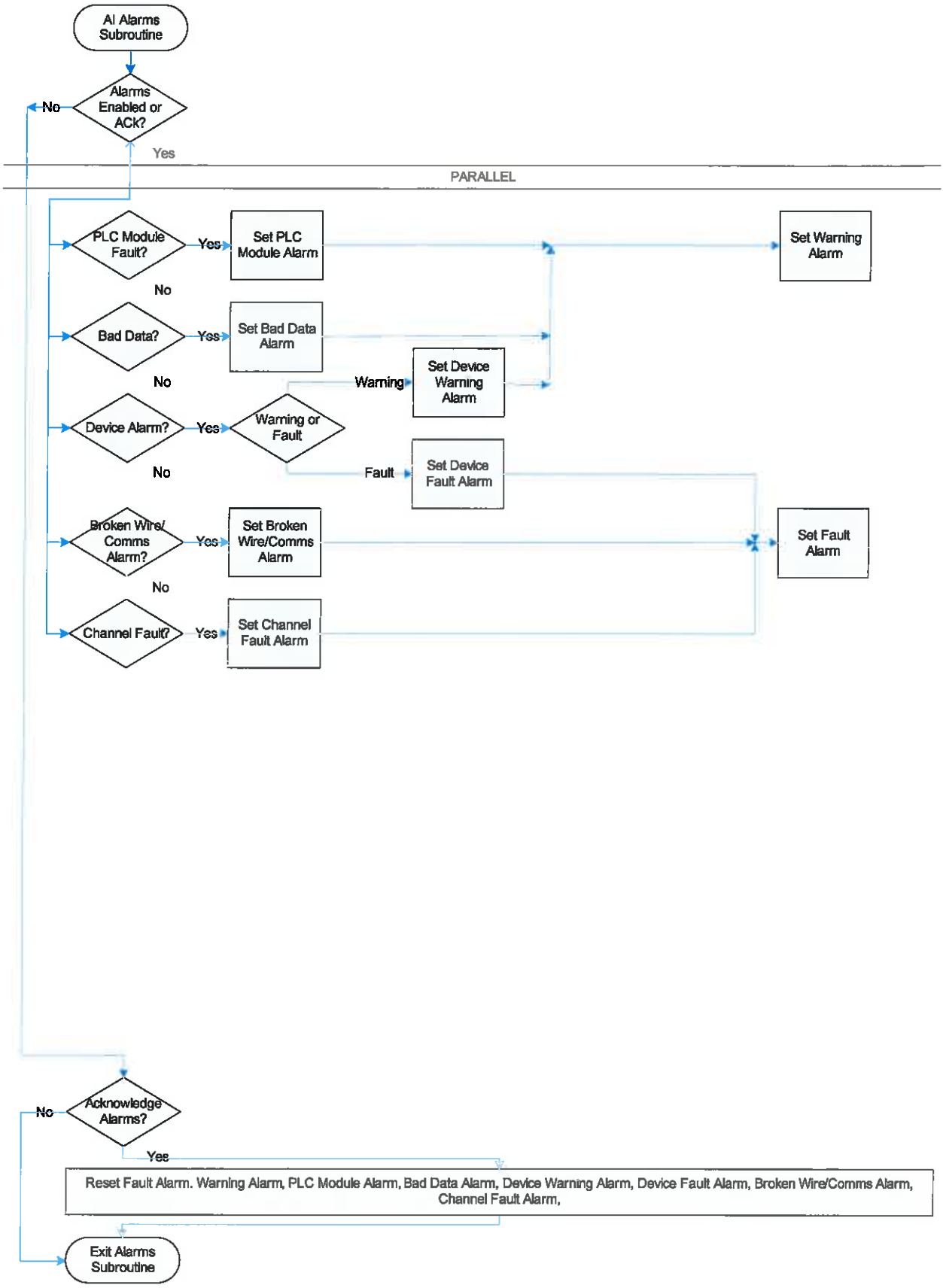
32.4.1. The primary function of this control module is to message the input for use in programming and display on the operator interface. This control module also handles all the BAD DATA, HI HI, HI, LOW and LOW LOW alarming for the analog input. This control module can be put in simulation mode that allows the programmer to simulate a raw analog input signal to the process. If the operator is logged in at the proper security level the Enable/Disable buttons will be enabled. Also the Operator will be able to adjust the alarm SetPoints.

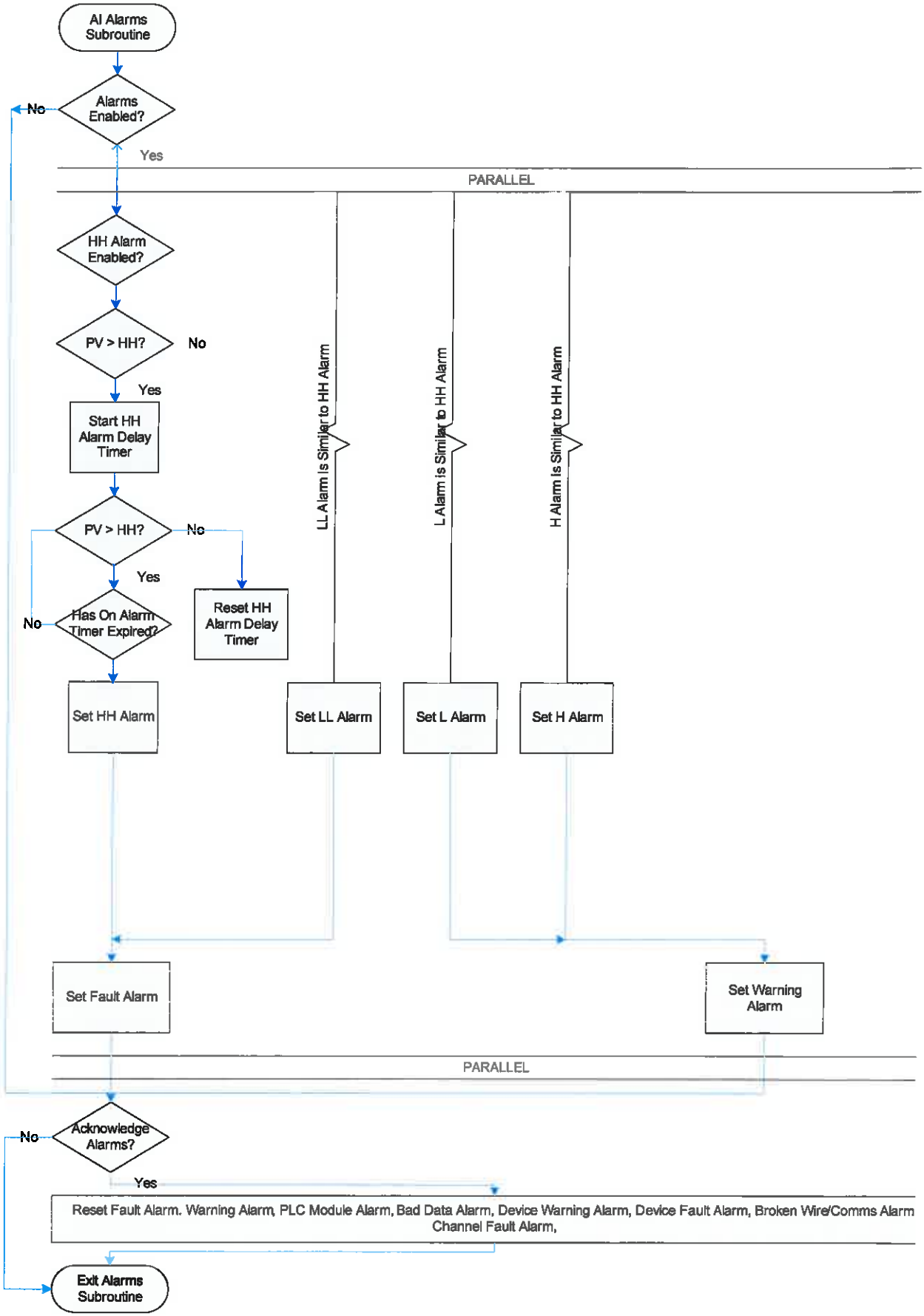
32.4.2. Main Routine



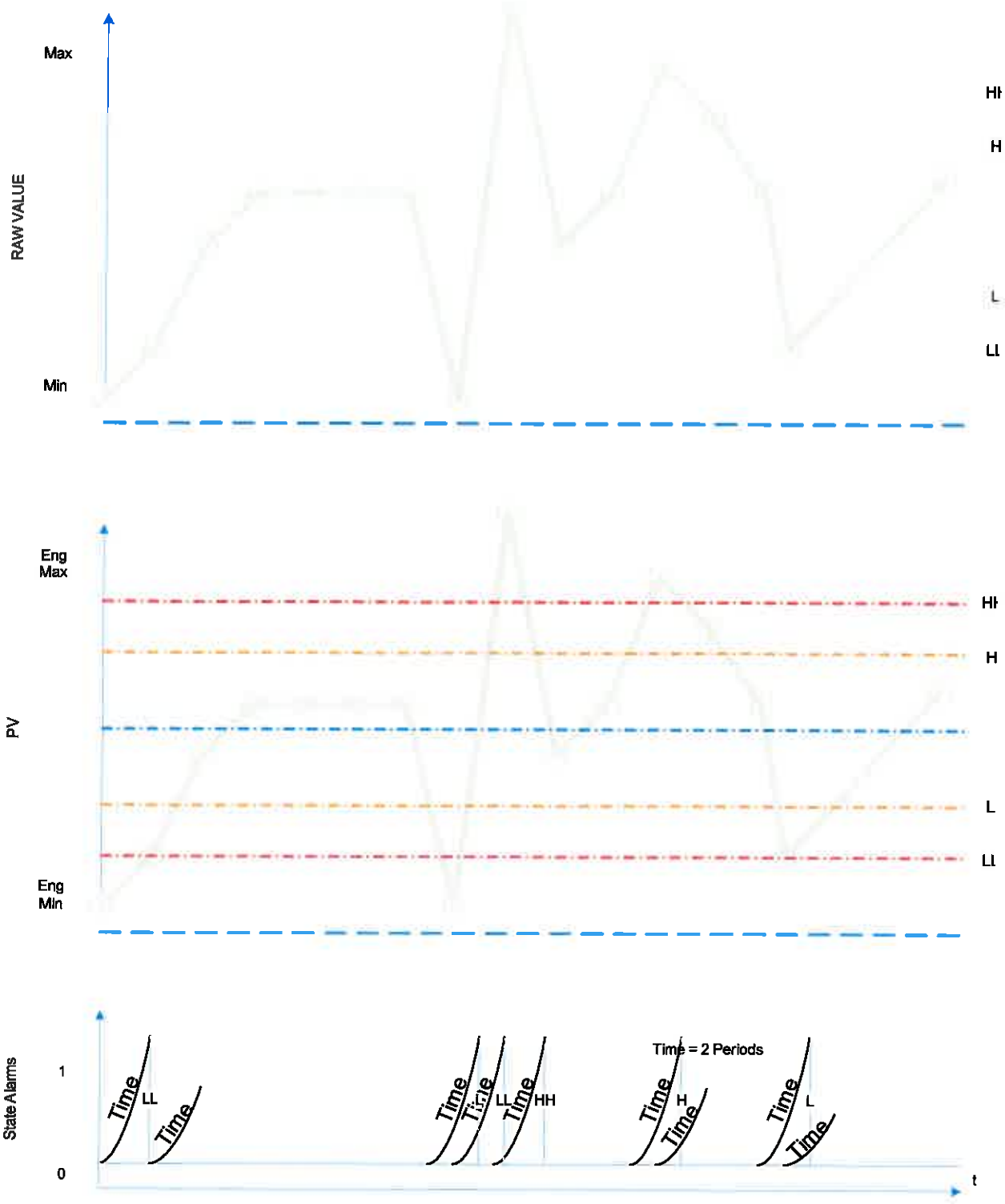
32.4.3. Alarm Routine

32.4.3.1. The two depictions below are part of one subroutine.


AI Alarms Subroutine
Alarms Enabled or ACK?
No
Yes
PARALLEL
PLC Module Fault?
Yes
Set PLC Module Alarm
Set Warning Alarm
No
Bad Data?
Yes
Set Bad Data Alarm
No
Warning
Set Device Warning Alarm
Device Alarm?
Yes
Warning or Fault
No
Fault
Set Device Fault Alarm
Broken Wire/ Comms Alarm?
Yes
Set Broken Wire/Comms Alarm
Set Fault Alarm
No
Channel Fault?
Yes
Set Channel Fault Alarm
Acknowledge Alarms?
No
Yes
Reset Fault Alarm. Warning Alarm, PLC Module Alarm, Bad Data Alarm, Device Warning Alarm, Device Fault Alarm, Broken Wire/Comms Alarm, Channel Fault Alarm,
Exit Alarms Subroutine


