Annexure 2,

Pre-Bid Reply of EPC Tender

Smart Integrated Building Management Systems (Smart IBMS) For Nalanda University

How can I save energy with an EMS?

Relay driven EMS

 Options are limited to basic scheduling and equipment control

Pneumatic EMS

Scheduling

Instrument feed back

•Utilizing basic Proportional Integral Derivative (PID) loops



How do EMS/BMS systems work?

Energy Monitoring and Management systems are integral to Building Management Systems (BMS) and Building Automation Controls (BAC), and use a networked system of sensors, software, and building controls.







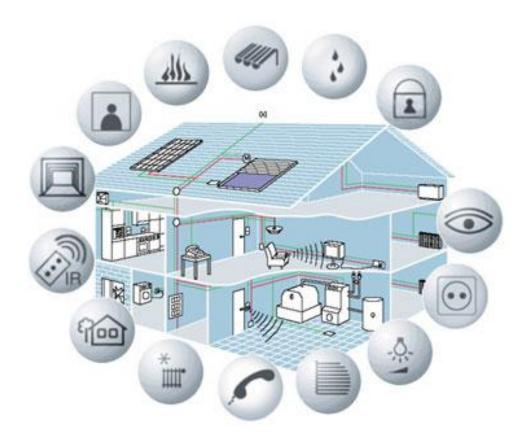
Building Automation Systems and the Environment – Profits for Stakeholders

The combination of energy management and building controls provides owners and occupants with benefits beyond economic savings, reductions in energy as a resource as well as emissions as a consequence

What is BMS?

A **Building Management System** (BMS) is a <u>computer</u>-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as <u>ventilation</u>, <u>lighting</u>, <u>power systems</u>, fire systems, and <u>security systems</u>.





Building Management Communication Protocols

A Building Management System (BMS) is a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems. A BMS consists of software and hardware; the software program, usually configured in a hierarchical manner, can be proprietary, using such protocols as C-bus, Profibus, and so on, recently, however, new vendors are producing BMSs that integrate using Internet protocols and open standards such as DeviceNet, SOAP, XML, BACnet, LonWorks and Modbus.

BMS Characteristics

- A BMS is most common in a large building.
- Its core function is to manage the environment within the building and may control temperature, <u>carbon dioxide</u> levels and humidity within a building.
- BMS systems are linked to access control (turnstiles and access doors controlling who is allowed access and egress to the building) or other security systems such as closed-circuit television (CCTV) and motion detectors.
- Fire alarm systems and elevators are also sometimes linked to a BMS

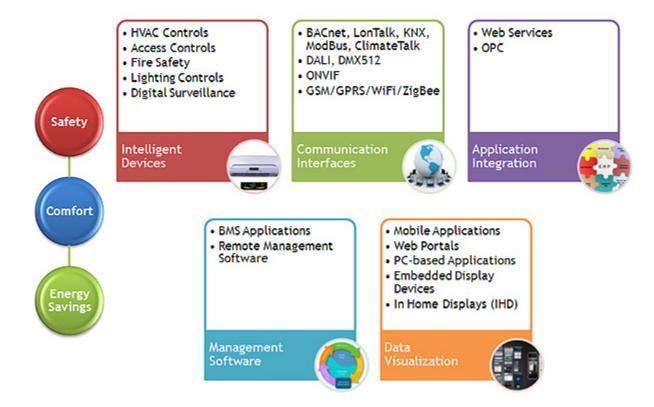
Functions of Building Management Systems

- To create a central computer controlled method which has three basic functions:
- Controlling
- Monitoring
- Optimizing
- Event List Display and Scheduler System the building's facilities, mechanical and electrical equipments for comfort, safety and efficiency.

A BMS system normally comprises

- Power systems
- Smart Illumination system
- Electric power control system
- Heating, Ventilation and Air-conditioning <u>HVAC</u> System
- Security and observation system
- Magnetic card and access system
- Fire alarm system
- Lifts, elevators etc.
- Plumbing system
- Burglar alarms
- Other engineering systems
- Trace Heating

Building Automation Systems



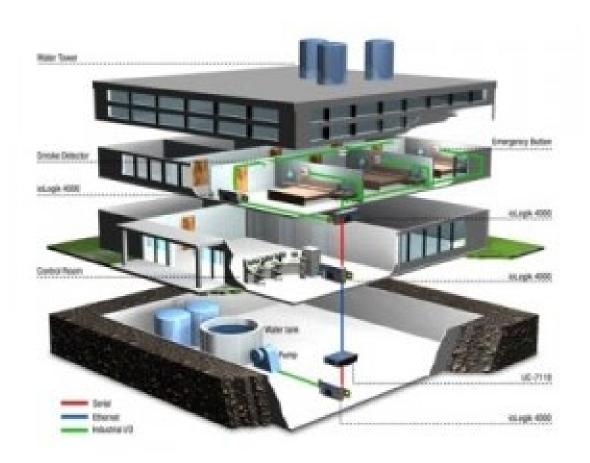


Energy Management in Building Systems

EMS/BMS helps with central services including chillers and boilers.

Building Automation Ref



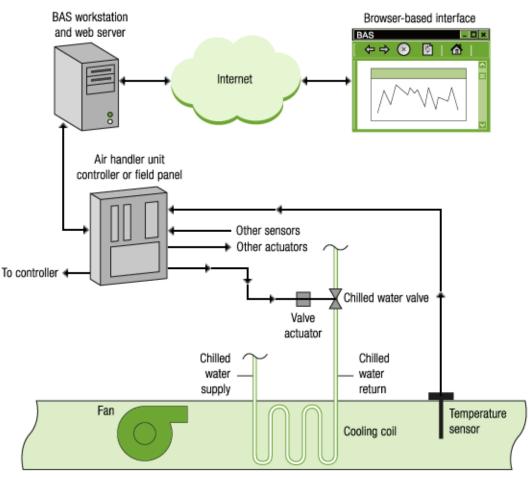


Building Management System Components

Building Management System (BMS) is a wide range of applications which covers Heating Ventilation Air Conditioning (HVAC), Environmental monitoring, Fire Protection system, Alarms & Surveillance System, Lift Management System, Smart Building Technologies and Energy Conservations.

How Building Automation Systems fit together

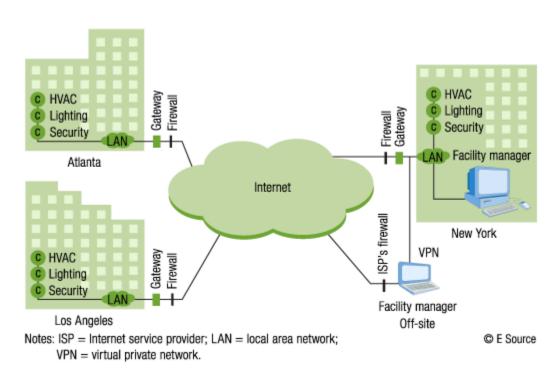
The building automation system (BAS) has become the accepted technology used in controlling HVAC and other systems in most new commercial and institutional buildings (Figure 1). Existing buildings can be retrofitted with BASs, a change that has been shown to provide economically beneficial improvements in energy efficiency and occupant comfort. Although most BASs are designed primarily for HVAC control, many incorporate additional functions, such as lighting control, computerized maintenance scheduling, life-safety functions (such as smoke control), and access (security) control. A building automation system (BAS) consists of sensors, controllers, actuators, and software. An operator interfaces with the system via a central workstation or Web browser



© E Source; adapted from Portland Energy Conservation Inc.

How Building Automation Systems work together

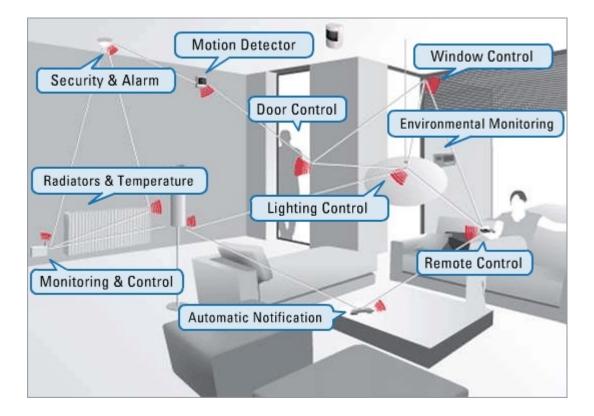
Controllers embedded in lighting, HVAC, and security equipment communicate with each other via a local area network. Each building is then connected to the Internet through a gateway that is protected by a security firewall. Because these networked building systems offer remote control capabilities, facility managers can monitor and control their buildings from any location with a Web connection. They can also manage multiple sites simultaneously or aggregate them for load control. Connecting a BAS to the Internet allows it to communicate with other computer applications such as online weather-forecasting services. The concept of enterprise-wide management for facilities throughout the world is exciting, whether it concerns the management of HVAC control for building comfort, fire and physical safety, security, or buying power.



Security Systems

- It is a multi level security system.(physical security).
- They have access control.
- All the employees are provided with access cards.
- The CCtv's are placed at all the gates and these are monitored at the reception.

Security Systems



Integrated Fire Alarm Systems

- Each room has a fire alarm which detect the smoke. It is also provided with the sprinkler system.
- These sprinklers will not be in server room
- The fire extinguishers will be different in server room. A mock fire drill is conducted every month.
- Fire extinguishers are placed every corners and 10m at suitable accessible place as per fire norms

Integrated Air Conditioning with sensor based exhausts and oxygen monitoring sytem

- The air chillers which are placed at the top of the building d cool air to the A.H.U(Air Handling Units) which are provided at all the levels.
- There are "N", N>4 A.H.U's in each level.
- The cool air is distributed to the entire level from the A.H.U's.
- CHP Integrated system

Server Room

- This is the main part in an IT room in which all the data is stored.
- This room cannot be accessed by everyone. It has a passcode and access card to enter.
- 18 degrees is maintained in the rooms through Precession Air Conditions with redundant System to ensure 24x7 and 5 start data center guidelines.

Server Room

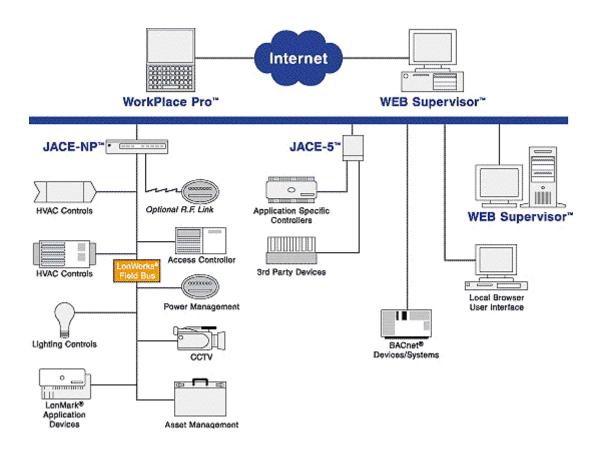


Due to the fast increasing requirement of information management in all kinds of industries, people are building more and more large data centers all around the world. Usually the large data center is bigger than 500 m2 and the numbers of racks inside is a large number. The requirements for power system include high power, high reliability, easy for upgrading and etc.

Integarted Power Systems

- The main power comes from the electricity board.
- Automatic switch on and off generators
 systems if one failed the other works.
- The main power will be sent to UPS (which has 120 min backup).
- Each cabin has 5 power sockets
- Microgrid Controller System

Integrated Systems



Network Integration with Demand Response

Significant imbalances between electricity supply and demand can destabilize the grid or cause severe voltage fluctuations and failures. Demand response, the reduction of electric demand from the grid, can relieve system stress and help prevent blackouts and brownouts. Demand response played an active role in managing energy events in various parts of the United States during the summer of 2006. Aggregating demand response efforts across a region has historically been a time-consuming and laborintensive process. EnerNOC uses its Network Operations Center (NOC), in Boston, MA to remotely manage electricity consumption across a network of end-use customer sites and make energy available to grid operators and utilities on demand. Echelon's i.LON® Internet Server, when installed at commercial, institutional, and industrial customer sites, can enhance EnerNOC's technology by enabling a direct wireless connection from the NOC to building and energy management systems.



Internet Protocols

- <u>DeviceNet</u> Interconnect Control Devices
- <u>SOAP</u> Simple Object Access Protocol
- <u>XML</u> eXtensible Markup Language
- BACnet Building Automation Controls
- LonWorks Local Operational Networks
- Modbus Serial Communication Protocol

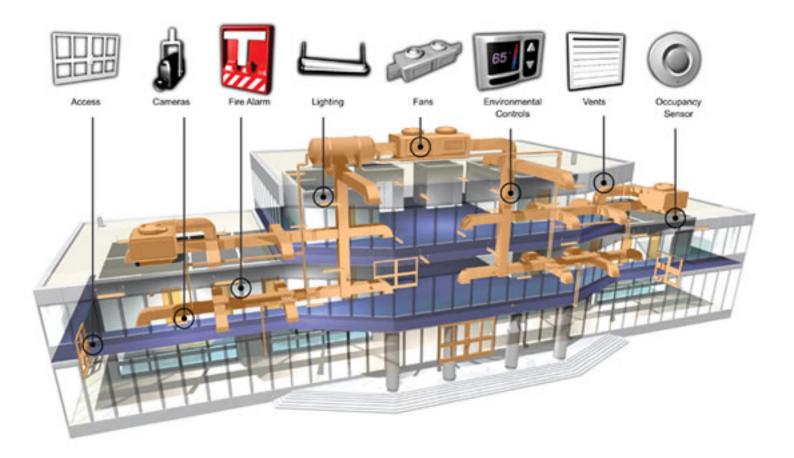
LonWorks

LonWorks (local operation network) is a networking platform specifically created to address the needs of control applications. The platform is built on a protocol created by <u>Echelon Corporation</u> for networking devices over media such as <u>twisted</u> pair, powerlines, fiber optics, and <u>RF</u>. It is used for the automation of various functions within buildings such as <u>lighting</u> and <u>HVAC</u>; see <u>Intelligent building</u>.

The Lon Works and other open Protocol

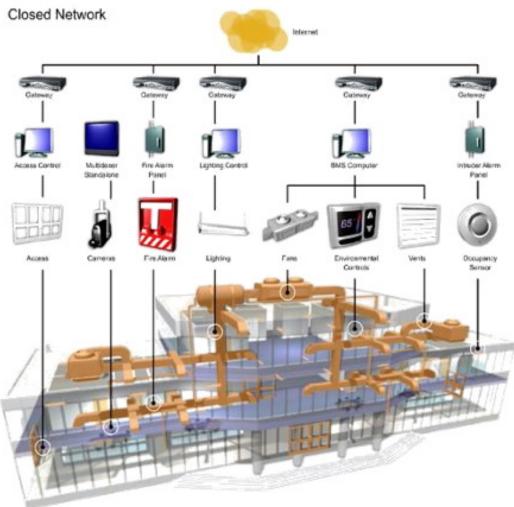
 The LonWorks[®] protocol provides services at each layer of the OSI seven layer reference model. The protocol is open for anyone to implement, and a reference implementation in the C programming language can be obtained from CEA. Since its invention, the protocol has become an ANSI standard, an IEC standard, a Chinese national standard, and recently has achieved ISO standardization

LONtalk Network

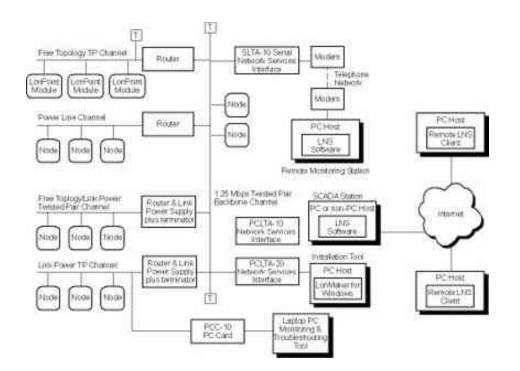


LONtalk Network

LonTalk is a protocol optimized for control created by Echelon Corporation for networking devices over media such as twisted pair, powerlines, fiber optics, and RF. It is popular for the automation of various functions in industrial control, home automation, transportation, and buildings systems such as lighting and HVAC; see Intelligent building. LonTalk is defined by ANSI Standard ANSI/CEA 709.1. The LonTalk protocol has been ratified by standards setting bodies in the following industries & regions: ANSI 709.1 - Control networking (US) EN 14908 - Building controls (EU) GB/Z 20177.1-2006 - Control networking and building controls (China) **IEEE** 1473-L - Train controls (US) SEMI E54 - Semiconductor manufacturing equipment sensors & actuators (US) IESE - International forecourt standard for EU petrol stations



What's a LON Works?

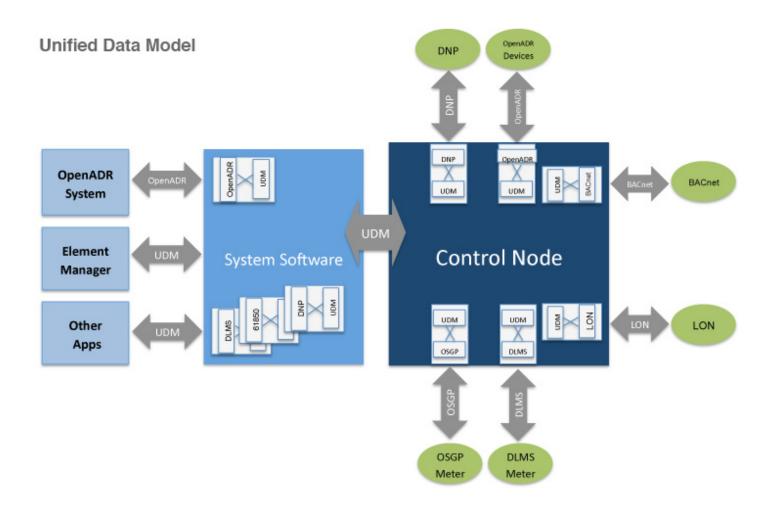


What's a LonWorks?

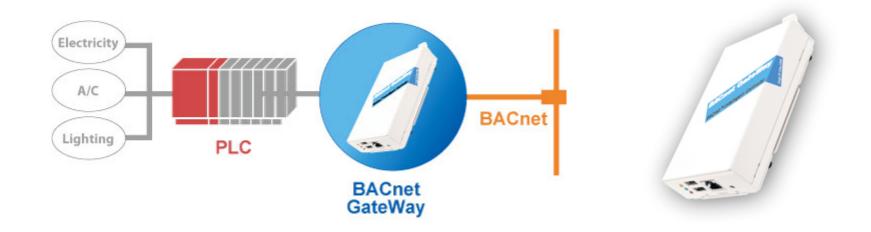
Let's take a quick look at control networks and LonWorks. A simple definition for a control network is: any group of devices working in a peer-to-peer fashion to monitor sensors, control actuators, communicate reliably, manage network operation, and provide complete access to network data. Control networks provide deterministic timing of commands, responses, events, and data transfers. LonWorks is based upon the LonWorks protocol, also known as the EIA 709.1 Control Networking Standard. Neuron chipsets are used in transceivers for communicating across LonWorks. LonWorks consist of devices such as:

•Network Interfaces => Control Modules => LonPoint Modules => Routers

Control Operating System (COS)

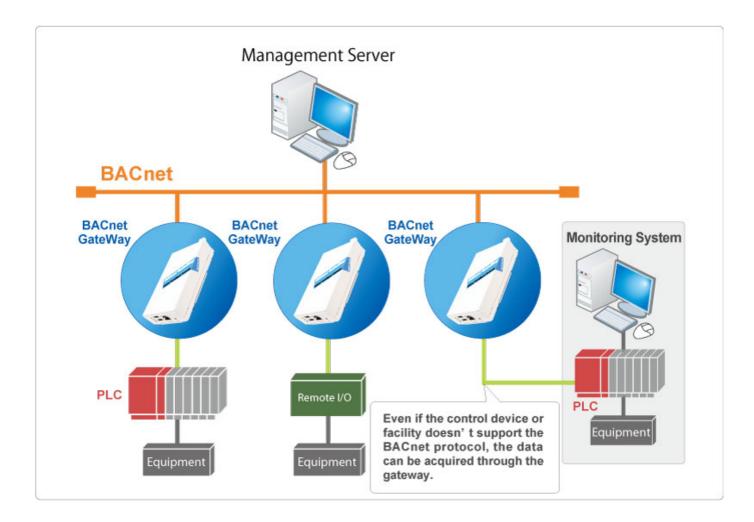


BACnet Components



BACnet is a communications protocol for building automation and control networks. It is an ASHRAE, ANSI, and ISO standard protocol. Facilities like electricity, air conditioning and lighting can be centrally supervised by using BACnet protocol. PLC Stands for Programmable Logic Controller. A sequence control device, used to control equipments by sequentially executing the programmed instructions planted beforehand with a computer or input device.

BACnet Network Diagram



Modbus

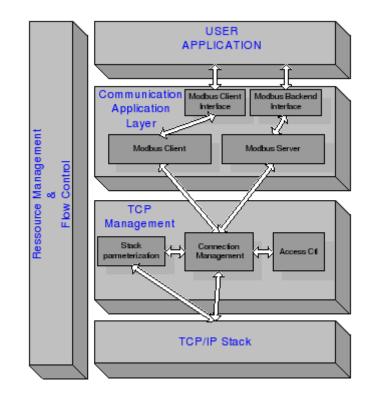
Modbus is a serial <u>communications protocol</u> published by <u>Modicon</u> in 1979 for use with its <u>programmable logic controllers</u> (PLCs). Simple and robust, it has since become a <u>de facto</u> <u>standard</u> communication protocol, and it is now amongst the most commonly available means of connecting industrial <u>electronic</u> devices. The main reasons for the extensive use of Modbus in the industrial environment are:

- It has been developed with industrial applications in mind
- It is openly published and royalty-free
- It is easy to deploy and maintain
- It moves raw bits or words without placing many restrictions on vendors

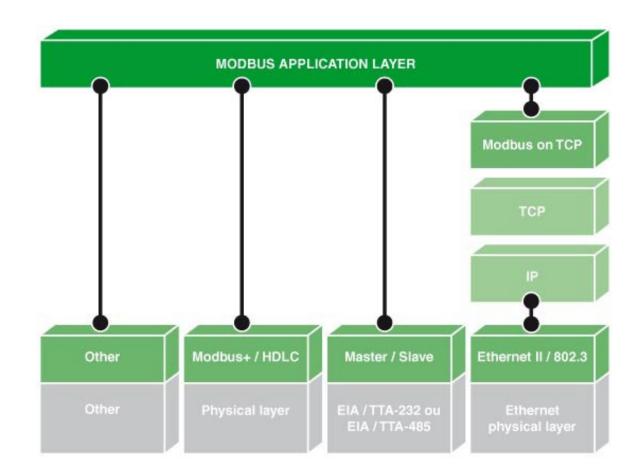
Modbus allows for communication between many (approximately 240) devices connected to the same network, for example a system that measures temperature and humidity and communicates the results to a <u>computer</u>. Modbus is often used to connect a supervisory computer with a <u>remote terminal unit</u> (RTU) in <u>supervisory control and data acquisition</u> (SCADA) systems.

Modbus Architecture

Modbus RTU is an open, serial (RS-232 or RS-485) protocol derived from the Master/Slave architecture. It is a widely accepted protocol due to its ease of use and reliability. Modbus RTU is widely used within Building Management Systems (BMS) and Industrial Automation Systems (IAS). This wide acceptance is due in large part to MODBUS RTU's ease of use.



http://www.rtaautomation.com/modbusrtu/



Modbus Diagram

Modbus is a message handling structure introduced by Modicon in 1979. Modbus is an application level protocol based on the OSI model. It is independent of the physical layer.

Summary

- Building Automation Systems help keep buildings operating at higher efficiency
- Also provide for security and comfort
- EMS/BMS ensure that energy is not being used at the wrong time / or when not needed
- EMS/BMS can be integrated with DEMS to provide Automated Demand Response (ADR)
- MicroGrid Controller System

DRAFT and BASIC /Tentative Functional Design Specification for automation and integration of various services in Net-zero Campus of Nalanda University.

EPC Main Contractor- Design and seek approval from NU

Project Name: Electrical SCADA System for Nalanda University

Project Description: Integrated Centralized SCADA and automation

outline requirement

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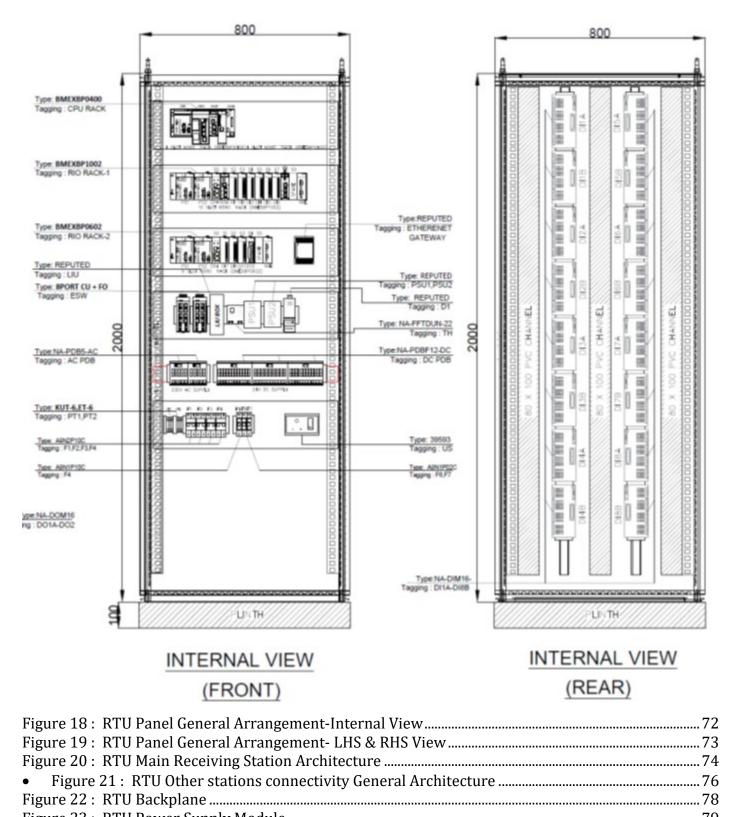


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1 Introduction and General information

1.1 Introduction

Nalanda University, Rajgir intends to establish centralized monitoring and control system through state-of-the-art SCADA system and automation at various 33 KV, 11 kV and 415V substations. The proposed project intends to provide substation automation for controls, monitoring and protection system to enhance operational reliability and security.

The campus is receiving power from 33kV Grid Incomer to cater the total demand power and further distribution is done via 33/11kV Substation. The list of differ Substation that are part of the campus power distribution system are

- 1. Main Receiving Station 33 & 11 kV HT Panel
- 2. Solar Station 11 kV HT Panel
- 3. Central Station 11 kV Distribution station
- 4. Academic Block Sub station
- 5. Sports Complex Sub station
- 6. International Centre Sub station
- 7. Faculty Housing Substation
- 8. Student Housing Sub station
- 9. Outreach Substation

Central Command Centre for SCADA is planned at central power station. Campus is designed to archive Annual Net-zero & hence various solar setups are included in the total system. Power to be managed such a way that majorly power to be drawn from inhouse sources only & supply company's power only shall be drawn in case of additional requirement during peak or any major fault in inhouse sources. SCADA will be the key parameter to this & other concepts for power management.

