CHAPTER-1: INTRODUCTION & GENERAL INFORMATION

1.0 Introduction:-

As per Government of India's commitment for providing 24x7 uninterrupted, quality, reliable and affordable power supply, that the Revamped Reforms Based and Results Linked Distribution Sector Scheme has been formulated by Ministry of Power for supporting DISCOMs to undertake reforms and improve performance in a time bound manner.

The Revamped Reforms-based and Results-linked, Distribution Sector Scheme seeks to improve the operational efficiencies and financial sustainability, by providing conditional financial assistance to DISCOMs for strengthening of supply infrastructure based on meeting pre-qualifying criteria and achieving basic minimum benchmarks.

The Revamped Distribution Sector Scheme has the following parts:

Part A - Metering & Distribution Infrastructure Works: Facilitating in installing smart prepaid meters for all consumers, communicable meters integrated with AMR for all DTs & Feeders and a unified billing and collection system; Feeder Segregation, aerial bunched cables, SCADA and distribution management system (DMS) in urban areas and regular distribution infrastructure creation and strengthening works in all areas.

Part B - Training & Capacity Building and other Enabling & Supporting Activities: Supporting and enabling components, such as Nodal Agency fee, enabling components of MoP (communication plan, consumer awareness and other associated measures such as third-party evaluation etc), up-gradation of Smart Grid Knowledge Centre, training and capacity building, awards and recognitions etc.

1.1 Objectives

The objectives of the scheme are to:

- Improve the quality, reliability and affordability of power supply to consumers through a financially sustainable and operationally efficient distribution sector;
- Reduce the AT&C losses to pan-India levels of 12-15% by 2024-25;
- Reduce ACS-ARR gap to zero by 2024-25.

The state-wise targets will depend on their current levels of AT&C losses and ACS-ARR gap.

1.2 Parts of the Scheme

The Scheme has the following parts -

- **Part A**
  - Component I: Metering
  - Component II: Distribution Infrastructure Works
  - Component III: Project Management
- **Part B:** Training, Capacity Building and other Enabling & Supporting Activities.

1.2.1 Eligible Works and Activities under Part A – Metering

- Facilitating in installing prepaid smart meters for all consumers along with associated AMI, communicable meters for DTs & Feeders, ICT including Artificial Intelligence (AI), Machine Learning (ML), etc. based solutions for power Sector and a unified billing and collection system;

- Distribution infrastructure works as required for strengthening and modernizing the system as well as measures for loss reduction. The infrastructure strengthening works will include separation of Agriculture feeders to enable implementation of the KUSUM scheme, Aerial Bunch cables and HVDS for loss reduction, replacement of HT/LT lines as required, construction of new/ up-gradation of substations, SCADA and DMS system etc. Each DISCOM/ State will draw up the scheme according to its requirement with the end objective of reducing losses and ensuring 24 x 7 supply.

1.2.2 Eligible Works and Activities under Part A- Distribution Infrastructure Works

Under this component, DISCOM can take up works related to loss reduction and system strengthening. 33kv level and below will be eligible under this component. In areas, were 33kv system does not exist, 110 kV/ 66kV shall be permitted. A list of indicative works is given below:

i. Construction of new substations, augmentation of substations
ii. Provision of Armoured / Aerial bunched Cables (ABC) or High Voltage Distribution System in high loss areas.
iii. Segregation / Bifurcation of feeders and other allied works
iv. Replacement of conductors, which are old/frayed
v. Additional HT lines to improve quality of supply
vi. IT/OT works
vii. Supervisory Control and Data Acquisition (SCADA) and Distribution Management System (DMS) in urban areas
    - SCADA/DMS in 100 towns (approx.) with eligibility of towns having population > =1 Lacs in special category states and towns having population > = 2.75 Lacs in other states as per Census 2011 data, as well as all Capital/DISCOM HQ towns, if not covered earlier.
    - Basic SCADA in 3875 towns approx. based on district-wise or Circle-wise common control centers in all other statutory towns
viii. Works like new feeders, capacitors etc. for loss reduction
ix. Under-ground cabling works
x. Any other works required for system strengthening and loss reduction

Segregation of feeders dedicated only for supply of power for agricultural purpose, which are proposed to be solarized under Kisan Urja Suraksha Evam Utthan Mahabhiyan (KUSUM) scheme will be sanctioned on priority under the scheme. Further, agricultural feeders once segregated will not be used for serving other non-agricultural consumers.

1.2.3 Eligible entities for Part A

All State-owned Distribution companies and State /UT Power Departments (referred to as DISCOMs collectively) excluding private Sector power companies will be eligible for financial assistance under the revamped scheme. The State transmission utilities which own and operate network at 110 kV and 66 kV levels in areas where 33 kV system does not exist shall also be eligible (for this purpose, all eligibility, and other relevant parameters of respective DISCOMs shall be evaluated) Further, funds release and any coordination shall be through DISCOM only, for such works to be executed in the specific manner by the transmission utility).

The scheme would be optional to DISCOMs and will be implemented in urban and rural areas of all States/UTs except private DISCOMs.

1.2.4 Eligible Works and Activities under Part B -

Part B encompasses work related to Training, Capacity Building and other Enabling & Supporting Activities

1.3 SCADA /DMS system

The objective of reducing Aggregate Technical and Commercial (AT&C) losses in the project area can be achieved by plugging pilferage points & reliability by improvement in supply of quality power, faster identification of faults & early restoration of power, proper metering, strategic placement of capacitor banks & switches, proper planning and design of distribution network. Bidder /Contractor responsible to implementation of the system shall be SIA (SCADA Implementation Agency)

1.3.1 Groups of SCADA system eligibility criteria's & components

1.3.1.1 Group-A: SCADA /DMS system in towns

1.3.1.1.1 Eligibility

The real time monitoring & control of the distribution system through state-of-the art SCADA/DMS system encompassing all distribution Sub-stations & secondary network emanating from S/S shall be implemented to achieve objective of this scheme. SCADA/DMS system for Towns with following criteria shall be eligible

Non special category states

- **Town population > = 2.75 Lacs (as per 2011 Census data) in non-special category states and Capital /Discom/PD HQ towns**

Special category states

- **Town population > =1 Lacs (as per 2011 Census data) in special category states and Capital /Discom HQ towns**

Further, works in existing SCADA /DMS towns due to outgrowth /suburb and differential area/electrical network (newly added S/S, Feeders) or functions such as OMS, FPI , additional RTU/ FRTU w.r.t RAPDRP or legacy SCADA/RT-DAS (For new locations or locations where faulty equipment or equipment with end of life) may be considered as up-gradation of the system as **Group U towns.**

Further, where RTDAS under IPDS is commissioned, the existing FRTU shall act as Sub RTU to new RTU and report all Input points captured to new RTU and I/O card for differential points may only be considered in configuration of new RTU in order maximize usage of infrastructure created under RT-DAS.

In case of numerical relays, RTU at substations to act as gateway , data concentrator for numerical relays/ BCPUs connected over IEC 61850 and I/O Cards in RTUs to be configured accordingly i.e. for bays where requisite I/Os are not served through numerical relays/ BCPUs.

1.3.1.1.2 Components of Group- A towns

Major components that a SCADA /DMS implementation would include are given as under. However, the final scope of work will be finalized by the utilities as per their requirements in

the relevant RFP document. Survey, Supply, Design, Engineering, Installation, Testing, Commissioning, Go-Live & service based (SLA) for utility for:

a. SCADA/DMS Control Centre (SDCC) at each Group-A town
b. Common Disaster Recovery Centre for SCADA/DMS for group-A towns per utility or town as per requirement and availability of infrastructure (Building etc.) by utility (CDRC)
c. SCADA & Information Storage & Retrieval (ISR) Functions
d. Load Shed application (LSA)
e. Outage data analytics and reporting (ODAR)
f. DMS Functions
    i. Network Connectivity Analysis (NCA)
    ii. State Estimator (SE)
    iii. Load Flow (LF)
    iv. Voltage VAR Control (VVC)
    v. Fault Management and System Restoration (FMSR)
    vi. Feeder Reconfiguration, Loss Minimization, Load Balancing, LMFR,LBFR)
    vii. Operation Monitor (OM)
g. OMS Functions
    i. Trouble call & Outage Management System (TCOMS)
    ii. Crew assignment & Work Order Management (CAWOM)
    iii. Mobile APP, Web client for Crew (MAWC)

h. SCADA/DMS/ Dispatcher training simulator (DTS) for each town
i. SCADA/DMS system to supervise & control primary S/S & secondary HV Distribution network
j. RTUs at all primary S/S & FRTUs at RMUs, /Auto Reclosers/Sectionalizers, FPI communicable on secondary HV Distribution network etc. MFTs at Feeders
k. Ring Main Units (RMUs) suitable for multi-feed systems for proposed loads
l. Sectionalizers for sectioning the circuit
m. Auto reclosers at proposed feeder heads
n. Fault passage Indicators (Communicable) for fault reporting
o. Secured Communication using VPN/SSL
    i. MPLS network for connecting all S/S RTUs to Main & DR center
    ii. Secured GPRS/MPLS-4G/DLC etc. for communicating of FRTUs /FPIs with controlcenters
p. Protocols for communication

i. IEC 60870-5-104 –RTU, IEC 60870-5-104/101 for FRTUs, FPI to control centers.

ii. MODBUS or IEC 60870-5-101/104 – MFTs to RTUs/FRTUs

iii. ICCP (TASE.2) between SCADA/DMS Control center /DR center & state load dispatch center(optional)

iv. Support /compliance to IEC61850 ,IEC60870-5 suite for RTU/CC for numerical relays

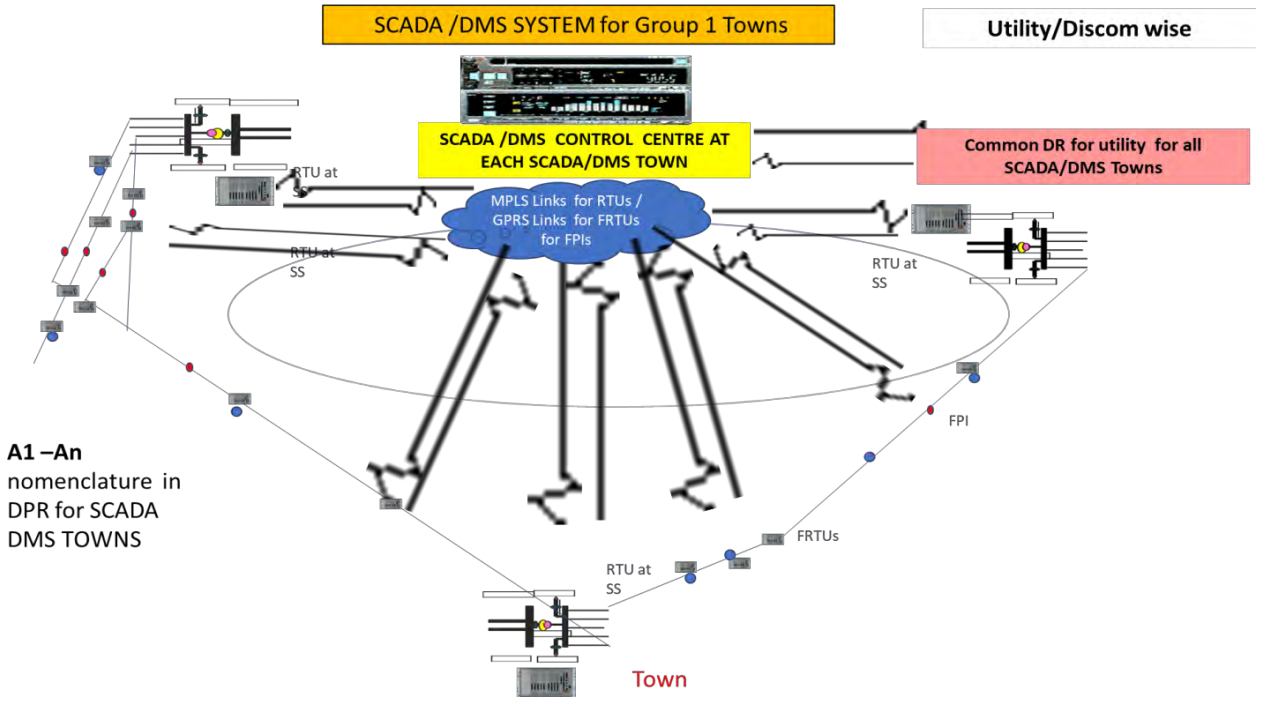
q. Support /compliance to DLMS/ IEC 62056 for SMART meters

r. Cyber security compliance from CERT.IN empanelled agencies and any other notified MoP/Nodal agency /CEA from time to time.

s. Machine to Machine requisite data transfer of reliability to National Power Portal or any other portal as directed by MoP /PFC / CEA in the desired format such as JSON Object, XML , CSV etc.

t. Conducting Factory Acceptance Test (FAT), Site Acceptance Test (SAT), Type test (as required), etc. successfully, Go live, operational acceptance & handing over to customer.

u. Service based (SLA) support for utility post enterprise Go-Live to utility



Ref Fig 1.1

FIG - SCADA DMS CONTROL CENTRE (SDCC) FOR EACH SCADA/DMS TOWN (GROUP A)

1.3.1.2 Group-B : SCADA system in towns

1.3.1.2.1 Eligibility

The real time monitoring & control of the distribution system through state-of-the art SCADA system encompassing all distribution Sub-stations & FPIs at secondary network emanating

from S/S shall be implemented to achieve objective of this scheme. SCADA system for Towns with following criteria shall be eligible

SCADA in towns based on Common district-wise or Circle-wise or Zone wise common control centers in all other statutory towns (2011 census) with population 25000 or more.

