

ANNEXURE 1

1. General:

The specification covers the supply of Human Machine Interface (HMI) software along with the valid licenses for IEC61850 based Substation Automation System (SAS).

2. Technical specifications:

Sl No	Specifications
1	The proposed HMI software is intended for usage in IEC 61850 based SAS projects. The SAS HMI software shall have the following modules as a minimum requirement: Main server: To perform data processing functionalities. Communication front end: Data acquisition functionalities on various protocols as listed out elsewhere in the document. Man Machine Interface (MMI) & Runtime module: Graphical user interface to present the process data in MMI screens, historical and online trend, alarms & events. Historical data server: To store the processed data. Gateway: To send data to upper level SCADA, Remote control center and other third party systems. The protocols to be supported is given elsewhere in the document.
2	The HMI software along with all of its module shall be compatible to install and run on windows 7 OS, windows 10 IOT OS, windows 2012R server OS. Dongle or Soft key based license shall be possible for HMI software modules.
3	The HMI software shall be capable of the following minimum functions: a) Status Supervision - Monitoring of position (Open/ Close/ Intermediate/ Faulty) of Circuit Breaker, Isolators and Earth Switches shall be possible. - Monitoring of Transformer tap changer position shall be possible - Every detected change of position shall be immediately displayed in the single line diagram of on the MMI screen and shall be possible to be record in the event list - Alarm shall be initiated if the position of equipment is inconsistent or if the time required for operating mechanism to change positions exceeds a predefined limit. b) Measurements - Analog values acquired shall be displayed on the MMI screen - Analog values refresh/update rate shall be less than one second - Threshold limit values shall be selectable for alarm indications Monitoring of graphical trends of various parameters c) Events Handling - The events shall be stored with 1 msec time stamp resolution. - It shall be possible to call up chronological event list on the MMI screen at any time.

	Event list shall be grouped or filtered as per Date and time, Bay, Device, Functions and Event severity
	d) Alarm Handling - Faults and errors occurring in substation shall be listed in an alarm list - The alarm list shall substitute a conventional alarm tableau, and shall constitute an evaluation of all station alarms. It shall contain unacknowledged alarms and persisting faults. The date and time of occurrence shall be indicated. - Each alarm shall be reported on one line that contains Date and time of alarm, Naming of the alarm object, descriptive text, acknowledgement state - Whenever alarm condition occurs, the alarm condition must be shown on the alarm list and must be displayed in the flashing state along with an audible alarm. - After acknowledgement of alarm, it should appear in a steady state and audible alarm shall stop. - The alarm should disappear only if the alarm condition has physically cleared and the operator has reset the alarm with the alarm command. - Alarm list shall be grouped or filtered as per Date and time, Bay, Device, Functions, Alarm group, Alarm severity and acknowledgement state.
	e) Trending - Dynamic configuration of Trend Viewer looks and feel in design and run modes, with optional locking - Simultaneous display of real time and historical data - Zoom in and zoom out in time axis or both time and value axes - Cursor for reading selected values - Multiple dynamic and scrolling scales - Dynamic addition, deletion and substitution of variables by operator at run time - Printing of displayed trends on graphical printers
	f) Data archiving of Historical data - It shall be possible to evacuate/archive the historical data in open database format like SQL/RDBMS etc., - It shall be possible to take back up of historical data to a mass storage for future use.
	g) Reports - It shall be possible to create flexible and customized reports with advanced data visualization including tables and charts. - The reports shall be fully user-designed and include parameterization capabilities enabling operator to specify report output according to simple input parameters such as values, dates or identifiers. - Several output formats like Excel or PDF shall be possible.