AI Alarms Subroutine
Alarms Enabled?
No
Yes
PARALLEL
HH Alarm Enabled?
PV > HH?
No
Yes
Start HH Alarm Delay Timer
PV > HH?
No
Yes
No
Has On Alarm Timer Expired?
Reset HH Alarm Delay Timer
LL Alarm is Similar to HH Alarm
L Alarm is Similar to HH Alarm
H Alarm is Similar to HH Alarm
Set HH Alarm
Set LL Alarm
Set L Alarm
Set H Alarm
Set Fault Alarm
Set Warning Alarm
PARALLEL
No
Acknowledge Alarms?
Yes
Reset Fault Alarm. Warning Alarm, PLC Module Alarm, Bad Data Alarm, Device Warning Alarm, Device Fault Alarm, Broken Wire/Comms Alarm Channel Fault Alarm,
Exit Alarms Subroutine

32.4.4. Timing Diagram



32.5. Field Attributes

32.5.1. These tags are communicated to/from the PLC.

Attribute (Abbreviation)	Type	Description
Auto	Bool	Auto mode selected
Local	Bool	Local mode selected
Maintenance	Bool	Maintenance mode selected
Manual	Bool	Manual mode selected
Remote	Bool	Remote mode selected
Noc_Alarm	Bool	No change alarm
Eng_Max	Float	Engineering maximum value
Eng_Min	Float	Engineering minimum value
Noc_Dev	Int	No change alarm deviation
Noc_Time	Int	No change alarm delay timer (seconds)
PV	Float	Process variable
Man_PV	Float	**Manual process variable**
Raw_Max	Int	Raw input maximum value
Raw_Min	Int	Raw input minimum value
AlarmAck	Bool	**This still needs to be defined and added to the object**
Damp_Factor	Real	**This still needs to be defined and added to the object**
Equipment	Bool	**This still needs to be defined and added to the object**

32.5.2. Object Functionality

32.5.2.1. Auto Mode

32.5.2.1.1. Value has **Generate Event Upon** Change selected.

32.5.2.2. Local Mode

32.5.2.2.1. Value has **Generate Event Upon** Change selected.

32.5.2.3. Maintenance

32.5.2.3.1. Value has **Generate Event Upon** Change selected.

32.5.2.4. Manual

32.5.2.4.1. Value has **Generate Event Upon** Change selected.

32.5.2.5. Remote

32.5.2.5.1. Value has **Generate Event Upon** Change selected.

32.5.2.6. Eng_Max

32.5.2.6.1. Value has **Generate Event Upon** Change selected.

32.5.2.6.2. Value is set to ***Configure*** security level.

32.5.2.7. Eng_Min

32.5.2.7.1. Value has **Generate Event Upon** Change selected.

32.5.2.7.2. Value is set to ***Configure*** security level.

32.5.2.8. NOC_Dev

32.5.2.8.1. Value has **Generate Event Upon** Change selected.

32.5.2.8.2. Value is set to ***Tune*** security level.

32.5.2.9. NOC_Time

32.5.2.9.1. Value has **Generate Event Upon** Change selected.

32.5.2.9.2. Value is set to ***Tune*** security level.

32.5.2.10. PV

32.5.2.10.1. Value ***Engineering Units*** to be set based on measuring units of the device (Template value set to %) Note this value is not changeable during runtime.

32.5.2.10.2. Enable history is checked with default values. Trend high and low is set to engineering max and min by using a data change script (TrendMaxMin) within the object.

32.5.2.10.3. Enable Limit Alarms is checked. Values of HiHi, Hi, Lo, LoLo are addressed to the object in the PLC using the IOInitialise script.

32.5.2.10.4. Enable rate of change alarms is checked. Up and down limits are addressed to the object in the PLC using the IOInitialise script.

32.5.2.10.5. Enable target deviation. The ***Minor, Major*** and ***Target*** values are internal to the Object in ArchestrA.

32.5.2.10.6. Enable Statistics is checked with default values.

32.5.2.11. Raw_Max

32.5.2.11.1. Value has **Generate Event Upon** Change selected

32.5.2.11.2. Value is set to ***Configure*** security level

32.5.2.12. Raw_Min

32.5.2.12.1. Value has **Generate Event Upon** Change selected

32.5.2.12.2. Value is set to ***Configure*** security level

32.6. Object Information

32.6.1. This AI object is derived from the $b_Userdefined object.

32.6.1.1. Description field must be entered manually on this page, all other fields are left to default settings. Object help may be inserted at a later stage.

32.7. Scripts

32.7.1. IOInitialise

32.7.1.1. This script handles the addressing for all the IO. Note that these scripts might change based on the design of the control modules at PLC level.

To be inserted…

32.7.2. Taglength

32.7.2.1. This script checks the length of the tag name, object description and WKS number and uses the values calculated to determine the sizes of the headings and descriptions used in Intouch. It also splits the description of the object into two lines if necessary.

32.7.3. TrendMaxMin

32.7.3.1. This script makes the values of the TrendHi and TrendLo equal to the Eng_Max and Eng_Min everytime the Eng_Max or Eng_Min values are changed.

32.8. User Defined Attributes (UDA)

Attribute (Abbreviation)	Type	Description
Description1	String	Object description line 1
Description2	String	Object description line 2
PLC	String	PLC object name (name of OPC object in Archestra)
ReadOnly	Bool	Read only bit used to enable/disable user input to object
Taglength	Int	Length in characters of the object tagname
WKS	String	WKS number for object

32.9. Extensions

32.9.1. The default SCADA settings apply.

32.10. Graphics

32.10.1. The following graphic windows shall apply.

Name	Description
Detail_Faceplate	Detail Faceplate
Display	Display value
Faceplate	Faceplate
Symbol	Graphical representation of the device
Tagname	Tagname displayed next to symbol
WKS_Number	WKS number of device

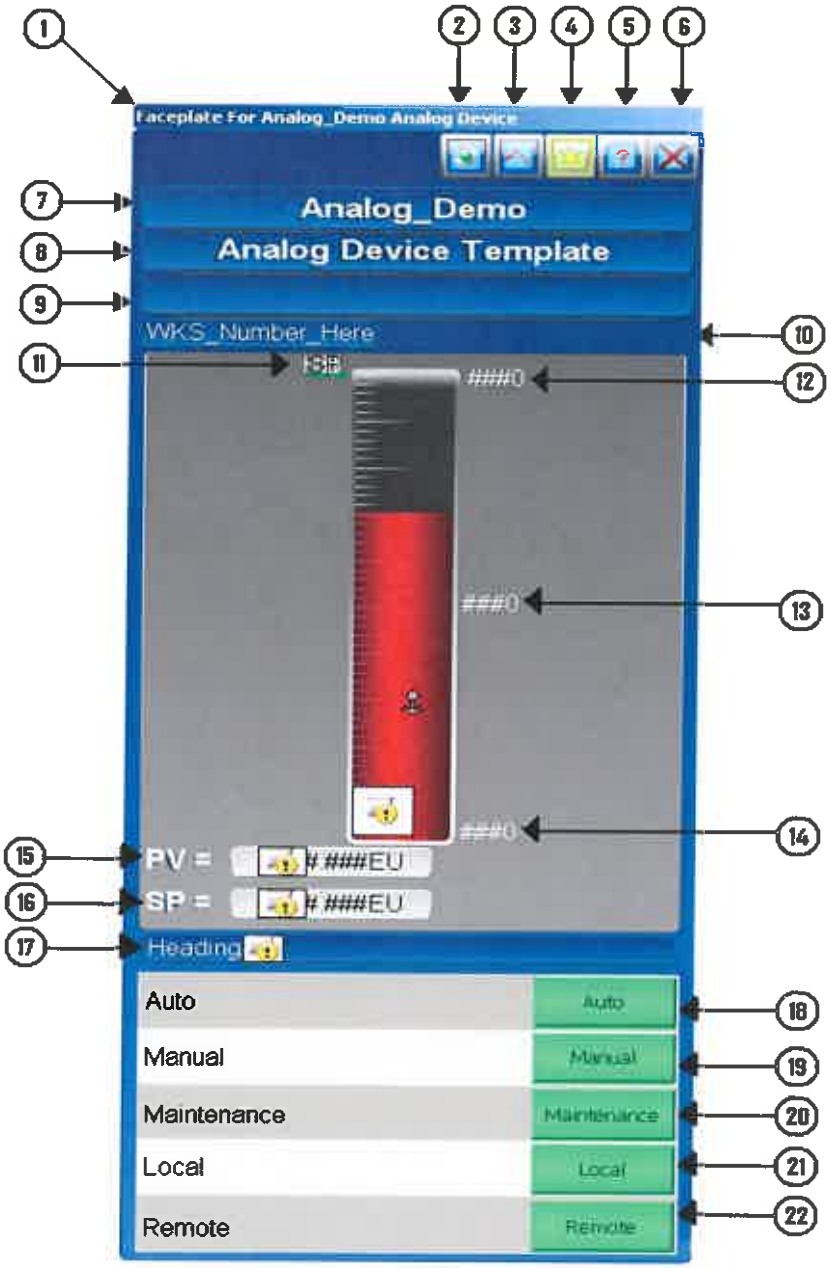
32.10.2. Symbol

32.10.2.1. This is a graphical representation of the instrument displayed on the InTouch screen. When this symbol is clicked, the Detail Faceplate will be displayed.

32.10.2.2. The Tagname and WKS_Number graphics are displayed near the Symbol.

32.10.3. Faceplate

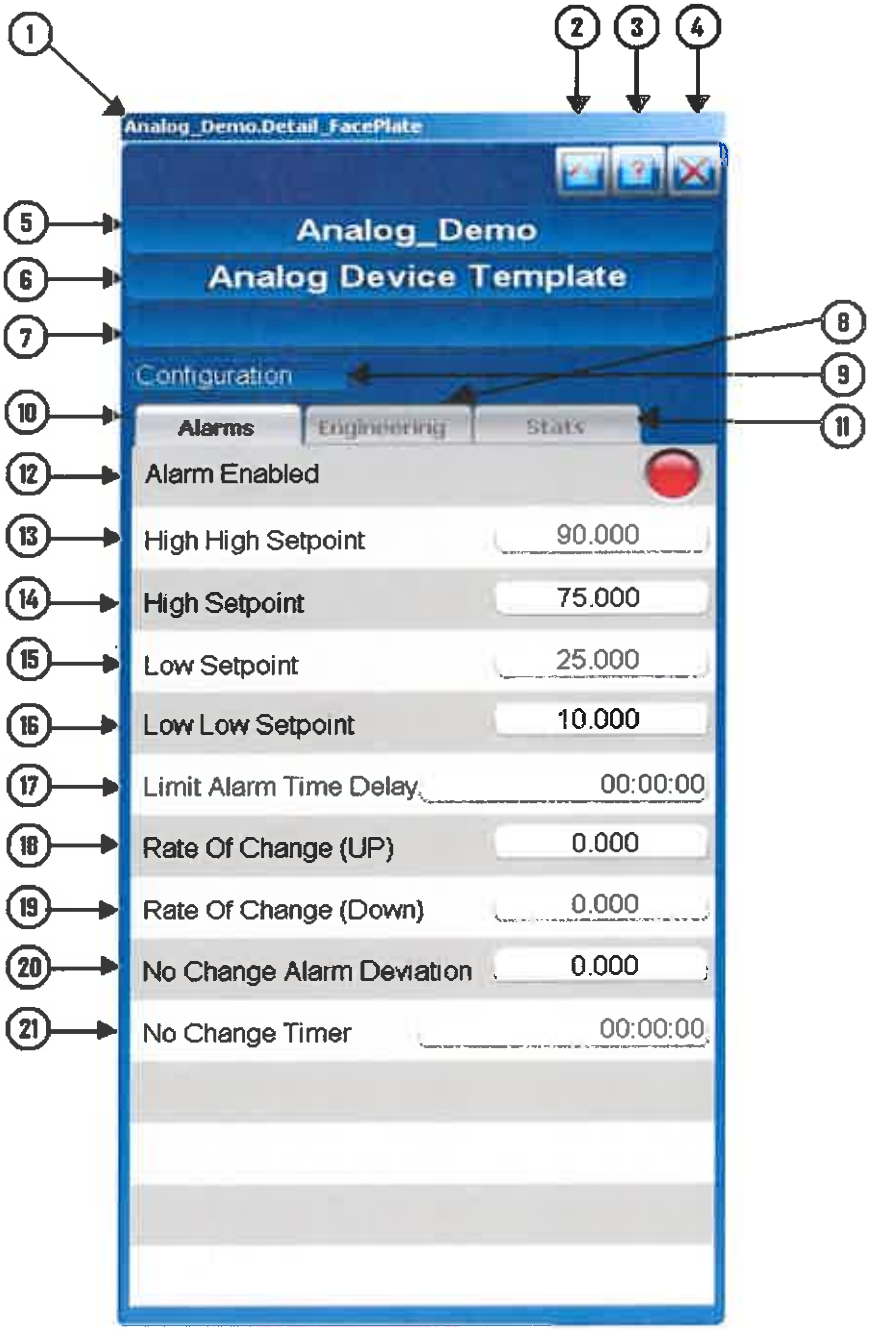
32.10.3.1. The faceplate displays a detailed representation of information contained within the object, e.g. PV, alarm set points etc. Tagnames, where used, are indicated in brackets e.g. (me.Tagname).