1.2 Existing System

Existing system in Nalanda university like Water Management system, Existing BMS system, Lighting and Electrical Protection & distribution System, HVAC, Plumbing Systems and Firefighting

system shall be interfaced with SCADA/DMS system through communication for the purpose of status monitoring.

1.3 Generic System Architecture

Below find the Generic System Architecture which provides us the representation of the system. The detailed system architecture is can be found in Annexure-1.

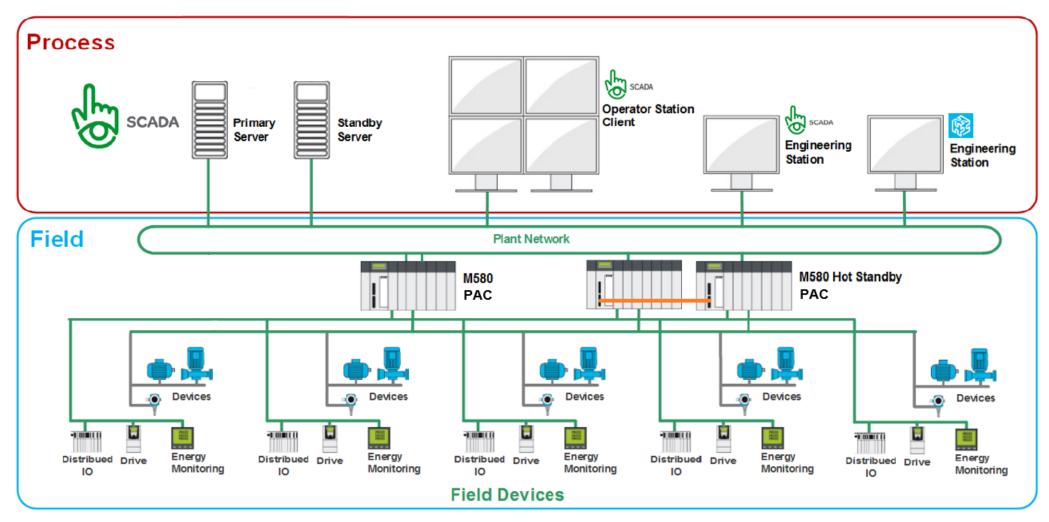


Figure 1: Generic System Architecture



Functional Design Specification

Project: Electrical SCADA for Nalanda University Package 4B



1.4 Proposed SCADA/DMS System

The proposed solution consists of a redundant central SCADA/DMS system at central command centre location connected to the PLC based RTU system at substation level. M580 based Hot Standby PLC is considered in substation to control and monitor the High Side electrical works, each substation having the HMI for local level control in case of communication failure from central SCADA.

Proposed PLC system in Substation having the facility to store the data for 1 month by using the Schneider NOR modules in local level, PLC communication is established with central SCADA in 2 Ways:-

1. Hardwired – Redundant Fibre based network.

2. RTU is integrated with Modems for wireless communication in case of fibre communication failure.

In SCADA, we are using 2 Nos. of Operator Workstation servers in redundant configuration along with 5 Nos. of web clients, for future expansion our system is designed and capable up to -100% additional tags. One Engineering workstation is provided.

1.5 Broad Role Definition of SIA

The SCADA/DMS Implementation Agency (SIA) in coordination with Employer (as per the requirement to be given in the detailed Tender specification) shall carry out field survey, design ,engineering, supply, installation, testing & commissioning of SCADA/DMS software applications, hardware (including PCs, Servers, Routers, Switches, VPS, RTU, Multi-function Transducers (MFTs), Communication equipment, Auxiliary power supply etc), software (including operating system, databases, etc.), network (LAN,), etc. Integration with existing /under implementation IT system & any other defined system interface which are defined in the Tender specification.

1.6 Reference Documents

This document is best understood with the listed documents available, and they will be referenced to in this document text when relevant.

Table 1: Reference Documents

Sl. No	Document No.	Document Title
1	4Bts	Technical Specifications
2	Annexure S R1- FOR REFERENCE ONLY	Tender IO Summary
3	SCADA ARCHITECTURE	Tender SCADA Architecture

1.7 Abbreviations

Table 2 : List of Abbreviations			
Acronym	Definition / Description		
AC	Alternating Current		
ACB	Air Circuit Breaker		
AMF	Auto Main Failure		
CSS	Compact Sub-Station		
DB	Distribution Board		
DC	Direct Current		
DCDB	Direct Current Distribution Board		
DER	Distributed Energy Resources		
DG	diesel generator		
DMS	Distribution Management System		
DR	Disaster Recovery		
EPC	Engineering, procurement, and construction		
FO	Fibre Optic		
FPI	Fault Passage Indicator		
FRTU	Feeder Remote Terminal Unit		
HT	High Tension		
HVAC	Heating, ventilation, and air conditioning		
IEC	International Electrotechnical Commission		

Acronym	Definition / Description	
IED	Intelligent Electronic Device	
IGBT	Insulated Gate Bipolar Transistor	
ITC	Installation, Testing and commissioning	
LAN	Local Area Network	
LDMS	Local Distribution Management System	
LT	Low Tension	
МСВ	Miniature Circuit Breaker	
МССВ	Moulded Case Circuit Breaker	
MFM	Multifunction meter	
MTBF	Mean Time Between Failure	
MTTR	Mean time to Repair	
NIT	Notice Inviting e-Tenders	
NU	Nalanda University	
OEM	Original Equipment Manufacturer	
OPC	Object Linking and Embedding for process control	
PLC	Programmable Logic Controllers	
RDBMS	Relational database management systems	
RMU	Ring main unit	
RTU	Remote Terminal Unit	
SCADA	A Supervisory control and data acquisition	
SDLC	Software Development Life Cycle	
UPS	uninterruptible power supply	
VCB	vacuum circuit breaker	
VPS	Video Projection System	
WAN	Wide Area Network	
FAT	Factory Acceptance Test	
SAT	Site Acceptance Test	

1.8 Standard

Sl. No	Standard	Description
1	IEC 61850	Communication for Intelligent Electronics
I	IEC 01050	Devices (IED)
2	NEC- 2008	National electrical code.
3	NBC-2016	National building code.
4	IER-1956	Indian electricity rules.
5	IEA-2007	Indian electricity act 2007.

Table 3: Applicable standards

2 SCADA Functions

2.1 General Requirements

List of major Modules of SCADA/DMS system as per the technical specifications.

- 1. SCADA –Control Centre (Centralized for all end /remotely installed equipment operation, monitoring and control as well)
- LDMS-Local Distribution Management System –with both way connectivity and control a. SCADA-Control Centre and b. Local sub-station level also
- 3. Overall Distribution Management and Control System -DMS
- 4. Load management System (Balanced and Unbalances, Critical and Non-Critical, DG set synchronization as a backup power and fuel monitoring system)
- 5. Weather monitoring system
- 6. Substation, feeder, area and building wise energy audit system along with the Billing Module for at least 1000 residents. The communicable meter for reading through RTU/SWITECS of the resident shall be provided and installed by the University.
- 7. Micro-grid Module
- 8. SLDC module
- SCADA-Control Centre (with wall size display, server (main server OPC type so that various modules will be integrated without any gateway), Engineering station/engineering laptop, Monitor console –as per the design confirmation)
- 10. Disaster Recovery/Data recovery System A data backup server with storage space at cloud for five years shall be maintained. The required internet services with dedicated bandwidth for cloud connectivity shall be provided by the University.
- 11. Water management modules.
- 12. This scope of the contractor includes all the equipment's, hardware, software and services covered under supply, installation and commissioning of centralized SCADA with LDMS substations level, minimum 5 no's authorized access through cloud & Wi-Fi access plus Substation Automation system including control & monitoring and other related aspects of substation operations for efficient and trouble-free operation

Conceptually Electrical distribution system is segregated into following major parts

- 1. Lighting, Electrical protection and distribution system.
- 2. HVAC
- 3. Plumbing System
- 4. Fire Fighting System

A Central power station on 11 KV level which will be a central command centre for electrical power distribution. The SCADA centre will be a part of this Central location.

To cater the total demand of the campus, 33KV will be received to the campus and further distribution takes place via 33 / 11 KV Central Sub-station.

There are 6 source sub-stations as listed below

- 1. Main Receiving Sub-station (33 KV & 11 KV)
- 2. Central Power Station
- 3. Solar Plant 1 Sub-station
- 4. Solar Plant 2 Sub-station (In Future Ph II)
- 5. CHP Plant 1 Sub-station (In Future)
- 6. CHP Plant 2 Sub-station (In Future Ph II)

Different load connected is distributed on 11 KV by Ring main system as listed below. Phase I development is

- 1. Academic Sub-station
- 2. International Centre Sub-station
- 3. Sports Area Sub-station
- 4. Student Housing Sub-station

- 5. Faculty Housing Sub-station
- 6. Outreach Sub-station
- 7. Library area Compact Sub-station
- 8. Expansion of Academic area Sub-station (In future Ph II)
- 9. Expansion of Student Housing Sub-station (In future Ph II)
- 10. Expansion of Faculty Housing Sub-station (In Future Ph II)

Above listed Substations are having following major equipment's

- 1. 33 & or 11 KV HT Panels
- 2. 33/11 KV & or 11/415 KV Transformers & RMU
- 3. 415 Volts LT Panels
- 4. UPS & Battery Setup for Sub-stations
- 5. 415 Volt DG Sets

SCADA shall also be integrated with third party equipment's / systems:

- 1. Water Storage & other plumbing drainage stations
- 2. Fire Fighting Pump room stations
- 3. Solar Farms
- 4. Roof top Solar setups
- 5. BMS (Integration / duplication of data on SCADA monitoring system)

During normal operation non-critical system with run over solar power supply. Once total load of non-critical system will be greater than solar system capacity then operator / Auto-System will give on command from central SCADA to close incoming 33KV HT breaker panel. During emergency when solar and grid supply will fail operator / Auto-System will give start command to DG from central SCADA.

2.2 Design Requirements

The software will be working on an 64-bit architecture platform 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.

The adjustments made to parameters by the user or programmer will become effective without any requirement of or recompile programs or regenerate all or portions of the database.

The software has been defined with user function w.r.t accessibility. There is different user category as detailed in "section 7.2 User Interface Requirements". The function can be classified as below. All such actions shall be recorded as events in the event log.

1. Single-user function

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.

2. Multi-user function

For a multi-user function any number of users, up to the maximum designated for the function, may have access to the function simultaneously.

2.2.1 SCADA/DMS Function Access

Supervisory Control And Data Acquisition (SCADA) system is the heart of Distribution Management System (DMS) architecture.

Central SCADA Control System should have all the infrastructure elements to support the multifaceted nature of distribution automation in 9 Nos. of Substations and the higher-level applications of a DMS. A Distribution SCADA system's primary function is in support of distribution operations over the redundant network of fibre as well the telemetry operation, alarming, event recording, and remote control of field equipment.

The main elements of a DMS system are:

- 1. Host equipment.
- 2. Communication infrastructure (network and serial communications).

3. Feeder Terminal Units devices for operations.

2.2.1.1 Host Equipment

The essential element of a distribution SCADA in proposed solution:-

- 1. Host servers (redundant servers with backup/failover capability).
- 2. Communication front-end nodes (network based).
- 3. Full graphics user interfaces.
- 4. Database Central SCADA Server

2.2.1.2 Communication infrastructure

The SCADA / DMS is connected with the Sub-Station equipment via following protocols over the fibre backbone as primary communication interface and wireless network as secondary communication interface.

 For LDMS / PLC : The data will be transmit over the Modbus TCP/IP protocol from the PLCs at Sub-station to SCADA / DMS
 For MFT's : The data will be transmitted over Modbus RTU Protocol to

PLC's at Sub-station.

- 3. For DR & third-Party Systems : The data will be transmitted over OPC-UA
- 4. Existing System(like BMS etc.,) : The data will be transmitted over OPC-UA
- 5. For IT Systems : The data will be transmitted over OPC-UA

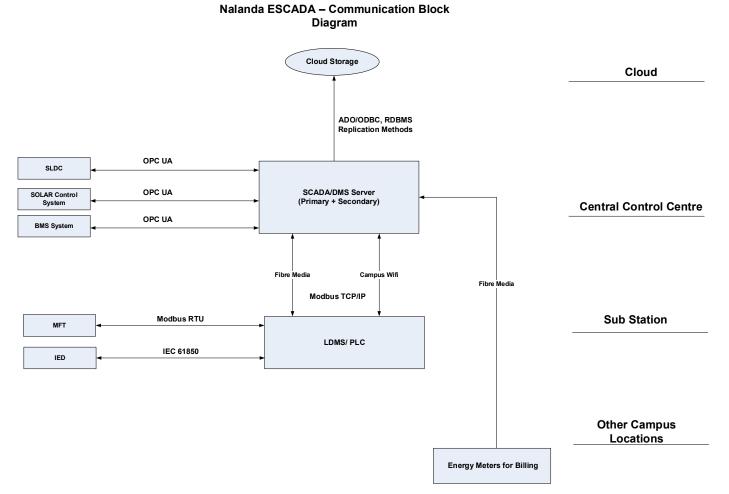


Figure 2 : Communication Block Diagram

2.2.1.3 Feeder Terminal Units devices for operations

RTU's are the main components of the distribution automation system to control and monitor the feeder terminal units, which meet specific operating and data gathering requirements. Each field devices provides the data for the system operations, includes fault detection, captures planning data and records power quality information.

2.2.1.4 Database Central SCADA Servers-

For archival of historical power system values, SCADA automatically compiles and delivers information for the 9 Nos. of Substation to a central control centre. This system sends digitized information in real time, and it also automatically compiles backlogs of all collected data for the analysis. This will be done over SQL database.

Collecting data from the distributed substations from the feeder terminal units allows to detect potential problems before they affect your workflow. RTUs will send the gathered information to central control centre.

2.2.2 Critical / Non-Critical Function

System is classified as Critical or as Non-Critical. All critical functions are redundant w.r.t hardware and software so that no single hardware & /software failure will interrupt the availability of the functions.

The proposed solution consists of a redundant central SCADA/DMS system at central command centre location connected to the PLC based RTU system at substation level. M580 based Hot Standby PLC is considered in substation to control and monitor the High Side electrical works, each substation having the HMI for local level control in case of communication failure from central SCADA.

Generally following are classified as Critical functions

1. SCADA Applications

SCADA application at central command centre executes data acquisition from PLC system and enables execution of all control and monitoring activities.

2. DMS Applications

Distribution Management functionality for the HT and LT distribution scheme is part of the SCADA application in Central Command Centre.

3. Web server Applications

Web server Applications is a feature of SCADA application which provides the operator with functionality for monitoring the SCADA/DMS system through the standard web browser on any computer connected with the SCADA/DMS network

4. Security applications

Security applications enables the access of the SCADA application functionality to manage user access control.

5. Network Management system (NMS)

SCADA/DMS System at central command centre is capable of integration with Network Management system over SNMP Protocol.

6. Data recovery function (DR)

Data/ Disaster Recovery Functionality is a feature of the system which enables cloud based data storage to enable geographical redundancy of the system data that can be used to recover the system in the event of a system failure at campus.

Following functions are classified as non-Critical

- Dispatcher Training Simulator (DTS) Not part of supplied scope.
- Database modification and generation
 Functionality of Engineering workstation to execute modification/ configuration
 updates in the database server.
- Display modification and generations
 Functionality of Engineering Workstation to execute display modification and generation.
- 4. Report modification and generation

Functionality of SCADA/DMS system to generate required reports as required by the operator.

2.3 SCADA Function

All input data and parameters, entered by an user or collected due to polling, 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 an 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.

Below is the sample representation of the overall connectivity of the system. The SCADA / DMS System is connected to multiple PLC based RTUs. SCADA / DMS / DMS provides two levels of clients. A Control Client has the complete functionality of the application to view any screen and read and write any variable controlled through the SCADA system. This makes the Control Client the perfect tool for operators. A View-only Client is able to view all information within the SCADA system but is unable to write to any variable or execute code to communicate with another server. This makes the View-only Client perfect for upper management, process optimisation or causal users of the control system. Readonly access is also available via a Control Client using project security.

Both levels of SCADA / DMS clients are used to display control system information. Within the control room, the complete SCADA / DMS client application is installed onto a machine. These machines are dedicated to running the control system and an application interface provides the maximum viewable space for visualisation and the fastest possible response.

Web Clients allow users outside the control room to access control system data in real time. The Web Client is a completely functional client with an identical interface to the dedicated Control Clients (displayed within a web page), which requires zero maintenance. The client controls and project are downloaded from the website and project updates will automatically be synchronised with the Web Clients.

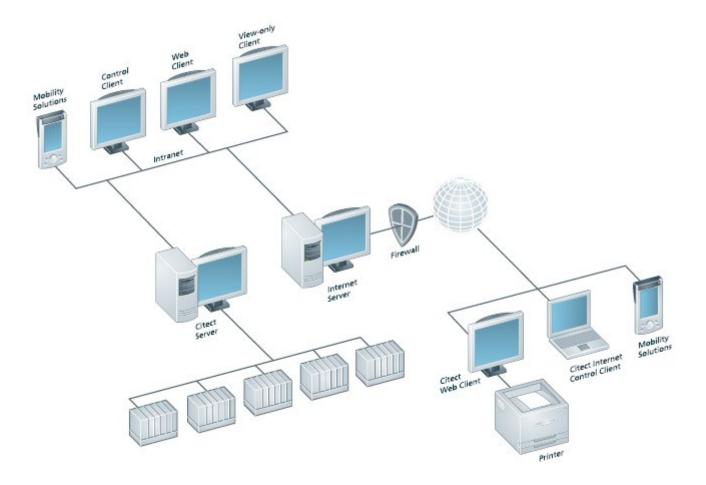


Figure 3 : Sample communication architecture

Proposed SCADA system contains redundant SCADA system. The data transferred between SCADA and PLC's shall be using redundant communication with primary via Fiber optic and the redundant communication over Campus WIFI network.

2.3.1 Data Acquisition

The Field equipment hardware IO points are monitored by the PLC application program and the monitored data values are transferred to the SCADA application IO server through OFS OPC communication driver.

2.3.1.1 Polling Method

Digital status data from Sub-stations will be updated and displayed on real time within 3 seconds. Digital status data shall have higher priority than the Analog data. The system shall have dead band for data by exception.

Different polling methods implemented as part of the SCADA/DMS system are:

- Cyclic polling method is adopted for scanning of hardwired input and output status as per the PLC program scan time in milliseconds. The scan time of the application shall be derived with finalization of detailed application design and simulation testing during the execution of Factory Acceptance Testing.
- 2. Cyclic polling method for analog data read as soft points shall be scanned at a sampling rate in seconds defined application program. The sampling rate shall be such that the required storage rate of 2 minutes interval shall be implemented.
- 3. Calculated energy values shall be collected by cyclic polling method for OPC tag groups shall be defined at the OFS OPC communication drivers of the SCADA IO servers such that the measured values in the PLC system at the substation level shall be updated for the operator in 3 seconds.

2.3.1.2 Telemetry Failure

SCADA/DMS system shall interface with the PLC based RTU system at substation level through redundant fibre network as the primary method of communication. In case of fibre network communication failure, the campus Wi-Fi wireless network shall be used for data transfer. At each Sub station location, PLC based RTU system contains a wireless interface module as part of the system which will establish the communication with campus wireless network provided by the customer.

The SCADA IO server shall accept the data from the PLC system at substation level through the IP address of the wireless interface module when communication link fails over the fibre-based network. Communication over fibre network shall be the primary mode of communication, hence SCADA/DMS system shall switch to communication over the fibre network once the media is available.

If data is not received from PLC 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. Quality codes shall be detailed during detailed design specification.

The following modes of data acquisition are supported:

- 1. Enable: When CHPS/SOLARS SS/ LDMS/VCBS/RMUS/RTU/FRTU/FPI is enabled, the data is scanned in normal fashion and control command execution is allowed.
- 2. Disable: When GENERATORS/ LDMS/RTU/FRTU/FPI is disabled, the data scanning & control execution is disabled. This is equivalent to" delete from scan "of complete PLC.

2.3.2 Time Synchronization of RTU

GPS time server shall be connected to the redundant networks switch at central command centre. NTP Time server in this unit shall function as the primary source for time synchronization by all other sub systems of SCADA/DMS system. RTU systems at substation level shall contain an NTP client application component which shall access the NTP time server IP over the ethernet communication interface between substation and central command centre.

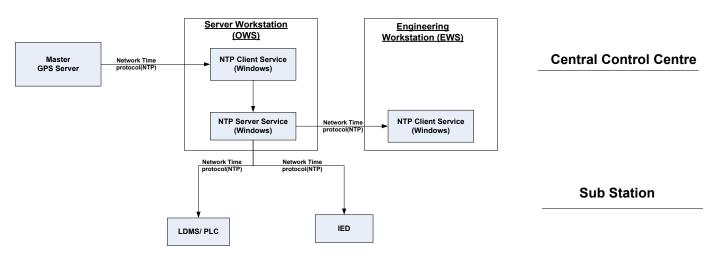


Figure 4 : Time synchronization scheme

2.3.3 Data Exchange

2.3.3.1 SCADA/DMS system with IT

The different IT systems that are part of SCADA/DMS system at central command centre are connected to the managed switch installed. The managed switch at this level shall be integrated as part of the campus IT network for connection of Web client and cloud-based disaster recovery system.

The Data Centre, DR Centre and Customer Care Centre under IT System, shall exchange data with the ISR System, using OPC-UA , ADO/ODBC , RDBMS replication methods.

2.3.3.1.1 Operator Workstations (OWS)

Two numbers of Operator Workstation servers are considered as part of the proposed solution. This operator workstation server has the SCADA application server and SCADA client application installed. The SCADA client application will be the user interface for the operation of Electrical SCADA system by the operator. The Hardware specification of the operator workstation is as below.

Sl.NO	Specification	Quantity
1	Intel® Xeon® , 1 X 16 GB RAM, C3, RAID 1 for 2 HDDs, 2 X 1TB	
	SATA, 3.5" Chassis up to 8 Hot Plug Hard Drives, 4 NIC Port, OS	2
	Windows Server , Redundant Power Supply,	
2	DELL 24 MONITOR E2420H : Maximum Resolution 1920 x 1080	
	Colour depth: 16.7 Million Viewing Angle 178°/178° Tilt Only (-5°	2
	to 21°)	

2.3.3.1.2 Engineering Workstations (EWS)

The Engineering workstation is a system which shall be used for configuration and modification of SCADA Application. The Hardware specification of the identified Engineering workstation is as below.

Table 5: EWS System HW Specification

Sl.NO	Specification	Quantity

	10th Generation Intel® Core [™] i7, 8 GB RAM, 1TB SATA Hard Disk	
1	Drive, Windows 10 Professional 64 bit, Raid -1 Configuration, 4	1
	NIC ports, Redundant Power supply, DVD/ CD R-W.	
	DELL 24 MONITOR E2420H : Maximum Resolution 1920 x 1080	
2	Colour depth: 16.7 Million Viewing Angle 178°/178° Tilt Only (-5°	1
	to 21°)	

2.3.3.2 For data exchange between SCADA/DMS control centres & DR centre, SLDC

State Load Dispatch Centre communication interface shall be provided at the network switch in Central command centre. Data exchange with SCADA/DMS system shall be OPC communication protocol. It shall exchange the following data

- 1. Real-Time data
- 2. Calculated data
- 3. SOE data
- 4. Historical data
- 5. Event / Alarm lists

2.3.4 Data Processing

SCADA/DMS system has PLC based RTU system at substation level which shall process hardwired signals connected to digital input and output modules. The analog data processing in the system shall be processed as soft data over communication interface.

The data acquired from PLC's shall be analysed 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.

It is envisaged that the utility will 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.

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

- 1. Real-time data received from control centres /IT system (data centre, customer care, DR centre and PLCs etc)
- 2. Calculated data
- 3. Manually entered data
- 4. Sequence of events data
- 5. Alternate data sources

2.3.4.1.1 Analog Data processing

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

2.3.4.1.2 Zero dead band processing

SCADA/DMS system 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.

2.3.4.1.3 Reasonability Limit Check

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 when 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.

2.3.4.1.4 Limit Monitoring

The 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. Emergency limit shall 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 an alarm message shall be generated. 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 authorized user shall be able to temporarily override any of the above limits (which are in use) by entering a new value. When the authorized 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 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-initialised. Any change in alarm states resulting from a change in limit value shall be reported. The limit shall be finalise & approved for implementation.

2.3.4.1.5 Rate of change /Gradient

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

2.3.4.1.6 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.

2.3.4.1.7 Accumulator Processing

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.

The Typical Analog signals processed in SCADA/DMS system are as listed below

2.3.4.1.8 Typical Soft I/O - Multifunction Meter (Modbus RTU - RS-485)

Sl. No.	Modbus (MFM) Electrical Parameters
1	L1 Phase Currents
2	L2 Phase Currents
3	L3 Phase Currents
4	L1N Phase Currents
5	L2N Phase Currents
6	L3N Phase Currents
7	L1 Phase Voltage
8	L2 Phase Voltage
9	L3 Phase Voltage
10	L1N Phase-Neutral Voltage
11	L2N Phase-Neutral Voltage
12	L3N Phase-Neutral Voltage
13	vTHD (%) Phase Voltage Harmonic distortion
14	iTHD (%) Phase Current Harmonic distortion
15	Aunb (%) Phase Current unbalance
16	Active Power (kW)
17	Reactive Power (kVAr)
18	Apparent Power (kVA)
19	Power Factor (PF)
20	Displacement Power Factor (dPF)
21	Peak Current (Apk)
22	Energy (kWh)

Table 6 : Typical Soft I/O's - Multifunction Meter

2.3.4.1.9 Typical Soft I/O's - Numerical Relay (IED) - Feeder Protection Relay (IEC 61850)

Table 7: Typical Soft I/O's – Numerical Relay (IED) – Feeder Protection Relay

Sl. No.	Numerical Relay (IED) Feeder Protection Relay
1	Overcurrent
2	Earth fault
3	Overvoltage
4	Undervoltage
5	Frequency
6	CT / PT supervision
7	Phase sequence

Sl. No.	Numerical Relay (IED) Feeder Protection Relay
8	Broken conductor protection

2.3.4.1.10 Typical Soft I/O's – Numerical Relay (IED) – Transformer Protection Relay (IEC 61850)

Table 8: Typical Soft I/O's - Numerical Relay (IED) - Transformer Protection Relay

Sl. No.	Numerical Relay (IED) Transformer Protection Relay
1	Differential
2	Restricted earth fault
3	High oil temperature
4	High winding temperature
5	Sudden pressure

2.3.4.2 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:

- 1. 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.
- 2. 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
- 3. 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:

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

- a. Open/Closed
- b. Tripped/Closed
- c. Alarm/Normal
- d. On/Off
- e. Auto/Manual
- f. Remote/Local
- g. On Control/Off Control

The list of different digital inputs and outputs processed by the SCADA/DMS system are listed as topicals below.

