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SERVICES COMPANY S.A.O.C**



**الشركة العمانية  
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**OMAN WASTEWATER SERVICE COMPANY**

**TECHNICAL STANDARD SPECIFICATIONS FOR**

**INSTRUMENTATION CONTROL & AUTOMATION**

**SECTION 05-04**

**SCADA SYSTEMS**

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## SCADA SYSTEMS

### 1. INTRODUCTION

This document details the standard requirements for the SCADA system.

SCADA systems provide detailed, local site and process alarm reporting, monitoring and process control facilities for treatment works installations where specified.

Data collected by the SCADA system is retained locally and is not routinely transferred off site. However, access to this data from a remote location shall be possible via a Wide Area Network connection to a Corporate Network, and via the SCADA remote access facilities.

Data shall be continuously acquired by the SCADA system through a network interface(s) to the PLC systems installed on the plant. This data shall be held in a real time database by the SCADA system. Some or all of this data shall be stored to provide historical information. SCADA data shall be displayed on either the local SCADA system or where specified, on a remote workstation in the form of alarm lists, mimics trends and reports.

Any SCADA system fitted with a remote terminal or client shall support at least two simultaneous users.

### 2. HARDWARE REQUIREMENTS

#### Computer Specification

The contractor shall provide a personal computer for use as a SCADA computer.

The personal computer shall include the following items:

- 3.5 inch 1.44MB floppy disk drive.
- DVD-RW compact disk writer for archive purposes.
- Network interface card.
- An appropriate number and type of serial and parallel interfaces for peripherals.

The contractor shall evaluate the performance requirements for the particular application and shall ensure that the hardware specification does not unduly limit the performance of

the SCADA system, taking into consideration applications such as report generators running concurrently with the SCADA software.

The contractor shall also confirm that the hardware platform meets the recommended system requirements specified by the relevant software vendors.

The supplied PLC network interface card supplied shall be as recommended by the PLC manufacturer. The relevant supporting software shall be installed and configured to enable direct communications with the supplied PLCs.

Sufficient solid-state memory shall be provided so that swapping of data with disc store is minimised and performance levels achieved. The computer shall be configured to operate from 230/240V AC 50Hz supply. Unless otherwise stated, all SCADA and associated equipment shall be supplied from a UPS.

Unless otherwise stated, the specification of the computer shall be such that when fully programmed and operational it complies fully with the performance requirements stated in Appendix 1 of this specification.

The level of redundancy shall be as detailed in the Particular Specification.

The contractor shall supply printers for use as SCADA equipment.

All printers shall be capable of being supplied from a 230/240V AC 50Hz supply.

Printers shall be provided with a suitable paper feed with the capacity of at least 100 sheets, and a receptacle for printed output.

Screen Printer - An ink jet colour printer shall be provided complete with an A4 sheet feeder mechanism and a suitable stand and configured so as to be able to produce full colour accurate representations of screen displays, including mimics, trend displays and reports.

Alarm / Event Printer - A dot matrix printer shall be provided complete with a paper feed mechanism suitable for use with continuous feed paper and a suitable stand so as to be able to print alarm print outs.

### **Equipment Environment Requirements**

The environmental specification of the SCADA equipment (including associated peripherals) and the specification of location in which it is to be located shall be matched such as to ensure that the SCADA equipment environmental specification is not exceeded.

### **Furniture**

The contractor shall provide furniture in accordance with the requirements of the particular specification.

### **Equipment Security**

The SCADA system shall be located in a suitable control room or other secure location

### 3. SOFTWARE REQUIREMENTS

The following shall be provided:

- PLC network interface software, as recommended by the PLC manufacturer
- the operating system used on all SCADA installations shall be as agreed with the Employer and as recommended by the SCADA application supplier

All documentation, including but not limited to software licences and licence keys, associated with the above software shall be provided to the Employer.

All software shall be licensed to the Employer by the contractor.

Software licences shall cover application run time and configuration.