1. TITLE OF CM: The faceplate will display the name of the control module type.
2. DETAIL FACEPLATE: This button will open the detail facplate.
3. TREND: This button will open the trend faceplate to provide the different trends associated with the analog device.
4. ALARM: This button will open the alarm faceplate and indicate alarm conditions for the purpose of use towards the operator. It also flashes yellow when there is an active alarm on the analog device
5. HELP WINDOW: This button will provide help regarding the faceplate and the device. (To be confirmed)
6. CLOSE WINDOW: This button will remove the faceplate form the display. If the detail faceplate is open it will also remove the detail faceplate.
7. HEADING_1: The object name (tagname) of the analog input object in ArchestrA will be displayed here. (me.Tagname)

8. HEADING_2: The object description line 1 (first 28 Characters of full words) of the analog input object in ArchestrA will be displayed here. (me.Descrition1)
9. HEADING_3: The object description line 2 (Remaining characters) of the analog input object in ArchestrA will be displayed here. Note the maximum amount of characters is limited to 56. (me.Descritption2)
10. WKS_NUMBER: The WKS number for the device will be displayed here. (me.WKS)
11. SET POINT: This is the target value for this analog input. It is used as the basis for deviation alarms. The marker will dynamically move up and down the scale based on the value and the engineering scale of the object. (me.PV.Dev.Target)
12. ENGINEERING MAXIMUM: The full scale value of the analog signal is displayed adjacent to the top of the scale tick marks. The value is the Eng_Max value in the analog object field attributes. (me.Eng_Max)
13. ENGINEERING MIDDLE: The middle value of the analog signal is displayed adjacent to the middle of the scale tick marks. This value is automatically calculated based on Eng_Max and Eng_Min.
14. ENGINEERING MINIMUM: The minimum value of the analog signal is displayed adjacent to the bottom of the scale tick marks. The value is the Eng_Min value in the analog object field attributes. (me.Eng_Min)
15. PROCESS VARIABLE: This value is obtained from the field transmitter scaled in engineering units by PLC. It is displayed numerically and as a scaled bar graph. (me.PV)
16. TARGET VALUE: This is the target value for this analog input. It is used as the basis for deviation alarms. (me.PV.Dev.Target)
17. MODE TAG: This the heading for the mode display of the faceplate. This is static text and will display the word Mode during runtime.
18. AUTO MODE: This button sets the object into auto mode. If the device is in this mode, the button will be green else it will be grey. (me.Auto)
19. MANUAL MODE: This button sets the object into manual mode. If the device is in this mode, the button will be green else it will be grey. (me.Manual)
20. MAINTENACE MODE: This button sets the object into maintenance mode. If the device is in this mode, the button will be green else it will be grey. (me.Maintenance)
21. LOCAL MODE: This button sets the object into local mode. If the device is in this mode, the button will be green else it will be grey. (me.Local)
22. REMOTE MODE: This button sets the object into remote mode. If the device is in this mode, the button will be green else it will be grey. (me.Remote)

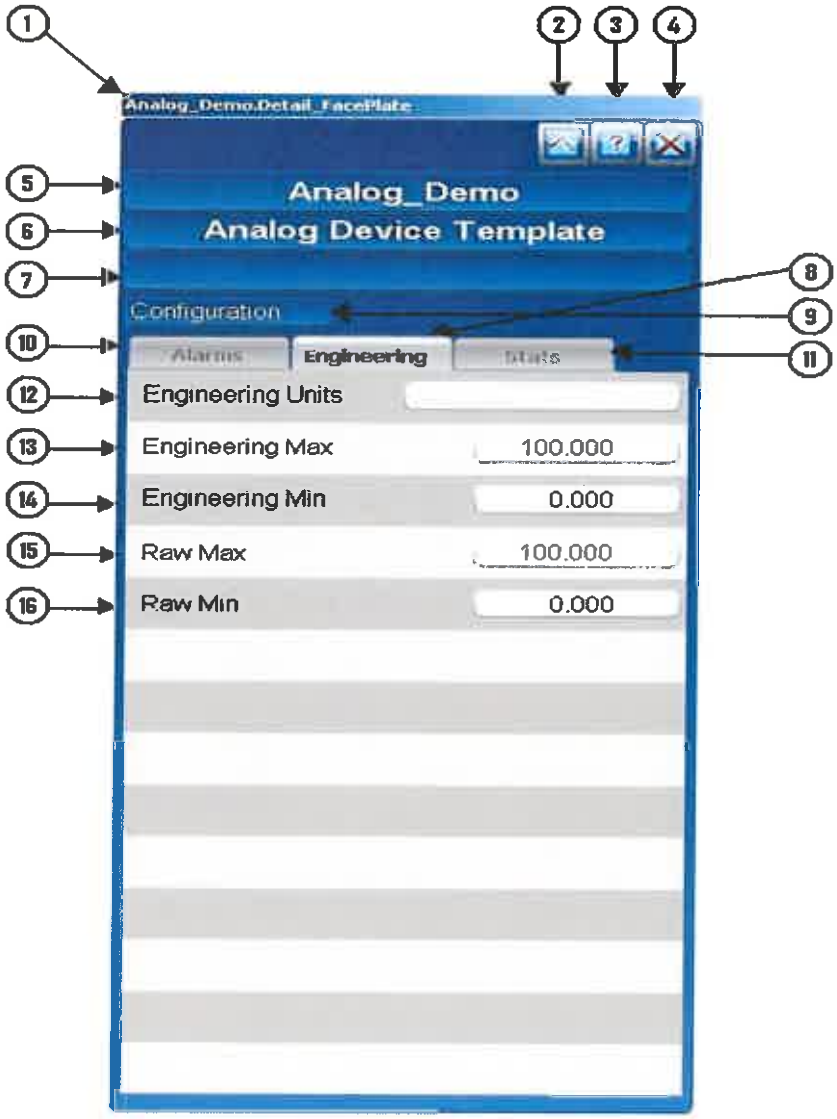
32.10.4. Detail Faceplate (Alarms)



1. TITLE OF CM: The faceplate will display the name of the control module type.
2. TREND: This button will open the trend faceplate to provide the different trends associated with the analog device.
3. HELP WINDOW: This button will provide help regarding the faceplate and the device. (To be confirmed)
4. CLOSE WINDOW: This button will remove the faceplate form the display. If the detail faceplate is open it will also remove the detail faceplate.
5. HEADING_1: The object name (tagname) of the analog input object in ArchestrA will be displayed here. (me.Tagname)
6. HEADING_2: The object description line 1 (first 28 Characters of full words) of the analog input object in ArchestrA will be displayed here. (me.Descrition1)

7. HEADING_3: The object description line 2 (Remaining characters) of the analog input object in ArchestrA will be displayed here. Note the maximum amount of characters is limited to 56. (me.Descritption2)
8. ENGINEERING_TAB: This opens the engineering information page
9. CONFIGURATION: This is the heading for the configuration section (Static Text)
10. ALARMS TAB: This opens the alarm information page. It remains highlighted once selected
11. STATS TAB: This opens the statistical information page.
12. ALARM ENABLE: This button will toggle all alarms for the object on/off. IE alarms are enabled/disabled using this button. The button will change from Red (Alarms Enabled) to Green (Alarms disabled) and the text will indicate enabled/disabled accordingly. The text is also grey when alarms are disabled. (me.AlarmInhibit)
13. HIGH HIGH SET POINT: This field allows entry for the high high set point in engineering units. This value cannot exceed Eng_Max or be less than High setpoint. (me.PV.HiHi.Limit)
14. HIGH SET POINT: This field allows entry for the high set point in engineering units. This value cannot exceed High High Setpoint or be less than Low setpoint. (me.PV.Hi.Limit)
15. LOW SET POINT: This field allows entry for the low set point in engineering units. This value cannot exceed High Setpoint or be less than Low Low setpoint. (me.PV.Lo.Limit)
16. LOW LOW SET POINT: This field allows entry for the low low set point in engineering units. This value cannot exceed Low Setpoint or be less than Eng_Min. (me.PV.LoLo.Limit)
17. LIMIT ALARM TIME DELAY: This field displays the alarm time delay value. (To be confirmed) This value is also changed from this field. (me.PV.LevelAlarm.TimeDeadBand)
18. RATE OF CHANGE (UP): This field displays the rate of change value up. This value is also changed from this field. (me.PV.ROC.IncreasingHi.Limit)
19. RATE OF CHANGE (DOWN): This field displays the rate of change value down. This value is also changed from this field. (me.PV.ROC.DecreasingHi.Limit)
20. NO CHANGE ALARM DEVIATION: This field allows entry of the no change alarm deviation in engineering units. (me.NOC_Dev)
21. NO CHANGE TIMER: This field will change the timer preset for the no change alarm. (me.NOC_Time)

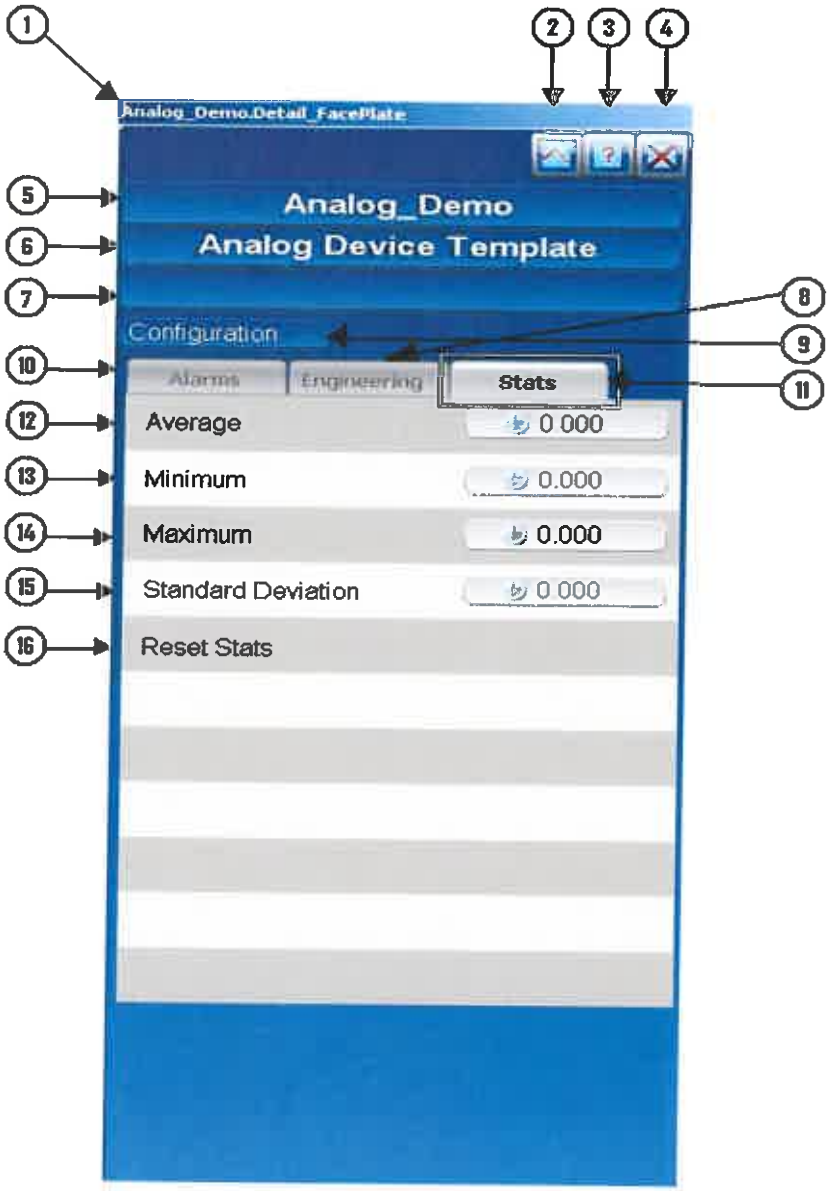
32.10.5. Detail Faceplate (Engineering)



