

## SECTION -2, CHAPTER –3

### User interface Requirements

#### 3.0 General Requirements

This chapter describes the User Interface requirements for the SCADA/DMS system. All SCADA/DMS functions shall have common user interface as user interaction shall be performed from Operator Consoles envisaged in this specification. All user interactions shall be from full graphics display. The sizing requirements are given in **the appendices in section 8**

#### 3.1 System Users

The term "user" is applied to the personnel interacting with the SCADA/DMS system. These users shall be required to login in one or more of following **user modes**, which include:

- (a) Supervisor Personnel responsible for SCADA/DMS system administration and management such as assigning the access area to users, creating users etc.
- (b) Dispatcher Personnel responsible for real-time Power system operations including real-time study.
- (c) Engineer Personnel having access to certain SCADA/DMS system functions and maintenance of database/ displays and responsible for support activities such as post fault analysis , report generation, regular backup of database
- (d) Programmer Personnel responsible for continuing development and maintenance of the SCADA/DMS system functions, databases, displays and report formats. Security system
- (e) Remote VDU user : Personnel having only monitoring access of real-time power system from SCADA/DMS system , reports..
- (f) DTS ( Instructor & Trainee modes): The Consoles dedicated for DTS shall have instructor & trainee modes . The requirements are defined in section 2 chapter 2

The role, accessibility for each mode is defined as above, However, the Utility with login as supervisor shall be able to assign the operation of certain functions, or features of functions, to specific user modes. Utility shall maintain the privileges as specified to each user mode .Each individual user shall be assignable to anyone or more user modes. User access to all SCADA/DMS functions shall follow a consistent set of common user access guidelines. A

mechanism for defining and controlling user access to the SCADA/DMS system shall be provided.

Password security shall be provided for access to the SCADA/DMS system, its operating system, layered products, and other applications. Each password shall be validated against the corresponding user information in the database. Users shall have the ability to change their own passwords.

### **3.2 Function and Data Access Security**

After a user has successfully logged on, access to the SCADA/DMS functions, displays, reports, and databases shall be restricted by pre-assigned operating jurisdictions. These operating area assignments shall be made when the function, display, report, or database element is defined.

The access security function shall compare the user's assigned operating jurisdiction against the operating jurisdictions assigned to the function, display, report, or database element each time a user attempts a console action, such as:

- (a) Calling a display
- (b) Entering or changing display data
- (c) Viewing, editing, or printing a report
- (d) Executing a supervisory control action

There shall be no restrictions on the assignment of multiple jurisdictions to a console & user or the assignment of a jurisdiction to multiple consoles & users. The access security function shall ensure that each jurisdiction is at all times assigned to a least one console. If a console failure or manual reassignment of jurisdiction results in one or more jurisdictions not being assigned to at least one console, the unassigned jurisdictions shall be automatically assigned to a pre-assigned default console and suitable alarms shall be generated.

SCADA/DMS users shall not required additional login (user name and password) to the other facility allowed as per operating jurisdictions such as ISR. "Single Sign-On" (SSO) technology be employed (i.e., a user logs on once to the SCADA/DMS using individually defined user name and password which permits appropriate level of access to all SCADA/DMS facilities, including IS&R. Further, the facility should be compatible with enterprise-wide SSO capabilities.

Each log-on and log-off shall be reported as an event. Unsuccessful attempts to log-on shall also be reported as events.

### **3.3 Windows Environment**

The user interface for SCADA/DMS system shall be web enabled. The SCADA/DMS system displays shall operate within a windows environment and shall conform to the standards contained in the X Consortium's Inter-Client Communications Conventions Manual (ICCCM). The window system shall work with the graphical user interface provided and shall allow windows created on the

workstations to communicate with processors equipped with X Windows-compatible software on their respective local area networks (LANs) and with future remote applications over the wide area network (WAN).

Alternatively, the SCADA/DMS system can have the user Interface based on Microsoft Windows. The functionality in technical specification related to the GUI features of X-windows, shall be met by available features of Microsoft Windows.