House keeping shall be automatically performed by the SCADA system. All operating system temp (.tmp) files and other system temporary files shall be deleted automatically on a regular basis.

Where a symbol and or a dynamo do not exist for a specific application a symbol or dynamo shall be designed and submitted to the Engineer for approval.

#### 3.1 Disaster Recovery

A disaster is defined as a complete failure of the SCADA system.

A disaster recovery system and procedure shall be provided. A description shall be submitted in the FDS to the Engineer for approval.

An additional (back-up) hard disc drive shall be provided for each computer supplied. Upon successful commissioning of the system, the complete contents of all active hard drives are to be copied to back-up drives.

- The disaster recovery procedure shall be fully described in the O&M manual.
- As part of the FAT and SAT the contractor shall be required to demonstrate the disaster recovery procedure as described in the O&M manual.

Alternative disaster recovery methods may be offered by the contractor and shall be fully described in the contractor's tender / scope submission.

#### 3.2 SCADA system configuration start up and power failure recovery

On start up or on resumption after power failure on the whole or any part of the plant, the system shall automatically self start, configure, connect to all external communications links and display the main menu.

The user shall not have to enter configuration data or initialisation commands during the start up process or operating period. The system shall retain all settings that have been previously set by the user. The FDS (at the design stage)

and the Operational and Maintenance Manuals (at As Built stage) shall list all such settings for the Engineer's approval.

After shutdown or on loss of power, or on resumption after loss of power, all totalised and other calculated values shall be retained and redisplayed. All log files and values shall also be available and uncorrupted.

The system set-up shall include the disabling of the auto run facility for CD-ROM.

### 3.3 Configuration

The contractor shall be responsible for the configuration and integration of all hardware, and communications, and shall also be responsible for all software installation and configuration including disk and memory allocation to meet the functional requirements of the system.

The Contractor shall submit details of the database configuration displays, trends, reports etc for approval as part of the Functional Design Specification (FDS).

### 3.4 Mimics

All mimics shall display a menu tool bar at the top of the screen capable of providing the following facilities: Login/logout, Alarm list summary Display, Event log display, Trend Menu display, Main Menu Display, System Menu Display.

The contractor shall configure sufficient mimics to cover the entire plant. Mimic pages shall show an overview of the whole plant.

The plant shall be broken up into logical areas with at least one mimic page per area. Each mimic shall show all controlled and monitored plant within the area that it covers.

In general, the mimic shall resemble the P&I diagram. Unmonitored or uncontrolled plant shall be shown where a contribution to the process is made by this plant.

All plant shown shall have its tag number displayed on screen as close as practicable to the plant item icon.

The operator shall be able to move between mimic pages by two methods, either by directly selecting the page from the overview graphic or by navigating through the plant using graphical buttons on the input or output links of mimic pages. These buttons shall clearly show in graphics or text the screen that will be selected if the button is pressed.

Mimics pages shall be of 2 distinct types: process pages (chained from the Main Menu Overview Screen) or system and diagnostic pages (chained from the System Menu Overview Screen).

The contractor shall not locate his company name or logo or any other form of advertising on any of the mimic screens. The contractor's name and contact details shall be configured on the system start up screen.

The engineering units associated with each reported value on the mimic shall be displayed beside the value.

Where the run / stop status of pumps is monitored, all pumps shall have their running hours totalised. The run hours shall be displayed on a different mimic / graphic.

Diagnostic mimic pages shall be configured to monitor the status of all the PLC I/O modules and all PLC network communications statistics. Each slot shall be clearly identified by slot number and card type and the I/O signals identified by number and name. The mimic shall also display for each I/O point:

- The raw PLC value
- Engineering unit value, default value (if a default is specified) and if the default is in use

### 3.5 Graphical User Interface

The graphical user interface will provide facilities for both process monitoring and control.

The facilities will be provided to monitor plant status, start and stop plant and change plant process set-points.