2.3.4.2.1 Typical I/O - Transformer Type 1 Breaker

Typical I/O - Transformer Type1 Breaker		
Sl. No.	Monitoring Inputs	Туре
1	Breaker Local/ Remote Selection Switch Feedback Status	VFC
2	Breaker On/Close Feedback Status	VFC
3	Breaker Off/Open Feedback Status	VFC
4	Breaker Direct Control Feedback Status	VFC
5	Breaker Trip Feedback Status	VFC
6	Breaker Spring Charge Feedback Status	VFC
7	Breaker Ready to Close (RTC) Feedback Status	VFC
8	Breaker Control Supply Healthy (CSH) Feedback Status	VFC
9	Breaker Service/ Test Position Feedback Status	VFC
10	Earth Fault Feedback Status	VFC
11	Trip Circuit Healthy Feedback Status	IEC 61850
12	Under Voltage Trip Feedback Status	IEC 61850
13	Emergency Trip Feedback Status	IEC 61850
14	PT Fuse Fault Feedback Status	IEC 61850
15	Protection Relay Feedback Status	VFC
16	Upstream Breaker Trip Feedback Status	VFC
17	Oil Temperature Indication (OTI)	RS-485
18	Wind Temperature Indication (WTI)	RS-485
19	Buchholz relay trip	VFC
20	MOG Trip	VFC

	Typical I/O - Transformer Type1 Breaker	
21	PRV Trip	VFC
Sl. No.	Control Commands	Туре
1	On/ Close	VFC
2	Off/ Open	VFC
3	Tip Coil	IEC 61850
4	Emergency Trip Coil	IEC 61850
Sl. No.	Communication Devices	Туре
1	MFM	RS-485
2	Protection / numerical Relay	IEC 61850

2.3.4.2.2 Typical I/O - HT Type-1 Breaker

Table 10: Typical I/O's – HT Type-1 Breakers

	HT Breaker	
Sl. No.	Monitoring Inputs	Туре
1	Breaker Local/ Remote Selection Switch Feedback Status	VFC
2	Breaker On/Close Feedback Status	VFC
3	Breaker Off/Open Feedback Status	VFC
4	Breaker Direct Control Feedback Status	VFC
5	Breaker Trip Feedback Status	VFC
6	Breaker Spring Charge Feedback Status	VFC
7	Breaker Ready to Close (RTC) Feedback Status	VFC
8	Breaker Control Supply Healthy (CSH) Feedback Status	VFC
9	Breaker Service/ Test Position Feedback Status	VFC
10	Earth Fault Feedback Status	VFC
11	Trip Circuit Healthy Feedback Status	IEC 61850
12	Under Voltage Trip Feedback Status	IEC 61850
13	Emergency Trip Feedback Status	IEC 61850
14	PT Fuse Fault Feedback Status	IEC 61850
15	Protection Relay Feedback Status	VFC
Sl. No.	Control Commands	Туре
1	On/ Close	VFC
2	Off/ Open	VFC
3	Tip Coil	IEC 61850
4	Emergency Trip Coil	IEC 61850
Sl. No.	Communication Devices	Туре
1	MFM	RS-485

HT Breaker		
2	Protection / numerical Relay	IEC 61850

2.3.4.2.3 Typical I/O – HT Type-2 Breaker

Table 11: Typical I/O's – HT Type-2 Breakers

HT Breaker		
Sl. No.	Monitoring Inputs	Туре
1	Breaker Local/ Remote Selection Switch Feedback Status	VFC
2	Breaker On/Close Feedback Status	VFC
3	Breaker Off/Open Feedback Status	VFC
4	Breaker Direct Control Feedback Status	VFC
5	Breaker Trip Feedback Status	VFC
6	Breaker Spring Charge Feedback Status	VFC
7	Breaker Ready to Close (RTC) Feedback Status	VFC
8	Breaker Control Supply Healthy (CSH) Feedback Status	VFC
9	Breaker Service/ Test Position Feedback Status	VFC
10	Earth Fault Feedback Status	VFC
11	Trip Circuit Healthy Feedback Status	IEC 61850
12	Under Voltage Trip Feedback Status	IEC 61850
13	Emergency Trip Feedback Status	IEC 61850
14	PT Fuse Fault Feedback Status	IEC 61850
15	Protection Relay Feedback Status	VFC
Sl. No.	Communication Devices	Туре
1	MFM	RS-485
2	Protection / numerical Relay	IEC 61850

2.3.4.2.1 Typical I/O - Buscoupler

Table 12 : Typical I/O – Bus coupler

Typical I/O - Buscoupler		
Sl. No.	Monitoring Inputs	Туре
1	LR Switch Remote Position	VFC
2	On Status	VFC
3	Off Status	VFC
4	DC Status	VFC
5	Trip Status	VFC
6	Spring Charge	VFC
7	Ready to Close (RTC)	VFC

	Typical I/O - Buscoupler	
8	Service Position	VFC
9	Earth Swtich Status	VFC
10	Test Position	VFC
11	Control Supply Healthy	VFC
12	Trip Circuit Healthy	VFC
13	Under Voltage Trip	VFC
14	Emergency Trip	VFC
15	PT Fuse Failure	VFC
	Control Commands	
16	On Command	VFC
17	Off Command	VFC
18	Trip Coil	VFC

2.3.4.2.2 Typical I/O – LT Breaker

Table 13: Typical I/O's – LT Breakers

LT Breaker		
Sl. No.	Monitoring Inputs	Туре
1	Breaker Local/ Remote Selection Switch Feedback Status	VFC
2	Breaker On/Close Feedback Status	VFC
3	Breaker Off/Open Feedback Status	VFC
4	Breaker Direct Control Feedback Status	VFC
5	Breaker Trip Feedback Status	VFC
6	Breaker Spring Charge Feedback Status	VFC
7	Breaker Ready to Close (RTC) Feedback Status	VFC
8	Breaker Control Supply Healthy (CSH) Feedback Status	VFC
9	Breaker Service/ Test Position Feedback Status	VFC
10	Earth Fault Feedback Status	VFC
11	Trip Circuit Healthy Feedback Status	IEC 61850
12	Under Voltage Trip Feedback Status	IEC 61850
13	Emergency Trip Feedback Status	IEC 61850
14	PT Fuse Fault Feedback Status	IEC 61850
15	Protection Relay Feedback Status	VFC
Sl. No.	Control Commands	Туре
1	On/ Close	VFC
2	Off/ Open	VFC
Sl. No.	Communication Devices	Туре

	LT Breaker	
Sl. No.	Monitoring Inputs	Туре
1	MFM	RS-485
2	Protection / numerical Relay	IEC 61850

Interface module provides the ability to communicate and exchange data with third party devices, number of MFM units available in the LT panel, shall be tabulated. The communication setting, such as unit/ meter ID, baud rate, stop bit, party etc. shall be documented in interface list during the detail engineering.

2.3.4.3 Calculated Data processing

Analog signal values which are processed in the system shall be used for calculation to provide additional operational insight into the system operation for the operator. These calculated data processing shall be carried out at the SCADA server level and displayed in the SCADA client. 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. Different forms of calculated data processing are

- 1. Energy dashboard
- 2. Data trend displays.

Instantaneous value of each feeder power shall be predefined in trend templates with grid lines to display in the runtime system with respect to time. The trends display the curves contained in it, whether as real-time values or as historical values. The server samples of parameter values are recorded as trend data and historical data are managed within the data base.

- Average this displays the average of the samples within the previous display period
- Minimum- This displays the lowest value that occurred during the previous display period.
- Maximum This displays the highest value that occurred during the previous display period.

Analysis of values based on the database points shall be processed based on the pre-deifined instructions to generate the above results shall be logged based on the change of status / value.

2.3.4.4 Substation Topology processing

The campus is receiving power from 33kV Grid Incomer to cater the total demand power and further distribution is done via 33/11kV Substation. This function shall be capable of analysing the open/closed status of switching devices, such as breakers and disconnectors, in order to define 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 is detected.

The list of differ Substation that are part of the campus power distribution system are

- 1. Main Receiving Station 33 & 11 kV HT Panel
- 2. Solar Station 11 kV HT Panel
- 3. Central Station 11 kV Distribution station
- 4. Academic Block Sub station
- 5. Sports Complex Sub station
- 6. International Centre Sub station
- 7. Faculty Housing Substation
- 8. Student Housing Sub station
- 9. Outreach Substation

2.3.4.4.1 Main Receiving Station

Inputs and outputs that are part of 33 kV HT and LT panel in Main Receiving Station are processed by M850 PLC based PLC system. This PLC system acts as the local control in case of communication failure from the SCADA system. The RTU panel which houses the PLC system also contains the HMI for operator interface during local operation.

2.3.4.4.2 Substation Group 1

The Inputs and outputs of Central station and Academic Block substation are processing by the M580 PLC system in high availability ethernet ring connection topology. The primary CPU rack is made available in Central substation and secondary CPU racks of the system is set up in the Academic Block

Substation. The contractor shall provide dedicated fibre-based communication between the PLC CPU racks and RIO racks to form the ring connection topology.

2.3.4.4.3 Substation Group 2

The Inputs and outputs of International convention centre and Faculty Housing substation are processing by the M580 PLC system in high availability ethernet ring connection topology. The primary CPU rack is made available in International convention centre substation and secondary CPU racks of the system is set up in the Faculty Housing Substation. The contractor shall provide dedicated fibre-based communication between the PLC CPU racks and RIO racks to form the ring connection topology.

2.3.4.4.4 Substation Group 3

The Inputs and outputs of Outreach Substation and Solar station substation are processing by the M580 PLC system in high availability ethernet ring connection topology. The primary CPU rack is made available in International Outreach Substation substation and secondary CPU racks of the system is set up in the Solar station Substation. The contractor shall provide dedicated fibre-based communication between the PLC CPU racks and RIO racks to form the ring connection topology.

2.3.4.4.5 Substation Group 4

Sports Complex and Student Hostel

The Inputs and outputs of Sports Complex and Student Hostel substation are processing by the M580 PLC system in high availability ethernet ring connection topology. The primary CPU rack is made available in International Sports Complex substation and secondary CPU racks of the system is set up in the Student Hostel Substation. The contractor shall provide dedicated fibre-based communication between the PLC CPU racks and RIO racks to form the ring connection topology.

2.3.4.5 Alternate Source of Data

The data processed through fibre network media shall be the primary source of data for processing by the SCADA/DMS system. In the event of non-availability of primary data source (fibre network) then the data from alternate source (through the wireless communication infrastructure) shall be considered. Once Primary source is healthy, it shall switch back to primary source.

2.3.4.6 Quality control

The Quality of the Data read over the OPC-UA interface between the SCADA/ DMS and the PLC system is monitored by the communication which is used for this project implementation. The communication driver provides below quality control parameters to decide on the communication link healthiness to switch between Fibre based wired and alternative campus Wi-Fi medium for connectivity. Details related to Quality control shall be provided in detailed design specification.

SCADA/DMS provides real-time data quality and status information. The 'quality' of the data is available to the operators, allowing for better informed processing decisions. Each tag data point contains properties that provides the data values along with the associated quality and time stamp of the data change. This allows each client access to not only the data, but also to information about when and how the data was collected from the field.

Having the validated last known data values provides with a clearer picture of the situation when a field communication has failed. Understanding the age and accuracy of the data assists other control system calculations.

Each variable tag represents information as a collection of data quality and timestamp elements. Operators can be informed about the value of each real-time tag, along with the last time the value changed and the quality status. The tag data has a time stamp for when the data value and the quality last changed. Data quality is split into three groups - good, bad and uncertain - with more detail available to provide additional analysis.

The detailed quality codes / indications shall be discussed with the customer during the software design and implementation phase. Distinct symbols / shapes / color will be used after approval of employer.

2.3.5 Continuous Real-time Data storage & playback

The SCADA / DMS server has several server components which executes specific functions as part of the SCADA sever system. IO server is a part of SCADA server which shall continuously poll for

data from the connected PLC based RTU system at substation level. This instantaneous data processed by the IO sever is used for display in the SCADA client for operator visualization.

The data gathered by the IO server is stored in Historical database in the form of SQL database. Each analog data shall be stored at data interval of 2 minutes into the database. The events and alarms shall also be stored in the SQL database along with their timestamp.

The report process of the server shall be used for playback of stored historical data in the form of trends for analog data and in the form of tabular grid for events/ alarms that has been stored in to the database.

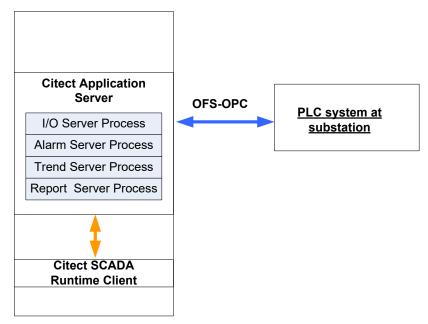


Figure 5 : IO server operation of SCADA/DMS system

2.3.6 Sequence of Events Data

Timestamped Sequence of events data are created at SCADA server based on configured conditions for different events and alarms and minimum of 1000 events can be stored in the SOE buffer. These data are recorded in the form of timestamped events in the SQL database for retrieval in the form of tabular reports at later stage. The Alarm scan time is a feature of the alarm server which indicates the minimum time between alarm transition of a single tag. The default Alarm scan time rate is set to 500

ms and the same shall be adjusted for optimal system loading such that the event of change shall be updated on the operator screen within 2 seconds as defined in the tender specification.

2.3.7 SCADA Language

The development and configuration of SCADA / DMS application screens shall be through the engineering environment of SCADA / DMS. As applications have particular requirements, SCADA / DMS provides you with the flexibility and power of two programming languages: Cicode and CitectVBA. Both languages can be used to extend available data to fields within your system configuration.



Figure 6 : Seamless dataflow of SCADA/DMS system

The application development for M580 PLC RTU system shall be carried Control Expert Engineering Tool which is compliant to IEC 61131 programming standard. Of the different languages supported in the M580 PLC system the logic development shall be carried out in the form of function blocks and structured text.

2.3.8 Supervisory Control

SCADA Software design shall have the feature of Input change by the operator and user input data verification, interlock and sequence of operation based on the control Narrative.

Any user command from SCADA(Setpoint, Alarm Limits, Manual/ Maintenance Control / Reset Acknowledge/ Enable / Disable) shall have confirmation from operator, with confirmation popup for

command acknowledgement and warning message shall be displayed when it detects irrelevant inputs and sequence.

Sequence / individual / Group command based on the priority, system healthiness and delay time , shall be initiated from SCADA

After selecting a point, the user does not execute the control action within a programmeradjustable 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 is not available, the control command shall be rejected and shall not remain in queue.

2.3.8.1 Digital status control

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 cancelled 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.

2.3.8.1.1 Breakers

The inputs and outputs that are to be monitored and controlled for the breaker are defined in section <u>Data Processing</u>

2.3.8.1.2 Active Compensator

The data will be monitored over modbus serial. Details to be updated after detailed design inputs.

2.3.8.1.3 Tap Changing Transformers

The analog data monitored over modbus serial for transformer are Oil Temperature Indicator (OTI) and Winding Temperature Indicator (WTI). In the case of oil transformer Buchholz relay trip, MOV trip and PRG trip inputs are additional inputs that are monitored by SCADA/DMS system.

2.3.8.2 Set point Control

Any user setpoint command from SCADA shall have confirmation from operator, with confirmation popup for command acknowledgement and warning message shall be displayed when it detects irrelevant inputs and sequence. Further details to be updated after detailed design inputs.

2.3.8.3 Auto Execution Sequence / Group Control

To be updated after detailed design inputs.

2.3.8.4 Control Inhibit Tag

The Control Inhibit Tag functionality allows critical system information to be protected and inhibits the unauthorized writing of data. Such functions are designed to enhance the security of your process while increasing efficiency in the case of a false alarm.

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

Circuit Br	eaker 2: Voltage C-A	
Tag:	Breaker_2\MMXU1\PPV\phsCA	23
	ol Inhibit mode OFF t control of tag value? Apply Remove	

Figure 7 : Control Inhibit Tag operation of SCADA/DMS system

2.3.8.5 Control Permissive interlocks

Substations shall be provided with a full interlocking scheme to ensure that all disconnectors, fixed earthing switches (or other interlocked earthing devices) and, where required, circuit-breakers are operated in the correct sequence so that personnel do not endanger themselves and/or the integrity of the transmission system by incorrect or inadvertent operation of equipment. Where necessary, such interlocking shall also be extended to cover limitation of access to areas where there is a risk that normal safety clearances may be infringed.

The interlocks may be classified in two categories:

• Functional interlocks incorporated in functional units and dedicated to the operation of the apparatus located in the units only. These interlocks are generally realized by means of specific mechanical devices linked with the mechanisms of the apparatus

- Interlocks between functional units or between a functional unit and another equipment such as a transformer. Most of these interlocks are realized by means of keys transferred from one equipment to another when they are made free. They may be improved or by additional electrical interlocks. The system shall operate in accordance with the agreed logic table for the application. Any combination of inputs for which an output has not been specified shall give no output.
- Operator shall be able to bypass the interlock which shall be recorded as an event message with user ID information to facilitate the operation without hampering the system safety.

As a typical example for control permissive / interlocking we consider one breaker signals. Breaker I/O's can be classified into Input (Monitoring) and Output (Command) I/O's. Control system monitors the input signals processes the signals based on the permissive / interlocks and output shall be controlled.

Sl. No.	Monitoring Inputs
1	Breaker Local/ Remote Selection Switch Feedback Status
2	Breaker On/Close Feedback Status
3	Breaker Off/Open Feedback Status
4	Breaker Direct Control Feedback Status
Sl. No	Permissive
5	Breaker Trip Feedback Status
6	Breaker Spring Charge Feedback Status
7	Breaker Ready to Close (RTC) Feedback Status
8	Breaker Control Supply Healthy (CSH) Feedback Status
9	Breaker Service/ Test Position Feedback Status
10	Earth Fault Feedback Status
13	Emergency Trip Feedback Status
14	PT Fuse Fault Feedback Status
15	Protection Relay Feedback Status

Table 14: Permissive interlocks

Sl. No	Control Inhibit Tag
11	Trip Circuit Healthy Feedback Status
12	Under Voltage Trip Feedback Status
Sl. No	Information
16	Upstream Breaker Trip Feedback Status

2.3.8.6 Control Action Monitor

All control actions initiated by the PLC system with activation of output shall be monitored for the success or failure status of the operation completion through the corresponding input feedback status for each operation execution. On receipt of the trip input for the processed operation the respective output shall be deactivated and the fault/ alarm for the control action shall be recorded in the database. The fault/alarm generation shall display the alarm in the alarm history as per its alarm priority.

2.3.9 Fail soft capability

The SCADA/DMS system is designed in high availability configuration with functional redundancy built into the system, hence the availability of the system is higher than systems with fail soft capability.

Sub system	Functionality	Configuration Type	Failure	Impact
SCADA/DMS Server	Executes Data acquisitions, process control and monitoring schemes, reporting	Primary & Secondary in redundant configuration	Primary server failure Secondary server failure	SCADA server will shift to Secondary Server.
Networking Infrastructure		• Redundant Fibre	Fibre Media failure	When both the fibre media fail, the network will shift to WIFI media

Sub system	Functionality	Configuration Type	Failure	Impact
		communication		
		ring		
		• WIFI Media	Wifi media	
		will be backup	failure	
		to redundant		
		Fibre media		
		CPU A & CPU B in	PLC CPU A	
LDMS/ PLC System		redundant configuration	PLC CPU B	

The different functional redundancy units built into the system are as below

2.3.9.1 SCADA / DMS

If the primary server isn't operating normally, control and monitoring of the system is lost. the ability of a single device to influence the system as a whole is minimized as we have a primary and standby Server in your system where the standby Server will assume operations in case the primary Server becomes inoperative.

The redundancy is provided as follows:

- By using a redundant data path from the server, we maintain the communication.
- If communications with either the primary server or standby server be disconnected, the device is still accessible.

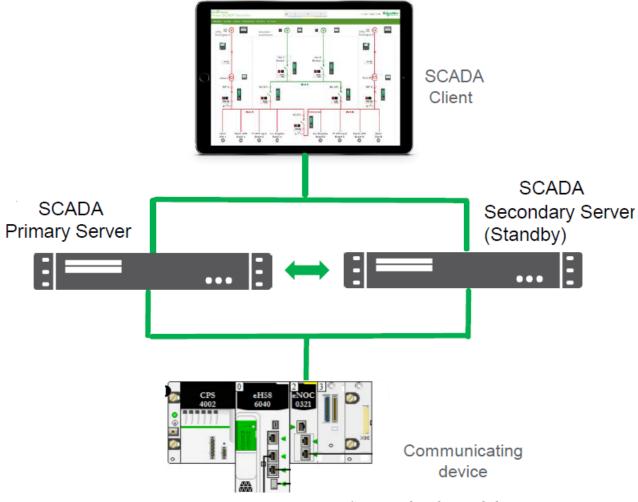


Figure 8 : SCADA/DMS Fail-soft Capability

2.3.9.2 PLC based RTU with functionally redundant PLC rack

2.3.9.2.1 Operation Philosophy

The proposed redundant system provides bump-less transfer of I/O control from Primary PLC to Standby PLC upon the failure of Primary PLC without using any relay circuits. Each PLC has a customized program for redundancy programmed into its user logic, which communicates status information between the two PLC processors and exchanges the state RAM.

The data exchanges between the two redundant processors (Primary and Standby), are using a very high-speed link of 1 Gbps/100 Mbps. In case standby PLC senses that Primary has failed, it will force the changeover irrespective of how Primary sees itself. This avoids total reliance on processor self-diagnostics for changeover.

Primary PLC runs the application by scanning user logic and operating distributed I/Os. At the end every program scan the Primary PLC sends input/output data and internal data tables to the standby PLC, so that in the event of changeover two processors will have the same data.

2.3.9.2.2 Changeover

The automatic changeover time of control from one PLC to the other PLC includes time required following events:

- Failure Detection
- Time to confirm failure.
- Time to confirm availability of the standby system.
- Time to switch over
- Time to confirm success of switching over.

The Standby is ready to assume control within one scan if Master fails. Master & Standby states are switch-able. Each Processor can be put into the Master state, but to do this the other must be in standby state. If a fault occur in the Master processor, control will be transferred to standby processor in maximum 500ms.During the changeover, PLC outputs are maintained in their last state until they come under control of the standby processer. Faulty data is sent workstation for reporting the processor failure. The system shall now recognize earlier standby processor as Master processor.

The below figure represents the following

- 1. Primary Rack with CPU
- 2. Standby Rack with CPU
- 3. Redundant Communication over Fibre with SCADA / DMS
- 4. Hot Standby Communication Link
- 5. RIO Main Ring
- 6. (e)X80 RIO Drop

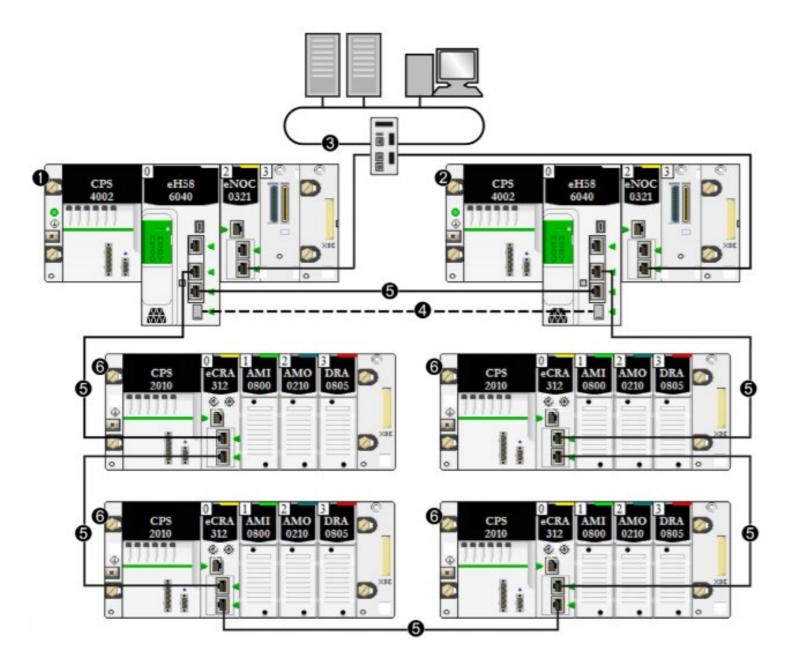


Figure 9 : PLC Redundant Architecture

2.3.10 Remote Database Downloading, Diagnostic and Configuration

The Engineering Workstation shall be used as the deployment server in this project. The configurator application that's part of the SCADA / DMS installation shall be used for the setup of deployment sever. Server/ client application of SCADA / DMS shall be downloaded remotely to the respective workstations and run diagnostics.

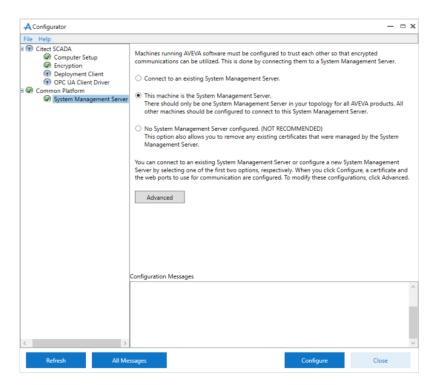


Figure 10 : SCADA Remote Database Downloading Mechanism

Database can be downloaded from centralised control centre also to RTU's and run diagnostics & configure and parameterize as per the requirement from the Ecostruxure Control Expert software

2.3.11 IEC 61850, SMART GRID interface requirements

PLC based RTU system of the sub station shall function as the Micro grid controller with implementation of the required control functionalities along with IEC 61850 communication interface with the Numerical relay (IED) for monitoring and control operation.

2.4 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

The data shall be retrieved for analysis, display, trending and report generation. All stored data shall be accessible for a time period.

Configuration data is stored in a Microsoft SQL database. The configuration manager creates a registration to this database and reads and writes the configuration data to and from this database. The Backup and Restore utility can be used to manage the storage of all configuration data to a file for use at a later time.

Historical data is collected from the SCADA and OPC production data and stored in the Microsoft

SQL database when the SQL data service is running. This database is separate from the configuration database and can therefore be run on a separate machine and maintained separately. There are two modes of data acquisition. The default is real-time acquisition, whereby the data source is polled every poll period (default setting: one second). If the variable's value has changed by more than the dead band, then a new sample with the data service's timestamp will be logged to the historian database.

The other mode is trend data acquisition. This mode is used for data collection from scheduled I/O devices such as Remote Terminal Units (RTU). However, it can also be used where it is preferable to request data from the trend server rather than from the SCADA system's I/O server. RTU devices periodically update the SCADA system with their data. In this mode, the historian data service requests the trend data from the SCADA system every xx minutes by default. If there are changes since the last known good sample, data from the trend system is logged to the historian database. This mode only applies to SCADA data sources and not to OPC data sources. Alarm data is requested by default every five minutes and changes will be logged to the historian database. OPC data sources have an update rate which can be set per data source or per tag. This is similar to the poll period for SCADA data sources. However, since OPC uses a "publish and subscribe" model, it sets the minimum period in which the historian data service is notified of changes.

2.4.1 Circuit Breaker Status Table

Digital data processed for each circuit breaker shall show on the SCADA client application screen for display of field input status as per the status of the field signals. Below is the typical representation of circuit breaker status table in the SCADA screen.