It shall be possible to save window configuration in Rooms. Rooms shall allow each user to configure and save a preferred layout, size, and location of windows and displays. The World Display Features shall provide two-dimensional graphic world displays that a user shall be capable of panning, zooming and rubber banding.. The world display features such as Layers, Declutter levels, Overlays shall be supported. Displays & navigation on VPS shall be same as on the operator workstations.

The user interface software shall be based on state-of-the-art web-based technology to present interactive, full-graphics views of system data via LAN, corporate intranet or the internet. The same displays shall be used.

It is essential that the same web-based user interface (same navigator, same tools) be available to the operator either for local use in the dispatching center or remotely.

The web technology shall be natively supported by the DMS product, which means that having the displays shown in the web browser shall not bring additional work to the maintenance engineer at display building time. Nor shall it require additional third-party software products like specific plug-ins.

The web user interface shall support and enforce all security features described in the following sections.

### **3.4 Display interactions**

Rapid, convenient, and reliable display requests shall be provided using the following methods:

#### **3.4.1 Display Requests**

- (a) Selection of a display from a menu display
  - (b) Cursor target selection on any menu, graphic, or tabular display
  - (c) Selection of an alarm : in this case, it shall call up the one-line display containing the alarm's location,
  - (d) Selection of an alarm or event message on a summary display followed by a display request command
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- (e) Selection of display by Entering a display name or number
- (f) Forward and reverse paging in a page-based display.
- (g) Selecting a previous display by re-call command.
- (h) Selecting a point of interest from an Overview display for viewing on full screen (such as viewing a SLD of a substation by selecting the Substation node from a Network diagram).
- (i) Selecting function keys or cursor targets dedicated to displays.

### **3.4.2 Display navigation**

Display navigation methods shall provide a consistent approach for moving within a display. The following methods shall be provided:

- (a) Panning with cursor positioning device or scroll bars
- (b) Zooming with cursor positioning device
- (c) Navigation window for rapid movement between portions of a world display
- (d) Rubber-band zooming.
- (e) Tool tip
- (f) Find & locate
- (g) Drag & drop

Zooming shall affect the magnification level of the data displayed. Panning shall move the viewed portion of a world map space. The size of the viewed portion of the map relative to the whole display shall be indicated by the width of the sliders in the scroll bars of the window displaying the sector. When a display is first called up in a window, it shall be automatically scaled as per default zoom level.

Both continuous and discrete panning and zooming control shall be provided. Continuous panning and zooming shall be done in a convenient and intuitive way using the mouse; and the resulting changes in the screen contents shall be “smooth” and instantaneous without any noticeable delay. Discrete panning and zooming in larger steps shall be possible by dragging the mouse, using the keyboard, and clicking on pushbuttons on toolbars.

When only a part of the display is shown in the active window, the user shall be able to request a “navigation” window for orientation. This window shall show a small replica of the complete display, with the displayed sector of the display highlighted. The user shall be able to move the navigation window anywhere on the screen, and shall be able to close it.

A decluttering mechanism that defines the visibility of a graphic construct as a function of its magnification shall be provided. As zooming changes the magnification of data displayed, the declutter mechanism shall cause levels of detail to be shown or suppressed.

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The magnification range corresponding to each declutter level shall be defined as system configuration parameter. Static and dynamic element within a display shall have associated with it a visibility designation as yes or no for each. In addition to reaching the various decluttering levels through zooming, users shall also be allowed to request a specific level from a dialog menu.

The user shall be able to scale (zoom) the image of a world co-ordinate space or display in a smooth fashion to any convenient scale factor. The scale factors shall allow the presentation of an entire world co-ordinate space or display on the full screen or a window.

Static and dynamic data shall be displayed and updated during a scaling operation, and display text shall be scalable to be consistent with the scaled image. At defined scale factors, levels of de-clutter shall be invoked.

The user shall be able to select an area of a world co-ordinate display by cursor manipulation (“rubber-banding”) and cause the display to be redrawn with the selected area centered in the display and with the selected area magnified to best fit the full window. The window dimensions shall not be changed by such an action.