1. TITLE OF CM: The faceplate will display the name of the control module type.
2. TREND: This button will open the trend faceplate to provide the different trends associated with the analog device.
3. HELP WINDOW: This button will provide help regarding the faceplate and the device. (To be confirmed)
4. CLOSE WINDOW: This button will remove the faceplate form the display. If the detail faceplate is open it will also remove the detail faceplate.
5. HEADING_1: The object name (tagname) of the analog input object in ArchestrA will be displayed here. (me.Tagname)
6. HEADING_2: The object description line 1 (first 28 Characters of full words) of the analog input object in ArchestrA will be displayed here. (me.Descrition1)
7. HEADING_3: The object description line 2 (Remaining characters) of the analog input object in ArchestrA will be displayed here. Note the maximum amount of characters is limited to 56. (me.Descritption2)
8. ENGINEERING TAB: This opens the engineering information page. It remains highlighted once selected.

9. CONFIGURATION: This is the heading for the configuration section (Static Text)
10. ALARMS TAB: This opens the alarm information page.
11. STATS TAB: This opens the statistical information page.
12. ENGINEERING UNITS: This field displays the units for the related value.
13. ENGINEERING MAX: This field allows the entry of the maximum engineering value for the analog value. The full scale value of the analog signal is displayed. The value is the Eng_Max value in the analog object field attributes. (me.Eng_Max)
14. ENGINEERING MIN: This field allows the entry of the minimum engineering value for the analog value. The minimum value of the analog signal is displayed. The value is the Eng_Min value in the analog object field attributes. (me.Eng_Min)
15. RAW MAX: This field allows the entry of the maximum raw value for the analog value. (me.Raw_Max)
16. RAW MIN: This field allows the entry of the minimum raw value for the analog value. (me.Raw_Min)

32.10.6. Detail Faceplate (Stats)



1. TITLE OF CM: The faceplate will display the name of the control module type.
2. TREND: This button will open the trend faceplate to provide the different trends associated with the analog device.
3. HELP WINDOW: This button will provide help regarding the faceplate and the device. (To be confirmed)
4. CLOSE WINDOW: This button will remove the faceplate form the display. If the detail faceplate is open it will also remove the detail faceplate.
5. HEADING_1: The object name (tagname) of the analog input object in ArchestrA will be displayed here. (me.Tagname)
6. HEADING_2: The object description line 1 (first 28 Characters of full words) of the analog input object in ArchestrA will be displayed here. (me.Descrition1)
7. HEADING_3: The object description line 2 (Remaining characters) of the analog input object in ArchestrA will be displayed here. Note the maximum amount of characters is limited to 56. (me.Descritption2)

8. ENGINEERING TAB: This opens the engineering information page.
9. CONFIGURATION: This is the heading for the configuration section (Static Text)
10. ALARMS TAB: This opens the alarm information page.
11. STATS TAB: This opens the statistical information page. It remains highlighted once selected.
12. AVERAGE: This field will display the average value of the PV. (me.PV.Stats.Average)
13. MINIMUM: This field will display the minimum value of the PV. (me.PV.Stats.Min)
14. MAXIMUM: This field will display the maximum value of the PV. (me.PV.Stats.Max)
15. STANDARD DEVIATION: This field will display the standard deviation value of the PV. (me.PV.Stats.StandardDeviation)
16. RESET STATS: This button allows the reset of the statistical values. (me.PV.Stats.Reset)

33. RW_DIGITAL_input (dl)

33.1. General

33.1.1. The Contractor shall put into operation a digital input for each asset classified as a digital input device.

33.2. Digital Input Devices

33.2.1. The following devices are classified as digital input.

Measurement
Flow Switch
Pressure Switch
Door Switch
Emergency Stop Pushbutton

33.3. PLC Attributes

33.3.1. Each digital input device shall have the following I/O and attributes:

Attribute	Comment	Type
En	Enable/Disable DFB or Objected	Bit
EnMode	Enable/Disable Mode Selection	Bit
AM	Auto or Manual Mode Selected (0=Auto; 1=Manual)	Bit
Rev	Forward or Reverse Action (0=Forward; 1=Reverse)	Bit

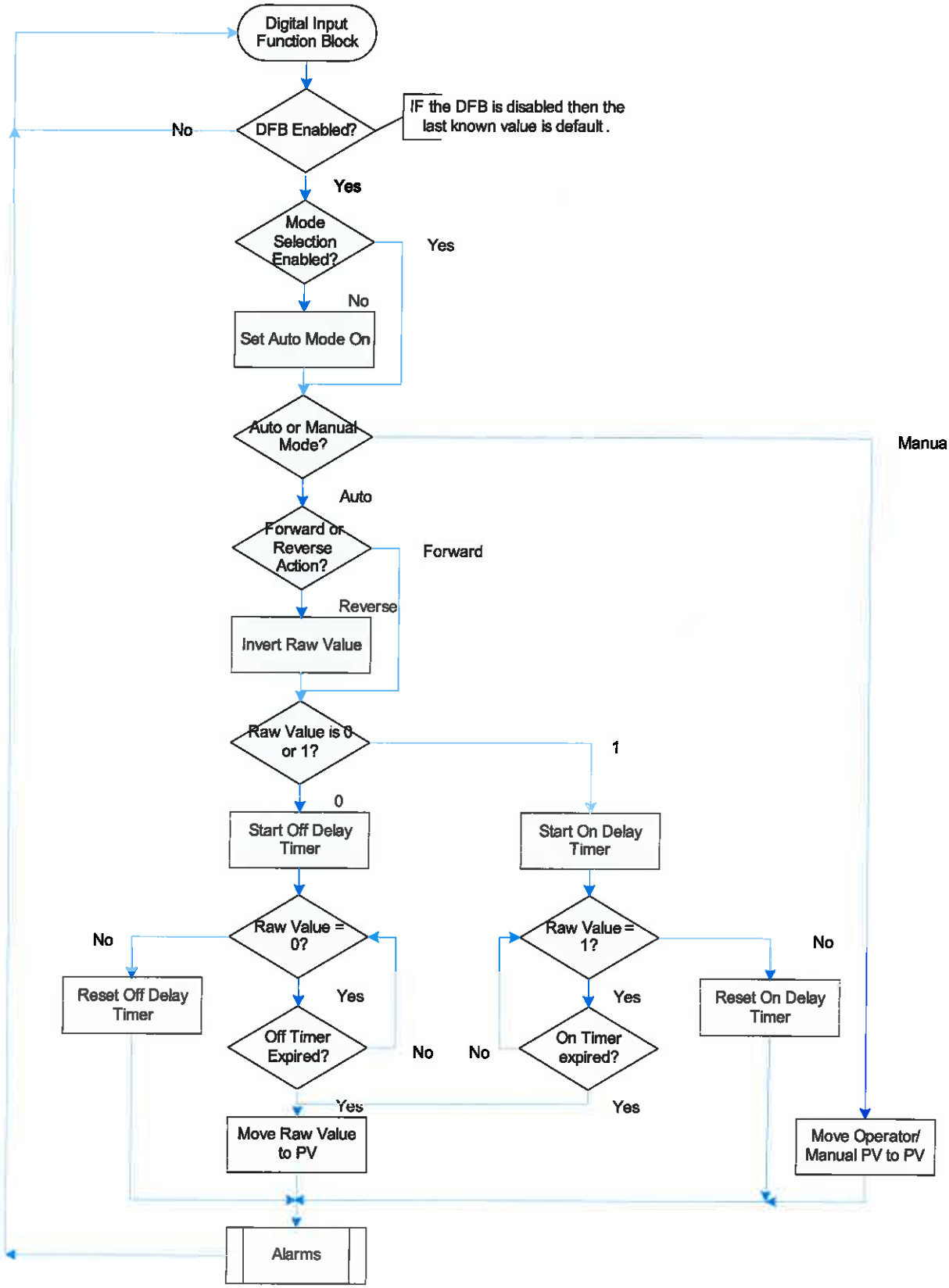
Raw	Raw Value from Source	Bit
OffTmr	PV Off Delay Time	Integer
OnTmr	PV On Delay Time	Integer
PV	Process Variable	Bit
MPV	Manual or Operator PV	Bit
EnAlms	Enable/Disable All Alarms	Bit
ModFlt	PLC Module Alarm	Bit
BadData	Bad Data Alarm	Bit
DevWarn	Device Warning Alarm	Bit
DevFlt	Device Fault Alarm	Bit
Comms	Broken Wire or Communication Alarm	Bit
ChFlt	Channel Fault Alarm	Bit
EnOnAlm	Enable/Disable PV On State Alarm	Bit
OnAlmTmr	PV On State Delay Alarm Time	Integer
OffAlmTmr	PV On State Alarm	Bit
EnNOC	Enable/Disable No Change Alarm	Bit
NOCTmr	No Change Delay Alarm Time	Integer
NOC	No Change Alarm	Bit
Warning	Warning Indication	Bit
Flt	Fault Indication	Bit
Ack	Acknowledge All Alarms	Bit
PPV	Previous PV	Bit