	• The reports shall provide time-related follow-ups of measured and calculated values. The data displayed shall comprise: Trend Reports: ○ Day (Mean, Peak) ○ Month (Mean, Peak) ○ Semi-annual (Mean, Peak) ○ Year (Mean, Peak) Historical Reports of selected Analogue Values: ○ Day (at 15 minutes interval) ○ Week ○ Month ○ Year • It shall be possible to select displayed values from the database in the process display, on-line. Scrolling between e.g. days shall be possible. Unsure values shall be indicated. It shall be possible to select the time period for which the specified data are kept in the memory. • Following printouts shall be printed on demand: ○ Daily voltage and frequency curves depicting time on X-axis and the appropriate parameters on the Y-axis. The time duration of the curve is 24 hours ○ Weekly trend curves for real and derived values ○ Printouts of the maximum and minimum values and frequency of occurrence and duration of maximum and minimum values for each analogue parameter for each circuit in 24 hrs. period ○ Provision shall be made for logging information about breaker status like number of operation with date and time indications ○ Equipment operation details shift wise and during 24 hours ○ Printout on adjustable time period as well as on demand for MW, MVAR, Current, Voltage on each feeder and transformer as well as Tap Positions, temperature and status of pumps and fans for transformers ○ Printout on adjustable time period as well as on demand system frequency, average frequency and MWH & VARH for each 15 minute time interval.
	h) Switchgear Interlocking: • The interlocking functions shall grant permission to operate apparatuses such as disconnectors and earthing switches. • The interlocking functions shall also ensure fail-safe switching. • It shall be possible to create interlocks for any control operation through user friendly GUI. • It shall be possible to view the interlock conditions along with the satisfying criteria in a user friendly graphic page or pop-up for any control operation.
	i) Control operation The control operation must handle • Select Before operate with two step command (select and confirm) shall be possible for control operation. • Selection of equipment and type of command for control operation (opening or closing)

	• It shall be possible to restrict the control operation with user access level. • Execution or cancellation of command • Execution of the command when the conditions of interlocks, synchro-check or other conditions are met • Capability of overriding of interlocks and execution of the automatic switching sequences • Tap changer control (YLTC) shall be possible • In case of failure of command execution, the reason for failure shall be displayed j) Synchro-check operation • The phasing function is to be carried out when two asynchronous systems are going to be connected, so that stress is avoided on the network and its components. The phasing function shall compensate for measured slip frequency as well as circuit breaker closing times. • For the control of the synchro-check function, on the following information to be displayed in SCADA: ○ The six measured magnitudes voltage, phase and frequency at both sides (V_1, φ_1, f_1, V_2, φ_2, f_2) and the corresponding differences (ΔV, $\Delta \varphi$, Δf), related to the permissible synchro-check limits. ○ The voltage comparison figure (from the above mentioned four) applied ○ In case of synchro-check operation failure, the reasons of failure (out of range voltage or/and angle or/and frequency). ○ Notification message “closing command of the circuit breaker” in case of successful synchro-check function k) Communication front end for data acquisition The HMI software shall be able to acquire data from the field devices or other third party systems on the following protocols • IEC 61850 client • Modbus RTU Master • Modbus TCP client • IEC 60870-5-104 Client/Master • SNMP Client l) Remote control center communication Gateway • The HMI software shall be able to communicate with control center through gateway on IEC 60870-5-101 and IEC 60870-5-104 protocols both as Master/Client and Slave/server. • The HMI software shall simultaneously respond to independent scans and commands from different control centers. • It shall possible to transmit the SOE/Alarms of SAS to control center with source (IED) time stamp. • It shall support and meet the telemetry interoperability requirement of Load dispatch centers in India.
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3. SCOPE OF SUPPLY:

The HMI software with latest valid licenses for minimum of **1500 tags** confirming to the Technical specifications (clause no.2) mentioned elsewhere in this document with the following scope of supply.

Sl No	Description	Unit	Quantity
1	HMI software license for Server cum historian cum gateway • Main server • Communication front end as per Sl. no 3k of Technical specifications • Historical data server • Evacuation to SQL/RDBMS • MMI Runtime • Report Viewer • Remote control center gateway as per Sl. no 3l of Technical specifications	No	1