A tool tip or equivalent method shall be provided for displaying information in English text & numeral upon moving cursor on the device etc.

Find & locate feature to take the user to the online/ network display where the particular component exists.

### **3.4.3 Permanent Indicators**

Several indicators, including those listed below, shall be permanently shown on each SCADA/DMS Display screen as minimum:

- Date and Time: Date shall be presented in the format DD/MM/YY. Time shall be presented in the format HH:MM:SS with a resolution of one second, and shall be updated once per second.
- Username: Name of the user logged in the SCADA/DMS
- Name of the active server
- Name of the SCADA/DMS display accessed
- Name of the display window

### **3.4.4 Default Screen Layout**

It shall be possible for each user to define a personal layout (Rooms) for the screens displayed on the screen(s) of the workstation, i.e. to define a personal default setup of the position, size, and contents of the screens.

The user’s default layout shall appear when the user logs on to a workstation. When a dispatcher takes over a new shift by logging on without the previous dispatcher logging off first, the current screen layout shall be preserved. It shall be possible to go to another room layout of the logged on user at any time.

### **3.4.5 Display Note pad**

An user shall be able to place and edit a note on bays , devices etc on any display. A symbol shall appear on the display indicating the presence of Note on that display. The content of the note shall be callable using a cursor target.

### **3.4.6 Quality Code and Tag Indication**

All displays and reports containing telemetered analog values, device status and calculated values shall have a data quality code associated with each data field. The quality code shall reflect the condition of the data on the display or report. When more than one condition applies to the data, the symbol for the highest priority condition shall be displayed.

A separate indicator shall identify the devices that have supervisory control inhibit tags. When more than one tags are present on a device, the highest priority tag shall be displayed.

## **3.5 User Interaction Techniques**

The user's interaction with the SCADA/DMS system for power system operations shall primarily be accomplished using a menu item selection technique. The first step in the interaction will be selection of the item to be operated upon. The user shall then be provided a menu of operations applicable to the selected item. The required operation alternatives include:

- (a) Supervisory control
- (b) Data entry
- (c) Device status entry
- (d) Scan inhibit/enable
- (e) Tag placement/removal
- (f) Trend.

A set of parameters shall be presented appropriate to the item type and operation to be performed. For example, selecting a device for control shall cause a menu of control actions to be presented. Selecting an analog value for trending shall cause a menu of parameters, such as range and trend rate etc., to be presented.

As appropriate for the data and function requested, a menu containing output destinations such as screen, printer, or file shall be presented. When the destination is selected by the user, the requested action shall begin. It shall not be necessary to select an execute command to complete the interaction except for supervisory control actions.

The user shall be able to end the interaction sequence at any time by selecting a cancel command. The progress of all user operations shall be monitored. If the user does not complete to a step within a multi-step operation within a pre-defined time, the process shall reset, and the user shall be informed of the reset. A partially completed action shall be reset if the user begins another non-related sequence. A programmer-adjustable time-out cancel shall also be provided.

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### 3.5.1 User Guidance

The SCADA/DMS system shall respond to all user input actions indicating whether the action was accepted, was not accepted, or is pending. For multi-step procedures, the systems shall provide feedback at each step. User guidance messages shall be English text and shall not require the use of a reference document for interpretation. User shall be guided for multiple options. The use of mnemonics is prohibited, unless the mnemonics are industry-accepted or approved by employer. Provisions are required for administrators to edit the toolbars and menus ,user guidance messages and to construct new ones through an interactive procedure and without programming.

### 3.5.2 User Help

In addition to the user guidance, general and specific context-sensitive on-line help shall be available to the SCADA/DMS user. Context sensitive means that the help information provided shall be applicable to the next step or steps in the sequence being performed. The Help menu shall present a list of topics available for reference. The topics shall refer to the SCADA/DMS user documents. The ability to scroll through the topic's explanatory text shall be supported.