1.3.1.2.2 Components of Group- B towns

Major components that a SCADA implementation would include are given as under. However, the final scope of work will be finalized by the utilities as per their requirements in the relevant RFP document. Survey, Supply, Design, Engineering, Installation, Testing, Commissioning, Go-Live & service based (SLA) utility for:

- Common District/ Circle /Zone - wise, Standard SCADA Control Centre (SSCC) for all eligible in the district. (A district control center can be clubbed in to Zonal SCADA control centers (ZSCC) adjoining districts if present count of aggregated O/G Feeders is up to 400 feeders. This includes monitoring of Substations of Group C also). Further, for Ladakh, Manipur, Mizoram, Nagaland, Meghalaya, Sikkim, Arunachal Pradesh, Tripura, Andaman, Puducherry, DNH&DD, Goa, Lakshadweep etc. may have common ZSCC in each state for all towns for SCADA besides SDCC for capital town. This is a guideline to create appropriate architecture. However, utilities of other states can decide to club / co-locate ZSCC with SDCC as per the ease in monitoring /control of electrical network / optimize control centers requirements based on availability of building infra for control centers as per sanction
- Common Data Recovery Centre for SCADA for group-B towns per utility
- SCADA & Information Storage & Retrieval (ISR) Functions
- Network Connectivity Analysis (NCA)
- State Estimator (SE)
- Load Flow (LF)
- Load Shed Application(LSA)
- Outage data analytics and reporting (ODAR)
- SCADA Dispatcher training simulator (DTS) per Control center
- SCADA system to supervise& control primary S/S & monitor FPIs at secondary HV Distribution network
- RTUs at all primary S/S &, FPI communicable on secondary HV Distribution network etc. MFTs at Feeders
- Fault passage Indicators (Communicable/ Non Communicable) for fault reporting
- Secured Communication using VPN/SSL
    - MPLS network for connecting all S/S RTUs to Main & DR center
    - Secured GPRS/MPLS-4G/DLC etc. for communicating of FPIs with control centers
    - Protocols for communication
        - IEC 60870-5-104 –RTU, IEC 60870-5-104/101 for FRTUs, FPI to control centers.
        - MODBUS or IEC 60870-5-101/104 – MFTs to RTUs

- ICCP (TASE.2) between SCADA/DMS Control center /DR center & state load dispatch center(optional)
- Support /compliance to IEC61850 ,IEC60870-5 suite for RTU/CC for numerical relays

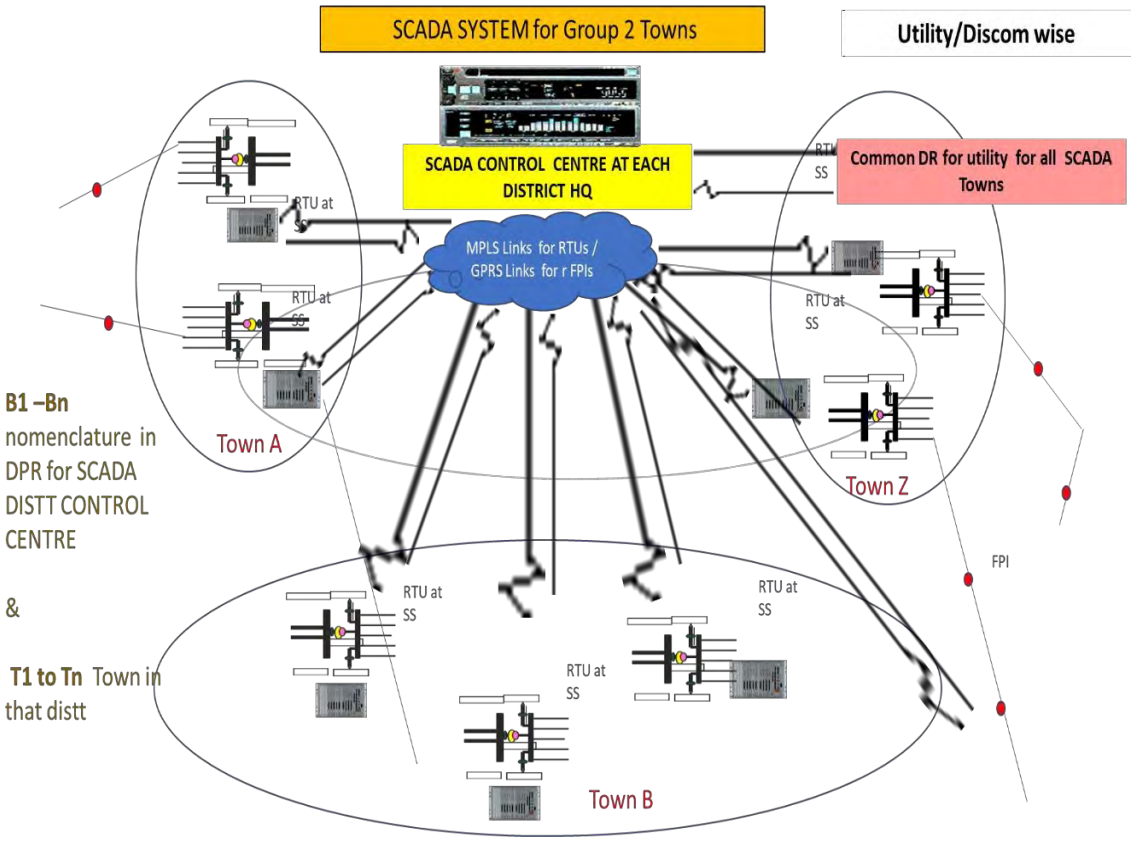


FIG – STANDARD SCADA CONTROL CENTRE (SSCC) FOR DISTT OR ZONAL SCADA CONTROL CENTRE (ZSCC EACH SCADA AND RT-DAS TOWNS (GROUP B &C)

Ref. Fig 1.2

- Support /compliance to DLMS/ IEC 62056 for SMART meters
- Cyber security compliance from CERT.IN empanelled agencies and any other notified MoP/Nodal agency /CEA from time to time.
- Machine to Machine requisite data transfer of reliability to National Power Portal or any other portal as directed by MoP /PFC / CEA in the desired format such as JSON Object, XML, and CSV etc.

- Conducting Factory Acceptance Test (FAT), Site Acceptance Test (SAT), Type test (as required), etc. successfully, Go live, operational acceptance & handing over to customer.
- Service based (SLA) support during FMS for utility post Operational acceptance (S.A.T)
- Further , where RTDAS under IPDS is commissioned , existing FRTU shall act as

Sub RTU to new RTU and report all Input points captured to new RTU and I/O card for differential points may only be considered in configuration of new RTU in order maximize usage of infrastructure created under RT-DAS

- In case of numerical relays, RTU at substations to act as gateway , data concentrator for numerical relays/ BCPUs connected over IEC 61850 and I/O Cards in RTUs to be configured accordingly i.e. for bays where requisite I/Os are not served through numerical relays/ BCPUs

1.3.1.3 Group-C : RT-DAS system in towns

1.3.1.3.1 Eligibility

The real time monitoring of the distribution system through state-of-the a RT-DAS system encompassing all distribution Sub-stations & FPIs at secondary network emanating from S/S shall be implemented to achieve objective of this scheme. SCADA system for Towns with following criteria shall be eligible

RT-DAS in towns based on Common district-wise or Circle-wise or Zone wise common control centers of Group B in all other statutory towns (2011 census) with population less than 25000. However, based on the requirement, utility may opt basic SCADA

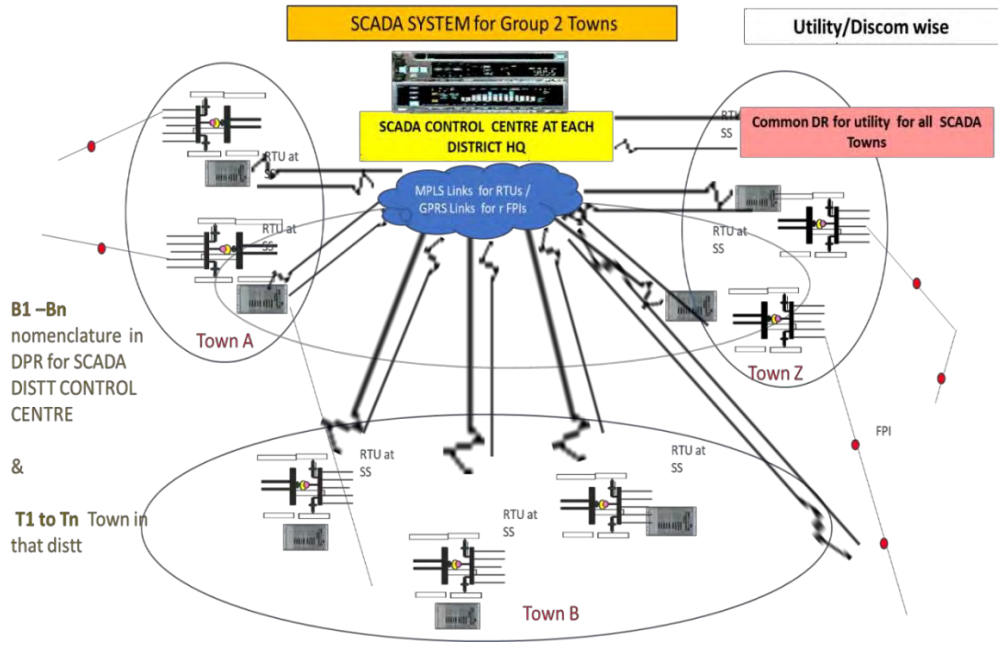
1.3.1.3.2 Components of Group- C towns

Major components that a RT-DAS implementation would include are given as under. However, the final scope of work will be finalized by the utilities as per their requirements in the relevant RFP document. Survey, Supply, Design, Engineering, Installation, Testing, Commissioning, Go-Live & service based (SLA) for utility for:

- Common District/ Circle /Zone - wise, Standard SCADA Control Centre (SSCC) for all eligible in the district. (A district control center can be clubbed Zonal SCADA control centers (ZSCC) adjoining districts if present count of aggregated O/G Feeders is up to 400 feeders. This includes monitoring of Substations of Group C also. Further, for Ladakh, Manipur, Mizoram, Nagaland, Meghalaya, Sikkim, Arunachal Pradesh, Tripura, Andaman, Puducherry, DNH&DD, Goa, Lakshadweep shall have common ZSCC in each state for all towns for SCADA besides SDCC for capital town.
- Real time Data Acquisition & Information Storage & Retrieval (ISR) Functions
- Network Connectivity Analysis (NCA)
- State Estimator (SE)
- Load Flow (LF)
- Outage data analytics and reporting (ODAR)
- RT-DAS system to supervise primary S/S & monitor FPIs at secondary HV Distribution network
- RTUs at all primary S/S &, FPI communicable on secondary HV Distribution network etc. MFTs at Feeders
- Fault passage Indicators (Communicable/ Non Communicable) for fault reporting
- Secured Communication using VPN/SSL
  - MPLS network for connecting all S/S RTUs to Main & DR center.

- Secured GPRS/MPLS-4G/DLC etc. for communicating of FPIs with control centers.

- Protocols for communication
  - IEC 60870-5-104 –RTU, IEC 60870-5-104/101 for FRTUs, FPI to control centers.
  - MODBUS or IEC 60870-5-101/104 – MFTs to RTUs
  - ICCP (TASE.2) between SCADA/DMS Control center /DR center & state load dispatch center(optional)
  - Support /compliance to IEC61850 ,IEC60870-5 suite for RTU/CC for numerical relays



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RT-DAS FOR GROUP C TOWNS

- Support /compliance to DLMS/ IEC 62056 for SMART meters
- Cyber security compliance from CERT.IN empanelled agencies and any other notified MoP/Nodal agency /CEA from time to time.

- Machine to Machine requisite data transfer of reliability to National Power Portal or any other portal as directed by MoP /PFC / CEA in the desired format such as JSON Object, XML , CSV etc.
- Conducting Factory Acceptance Test (FAT), Site Acceptance Test (SAT), Type test (as required), etc. successfully, Go live, operational acceptance & handing over to the customer.

- Service based (SLA) support during FMS for utility post Operational acceptance (S.A.T)

1.3.2 Make in India

Keeping in view the aims and objectives of Atma Nirbhar Bharat Abhiyan, Ministry of Power has issued Public Procurement (Preference to Make in India) for Purchase Preference (linked with local content) Order in respect of Power Sector on 28.7.2020. This order is in line with the DPIIT Notification No.P-45021/2/2017-PP (BE-II) dated 4th June, 2020. This order along-with amendments, if any, from time to time, shall be followed by the DISCOMs and bidder inthe implementation of the scheme.

1.3.3 Broad Role Definition for SIA

The SIA in coordination with utility (as per the requirement to be given in the detailed RFP and group A , B , C, U towns) shall carry out field survey, design ,engineering, supply, installation, testing & commissioning of SCADA/DMS software applications, Dispatcher Training Simulator (DTS) , hardware (including PCs, Servers, Routers, Switches, VPS, RTU, FRTUs, Multi-function Transducers (MFTs), Communication equipment , Auxiliary power supply etc.), software (including operating system, databases, network management system etc.), network (LAN,WAN), RMUs, Sectionalizers, A/R , FPIs etc.

Integration with existing /under implementation IT system under IPDS & any other relevant SCADA/ DMS or RT-DAS legacy/ Numerical relay in the identified project areas of the utility in the RFP

Data of outage /SAIDI/SAIFI to be transported in machine to machine mode to National Power portal or any other GoI portal as notified in future.

Integration with State Load Dispatch center (SLDC) for the state for exchanging relevant real time data & scheduling data over ICCP if opted by utility. In case utility includes data exchange facility with SLDC, then it is their responsibility to do necessary bilateral agreement for data exchange with TRANSCO or owner of SLDC. & facilitate necessary help to SIA

Facilities management services for maintaining infrastructure as per SLA , post successful completion of acceptance tests for a period of seven years from the date of completion of acceptance test.