The ISR function shall maintain a table in SQL database where real-time status of all Circuit breakers shall be stored.

		11 KV HT Feede	er
		Breaker	Status
33 KV HT Feed	der	Transformer Incomer-1	Off
Breaker	Status	Transformer Incomer-2	Off
HT Incomer-1	Off	Solar Incomer-1	Off
HT Incomer-2	Off	Solar Incomer-2	Off
Transformer OG-1	Off	Bus Coupler	Off
Transformer OG-2	Off	Central Station OG-1	Off
Bus Coupler	Off	Central Station OG-2	Off

Figure 11 : Circuit Breaker status table

2.4.2 Realtime Database Snapshot Table

Tag groups configured in SCADA are updated with real time values of the tags based on the values of the parameters in the PLC application program. Only the tags that are configured to be recorded in the database are stored as per the configured interval of data storage. Snapshot view of a typical database table is provided below

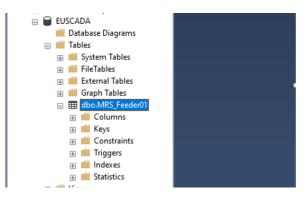


Figure 12 : Real Time Database Snapshot

2.4.3 Hourly Data Table

Analog data processed by the SCADA application server are programmed to be stored in respective tables of SQL database of the SCADA server at the defined datalogging interval.

Below figure is the sample format of the hourly data table.

Energy Report Daily- (kWh)



From Date	: 15-06-2021 00:00:00 To Date : 15-06-2021 13:22:58
Generated By	: Guest Access View
Generated Date	: 15-06-2021 13:23:01 (DD:MM:YYYY HH:MM:SS)
Station Name	:

ime Duration	MDB-1	MDB-2	CPP	EPP	ESPP	MLP	DG	AMF
00:00	.0	.0	.0	.0	.0	.0	.0	0.
01:00	.0	.0	.0	.0	.0	.0	.0	0.
02:00	.0	.0	.0	.0	.0	.0	.0	0.
03:00	.0	.0	.0	.0	.0	.0	.0	0.
04:00	.0	.0	.0	.0	.0	.0	.0	0.
05:00	.0	.0	0.	.0	.0	.0	.0	0.
06:00	.0	.0	.0	.0	.0	.0	.0	0.
07:00	.0	.0	.0	.0	.0	.0	.0	0.
08:00	.0	.0	.0	.0	.0	.0	.0	0.
09:00	.0	.0	.0	.0	.0	.0	.0	0.
10:00	.0	.0	0.	.0	.0	.0	.0	0.
11:00	.0	.0	.0	.0	.0	.0	.0	0.
12:00	.0	.0	.0	.0	.0	.0	.0	0.
13:00	.0	.0	0.	.0	.0	.0	.0	0.
14:00	.0	.0	.0	.0	.0	.0	.0	0.
15:00	.0	.0	.0	.0	.0	.0	.0	0.
16:00	.0	.0	.0	.0	.0	.0	.0	0.
17:00	.0	.0	.0	.0	.0	.0	.0	0.
18:00	.0	.0	.0	.0	.0	.0	.0	.0
19:00	.0	.0	.0	.0	.0	.0	.0	0.
20:00	.0	.0	.0	.0	.0	.0	.0	0.
21:00	.0	.0	0.	.0	.0	.0	.0	0.
22:00	.0	.0	.0	.0	.0	.0	0.	0.
23:00	.0	.0	0.	.0	.0	.0	.0	.0
Total	.0	.0	.0	.0	.0	.0	.0	0.

1/1

Figure 13 : Hourly Report data Snapshot

Hourly data tables shall be created on daily basis. Such daily tables for two months duration shall be stored on memory. Hourly data table for the previous month shall be backed up to Magnetic tape by the user on monthly basis.

2.4.3.1 Missed Hourly Data storage

PLC system at substation level has the event recording module which shall recode the monitoring analog value parameters in its module memory. This local storage acts as second level of data recording which can be retrieved by the SCADA system after a communication disaster recovery.

2.4.3.2 Hourly Data calculation

Computation of Hourly data is calculated as view table in the SQL database in which the Hourly data for consumption is calculated. When required to be displayed to the operator or to be generated as report the view table from the SQL database shall be queried to display the hourly consumption data.

The following calculations shall be provided:

- 1. Addition, subtraction, multiplication, and division
- 2. Summation of an hourly value
- 3. Maximum and minimum of a value
- 4. Average of a value

2.4.4 Daily Energy Data Table

Computation of daily energy data is calculated as view table in the SQL database in which the daily data for consumption is calculated. When required to be displayed to the operator or to be generated as report the view table from the SQL database shall be queried to display the hourly consumption data.

Day MDB-1 MDB-2 CPP EPF 1 .0 .0 .0 .0 .0 2 .0 .0 .0 .0 .0 3 .0 .0 .0 .0 .0 4 .0 .0 .0 .0 .0 5 .0 .0 .0 .0 .0 6 .0 .0 .0 .0 .0 7 .0 .0 .0 .0 .0 9 .0 .0 .0 .0 .0 10 .0 .0 .0 .0 .0 11 .0 .0 .0 .0 .0 12 .0 .0 .0 .0 .0 13 .0 .0 .0 .0 .0 14 .0 .0 .0 .0 .0 15 .0 .0 .0 .0	0. 0. 0. 0. 0. 0. 0. 0.	MLP .0 .0 .0 .0 .0 .0 .0	DG .0 .0 .0 .0	AMF .0 .0
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Figure 14 : Daily Report data Snapshot

Daily energy data table shall store daily energy values for each feeder on hourly / daily basis. This stored data shall be exchanged with the Billing system in Data centre & DR on daily basis or on demand. Daily Energy data table for the previous month shall be backed up to Magnetic tape by the user on monthly basis.

2.4.5 Load Priority Table

Load priority table containing information such as breaker name, Breaker load and and Load priority of each Breaker shall be stored. The load priority details shall be designed and have an feature to be modified by the operator.

Load priority table shall be designed and updated after detailed design inputs.

2.4.6 SOE Data Table

Events generated by SCADA application server, in non-volatile memory of numerical relay and module memory of PLC system shall be stored in the events table of SQL database server for complete distribution system. This event shall be queried for generation of Sequence of events for the purpose of report generation. There shall be feature to sort the table by Time, Date, Substation name/ device name etc. using SQL commands which shall be designed and updated after detailed design inputs. This table shall be made on daily basis. The data stored shall be backed up to Magnetic tape by the user on daily / monthly basis.

2.4.7 Historical Information (HI) Data Retrieval

Historical information like alarm and events are stored in the events tables of the SQL server along with the time stamp and the details of the event. Other monitoring data of the respective equipment's shall be stored in the respective tables of the SQL database for this project. When required for the retrieval of the historical data, depending on the availability the data records shall be queried from the primary server database or secondary server database to generate the required data in tabular form on the SCADA client GUI or in the form of report.

2.4.8 System Message Log Storage and Retrieval

System event message logs like user logged in, logged out, redundancy failure, synchronization successful., etc are system event messages which are created with timestamps on the SQL sever database. The events are stored in the system events table of the SQL database with the timestamps. When retrieval request is given by the user, the data are queried from the system events table and displayed as view table or as reports.

2.4.9 Mass Storage of Data / Files

Mass storage of data or files can be carried out in the Operator workstation system and the Engineering workstation system using windows copy and paste functionality. The access to unused USB port of the server and engineering PC shall be disabled after hardening of the systems. Transfer of data can be carried out using the DVD/CD writer in the Engineering workstation.

2.5 Data Recovery Function (DR)

The application data of SCADA/DMS system is backed up in the form a SQL database in the server. The SQL sever backup of the primary and secondary database are maintained by the SCADA primary and secondary application server. For the purpose of data recovery, a local copy of the SQL database and cloud-based SQL server database is maintained from which the data recovery function shall be executed when initiated from the SCADA sever application.

Cloud-based SQL server database shall store one year backup with data i.e. system build ups shall be available of each area separately so that the same can be utilised upon setting up newer system after disaster.

All logs, data model etc & necessary interfaces that are essential for complete system build up shall be stored at DR centre. All requisite data which is build the system from scratch shall be transferred to DR.

3 Proposed Solution

The proposed system for Electrical SCADA system for this project shall be categorized as below.

1. SCADA system at Central Command Centre:

The Central Command centre which is envisaged central operation and control location shall contain the below key sub systems.

- a. Redundant Operator Workstation server (OWS): This server workstations containing both SCADA / DMS application server and SCADA / DMS client application deployed in primary and secondary configuration. The Key components of the SCADA Application server are I/O server, Alarms Server, Reports Server and Trend Server. SCADA client application is the operator user interface for process visualization and control for the operator.
- Engineering Workstation (EWS) This workstation shall be used as the engineering Node for SCADA and PLC systems of the project.
- c. Video Display Unit Matrix Display unit (2 x 3) for concurrent display of SCADA
 Display screens
- d. GPS Time Synchronization system Central GPS Timer server present in this location shall be used for time synchronization of other sub systems of SCADA and PLC RTU system.
- e. Networking Interfaces: Networking setup with Managed Network switches and firewall for other sub systems interconnection and Campus IT infrastructure for internet connectivity to cloud-based Database recovery system.

2. RTU system at Sub-stations.

Typical PLC based RTU system at each sub- station shall be housed inside an enclosed panel with following key sub systems.

a. M580 Hot standby PLC system: This system contains CPU Rack and RIO racks. The Digital input and output modules are housed as part of the RIO Racks.

 b. Networking Interfaces: Managed switch compliant to IEC 61850 and other network accessories for connectivity to Fibre network medium and Wireless – Wi-Fi connectivity.

3.1 SCADA System at Central Command Centre:

3.1.1 Hardware Systems

3.1.1.1 Operator Workstations (OWS)

Two numbers of Operator Workstation servers are considered as part of the proposed solution. This operator workstation server has the SCADA application server and SCADA client application installed. The SCADA client application will be the user interface for the operation of Electrical SCADA system by the operator. The Hardware specification of the operator workstation is as below.

SI.NO	Specification	Quantity
	Intel® Xeon® , 1 X 16 GB RAM, C3, RAID 1 for 2 HDDs, 2 X 1TB	
1	SATA, 3.5" Chassis up to 8 Hot Plug Hard Drives, 4 NIC Port, OS	2
	Windows Server , Redundant Power Supply,	
	DELL 24 MONITOR E2420H : Maximum Resolution 1920 x 1080	
2	Colour depth: 16.7 Million Viewing Angle 178°/178° Tilt Only (-5°	2
	to 21°)	

Table 15: OWS System HW Specification

3.1.1.2 Engineering Workstations (EWS)

The Engineering workstation is a system which shall be used for configuration and modification of SCADA Application. The Hardware specification of the identified Engineering workstation is as below.

Table 16: EWS System HW Specification

SI.NO	Specification	Quantity
	10th Generation Intel® Core™ i7, 8 GB RAM, 1TB SATA Hard Disk	
1	Drive, Windows 10 Professional 64 bit, Raid -1 Configuration, 4	1
	NIC ports, Redundant Power supply, DVD/ CD R-W.	

	DELL 24 MONITOR E2420H : Maximum Resolution 1920 x 1080	
2	Colour depth: 16.7 Million Viewing Angle 178°/178° Tilt Only (-5°	1
	to 21°)	

3.1.1.3 GPS Time server

For time synchronization of all devices of the system, a GPS time server is provided at central Command centre. The time synchronization takes place over Network Time Protocol (NTP), which has been designed to provide accurate time synchronization over Ethernet networks.

3.1.1.4 Video Display Wall

Wall Display unit provided at Central Command Centre consists

- a. Video Display Wall of 70 inch size
- b. Supporting a resolution of 1920 x 1080 pixel
- c. Lifetime of 80,000 Hours
- d. Video wall controller and Software for processing 2 display inputs

3.1.1.5 Networking switch

Redundant managed network switch which shall be compliant with IEC 61850 based communication with IED devices is considered in Central Command Centre. This switch shall have uplink connectivity with redundant fibre network and enable below planned network connections.

- 1. SCADA Operator workstation (OWS) and Engineering workstation shall be connected to this switch.
- 2. GPS Time server shall be connected to this switch.
- 3. Display wall controller shall be connected to this switch.
- 4. Campus IT network shall be connected this switch for web client access by the end user.
- 5. Internet access from campus and connectivity to Cloud based disaster recovery system.
- 6. Solar control system and Existing BMS system shall be connected to this network switch.
- 7. State Load Dispatch Centre (SLDC) interface connection shall be from this network switch.

8. The protocol convertors of the building energy monitoring meters shall be connected to this switch.

3.1.1.6 UPS

Redundant 2KVA UPS shall be supplied to support SCADA Hardware system located at MRS control centre. UPS shall be of single phase with following specifications.

Sl. No	Description	Ratting	Remarks
1	Input Voltage	230 VAC	
2	Input Frequency	50Hz ± 0.1Hz	
3	Nominal Output Voltage	220VAC / 230VAC / 240VAC ± 1%	
4	Output Frequency	50Hz ± 0.1Hz	
5	SCADA Integration	RS-232 / RS-485	

3.1.2 Software Systems - SCADA / DMS

SCADA / DMS is a Supervisory Control and Data Acquisition (SCADA) solution that is used to manage, monitor and control the process parameters in this project. SCADA / DMS software applications and suites from Schneider Electric give you the ability to see, measure, and manage Efficient Enterprise across buildings, industrial plants, and data centres, resulting in significant savings on capital and operational expenses - without sacrificing business continuity and performance. SCADA / DMS software enables you to manage efficiency from shop floor to top floor, across three levels of your business: Enterprise, Operations, and Control.

The graphics, controls, configuration data and programming associated with a SCADA / DMS installation is configured and implemented through projects in the system. A project acts as a digital representation of the production facility that is deployed in tandem with the plant infrastructure,

allowing the entire system to be monitored and controlled in real-time. SCADA / DMS is a reliable, flexible and high-performance system for any monitoring and control application. SCADA / DMS comes with some powerful features including:

- Object based referencing
- Graphical process visualization
- Superior alarm management
- Advanced clustering options for control when and where it is required.
- Historical and real-time trending (Optional) Built-in reporting
- Statistical Process Control
- Powerful analysis tools

SCADA / DMS is designed to provide industrial companies of all sizes with agile control over both engineering and runtime operations. Its design is centred on multi-level redundancy for the reliable, constant communication and operation of the system.

The SCADA system shall be installed in

- Primary and Secondary Server Monitoring and control of entire control system
- Engineering Station Configuration/ Modification of the SCADA system.

3.1.2.1 SCADA / DMS deployment Model

The SCADA deployment model for Operator workstation system involves the deployment of Citect Application server and SCADA / DMS runtime client application on the server system. The SCADA application server contains the below core server processes.

- I/O Server Process dedicated communications server that exchanges data between I/O devices and control clients.
- 2. Alarm Server Process -responsible for evaluating the conditions that define an alarms.
- 3. Trend Server Process controls the accumulation and logging of trend information.
- 4. Report Server Process report server communication with clients.

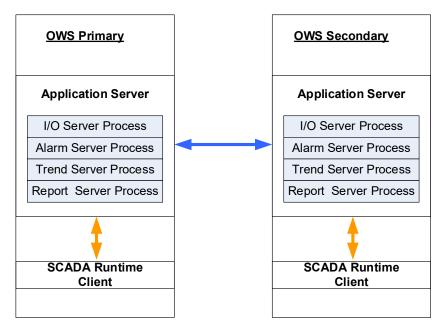


Figure 15 : SCADA deployment model for OWS

The Application server primary and secondary processes shall be deployed to function as redundant application servers. Runtime control client application of SCADA / DMS applications is used by the operator for the visualisation and operation of the SCADA control system.

3.1.2.2 Web Client

The Web Client SCADA allows you to view a live SCADA Server project within a Web browser. It provides easy access to Runtime for LAN-connected users with the right user authentication without the need for extensive downloads or software installation. The Web client functionality of SCADA / DMS involves the interaction of SCADA / DMS webserver, SCADA / DMS runtime server as per the request from the web client to gain the access of the web browser based live view of SCADA application.

SCADA / DMS web server performs the server-side functionality of the system. It operates by accepting requests from the client, and providing a response to the client when the clients details are authenticated. It then directs a client to the graphical and functional content of a SCADA / DMS project and the location of the runtime servers. This information is stored on the Web Server when a SCADA / DMS project is configured as a "web client deployment". A SCADA / DMS Web Server can contain multiple web client deployments. The below figure explains the implementation scheme of web client.

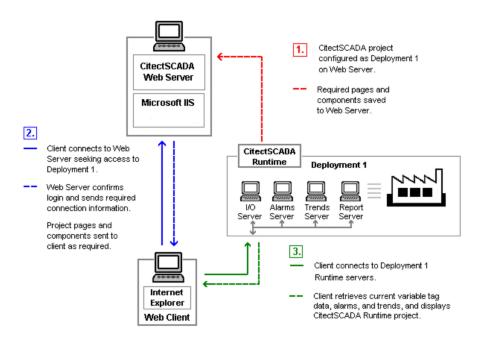


Figure 16 : Web client

3.2 RTU System at Sub-station:

3.2.1 Typical RTU system

PLC based RTU system shall be housed in sheet steel panel in respective substation location. The RTU system panel shall contain the required power supply for the operation of the PLC system and the Digital input and output modules that are required for processing the field inputs at the respective location. Below is the physical. The Typical RTU system panel general arrangement is presented below.

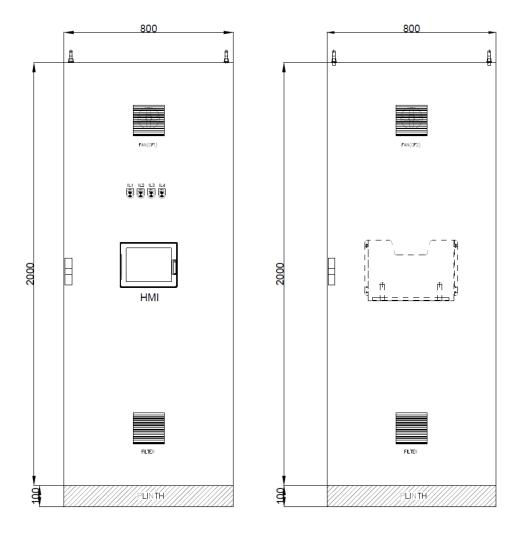


Figure 17: RTU Panel General Arrangement-1

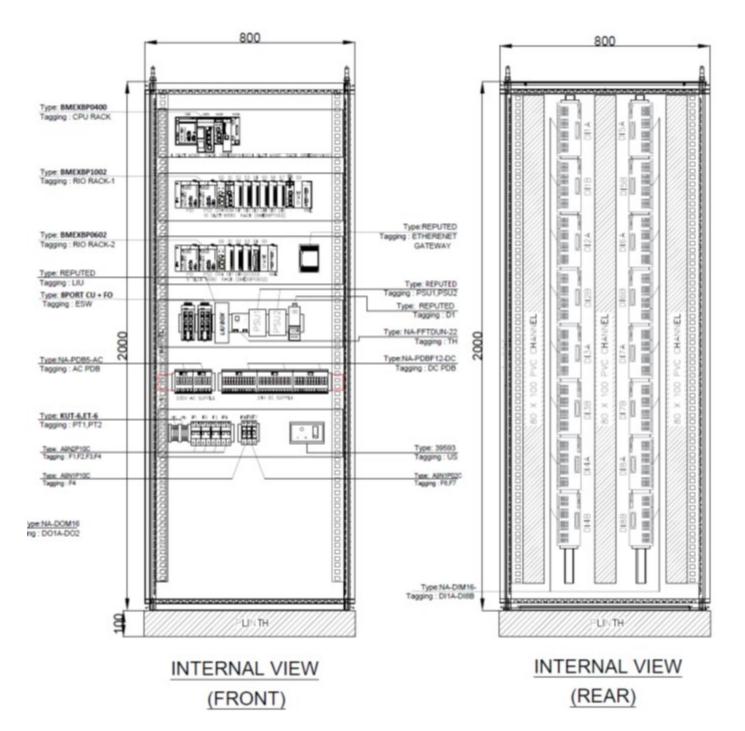


Figure 18: RTU Panel General Arrangement-Internal View

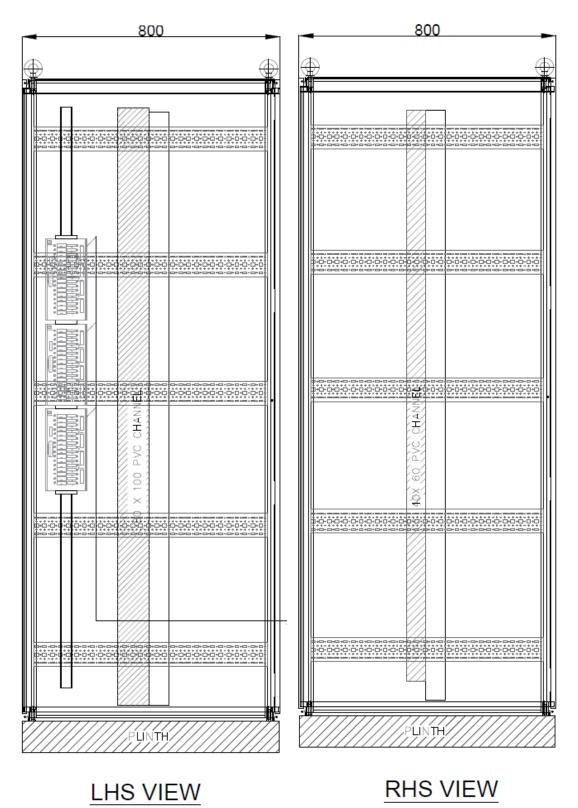
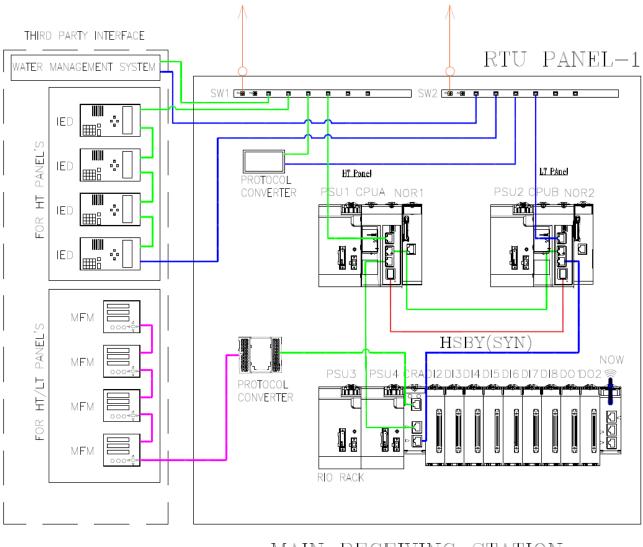


Figure 19 : RTU Panel General Arrangement- LHS & RHS View



MAIN RECEIVING STATION

Figure 20 : RTU Main Receiving Station Architecture

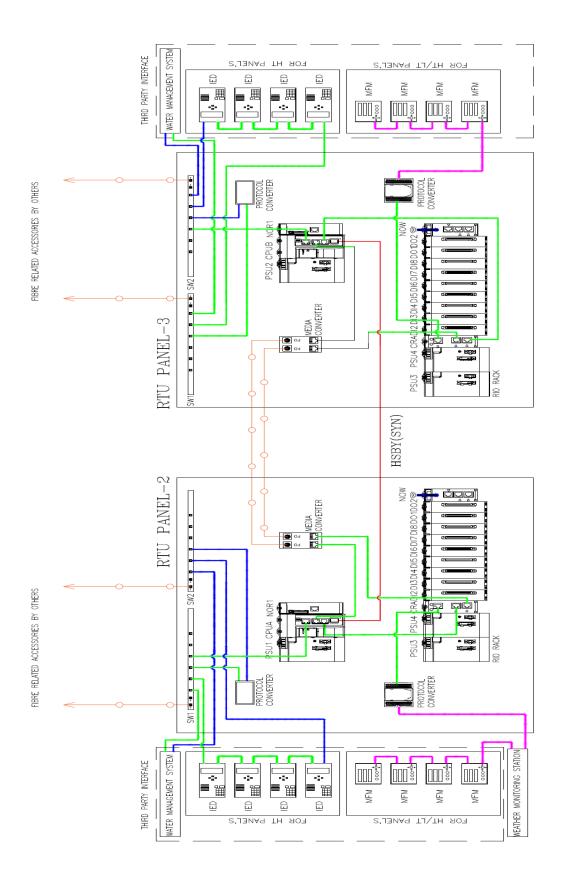


Figure 21 : RTU Other stations connectivity General Architecture

3.2.1.1 RTU Panel

The RTU panel specification considered for this project are as specified below

Sl.No	Specification					
1	Dimension in mm	800 x 800 x 2000 (l x b x h)				
2	Plinth in mm	100 mm				
3	Material	Sheet Steel				
4	IP rating	IP 54				
5	Access	Front and Rear access				
6	Front Door Thickness	2.0 mm				
7	Rear Door Thickness	1.5 mm				
8	Gland plate thickness	2 mm				
9	Cable entry	Bottom				
10	Door	Single door in front & rear				

Sl.NO	Location/ Sub station	DIMENSSION (in MM)	Qty
1	MAIN RECEIVING STATION	IP 54 panel, 800x800x2000 (w x b x l)	1
2	Solar Station	IP 54 panel, 800x800x2000 (w x b x l)	1
3	Central Station	IP 54 panel, 800x800x2000 (w x b x l)	1
4	ACADEMIC SUSBTATION-01	IP 54 panel, 800x800x2000 (w x b x l)	1
5	Sports Complex SUBSTATION-05	IP 54 panel, 800x800x2000 (w x b x l)	1
6	SUBSTATION-02 INTERNATIONAL CENTER	IP 54 panel, 800x800x2000 (w x b x l)	1
7	SUBSTATION-03(Faculty Housing)	IP 54 panel, 800x800x2000 (w x b x l)	1
8	SUBSTATION-04 (STUDENT HOUSING)	IP 54 panel, 800x800x2000 (w x b x l)	1
9	Outreach Substation	IP 54 panel, 800x800x2000 (w x b x l)	1

3.2.1.2 RTU Backplane:

Backplane hold the modules and mount it on the hooks near the top of the backplane. Key role of a rack is to provide power and communication bus for the modules installed on the rack. Ethernet backplane provides eX80 I/O modules, which require an Ethernet bus on the rack in order to exchange data (for example, X80 HART modules), Third-party modules that require Ethernet and Ethernet communication modules (interlinked to the CPU)

Each slot in a backplane/ rack is equipped as standard with a protective cover that should only be removed when inserting a module. The module can be replaced when power to the module is either on or off. The identified backplane for this project shall be as per the number of module quantities worked out based on the number of IOs in each location.