The Help button in a dialog box and help key shall present the text of the user documents where use of the dialog box is explained. The user shall be able to scroll through this text. Exit from the help facility shall return the user to the same point in the sequence for which help was requested.

Context sensitive help facilities shall be provided for each application software package and operator display. The capability to easily edit or add additional help facilities in the future shall be provided.

The provided help facility shall also support:

- search mechanism
- navigation links between related topics within the help documents
- select/copy mechanism
- print facilities

### 3.5.3 Overlapping user access

The ability to queue multiple commands from different consoles shall be provided. In this regard, however, interlocks shall be provided to avoid overlapping user access to certain functions such as data entry and supervisory control as follows:

- (a) Data Entry: Although the same data entry field , device status entry or fields (in the case of full-page data entry) may appear concurrently in multiple windows at multiple consoles, data entry
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for the field or fields shall be restricted to one window at one console at a time. An attempt to initiate data entry for the field or fields from another window shall result in a user guidance message. Concurrent data entry on different areas of a world display, however, shall be allowed.

- (b) Supervisory Control: Although the same power system device, such as a circuit breaker, may appear concurrently in multiple windows at multiple consoles, control of the power system device shall be restricted to one window at a console at a time. An attempt to initiate control of the power system device from another window shall result in a user guidance message.

### **3.5.4 Function Key Usage**

Special functions shall be assigned to the 12 function keys on a standard keyboard. With extensions (e.g., Shift, Alt, Esc) this shall result in a minimum of 48 function key actions.

### **3.5.5 Trend**

Trend shall be a display of series of values of parameters on a time axis. Both graphical trend and tabular trends shall be supported. The attributes of the trend display shall be user configurable. The trend application shall be able to show trends for any measurement type from more than one source, at least from real-time, historical and forecast sources. It shall be possible to combine this data showing data for comparison using a shared timeline simultaneously comparing for example yesterday (historic) and today (historic, actual and forecast) as two curves on the same time axis. It should be possible to trend different types of parameters (P, Q, V, I, F etc.) with associated Scales on the same display. The user shall be able to select a trend rate different than the sampling rate.

#### **3.5.5.1 Graphical Trend**

The user shall be able to select and configure trending on Graphical displays enabling user for entry of the following parameters:

- (a) Data value name
  - (b) Trend header
  - (c) Trend direction (horizontal or vertical)
  - (d) Scale (unidirectional and bi-directional)
  - (e) Zero offset
  - (f) Trace number, colour & texture
  - (g) Trend data rate
  - (h) Trend start time and date (historical data only)
  - (i) Total trend duration (historical data only)
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- (j) Reference lines or shading axes ( With default to restrictive alarm limits)
- (k) Windows/chart to be used
- (l) Simultaneous trending of different parameters with associated scales.

Trending of at least four values simultaneously, on a common axis or separate axes shall be supported. All scales corresponding to the values selected shall be visible on the Trend Display simultaneously. There shall be automatic movement of data down or across the screen as new values are generated. When the number of real-time trend samples reaches the limit that can be displayed, the oldest value shall automatically be removed as the display is updated.

The magnitude & time of all the trended quantities at a particular time instant shall be displayed when the cursor is placed on the timescale on the trend display.

When historical data is selected for trending, the user shall be able to page forward and backward, or scroll by the use of a scroll bar, through a non-updating snapshot of the data within the constraints of the data stored in the historical files.

Shading between each trend value and user-definable axes shall be provided. Trend colour shall be changeable based on a comparison of the trend value against associated alarm limits.

It shall be possible to have at least data samples corresponding to 2 months on line storage for each of the trended variable. The user shall be able to print the trend without interfering with the continuing trending process.

### **3.5.5.2 Tabular Trending**

Tabular trending shall be a listing of the time-sequential values of a variable/ variables. The tabular trend shall present the data in a tabular form with one column for Date/time and additional columns for each of the trended variable. The tabular trend shall contain at least rows for samples corresponding to 2 months on line storage. Each row shall contain the values of the trended variables. It shall be possible to scroll up and down to see the rows. The sampling rate shall be individually definable for each tabular trend.