The key components of the model RFP includes & not limited to following:

1) **Hardware:** site survey, planning, assembly/ manufacturing, design & Engineering, Supply, loading, transportation, unloading, insurance, delivery at site, handling, storage, installation, testing, commissioning and documentation of all necessary hardware and networking equipment and its connectivity, as specified in the detailed specifications. The SIA shall take the responsibility to install the servers, RTU/FRTU, MFTs, Video Projection System (VPS) switches, routers, backup and tape devices, Workstation PCs, Aux Power supply, communication equipment, RMUs, Sectionalizers, A/R, FPIs etc. and other necessary hardware/software at the sites. The SIA shall provide the time frame for procuring and delivering all the necessary hardware. Though the scope covers establishment of a SCADA/DMS control center along with associated hardware and software, the SIA shall design and provide the Software & hardware at SCADA/DMS control center including RTU/FRTU locations with 100% expandability for future growth in electrical distribution network of the city. The delivered hardware (Processor ,HDD, RAM &software etc.) for servers, PCs ,RTU, FRTU etc. shall be sized for ultimate system sizing while maintaining the performance, availability & functions as per specification.. However, other items such as I/O modules,

additional workstation can be added as per the growth in the network The SIA shall provide the necessary design & engineering documents, drawings and plan, sizing, cabling and connectivity and the bill of material, etc. & obtain approval from utility

2) **Software**: Site survey, planning, assembly/ manufacturing, design & Engineering, Supply, loading, transportation, unloading, insurance, delivery at site, handling, storage, installation, testing, commissioning and documentation of operating systems at servers/desktops, database and SCADA/DMS,OMS, RTDAS application software, etc.

3) **Facilities management services (FMS)** for maintaining infrastructure, activities for creation/ modification /deletion of database / display, reports , GIS data maintenance and activities related to additional RTU/FRTU/ and enablers etc. procured by utility to cater growth of electrical distribution network . During the FMS period any creation modification/addition/deletion of database incl. GIS , RTU/FRTU/displays/ reports, limits setting etc. shall be ensured in line with change/ growth of electrical network in form of new RTU/FRTU/ RMU/Sectionalizers/ FPIs , numerical replays etc. provided by utility. The activities shall be ensured for atleast post successful completion of acceptance tests for a period of seven years from the date of completion of operational acceptance of the SCADA/DMS System. However, under RDSS scheme, utilities will be funded & awarded for FMS for two years from the date of Go-Live / S.A.T only but bids will be evaluated considering 5 years of FMS

The Contractor shall be required to provide the services under FMS so as to manage entire system including all equipment, installations including hardware, software & networks installed & commissioned by Contractor for the utility in order that they meet the availability requirement as specified in the document.

The System Management Services shall be provided by SIA as FMS Contractor inorder that maximum uptime & performance levels of systems installed are ensured. As such, FMS Contractor is expected to provide services as per ITIL (IT Infrastructure Library) standards with performance levels meeting or exceeding those mentioned in Service Level Agreement (SLA) agreed between utility & Contractor.

To achieve the desired Service Levels, the Contractor may need to interact, coordinate and collaborate with the other Service Providers as required. The Contractor will act as the Single Point of Contact for all issues relating to the Service Levels. The Contractor will have the responsibility to deal with the other vendors (during warranty period) /other vendors as selected by utility (after warranty period) as the case maybe, to provide the services at agreed service levels. However, the prime responsibility of providing desired services shall be that of lead Contractor during warranty period. The role of SIA as FMS Contractor (shall start immediately after systems are installed, commissioned and handed over to the owner after Operational acceptance (S.A.T) of the System.

The Scope of Work shall include the software and hardware maintenance support to be provided by the Contractor in respect of the system supplied including interim audit in case of major change and regular annual Cyber security audit by CERT.IN empaneled agency or any agencies notified by MoP/GoI /Nodal agency under this project during 5 year Facility Management Services (FMS) period along with Supervision & Operationalizing 5 year warranty of the SCADA,DMS,OMS, RTDAS System and communication network after the Operational Acceptance of the same.

4) **System Design and Engineering:** The SIA shall be responsible for detailed design and engineering of overall system, sub-systems, elements, system facilities, equipment, services, including systems application software and hardware etc. It shall include proper definition and execution of all interfaces with systems, equipment, material and services of utility for proper and correct design, performance and operation of the project.

SIA shall provide complete engineering data, drawings, reports, manuals and services offered etc. i.e. complete set of documentation /drawings for Utilities review, approval and records

5) **Supply of Equipment and Material:** The SIA shall also be responsible for manufacture, inspection at manufacturer's works, supply, transportation, insurance, delivery at site, unloading, storage, complete supervision, installation and successful commissioning of all the equipment, systems and application software. The proposed deliverables should be state of the art in architecture and engineering practices In case of third party products/software packages, SIA should furnish at least 5 years warranty along with supporting plan from respective OEMs to support FMS time line

Any item though not specifically mentioned, but is required to complete the project works in all respects for its safe, reliable, efficient and trouble free operation & to meet performance ,availability & functional requirements as envisaged in the RFP shall also be taken to be included, and the same shall be supplied and installed by the SIA without any extra cost

6) **Testing and Commissioning**: The SIA shall be responsible for the testing processes such as planning (includes preparing test plans and defining roles and their responsibilities), preparation (consists of preparing test specification, test environment and test data) for all tests viz. Type tests, FAT, SAT and successful commissioning. During the FMS period any modification/addition/deletion of database/displays/ reports etc. shall be ensured in line with growth of electrical network in form of new like RTU/FRTU/ RMU/Sectionalizers / FPIs provided by utility. SIA shall also be responsible for successful conduction of cyber security audit by CERT.IN empaneled agency.

7) **Geographical Scope:** The Locations where the systems shall be implemented shall be detailed by the particular utility in the RFP

8) **Integration Scope:** SIA should ensure that legacy systems and the new solutions lined up by them are tightly integrated and do not remain stand-alone and shall perform on real time basis as envisaged in specifications. All required external systems shall be integrated using an integration middleware layer. The scope of integration of external systems includes, legacy SCADA/DMS system, RTU/FRTU, IT systems, Numerical relays etc. including billing , customer care , GIS etc. already existing and functional in the utility, but outside the present scope of work and defined in RFP by utility . The integration is expected to be Industry Standards Based on IEC 61968-1 Bus (SOA Enabled on enterprise Bus) using CIM/XML, OPC, ICCP etc., which is, on-line, real time or offline where appropriate and shall operate in an automated fashion without manual intervention, which is documented for future maintenance.

SIA shall make necessary provisions/software linkages in the proposed solution so that the IT system or any legacy SCADA/DMS system as specified in the RFP may be integrated seamlessly.

9) **Training for Employees:** The SIA shall organize training to the core Group of

implementation team of the utility as well as end user training. Representatives from the successful bidder, Purchaser's implementation project and change management teams will be involved throughout in the development of training strategy, training material design and development, standards and training delivery to ensure that change management issues are incorporated, and that training strategies and materials are aligned to the requirements of the project and as business-specific as possible

10) **Assist Utility and PMA for responding to queries to Nodal Agency**: SIA may be responsible for preparing responses to the queries raised by the Nodal Agency. Adequate support will be provided by the utilities to the SIA

11) **Progress Update:** The SIA may also provide periodic status update reports highlighting critical issues to the utility. Further, any information (progress report, etc.) as and when sought by the Nodal Agency/Ministry of Power shall be furnished by the SIA.

12) In addition to the above, following works are also in the scope of the contractor:

(a) Database, Reports and display development

(b) Training

(c) Obtaining the statutory clearances required, if any from Ministry of Communication/ Govt Authority. All the charges deposited to aforesaid authority for obtaining statutory clearance will be reimbursed by the owner. The owner will also provide the necessary support if required in getting the clearances

d) Hired /leased communication network & arrange SLA with service provider in line with SLA of FMS period. Once SIA is appointed, a tripartite agreement among Utility, service provider & SIA shall be signed.

e) Sufficient SPARES /INVENTORY for FMS period of 5 years to meet SLA

13) **Other Services and Items:** The scope also includes, but not limited to the following services/items described herein and elsewhere in specification:

a. **Project Management and Site Supervision:** The bidder shall be responsible for the overall management and supervision of works, including the implementation of risk management as well as change management initiatives. He shall provide experienced, skilled, knowledgeable and competent personnel for all phases of the project, so as to provide the utility with a high quality system

b. **Interface Coordination:** The bidder shall identify all interface issues with utility and other agencies if any, and inform utility which shall interface, coordinate and exchange of all necessary information among all concerned agencies.

c. **Scope Change Management:** Utility to finalize the scope change management procedure during development/Implementation stage

d. **Suitable Electronic Earthing** and surge protection devices to insulate SCADA system including RTU/FRTU from fault current / voltage surges in the HV electrical system etc.

e. **Any compliance notified by GOI/ MoP/CEA** from time to time such as cyber security guidelines dtd 07.10.21 etc.

1.3.4 Specific Exclusions

The SIA is not expected to address the following:

a. All civil & architectural works, internal and external electrification, Air conditioning and ventilation, fire-fighting system and Access control system required for SCADA/DMS system are outside the scope of the SIA, however contractor has to indicate the space requirement for control center, DR center, RTU / FRTU/Auxiliary power supply & communication equipment any other specific requirement, power supply requirement including standby supply requirement, so that the utility can provide the same as per bidder's requirement

b. Manpower required operating SCADA/DMS, SCADA, RTDAS system.

c. A.C. input power supply

d. Augmentation of field devices to make existing field devices, CT/PT, breaker, switches etc. SCADA ready

The detailed technical requirements including Bill of Quantity of the above components is described in subsequent sections of this volume.

The responsibility of the Contractor shall include supplying, laying and termination of the cables, wherever required for:

a. Acquiring analog data using MFT , transducer, sensor which shall be connected with the primary devices.

b. Acquiring the digital data for status of field devices relays in the control room.

c. Extending control output to field devices through heavy duty relays

d. Interconnection between Contact Multiplying Relays (CMRs) and RTUs/FRTUs & field devices (CMRs to be supplied by the contractor as per BOQ),

e. Power and signal cabling between the supplied equipment & Owner’s equipment Incl. Outdoor panels

f. Any other cabling required for completion of the project.

1.3.5 Generic requirements:

The contractor shall undertake detailed site survey immediately after award of the contract of all the sites to access the various requirements such as space, identification of input terminals, and availability of air-conditioning, spare contacts etc. for completion of engineering, site installation, testing and commissioning of the project. The type and number of hardware and software elements (Bill of Quantity) within the scope of the project to be supplied for the various sites are identified in the Appendices. The individual functions to be performed by the hardware and software and system sizing criteria are described in the relevant sections. The specification defines requirements on functional basis and does not intend to dictate a specific design. On the other hand certain minimum requirements must be met in accordance with the particular details provided elsewhere in the specification.

The items, which are not specifically identified but are required for completion of the project within the intent of the specification, shall also be supplied & installed without any additional cost implication to the employer/owner.

The utility can invite bids in multiple packages i.e. Group of districts /zone/region including upgradation separately (Zone size for packaging shall be maximum 2 Zones per package).

Similarly for Group A Towns of SCADA/DMS, bidding can be done in multiple packages (Maximum 5 towns of Group A). Also, for Group U Towns of SCADA/DMS, bidding can be done in multiple packages (Maximum 5 towns of Group U). The package mentioned here is indicative for optimal configuration for packaging and utility may reconfigure as per the need of the project

1.3.6 Facilities to be provided by Employer/Owner (Utility)

a. Arranging necessary shutdowns and work permits at various sites.

b. Formation of team for SCADA works at control center and field level both.

c. Timely approval of documents, tests etc.to ensures completion of project in time.

d. Timely release of payment to contractor on achievement of milestones/compliances

e. Reconductoring of line for switching of loads in case of RMU connected networks

f. Retrofittment of breaker for SCADA ready

g. Any other communication infra like Fiber/ radio optic etc. other than MPLS ,GPRS/MPLS-4G

h. Providing all the necessary data regarding the power distribution system network.

i. Providing storage space at site free of cost wherever available. Special storage needs such as watch and ward services and air conditioning shall be provided by the contractor.

j. The existing earthing system at the substations may be utilized for earthing of the offered equipment. However, it is essential that the contractor shall assess its suitability for the offered equipment and carry out the modifications if required. It is recommended to provide separate electronic earthing for SCADA equipments by contractor.

k. Suitable space/Infrastructure incl. civil works, electrical raw supply , Air-conditioning , firefighting , building security , lighting , furniture etc. for Control center/DR, Substations for installation of control center/ DR equipments, RTUs /FRTUs/APS etc.in line with SCADA/DMS system implementation schedule.

l. Providing details of Existing Legacy systems if any SCADA/DMS/ RTDAS, RTU/FRTU, IT, Numerical relays RMU/FPI, GIS etc. system under R-APDRP for integration.

m. Utility shall ensure that Project implementation & operation to be done by O&M dept. of utility where IT dept. /cadre shall work as support. This is mandatory

1.3.7 General Requirements

The Bidder's proposal shall address all functional, availability and performance requirements within this specification and shall include sufficient information and supporting documentation in order to determine compliance with this specification without further necessity for enquiries

An analysis of the functional , availability and performance requirements of this specification and/or site surveys, design, and engineering may lead the Contractor to conclude that additional items and services are required that are not specifically mentioned in this specification. The Contractor shall be responsible for providing at no added cost to the employer all such additional items and services such that a viable and fully functional system is implemented that meets or exceeds the capacity, and performance requirements specified. Such materials and services shall be considered to be within the scope of the contract. To the extent possible, the Bidders shall identify and include all such additional items and services in their proposal.

All equipment provided shall be designed to interface with existing equipment and shall be capable of supporting all present requirements and spare capacity requirements identified in this specification.

The offered items shall be designed to operate in varying environments including suitability as per higher altitude requirement. Adequate measures shall be taken to provide protection against rodents, contaminants, pollutants, water & moisture, lightning& short circuit, vibration and electro-magnetic interference etc.