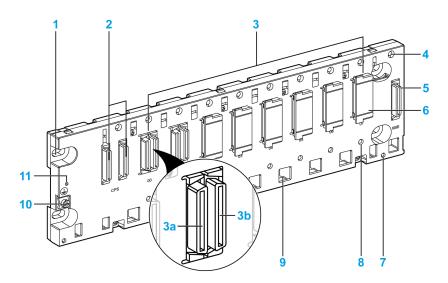


Figure 22 : RTU Backplane

- 1. Panel mounting hole (x4)
- 2. Power supply module slot connectors
- 3. Module slot connectors

- 4. 3a) Ethernet connector
- 5. 3b) X bus connector
- 6. Tapped hole for locking screw on each module
- 7. 40-pin female connector for a rack extender module
- 8. Protective cap
- 9. Screw hole (X2) for shielding connection kit
- 10. Keying hole for Ethernet module
- 11. Holes for anchoring the module pins
- 12. Protective earth screw
- 13. Rack status LED

3.2.1.3 RTU Power supply module:

In Modicon X80 Ethernet RIO drops, shall have power supply in the slot 0 and marked CPS. The BMXCPS•••• power supply modules convert the primary power line into voltages distributed through the backplane to supply the rack and the modules plugged in it. The power supply modules is delivered with two removable terminal blocks.

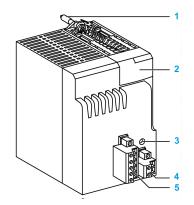
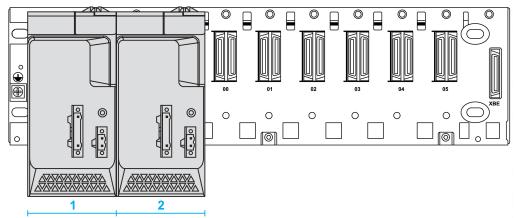
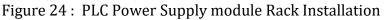


Figure 23: RTU Power Supply Module

- 1) Mounting screw
- 2) LED display
- 3) RESET button
- 4) Input/output 5-pin removable terminal block
- 5) Alarm relay 2-pin removable terminal block

BMXCPS4022 — Power supply (24-48) VDC, in redundant configuration is considered in an extension EIO rack of the PLC system.





- 1) Redundant power supply in the master position (after power-up).
- 2) Redundant power supply in the slave position (after power-up).

3.2.1.4 RTU Processor module:

The purpose of a Hot Standby system is to be ready to perform a switchover, if needed. A switchover is the immediate transfer of control of the network from the primary PAC to the standby PAC. The transfer needs to be swift and seamless. The M580 Hot Standby system continuously monitors ongoing system operations and determines if a condition requiring a switchover exists. On each scan, both the primary PAC and the standby PAC check the health of the system. If both the primary PAC and standby PAC are operating normally, the Hot Standby system detects a switchover causal event within 1 scan time.

On switchover, the Main IP address setting is automatically transferred from the former primary CPU to the former standby – now the new primary – CPU. Similarly, on switchover the Main IP address + 1 setting is automatically transferred from the former standby CPU to the new standby. In this way, the configured links between the distributed equipment and the primary CPU do not need to be edited in the event of a switchover. A switchover does not affect the assignment of IP address A or IP address B

The Hot Standby CPUs perform two periodic data exchanges:

- 1) Before each MAST cycle, the primary CPU transmits to the standby CPU application variables, system status and I/O data.
- 2) Periodically, both CPUs exchange the content

Each CPU module includes one SFP socket, to which you can connect either a fibre optic or a copper transceiver. Hot Standby PACs, no I/O modules are supported in the local rack. M580 Hot Standby system, the primary CPU and the standby CPU operate their own system timers, which are not automatically synchronized. Because both the primary CPU and the standby CPU share a common configuration, both can be configured to perform as NTP client or NTP server. When the NTP client function is enabled in a Hot Standby system, the primary CPU and the standby CPU independently receive time settings from a designated NTP server.

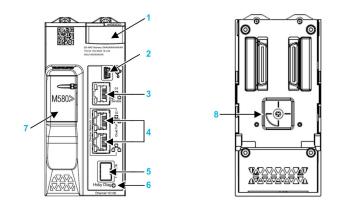


Figure 25 : PLC Processor

The front of the module is on the left. The back of the module is on the right:

- 1) LED diagnostic display panel
- 2) Mini-B USB port for module configuration via PC running Control Expert
- 3) RJ45 Ethernet service port connector
- 4) RJ45 connectors that together serve as a dual port to the Ethernet network
- 5) SFP socket for copper or fibre-optic Hot Standby link connection
- 6) Hot Standby status link LED

- 7) SD memory card slot
- 8) A/B/Clear rotary selector switch, used to designate the PAC as either PAC A or PAC B, or to clear the existing Control Expert application

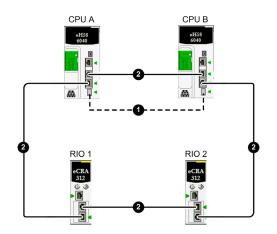


Figure 26 : HSBY Connectivity

- 1) Hot Standby fibre optic link between CPU A and CPU B
- 2) Ethernet RIO main ring

The front face of a BMEH582040 Hot Standby CPU presents the following LED panel, which you can use to diagnose the state of the M580 Hot Standby system.

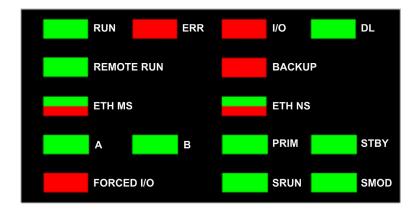


Figure 27 : PLC Diagnostic LED

3.2.1.5 RTU Advanced NOR Module

The module provides telemetry protocol connection availability in complex M580 configurations through the Modbus TCP communication protocol. The advanced RTU module has enhanced cyber security features and better performance than the BMXNOR0200H module, including telemetry protocol connection availability and several Ethernet-based services.

Make connections to the BMENOR2200H module with a cable:

- Upstream connection: Connect the module to a SCADA system through the DNP3 or IEC 60870-5-104 protocol. (A Modbus TCP connection is another option.)
- 2) Downstream connection: Connect the module to remote server devices and stations through the DNP3 or IEC 60870-5-104 protocol.

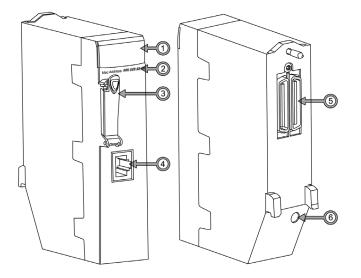
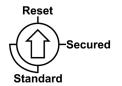


Figure 28 : NOR Module

- 1) LED array
- 2) MAC address
- 3) Memory card slot
- 4) Serial port
- 5) Dual-bus backplane connector
- 6) Rotary switch

Rotary Switch:



A three-position rotary switch is located on the back of the module. Set this switch to configure a cybersecurity operating mode for the module: Install the module on a local Ethernet backplane in a Modicon M580 system and access to a Modicon M580 network through the external ports of the CPU and Main Features and Functionality as below

- 1) Cyber security enhancements:
 - Secure boot
 - Firmware signing and integrity check
 - Secure firmware upgrade
 - HTTPS-based Web pages
 - RBAC
 - TLS for RTU protocols
 - Password complexity
 - Secure mode selection
 - DNP3 secure authentication version 2 & 5
 - secure Hot Standby communication between modules
- 2) High data throughput capacity when the module acts as an RTU server (transmits 4,000 events/second to client devices)
- 3) Exclusive data exchange bandwidth for each module installed on the same rack
- 4) Maximum of 150,000 RTU events stored in module buffer

The module LED indicators are located on the front of the BMENOR2200H module. The LEDs provide information on:

1) Module status (run, error, downloading)

- 2) Serial communications
- 3) Ethernet network communications
- 4) SD memory card state
- 5) Cyber security status

This is the LED display on the front of the BMENOR2200H module:



Figure 29 : NOR Module Diagnostic LED

Communications across the dual-bus backplane of this sample local rack (which includes an M580 CPU) implement both the Ethernet (red line) and X-Bus (blue line) protocols: The data exchange uses implicit messaging to facilitate memory sharing between the module and the CPU. For each CPU scan cycle, the CPU publishes all data at the same time to share the most current information with the RTU.

Redundant systems contain separate primary and standby control networks. The configuration of the primary and standby racks is identical. A redundant system that implements BMENOR2200H modules, therefore, includes one such module in both the primary and standby racks with these IP addresses:

- IP address: BMENOR2200H module in the primary configuration
- IP address + 1: BMENOR2200H module in the standby configuration

Upon a redundant switch-over, the IP address setting is automatically transferred from the (former) primary BMENOR2200H module to the (former) standby

3.2.1.6 RTU Wireless Adaptor/ Bridge Module

PMXNOW0300 – is a wireless adaptor/ bridge is used for communication using campus Wi-Fi network in case of communication failure with the FO communication network.



Table 17 : Technical Specification of Wi-Fi Adaptor/Bridge

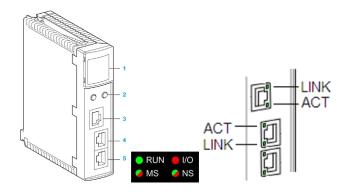
Sl.NO	Feature	Specification
		13 conforming to IEEE 802.11b/g
1	Number of channels	8 conforming to IEEE 802.11a
		11 conforming to IEEE 802.11h
2	Transmission frequency	5.4 GHz,2.4 GHz,5 GHz
		WEP
		WPA-PSK
2	3 Encryption protocol	WPA2-PSK
5		RADIUS conforming to IEEE 802.11x
		MAC addresses filtering
		SSID broadcast control

Sl.NO	Feature	Specification
4	Transmission rate	<= 108 Mbps
5	Maximum sensing distance	150 m

3.2.1.7 RTU – Ethernet Remote adapter module

BMECRA31210 - Adapter module in an (e)X80 EIO drop can be installed only in slot 0 (directly to the right of the power supply) in the main rack of the drop. An RIO drop is connected to the daisychain loop on which the Ethernet RIO network resides. Each remote drop contains one BMECRA31210 adapter module. Each rack in a remote drop contains its own power supply module. Modicon M580 delivers a remarkably high level of computing power for increasingly data-intensive processes and Cyber-security certified (Achilles Level 2).

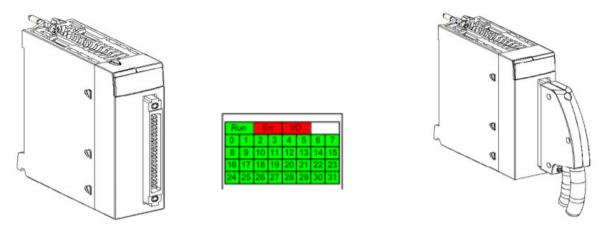
The maximum distance between drops is 100 m and Each EIO drop contains one adapter module. Main rack is one with an address of 0 and a CPU or communication adapter module (CRA) in slot 0 or 1. An extension rack is not a main rack. The CPU can make a diagnostic request of redundant power supplies on the local rack and, via a communications adapter (CRA), of redundant power supplies on a remote rack.



- 1) LED display
- 2) Rotary switches
- 3) Service port (ETH 1)
- 4) Device network port (ETH 2)
- 5) Device network port (ETH 3)

3.2.1.8 RTU – Digital Input Module

The BMX DDI 3202 K module is a 24 VDC, fast blow fuse of 0.5A discrete module connected via a 20-pin terminal block. This module has 16 input channels that operate on alternating current. The BMX DDI 3202K module is fitted with a removable 40-pin terminal block for the connection of sixteen input channels.

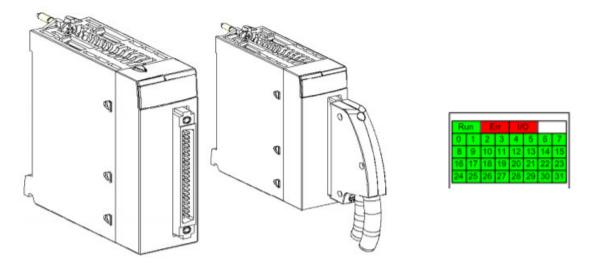


These modules have:

- 3 module status LEDs: RUN ERR I/O
- 32 channel status LEDs

3.2.1.9 RTU - Digital Output Module

The BMX DDO 3202 module is a 24 VDC or 24...240 VAC, fast blow fuse of 12 A for each 8-channel group discrete module connected via a 40-pin terminal block. Its 16 non-isolated relay output channels operate either on alternating current or direct current.



These modules have:

- 3 module status LEDs: RUN ERR I/O
- 32 channel status LEDs

3.2.1.10 Networking switch in RTU panel

Redundant managed network switch which shall be compliant with IEC 61850 based communication with IED devices is considered in each RTU Panel. This switch shall have uplink connectivity with redundant fibre network and enable below planned network connections.

- 1) Connection of the CPU Module communication ports
- 2) Connection of Water Management system interface
- 3) Connection of IEDs of the sub station

4 System Hardware Design

4.1 System IO Consideration

4.1.1 RTU System – Substation typical

The following electrical equipment's shall be monitored/ control at the substations from RTU system. Graphical view and SLD shall be depicted in the HMI, provides operator interface at local.

- 1) Transformer (Type1: Indoor)
- 2) Transformer (Type2: Outdoor)
- 3) Incomer Breaker
- 4) Bus Coupler Breaker
- 5) Outgoing Breaker
- 6) RMU
- 7) Feeder ACB
- 8) Feeder MCCB

The following are the typical hardwired IO for the typical electrical equipment and shall be hardwired / soft-interfaced to RTU remote IO modules.

4.2 RTU System Sizing

As per the typical equipment I/O and the comparison of the Single line Diagram of the power system the signal count estimation has been carried out to arrive at the overall RTU system sizing as listed below. Detailed IO List can be found in annexure -2

Location/ Sub station		Signal Count - Design Estimation					Signal Count - Design Estimation (30% SPARE)					MODULE Count - Design	
	DI	DO	AI	AO	SOFT	DI	DO	AI	AO	SOFT	DI- 32	DO- 32	
MAIN RECEIVING STATION	192	34	0	0	514	250	45	0	0	669	8	2	
Solar Station	69	14	0	0	186	90	19	0	0	242	3	1	
Central Station	150	28	0	0	360	195	37	0	0	468	7	2	
ACADEMIC SUSBTATION-01	194	55	0	0	784	253	72	0	0	1020	8	3	
Sports Complex SUBSTATION-05	169	47	0	0	786	220	62	0	0	1022	7	2	

Table 18: Soft I/ O's - Numerical Relay (IED) - Transformer Protection Relay

SUBSTATION-02 INTERNATIONAL CENTER	245	69	0	0	786	319	90	0	0	1022	10	3
SUBSTATION-03 (Faculty Housing)	218	61	0	0	920	284	80	0	0	1196	9	3
SUBSTATION-04 (STUDENT HOUSING)	293	95	0	0	1446	381	124	0	0	1880	12	4
Outreach Substation	96	24	0	0	382	125	32	0	0	497	4	1
	1626	427	0	0	6164	2117	561	0	0	8016	68	21
NOTE :	32 CHA	ANNEL D	I CARD									
NOTE:	32 CHA	NNEL D	0 CARD									

4.3 System Power Requirements

	24V DC Load Calculation (Typical RTU PANEL)					
Sl.No	DESCRIPTION		Qty	CURRENT (A)	TOTAL CURRENT (A)	
1	Power Supply Module DC For PLC Rack		2	1.65	3.30	
2	Power Supply Module DC For RIO Rack		2	1.9	3.80	
3	Panel Indication Lamp		2	0.027	0.05	
4	32 Channel DI Module		11	0.064	0.70	
5	32 Channel DO Module		2	0.704	1.41	
6	Ethernet Switch		2	0.63	1.26	
7	НМІ		1	0.625	0.63	
	TOTAL CURRENT				11.15	
	TOTAL CURRENT & POWER REQUIRED @ 24VDC POWER SUPPLY UNIT	11.15	A	267.624	VA (DC)	
	TOTAL CURRENT & POWER REQUIRED @ 24VDC POWER SUPPLY WITH 50% FOR FUTURE	16.73	A	401.436	VA (DC)	
	Power Supply - SMPS Selection (Typical R	ΓU ΡΑ	NEL)		
1	CONSIDERING MAXIMUM POWER INPUT 240 VAC/ OUTPUT 24V DC OF 20 A (480 W) SMPS	6.00	A	1440.00	VA (AC)	

240V AC Load Calculation (Non-UPS) - Typical RTU PANEL

Sl.No	DESCRIPTION		Qty	CURRENT (A)	TOTAL CURRENT (A)
1	Tube light		2	0.075	0.15
2	FAN		2	0.15	0.30
3	Utility Socket		1	5	5.00
4	Panel Indication Lamp		1	0.02	0.02
	TOTAL CURRENT				5.47
	TOTAL CURRENT & POWER REQUIRED @ 240 VAC POWER SUPPLY UNIT	5.47	Α	1312.8	VA (AC)
	TOTAL CURRENT & POWER REQUIRED @ 240 VAC POWER SUPPLY WITH 50% FOR FUTURE	8.21	A	1969.2	VA (AC)
			_	_	_

	Load IN KVA
Total UPS Load Required (AC)	1.44
Total Non-UPS Load Required (AC)	1.97

Note:

- 1 Required One UPS Feeder
- 2 Required One Raw Power Feeder

4.4 Typical Digital Input Wiring

Internal panel wiring scheme adopted for a typical Digital Input module is executed using prefabricated cable from the PLC Input module and plugged into the connector on the interface module board for the Digital input. This methodology of wiring eliminates the terminal block wiring in the panel and provides ease of system maintenance post commissioning of the system.

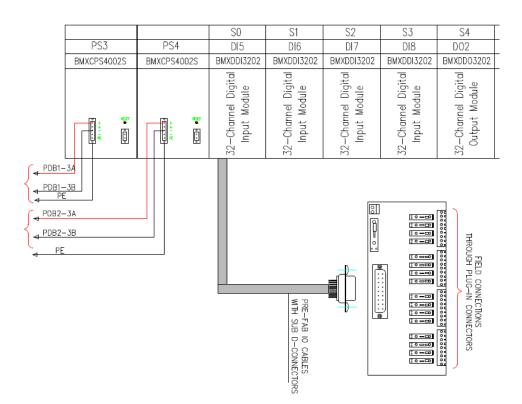


Figure 31 : Typical Digital Input Wiring

4.5 Typical Digital Output wiring

Internal panel wiring scheme adopted for a typical Digital Output module is executed using prefabricated cable from the PLC Output module and plugged into the connector on the interface module board for the Digital input. This methodology of wiring eliminates the terminal block wiring in the panel and provides ease of system maintenance post commissioning of the system.

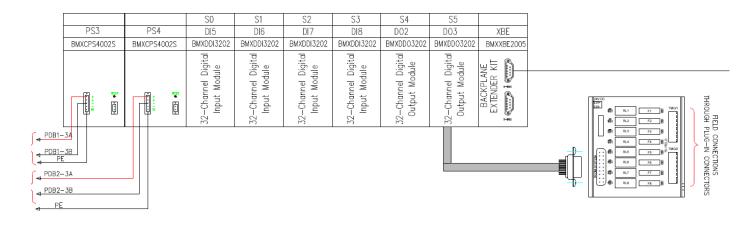


Figure 32 : Typical Digital output Wiring

4.6 Panel Design

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Panel Design and wiring shall be carried out as per Standard practices and guidelines set out by the manufacturer. The details of the current rating, wire size and colour codes that shall be adapted for this project has provided below. The cable wiring used in the panel shall be with FRLS insulation.

Description	Voltage	Wire Color	Wire Size		
Phase	2401/46	Red	2CORE 2.5 Sq.mm		
Neutral	240VAC Control	Black	2CORE 2.5 Sq.mm		
Ground		Yellow/Green	2.5 Sq.mm		
Positive		Blue	2CORE 1.5 Sq.mm		
Negative	24VDC Control	Green	2CORE 1.5 Sq.mm		
Ground		Yellow/Green	1.5 Sq.mm		
Positive	Analog		D-SUB 9 pin female		
Negative	Input	Multicolor Prefabricated cable	connector		
Positive	Analog	Multicolor Prefabricated cable	D-SUB 25 pin female		
Negative	Output	Wulticolor Pretabricated cable	connector		
Signal	Digital Input	Multicolor Prefabricated cable	D-SUB 25 pin female connector		
Signal	Digital Output	Multicolor Prefabricated cable	D-SUB 25 pin femal connector		

Table 20 : Wire Sizes and Color codes

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Table 21: Current Rating & Wire Sizing

Current Rating	Wire Sizing considered
Below 10 A	1.5 Sq. mm
11 A to 20 A	2.5 Sq.mm
21 A to 30 A	6.0 Sq.mm
31 A to 40 A	10 Sq.mm

5 System Functional Design

5.1 Overall Distribution Management System (DMS)

Supervisory Control And Data Acquisition (SCADA) system is the heart of Distribution Management System (DMS) architecture.

Control System Central SCADA system should have all the infrastructure elements to support the multifaceted nature of distribution automation in 9 Nos. of Substations and the higher level applications of a DMS. A Distribution SCADA system's primary function is in support of distribution operations over the redundant network of fibre as well the telemetry operation, alarming, event recording, and remote control of field equipment.

The main elements of a DMS system are:

- 4. Host equipment.
- 5. Communication infrastructure (network and serial communications).
- 6. Feeder Terminal Units devices for operations.

5.1.1 Host Equipment

The essential element of a distribution SCADA in proposed solution:-

- 5. Host servers (redundant servers with backup/failover capability).
- 6. Communication front-end nodes (network based).
- 7. Full graphics user interfaces.
- 8. Database Central SCADA Server
- 9.

5.1.2 Communication infrastructure

The DMS is connected with the distributed substations RTU over the fibre backbone and wireless network as well.

The data will be transmit over the Modbus TCP/IP protocol from the distributed RTUs, The distributed IO modules are connected to a data concentrating unit placed in each substation to communicates with the central SCADA computer system

5.1.3 Feeder Terminal Units devices for operations

RTU's are the main components of the distribution automation system to control and monitor the feeder terminal units, which meet specific operating and data gathering requirements. Each field devices provides the data for the system operations, includes fault detection, captures planning data and records power quality information.

5.1.4 Database Central SCADA Servers-

For archival of historical power system values, SCADA automatically compiles and delivers information for the 9 Nos. of Substation to a central control centre. This system sends digitized information in real time, and it also automatically compiles backlogs of all collected data for the analysis. This will be done over SQL database.

Collecting data from the distributed substations from the feeder terminal units allows to detect potential problems before they affect your workflow. RTUs will send the gathered information to central control centre.

5.2 Central & Local Distribution Management System (LDMS)

In first level of local distribution management system, the Supervisory Control and Data Acquisition (SCADA) system acquiring, and analysing information obtained from the devices placed on the electrical substation. SCADA system monitor and control the input-output points of each substation over the Modbus TCP/IP protocol. All the 9 Substation connected to central SCADA system.

The Central SCADA system is used both at the distribution and the transmission level. The Collected data from all the 9 Nos. of Substation viewed on the 2 Nos. of Operator Workstations located at the central SCADA where it is used for controlling and monitoring the various grid element. SCADA system

enables monitoring of the status of switches, protection relays, and detecting the occurrence of faults at feeder terminal units.

In Proposed solution there is 2 level of controls-

- 1. Master Station- Located in Central SCADA Room
- 2. Remote Units- 9 Nos. in distributed location.

The master stations is equipped with local area network, workstation, servers and video wall while the remote stations having the remote terminal units (RTUs), a local Distribution monitoring system (LDMS) with HMI.

In local substation level each substation shall also have HMI with SCADA application connected with RTUs over Modbus the TCP/IP to control, monitor and data storage as well for one month in case of any communication breakup between the central SCADA and field RTUs.

RTU is a microprocessor-based electronic device that acquires data from feeder terminal units and transmits it to the control centre. RTU will collect data from metering and other equipment and calculate the values for desired grid parameters such as voltage, current, reactive power, etc. An LDMS or HMI presents processed data to the substation operator. It is linked to the SCADA system's databases and software programs to provide trending, diagnostic data and management information to the substation operator.

A SCADA system also consists of a fault passage indicator, a device which provides visual or remote indication of a fault in the electric power system. Further, a SCADA system having dedicated and reliable communication systems between various field devices and the master station.

5.3 Load Management System

NU building have following power sources for building equipment operation: -

- 1. Solar Power Supply.
- 2. CHP power supply
- 3. State Load Dispatch Centre (From Grid).
- 4. DG Power Supply.

During normal operation non-critical system with run over solar power supply. Once total load of noncritical system will be greater than solar system capacity then operator / Auto-System will give on command from central SCADA to close incoming 33KV HT breaker panel. During emergency when solar and grid supply will fail operator / Auto-System will give start command to DG from central SCADAs. Central SCADA workstation display healthy status along with other essential data of UPS system.

Methodology of Load Management System to control and monitor the substation in NIT:-

- Control total system average demand to pre-defined load targets by switching of load groups.
- Control demand at Points of Supply independent of pre-defined load targets.
- Monitor several sources of demand input and fail-over to secondary inputs should the primary inputs fail.
- Timetable switching of load groups.
- Assign priorities to load groups for shedding and restoring.
- Share the total time off for a set period between all load groups of a similar priority.
- Automatic fail-over of load groups to a manual control after a set number of unsuccessful attempts at control.
- Provide operator displays that allow for complete monitoring and control of the Load Management system.

5.4 SLDC

State Load Dispatch Centre (SLDC) shall be interfaced with SCADA station at central command centre through OPC communication protocol.

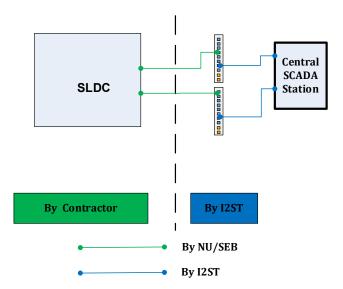


Figure 33 : SCADA/DMS and SLDC Communication

5.5 Resident Energy Billing Module

The modbus gateway will collect the data from the energy meters installed in respective buildings and transmit to central SCADA. All the gateways communication is in redundant communication to transmit the data over Modbus RS485.

Data Analytics is done on the data derived from these meters. Thus the first step is to extract the data from these meters in order to carry out further analytics.

Proposed Energy Billing Module Features: -

- Energy Dashboard.
- Report engine allows you to easily configure, save and send.
- Rate engine supports custom utility rates and charges.
- Configurable line items for flexible report output.
- Net metering, meter splitting and common area allocation.

5.6 Weather Monitoring System

Weather monitoring plays an important role in electrical power generation and distribution substations. There are many different variants of weather monitoring systems. We have considered all-inone modular weather station at Central Command Centre substation. This weather monitoring system

has several dedicated sensors which shall be installed at appropriate outdoor conditions required for the specific type of measurement.

Advantages of all-in-one weather stations are that installation and maintenance are much less. The measured parameters can be stored in microcontroller of this weather monitoring system(WMS) and shall be transmitted via modbus RTU communication interface to RTU system at Central Command centre. From the PLC based RTU system the values are transferred to SCADA for display to operator.

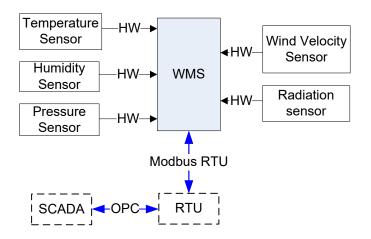


Figure 34 : Weather Monitoring system scheme.