The historical tabular trends, which shall be produced from the previously stored values in trend files, it shall be possible to choose the start time, the end time, and the sampling rate independently of the sampled rate of historical data.

It shall also be possible to save trend output to an ASCII file. The file output shall be in ASCII format, with date and time information and the engineering unit value of the trended variables for each collection interval. The user shall be able to print the trend on a user-selected printer without interfering with the continuing trending process.

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## 3.6 Alarms

Alarms are conditions that require user attention. All alarms shall be presented to the user in a consistent manner. Alarm conditions shall include, but not be limited to, the following:

- (a) Telemetered or calculated value limit violations
- (b) Values returning to normal from a limit violation state
- (c) Uncommanded changes of a power system device state
- (d) SCADA/DMS application program results
- (e) Data source communication errors resulting in loss of data
- (f) SCADA/DMS system hardware or software failures.

Each alarm shall be subjected to a series of alarm processing functions. A device or value's alarmable conditions shall be assigned to an alarm category and alarm priority levels. Alarms shall also be subjected to advanced alarm processing. The results of the alarm processing shall determine the console(s) that will receive and be authorized to respond to the alarm and the associated actions with the alarm.

All alarm messages shall be recorded on auxiliary memory of SCADA/DMS system and archived in chronological order & reverse chronological order. It shall be possible to sort, display and print user selected alarm messages from any console by the user.

### 3.6.1 Alarm Categories

An alarm category provides the logical interface that connects an alarm condition to a specific Area of Responsibility (AOR) or operational jurisdiction as defined and accordingly alarm shall be reported to user. Every alarm shall be assignable to a category. Each category shall, in turn, be assignable to one or more users. A means shall be provided for changing operating shifts without reassignment of alarm categories at a console. Each log-on and log-off shall be reported as an event.

### 3.6.2 Alarm Priority levels

Each alarm shall be assigned to an alarm priority level. Up to 8 alarm priority levels shall be supported. Each alarm priority level shall be presented in separate display. For each alarm, it shall be possible for the programmer to independently configure the following actions:

- (a) Audible alarm tone type selection and its enabling/disabling
  - (b) Alarm messages to be displayed on an alarm summary
  - (c) Alarm message deleted from alarm summary when acknowledged
  - (d) Alarm message deleted from alarm summary when return-to-normal alarm occurs
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- (e) Alarm message deleted from alarm summary when return-to-normal alarm is acknowledged
- (f) Alarm message deleted by user action.

This assignment shall determine how the alarm will be presented, acknowledged, deleted, and recorded.

### **3.6.3 User Interaction for Alarms**

The User shall be able to perform the alarm interactions described below.

#### **3.6.3.1 Alarm Inhibit/Enable**

Inhibiting alarms for a value or device, including a complete RTU /FRTU/FPI or other data source, shall cause all alarm processing of that value or device to be suspended. The action shall be recorded in the event log. However, Scanning of the value or device shall continue and the database shall be updated.

#### **3.6.3.2 Alarm Acknowledgment**

An alarm shall be acknowledged by selecting an alarm acknowledge command when the item in alarm is selected on:

- (a) Any display showing the item in alarm
- (b) Any display showing the alarm message.

User shall be able to acknowledge alarm individually, by page, user selected manner. It shall be possible for the user to distinguish persistent & reset alarms under acknowledged & unacknowledged conditions. All alarms shall be stored by the system

#### **3.6.3.3 Audible alarm silencing**

User shall be able to silence alarm without acknowledgement and shall remain until the user enable the audible alarm. The silencing & enabling shall be recorded as event. The tones shall be definable on the console basis. For each console, multiple tones shall be available. Tones shall be of continuous & short duration type both. The former shall be of high priority condition & require operator intervention to stop. In case of short duration tone, it shall go off at it's own.