The Contractor shall demonstrate a specified level of performance of the offered items during well-structured factory and field tests. Further, since at the substations limited space is available the contractor shall make all the efforts to economize the space requirement.

The Bidders are advised to visit sites (at their own expense), prior to the submission of the proposal, and make surveys and assessments as deemed necessary for proposal submission.

The successful bidder (Contractor) is required to visit all sites. The site visits after contract award shall include all necessary surveys to allow the contractor to perform the design and implementation functions.

After the site/route survey the Contractor shall submit a survey report for all the sites. This report shall include at least the following items; however, the exact format of the report shall be finalized by the contractor with the approval of Employer.

a. Proposed layout of Equipment in the existing rooms and buildings.
b. Proposed routing of power, earthing, signal cables and etc.
c. Confirmation of adequacy of Space and AC Power supply requirements
d. Proposals for new rooms/buildings, if required
e. Identification of facility modifications, if required
f. Identify all additional items required for interconnection with the existing equipment.
g. Requirement of Modification to existing earthing arrangement, if any.

1.3.8 General Bidding Requirements

The offered equipment/system/ solution must be in successful operation for at least one year as on the date bid opening. However, the computer software /hardware shall be of latest current industry technology/ standard models as per Model Technical specification chapter 1-19 The Bidder shall beresponsive to the technical requirements as set forth in this specification. To be considered responsive, the Bidder's proposal shall include the following:

1. A detailed project implementation plan and schedule that is consistent with the scope of the project. The plan shall include all the activities required, show all key milestones, and clearly identify the nature of all information and project support to be provided for completion of the project. Manpower resources, proposed to be deployed by the Contractor during the execution phase, shall be clearly indicated.
2. Documentary evidence in support of the qualifying requirements specified in the bidding document i.e. RFP shall be submitted along with the bid.
3. Performance certificate for the offered equipment/systems from the user’s in line to the requirements mentioned in the biding documents.

4. The type test certificates for the offered equipments. In case it is not type tested. The commitment for same to be conducted during implementation
5. Completed equipment Data Requirement sheets/Questionnaire
6. Technical details of the offered equipment/systems.
7. Description of existing IT system shall be included by utility
8. SLA & Cyber security compliance plan

1.3.9 Items of Special Interest

To assist in understanding the overall requirements of the project, the following items of special interest are listed. The Bidder shall pay particular attention to these items in preparing the proposal.

a. The contractor shall be responsible for overall project management, system integration and testing to complete all the facilities under the project.

b. The project shall be implemented in the time schedule described in the section- 9.

c. The database, displays and reports for SCADA/DMS/OMS/RT-DAS system are to be developed by the contractor; however, the contractor shall associate the employer/owner's engineers also during the data base development. The required hardware & software for completion of this activity may be used out of the hardware & software to be supplied under this contract.

d. The APIs (Application Program Interfaces) specified/needed chapter 2 is to be supplied. However the supply of source code is not mandatory. (API only for customized portion ,if any is to be provided)

e. Integration with legacy system if indicated in the RFP

1.3.10 Site Conditions

The sites are located in the towns of Group A for SCADA/DMS as per list in Chapter 19 Annexure 1. The minimum to maximum temperature & relative humidity generally falls between … to … C. & ..... to. % respectively. The sites are located in the towns of Group B for SCADA as per list in chapter 9 Annexure 2. Further, where RTDAS under IPDS is commissioned, the existing FRTU shall act as Sub RTU to new RTU and report all Input points captured to new RTU and I/O card for differential points may only be considered in configuration of new RTU in order maximize usage of infrastructure created under RT-DAS as per list in chapter 19 Annexure 2.

The minimum to maximum temperature & relative humidity generally falls between … to … C. &..... to.... % respectively. The sites are located in the towns of Group C for SCADA as per list in Annexure 3 The minimum to maximum temperature & relative humidity generally falls between … to … C. &..... to.... % respectively. The sites are located in the towns of Group U for SCADA /DMS as per list in Annexure 4 The minimum to maximum temperature & relative humidity generally falls between … to … C. &..... to.... % respectively. Utility shall also indicate locations at above 2000 m form M.S.L if any for suitable hardware. The system/equipment shall be designed as per the environmental conditions mentioned in the relevant section of this specification. The operating and ambient temperature specified for hardware /equipment in respective chapters are indicative for each equipment in the specification . Utility may change as per the climatic condition and operational requirement with vendor neutral approach

1.3.11 Applicable Standards

The applicable standards are mentioned in the respective technical section. The offered

equipment shall conform to the standards mentioned in the specification except to the extent modified by this specification. In case of any discrepancy between the description given in the specification and the standards the provisions of the technical specification shall be followed. The parameters not specifically mentioned in this specification shall conform to the standard mentioned in this specification.

Wherever, new standards and revisions are issued during the period of the contract, the Contractor shall attempt to comply with such standards, provided there is no additional financial implication to employer/owner.

In the event the Contractor offers to supply material and/or equipment in compliance to any standard other than those listed herein, the Contractor shall include with their proposal, full salient characteristics of the new standard for comparison for equivalence or better.

For Group A , SCADA/DMS/OMS and Group B , SCADA and Group C RTDAS and Group U shall be considered irrespective of terms of SCADA , DMS, OMS, RTDAS is mentioned in any combination in specification as per the relevant functional requirements common and specific both that group .

1.3.12 Warranty

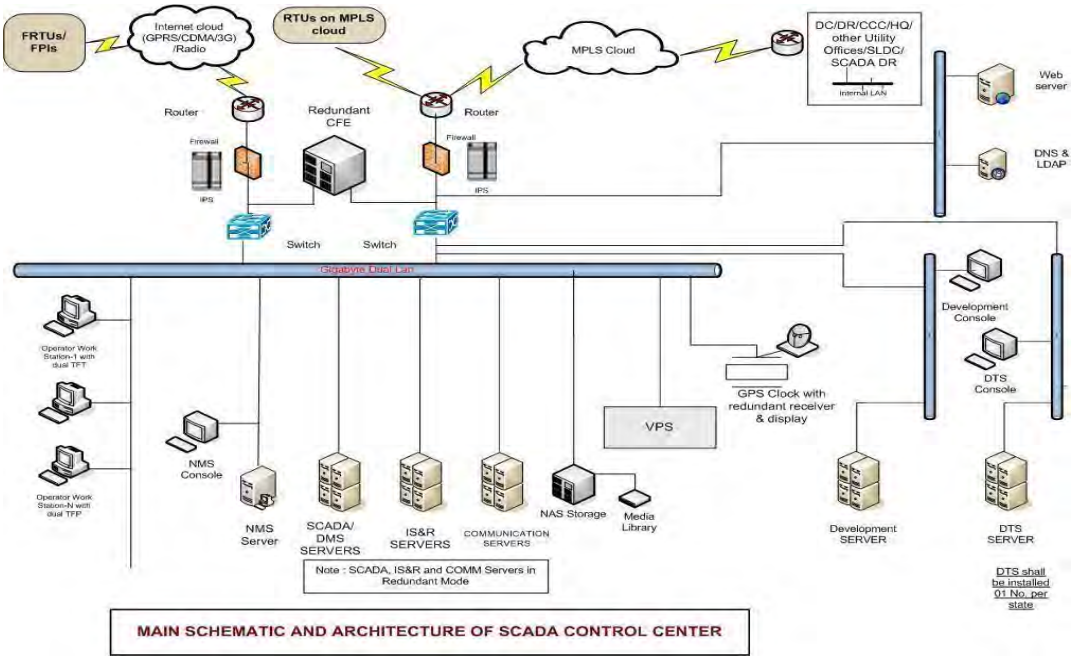
This would include seven years warranty for the related hardware & software supplied under the SCADA/DMS project after the Site acceptance test (S.A.T), operational acceptance of the SCADA/DMS System. The 5 year warranty shall include comprehensive OEM on-site warranty for all components (H/W and Software including OS) supplied including reloading and reconfiguration of all Software and device drivers/patches etc. if required. *In case 5 Years warranty is beyond standard warranty period of the equipment or required to cover to cover FMS period , the extended warranty shall be the responsibility of SIA.*

1.3.13 Terms for utility & SIA

The term contractor & bidder shall be referred as SCADA/DMS implementation agency (SIA) & owner; employer shall be referred as utility where ever mentioned in the RFP /Model Technical specification (MTS)

1.3.14 Proposed SCADA/DMS system

Utility shall write in brief about the proposed system for Group A ,B &C



Ref Fig 1.3

1.3.15 Existing System for Group A , B, C & U towns separately.

Utility shall include write up about their existing geographical details (pop (2011 census), annual energy in MUs , sq.km, organization setup , hierarchy, town , district , no. of substations, DT, RMU , electrical network etc. Of the project area. Utility shall provide details electrical system considered /committed, enabling SCADA/DMS implementation.

Utility shall also list all existing infrastructure / legacy systems viz SCADA/DMS, RTU, FRTU, MFTs , RMU/Sectionalizers, Numerical relays/ IT system under R-APDRP viz. billing ,customer care, GIS etc., if any that are required to be integrated with this system. Utility shall provide details of Existing Legacy systems SCADA/DMS, RTU/FRTU, IT system under R-APDRP for integration including protocol implementation profiles, interface details etc.

Utility shall give configuration diagram & technical write up of IT data center, customer care center DR center, sub div, other offices under R-APDRP.

Utility shall provide details electrical system considered for enabling SCADA implementation.

Utility shall mention details of existing communication, power supply, building infrastructure for SCADA system. Utility shall ensure the data mentioned above is true & according to approved DPR for the project area.

End of Chapter 1

CHAPTER -2: SCADA FUNCTIONS

2.0 General requirements

This chapter describes the functions to be performed by the SCADA applications for distribution system for the project area. Bidders are encouraged to supply standard, proven & tested products that meet or exceed the Specification requirements. This chapter describes the requirements of ISR functions also. Unless specified as optional functions/ features all functions/ features mandatory for the project area. This chapter is applicable to Group A, B, C, U towns as per functional requirements

2.1 Design requirements

The software shall be modular in nature. The software shall be able to work platform based on minimum 64 bit architecture. All the variable parameters of SCADA/DMS applications, which require adjustment from time-to-time, shall be defined in the database and shall be adjustable by system personnel. All periodicities and time intervals contained in the Specification that define these parameters shall be considered as initial values to be used for performance purposes. The adjustments made to parameters by the user or programmer shall become effective without having to reassemble or recompile programs or regenerate all or portions of the database.

The specific requirements for output results are described along with the other requirements of each function. However, all results that the user deems to be important shall be stored in a form accessible for display and printing, whether or not explicitly specified in the particular subsection.

The SCADA functions specified for Group A Towns only means that system will presently be using the same due to consideration of corresponding field equipment like FRTU at RMU, SECTIONLIZER etc. but the system for Group B Towns shall also be compliant to use the function to use field devices if available on field/ will be available in future. In the specification SCADA/DMS or SCADA or RTDAS shall be considered by per functional requirement of Group A , Group B towns , Group C and term SCADA/DMS shall be read as SCADA for B , C Towns accordingly as per functional and BoQ requirements or unless specified in the bid specifically .

2.1.1 SCADA/DMS Function Access

Various application functions shall be designated as single user/ multi-user. For a single-user function, the user with access to the function must relinquish access to it before access can be granted to another user. For a multi-user function any number of users, up to the maximum designated for the function, may have access to the function simultaneously. All such actions shall be recorded as events in the event log

2.1.2 Critical & non critical functions

The functions defined in this specification shall be classified as Critical or as Non- critical. Every critical function must be supported by sufficient hardware & software redundancy to ensure that no single hardware & /software failure will interrupt the availability of the functions for a period exceeding the automatic transfer time defined in the specification.

Non-critical function may not be supported by hardware & software redundancy and can be suspended in case of non-availability of corresponding hardware.

Generally the following are to be classified as Critical functions:-

a) All SCADA applications

b) Information Storage and Retrieval (ISR)

c) Load Shed application (LSA)

d) Outage data analytics and reporting (ODAR)

e) All DMS & OMS applications (Group A Towns only)

f) Data exchange among the contractor supplied SCADA/DMS system, IT system established under R-APDRP

g) Web server applications, Security applications

h) Network Management system (NMS)

i) Disaster Recovery for Group A & Data recovery function (DR) for Group B & C

The following are non-Critical functions

a) Dispatcher Training Simulator (DTS)

b) Database modification and generation

c) Display modification and generation

d) Report modification and creation

e) Data exchange with Remote VDUs, if any

2.2 SCADA Functions

The following SCADA functions are envisaged under this specification.

- Data Acquisition from RTUs at S/S & FPIs , FRTUs at RMU/Sectionalizers for Group A/U towns
- Data Acquisition from RTUs at S/S & FPIs for Group B,C Towns
- Time synchronization of RTUs,, FRTUs & FPIs(if time synch is supported in FPI)
- Data Exchange among the contractor supplied SCADA/DMS system, IT system established under IPDS (in specified format (OPC / CIM-XML / ICCP /ODBC Format) Model & Data Exchange over IEC 61968-1 Enterprise SOA Based BUS), or any other legacy system defined in the RFP
- Continuous real-time data storage and playback
- Sequence of event processing
- Supervisory Control for all towns except Group C
- Fail-soft capability
- Remote database downloading ,diagnostics & configuration
- CIM compliance IEC61968
- GIS adaptor (GIS Land base data, network model using GIS engines/adaptors supporting Native Adapters , CIM/XML Model for Distribution / Power System, using Model Exchange & Data Exchange over IEC 61968-1 Enterprise SOA Based BUS) (Group 1 Towns only)

- Information Storage & Retrieval (ISR)
- Load Shed Application (LSA)
- Disaster Replica Recovery (DRR) for Group A & Data recovery function (DR) for Group B& C

The System Design Parameters of SCADA/DMS functions ,The power system sizing, Performance requirements for complete SCADA/DMS system are specified are specified in DESIGN PARAMETERS AND PERFORMANCE given chapter 19

The SCADA system shall have capability to accept data from the following sources:

(a) Telemetered data received from RTUs,

(b) Telemetered data received from FRTUs (Group A Towns only)

(c) Telemetered data received from FPIs

(d) Data received from IT system established under IPDS Data exchange

(e) Calculated data

(f) Pseudo-data (Manually entered data)

(g) GIS land base data, network model using GIS engines/adaptors (Group A Towns only)

All input data and parameters, whether collected automatically or entered by a user, shall be checked for reasonability and rejected if they are unreasonable. All intermediate and final results shall be checked to prevent unreasonable data from being propagated or displayed to the user. When unreasonable input data or results are detected, diagnostic messages, clearly describing the problem, shall be generated. All programs and all computer systems shall continue to operate in the presence of unreasonable data.