33.4. PLC Functionality

33.4.1. The primary function of this control module is to monitor and control a digital input device.

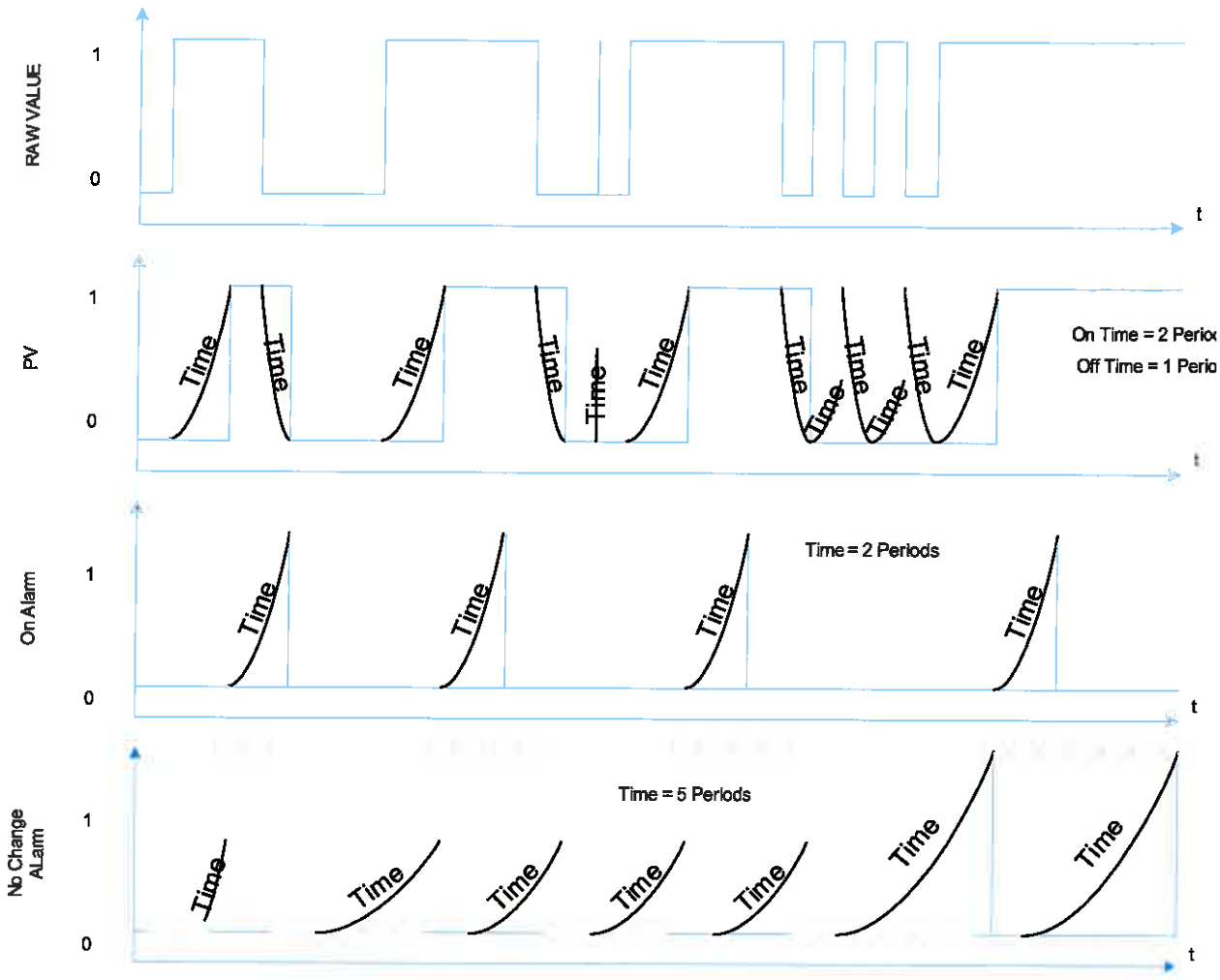
33.4.2. The module shall have a main processing section and an alarm subroutine.

33.4.3. Main Routine


Digital Input Function Block
DFB Enabled?
No
IF the DFB is disabled then the last known value is default.
Yes
Mode Selection Enabled?
Yes
No
Set Auto Mode On
Auto or Manual Mode?
Manua
Auto
Forward or Reverse Action?
Forward
Reverse
Invert Raw Value
Raw Value is 0 or 1?
1
0
Start Off Delay Timer
Start On Delay Timer
Raw Value = 0?
Raw Value = 1?
No
No
Reset Off Delay Timer
Yes
Yes
Reset On Delay Timer
Off Timer Expired?
No
No
On Timer expired?
Yes
Yes
Move Raw Value to PV
Move Operator/ Manual PV to PV
Alarms

33.4.4. Alarm Subroutine

33.4.5. Timing Diagram (Example)



33.5. PLC Code

To be completed…

33.6. Field Attributes

33.6.1. These tags are communicated to/from the PLC.

Control Module	Type	Description
Alarm	Bool	Digital input alarm
Alarm_Enable	Bool	Enable digital alarm
AlarmAck	Bool	Acknowledge alarm
Auto	Bool	Auto mode selected
Invert	Bool	Invert action of raw field input
Local	Bool	Local mode selected

Maintenance	Bool	Maintenance mode selected
Manual	Bool	Manual mode selected
PV	Bool	Process variable
Raw_In	Bool	Raw field input
Remote	Bool	Remote mode selected
On_Time	Int	Delay On Time
Off_Time	Int	Delay Off Time
Alarm_Time	Int	Digital Alarm Delay Time

33.6.2. Object Functionality

33.6.2.1. Changes to the following attributes are noted otherwise all default SCADA values apply.

33.6.2.2. Alarms

33.6.2.2.1. Enable State Alarm selected.

33.6.2.2.2. Enable Statistics selected.

33.6.2.3. Alarm_Enable

33.6.2.3.1. Value has **Generate Event Upon** Change selected.

33.6.2.4. AlarmAck

33.6.2.4.1. Value has **Generate Event Upon** Change selected.

33.6.2.5. Auto Mode

33.6.2.5.1. Value has **Generate Event Upon** Change selected.

33.6.2.6. Invert

33.6.2.6.1. Value has **Generate Event Upon** Change selected.

33.6.2.7. Local Mode

33.6.2.7.1. Value has **Generate Event Upon** Change selected.

33.6.2.8. Maintenance

33.6.2.8.1. Value has **Generate Event Upon** Change selected.

33.6.2.9. Manual

33.6.2.9.1. Value has **Generate Event Upon** Change selected.

33.6.2.10. PV

33.6.2.10.1. Enable History has been selected.

33.6.2.10.2. Enable Stats has been selected.

33.6.2.11. Raw_In

33.6.2.12. Remote

33.6.2.12.1. Value has **Generate Event Upon** Change selected.

33.6.2.13. On_Time

33.6.2.14. Value has **Generate Event Upon** Change selected

33.6.2.15. Value has ***Engineering Units*** set to seconds.

33.6.2.16. Off_Time

33.6.2.16.1. Value has **Generate Event Upon** Change selected.

33.6.2.16.2. Value has ***Engineering Units*** set to seconds.

33.6.2.17.Alarm_Time

33.6.2.17.1. Value has **Generate Event Upon** Change selected.

33.6.2.17.2. Value has ***Engineering Units*** set to seconds.

33.7. Object Information

33.7.1. This DI object is derived from the $b_Userdefined object.

33.7.2. Description field must be entered manually on this page, all other fields are left to default settings. Object help may be inserted at a later stage.

33.8. Scripts

33.8.1. IOInitialise

33.8.1.1. This script handles the addressing for all the IO. Note that these scripts might change based on the design of the control modules at PLC level.

To be inserted…

33.9. User Defined Attributes (UDA)

Attribute (Abbreviation)	Type	Description
Description1	String	Object description line 1
Description2	String	Object description line 2
PLC	String	PLC object name (name of OPC object in Archestra)
Taglength	Int	Length in characters of the object tagname
WKS	String	WKS number for object
WKSLength	Int	Length in characters of the objects wks number

33.10. Extensions

33.10.1. The default SCADA settings apply.

33.11. Graphics

33.11.1. The following graphic windows shall apply.

Name	Description
Detail_Faceplate	Detail Faceplate
Faceplate	Faceplate
Symbol	Graphical representation of the device
Tagname	Tagname displayed next to symbol

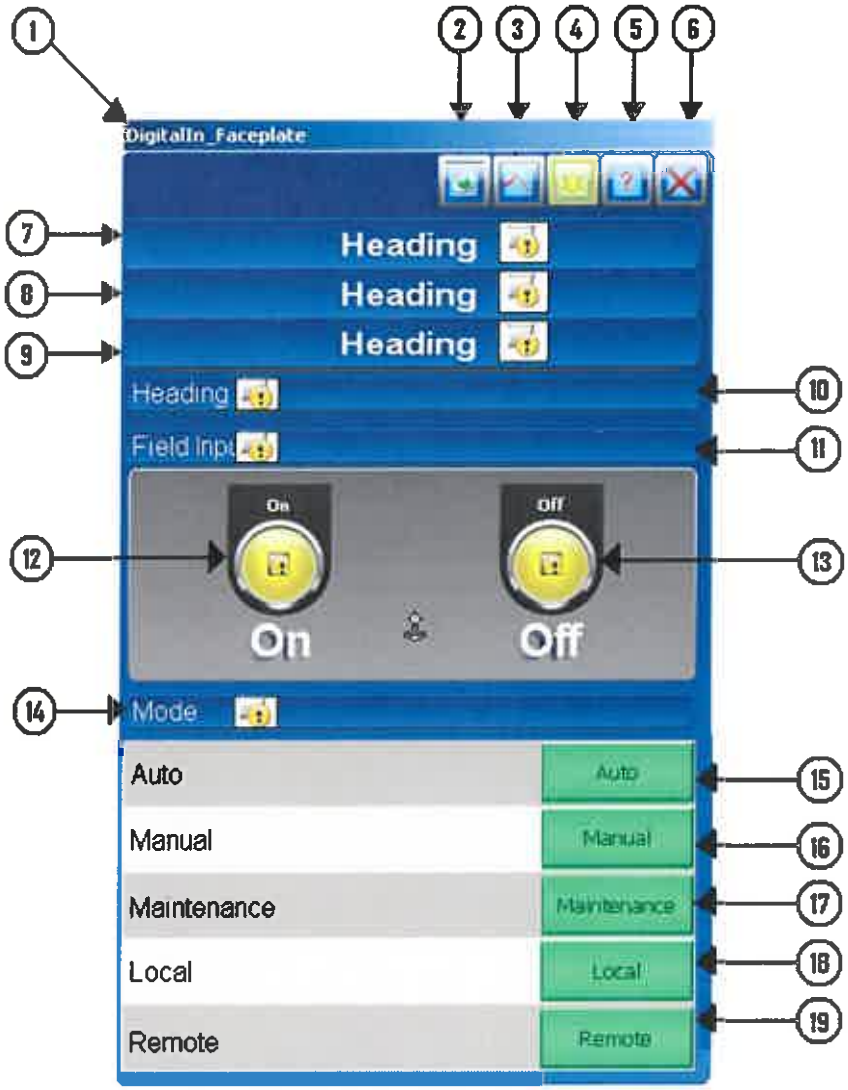
33.11.2. Symbol

33.11.2.1. This is a graphical representation of the instrument displayed on the InTouch screen. When this symbol is clicked, the Detail Faceplate will be displayed.

33.11.2.2. The Tagname and WKS_Number graphics are displayed near the Symbol.

33.11.3. Faceplate

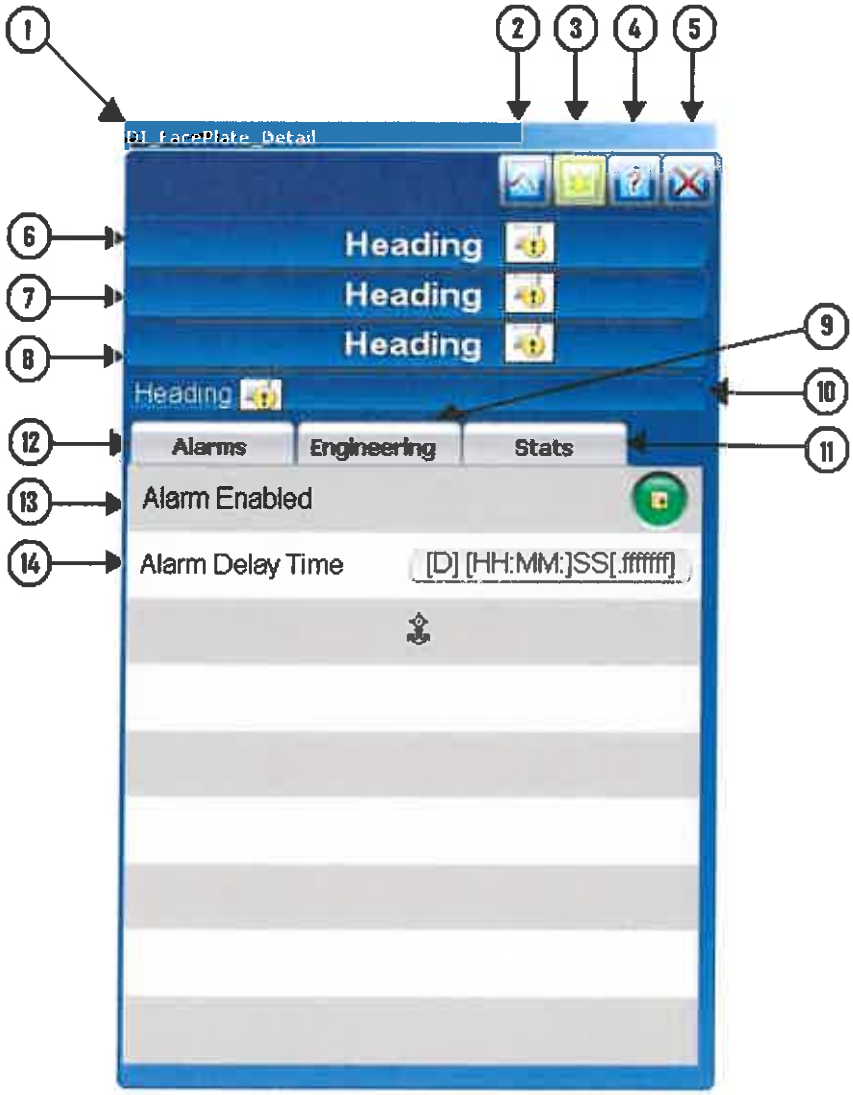
33.11.3.1. The faceplate displays a detailed representation of information contained within the object, e.g. PV, alarm timer etc. Tagnames are indicated in brackets.