#### **3.6.3.4 Change Alarm Limits**

The user shall be able to change the alarm limits.. When the user selects an item to change its alarm limits, a menu showing the alarm limits currently in use and a data entry field for the revised limits shall appear. All changes to alarm limits shall be subjected to data entry error checking and recorded as events. The alarms

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shall be annunciated according to the changed alarm limits. The user shall be able to reset alarm limits to the limits set in the SCADA database. However, these shall be treated as temporary changes & if the system is re-initialised, the original limits defined in the SCADA database shall be operationised.

### **3.6.3.5 Alarm Presentation**

Alarm presentation shall be determined by the alarm's category and priority. Displays shall highlight every alarm condition using a combination of colour, intensity, inverse video, blinking and audible sound. The alarm condition highlighting shall show whether the alarm has been acknowledged. The highlighted alarm condition shall appear on all displays containing that device or value at all consoles regardless of the alarm's category.

Alarm messages shall be a single line of text describing the alarm that has occurred and the time of occurrence. The alarm message shall be English text and shall not require the use of a reference document for interpretation.

## **3.7 Events**

Events are conditions or actions that shall be recorded by the SCADA/DMS system but do not require user action. Events shall be generated under the following conditions

- (a) User initiated actions
- (b) Conditions detected by application functions that do not require immediate user notification, but should be recorded.

Events shall be recorded in the form of an event message. The event message format shall be similar to the alarm message format. The same message format shall be used for displaying and printing events. Event messages shall be displayed on an events summary.

Event messages shall be stored on auxiliary memory of SCADA/DMS system and archived in chronological order and reverse chronological order.. It shall be possible to sort, display, and print event messages from any console.

## **3.8 Hardcopy Printout**

The SCADA/DMS system shall have features to produce a print out of a display, reports, Alarms, Events etc. from a menu. Any of the available printers shall be selectable by the SCADA/DMS users from menus for taking printout.

It shall be possible to print a complete display or a selected portion of a display. The options for printing shall include at least choice for orientation, background colour, page size, colour/ black & white and print preview. Also any of the available printers shall be selectable from the print Menu.

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### **3.9 Report Generation**

The contractor shall be required to generate the Daily, Weekly, Monthly reports formats for SCADA/DMS system. The report formats shall be finalised during detailed engineering stage. The user shall be able to schedule periodic generation of reports, direct report to display, print report, and archive report using report-scheduling display. The report scheduling display shall enable entry of the following parameters, with default values provided where appropriate:

- (a) Report name
- (b) Report destination (printer or archiving device)
- (c) Time of the system should produce the report.

The user shall be able to examine and modify the contents of reports for the current period and for previous report periods using displays. Any calculation associated with the revision of data in a report shall be performed automatically after data entry has been completed.

The report review displays shall accommodate formatted report pages up to 132 characters in width and 66 lines in length and shall contain headings that correspond to the printed report headings. For reports containing more columns or rows than the display, the system shall include a means to view the entire report in a graphic format. The report view and editing displays shall function with the initially supplied reports and all future reports added by employer.

### **3.10 System Configuration Monitoring and Control**

The user shall be provided with the capability to review SCADA/DMS computer system configuration and to control the state of the configuration equipment using displays. The following operations shall be possible:

- (a) Failover of each server
- (b) Monitoring of servers, device, including workstations, RTUs, FRTUs, FPIs, status & loading of WAN LANs etc.
- (c) Monitoring of the processor resource, hard disk & LAN/WAN utilization
- (d) Control & monitor of SCADA/DMS functions

### **3.11 Dynamic Data Presentation**

It shall be possible to present any item in the database on any display. All supervisory control and data control capabilities shall be supported from any window of a world display. Device status or data values shall be displayable anywhere on the screen, excluding dedicated screen areas such as the display heading.

Only standard X Window system or Microsoft windows standard fonts shall be provided with the SCADA/DMS. All fonts supplied shall be supported on the user interface devices and all printers supplied with the system. The types of fonts to be used in a particular display shall be selected at display definition time.