Each of the SCADA functions is described below.

2.2.1 Communication protocol.

SCADA system shall use the following protocols to communicate

(a) For RTU - IEC 870-5-104 protocol also 101 to communicate when acting as data concentrator with slave devices

(b) For FRTU- IEC 870-5-101 /104 protocol

(c) For FPIs - IEC 870-5-101 /104 protocol d) for MFTs – MODBUS

(d) For DR & Other any other SCADA system - ICCP/TASE.2 in specified format (OPC / CIM-XML / ICCP / ODBC Format) Model & Data Exchange over IEC 61968-1 Enterprise SOA Based BUS)

(e) For IT Systems - (in specified format (OPC / CIM-XML / ODBC Format) Model & Data Exchange over IEC 61968-1 Enterprise SOA Based BUS)

(f) In case existing system uses DNP3.0 protocol, the same shall be used for integration of existing RTUs.

(g) IEC62056 (DLMS) SMART meters compliant in case of integration of SMART Meters in future

The protocol considerations shall be made in accordance to the system/ device to be interfaced. However, system shall have capability to interface using all necessary protocols as specified

above for the devices that may be interfaced in future

2.2.2 Data Acquisition

SCADA system shall acquire data from Remote Terminal Units (RTUs) (Group A, B, C, U Towns), FRTUs (Group A, U Towns) & FPIs (Group A, B,C, U Towns).

The type of data to be acquired through RTUs, FRTUs shall include analog values, digital status data (Double point and single point indications) and SOE data from the substation, RMUs etc.

Analog values like P, Q, F, each phase V, each phase I, each phase pf, and energy values (Export/Import KWh and KVARh) shall be collected by the RTU, FRTUs from the M F T s .

Analog values such as station battery voltage, oil temperature, winding temperature, tap changer transducer data etc. shall also be acquired through RTU using analog input modules & suitable transducer, if defined in the RTU BOQ.

For FPIs, Digital status in the form Fault protection indication viz O/C & E//F & in case also analog data such as Fault settings are remotely.

The actual point counts & type of data acquired are given in the RTU, FRTU are specified in Annexure **for in I/O points in chapter 19**

2.2.2.1 Polling method

Digital status data from RTU shall be reported by exception and shall be updated and displayed within 3 seconds. Digital status data from FRTU & FPI shall be also be reported by exception and shall be updated and displayed within 3 seconds. Digital status data shall have higher priority than the Analog data. The system shall have dead band for data by exception.

All analog values except energy values shall be reported by exception from the RTU, FRTU & FPI. The analog value, when reported by exception, shall be updated & displayed within 4 sec from S/S & 6 sec from RMU/Sectionalizers locations at the control center. An integrity scan of all status & Analog values shall also be made every 10 minutes (configurable).

The provision shall also be made to report analog values & status data periodically at every 10sec (user configurable), if required by the user.

The time skew at SCADA/DMS control center, S/S , RMU,FPI shall not be more than 0.1sec at each location & latency shall not be more than 0.5sec for status. For analog data the time skew shall not be more than 1sec & latency shall not be more than 1sec for analog as per IEEE C37.1.

Energy values of 15-minute blocks shall be collected periodically from the RTU, FRTU at scan rate of 15 minute/1 hour (configurable up to 24 hours). Alternatively, the energy values shall be calculated for each 15 minutes/1 hour blocks at SCADA level from the acquired energy values of MFTs through RTU & FRTU.

The contractor must assess & take the network delay into consideration while designing the system so that the update time in normal & peak level of activities are met.

The SCADA/DMS computer system shall also be able to collect any and all analog & digital data from its RTUs/FRTU/FPI on demand. Apart from the periodic integrity scan, the integrity scan shall also be initiated automatically for an RTU/ FRTU/ FPI whenever the following situations arise:

i. Upon startup of the system

ii. RTU/ FRTU/ FPI status change is detected such as RTU/ FRTU/ FPI restart, Communication Link restoration

iii. On demand by SCADA/DMS functions

iv. On request by the user

The TCP/IP Communication for RTU, FRTU,FPI on public network shall be encrypted over SSL Security / VPN & the equipment should take control command from designated Master IP address only and no other IP. The RTU, FRTU, FPI & all TCP/IP devices that are on Public Network shall form a private VPN network with the SCADA Front End, through which encrypted data gets exchanged. In case, RMU & Sectionlizer is supplied with built -in FRTU is supplied, then also the above time skew and update requirement shall be met .

2.2.2.2 Telemetry Failure

If data is not received from an RTU/FRTU/ FPI after a user-adjustable number of retries, each affected point in the SCADA system shall be marked with a **'telemetry failure quality code'** and an alarm shall be generated. Telemetry failure of data can be due to failure of communication link, failure of complete RTU/, FRTU/FPI or RTU/ FRTU module or MFT etc. Only a single alarm shall be generated if an entire RTU/ FRTU or its communication channel fails.

In the event of telemetry failure, the last good value/status shall be retained in the database for each affected point. When telemetry returns to normal, the associated SCADA system shall automatically resume updating the database with the scanned data.

The user shall be able to substitute a value in the database for any point that is experiencing telemetry failure which shall be marked with **'manual replaced' quality code** in addition to the **'telemetry failure' quality code.** The user shall also be able to delete any point (or entire RTU/FRTU/FPI) from scan processing. All deleted points shall be marked with a **'delete-from-scan' quality code.**

Acquisition Modes

The following modes of data acquisition shall be supported:

a) Enable

When RTU/FRTU/FPI is enabled, the data is scanned in normal fashion and control command execution is allowed.

b) Disable

When RTU/FRTU/FPI is disabled, the data scanning & control execution is disabled. This is equivalent to" delete from scan "of complete RTU/FRTU/FPI

c) Test /Maintenance

Placing an RTU/ FRTU in test mode shall generate an appropriate event message. When an RTU/FRTU is in the test mode, the real-time database shall retain the last value from all points collected via the RTU/FRTU before it was placed in the test mode. The points shall be marked in the database with a quality code indicating that their source RTU/FRTU is in the test mode. All system displays, programs, data links, and other devices shall use this value. Supervisory control of points that are in the test mode shall not be permitted.

When an RTU/FRTU is removed from the test mode, a message shall be generated, the test mode quality code shall be removed from all points assigned to the RTU/FRTU, the database values shall resume updating on each scan, and any controls for the RTU/FRTU shall be

enabled.

2.2.3 Time synchronization of RTUs

The SCADA/DMS system will be synchronized from the GPS based Time and frequency system. The SCADA system shall synchronize the time of all connected RTUs/FRTUs/FPI every 15 minutes (user configurable from 5 minutes to 24 hrs.) using time synchronization message in the IEC 870-5-104/101 protocol /NTP/SNTP. The servers /Workstations at SCADA/DMS control center shall be synchronized using NTP/SNTP. The time of DR center shall also be synchronized from the GPS based system installed in one of the associated SCADA/DMS control center or SCADA centre in the DISCOM

2.2.4 Data Exchange

Utility shall specify the external systems, if any with which data exchange of SCADA system is envisaged and shall specify interface and interoperability parameters in the RFP. Utility shall also provide the required access & information of such existing systems to SIA for implementation

2.2.4.1 National Power Portal (NPP) & National Feeder Monitoring System (NFMS)

Machine to Machine data transfer to existing National Power Portal (NPP) & National Feeder Monitoring System (NFMS envisaged under PART A of the scheme separately. The data transfer shall be done in JSON object or any other format as finalized required, by creating suitable APIs at SCADA control Centre. The data primarily will be feeder wise SAIFI/SAIFI values on daily basis. Further, it shall be possible to transfer other telemetered data of interest of feeder also. The data & exchange format will be decided during design & Engineering phase.

Further, the real time SCADA/DMS status /reports in view only mode for capacity building may be required to be linked with any common infra directed by MoP/ PFC

2.2.4.2 SCADA/DMS system with IT system (optional)

If data exchange requirement of specific parameters with IT system is envisaged by utility in the RFP then, SCADA/DMS System shall exchange data with ISR System & ISR System shall be the nodal interface with all IT System. The Data Center, DR Center and Customer Care Center under IT System, shall exchange data with the ISR System, using Open Standards like CIM/XML & IEC 61968 Series Standards for Power System, OPC, ICCP/TASE.2., ODBC The GIS System shall exchange data with SCADA System over IEC 61968-1 SOA based ESB/Bus using CIM/XML Models for Power System using GIS Engine / Adapters supporting the standard.

Direct SQL/ODBC interfaces should continue to be supported for report generation and ad-hoc queries.

If utility was having GIS/ billing/customer system prior to this scheme such as IPDS i.e. considered as legacy, then interfaces may be selected accordingly viz. ODBC/DDE etc. using ASCII files. However, they shall provide system in compliance of the data exchange requirement specified in this para.

Data to be exchanged with IT system is defined ISR section. For DR & SLDC, it is given below:

2.2.4.3 For data exchange between SCADA/DMS control centers & DR center, optional (SLDC):

If opted & requirement specified by utility in this RFP, then SCADA/DMS control centers

shall also exchange data using ICCP with State Load Dispatch Centre (SLDC) of the state. Data exchange shall also allow other information to be transferred report by exception but also configurable periodically, or on demand. It shall be possible to exchange at least the following data:

- Real-time telemetered data of the interconnected network,
- Non-telemetered data of the interconnected network,
- Calculated data of the interconnected network,
- SOE data of the interconnected network
- Historical data of the interconnected network
- Scheduling data
- Operator messages.
- Event /alarm lists

It is envisaged that the utility shall get the load forecasting & drawl schedules from SLDC & versa in order to execute planning of load distribution. In addition, status /measurement of interconnected network shall be able exchanged in both directions.

For Group-A towns, Disaster recovery is replica of main control center and hence shall be in sync on daily basis or on demand also.

Whereas for Group B&C, the data exchange with DR is required all the data to be transferred from control center to DR which is required for system build in order to build a system from scratch. ICCP TASE.2 protocol or equivalent nonproprietary/ De-Facto protocol shall be used transfer network model / database changes on incremental /global basis automatically once a day & on demand It shall transfer all data /information which are required for system build in order to build a system from scratch.

2.2.5 Data Processing

The SCADA/DMS system shall prepare all data that they acquire for use by the power system operations and other applications. The data processing requirements shall apply to data collected from all specified sources.

Data acquired from RTUs/FRTUs/FPI/IT system, as well as data received from the DMS and the existing control centers (if any and specified by utility in this RFP), shall be processed and placed in the Real-Time Database as soon as it is received.

Data processing involves a value which has been converted to internal form and analyzed for violations of limits. The data processing shall set various data attributes depending on the results of the checks and shall trigger any additional processing or calculation. The SCADA /DMS system shall prepare all the acquired data for use by the power system applications. The SCADA system shall have capability to accept data from the following sources:

a. Real-time (also referred as telemetered) data received from control centers /IT system (data center, customer care, DR center and RTUs/FRTU/FPI etc.)
b. Calculated data
c. Manually entered data
d. Sequence of events data
e. Alternate data sources

2.2.5.1 Analog Data Processing

Analog data processing shall be performed according to the requirements listed below.

(i) Conversion to Engineering Units

Analog points that are transmitted to SCADA system in raw data format shall be converted to engineering units before being stored in the database. This conversion function shall include, as a minimum, the capability to perform the following conversion algorithm:

Value = (A * scanned valued) + B,

Where A and B are programmer-adjustable constants assignable as database attributes on a per point basis.

(ii) Zero dead band processing

The SCADA system at control center shall process each analog input for dead band zone processing. The acquired value, if falls between the dead band range around zero then it shall be considered as clamped zero value else the actual value shall be considered.

(iii) Reasonability Limit Check

The reasonability limits shall represent the extremes of valid measurements for the point's value. All analog values shall be compared against defined high and low reasonability limits. The comparisons shall be performed at the scan rates of the analog values. An alarm shall be generated the first time a reasonability limit violation is detected. The last valid value of the variable shall be maintained in the database and marked with a quality code indicating the **'reasonability limit violation'**. When data returns to a reasonable value, the new value shall be accepted and a return-to-normal message shall be generated.

(iv) Limit Monitoring

For bi-directional quantities (positive or negative) there shall be a set of three limits for each direction. For unidirectional quantities there shall be a set of three limits in one direction. These limits will represent increasing levels of concern and shall be named as **"Operational", "Alarm" and "Emergency"** limits. These three limits shall be set within the boundaries of reasonability limit. Generally, any alarm can be assigned as audible alarm but emergency limit shall necessarily be assigned as audible alarm.

All telemetered and calculated analog point shall be compared against above sets of high and low limits each time the value is scanned or calculated. Whenever a monitored point crosses a limit in the undesirable direction a limit violation alarm message shall be generated. Whenever a monitored point crosses a limit in the desirable direction, an exit alarm message shall be generated. If multiple limits have been crossed since the last check, each limit crossedshall be reported.

All limit monitoring shall preclude annunciation of multiple alarms when a value oscillates about an alarm limit by utilizing a programmer-adjustable alarm dead- band for each point.