It is intended that all mimics will have a common "look and feel" as far as is possible. Mimics will consist of three main types.

- **Overview Mimics**

The Overview Mimics are the 'gateway' to the Detail Mimics. They will not display any detailed information, although the Overview Mimic for an area of plant may indicate the most important status information.

- **Detail Mimics**

The Detail Mimics will show detailed status of all of the dynamic equipment on the plant. All of the required monitoring and control facilities will be available from these screens.

- **Pop-up Mimics**

Pop-up mimics will be partial page mimics that are selected from detail mimics. They will normally be associated with plant items.

The system structure will be such that all full-page mimics should be accessible within 4 selections from any other mimic in the system.

The user interface will be via a keyboard and 'pointing device'. Typically the 'pointing device' will be a mouse or tracker ball.

Plant items on detail mimics may be selectable items. Plant items, which are selectable, will be outlined in grey when the pointing device is over them.

Selection of individual plant items will display a pop-up mimic. This would be a face plate type mimic for most plant items, from which further pop-up mimics may be selected using windows buttons. The faceplate would facilitate the calling of the following options.

Control Pop-up - will facilitate the manual control of plant items, when it is appropriate.

Trend Pop-up - will display a real time trend of a selected analogue plant instrument.

PID Pop-up - will display the current PID parameters associated to a control loop.

Statistics Pop-up - will display the current running hours, no. of starts etc. for a plant item.

Plant equipment which only has one option (i.e. an instrument may only have trend information) will go directly to the appropriate pop-up without the need for a faceplate. Only one pop-up mimic may be open at any time. When a detail mimic is closed any pop-up mimic, which is displayed at the time must also be closed

### 3.6 General Mimic Discipline

This section will detail the general graphical rules for the generation of mimics; most will also be relevant to pop-up mimics.

Each mimic will have a title bar, which, along with the mimic title, will display the time, date and the numbers of unacknowledged and total alarms. The site name will also be displayed within the title bar. Every full-page mimic will have a 'Help' button on the right hand side of the title bar.

An alarm banner consisting of the three most recent alarms will exist at the bottom of the page; the banner will be the full width of the screen. Above the alarm banner will be a function key banner. The function keys F2 to F9 and F11 to F12 will be displayed. Function keys F1 and F10 are not used as they have reserved functions within Windows.

The following rules should be observed in the creation of full-page mimics: [1] The filenames used for graphics must be meaningful text

[2] All screen development shall be based upon a screen resolution of 1024 by 768 pixels. The screen size shall be 17"

[3] Graphics will be drawn in two dimensions

- [4] All process flow lines shall be vertical or horizontal
- [5] Process flow lines shall be the appropriate process colour. Process lines shall not be animated in any way
- [6] Process flow shall be from left to right, unless it is unavoidable or would reduce clarity. Sufficient process coloured direction arrows will be super-imposed on the process flow line to ensure clarity
- [7] The crossing of flow lines shall be avoided. Where it is unavoidable, the vertical flow line shall have breaks either side of the horizontal line. These breaks will be as small as possible to maintain clarity and of a uniform size
- [8] All process flow lines shall be of a uniform thickness; there shall be no increase in size at process flow lines junctions. Line thickness for process flow lines shall be 3 points (pixels)
- [9] Text shall be lower case with leading upper case. The exception to this being equipment tags names which shall be all upper case
- [10] Equipment status shall be displayed in a graphical manner and through the use of colour of the appropriate symbol. Process critical and alarm conditions shall not be indicated by colour alone
- [11] Tag names and status words shall both be inserted below or to the right of equipment symbols. Where either position would be possible, the preferred position is below the symbol
- [12] Static symbols shall only be shown on mimics where they are necessary to aid overall clarity. When it is necessary to show static symbols they shall be drawn in black
- [13] Selectable area on any screen will be highlighted in a grey rectangle when the pointing device passes over the area
- [14] Where possible common features on mimics shall be placed in consistent positions. This will include Help, Trend and Alarm summary selection
- [15] Pop-up mimics will not be sizeable and should appear on detail mimics in such a position so as not to obscure the plant item to which they refer

• **Main Overview**

The Main Overview is the top-level mimic, which will be displayed when the system is first started. It should be possible to return to this Overview mimic from any other mimic by a single action from the keyboard or pointing device. The 'F2' function key on every other mimic shall be used for this purpose.