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Status and data values shall be presented in the following formats as appropriate:

- (a) Numerical text that presents analogue values shall have the provision for the format definition of the text shall include the number of characters, number of decimal places, and the use of positive /negative sign or flow direction arrows, etc.
- (b) Normally the telemetered MW/Mvar values alongwith the sign/direction shall be displayed on the Single line diagram and Network diagram. However the user shall also be able to display all other telemetered and calculated/ estimated analog values (I, V, pf etc. for each phase) on the Single line diagram (SLD) and Network diagram. All the displays shall be suitably designed to view 12 telemetered and 12 estimated/calculated values simultaneously for each feeder.
- (c) Symbols, including alphanumeric text strings for an item, based upon state changes e.g., circuit breaker (OPEN/CLOSE/INVALID).
- (d) Symbols, including alphanumeric text strings for indicating the data quality flags.
- (e) Colours, textures, and blink conditions based upon state or value changes or a change of data quality, e.g., alarm limits.

### **3.12 Element Highlighting**

Element highlighting techniques shall be provided to draw the attention of Dispatcher to critical state of the system. The highlighting technique shall include change of colour, colour intensity, blinking, Character inversion, Line texture, appended symbols etc. This feature shall be used to highlight alarms, power system device and measurement status, data quality, data entry locations on a display and error conditions.

### **3.13 Display Types**

The following list describes the types of displays that are to be included in the SCADA/DMS system. The user interface shall support the capabilities of all displays as specified. The User mode, Current Time and date shall be displayed on a screen-basis, not on a display basis, and shall be always visible.

#### **3.13.1 SCADA/DMS System Display**

A display shall be provided that lists all SCADA/DMS system directory displays. The displays shall be listed in alphabetical order with suitable separation in the list to enhance readability. Each entry in the list shall have a cursor target for display selection.

#### **3.13.2 Distribution System Network Display**

A graphic overview network display of the distribution system with substations, feeders. Distribution network colour coded by voltage shall be provided. This display shall present the distribution system in a graphic format provided by employer. Telemetered and calculated data like Real and reactive power flows shall be displayed as a value with a direction arrow/positive- negative signs. Lines that have exceeded their loading limits shall be highlighted. Substations and power stations shall be depicted by symbols that reflect the presence of alarms at that substation or power station. Cursor selection of a substation/ power station symbol shall result in the associated Single line diagram display for that substation/ power station.

### 3.13.3 **Interchange Display**

The interchange display shall be provided as a schematic diagram showing power transfers among various utilities. This diagram shall show each power system as a block with actual and scheduled net interchange values outside the block. Symbolic arrows shall indicate power flow directions. The diagram shall also show schedule deviations. This display shall show the frequency values collected from all substations having tie-lines.

### 3.13.4 **Substation SLD displays Menu**

A display shall be provided that lists all substations that can be viewed via a SLD display. The name of the SLD displays shall be listed in alphabetical order, according to substation name, with suitable separation in the list to enhance readability. Each entry in the list shall have a cursor target for graphic display selection.

### 3.13.5 **Substation SLD Displays**

SLD displays shall be provided for each substation, including those for which telemetry may not be available but are required for running the DMS applications. Each display shall present telemetered, manually entered, and calculated power system data on a Single line diagram that shows substation layout in terms of its buses, switches, lines, and transformers. The feeder names in the SLD shall have linkage with remote substation end SLD, distribution network associated with that feeder. It shall be possible to move to remote-end substations SLD by selecting this feeder. The user shall be able to perform any user interaction defined by the Specification on these displays.

### 3.13.6 **Control panel displays**

As utilities are presently using conventional panels at S/S for supervision & monitoring, The control panel displays giving look -alike feeling shall be provided for operator supervise & operate .

### **3.13.7 Substation Tabular Displays**

Tabular displays shall be provided for each substation. These displays shall list the real-time values of telemetered, manually entered, and calculated data associated with the substation as well as related information such as alarm limits. The user shall be able to perform any user interaction defined by the Specification on these displays.