S.N	Parameters	Data type	Unit
1	Relative Humidity	Real/Analog Value	%
2	Environmental Temperature	Real/Analog Value	°C
3	Atmospheric Pressure	Real/Analog Value	bar
4	Air Quality	Real/Analog Value	ppm
5	Rain Fall	Real/Analog Value	mm
6	Solar Radiation	Real/Analog Value	W/m ²
7	Sun Shine Duration	Real/Analog Value	S
8	Soil Moisture	Real/Analog Value	

S.N	Parameters	Data type	Unit
9	Soil Temperature	Real/ Analog Value	°C
10	Wind Velocity	Real/ Analog Value	m/s
11	Wind Direction	Real/Analog Value	

5.7 Microgrid

RTU will act as a micro grid controller in substation.

The control system includes:

1) Energy management function – For local management of Distributed Generation and Storage (DER) shall be done in RTU level as per the load curtailment and demand response. Energy management system in Central SCADA control room dispatches the assets to supply the load and meet required load at the point of connection to the grid.

2) RTU will manage local critical loads in the event of the failure of the distribution grid which improves the reliability, security and resilience of the electric power supply to the loads within the microgrid.

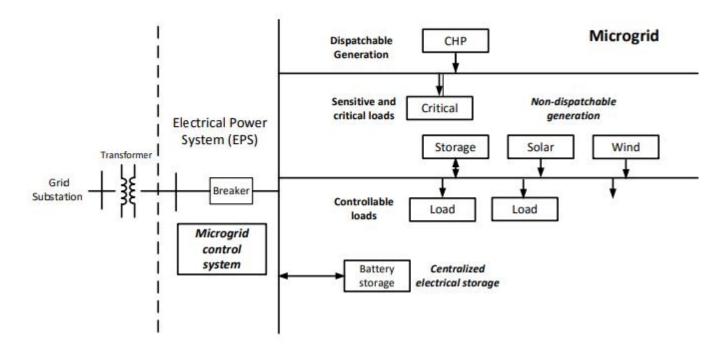


Figure 35 : Microgrid Overview

The RTU control system manages all aspects of the microgrid operation at the point of connection to the distribution grid, in steady state and under transient conditions. Under steady state operation, the control system dispatches the microgrid assets, including DER units and interface and switching

devices. Under transient conditions, the control system is responsible for ensuring the smooth connection and disconnection from the distribution grid.

The two core functions is implemented in microgrids are the following:

The dispatch function – It computes and distributes the set-points for generation and storage, including DER units and loads (controllable and curtailable) in grid-connected and islanded modes, under steady state and transient conditions, including disconnection from and reconnection to the grid.
 The transition function – It defines the operations required to implement the transition from grid connected to islanded modes, including disconnection from the distribution grid and resynchronization to the grid.

Block 4	Grid interactive control Area electric power system control, electricity markets, DMS interaction, distribution system interaction, SCADA	
Block 3	Supervisory control Generation and load dispatch, optimization (voltage profile, economic), spinning reserve, reconfiguration, black start, protection coordination, forecasting, data management and visualization	
Block 2	Local area control Load management, energy management, automatic generation contro fast load shedding, disconnection, resynchronization	
Block 1	Device level control Voltage/frequency control, current/power control, reactive power control, generation control, load control, energy storage control, islanding detection, fault detection and protection	

Figure 36 : Microgrid control levels

5.8 Network Redundancy

Nalanda University campus SCADA and Local system communicates primarily on physical FO ethernet ring for inter substation communication, however in case, if there is a failure of this physical network (of any station/complete) due to any highly unlikely reason then we still have a backup mode of communication.

This communication is done via wireless WIFI bridge installed at substations which in turn are sending the data to main control centre where SCADA systems are connected to the network infrastructure which maintains the campus Wi-Fi infrastructure. The local RTUs cum data concentrator will communicate to control centre via OPC protocol. For this Ethernet WIFI bridge will be mounted in the local SCADA substation.

5.9 Disaster Recovery System

The primary SCADA server application data are maintained in the form of SQL database. Replication of the primary SQL database in the secondary sever is created through redundancy configuration. The SQL database in primary and secondary sever acts as the first level of disaster recovery mechanism. Through the internet connection provided by the university the a tier two replication of the primary SQL database shall be maintained over the Cloud platform maintained by I2ST.

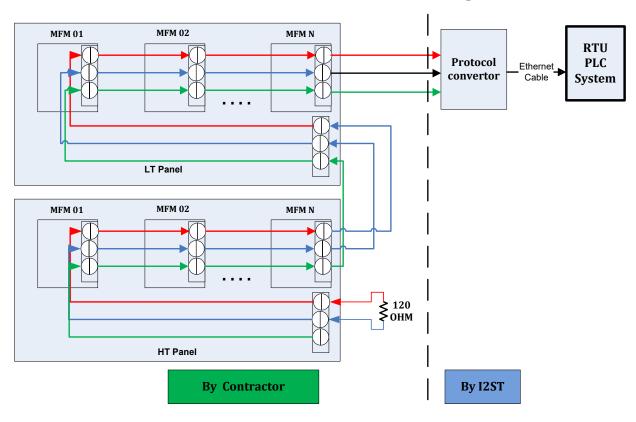
6 System Interfaces

Electrical SCADA system shall interface with several other sub systems with predefined communication protocol as defined in the technical specification section C of . This section provides the detailed interface specifications of the SCADA system with other sub systems.

6.1 Multifunction meter Interface Specification

Multi-Function Meters (MFM) which are present in different LT and HT panels in each substation shall be monitored by the RTU system for the electrical parameters. These MFM meters shall be wired

internally in the panel in the form of daisy-chain connection. The communication cables from the multifunction meters shall be wired to the protocol convertor by the contractor. The RTU PLC system shall read the data from the protocol convertor over modbus TCP/IP protocol. The monitored parameter values shall be transferred to the SCADA system through OPC protocol.



6.1.1 Protocols and Interface Demarcation Diagram

Figure 37 : Block Diagram – RTU system and MFM connection

6.1.2 Communication Protocols of MFM

Modbus communication details are mentioned below

Tak	e 23: Modbus Communication setting

SI. No	Communication Settings	
1	MFM Qty	

Sl. No	Communication Settings	
2	MFM Location	TBD
3	Electrical Specification	9600
4	Transmission System	None
5	Connector	
6	Baud Rate	
7	Data bits	
8	Stop Bit	
9	Parity	

6.1.3 IO Description of MFM

Table 24: MFM Parameters

Modbus (MFM) Electrical Parameters							
Sl. No.	IO Description	Data types	Register type	Address	Unit & Range		
1	L1 Phase Currents						
2	L2 Phase Currents						
3	L3 Phase Currents						
4	L1N Phase Currents						
5	L2N Phase Currents						
6	L3N Phase Currents						
7	L1 Phase Voltage						
8	L1 Phase Voltage						
9	L1 Phase Voltage						
10	L1N Phase-Neutral Voltage						
11	L2N Phase-Neutral Voltage						
12	L3N Phase-Neutral Voltage						
13	vTHD (%) Phase Voltage Harmonic distortion						
14	iTHD (%) Phase Current Harmonic distortion						
15	Aunb (%) Phase Current unbalance						
16	Active Power (kW)						
17	Reactive Power (kVAr)						
18	Apparent Power (kVA)						
19	Power Factor (PF)						
20	Displacement Power Factor (dPF)						

	Modbus (MFM) Electrical Parameters					
Sl. No.	IO Description	Data types	Register type	Address	Unit & Range	
21	Peak Current (Apk)					
22	Energy (kWh)					

6.2 Intelligent Electronic Device (IED)

The RTU panel has network switches that support IED communication based on IEC 61580 protocol. The contractor shall execute internal looping of the IED devices in the electrical panels and connect these devices to the RTU panel network switches. The SCADA system shall monitor the electrical parameters of the IED and the internal events recorded in the IED devices. The SCADA system shall transfer the data from IED memory buffer through ftp protocol.

6.2.1 Protocols and Interface Demarcation Diagram

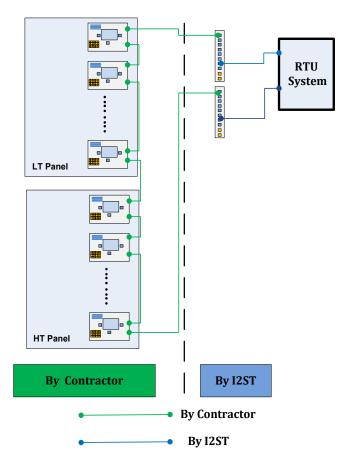


Figure 38 : Block Diagram IED – RTU interface

6.3 Existing System

The SCADA system shall interface with BMS and other auxiliary system that are already existing in the university campus. This interface is only for the purpose of monitoring and no control operation is planned in the implementation. The contractor shall provide network communication of all the existing system at the networking switch provided in central command centre.

The communication interface with existing systems shall me through OPC communication protocol. Below are the list of auxiliary systems that are envisaged to be connected to the SCADA system.

- Existing BMS system
- Lighting and Electrical Protection & distribution System
- HVAC

- Plumbing Systems
- Fire Fighting system

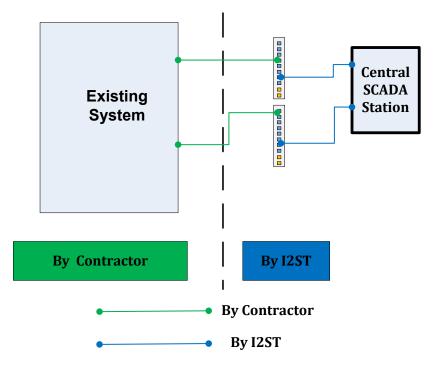


Figure 39 : Block Diagram – SCADA/ DMS and Existing BMS Interface

6.4 Diesel Generator Set

Diesel Generator (DG) set that are available in Academic substation, International centre substation and CRS Library substation shall be interfaced with the respective RTU system for monitoring and control operation. The substation PLC system shall monitor and control the DG sets over Modus TCP/IP communication protocol. The controller of Diesel Generation set shall be connected to the network switch in the substation RTU panel by the contractor.

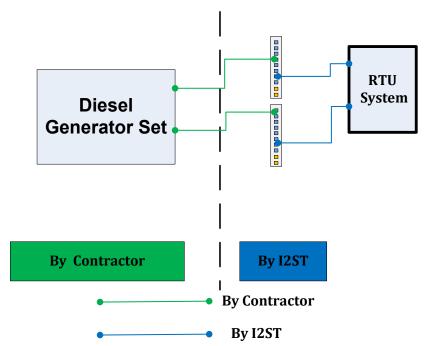


Figure 40 : Block Diagram DG Set - RTU communication

6.5 Solar Control System

The SCADA system shall interface with the Solar system controller at the central command centre through OPC protocol. SCADA control system shall be connected to the network switch at central command centre by the contractor.

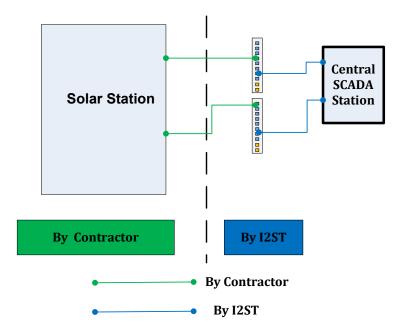


Figure 41 : Block Diagram – Solar Station – SCADA system interface

6.6 SLDC

State Load Dispatch Centre (SLDC) shall be interfaced with SCADA station at central command centre through OPC communication protocol.

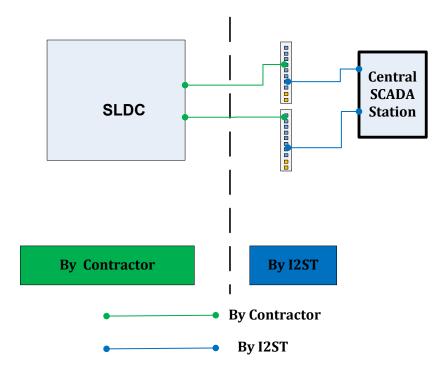


Figure 42 : Block Diagram – SLDC – SCADA system interface

6.7 Water Management system

Water management system at each Water treatment plant and other facilities(Like irrigation and Fire) shall be interfaced with the SCADA/DMS system.

The control system of water management system shall be connected to the network switch at SCADA / DMS Level. The data shall be monitored from the water management system through OPC-UA communication protocol.

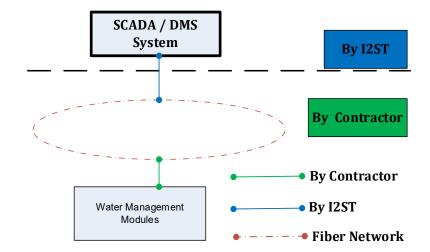


Figure 43 : Block Diagram Water Management system – SCADA/DMS system interface

6.8 Resident Billing Module

Resident Billing module implementation shall require energy consumption monitoring meters installed in the respective buildings with daisy chain looping between the energy meters. The energy meter serial network shall be connected to Serial to ethernet gateway. The gateway shall be connected to ethernet/ Fibre connector media converter and interfaced with the SCADA/DMS system at the central command centre. The data shall be read by the SCADA/DMS system through modbus TCP/IP communication protocol.

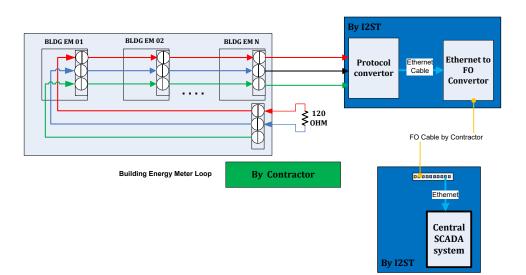


Figure 44 : Block Diagram -Resident Billing Module and SCADA system interface

6.9 Interface with GIS

SCADA and GIS system shall interface over modbus TCP/IP or OPC UA communication protocol for exchange of data. The SCADA application shall provide below visualization for the operator

- Markers A pointer to a specific coordinate in a predefined map that is represented as an image or Archestra Graphic shall be shown for different sub-systems.
- Shapes A collection of specific coordinates in a map shall represent key status of the sub system. Upon further clicking of the shapes detailed information of the sub system shall be made available to the user.

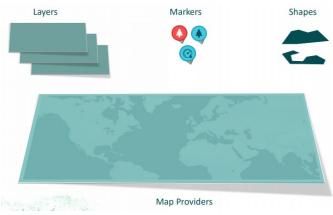


Figure 45 GIS Core Objects

7 User Interface Requirements

7.1 General Requirements

User hierarchy and Authentication details are listed as below. Operation equipment and control shall detail based on the input document (control philosophy / narrative provided by client)

- 1. Operator Refer section 7.2.1
- 2. Engineer Refer section 7.2.2
- 3. Manager Refer section 7.2.3
- 4. Maintenance Refer section 7.2.4
- 5. Guest Refer section 7.2.5

7.2 System User

This includes the user rights allocated to each level of users. All users are grouped under 5 categories.

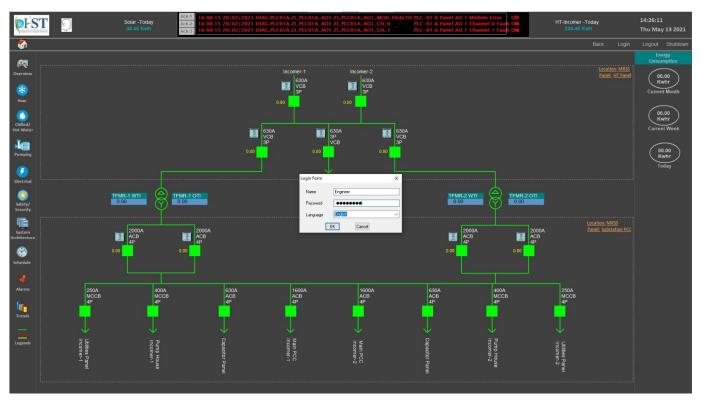


Figure 46 : SCADA System user login

7.2.1 Operator Level

This level of security shall permit the following:

- General monitoring of process
- Equipment On/Off operation
- Fault Acknowledge and alarm
- Enter data on Reports

7.2.2 Engineer Level

This level of security shall permit the following:

- All functions detailed in operator's level
- Alarm and process set points change.
- Shutdown Scada.
- Change programs
- Modify graphics and control functions
- Configuration of I/O points/database (including changing tag numbers)
- Modification of existing graphics
- Data amendment

7.2.3 Manager Level

This level of security shall permit the following:

- All functions detailed in operator's and engineer level
- Alarm and process set points change.
- Re-configure System Architecture.
- User Access Modification.

7.2.4 Maintenance Level

This level of security shall permit the following:

- All functions detailed in operator's level
- Alarm and process set points change.
- Shutdown Scada.
- Change programs

• Modify graphics and control functions

7.2.5 Guest Level

This level of security shall permit the following:

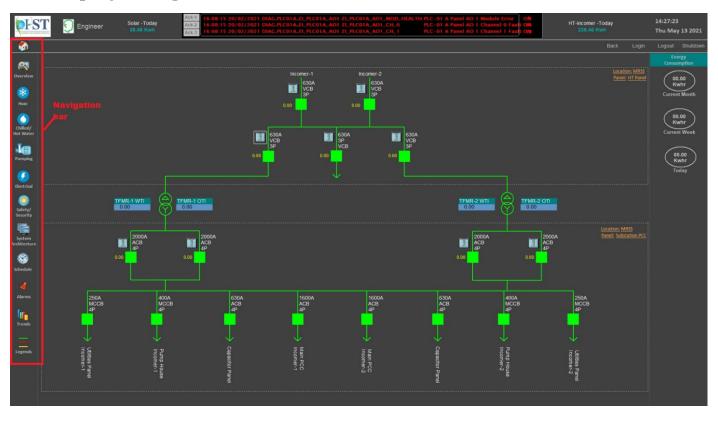
• Monitoring of all the SCADA Screens and permitted data

7.3 Function and Data security

Security level of the user is created to limit functional access asper the system user.

System / Hardware	Information LAPTO	DP-6FM26VDJ
IO Device Stats Server Status		TrendServer_P AlarmServer_P
some online	Create User	X
User Modification Modify Users	User Name Full Name	
Edit Users Create User	Type Enter Password	Engineer
	Retype Password	Cancel

Figure 47 : User creation



7.4 Display Navigation

Figure 48 : Display navigation screen

7.5 Permanent Indicators

Below are the list of permanent indicator dashboards that are available as part of SCADA application in all screens for the visualization of key information by operator.

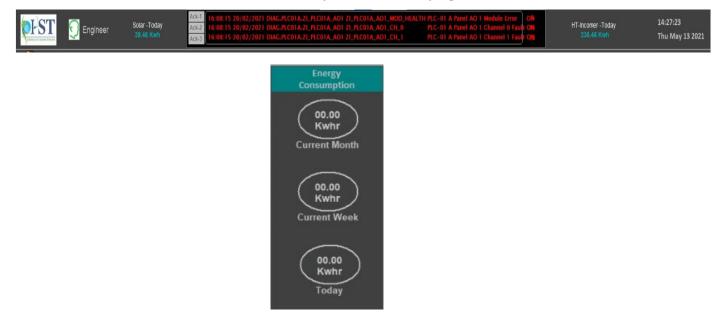


Figure 49 : SCADA/DMS Permanent Indicators

7.6 Trend

SCADA / DMS trends are a seamless combination of real-time and historical data. When you display a trend page, you can monitor the current activity as it happens, and simply scroll back through time to view the trend history.

A trend builds a picture over time of how the variable (Voltage, kW etc.) is changing or how a device is performing. SCADA/ DMS trends are created from a selection of sample values.

The sample values are plotted against time, and the resultant graph gives you an indication of process behaviour. Trend samples can be taken periodically, or when specific events occur in your system. Sampling rates can be as frequent or as moderate as 24 hours.

Selection of different analog parameters for trending of data shall be configured in the SCADA / DMS application and the configured trend display data shall be exported as csv files.

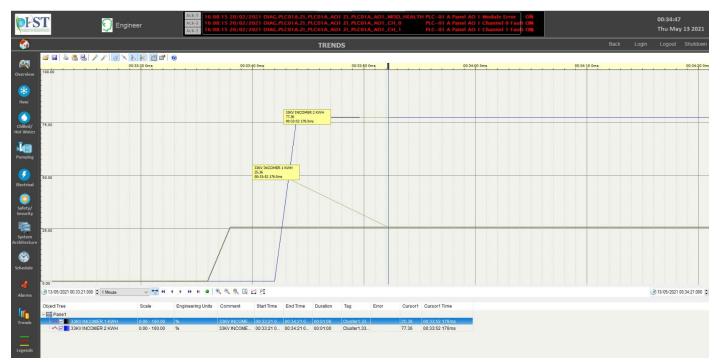


Figure 50 : Trends

7.7 Alarms/ Events

Alarms both from the process and system can be viewed and acted upon from the operator Workplace via lists, alarm summary indication etc. An alarm list only includes the alarms that an operator needs to pay attention to, such as unacknowledged or still active alarms.

- Process Alarms are alarms that are generated from the process, such as failure in a valve or pump or High/High High/Low/ Low Low etc.
- System alarms include alarms related to hardware in the control system such as network line fault, module fault etc.

Latest alarms can be viewed in the bottom of each process graphics. It is also possible to monitor the previous active alarms from the Alarm summary screen. Critical alarms shall be provided with sound to alert the operator.

Alarms shall be indicated by colour changes in displayed value or symbol and states shall be indicated as follows:

- Flashing red when in alarm and not acknowledged by operator.
- Steady red when no longer in alarm and not acknowledged by operator.
- Steady yellow when still in alarm and following acknowledgement by operator.
- Back to original colour when no longer in alarm and following acknowledgement by operator.

The following information for each alarm as it appears on an alarm display page:

- a) Time
- b) Date
- c) Tag Name
- d) Alarm Description
- e) Value of the Variable
- f) Alarm Status Disabled, Acknowledged, Unacknowledged
- g) Alarm Category or Priority
- h) Alarm Priority
- i) Category

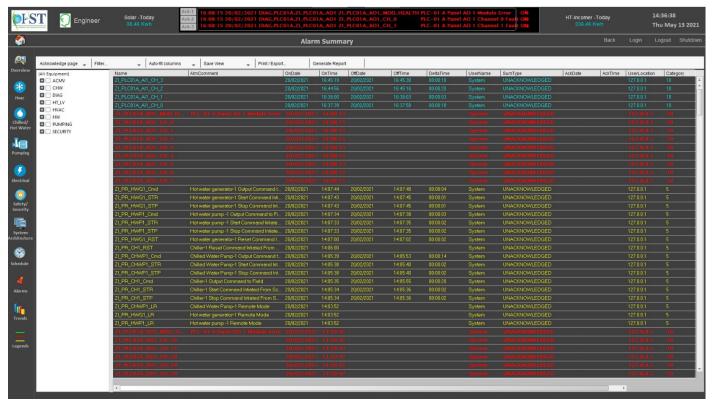


Figure 51 : Alarm Summary Screen

7.8 Computer system configuration and monitoring displays

The operation status of differ computer system and their monitoring shall be made available in the system information and configuration page of the SCADA screen. The information related to the status of the SCADA application server and its key functional components are monitored and displayed in this screen. Preconfigured system events and alarms related to system configuration and its operation states are logged with its time stamps in the SQL database.

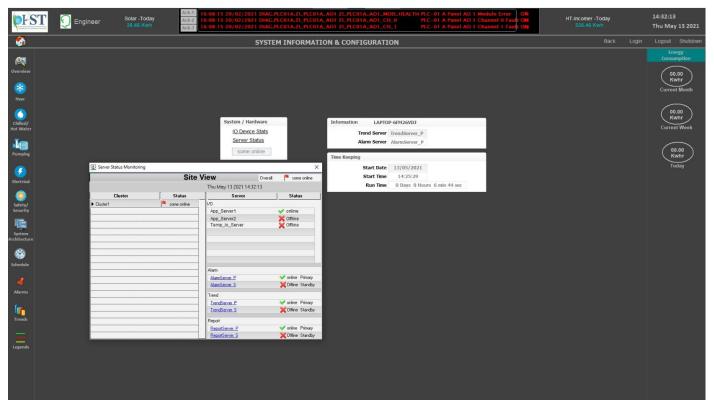


Figure 52 : System configuration and status monitoring

7.9 System Diagnostics and Monitoring

The Overall architecture of the system is shown in the system diagnostics and monitoring section of the SCADA application. All key monitoring status of the processor, communication, status of the modules of the PLC system shall be shown here to enable quicker identification of fault and planning of rectification measures.

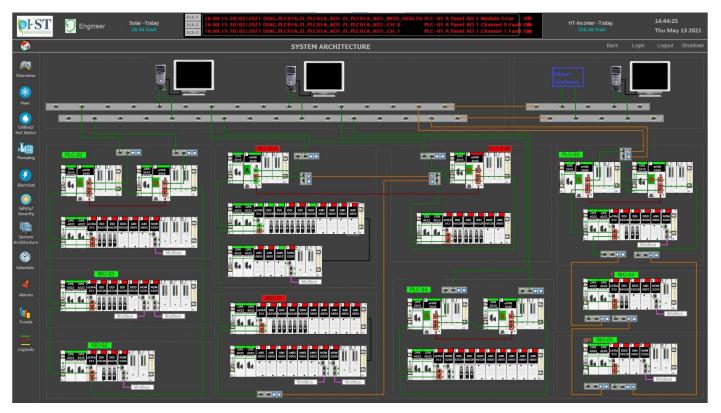
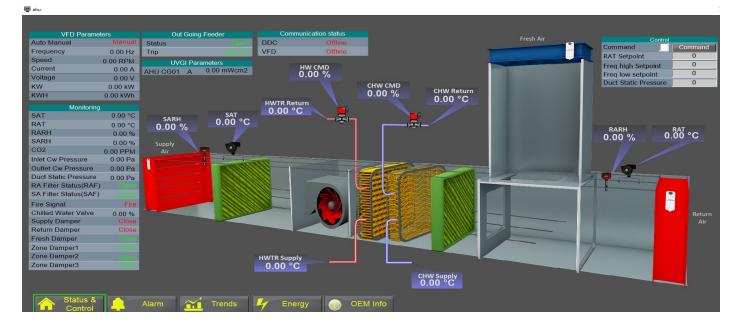


Figure 53 : Sample System Diagnostics Screen.

7.10 Sample Process Screens





8 Testing and Documentation

The testing and testability of the components parts of the Hardware / Software systems will be as described in the following section.

In summary, the systems will be subject to stage manufacturing checks, Internal functional testing, Factory Acceptance Test (FAT), Site Acceptance Test (SAT).

Upon successful completion and acceptance of FAT, Panel's will be shifted to site and stored at the storage facility provided by customer. The supplied panel's will be installed, tested, and commissioned before subjected to SAT.

8.1 Type Testing (Not Applicable for RTU Panel)

8.2 Internal Functional testing

Prior to inviting, the client to perform the FAT, I2ST will perform pre-testing of the systems by applying and performing the approved client FAT document.

Solution to any comments will be provided by the responsible engineer and implemented by technicians. On completion of any remedial work, the affected area will be subjected to a retest to the satisfaction of the responsible engineer. When all points have been resolved, the client will be invited to attend an FAT.