The main overview will be used as the 'gateway' to either detail mimic or to lower level overview mimics, this will be dependent on the complexity of the installation.

The 'F4' function key on this mimic will be used to select the 'Operator Log-In' pop-up mimic.

### • Process Overview

Process overviews shall be provided for more complex installations, these will allow direct access to the detail mimics. Smaller installations will have the functionality of the process overview combined into the main overview.

The process overview shall be developed in such a way as to portray the physical plant layout. Each area of plant would be illustrated as a 'box' on the mimic, showing the main process flow lines between the areas of plant. Essential information may also be represented on the mimic.

The appropriate detail mimic will be selected by clicking the pointing device on the appropriate box, which represents the required plant area. It should be possible to return to the process overview from any given detail mimic by a single action from the keyboard or pointing device. The 'F3' function key shall be used for this purpose.

The box representing each area of plant shall be a grey button, having a border, which will only be visible when an alarm is present in that area of plant. The general area alarms for this purpose shall be generated within the PLC and not within the SCADA. When clicked, the button shall activate the appropriate screen.

### 3.7 Symbols

A standard symbols library shall be developed in conjunction with the Engineer.

### 3.8 Screen Navigation

Navigation shall be developed in conjunction with the Engineer. This is the method by which the operator will select new full-page mimics and call up partial page pop-up mimics from full-page mimics.

### 3.9 Function Key Bar

The function keys will be selectable using the keyboard or the pointing device. These keys will generally be used to select the standard full page mimics that should be selectable from every mimic. They will include:

- F2 Main Overview
- F3 Process Overview (If required)
- F4 Return / Login (on Main Overview)
- F5 Spare (Project Configurable)
- F6 Spare (Project Configurable)
- F7 Communication Status
- F8 Trends
- F9 Alarms Log
- F10 Access to Supervisor level and above
- F11 Alarm Summary
- F12 Alarm Reset

The remaining function keys, which have not been specified, may be used on a project specific basis. These keys shall not be used to navigate between detail mimics.

## 4. ALARMS

Alarms of all types generated by the system shall be time-stamped at SCADA to an accuracy of one second.

The SCADA system shall be able to receive and respond to incoming alarms at any time and under any prevailing operating conditions, including the routine polling cycle, within the response times defined by the specified performance requirements in Appendix 1.

The Contractor shall define the priority of all alarms and submit to the Engineer for approval. Upon approval, the definitive list shall be incorporated into the FDS.

The Contractor shall define alarm groups and assign each alarm to an alarm group. This list shall be submitted to the Engineer for approval. Upon approval, the definitive list shall be incorporated into the FDS.

An alarm list shall be available to record all alarms and shall enable users to inspect or recall alarms in various formats, with the aid of structured query facilities. The alarm list shall have a capacity of at least 2000 alarms. The alarm list shall identify as a minimum, the source, date and time of occurrence, priority and status by colour code. On an annunciation of an alarm condition, the operator shall be able to acknowledge alarms whilst viewing the alarm list. Provided the condition causing the alarm is no longer present the alarm shall be removed from the list and an alarm acknowledged message recorded in the event log and if defined within the FDS, additionally sent to the alarm printer. If the condition causing the alarm is still present a tick shall be shown beside the alarm message on the list and the message will not be removed from the list.

All alarms shall remain active until acknowledged by the user and must remain on the alarm banner and summary list in a form, which is clearly displayed until the source of the alarm condition has been removed

### 4.1 The Alarm Banner

As a minimum, the alarm messages shall contain the I/O tag name, the I/O point name, the text status, Priority, Time and Date. Note that priority shall be indicated by different colours for different priorities.