### **3.13.8 Alarm Summary Displays**

Displays that list or summarize all unacknowledged and acknowledged alarms shall be provided. The summary shall separate acknowledged and unacknowledged alarms. Capacity shall be provided for at least 200 alarm messages for each alarm summary type. If an alarm summary display becomes full, the oldest messages shall be automatically deleted and the newest messages shall be added. It shall be possible to perform any alarm interaction from this display. The user shall be able to select between viewing events in chronological or reverse chronological order.

### **3.13.9 Event Summary Displays**

Event summary displays shall list the most recent events and shall be organized by category for those categories assigned to a given console, as one summary display for all categories assigned to a console, or by all conditions system-wide without reference to the categories assigned to a console, as selected by the user. The user shall be able to select between viewing events in chronological or reverse chronological order.

### **3.13.10 Operating Information Summaries**

The operating information summaries defined below shall be provided. Summary items shall be listed in reverse chronological order with the most recent item shown on the first page. All summary displays, except for Tag Summary shall be information-only displays; no user interaction, other than display call up, shall be associated with them. The Tag Summary shall be interactive, i.e., the user shall be able to place or remove tags on this summary.

### **3.13.11 Manual Override Summary**

The manual override summary shall list all telemetered and calculated device status and data values for which a user has substituted a value

### **3.13.12 Off-Normal Summary**

The off-normal summary display shall list devices and values that are found to be abnormal, i.e., are not in their normal state. Telemetered, calculated, and manually entered status and data values shall be included.

### **3.13.13 Out-of-Scan Summary**

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The out-of-scan summary display shall list device status and data values that are not currently being processed by the system. If an entire telemetry source such as an RTU /FRTU /FPI is out-of-scan, the out-of-scan summary shall display the source without any of the individual device status or data values associated with the source

#### **3.13.14 Alarm Inhibit Summary**

This display shall list devices and data values for which the user has suspended alarm processing.

#### **3.13.15 Tag Summary**

This display shall list and describe all active device tags.

#### **3.13.16 Graphical Trending Summary Displays**

The summary display shall list all items being trended. The list shall include the item name, trace number or colour, trend orientation, and trend range.

#### **3.13.17 Tabular Trending Summary Displays**

The summary display shall list all items being recorded for tabular trends. The list shall include the item name and the file name.

#### **3.13.18 Notes Display**

This display shall include a minimum of 5 pages on which a user at any console may enter and edit messages. The contents of these pages shall be accessible by any console. The user shall have the ability to clear any page of this display and to type over previous messages.

#### **3.13.19 Computer system Configuration and Monitoring Displays**

Graphic and tabular displays shall be provided that allow the user to:

- (a) Monitor and revise the configuration of the computer system
- (b) Monitor the system's resource utilization statistics

#### **3.13.20 RTU/ FRTU/FPI Communication Channel Monitoring and Control Display**

This display shall show information on the status of the system's communication interface devices (including communication channels), the accessibility of each RTU/FRTU/FPI in a graphical form. The user shall be able to Enable/Disable any communication channel from this display.

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### **3.13.21 SCADA/DMS Application Program Displays**

Application program displays shall be provided to satisfy the user interface requirements of the system functions stated throughout this Specification. Application program displays shall be based on a standard user interface design across all applications to provide a common look and feel. The application's information shall be presented in such a way as to facilitate user operations.

The required displays for all DMS Applications, as defined in Chapter 2 shall also be made available to the user.

### **3.13.22 GIS integration**

The SCADA/DMS dynamic distribution network with GIS land base at the back ground shall be available for navigation. Operator shall be able to perform all functions & have features as envisaged in the specification . Suitable GIS adaptor shall be provided to import the distribution network model & GIS information from GIS system. Refer other GIS details as mentioned in chapter 1 &2 of this section.

### **3.13.23 Help Displays**

Help displays shall be provided to aid the user in interpreting displayed information and to guide the user through a data entry or control procedure. Help displays shall be provided for each display that is provided with the system. Each display shall have a prominent cursor target that the user can select to request the associated help display. For standard displays, software aids (such as context sensitivity) shall be used to present pertinent help information in an expeditious manner. A programmer shall be allowed to modify and create help displays.