1. TITLE OF CM: The faceplate will display the name of the control module type.
2. DETAIL FACEPLATE: This button will open the detail facplate.
3. TREND: This button will open the trend faceplate to provide the different trends associated with the digital device.
4. ALARM: This button will open the alarm faceplate and indicate alarm conditions for the purpose of use towards the operator. It also flashes yellow when there is an active alarm on the digital device
5. HELP WINDOW: This button will provide help regarding the faceplate and the device. (To be confirmed)
6. CLOSE WINDOW: This button will remove the faceplate form the display. If the detail faceplate is open it will also remove the detail faceplate.
7. HEADING_1: The object name (tagname) of the digital input object in ArchestrA will be displayed here. (me.Tagname)
8. HEADING_2: The object description line 1 (first 28 Characters of full words) of the digital input object in ArchestrA will be displayed here. (me.Descrition1)
9. HEADING_3: The object description line 2 (Remaining characters) of the digital input object in ArchestrA will be displayed here. Note the maximum amount of characters is limited to 56. (me.Descritption2)

10. WKS_NUMBER: The WKS number for the device will be displayed here. (me.WKS)
11. FIELD INPUT This is a static text heading
12. ON Displays green if the PV is true and flashes yellow if this is a alarm state. This turns into a push button when Manual Mode is selected
13. OFF: Displays red if the PV is true and flashes yellow if this is a alarm state. This turns into a push button when Manual Mode is selected
14. MODE: This is a static text heading.
15. AUTO MODE: This button sets the object into auto mode. If the device is in this mode, the button will be green else it will be grey. (me.Auto)
16. MANUAL MODE: This button sets the object into manual mode. If the device is in this mode, the button will be green else it will be grey. (me.Manual)
17. MAINTENACE MODE: This button sets the object into maintenance mode. If the device is in this mode, the button will be green else it will be grey. (me.Maintenance)
18. LOCAL MODE: This button sets the object into local mode. If the device is in this mode, the button will be green else it will be grey. (me.Local)
19. REMOTE MODE: This button sets the object into remote mode. If the device is in this mode, the button will be green else it will be grey. (me.Remote)

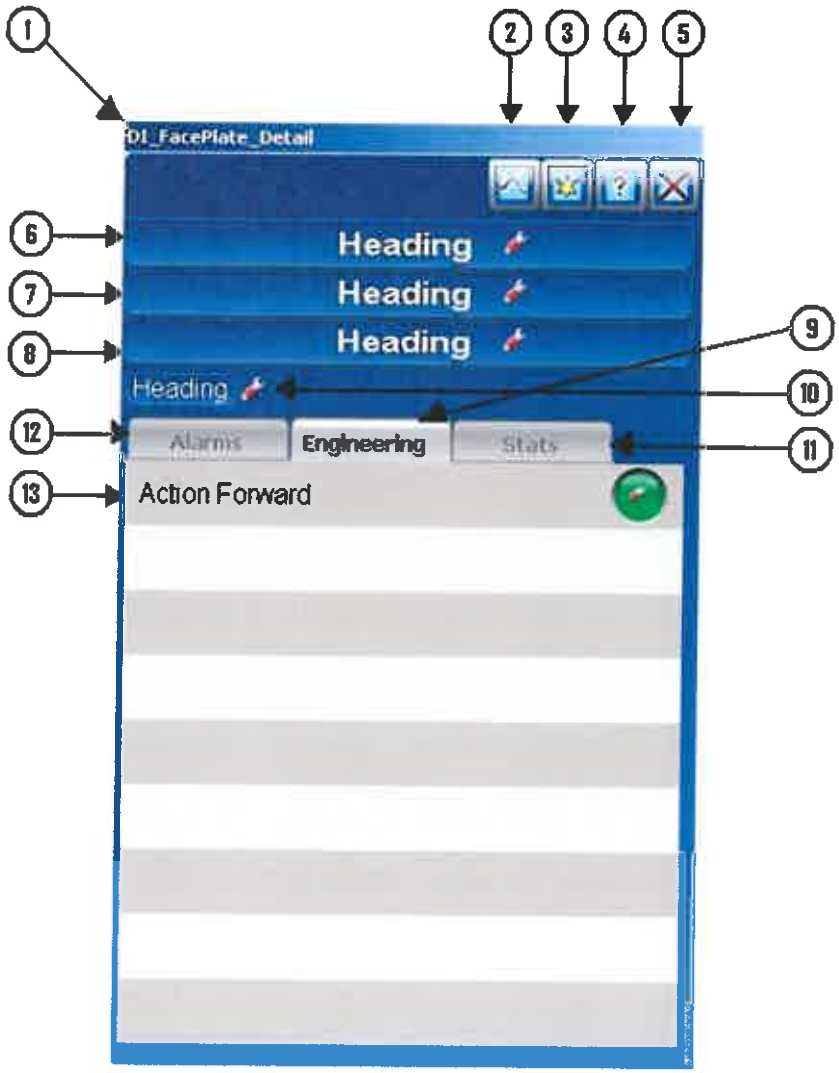
33.11.4. Detail Faceplate (Alarms)



1. TITLE OF CM: The faceplate will display the name of the control module type.
2. TREND: This button will open the trend faceplate to provide the different trends associated with the digital device.
3. ALARM: This button will open the alarm faceplate and indicate alarm conditions for the purpose of use towards the operator. It also flashes yellow when there is an active alarm on the digital device
4. HELP WINDOW: This button will provide help regarding the faceplate and the device. (To be confirmed)
5. CLOSE WINDOW: This button will remove the faceplate form the display. If the detail faceplate is open it will also remove the detail faceplate.
6. HEADING_1: The object name (tagname) of the digital input object in ArchestrA will be displayed here. (me.Tagname)
7. HEADING_2: The object description line 1 (first 28 Characters of full words) of the digital input object in ArchestrA will be displayed here. (me.Descrition1)
8. HEADING_3: The object description line 2 (Remaining characters) of the digital input object in ArchestrA will be displayed here. Note the maximum amount of characters is limited to 56. (me.Descritption2)
9. ENGINEERING_TAB: This opens the engineering information page.

10. CONFIGURATION: This is the heading for the configuration section. (Static Text)
11. STATS TAB: This opens the statistical information page.
12. ALARMS TAB: This opens the alarm information page. It remains highlighted once selected
13. ALARM ENABLE: This will toggle the CM process alarm enable bit. Text will display enabled/disabled and the button will turn green and red. (me.Alarm_Enable)
14. ALARM DELAY TIME: Sets the process alarm delay on timer preset, (me.Alarm_Time).

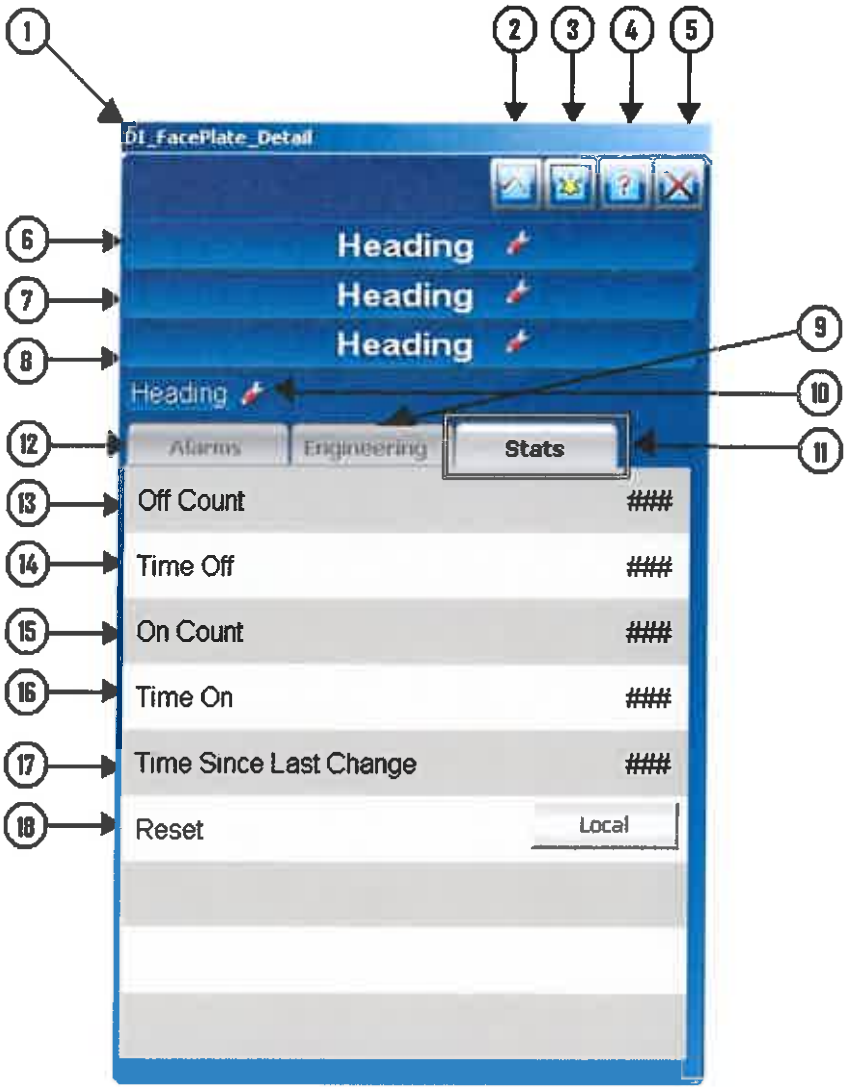
33.11.5. Detail Faceplate (Engineering)



1. TITLE OF CM: The faceplate will display the name of the control module type.
2. TREND: This button will open the trend faceplate to provide the different trends associated with the digital device.
3. ALARM: This button will open the alarm faceplate and indicate alarm conditions for the purpose of use towards the operator. It also flashes yellow when there is an active alarm on the digital device
4. HELP WINDOW: This button will provide help regarding the faceplate and the device. (To be confirmed)

5. CLOSE WINDOW: This button will remove the faceplate form the display. If the detail faceplate is open it will also remove the detail faceplate.
6. HEADING_1: The object name (tagname) of the digital input object in ArchestrA will be displayed here. (me.Tagname)
7. HEADING_2: The object description line 1 (first 28 Characters of full words) of the digital input object in ArchestrA will be displayed here. (me.Descrition1)
8. HEADING_3: The object description line 2 (Remaining characters) of the digital input object in ArchestrA will be displayed here. Note the maximum amount of characters is limited to 56. (me.Descritption2)
9. ENGINEERING_TAB: This opens the engineering information page. It remains highlighted once selected
10. CONFIGURATION: This is the heading for the configuration section. (Static Text)
11. STATS TAB: This opens the statistical information page.
12. ALARMS TAB: This opens the alarm information page.
13. ACTION INVERT: This button will toggle the action of the control module Forward/Reverse. The text will display Forward or Reverse and the button will indicate green or red. (me.Invert)
14. RAW VALUE: Displays the raw field value. The text indicates On or Off. (me.Raw_In)

33.11.6. Detail Faceplate (Stats)



1. TITLE OF CM: The faceplate will display the name of the control module type.
2. TREND: This button will open the trend faceplate to provide the different trends associated with the digital device.
3. ALARM: This button will open the alarm faceplate and indicate alarm conditions for the purpose of use towards the operator. It also flashes yellow when there is an active alarm on the digital device
4. HELP WINDOW: This button will provide help regarding the faceplate and the device. (To be confirmed)
5. CLOSE WINDOW: This button will remove the faceplate form the display. If the detail faceplate is open it will also remove the detail faceplate.
6. HEADING_1: The object name (tagname) of the digital input object in ArchestrA will be displayed here. (me.Tagname)
7. HEADING_2: The object description line 1 (first 28 Characters of full words) of the digital input object in ArchestrA will be displayed here. (me.Descrition1)
8. HEADING_3: The object description line 2 (Remaining characters) of the digital input object in ArchestrA will be displayed here. Note the maximum amount of characters is limited to 56. (me.Descritption2)

9. ENGINEERING_TAB: This opens the engineering information page.
10. CONFIGURATION: This is the heading for the configuration section. (Static Text)
11. STATS TAB: This opens the statistical information page. It remains highlighted once selected
12. ALARMS TAB: This opens the alarm information page.
13. OFF COUNT: This will indicate the off count of the PV. (me.PV.Stats.State0Cnt)
14. TIME OFF: This will display the total amount of time the PV has been in the off (0) state. (me.PV.Stats.State0Time)
15. ON COUNT: This will indicate the on count of the PV. (me.PV.Stats.State1Cnt)
16. TIME ON: This will display the total amount of time the PV has been in the on (1) state. (me.PV.Stats.State1Time)
17. TIME SINCE LAST CHANGE: This will indicate the time since the last change of being on/off. (me.PV.Stats.TimeSinceLastTransition)
18. RESET: This button allows the operator to reset the stats values to zero. (me.PV.Stats.Reset)

34. BASIC MODULES

34.1.1. The Employer has put into operation the basic modules and has derived these modules from the default SCADA configuration.