There shall be a simple means of navigating from the alarm message to the related mimic.

Only the three most recent active and unacknowledged alarms shall be displayed on the alarm banner. The format and detailed functionality shall be agreed in conjunction with the Engineer

#### 4.2 Alarm and Event Log

All events (including user log in / out and other user activity) and alarms / events detected by the system shall be logged and stored in a permanent file, which shall be capable of being accessed and viewed by operator level upwards. Event log viewing shall be initiated by a button on the menu tool bar.

Log records shall be kept in a manner such that they are not alterable by any party.

Any part of the event log (including during the current day and current time) shall be capable of being viewed and/or printed at any time.

Search and locate facilities (including specification of date range) shall be provided to assist the user to locate specific events, tag numbers etc.

The alarm log shall be divided into logical groups that represent the different elements of the process, for example main alarm groups for primary treatment, secondary treatment, electricity distribution, etc. Each main group shall be divided into sub-groups as appropriate, for example primary treatment might be divided into inlet screens, grit removal, etc.

The alarm log shall incorporate the facility for the user to view specific alarm groups only as well as all alarms.

The alarm log shall incorporate the facility for the user to view separately the alarms that fall into the following categories:

- Active and unacknowledged
- Active and acknowledged
- Inactive and unacknowledged
- Inactive and acknowledged

For active alarms, the alarm log shall display when the alarm became active and, if appropriate, when it was acknowledged.

For inactive and unacknowledged alarms, the alarm log shall display when the alarm last became active and when it became inactive.

For inactive and acknowledged alarms, the alarm log shall display when the alarm became inactive and when it was last acknowledged

Log records shall be kept in a rolling event log file, which shall be stored in a reserved portion of hard disk space. The amount of hard disk space reserved for the alarm log shall be agreed with the Engineer. Alarms shall be stored on a first-in-first-out basis.

#### 4.3 Printing Functionality

Printers shall be supplied as defined under the Hardware Requirements section of this specification. The contractor shall be responsible for the configuration of all printers provided.

Alarm and event log to be printed on request.

#### 4.4 Alarm Priority

There shall be a facility for defining alarm priorities.

If alarms are required to be prioritised, then this shall be stated in the Particular Specification.

Alarm priorities shall be agreed with the Engineer.

#### 4.5 Alarm Generation

It is intended that all alarms shall be generated in the PLC, and then passed to the SCADA system as digital signals. This shall include analogue alarm levels, which shall not be generated within the SCADA system.

Plant items which have several alarms associated with them shall also have a general failure alarm generated within the PLC. Plant Area general alarms shall also be generated. These general alarms shall be used on the mimics to indicate plant item and plant area alarms on the process overview mimics.

In the event of a major alarm e.g. mains electricity supply failure, an alarm shall be raised for this alarm but all consequential alarms shall be suppressed. The alarms to be classed as major alarms shall be agreed with the Engineer.

#### 4.6 Alarm Display

There shall be three separate ways of displaying alarms:

- Alarm Banner - This shall appear at the bottom of each full page mimic displaying the three most recent alarms on the system. Acknowledged alarms shall remain on the banner until they are cleared or replaced by more recent alarms
- Alarm Summary - This shall be accessible from every full page mimic and shall contain up to a full page of the most recent alarms. Alarms shall remain on this page as long as they are still current or have not been acknowledged
- Alarm Log - This shall show all the alarms regardless as to whether they are still current or not. The length of this alarm log shall be configurable

### 5. SECURITY

#### 5.1 Security Codes

The contractor shall implement the passwords defined by the Engineer. These shall be defined during the design phase

- Default / Guest

This user group will only have access to View screens. They will not be able to select anything which may effect plant or system operation in any way. This will include the inability to acknowledge or reset alarms.

- Operator

The operator user group will have similar security access to the default and guest user groups. In addition it will be possible to change duty selections for items of plant.