The user shall be able to temporarily override any of the above limits (which are in use) by entering a new value. When the user overrides a limit, it shall be marked with a **'limit override quality code'** on all displays. The override value shall be recognized, and any display, report, or log containing the value of the overridden limit shall include it as such. An override value shall be used instead of the permanent value until the user removes the override condition or system is re- initialized. Any change in alarm states resulting from a change in limit value shall be reported. Contractor shall finalize & take approval from utility for limit values.

(v) Rate of change /Gradient

All telemetered and calculated analog points shall also be processed for rate of change / Gradient processing, if defined that point for such processing in the database. An Alarm for over shoot & event message for return to normal shall be generated.

The rate of change shall be calculated periodically for each assigned point, by dividing the point's values at the beginning and the end of the period into the length of the period. Filtering shall be applied so that single scan excursions do not cause an alarm. The result shall be saved as a non-telemetered database point. All the requirements that apply to calculated points, such as limit checking,

Alarming and availability for display and processing shall apply to the ROC points. There shall be a positive limit and a negative limit to catch excessive rises in the analog value.

(vi) Sign Conventions

The sign conventions for the display, data entry and reporting of active and reactive power flow shall be used universally by all SCADA/DMS functions. All imports to bus bars shall be represented with + sign and all exports from bus bars shall be with –ve sign.

(vii) Accumulator Processing

The system shall be able to store accumulator history. Storing accumulator history shall be provided with a method in which that stores data only once per hour and in other method that stores data each time new data enters the system.

It shall be possible to use the two methods concurrently for any pulse accumulator, making it possible to maintain two records for data that are read more than once an hour.

2.2.5.2 Digital Input Data processing

Each state of a digital input point shall be associated with the state of an actual device. The number of bits that will be used to define the state of a device is defined in the RTU/FRTU Specification. A status point shall be defined as being either legal or illegal, and normal or abnormal:

- Illegal state: The first check on a new input to a digital status point is the legality check. If the new state is illegal, then the old value shall be left in the database and marked old with relevant quality code such as telemetry failure etc.
- Abnormal state: If the new state is legal, it shall be checked to see if it is among the normal states defined for the point. If not, the status point shall be marked as abnormal. While abnormal, it shall appear in the summary display of abnormal conditions/ off-normal summary
- Alarm checking: Each new value shall be checked to see if transitions into that state are to be alarmed. If so, and if no control action is pending on the status point, then an alarm action shall be triggered.

The following digital input data types shall be accommodated as a minimum:

a. Two-state points: The following pairs of state names shall be provided as minimum :

(1) Open/Closed

(2) Tripped/Closed

(3) Alarm/Normal

(4) On/Off

(5) Auto/Manual

(6) Remote/Local

(7) On Control/Off Control

(8) Set/Reset

b. Three-state points: Any of the state combinations listed in (a) above shall be supported with a third, typically, in-transit state which is the case for slow operating devices such as isolator. If a device remains in this state for a period more than a threshold value, the same shall be alarmed.

c. Momentary change Detection (MCD): The input to capture the states of fast acting devices such as auto-reclosers.

Commanded changes initiated by supervisory control shall not be alarmed but shall generate an event message. All other status changes in the state of telemetered, calculated digital input points & uncommanded changes shall be alarmed.Each CB, isolator, switching device etc. shall have normal & off normal positions states defined. In the event of off normal positions, the same shall be reflected in the off normal summary list

2.2.5.3 Calculated Data processing

SCADA system shall be capable of performing calculations and storing the result in the database as calculated data available for display. The database variables to be used for arguments and the mathematical/statistical/logical functions to be used as operations shall be definable interactively at a console as well as by the programmer using database creation and maintenance procedures.

Calculated analog values shall use database points as the arguments and mathematical and statistical functions as the operations. Functions such as addition, subtraction, multiplication, division, maximum value, minimum value and average value, count, integration, square root extraction, exponentiation, trigonometric functions, logarithms and logical & comparative operators etc. shall be provided.

It shall be possible to calculate running maximum value, minimum value and average value over a time interval (time interval configurable from 5 minutes to 60 minutes). The value shall be reset after the elapse of defined time interval. These values shall be stored with time of occurrence for maxima and minima and the time for averaging.

Calculated status values shall use database points as arguments and combinational logic functions that include the logical, comparative operators such as AND, inclusive OR, exclusive OR, NOT, Less Than, Greater Than, Less Than or Equal To, Greater Than or Equal To, and Equal To ,If , else if etc. Suitable rules or operators (such as multi-level parentheses) shall be provided to indicate the sequence of operations in the calculation.

2.2.5.4 Substation Topology Processing

The SCADA /DMS system shall be provided with a Substation topology processor function. This function shall be capable of analyzing the open/closed status of switching devices, such as breakers and disconnectors, in order to defi~~n~~e the configuration of the substation for display. The energization of lines, transformers, bus sections and generating units shall be determined so that the associated displays may correctly show the status of these power system elements. The configuration shall be re-evaluated and updated whenever a switching device status change & analog value change beyond dead-band is detected.

2.2.5.5 Alternate source for data:

The system shall have capability to accept multiple data sources by defining as main & secondary. Normally, data from normal source will be considered. In the event of non-availability of primary source, data from secondary source shall be considered & once primary source is healthy, it shall switch back to primary source. There shall be an indication for primary /secondary source in displays, reports etc. Suitable alarm shall be generated in the event to change from primary to secondary & vice versa. Alternate source of data can be defined for certain critical points in the database.

2.2.5.6 Quality Codes

Quality codes indicate the presence of one or more factors that affect the validity of a data value. All quality codes that apply to a data value shall be maintained in the database for that data value.

The quality of the calculated value shall be the quality of its "worst" component of its arguments. The presence of a quality code on any of the component data values shall not disrupt the calculation using that value. Results of calculations that are manually overridden by the user shall be denoted with a quality code that can be differentiated from the propagation of a manual replaced quality code from one of its component values.

At least the following data quality codes preferably as the following single letter code shall be provided. However, distinct symbols /shapes after approval from employer may also be used.

S. No.	Quality code	Code	Reason
1.	Telemetry Failure (RTU Link)	T	Telemetry has failed
2.	Manual Replaced	M	Manual updation
3.	Delete from Scan (RTU/point)	D	User disabled the scan of the of data/point
4.	Questionable data	Q	Analog values of the de- energized elements
5.	Calculated	C	Calculated data
6.	Estimated	E	Estimated data from state estimator
7.	Limit Override	L	Limits are overridden
8.	Primary /secondary source	P/S	Primary or secondary source
9.	Reasonability Limit Exceeded	R	Value beyond reasonability limit
10.	Alarm Inhibit	A	Alarm processing is inhibited
11.	Test or maintenance mode	X	Point is in test /maintenance mode

2.2.6 Continuous Real-time data storage and playback

All real-time data (Analog and status) shall be continuously stored in auxiliary memory for at least two weeks as and when it is received in the SCADA database from the RTUs/FRTUs//FPIs.

It shall be possible to playback above stored data on single line diagram and network diagram for a time window of at least 10 minutes (configurable in seconds /minutes) by defining Start and End date and time. It shall be possible to have tabular and graphical trends of the

stored data. It shall be possible to set a different sampling rate for playback than the sampling rate for data storage.

The users shall be able to select the time window of interest for archival of data in the ISR system for future retrieval and playback in SCADA system. This archived data shall be transferable in RDBMS database tables of ISR system for generation of tabular displays and reports.

2.2.7 Sequence-of-Events data

Sequence-of-events (SOE) data shall be chronological listings of „status change events with time stamp" acquired from RTUs /FRTUs/FPIs. The SOE data shall be collected from all RTUs/FRTU/FPI either in normal polling or periodically/on demand. SOE data collection shall have lower priority than supervisory control actions and normal data acquisition. The SOE data collected from different RTUs/FRTU/FPI shall be merged for chronological listings and stored for subsequent review. At least latest 1000 SOE data shall be available for display.

The SOE resolution of RTU/FRTU/FPI is defined in respective sections for RTU/FRTU. SCADA/DMS system at control center shall have 1ms SOE resolution. However, as SOE time stamping is done at RTU/FRTU/FPI level, the same shall be in line with resolution defined for RTU/FRTU/FPI.

All SOE data collected from all RTU/ FRTU/FPIs shall be stored in daily RDBMS database of ISR system**.**

2.2.8 SCADA language

The SCADA system shall have capability to write various programs using IEC 61131-3 SCADA language or C/C++ or any non-proprietary language. It will facilitate user (programmer) to write various programs/ logics using points defined in the database.

2.2.9 Supervisory Control

The operator shall be able to request digital status control, set-point control and raise/lower control on selected points and analogs using Select check before operate (SCBO) Sequence.

Supervisory control shall allow the SCADA system to remotely control switching devices. A control action shall require a confirmation-of-selection-prior-to-execution response. Initiation of the control execute step shall occur after the dispatcher confirms that the correct point and control action have been selected.

After the dispatcher/DMS function initiates control execution, the RTU/FRTU shall be addressed for verification that the correct point has been selected at the RTU/FRTU and then the control action shall be executed. It shall also be possible to reset the flag in FPI through a command.

It shall be possible to issue control commands as a group control from SCADA where switching devices pertaining to different RTUs/FRTU or a RTU/FRTU may be controlled as a group. The SCADA system shall send the control commands sequentially (without dispatcher intervention), if the commands pertain to switching devices in the same RTU/FRTU, using the Selection Check before operate (SCBO) of prior–to-execution. The control commands pertaining to different RTUs /FRTUs may be executed in parallel.

If, after selecting a point, the user does not execute the control action within a programmer-adjustable time-out period, or if the user performs any action other than completing the control action, the selection shall be cancelled and the user be informed. If the communication to the

RTU /FRTU/FPI is not available, the control command shall be rejected and shall not remain in queue.

The user shall not be prevented from requesting other displays, performing a different supervisory control action, or performing any other user interface operation while the SCADA/DMS system waits for a report-back on previously executed control actions.

The system shall process supervisory control commands with a higher priority than requests for data from the RTU /FRTU /FPI data acquisition function.

Functional requirements for the various types of supervisory control are given below. A supervisory control request shall be sent from control center only after the controlled point was checked for proper conditions. The request shall be rejected by the System if:

1. The requested control operation is inhibited by a tag placed on the device or maintenance tag
2. The device or S/S in local manual control mode
3. An Uninitialized, Telemetry failure, delete from scan, manual replaced, Test/maintenance , or Manually Entered data quality indicator is shown for the device;
4. The Operating Mode/ user permission of the workstation/console attempting control does not permit supervisory control
5. The device is already selected for control request or control execution is from another workstation / user/window /console or control request is progressing
6. Time out after selection
7. The device is not subject to supervisory control of the type being attempted

Rejection of a control request from control center shall occur before any transmission is made for control purposes. A control rejection message shall be displayed for the Dispatcher

2.2.9.1 Digital Status Control

A digital control output results in the activation of an output relay in a RTU/FRTU.Different commands shall be possible for these digital status controls.

Successful completion of the control request shall be recorded as an event. Failures to complete shall be handled as specified in UI section. Control requests shall be canceled and the selection of the point shall be terminated when the user cancels a request, does not perform the next step of the control procedure within the selection time-out period from the previous step of the procedure, or the request is rejected.

2.2.9.1.1 Breakers

The user shall be able to select and operate the two state controllable switching device i.e. Circuit breakers/ LBS/ in case of RMUs, Isolator also

2.2.9.1.1.1 Reset flag of FPI

The user shall be able to select and operate switches or the reset flag of FPI as per utility SoP.

2.2.9.1.1.2 Capacitor Banks

The user shall be able to control capacitor devices. The procedure for controlling these devices shall be the same as that of a switching device except that any supervisory control action must

be inhibited for a programmer-adjustable time period after the capacitor/ reactor device has been operated. A message shall appear if an attempt is made to operate the device prior to expiration of that time period & dispatcher is required to give command after expiration of inhibited time period.

2.2.9.1.1.3 Tap Changing Transformers

SCADA system shall have the capability to raise and lower the on load tap position of the transformers from SCADA control center through supervisory commands.

Depending on system conditions, the user may raise or lower the tap positions of On Load Tap Changing (OLTC) transformers. OLTC's tap position needs to be monitored if supervisory control action is to be exercised. OLTC tap position input shall be acquired as an analog value. Tap excursions beyond user-specified high and low limits shall cause the master station to generate an alarm.

Supervisory control of OLTCs shall only be permitted when the transformer's control mode is Supervisory. All attempted invalid control actions shall be rejected.

For supervisory operations, the initial selection and control of the transformer for a raise/lower operation shall follow the (SCBO) Sequence. Upon receipt of the raise/lower command, the RTU will immediately execute the control action. It shall not be necessary for the user tore-select the transformer for additional raise/lower operations; the user shall only have to repeat the desired number of raise/lower commands, which shall be executed immediately. Normal scanning functions shall not be suspended between the times that repeated raise/lower commands are issued.

The user shall be able to cancel the operation or have it automatically cancelled by the master station after a programmer-adjustable time period elapses after the last raise/lower command. This multi-step procedure as described below

1. The RAISE and LOWER pushbuttons shall be displayed.
2. The command shall be launched as soon as RAISE or LOWER is selected. The Raise and Lower buttons shall not be replaced by a single Execute button. The RAISE/LOWER pushbuttons shall continue to be displayed, and it shall be possible to initiate these controls repeatedly without reselection of the controlled point, provided that the execution of the previous control command has successfully been completed.
3. The RAISE/LOWER pushbuttons shall remain available until either (a) the dispatcher clicks the CANCEL button or (b) the control times out due to inaction by the dispatcher.
4. A separate timeout period, adjustable in the range of up to 120 seconds, shall be provided for incremental control. The timer shall be reset and start counting again whenever a RAISE or LOWER command is issued.