8.3 Factory Acceptance test (FAT)

The activities that are scheduled to take place during the Factory Acceptance Test are as follows:

- Hardware Integration Test.
- General Arrangement & Layout checks.
- Communication check between PLC &HMI.
- I/O checks.

• HMI graphics and animation and functions check.

The FAT will be documented to verify that the system has been tested to the extent possible before shipping to the installation at site.

Each complete unit shall undergo FAT. The list of Routine tests to be performed in the factory as per FAT Plan

The FAT will be carried out in the presence of the client at designated premises at I2ST Bangalore. The client will be furnished with a copy of FAT procedure and an Inspection comments sheet. Any fault or deviations from the inspection discovered during the tests will be recorded on an inspection comments sheet.

Solution to any comments will be provided by the responsible engineer and implemented by the technicians. On completion of any remedial work, the affected area will be subjected to a retest to the satisfaction of the client. When all points have been resolved, the FAT will be deemed to have been successfully completed.

8.3.1 Hardware Integration Test

The following are the checks to be performed under hardware Integration Test:

- 1. Design Compliance Check
- 2. Cabinet Quality Check
- 3. BOM Check
- 4. Cabinet Power supply Check
- 5. RTU Controller Configuration Check
- 6. RTU Power on Check
- 7. RTU Start-up Check
- 8. SCADA/DMS Hardware check
- 9. SCADA/DMS Start-up check
- 10. SCADA/DMS and RTU Integration and communication test

8.3.1.1 Design Compliance check

The Below test procedures shall be verified visually to check that the system (controllers, power supplies, cabling, I/O modules, etc.) installed in each individual cabinet complies with the design drawings.

Procedure			
Verify that actual arrangement inside the panel matches with GA			
drawing			
Verify the Cable troughs, Cable labels, and wire tie-wrap and			
adequate space inside tray			
Verify the Panel Earthing provision			
Panel Earth			
System Earth			
Verify that all the IO Racks are mounted as per the drawing			
Verify that all the IO cards are mounted as per the drawing			
Verify that all the DI, DO, AI and AO are placed as per the documents			
Verify that all the power distribution for 230/240VAC and 24VDC is			
as per the drawing.			
Check required Fuses, MCB's connectors			
Check all the Termination Blocks labelling, equipment labelling are			
as per the drawing			
Verify the I/O wiring from I/O cards to terminals and it is same as			
wiring diagram.			
Verify the SCADA / DMS System has been configured as per the			
approved specification.			

Table 25: Design Compliance Check

8.3.1.2 Cabinet Quality Check

The below test procedures shall be verified visually to check that all panels are free from scratches, any kind of deformation, earthing connections & labels.

S. No	Procedure
1	Verify Panel general appearance, panel type and size
2	Verify that doors locks are installed properly and close without
	undue pressure
3	Verify that Doors, side plates, gland plates are bonded
	appropriately
4	Verify that all earth connections properly tightened
5	Verify that components labels, Terminal block labels & All
	modules labels are provided as required
6	Verify that panel name plates as per approved drawings. Panel
	labels mechanically secure.
7	Verify that Equipment on mounting plate installed securely
8	Verify that Circuit breaker of proper rating installed & operating correctly
9	Verify that Panel utilities like lighting, fans, and utility sockets etc.
	installed properly
10	Check the Wiring connection as per approved drawings
11	Visually check that all cabinets are free from scratches and
	deformation

Table 26 :	Cahinet	Ouality	check
10010 20.	Gubinet	Quanty	UNCER

8.3.1.3 System Start-up test

The following test will verify that the PLC system will power up correctly.

S. No	Procedure			
	a) Power up the RTU system & Corresponding RIO system,			
1	b) RTU system and corresponding RIO system should			
	automatically go to RUN mode without any user intervention.			
2	a) Power Off the RTU system & Corresponding RIO system,			

Table 27 Days all Ch

		b) RTU system and corresponding RIO system should				
		automatically go to Off mode without any user intervention.				
3	C	a) Power up the SCADA / DMS system & Corresponding system,				
	3	and related components				

8.3.2 Functional Performance

The functional performance test shall verify all features of the SCADA/DMS hardware and software. As a minimum, the following tests shall be included in the functional performance test:

- a) Test the communication between SCADA / DMS system and RTU (minimum one station) to demonstrate the communication.
- b) Test the functionality of the system with third party communication simulation over OPC / Modbus TCP/IP
- c) Testing of the proper functioning of all SCADA/DMS & other software application software in line with the approved functions.
- d) Simulation of field inputs (through RTU) from test panels that allow sample inputs to be varied over the entire input range
- e) Verification of RTU communication Protocol OPC etc
- f) Verification of compliance of supporting interfaces such as
- g) Verification of Data Integration from SCADA/DMS system other systems viz OPC
- h) Verification of data exchange with other systems
- i) Verification of interoperability profile of all profiles of all protocols being used.
- j) Verification of RTU communication interfaces
- k) Verification of LAN and WAN interfaces with other computer systems
- l) Testing of all user interface functions, including random tests to verify correct database linkages
- m) Simulation of hardware failures and input power failures to verify the reaction of the system to processor and device failure
- n) Demonstration of all features of the database, display, and report generation and all other software maintenance features on both the primary and backup servers. Online database editing shall also be tested on primary server.
- o) Demonstration of the software utilities, libraries, and development tools.
- p) Verification that the SCADA/DMS computer system meets or exceeds employer's performance requirements (as per table for peak & normal loading in section 8Verification of Design parameters as mentioned in section 8 & wherever defined in the specification.
- q) Verification of Development system

8.3.3 Continuous operation Test (48 hours)

The stability of the SCADA/DMS hardware and software after the functional performance test has been successfully completed. During the test, SCADA/DMS functions shall run concurrently and all Contractor supplied equipment shall operate for a continuous 48 (forty eight) hour period with simulated exchange with other interconnected system viz. IT system etc.

The activities to be tested shall include database, display, configuration changes, switching off of a primary server and the execution of any function During the tests, uncommanded functional restarts or server/device failovers are not allowed; in case the problems are observed, M/s I2ST shall rectify the problem and repeat the test.

8.4 Site Acceptance Test (SAT)

1. Field Tests

After RTU panel installation, interface cabling with RMU panels/Termination boxes, communication panel and interface cabling with field & communication equipment, the Contractor shall carry out the field-testing. The list of field tests for RTU as per SAT Plan

2. Availability Tests

After field testing, RTU shall exhibit a 99% availability during test period. Availability tests shall be performed along with SCADA. The FRTU shall be considered available only when all its functionality and hardware is operational. The non-available period due to external factors such as failure of communication link etc., shall be treated as hold-time & availability test duration shall be extended by such hold time.

8.4.1 End to End test

The End-to-End test shall verify all features of the SCADA/DMS hardware and software. The following tests shall be included in the performance test:

a) Test the communication between SCADA / DMS system and RTU.

- b) Test the functionality of the system with third party communication over OPC / Modbus TCP/IP
- c) Testing of the proper functioning of all SCADA/DMS & other software application software in line with the approved functions.
- d) Field inputs (through RTU) from panels that allow sample inputs to be varied over the entire input range
- e) Verification of RTU communication Protocol OPC etc
- f) Verification of compliance of supporting interfaces such as
- g) Verification of Data Integration from SCADA/DMS system other systems viz OPC
- h) Verification of data exchange with other systems
- i) Verification of interoperability profile of all profiles of all protocols being used.
- j) Verification of RTU communication interfaces
- k) Verification of LAN and WAN interfaces with other computer systems
- l) Testing of all user interface functions, including random tests to verify correct database linkages
- m) Demonstration of all features of the database, display, and report generation and all other software maintenance features on both the primary and backup servers. Online database editing shall also be tested on primary server.
- n) Demonstration of the software utilities, libraries, and development tools.
- o) Verification that the SCADA/DMS computer system meets or exceeds employer's performance requirements (as per table for peak & normal loading.

8.4.2 System Availability Test (360 hours)

The stability of the SCADA/DMS hardware and software after the End-to-End test has been successfully completed. During the test, SCADA/DMS functions shall run concurrently and all Contractor supplied equipment shall operate for a continuous 360-hour period with simulated exchange with other interconnected system viz. IT system etc.

The activities to be tested shall include database, display, configuration changes, switching off of a primary server and the execution of any function During the tests, uncommanded functional restarts or server/device failovers are not allowed; in case the problems are observed, M/s I2ST shall rectify the problem and repeat the test.

8.4.3 System Architecture- to be designed by ECP contractor as per the Net-Zero Campus Requirement which will be further reviewed and approved by NU.

8.5 DALI System for automatic Lighting control and monitoring system

Design Supply, Store, Shifting, Installation, Testing & Commissioning of following DALI based lighting control system including required all misc accessories & supporting items. Components are given below (Note for all DALI related items: This includes providing system architecture for approval as per OEM system requirement; the successful bidder has to co-ordinate for DALI system installation with existing contractor concerned at the site and in case of any fail, the successful bidder of this DALI system will be sole responsible for its execution without any extra cost.) All equipment's shall have 50% spare capacity for future usage.

Design Supply, Store, Shifting, Installation, Testing & Commissioning of DIN Rail Infusion Controller. Ethernet enabled / Plug-and-play design / adequate RS-232 ports / RS-485 ports / 120 low voltage stations / Clips on 35mm DIN rail / Built-in USB port / SD Memory Card /Extremely fast processor /Runs on upgradeable internal software. Should have in built access over internet for trouble shooting, maintenance, firmware upgrades and updates. Adequate size of factory fabricated lockable enclosure to house Controller & all other required hardware like power supply, gateway etc shall be included in this item, having double door & at least IP43 rating.

Design Supply, Store, Shifting, Installation, Testing & Commissioning of suitable range Power Supply unit DIN rail mount / Convection cooling / Maximum station integration (atleast 120 wireline and 60 Ethernet bus stations).

Design Supply, Store, Shifting, Installation, Testing & Commissioning of Dali Gateway to hook up the local DALI network on IP for further connectivity to central server via OFC ring. Clips on to a 35-mm DIN rail Max. Dali : 64 Ballast.

Supply, Store, Shifting, Installation, Testing & Commissioning of Station bus cable. Two conductors / Free topology / No polarity / Max 90pF/m and approx. Diameter 1.5mm²

Design Supply, Store, Shifting, Installation, Testing & Commissioning of KNX cable as reuired to connect DALI controllers to key pad sensors etc made of Copper, bare class1 conductor with PVC Insulation, twisted cores in star quads PVC outer sheath, rated voltage 300 V, testing voltage 4000V, Insulation resistance shall be \geq 100 MΩ/km, 8X Bending radius fixed & Min. bending radius moved as 15X Working temp fixed min/max [C] : -30°C up to +70 & Working temp moved min/mac [C] : -5°C up to +50 Burning behavior shall be as per: VDE 0482-332-1-2/IEC 60332-1: flame-retardant and self extinguishing. Makes shall be from Hager, Lapp, Helu Kable / equi

Design Supply, Store, Shifting, Installation, Testing & Commissioning of KNX Connected Motion Cum Day Light Sensor as required to facilitate energy saving with DALI system. It shall be Multi Combination Sensor including Motion detection with Light Level Sensing and built-in IR Receiver, Flush Mount, 360 Degrees, shall have Light and PIR sensitivity adjustment, Dual detection element inside to minimise false triggering. Internal Light Sensor infinitely adjustable from approx. 10 to 2000 Lux. The Sensor may be ceiling mounted or wall mounted as required at site.

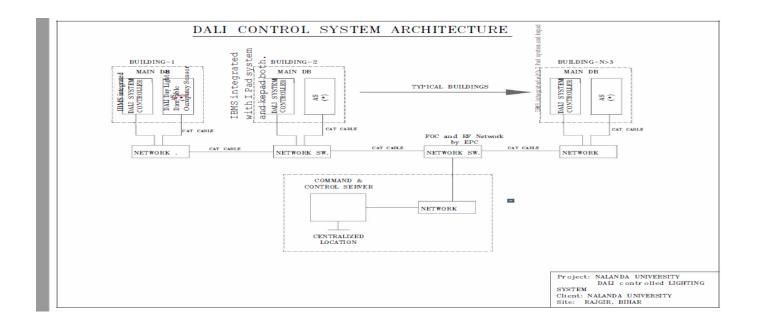
Design Supply, Store, Shifting, Installation, Testing & Commissioning of KNX Connected Decorative Automation Keypads as required to facilitate operations/controlling/scene control with DALI system. It shall have Integrated bus coupling unit, Push buttons with 8 operations, Labelling field, Should have scene retrieval, scene saving ,disable function, made of good industrial Plastic material & having KNX bus connecting terminal as required. Colours shall be white or black as per requirement provided by architect / site in charge. This shall include cost of back box & face plate as required with all accessories.

Design Supply, Store, Shifting, Installation, Testing & Commissioning of Intelligent Supervisory Level Network Controller which shall interconnect the DALI System Network Server with the Centralised Software. It shall be Din Rail mounted, Microprocessor based (at least 32 Bit), 4GB Flash Memory, 128 MB SD RAM, communication interface cards, etc.

The Unit should have 02 Nos. RS485 Ports which can be configured for BACNET / MODBUS Devices for Software Integration. The Unit should have 01 Nos.LON Ports for LON Devices Integration. Unit shall have built-in USB Ports (USB-A & USB-B), BTL Certified and UL Listed (All Certificates should be provided). shall include Supervised Power Supply of the same Make. Shall be provided with lockable MS Cabinet or similar arrangement as required.

Design Supply, Store, Shifting, Installation, Testing & Commissioning of Central DALI Command centre & centralised server to connect all DALI controller / automation servers speeded in the campus at various buildings & to enable controlling & monitoring of all the DALI controlled fixtures from a central location. All required software, hardware, accessories, license, cloud storage, interconnectivity (except main back bone as OFC throughout the campus), screens, UPS, to be included in this item. Configuration of server shall be such a way that 100% redundant system shall be made available during fault or maintenance instance. This item includes training to be provided to client's O&M

The GUI Based system software supplied shall be suitable for real time and distributed processing under Local Area Network (LAN) environment. The software shall be structured and modular with high degree of isolation between program modules for system integrity. The Software shall support minimum 10,000 IO Points or as per the EIC approval for Hardware as well as Software. The Software should be Client Server based that should have built-in 5 Licences Client Nos Network Concurrent for 5 llser provided Minimum 25% capability shall for expansion be the svstem. Note: This item and complete system shall have the capacity to command, review etc. of the DALI system considered in the non-residential blocks. necessary hardware, software, accessories, connecting links shall be covered in this item.





IBMS - Integrated Building Management System

An Integrated Building Management System (IBMS) from Messung is a single comprehensive Building Management System for the integration of HVAC, Fire Alarm, Public Address, Access Control, Security, Lighting and other systems.

Messung IBMS brings the benefit of better indoor comfort, energy efficiency, safety and security, and most importantly better management of all systems under the unified platform.

The overall system architecture comprises of the following logical layers.

- Management Layer for system monitoring, controlling, data storage and reporting.
- Control Layer for intelligence of the systems.
- Field Layer for sensing, controlling and protecting environmental conditions.

8.6 FAS- Fire Alarm System

Fire Alarm System (FAS) helps to ensure employee safety and the overall welfare of a business through detection and announcement to the occupants by guiding safe egress routes during the situation of distress.

Addressable Intelligent Fire Alarm System from Messung consists of detectors and devices wired in loop, each with unique ID and location. These devices are directly connected to central intelligent fire alarm control panel that monitors the functionality and status of each device programmed in the system. In the event of fire, these devices detect smoke, heat etc and help to generate audio and visual alarms as well as guide safe egress route.

IP based fire alarm system when integrated with BMS can provide further safety and interlocks to safe guard human and equipment like park elevators, open access doors, activate pressurization and exhaust fans, safe control of HVAC equipment etc.

8.7 CCTV – Surveillance System

CCTV technology has evolved exponentially from simple video footage monitoring to today's intelligent systems that are capable of identifying abnormal events or behaviors.

The system is comprised of a network of security cameras and collective functions and monitors from video feeds on an internal system of monitors. CCTV surveillance systems are more often used to monitor large areas such as retail stores, hospitals, datacenters, banks as well as public spaces like airports and metro stations.

Internet protocol in security cameras turns them into digital video cameras that transmit video footage via computer network. The advantages of IP CCTV systems –

- High resolution, remote access, redundant storage and wireless.
- High scalability, NVR redundancy and high coverage area.
- Powerful analytics, virtual unlimited clients and large video wall for all feeds.

8.8 ACS – Access Control System

Modern Access Control System (ACS) helps to protect people and assets by controlling access to work area through smart systems. It allows access to legitimate visitors and also records their movements.

The smart system consists of smart cards cum readers, biometric identification, face recognition, methodology along with access control software. It is possible to integrate access control system seamlessly with CCTV, fire alarm, Intruder alarm and employee's time and attendance systems. Some of the advantage of seamless integrated systems are –

- Open security doors in the event of fire.
- Record CCTV footage in case of burglar alarm or intruder alarm.
- Generate report on personnel tracking.

8.9 Public Address System

Public Address System (PAS) plays an important role in safe management of buildings. The voice messages guide the occupants what to do in case of emergency. People are most likely to follow the voice command to take the correct action during an evacuation.

PAS from Messung is an advanced IP based system consisting of digital controllers/ router, powerful mixing amplifiers, stylish call stations and different type of highquality speakers. It provides flexibility to interface standard music player and dry contacts from other systems like fire alarm. Touch screen graphical user interface manages complete system.

8.10 Other Systems

Some of the important subsystems of an IBMS required specially for some of the applications like datacenter, large document storage, etc. are as below.

- Water Leak Detection System
- VESDA System
- Rodent Repellant System
- Gas Suppression System

1 Reference for HVAC basic requirement which will be finally approved by Nalanda University during execution



Draft and Tentative Functional Design Specification

for Building Management System & its integration with various system

Client: Nalanda University at Rajgir, Bihar

The actual Combinations, Functioning and Logics will depend on the design approval by the NU. This is just for the level of Automation understanding.

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3 Reference for HVAC basic requirement which will be finally approved by Nalanda University during execution

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4 Reference for HVAC basic requirement which will be finally approved by Nalanda University during execution

1. Introduction

Nalanda University located in Rajgir, Bihar was founded back in 5 BC, and was one of the World's first university, where more than 10000 students & scholars will studied at the same time. Nalanda as name itself mean 'Place of higher learning' was once visited by Gautam Buddha and was one of monasteries for Buddha disciples. It was built during Mauryan empire & then further developed by Gupta dynasty. During those days it attracted students from China, Greece & Persia. Nalanda University has a magnificent history it carries with itself.

Building Management system for which this document is intended, are to be installed across the campus locations & will share information using Network backbone across the campus. The system planning & automation is planned in such a way so that there is a low carbon emission & utilization of system is at its optimum level.

Complete campus buildings are planned in such a way that, it is easier for modular and phase wise implementation of all the system which can further be integrated to share data & information among themselves.

1.1 Purpose of the document

The purpose of this document is to introduce with all the major components & system proposed/ to be implemented to achieve a sustainable & low emission system for air conditioning across the campus. This document is created with a sole purpose of defining the schema of operations of all the systems when they start working in conjunction. The FDS document will also throw some light on the data information flow, data integrity & data security among all the system to attain the desired results & interdependence of various stakeholders.

This document shall be treated for future reference of the operation of complete system. It is an attempt to include certain use cases & process flow diagrams for systems such as Chiller Plant Manager, EFFICIENT CHILLERS AS ON SUPPLY DATE system, Building management system etc.

1.2 Project Scope

Project Scope for this document can be defined as providing complete scheme for the control & automation of the Air conditioning system which included Chiller plant manager, CHP Engines, HVAC field equipment such as DeVAP, AHUS, TFAs etc., Radiant chiller, Geo-thermal system & its interconnection with Building management system. The scope will also define the control logics to be defined for the optimum utilization of system with an aim to have low carbon emission & achieve sustainable solution.

1.3 Risks and Assumptions

Following assumptions are made & considered to provide the required system performance.

- 1. All systems are required to function as per the design requirement.
- 2. Through FOC and RF as redundancy both together / parallel at a time for each and individual system
- 3. Power supply to all EFFICIENT CHILLERS AS ON SUPPLY DATE ODU is available, depending on the critical scheme of SCADA system.

2. System/ Solution Overview

System proposed for the Nalanda University is a network of various subsystem interacting, communicating among themselves at various level. We have classified these as lo-level (only monitoring & no control) & Hi-level Integration (monitoring, control, customization). For-Example while taking data from a Variable refrigerant system we are doing Lo-level integration whereas we are just monitoring & collecting data from ODUs & IDUs. While

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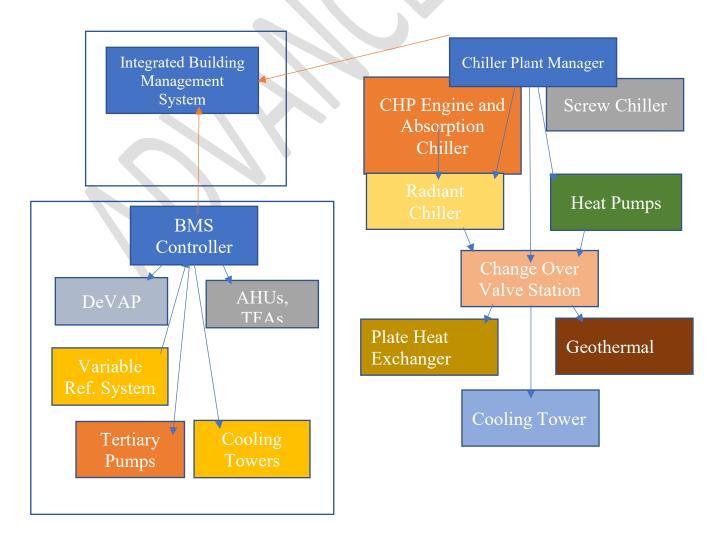
an integration with Chiller Plant, there is 2way data transaction is hi-level integration.

Below is a functional block diagram depicting the data flow among various systems, sub-systems for which optimum network bandwidth availability is required.

Systems interacting below are

Chiller Plant Manager interlocked with screw chillers, efficient chillers, Radiant chiller & geo thermal system etc. & there is a two-way data flow among these systems.

Building Management system is interlocked with Chiller plant manager, HVAC equipment (thru DDC), SCADA system, EFFICIENT CHILLERS AS ON SUPPLY DATE system & DEVAP's controller. It will be monitoring & controlling various HVAC equipment based on the control logic defined.



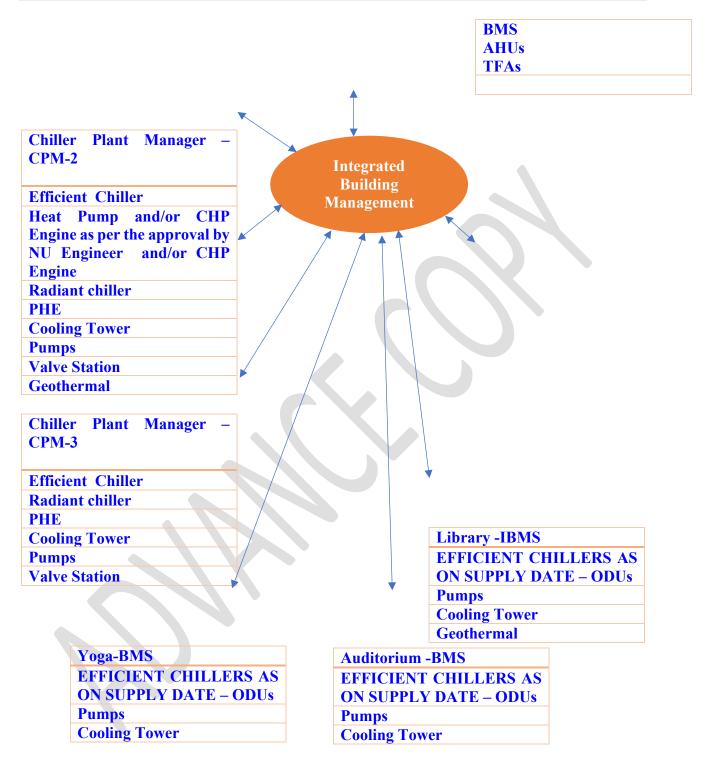
Block diagram: interaction & communication between various system & sub-system

Following pages will be explaining all these systems & sub systems, their process flow diagrams & standard operation procedures.

Chiller Plant Manager –				
CPM-1				
Academic Block				
Electric Chiller				
Efficient Chiller				
Heat Pump and/or CHP				
Engine as per the approval by				
NU Engineer and/or CHP				
Engine				
Radiant chiller				
PHE				
Cooling Tower				
Pumps				
Valve Station				

Academic Block -BMS	
DeVAP	
Tertiary Pumps	
Air Washer Unit	
Dry Scrubber	
TFAs	





4. Philosophy

Control Philosophy for Nalanda university is explained here block-wise. building blocks are defined such as

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a) CPM Operation

Chiller Plant Manager operation is explained as per below table.

Working + Standby

Combination with N+ 2 Chiller, N>2 as per the design approval by NU Engineer

b) Sequence of Operation

1. Normal Operation Mode

Chiller Plant Manager will perform below mentioned functions in normal operation mode

Step 1: Check for Heating Load H_d, Cooling Load C_d demand for the building.

Step 2: Check for solar power input from Solar Power energy meter.

Step 3: Check for online/ offline mode, working hours of Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engines, Efficient Chillers, Electrical Chillers, Pumps, & Cooling Towers Step 4: Check Ambient temp. & Rh

Step 5: Check chilled water supply & return header temperature

Step 6: Check Hot water supply & return header temperature

Step 7: Check condenser Water supply & return header temperature

Step 8: Check CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL working, creating a %age scale in CPM based on CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL outlet temperature.

Chiller plant manager will keep on performing Step 1 to 8 for normal operation mode.

2. Summer & Monsoon operation (Daytime)

During summer & Monsoon season, CPM will perform below mentioned functions sequentially

Step 1: CPM will check for isolation valve status for heating & cooling side for lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

Step 2: Open Isolation valve for heating & cooling side for lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine to connect it with heating circuit & cooling circuit.

Step 3: Start PS-05 Lead pump after checking working hours & lead/lag function

Step 4: Start PS-06 Lead pump after checking working hours & lead/lag function

Step 5: Check water flow status at Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine

Step 6: Start PS-02 lead pump after checking working hours & lead/lag function

Step 7: Start PS-03 lead pump after checking working hours & lead/lag function

Step 8: Check Water flow status in chilled water circuit.

Step 9: Check condition Is Cooing Load C_d demand less than available free cooling C_{HP} ?

If yes,

Step 9.1: Check working hours & lead/lag function of Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engines.

Step 9.2: Check condition Is Heating demand load H_d is less than 532 KW?

If yes,

Step 9.2.1: Run Lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine

If no,

Step 9.2.2: Check condition Is Heating demand Hd is less than 1062 KW

If yes,

Step 9.2.2.1: Run 2nd / Lag-1 Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine

If no,

Step 9.2.2.2: Run 2^{nd} & 3^{rd} Lag-1 & Lag-2 Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine

If no,

Step 9.3: Check condition, is Cooling demand load Cd = Free available Cooling.

If yes,

Step 9.3.1: Go to step 9.2

If no,

Go to next step.