- Supervisor

The supervisor user group will have similar security access to the operator, except that the supervisor will be able to control all items of plant and change any system set-point. The operator will also be able to acknowledge and reset alarms.

- Developer

The Developer will have access to all areas of the system. This will include the ability to close the SCADA application and return to the operating system. There will normally be only one system administrator on any site installation. Any new user accounts or modifications to the security codes must be configured by the Developer.

## 5.2 General Security Considerations

All installations of the SCADA application will automatically enter the Run mode when the system is started. The ability to switch applications, using Ctrl\_Alt\_Esc or Ctrl\_Shift\_Esc to display the Windows start-up menu, will be disabled in Run mode

## 6. ARCHIVING AND RETRIEVING

A utility shall be implemented to allow the supervisor to archive and retrieve data by selecting options from a System menu via a button on the tool bar at the top of the screen.

When it is selected the system shall prompt the supervisor to insert the appropriate CD and select the information which is to be archived, e.g. reports, data, events alarms, trends etc.

By default all trend data, all alarms (of all priorities) and all operator and supervisor actions shall be archived. The supervisor shall be able to retrieve data by selecting the date of the archive file.

Archive data shall be held in a form that allows it to be retrieved and entered into an Excel spreadsheet.

Data shall normally be archived onto optical disc, but floppy could be selected. Usually the optical CD will reside in the SCADA PC ready to archive or retrieve data.

System data and events / alarms shall be stored on hard disk. The hard disk area reserved for data storage shall be managed on a first-in-first-out basis. The amount of hard disk space available for data storage shall be agreed with the Engineer.

Data archive shall be performed automatically by the SCADA system by writing weekly data to the optical drive. This process shall be completely automatic, to ensure that the data archive is successful, the system shall perform all checking of system devices as required and prompting of the supervisor will be performed only to assist with fault diagnosis to resolve problems associated with a failure to write archive data. The time

at which data archive takes place shall be capable of being changed by the supervisor. An alarm shall be generated if for any reason the hard disk is nearing full capacity. This warning shall be set at 80% of disk capacity. Additionally, an alarm shall also be generated via the PLC system to telemetry.

## 7. REPORTS

The software shall provide Operational, Engineering and Management Reports. As a minimum these shall include:

- Daily / weekly summated flow
- Min / max / average process data
- Process trends
- Chemical consumption
- Power usage, etc.
- Data on operational plant and process availability
- Any other reports required arising from discussion with Scottish Water on a site basis.

The reports shall be generated using Microsoft Excel and shall be generated automatically and on operator request. They will be stored in electronic format in addition to a printout.

Selection of the Report button will initiate an instance of Excel for the viewing of System reports.

The printing, saving, closing etc of any report will be provided by the facilities provided within Excel.

Note that it will be the Users responsibility to close any instance of Excel.

The system reports are to be constructed to a standard layout. These reports are to be formatted within Excel. Within Excel the Page can be split into a number of sections. For the purpose of these reports the following sections are to be used.

- Page Header

This contains information that will appear on every page positioned below the report header on page one and at the top of every other page. This section should contain the main report title positioned centrally on the page.

- Details Section(s)

A 'details' section will appear on every page of the report with a new details section on every page, i.e. three pages means three details sections. These sections contain all of the details contained within each report. The 'details' section should be constructed to allow the

relevant information to be easily read. A 3pt horizontal Navy line should separate different sections within the 'details' section.

•Page Footer

This will appear at the bottom of every page of the report. This section should contain the page number and total number of pages in the format "Page 1 of 5". This should be positioned centrally on the page. A 3pt horizontal line should be positioned above the page number to separate this from the main body of the report.

•System Time

The SCADA system real time clock shall be synchronised to local time. Where a real time clock is required in a PLC / SCADA control application, all PLCs/ SCADA/Telemetry shall be synchronised to a single clock source.