34.1.2. The basic level consists of data type modules and is the lowest level in the physical model.

34.1.3. The Contractor shall refer to the manufacturer's manual and help files for additional information on each of the SCADA system module type as identified in the table above.

34.1.4. The Contractor shall comply with the Manufacturer's guidelines and best practice advice.

34.1.5. The Contractor shall utilise the basic modules (not exhausted yet) as tabulated below:

Basic Module Name	Additional Information
RW_BOOL	Boolean (1 bit)
RW_BYTE	Byte (8 bits)
RW_DINT	Double Integer (32 bits)
RW_UDINT	Unsigned Double Integer (32 bits)
RW_INT	Integer/Word (16 bits)
RW_UINT	Unsigned Integer (16 bits)
RW_REAL	Real/Floating Point (32 bits)
RW_STR	String (Default of 32 bytes/characters)

Sorted Alphabetically

35. Modes of Operation

35.1.1. The Contractor shall put into operation the following modes of operation i.e. auto, manual, semi-auto, maintenance, local and remote for each object as required.

35.1.2. The Contractor shall put into operation auto, manual and maintenance mode for each object as these are software modes.

35.1.3. Each mode shall be uniquely identifiable and event logged.

35.1.4. Each mode shall be selectable from the SCADA with a prompt message for the user to confirm the intended command or action.

35.1.5. Users with an operator user role or higher and within the specific user group shall be permitted to perform a mode change.

35.1.6. Each software mode is mutually exclusive and only one mode may be active at any given time.

35.1.7. Each software mode shall be dependent on the field local/remote selection.

35.1.8. Lower level modules shall derive its mode from higher level modules.

35.2. Auto Mode

35.2.1. The Contractor shall configure the auto mode as the default mode for all plant operations when the PLC program execution has been acquired. Auto mode is synonymous with program mode.

35.2.2. The activation of auto mode at a higher level, after a prompt and confirmation, shall force all lower level modules in the physical model to auto.

35.3. Semi-Auto Mode

35.3.1. The Contractor shall configure the semi-auto mode to facilitate a mixture of auto and manual operation of devices.

35.3.2. The activation of semi-auto mode at a higher level, after a prompt and confirmation, shall force all lower level modules in the physical model to semi-auto.

35.3.3. The activation of semi-auto mode facilitates a mixture of manual operation and auto operation for lower level modules in the physical model.

35.3.4. The selection of semi-mode at a higher level shall not alter the state of the modules lower in the physical model.

35.4. Manual Mode

35.4.1. The Contractor shall configure each object with a manual mode. Manual mode is synonymous with Operator mode.

35.4.2. The manual mode shall disable the auto mode and hand control to the operator.

35.4.3. The activation of manual mode at a higher level, after a prompt and confirmation, shall force all lower level modules in the physical model to manual.

35.4.4. Selecting the object back to auto mode annuls the manual mode.

35.4.5. Selecting manual mode from auto mode shall retain the last state of the object without disrupting operations e.g. if a pump is running in auto mode then when the manual mode is selected the pump shall continue to run until the operator decides to stop the pump in manual mode.

35.4.6. Maintenance Mode

35.4.7. The Contractor shall configure each object with a maintenance mode. Maintenance mode is synonymous with out of service mode.

35.4.8. The maintenance mode shall disable the auto and manual modes rendering the object unoperable.

35.4.9. The activation of maintenance mode at a higher level, after a prompt and confirmation, shall force all lower level modules in the physical model to maintenance.

35.4.10. Selecting the object back to auto or manual mode shall require a double user role verification securty feature i.e. two users must confirm the mode change.

35.4.11. Maintenance mode shall disable all control functionality and alarms.

35.4.12. The following icon shall be used to indicate that an object, device or module is in maintenance mode.

35.4.13. Local Mode

35.4.14. The Contractor shall configure each object with a local mode only if such a mode is a physical input from an external source e.g. PLC or device to the SCADA.

35.4.15. The local mode shall disable the auto, manual and maintenance modes.

35.4.16. Remote Mode

35.4.17. The Contractor shall configure each object with a remote mode only if such a mode is a physical input from an external source e.g. PLC or device to the SCADA.

35.4.18. The remote mode shall enable the auto, manual and maintenance modes.

36. Messages

36.1.1. The Contractor shall configure each object to display faults, diagnostics, states, information and prompt messages for each object.

37. SECURITY AND ACCESS CONTROL

37.1.1. The Contractor shall put into operation security and access control features and comply with the criteria and requirements stipulated in this entire section.

37.1.2. The Contractor shall put into operation all user-initiated actions and control these actions to prevent unauthorised access; system and operation failures.

37.1.3. The Contractor shall provide access to configuration functions of the SCADA and shall always provide security measures.

37.2. ArchestrA Security

37.2.1. The Contractor shall utilise the ArchestrA Galaxy authentication mode as opposed to the Operating System authentication mode.

37.2.2. The Contractor shall put into operation the users, roles and groups and assign security and access to each attribute of an object.

37.2.3. The Contractor shall put into operation the security groups to match the physical model.

37.2.4. Users are all assigned roles within the system. Users shall be granted as many roles as required to perform their job.

37.2.5. The roles are then mapped to security groups. Thus, only users (who are in a certain role) will be able to gain a particular type of access to an attribute.

37.2.6. The Contractor shall put into operation these issues with due diligence:

37.2.6.1. The need for authorised personnel only, to be able to change process set points.

37.2.6.2. The need for operators to be able to control devices only within their section of plant.

37.2.6.3. The need for availability of additional functionality based on the type of user that is logged into the system.

37.3. Groups

37.3.1. The Contractor shall put into operation groups in line/the same as the physical model structure.

37.4. Users

37.4.1. The Contractor shall obtain the list of users and shall put into operation the SCADA according to the approved list.

37.4.2. Each person authorised to access and control plant equipment via the SCADA would be allocated a username and password.

37.4.3. Users shall automatically be logged out if the inactivity time-out period expires or at the end of the shift. An inactivity timeout will occur after 10 minutes and the current user, excluding operators, shall be logged off automatically.

37.4.4. User names should be derived according to the following rule:

37.4.4.1. First letter of first name + first seven characters of surname

Where: + = concatenate

37.4.4.2. In the case, that there are more than one user that will share the same user name, the second part of the user name will be reduced by one character and a running numeral shall be appended e.g.

No.	Name of Individual	User Name
1	Joe Soap	JSoap1
2	John Soap	JSoap2

37.5. User Roles

37.5.1. Each user will be allocated an access level or role that will determine the functions that can be accessed by that user.

37.5.2. Access level can be organised into groups.

37.5.3. A user shall be allowed to access all functions that are assigned to his/her role or access level, and to those on all lower levels.

37.5.4. A workstation that is not logged into the system, will not have a role or access level assigned to it, so it will act in a purely view only mode.

37.5.5. The following user roles shall be configured. Each individual shall have a user name, password and role. Passwords are changeable at any time.

No.	Role	User Rights
0	None	None/Default User
1	Observers	Read only access
2	Artisans	Read/Write related to instruments in particular area only
3	Operators	Read/Write related to processes in a particular area only
4	"Scientific Services"	Read/Write related to analytical instruments in a particular site only
5	Technicians/Supervisors	Read/Write related to all instruments and processes in a particular site only
6	Site Administrator	Read/Write to the entire SCADA System in a particular site

7	System Administrator	Full administrator rights
8	-	-
9	-	-

37.6. Alarms and Events

37.6.1. The Contractor shall put into operation all logins and logouts.

37.6.2. Each login and logout shall be event logged.

38. ALARMS, failures and warnings

38.1.1. The Contractor shall put into operation alarms consisting of failures and warnings and obtain written approval from the Chief Automation Engineer prior to implementation.

38.1.2. All alarms require acknowledgement from identifiable users only. Alarms shall apply to all objects as per the levels in the physical model.

38.1.3. Alarms shall be classified according to two categories namely warnings and failures.

38.1.4. Failures shall be activated when a process or equipment is operating outside the maximum allowable thresholds or abnormally.

38.1.5. Warnings shall be activated when a process or equipment is operating outside the inner threshold values but inside the maximum allowable thresholds. Warnings are only permitted when failures are defined.

38.2. Alarm Priorities

38.2.1. The Contractor shall put into operation the following priority levels of failures for each object in the physical model:

Low Priority	Medium Priority	High Priority
Grid 1 (Selection Failure)	Grid 4 (Section Failure)	Grid 7 (Water Quality Failure)
Grid 2 (Control Failure)	Grid 5 (Communication Failure)	Grid 8 (Environmental Failure)
Grid 3 (Equipment Failure)	Grid 6 (Site/Area Failure)	Grid 9 (System Failure)

38.2.2. The Contractor shall put into operation all plant data with high or medium priority to be transmitted via SMS and e-mail using the SCADAlarm system as follows:

38.2.2.1. **Grid 4 – Section**	Inform relevant supervisor(s)
38.2.2.2. **Grid 5 – Communication**	Inform technician(s)
38.2.2.3. **Grid 6 – Site/Area**	Inform supervisor & Executive (Station) Manager
38.2.2.4. **Grid 7 - Water Quality**:	Inform relevant Supervisor(s)
38.2.2.5. **Grid 8 - Environmental**:	Inform Executive (Station) Manager
38.2.2.6. **Grid 9 - System**:	Inform SCADA System Administrator(s)

38.2.3. The Contractor shall put into operation one warning priority level for each object in the physical model.

38.3. Alarm Animation

38.3.1. The Contractor shall put into operation the following icon for warnings on each object:

38.3.2. The Contractor shall put into operation the following icon for failures on each object:

38.3.3. The above icons shall disappear when the alarm condition is no longer active or implicitly acknowledged i.e. returned to normal.

38.3.4. The colour to denote an alarm condition shall always be yellow and shall blink fast and invisible for unacknowledged alarms.

38.3.5. Acknowledged alarms shall not blink but the respective icon shall be visible.

38.4. Alarm Filtering and Sorting

38.4.1. The Contractor shall put into operation each overview screen and navigation button/object and shall indicate the presence of alarms, acknowledge or otherwise, within the area represented.

38.4.2. All alarms shall be filtered and sorted according to the:

38.4.2.1. Site

38.4.2.2. Area

38.4.2.3. Section or subsection

38.4.2.4. Operation, phase or Process

38.4.2.5. Equipment (equipment modules)

38.4.2.6. Devices (control modules)

38.4.2.7. Individual objects excluding parameters and attributes (basic modules)

38.4.2.8. Time (Default)

38.4.2.9. Priority

38.4.2.10. Period

38.4.2.11. Users

38.4.2.12. User Roles

38.4.2.13. Any combination of the above

38.4.3. Alarms on the main alarm window shall be filtered to display the alarms generated by the last selected area when the page is opened.

38.4.4. The buttons on the display control area shall still indicate that alarms exist on the other areas (via colour animations), irrespective of the selected area and the filtering options shall be made available for extended or reduced filtering and sorting.