Successful completion of incremental control shall be recorded as an event. However failure of incremental control, including failure to achieve the intended result, shall be alarmed.

2.2.9.1.1.4 Set point Control

The SCADA/DMS shall provide the capability to issue set point control using SCBO procedure to field equipment The SCADA/DMS shall transmit a numerical value to the device being controlled, to indicate the desired operational setting of the device.

2.2.9.1.1.5 Auto execution sequence /Group control

The Auto execution sequence function shall permit multiple supervisory control commands to be programmed for automatic execution in a predefined sequence. The dispatcher shall be able to execute this sequence. Commands to be supported shall include:

- Time delayed
- Pause & until a user commanded restart or step execution
- Jump to other sequence on certain conditional logic
- Manual Entry.

After executing a supervisory control action, the SCADA/DMS shall pause to obtain an indication of a successful control completion check. If the control completion check is not received, or does not have the expected value, the SCADA/DMS shall terminate the execution of the sequence and shall declare an alarm. Apart from waiting for control completion checks, and unless there is an explicit command for a delay, such as a "Pause" or "Stop" command, the SCADA/DMS shall not introduce any other delays in the execution of an sequence. No limit shall be placed on the number of Auto execution sequences, which may execute in parallel. At any time during the execution of a list, the user shall be able to stop further execution via a cancel feature.

2.2.9.1.1.6 Control Inhibit Tag

A user shall be able to inhibit or enable supervisory control on any device. A tag symbol indicating the control inhibit conditions shall be displayed next to the device on all displays where the device is presented.

The programmer shall be able to define up to 4 tag types with the following attributes for each:

a) Type of controls that shall be inhibited by the tag (e.g. open only (Green tag) close only (Yellow tag), open and close (Red tag), or information only - no control inhibit (White tag). Tags shall be preferably identified by colors. However, distinct symbols /shapes after approval from employer may also be used.

b) Tag priority

Further the user shall be able to place at least 4 tags per device. Only the highest priority tag shall be displayed. Any combination of tags shall be supported, including multiple tags of the same type. The combined effect of multiple tags shall be to inhibit a type of control if it is inhibited by any of the tags.

When a tag is placed on a device, the user shall be prompted to enter tag number and comment. An event message shall be generated each time a control inhibit tag is placed or removed with information on user ID, type of tag, time of placement or removal of tags.

2.2.9.1.1.7 Control Permissive interlocks

It shall be possible to define the interlocks at SCADA level as necessary for control actions. It shall also be possible for operator to bypass the interlock which shall be recorded as an event message with user ID information.

2.2.9.1.1.8 Control Action Monitor

The response to all control actions shall be verified by monitoring the appropriate feedback variable. A report-back timer (the duration dependent on the type of device) shall be initiated

when the command is issued. At least ten timer periods of 1 to 60 seconds (adjustable in steps of one second) shall be supported, any of which may be assigned to any device.

The user shall be provided with an indication that a control action is in progress and, subsequently, a report of the result. If the control was unsuccessful, an alarm shall be generated that states:

(a) The control message exchange was not completed successfully,

(b) The device failed to operate, or

(c) The device operated but failed to achieve the desired result (e.g., following a close control action, a three-state device operates from the open state, but remains in the transition state).

If the control was successful, an event message shall be generated.

For commands issued as part of a group control, DMS applications etc., the successful completion of all device control actions shall be reported via a single message. If the operation is unsuccessful, the user shall be informed of those devices in the group that failed to operate.

2.2.10 Fail-soft capability

The SCADA system shall be able to manage & prevent system from total shutdown / crash etc.in the event of system crosses mark of peak loading requirements through graceful de-gradation of non –critical functions & also relaxing periodicity / update rate of display refresh & critical functions by 50%.

2.2.11 Remote database downloading, diagnostics & configuration :

The SCADA/DMS system shall be able to download database run diagnostics & create/modify /delete configuration/ parameterization from centralized control center locations to RTU/FRTU/FPI etc. using ASDU/ messages of respective protocols or file transfer.

2.3 Information Storage and Retrieval

Information Storage and Retrieval (ISR) function shall allow collection of data from real-time SCADA/DMS system and storing it periodically in a Relational database management system (RDBMS) database as historical information (HI) data. This includes storing of data such as SOE, status data, Analog values, calculated values, Energy values etc. Programmer shall also be able to set storage mode as by exception in place of periodic storage.

Subsequently, the data shall be retrieved for analysis, display, and trending and report generation. All stored data shall be accessible from any time period regardless of changes made to the database after storage of that data (e.g., it shall be possible to retrieve stored data for a variable that no longer exists in the SCADA/DMS computer system through backups on storage medias viz. tapes /MO disks etc. and initialize study-mode DMS functions with stored data on the corresponding power system model).

The addition, deletion, or modification of data to be collected and processed shall not result in loss of any previously stored data during the transition of data collection and processing to the revised database.

It should be able to compress data, and should have 100% retrieval accuracy. However, the retrieval of compressed historical streams should be of the same performance levels as normal SCADA retrieval. The ISR should be able to interface over ICCP, OPC, ODBC and CIM/XML, JSON to external systems **(as defined by utility to interface with in the section "Data exchange")** for analytics over SOA / ESB for Integration with IT Systems, over the Enterprise Services Bus & SOA Architecture provided as part of legacy system. The ISR

system shall act as the real interface between SCADA and IT System, where-by the real-time operational system is not affected with a transaction processing system like IT, and the IT Integration efforts will not in any way effect the real-time operationally of SCADA/DMS System.

In ISR should also support ad-hoc queries /reports, and define display and report formats for selected data via interactive procedures from operator workstations. Formatted reports and responses to user queries shall be presented in alphanumeric or graphical format on either operator workstations or printers at the option of the user. Procedure definition facilities shall be provided for activities that will be frequently performed. SQL-based language shall be used for selecting, retrieving, editing, sorting, analyzing, and reporting ISR data stored. The selection and sorting criteria shall include time tags and ranges, station names, point names, equipment types, status values, text string matches on selected data fields etc. and combinations of these criteria.

It shall be possible to reload any IS&R archival media that has been removed from IS&R and access the archived data without disturbing the collection, storage, and retrieval of IS&R data in real-time.

The ISR system shall also be used for mass storage of data/files such as DMS application save-cases, Output results of DMS applications, Continuous real-time data of selected time window etc.

The online period of data tables is 24 months, however, there shall not be time restriction to online availability of logs, real time data based on the stored values.

The System Design Parameters of ISR system is given in the **chapter19**

2.3.1 Circuit breaker status Table

The ISR function shall maintain a table in RDBMS database where real-time status of all Circuit breakers, in case of RMU -LBS, isolators & Sectionalizers switching also along with the associated quality codes shall be stored. The change of status of any breaker shall be updated in this table as soon as the change is detected by the SCADA system. This table shall contain additional information such as date & time of tripping, cause of tripping, Expected duration of outage etc. Some of the causes of tripping could be Supervisory controlby user, Protection tripping, Tripping / closing by DMS applications. Information on expected duration of outage shall be taken from schedules for DMS application such as Loadshed application etc. For expected duration of outages due to protection tripping, the sameshall be user enterable field. Such daily tables for 24 months duration shall be stored on auxiliary memory (Online). Tables for the previous day shall be backed up to Magnetic tape/or any offline storage device for this purpose by the user at 10AM daily.

The ISR function shall transfer the information available in the "Circuit breaker status table" as defined above, and may be used by existing Customer Care center /legacy system using SOA/Enterprise Service Bus, over ODBC/OPC/ICCP Adapters / Interfaces. The complete Circuit Breaker Information shall be transferred to Customer care center on demand & by exception along with the associated quality codes and additional information associated with the CB.

2.3.2 Real-time Database Snapshot Tables

At the end of each 5 minutes, the following real time snapshot data shall be stored in RDBMS **in Real-time Database Snapshot tables:**

a) All telemetered analog values and Calculated values for all tele-metered analog points (at least maxima & minima with associated time and average values). Energy values are not envisaged for storage in Data snapshot tables.

b) All status values with time stamp

All the above values as specified above in (a) & (b) shall be stored along with their associated quality code. The periodicity of the snapshot shall be user adjustable to include 5, 15, 30, and 60 minutes. Data Snapshot tables shall be created on daily basis. Such daily tables for 24 months duration shall be stored on auxiliary memory (Online). Tables for the previous day shall be backed up to Magnetic tape/ or any offline storage device for this purpose by the user at 10AM daily.

The ISR function shall prompt the user through a pop-up window to inform the user for taking the backup. The pop-up window shall persist till user acknowledges the same. In addition to that data can be stored on offline storage device.

The user shall also be able to initialize the study-mode power system analysis functions from stored snapshot data.

2.3.3 Hourly Data tables

At the end of each hour information as defined below shall be included in the hourly data tables, in RDBMS database form:

(a) Selected analog values along with their associated quality codes

(b) Selected status values along with their associated quality codes

(c) Results of hourly calculations for selected analog points (atleast maxima & minima with associated time and average) alongwith their associated quality codes.

(d) In addition to above a separate hourly energy data table exclusively for energy values (Export and Import Active and reactive Energy values for each feeder) shall be created in ISR alongwith their associated quality codes.

Hourly data tables shall be created on daily basis. Such daily tables for 24 months duration shall be stored on auxiliary memory Online). Tables for the previous day shall be backed up to Magnetic tape/ or any offline storage device for this purpose by the user at 10AM daily.

The ISR function shall prompt the user through a pop-up window to remind the user for taking the backup. The pop-up window shall persist till user acknowledges the same.

2.3.3.1 Missed Hourly Data Storage

The programmer shall be able to independently assign any one of the following processing for each hourly value to be executed when the value is missed and cannot be acquired prior to the storage of hourly values.

(a) Store zero and a telemetry failure quality code for each missed hour.

(b) Store the last good data value, with a questionable data quality code, for each missed hour.

(c) Temporarily store zero with a telemetry failure code for each missed hour.

(d) When the next good hourly value is obtained, divide that value by the number of hours since the last good value was obtained and insert this value, with a questionable data quality code, for all hours with missed data and the first hour

that good data was obtained as is the case for energy values.

2.3.3.2 Hourly Data Calculations

The programmer shall be able to define calculated values using stored hourly data and constants as operands. The calculations shall allow the carry-forward of data from one day, week, or month to the next. The results of all calculations shall include quality codes derived from the quality codes of the operands. The following calculations shall be provided:

(a) Addition, subtraction, multiplication, and division

(b) Summation of an hourly value by day, week, and month: The running total of the summation for the current day, week, and month shall be updated each hour and made available for display.

(c) Maximum and minimum of a value over a programmer-definable time period, and the time the maximum or minimum occurred

(d) Average of a value over a programmer-definable time period

2.3.4 SAIDI/SAIFI table

SAIDI/SAIFI values of each feeder shall be stored on daily/ weekly/ monthly/ quarterly and yearly and user defined timeline basis The values shall be determined from IEEE 1366 standard formula. In addition any customization as per Govt requirement may also be incorporated.

The SAIDI/SAIFI data shall be determined from outage and restoration time (breaker on & off /on cycle) and the time of outage. SAIDI /SAIFI shall be determined considering reason of outage in terms of planned and unplanned outage (Planned due to maintenance /operator command driven), Unplanned (Fault/Trip driven). In addition, the data consumer count and load connected on feeder on monthly basis shall be updated from user entry or export from IT system if any. There shall be suitable alarm/event message including user ID for such activity. Such tables on daily/ weekly/ monthly/ quarterly and shall be available

The data so captured shall also derive town wise SAIDI/SAIFI on daily/ weekly/ monthly/ quarterly, yearly and user defined timeline basis. Such daily tables for two years duration shall be stored on auxiliary memory (Online). Tables for the every year shall be backed up to Magnetic tape/ or any offline storage device for this purpose by the user.

2.3.5 Daily Energy Data table

The daily energy data table shall be generated for storage of daily energy values for 15 minute blocks / one hour blocks of a day & shall be stored for each feeder on daily basis along with quality codes. This daily energy data shall be exchanged with the Billing system in Data center/ legacy master billing center, if so defined to integrate in data exchange on daily basis and on demand. This table shall be created on daily basis. Such daily tables for 24 months duration shall be stored on auxiliary memory. Daily Energy data table for the previous month shall be backed up to Magnetic tape by the user on the 10^{th} of every month.

2.3.6 Load priority table

ISR system shall maintain a Load priority table containing information such as breaker name, number of consumers connected to each Breaker and Load priority of each Breaker. In addition, the priority of the feeders shall be updated from user entry or export from IT system if any on monthly basis or user defined based on AT&C and revenue generation /collection or any other priority Besides, this system shall also be able to set load priority based on the AT&C an revenue information collected from IT system for each feeder

There shall be suitable alarm/event message including user ID for such activity. The table information shall be used by various DMS applications.

2.3.7 SOE data table

ISR system shall maintain SOE data table which shall store the SOE data for complete distribution system. It shall be possible to sort the table by Time, Date, Substation name/, feeder/line name, device name etc. using SQL commands. This table shall be made on daily basis. Such daily tables for two years duration shall be stored on auxiliary memory. For the purpose of sizing of table, daily 4 changes per SOE point may be considered. All CBs, protection and alarm contacts shall be considered as SOE. Tables for the previous day shall be backed up to Magnetic tape/ MO disks by the user at 10AM of every day.

2.3.8 Feeder Limit overshoot table

ISR system shall maintain feeder limit over shoot instances record for each feeder load for overload condition, voltage for under voltage, over voltage and power factor for low power factor any other parameter utility required to define Feeder Limit overshoot table. The data shall contain count of such instances and duration for which feeder experienced such condition and index for overshoot limit of voltage) low ,high), current (high), power factor (low) etc on daily, monthly, quarterly, yearly basis. Such daily tables for two years duration shall be stored on auxiliary memory. Tables for the previous day shall be backed up to Magnetic tape/ MO disks by the user at 10AM of every day.