## 8. ANALOGUE DEAD-BANDS

The dead-band of each analogue shall be defined and submitted to the Engineer for approval in the FDS.

## 9. SYSTEM DIAGNOSTICS

The SCADA system shall include internal diagnostics facilities. As a minimum the number of communications statistics counters e.g. number of errors, number of packets/bytes sent and received, shall be recorded, totalised and displayed on a diagnostic mimic until reset by the operator. The reset shall be recorded by a message in the event log.

Screens shall be provided for I/O diagnostics. E.g. Raw digital inputs and outputs from the PLC.

In PLC network systems, diagnostics screens shall be provided for all PLCs on the network.

Watchdog timers shall be implemented to monitor the communications for each PLC that communicates with the SCADA system. On expiry of a watchdog, a communications alarm (relevant to that particular failure) shall be annunciated on both the SCADA system and the telemetry outstation.

## 10. HISTORICAL AND REAL TIME TREND GRAPHS

All process analogues shall be configured for real time and historical trending and logging.

The system shall allow for one, two, three or four variables to be displayed on the same trend. Following discussions with the Engineer, the groups of signals allocated to trends shall be as defined in the FDS.

## 11. STANDARDS FOR PROGRAMMING

No programming shall be carried out unless the required functionality cannot be implemented by configuration of the supplied software packages. In the event that programming is required written approval from the Engineer must be obtained.

## 12.PERFORMANCE OF SCADA SYSTEM

The table shown in Appendix 1 shall define the performance requirements.

## 13.SCADA SYSTEM TESTS

The contractor shall develop a test schedule for the SCADA system. The test schedule shall be submitted to the Engineer for approval.

SCADA system tests shall place particular emphasis on tests that demonstrate compliance

in the following areas:

- I/O database
- Mimic displays
- Operator controls
- Manual operations
- Alarm generation
- Interlocks
- Data entry (alarm and control set points)
- Control simulation
- PLC to SCADA communications
- External interfaces
- Memory backup
- Archiving & retrieval of data
- Mains failure and recovery facilities
- Event and alarm log/s ummary
- Report generation
- System performance
- Automatic house keeping and file management
- Disaster recovery

Unless otherwise stated, tests shall be demonstrated to the Engineer during both the FAT and SAT.

In the event that the Engineer has stated that the testing shall not be witnessed, the Contractor shall perform the testing without the Engineer present and upon completion, submit the test results to the Engineer.

## 14. SCADA SYSTEM COLOUR CODING

Colour coding shall be in as provided below and where not stipulated in accordance

EN 60073:2000:

**Status of Operation**

**Colour Code**

Equipment running and normal

Green

Equipment stopped and normal

White/Grey

Equipment tripped

Yellow

Equipment selected "on Auto"

Blue

Equipment or process unsafe / danger in operation

Red

Panel Energized /isolator or ACB ON

White

Process Flow ON (e.g. Valves open)

Green

Process flow Stopped OFF (e.g. Valves closed)

White

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## SCADA Performance Requirements

### APPENDIX 1

<b>Description</b>	<b>Response in Seconds</b>
<b>Change in status of a plant item (Digital) and display on SCADA</b>	<b>5</b>
<b>Change in status of a plant item (Analogue) and display on SCADA</b>	<b>5</b>
<b>Annunciation of an alarm from alarm condition occurring at plant</b>	<b>5</b>
<b>Display of a real time trend (including the data) with 24 hour axis</b>	<b>5</b>
<b>Display of an historic trend (including data) with 4 traces and 24 hour axis</b>	<b>5</b>
<b>Display of the alarm summary page with a “screen” of alarms</b>	<b>3</b>
<b>Time to silence the audible alarm after acknowledgement of the alarm.</b>	<b>0.5</b>
<b>Time for mimic to update after the execution of a control output on SCADA</b>	<b>4</b>
<b>Time for a a new mimic to be displayed after a request to chain or load a new mimic ( including new data)</b>	<b>3</b>