38.4.5. The main alarm window shall contain an alarm tree or hierarchy and the main alarm display. The operator shall be able to filter the logged alarms on the alarm display by selecting the relevant area from the alarm tree.

38.4.6. The alarm display shall be configured to show the history of warnings, trips and events separately or jointly.

38.4.7. The alarm display shall be configured to show current warnings, trips and events separately or jointly.

38.4.8. The alarm display shall provide a list of all alarms based on the filtering options selected by the user.

38.4.9. Scroll Bars shall be available for viewing alarms in excess of the standard viewable area. The latest alarm shall be displayed on the first line of the alarm display.

38.4.10. The Contractor shall put into operation a report to extract warnings, alarms and events.

38.5. Main Alarm Window

Forthcoming

39. EVENTS

39.1.1. The Contractor shall put into operation all user-initiated activities such as logins, logouts, mode changes, set point changes etc. to be logged as events excluding navigation.

39.1.2. The Contractor shall put into operation a report to extract events (and alarms).

39.2. Event Priorities

39.2.1. The following event priority levels shall be configured for each object in the physical model:

Low Priority	Medium Priority	High Priority
Grid 1 (No Impact)	Grid 2 (Process & Equipment)	Grid 3 (System)

39.3. Event Filtering and Sorting

39.3.1. The Contractor shall refer to Alarm Filtering and Sorting and substitute the word alarm(s) with event(s) as far as reasonably possible.

39.3.2. The Contractor shall put into operation event filtering and sorting.

40. COMPUTERS

40.1.1. The Contractor shall configure each new SCADA component node adhering to the following computer naming convention:

40.1.1.1. Station/Reservoir identifier, and 2 alpha characters

40.1.1.2. Area/Plant identifier, and 2-3 alpha characters

40.1.1.3. Application identifier 3-4 alpha-numeric characters

E.g. PFSPAOS1; VGCP2AOS, PFAOS1, VGCCAOS2

40.2. Multiple Monitors

41. COLOURS

41.1.1. The Contractor shall put into operation the background of the all the displays as light grey in order to mitigate glare.

41.1.2. All plant equipment will be depicted in white, and will be filled in light red if the need arises to depict a level change.

41.1.3. All text shall be depicted in black, unless it can be used to enter values or if it is to indicate values or status. In that case, it shall be depicted in blue.

41.1.4. All buttons shall be depicted with black text, unless the button is in a disabled state, whereupon, the text shall be depicted in dark grey.

41.1.5. The use of subtle shading to create the illusion of raising or lowering a section of the display can be used with great effect to differentiate areas of the display.

41.1.6. The preferred color convention, following the standard for safety signs (BS 5378) is defined as follows:

Status	Colour
Red	stop, prohibition, danger
Green	safe condition
Yellow	caution, risk of danger
Blue	Mandatory action
Grey	Disabled

41.1.7. Blinking is only used to indicate transient states or unacknowledged alarms.

41.1.8. Display designs shall not rely solely on color to indicate plant status.

42. HELP FUNCTIONALITY AND EMBEDDED DOCUMENTATION

42.1.1. The Contractor shall put into operation help functionality and embed the final documentation in the SCADA system.

42.1.2. The icon to link to a help file is depicted below

43. COMMUNICATION

43.1.1. The Contractor shall use ArchestrA data quality displays to indicate the quality of all displayed data.

44. MISCELLANEOUS

44.1. Printing

Not available.

44.2. Backup

Not available.

44.3. Operating System Impact

44.3.1. Start Up of Operating System or SCADA

44.3.2. Node start-up is automatically initiated either upon power-up or after a manual restart (e.g. after a failure or modification). In either case, the start-up (once initiated) is a fully automatic procedure, not requiring any intervention from the user.

44.3.3. Shut Down of Operating System or SCADA

44.3.4. For maintenance purposes, a function shall be provided for shutdown of each computer node. This shall allow the system to be maintained without adverse effect on the operation of communication networks and without corruption of data. The shutdown can be initiated by the user at each workstation or server, if the access level of the user allows for this action i.e. Technician user role or higher in conjunction with the security group.

44.4. Redundancy

44.4.1. The system shall be capable of Warm/Hot standby options, and shall be implemented where such redundancy has been specified by the project.

44.5. Diagnostics

44.5.1. System faults caused by software or hardware failures shall be diagnosed and indicated by the SCADA. Information shall be made available so that problems can be speedily identified and corrected.

45. NAVIGATION

Not available.

46. REPORTS

46.1. Report for each SCADA Component

46.1.1. The Contractor shall put into operation separate reports for each new primary SCADA component/node with the following minimum information:

46.1.1.1. System component class i.e. GR, AOS, etc.

46.1.1.2. System component hierarchical name and node name

46.1.1.3. Start and End Date

46.1.1.4. Start and End Time

46.1.1.5. CPU usage trend and number of peaks exceeding 30%

46.1.1.6. Average, maximum and minimum CPU usage values

46.1.1.7. Hard drive capacity at End Date and Time

46.1.1.8. Available hard drive space at Start Date and Time

46.1.1.9. Available hard drive space at End Date and Time

46.1.1.10. Change in available hard drive space

46.1.1.11. Unavailable hard drive space at End Date and Time

46.1.1.12. Memory usage trend

46.1.1.13. Average, maximum and minimum Memory usage values

46.1.1.14. Network utilisation trend

46.1.1.15. Average, maximum and minimum Network utilisation values

46.1.1.16. Number of power failures

46.1.1.17. Number of node shutdowns and reboots

46.1.2. The Contractor shall put into operation each report with the above-mentioned requirements and by default set the automatic printing of each report for each Monday, 00h00:

46.1.3. The Contractor shall backup the report templates to the Employer's software control program, VersionWorks®.

46.2. Reports for Production and Operation

46.2.1. The Contractor shall put into operation separate reports for each plant with the following minimum information:

46.2.1.1. Site

46.2.1.2. Plant

46.2.1.3. Area

46.2.1.4. System component hierarchical name and node name

46.2.1.5. Start and End Date

46.2.1.6. Start and End Time

46.2.1.7. Consumption of resources such as material, chemicals and running hours

46.2.1.8. Number of plant starts and stops

46.2.1.9. Number of plant shutdowns, abnormal stops and stops due to plant/section faults

46.2.1.10. Number of device/equipment failures

46.2.1.11. Number of unacknowledged alarms

46.2.1.12. Number of alarms

46.2.1.13. Number of warnings

46.2.1.14. Electrical consumption, if available

46.2.1.15. Trends of water quality variables

46.2.1.16. Average, maximum and minimum values of each water quality variable

46.2.1.17. Trends of process set points, process variables and outputs based on a PID or other tuning algorithm

46.2.1.18. Average, maximum and minimum values of each algorithm based variable

46.2.1.19. Water balance information

46.2.1.20. Equipment, mainly pumps and motors, running hours

46.2.1.21. Equipment, mainly pumps and motors, efficiency calculation

46.2.1.22. Equipment, mainly pumps and motors, efficiency trends

46.2.2. The Contractor shall put into operation each report with the above-mentioned requirements and by default set the automatic printing of each report as follows.

46.2.2.1. Every 2 hours (14H00, 16H00, 18H00 etc)

46.2.2.2. Every 8 hours (06H00, 14H00 and 22H00)

46.2.2.3. Every 24 hours (00H00)

46.2.2.4. Every Monday (00H00)

46.2.2.5. Every month (1st day of each month at 00h00)

46.2.2.6. Every quarter (1st day of each period at 00h00 i.e. Jul, Oct, Jan, Apr)

46.2.2.7. Every year (01st July at 00h00)

46.2.3. The Contractor shall put into operation the report templates with provision for manually changing the dates and times.

46.2.4. The Contractor shall backup the templates to the Employer's software control program, VersionWorks®.

47. TRENDS

47.1.1. The Contractor shall put into operation real time trends for all analog and digital modules.

47.1.2. The SCADA shall log trends to the Wonderware Historian or to the SCADA node.

47.1.3. Trends are usually a graphical representation (x-y plot or scatter graph) of process variables. The software that shall be used to view trends is Active Factory.

47.1.4. Standalone nodes shall log data to a text file that shall be importable to any Wonderware Historian node. Users shall be prompted to copy the text file and import the file at 30-day intervals. The age of the trend file as well as the location shall be available on the SCADA.

47.1.5. These tools provide an intuitive point-and-click interface to access, analyse and graph real time and historical time-series data, as well as abstract the requirement of being familiar with SQL.

47.2. Required Trends

47.2.1. The following data shall be configured for trending purposes and shall be stored permanently in a (MSSQL) database:

47.2.1.1. All physical digital inputs and outputs

47.2.1.2. All physical analog inputs and outputs

47.3. Main Trend Window

47.3.1. Trends shall be viewable in two manners viz. via the main trending window and via the trend window associated with a particular device. Particular devices are discussed in the relevant sections.

47.3.2. The main trend window will contain the trend display, which shall be configured to connect to a Wonderware Historian node. The main trend window shall allow a user to browse the Wonderware Historian database and select tags from the database table. Thus, the user shall be able to trend a custom selection of process variables. This sort of functionality is useful when a number of variables are to be trended against each other.

47.3.3. Device specific trends shall be invoked by clicking the trend icon (shown below) on the device faceplate.

47.3.4. Clicking the trend button on the device faceplate will display the device specific trend display.

48. TAG NAMING CONVENTION

Refer to RW-AES-00010-AS-Tagnaming Convention Rev-B

49. SQL DATABASE

Forthcoming

50. TEXT (GENERAL)

50.1.1. The Contractor shall use the **Arial font**.

50.1.2. The **Arial** font in normal style, 10 point, black colour shall be used to depict all textual data on the HMI, with the exception of the following cases:

50.1.2.1. Tag names for maintenance shall use the 8-point text size

50.1.2.2. Headings of all displays (except for pop-up displays) shall use the bold style, 12 points, white text.

50.1.2.3. All alarms shall be displayed using the bold style, 12 points, yellow (or black) text.

50.1.2.4. Text should be in lower case, with the first letter word a capital e.g. Discharge Pump Temperature. The use of upper case text should be minimized as it can be difficult to read and can cause eyestrain. Underlining of words should also be kept to a minimum.

50.1.2.5. The operator should be allowed to choose data from a list of alternatives as opposed to manually typing in data.

50.1.2.6. Text and (especially) data values should be either grouped in areas of the screen, or in the case of multiple similar vessels, be kept in the same line of sight. Randomly placing data values around a display makes it difficult to scan for data values. If the operator has to compare values, they should be placed together in a table. If there is multiple tables with the same data types (e.g. temperature, pressure, etc.) it should be ensured that the data is presented in the same order in each of the tables.

50.1.2.7. The display of data values should avoid unnecessary decimal places. The displayed data resolution should be appropriate to the application and intended purpose.

50.1.2.8. The use of subtle changes in background colour, especially in tables, can be used to enhance the presentation of data and alleviate eyestrain.

51. WINDOWS/MIMICS

51.1.1. The Contractor shall put into operation mimics to depict the position, status, control and relationship of field equipment for the SCADA work in concern.

51.2. Application Specific Windows

51.2.1. The Contractor shall configure each overview, network and subsection window as follows:

Description	Requirement
Background Colour	Light Grey
Contrast Colour	N/A
Resolution	1280 x 1024 pixels
Type	Replacement
Position	Below navigation bar

51.3. Template Type Windows

51.3.1. A template type window is created once and reused across several applications. The majority of the contents are dynamically updated and manipulated via the software program. The Contractor shall not put into operation new template type windows without the written permission of the CAE.

51.3.2. These types of windows are created as follows:

Description	Requirement
Background Colour	Dark Blue
Contrast Colour	Light Blue
Resolution	1280 x 1024 pixels
Type	Popup
Position	Right hand side of object

51.4. Information Window

Not available.

51.5. Web-viewer Window

Not available.

52. CHECK LIST

52.1.1. The Contractor may check the following items and clarify all issues with the Project Manager prior to the submission of the tender document.

Category	Findings	Checked
Site		
Existence of WH		
Number of manned plants		
AOS CPU usage calculation		
Number of existing AOS and/or new		
Number of existing VN and/or new		
Number of existing AF and/or new		
Network communication		