2.3.9 FPI fault table

ISR system shall maintain feeder FPI instances record for each feeder for o/c & E/F instances required to define FPI index table . The data shall contain count of such instances and type , section (FPI) for which feeder experienced such condition and index for FPI fault index on daily, monthly, quarterly, yearly basis. Such daily tables for two years duration shall be stored on auxiliary memory. Tables for the previous day shall be backed up to Magnetic tape/MO disks by the user at 10AM of every day

2.3.10 Equipment Failure Table

ISR system shall maintain record of DT, Power transformer failure information on weekly manner . The same shall be collected from ERP system if any or any other system where such data is maintained and also there shall be provision for user to enter data pertaining to failure of power transformer and DT to determine DT & Power transformer failure rate shoot instances record on weekly monthly, quarterly, yearly basis. Such daily tables for two years duration shall be stored on auxiliary memory. Tables for the previous day shall be backed up to Magnetic tape/ MO disks by the user at 10AM of every day.

2.3.11 User defined index table

ISR system shall maintain record of user defined indexes derived for performance from telemetered data to record on daily weekly monthly, quarterly, yearly basis. Such daily tables for two years duration shall be stored on auxiliary memory. Tables for the previous day shall be backed up to Magnetic tape/ MO disks by the user at 10AM of every day.

2.3.12 Average time restoration table

ISR system shall maintain record of avg time to report outage location, restoration of supply of feeder, project area on monthly, quarterly, yearly basis. Such daily tables for two years duration shall be stored on auxiliary memory. Tables for the previous day shall be backed up to Magnetic tape/ MO disks by the user at 10AM of every day.

2.3.13 Daily /Weekly Flash report for management of utility

ISR system shall maintain record and flash report in form of dashboard for management of utility exhibiting key performance indices. Such daily tables for two years duration shall be stored on auxiliary memory. Tables for the previous day shall be backed up to Magnetic tape/ MO disks by the user at 10AM of every day

2.3.14 Historical Information (HI) Data Retrieval

The data stored in the ISR system shall support the following retrieval capabilities:

(a) The user shall be able to view and edit HI data on displays/Forms and reports. The user shall be able to edit HI data, request recalculation of all derived values, and regenerate and print any daily, weekly or monthly HI report for the current and previous month.

(b) The user shall be able to view tabular trend and graphical trend of multiple data points simultaneously by specifying the start date and time, the end date and time, and the time period between displayed samples. The duration of viewable tabular trend and graphical trend could be up to 24 hours. The features of Tabular/graphic trend are mentioned in the specification for User interface.

(c) The HI retrieval shall expose the ISR Data over SOA / Enterprise Services BUS Supplied by ITIA, over CIM/XML, ICCP or OPC ODBC Interfaces / Adapters.

(d) The retrieval shall provide 100% accuracy and fidelity of data

2.3.15 System Message Log Storage and Retrieval

System message log, which shall consist of the chronological listing of the SCADA/DMS computer system alarm messages, event messages and user messages shall be stored for archival and analysis. Each entry shall consist of time tag and a text containing user and device identification as displayed on the Alarm Summary or Event Summary displays. The System message log data storage shall be sized for up to 20,000 entries per month.

System message log data shall be stored in daily tables & shall be available for minimum two months on auxiliary memory (online) System message log data for previous months shall be Backed up on Magnetic tapes/ MO disks by the user for which ISR function shall prompt the user every hour with suitable message to remind user for taking the backup on the 10^{th} of every month. This message shall be disabled once the backup is taken.

Facilities to sort and selectively display and print the contents of the system message log shall be provided. The user shall be able to select the display of system message log entries based upon Alarm type, Events, User generated messages, Device, and Time period.

2.3.16 Mass storage of data/files

The ISR system shall be sized for mass storage of data/files for at least the following :

a) 10 save-cases for each DMS & OMS application

b) 10 Output results of each DMS & OMS applications

2.4 Load Shed Application (LSA)

The load-shed application shall automate and optimize the process of selecting the best combination of switches to be opened and controlling in order to shed the desired amount of load. Given a total amount of load to be shed, the load shed application shall recommend different possible combinations of switches to be opened, in order to meet the requirement. The despatcher is presented with various combinations of switching operations, which shall

result in a total amount of load shed, which closely resembles the specified total. The despatcher can then choose any of the recommended actions and execute them. The recommendation is based on Basic rules for load shedding & restoration

In case of failure of supervisory control for few breakers, the total desired load shed/restore will not be met. Under such conditions, the application shall inform the dispatcher the balance amount of load to be shed /restore. The load-shed application shall run again to complete the desired load shed /restore process. The result of any Load Shed operation shall be archived in Information storage and retrieval (IS&R) system.

2.4.1 Basic rules for load shedding & restoration

The load shall be shed or restored on the basis of following basic rules:

(a) By load priority

The LSA shall have a priority mechanism that shall allow the user to assign higher priorities for VIP/ Critical loads or any other important load or feeders with high revenue or low AT&C losses. The load assigned with the higher priorities shall be advised to be shed later and restore earlier than load with relatively lower priorities. Each load priority shall be user definable over the scale of at least 1-10.

(b) By 24 Hrs. load shed /restore history

The loads of equal priorities shall be advised for restoration in such a way that loads shed first shall be advised to be restored first. The application shall ensure that tripping operations is done in a cyclic manner to avoid the same consumers being affected repeatedly, however, priority loads shall be affected least.

(c) By number of consumers affected

The consumer with equal priority and similar past load shed history shall be considered by the application in such a way that minimum number of consumers are affected during the proposed load shed. The data for number of consumers connected to a feeder /device shall be taken from computerized billing system.

2.4.2 Modes of operation

The load-shed application shall operate in the following modes:

(a) Manual load shed

(b) Manual load restoration

(c) Auto load shed

(d) Auto load restoration

Each mode of operation can be enabled or disabled by operator independently. The load can be shed & restore in possible combination i.e. manually shed & auto restore vice versa or both operations in the same modes.

2.4.2.1 Manual Load Shed

In this mode operator specifies a load to be shed in a project area The software shall determine & propose all the possible combinations of switches to be operated for the requested load shed considering the basic rules for load shed & restoration.

In case more than one options are possible, then the application shall identify all such options with the priority of consumers along with the number of consumers are likelyto be affected for the particular load shed option. The despatcher shall select & execute one

of these options for affecting the load shed.

2.4.2.2 Manual Load Restoration

In this mode operator specifies the desired load to be restored. The software shall determine the switches to be operated for the requested load restore considering the basic rules for load shed & restoration.

In case more than one options are possible, then the application shall identify all such options with the priority of consumers along with the number of consumers are likely to be restored for the particular load restore option if chosen by despatcher. The despatcher shall select & execute one of these options for effecting the load restoration.

The Load shed Application shall maintain a load restore timer, which shall automatically start after tripping of CB due to manual load shedding. An alarm shall be generated to remindthe operator to restore the loads when this timer expires. For manual mode of operation the dispatcher shall enter the value of load restore timer.

2.4.2.3 Auto Load Shed

This shall have two modes namely frequency based load shed & time of day based load shed as described below.

(a) Frequency based Load Shed

The function shall execute the tripping of breakers based on the system frequency automatically considering the basic rules for load shed & restoration.

The software shall automatically execute the switching operations as soon as system frequency reaches at load shed start (LSS_str) frequency threshold and it shall continue to do so unless system frequency crosses the load shed stop (LSS-stp) frequency limit. The frequency limits shall be despatcher assignable up to single decimal points. Once frequency crosses below LSS_stp limit, then load shed can only be started again when frequency attains LSS_str. Limit LSS_str shall be lower than LSS_stp & suitable protection to ensure that shall be provided in user interface such as discard, forbidden etc. if user accidently enters LSS _str higher or equal to LSS_stp or LSS are entered higher than LSR

(b) Time of day based Load Shed

The function shall operate to shed load at the predefined time of the day & load to be shed. The software shall automatically execute the switching operations considering the basic rules for load shed & restoration.

2.4.2.4 Auto Load Restoration

This shall have two modes namely frequency based load restoration & time of day based load restoration as described below:

(a) Frequency based restoration

The function shall execute the closing of breakers based on the system frequency automatically considering the basic rules for load shed & restoration.

The software shall automatically execute the switching operations as soon as system frequency attains load restore start frequency limit (LSR_ str) and it shall continue to do so as long as system frequency is crosses below the mark load shed restore stop frequency limit (LSR_stp). The frequency limits shall be despatcher assignable up to single decimal points. Once frequency crosses below LSR_stp limit , then load shed can only be started again when frequency attains LSR_str. Limit LSR_str shall be higher than LSR_stp &

suitable protection to ensure that shall be provided in user interface such as discard ,forbidden etc. if user accidently enters LSR _stp higher or equal to LSR_str or LSR limits or LSS _str higher or equal to LSS_stp or LSR limits, lower than LSS . The sequence of frequency limits shall be permitted as LSR str>LSR_stp>LSS _stp >LSS_str. Adequate protection as mentioned above shall be given if user tries to violate the same.

(b) Time of day based restoration

The function shall operate to restore load at the predefined time of the day & load to be restored. The software shall automatically execute the switching operations considering the basic rules for load shed & restoration.

2.4.3 Alarms/Events

All Load shed & restore operations executed shall be logged in the system as events. In case the supervisory control fails during the operation in predefined time, an alarm shall be generated with the possible reason for the failure.

2.4.4 Summary Report

Load shed application shall generate Summary Reports for project area on daily basis. These reports shall be available online for minimum period of two days. The following reports shall be made.

(a) Daily Load shed report indicating, substation name, feeder/device name,d a t e /time, duration of load shed and amount of load shed, Number of consumers affected based on consumer indexing information, mode of load shed including planned outages of feeders/network equipments.

(b) Daily Alarm summary pertaining to LSA, substation wise.

(c) Substation wise daily Served, un-served power & energy for every 5 minute time block

(d) Served & un-served power for last seven days for every 5-minute time block to calculate Load forecast for the next day. The report shall contain a column to define weightage factor (multiplier) by despatcher to calculate Load forecast for the next day. The weightage factor is required to consider the type of the day such as holiday, festivals, rainy day, etc. Separate report for total load forecast of complete project area shall also be generated from above two reports.

2.5 Common Disaster Replica Recovery Centre (DRR)

The same shall be replica of SCADA DMS Control center for Group A and with secured permission and upon non availability of main SCADA/DMS Control center, the operation of that town shall be possible from DRR. However, system shall remain in sync at hourly basis and shall be suitable interlocks to avoid any accidental command. In case main control center is not available, all underlying equipment i.e. RTU/FRTU/FPI etc shall switch reporting to DRR and DRR will now act as master and sych old master. The process of switching shall not take more than 15 minutes. Now, after swapped configuration of DRR and Main Control Centre, the data sych shall continue from new master SCADA Centre to swapped DRR centre

2.6 Data recovery function (DR)

The DR function is a repository of system build up software of all towns Group B & Group C towns.Two year online backup shall be available at this location with data pertaining to each town i.e. system build ups shall be available of each town separately so that the same can

be utilized upon setting up newer system after disaster. The data related to network model of SCADA/DMS control center of each town shall be sent to DR center periodically once a day & upon user request. The data shall be configured to be sent globally & incremental. All logs, data model etc. & necessary interfaces that are essential for complete system build up shall be stored at DR center. All requisite data which is build the system from scratch shall be transferred to DR. An alarm shall be generated & send to SCADA/DMS control center upon attaining user defined threshold e.g. 80% for storage at DR center.

2.7 RT-DAS system

The RT-DAS system shall use control center of Group B towns and shall have SCADA features except control capability. However, the same may be upgraded for enabling control ,if need be without additional license and only by adding output cards and enabling in the configuration software.

End of Chapter 2

CHAPTER 3: DMS FUNCTIONS & SUPPORTING FUNCTIONS

3.0 General Requirements

This chapter describes the Distribution Management System (DMS) applications & other supporting applications that are required for SCADA/DMS System. The DMS applications shall utilize the data acquired by the SCADA application. Distribution management System Software s h a l l include the following applications. Utilities shall select /all or certain applications according to the need & characteristic / profile of the electrical network in the project area. This chapter is applicable to Group A. However also applicable for B, C towns as per functional requirements mentioned explicitly in this chapter. For U-category towns, the functions that are required sanctioned to be integrated, are applicable.

3.1 DMS functions

These functions are applicable to Group A Towns only except LSA, LFA, OM & DTS functions which are also applicable for Group B, C towns as pseudo SCADA functions limited to substation network).

- Network Connectivity Analysis (NCA)
- State Estimation (SE)
- Load Flow Application (LFA) (Group B,C) towns also as a pseudo SCADA feature also limited to Substation network)
- Voltage VAR control (VVC)
- Load Shed Application (LSA) (Group B,C) towns also as a pseudo SCADA feature also limited to Substation network). **(Chapter 1, ClauseNo. 1.4))**
- Fault Management and System Restoration (FMSR)
- Loss Minimization via Feeder Reconfiguration(LMFR)
- Load Balancing via Feeder Reconfiguration(LBFR)
- Operation Monitor (OM)) (Group B,C) towns also as a pseudo SCADA feature also limited to Substation network)

Other Supporting functions

- Dispatcher training Simulator (DTS)

Contractor's Standard product

The bidders are encouraged to supply standard, unmodified products that meet or exceed the Specification requirements. These products may be provided from the bidder's in-house baseline offerings as standard products from other established suppliers. Bidders shall describe all standard; unmodified products proposed and shall highlight those features that exceed the Specification requirements. Although the bidder is encouraged to use as much standard hardware and software as possible, the proposal will be judged by its conformance to the Specification. Hence, a minimum level of customization in order functional requirement is permitted. The product CIM based interfaces to other enterprise applications shall be available. Bidder shall survey and collect network element parameters from utility and utility shall provide the same to run DMS functions.

Graphical & Tabular display requirements for DMS functions