Step 10: Check condition, Is CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL Radiant chiller fully charged?

If no,

Step 10.1: Check condition, Is Available Solar Power P_{SOL} is greater than

required Radiant chiller working power $P_{CHP PREFERABLY AND/OR}$ chiller as per the NU approval during hvac design approval?

If yes,

Start Radiant chiller working.

Note: Radiant chiller monthly Working/disworking profile is attached as annexure.

If no,

Start Partial Radiant chiller working.

If yes,

Go to next step.

Step 11: Open 3-way motorised Valves MV1 & MV2 to isolate Efficient chiller & start flow through Plate type heat exchanger.

Step 12: Check condition, Is Cooling load demand C_d greater than free cooling C_{HP} & available Radiant chiller Tonnage C_{CHP} preferably and/or chiller as per THE NU APPROVAL DURING HVAC DESIGN APPROVAL·

If no,

Step 12.1: Start Radiant chiller disworking.

If yes,

Go to next step

Step 13: Start Electrical Chiller Sequence.

Step 14: Check working hours for Electrical Chillers for lead/lag function.

Step 15: Check chilled water Primary pumping system (PS-01) & Secondary Pumping system (PS-03) status

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Step 16: Check condenser pumping system (PS-04) status

Step 17: Check lead chiller isolation valves status

Step 18: Open lead chiller isolation valves

Step 19: Run lead chilled water pumps, condenser pumps

Step 20: Check chiller water & Condenser water flow status

Step 21: Monitor Condenser water supply & return water temperature

Step 22: Start Cooling Tower sequence.

Step 23: Start & run lead Electrical Chiller

Step 24: Check condition, Is Cooling load demand greater than 540 TR?

If yes,

Step 24.1: Start lag chiller sequence.

If no,

Step 24.2: Go to Step 23.

3. Summer & Monsoon operation (Night time)

Below are the steps based on which CPM will initiate Night-time function.

Step 1: CPM will initiate night time schedule profile.

Step 2: Check Electrical chillers, Pumps status & start Turn-off staging sequence.

Step 3: Check condenser pumps, Cooling tower status & start Cooling tower, Condenser pump Turn-off staging sequence.

15 | Reference for HVAC basic requirement which will be finally approved by Nalanda University during execution

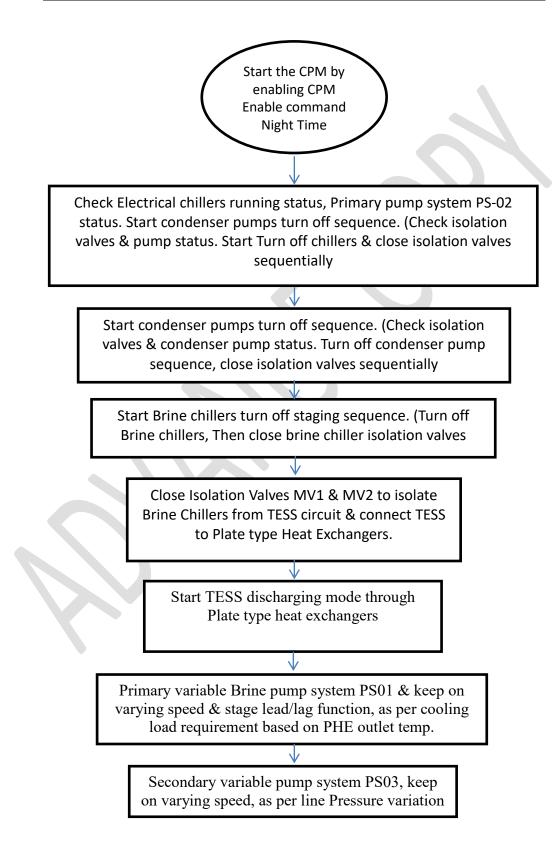
Step 4: Check Efficient Chiller status, & start turn-off staging sequence & isolation valves.

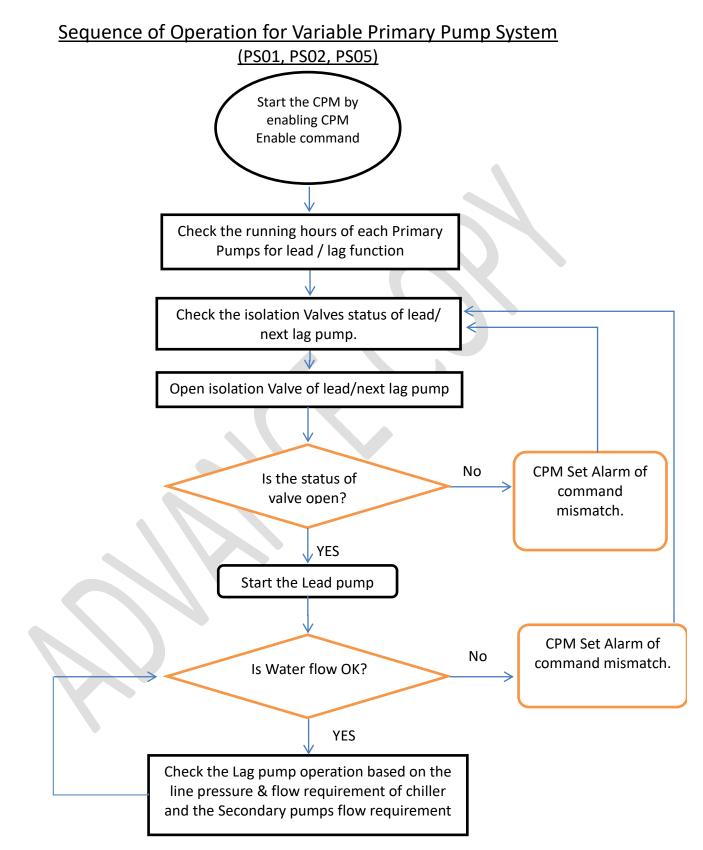
Step 5: Close Isolation valves MV1, MV2 for Efficient chiller to isolate the Efficient Chiller from CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL working circuit.

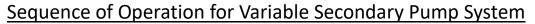
Step 6: Start CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL disworking mode through PHE.

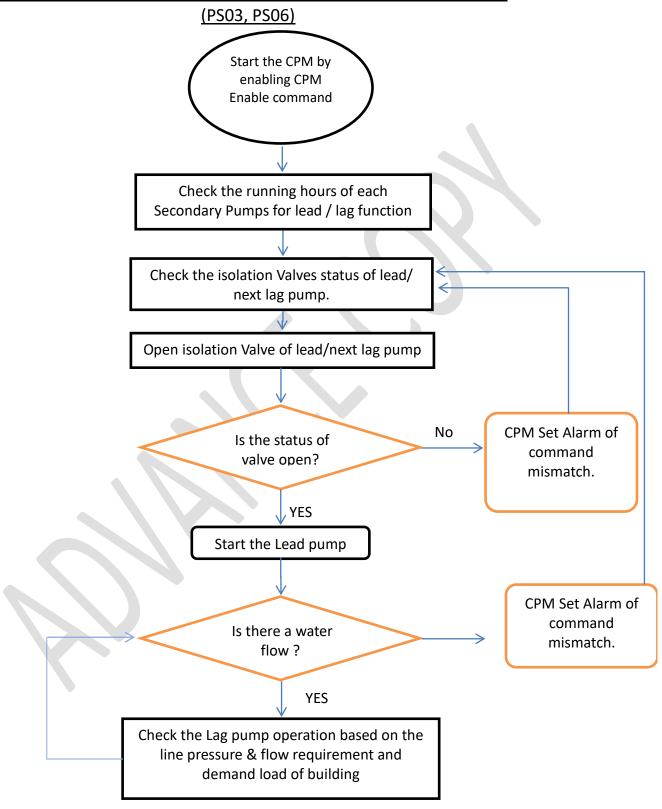
Step 7: Based on flow requirement & line pressure variation, CPM keep on modulating Variable Chilled water pumping system PS-01, & Variable Secondary pumping system PS-03.

CPM Sequence of Operation for chiller Night profile



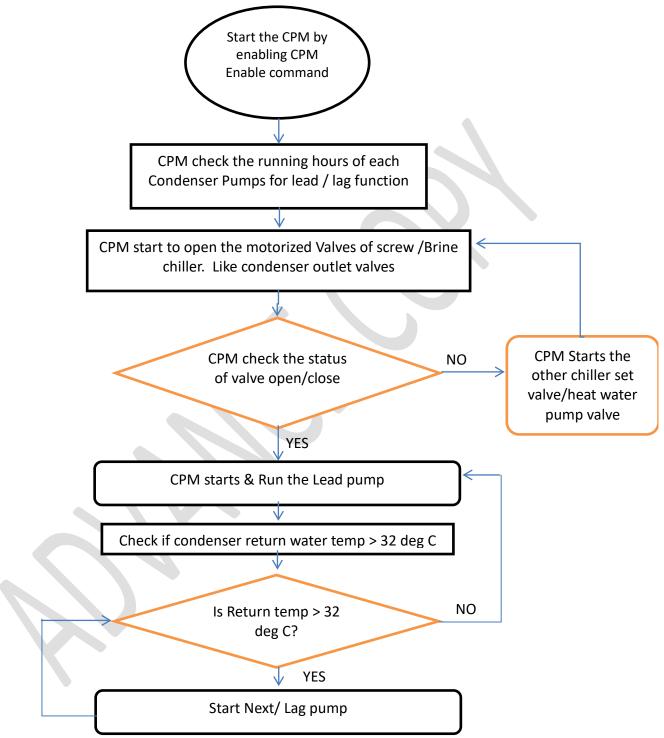


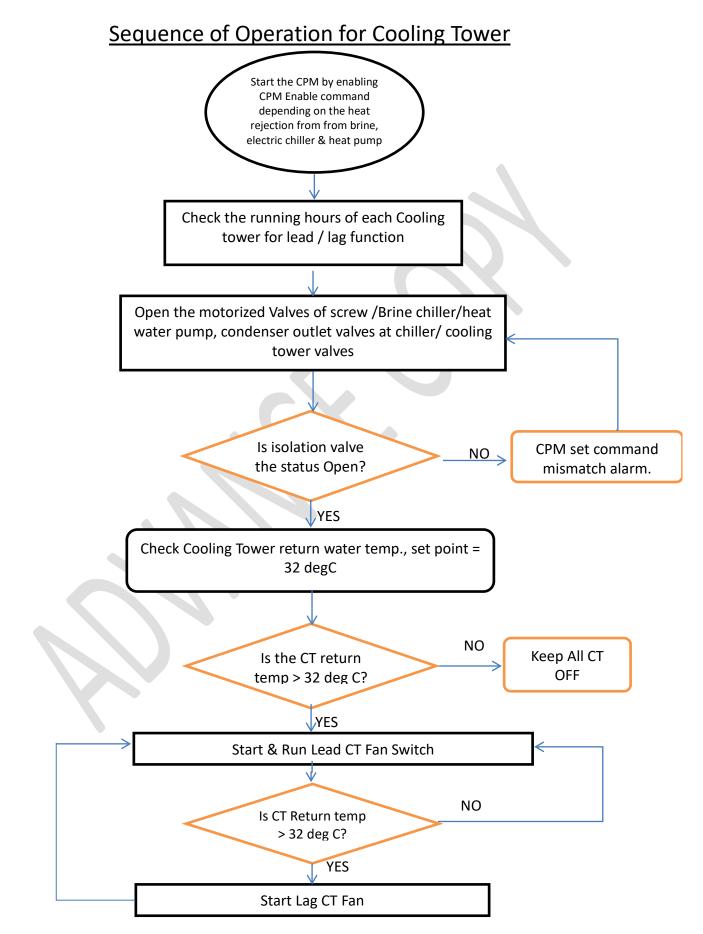


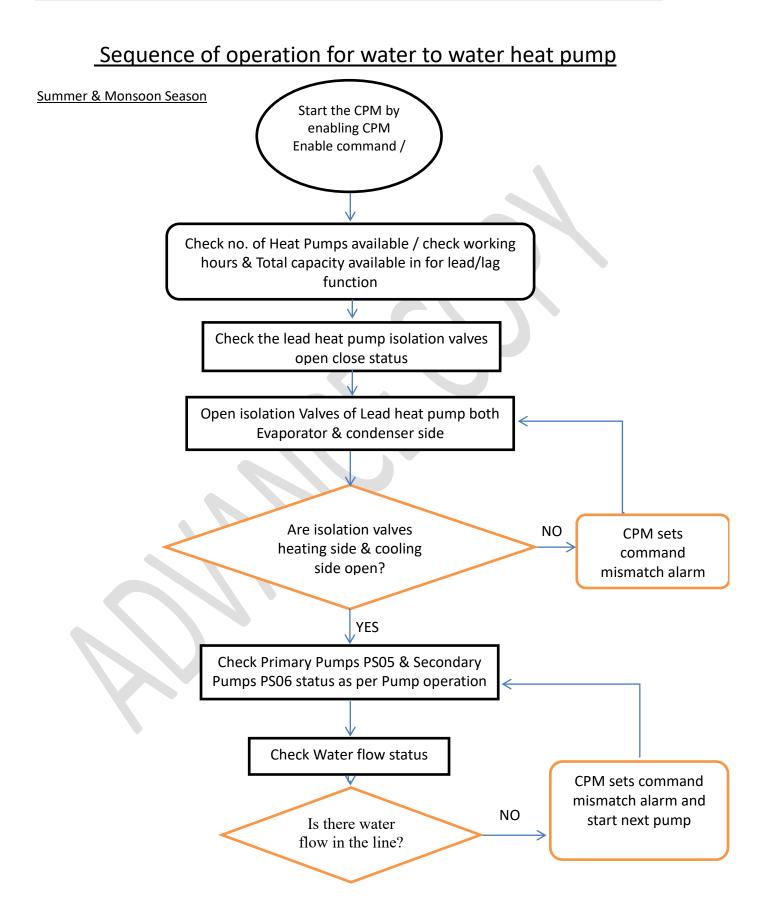




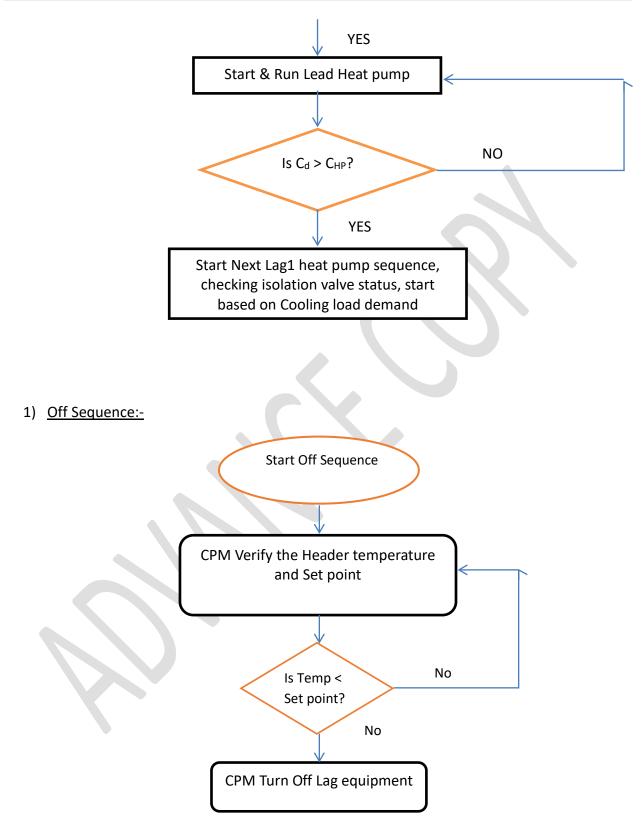
Sequence of Operation for Condenser pump PS04







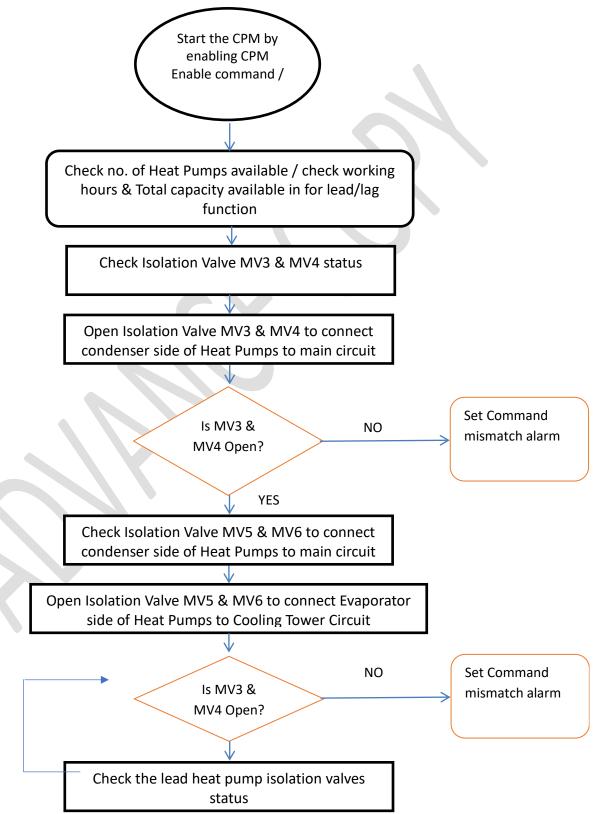
22 | Reference for HVAC basic requirement which will be finally approved by Nalanda University during execution



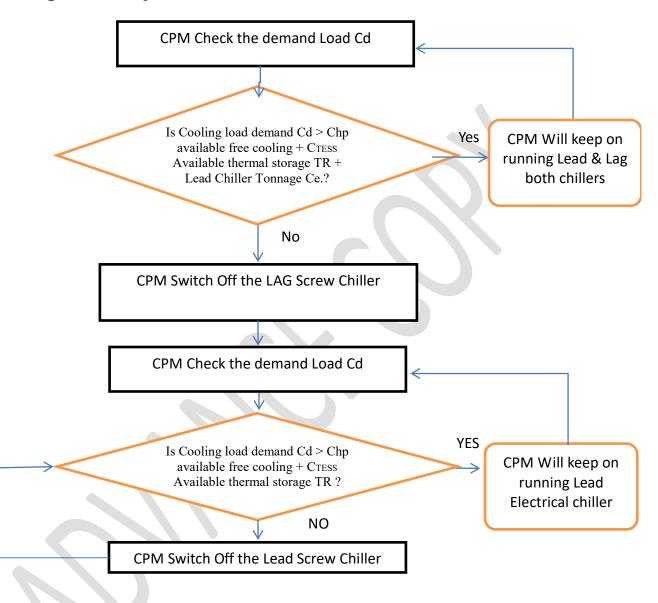
Sequence of operation for water to water heat Pump in

Winter Season

Start Sequence



CPM Stage Down Sequence for Chiller



4. Winter operation

Step 1: Open 3-way motorised valve MV3 & MV4 to connect Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engines heating side to chilled water circuit & isolate DEVAP Hot Water Circuit for regeneration.

Step 2: Open 3-way motorised valves MV5 & MV6 to Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engines cooling side to Condenser/ Cooling tower circuit & isolate Chilled water circuit.

Step 3: Check working hours for lead/lag functions of water to water Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engines.

Step 4: Check Isolation valves status of lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

Step 5: Open both heating side & cooling side isolation valves for Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engines.

- Step 6: Start PS-05 lead hot water pump after checking running hours & lead lag function.
- Step 7: Start PS-06 lead hot water pump after checking running hours & lead lag function.
- Step 8: Check Hot Water flow status
- Step 9: Check working Hours, Lead/ lag function for Cooling towers, condenser pumps.
- Step 10: Run lead cooling tower
- Step 11: Check condition, Is cooling tower return temp. is greater than 12 deg.C

If yes,

Step 11.1: Start next lag cooling tower

If no,

Step 11.2: Go to step 10.

Step 12: Check lead/lag Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engines

Step 13: Check condition, Is heat load demand H_d is less than 532 KW?

If yes,

Step 13.1: Start Lead chiller

If no,

Step 13.2: Check condition, Is Heat load demand Hd is less than 1062 KW?

If yes,

Step 13.2.1: Start 2nd / LAG Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine sequence

If no,

Step 13.2.2: Start 3rd/ LAG Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine sequence

c) Desiccant Enhanced Evaporative Air-conditioning System

DEVAP air conditioning unit recovers the heat from the room exhaust/ return air to pre cool the entering fresh air through the heat recovery wheel. Desiccant wheel has been introduced to remove the humidity from the incoming air thus trim cooling to generate the required cooling effect. Hot water from Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine is circulated through these units to heat up the desiccant wheel of regeneration, hence improving the efficiency of the system. All the latent load brought by outside air is removed at the source & also air is supplied at a low dew point to take care of internal latent load. This equipment shall take the latent load of the indoor along with the fresh air load.

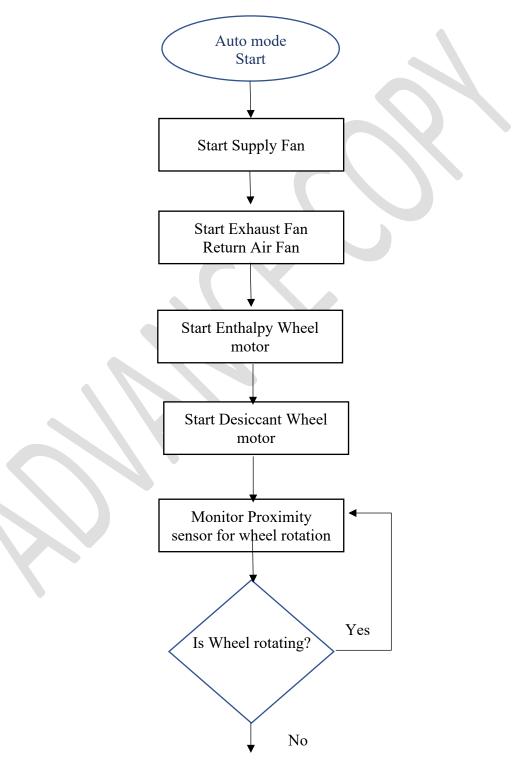
1. DEVAP Program				
Components:	Controlled By M		Set Point	
Supply air Fan	EC Fan Control through		As per unit air flow	
Reactivation air Fan	PLC & BMS through Modbus	%	As per unit air flow	
Exhaust air Fan	Fixed speed		As per unit air flow	
Enthalpy wheel motor	Fixed speed			
Desiccant wheel motor	Fixed speed			
modulating valve 1,2,3	Temperature Sensor	°C	Set point on HMI as well as on BMS	
Temperature transmitter Return air	Temp Transmitter	°C	Display actual readings	
Humidity Transmitter Return air	Fixed speed	%	Display actual readings	
Temperature transmitter Outside Air	Temperature Sensor	°C	Display actual readings	
Humidity Transmitter outside air	Temp Transmitter	%	Display actual readings	
Humidity transmitter supply air	RH transmitter	%	Display actual readings	
Temperature transmitter supply air	Temp Transmitter	°C	Display actual readings	
Temperature transmitter pre-cooling coil	Temp Transmitter	°C	Display actual readings	
Temperature transmitter post-cooling coil	Temp Transmitter	°C	Display actual readings	
Temperature transmitter Heating coil	Temp Transmitter	°C	Display actual readings	

1. DEVAP Program

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Pre-Filter	DP Switches-1,2,3		Set point on DP Switch	
Desiccant wheel	Proximity switch		Display rotation alarm if wheel not rotate	
Enthalpy wheel	Proximity switch		Display rotation alarm if wheel not rotate	

2. DEVAP Operational Sequence



Set Alarm after 3 mins.

3. DEVAP Alarm Sequence

In case of supply air fan fault supply air fan will off and the alarm pops up on HMI and BMS both.

In case of Exhaust air fan fault, Exhaust air fan will off and the alarm pops up on HMI and BMS both.

In case of Return air fan fault, Return air fan will off and the alarm pops up on HMI and BMS both.

Supply pre filter of differential pressure switch alarm, the alarm pops up on HMI and BMS both.

Supply air fan section door limit switch fault, the alarm pops up on HMI and BMS both.

Return air fan section door limit switch fault, the alarm pops up on HMI and BMS both.

Exhaust air fan section door limit switch fault, the alarm pops up on HMI and BMS both.

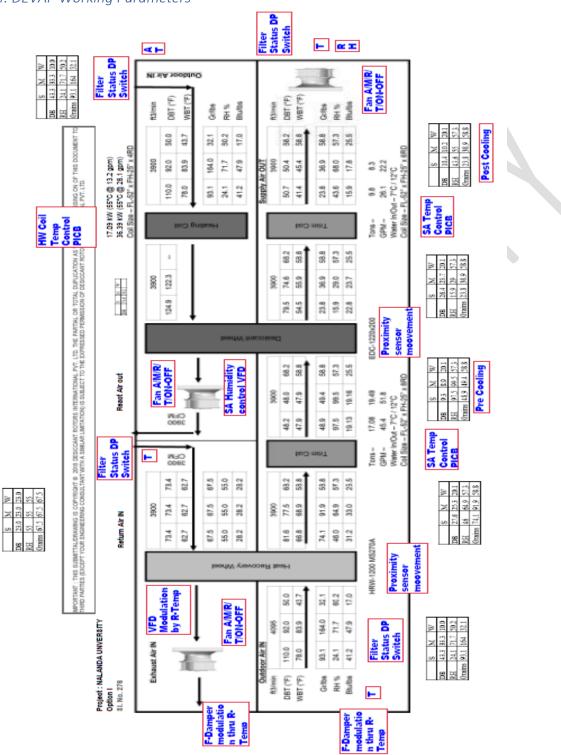
Enthalpy wheel overload fault, the alarm pops up on HMI and BMS both.

Desiccant wheel overload fault, the alarm pops up on HMI and BMS both.

Emergency switch for auto cut of the power of circuit.

Enthalpy wheel rotation fault, the alarm pops up on HMI and BMS both

Desiccant wheel rotation fault, the alarm pops up on HMI and BMS both

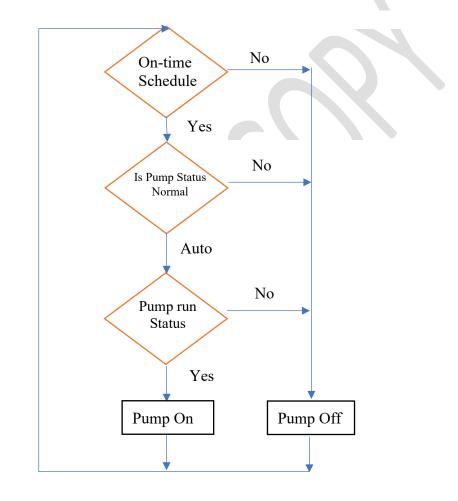


4. DEVAP Working Parameters

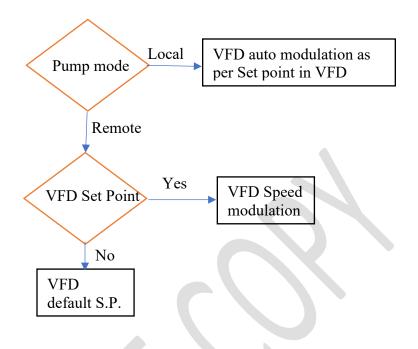
d) Tertiary Pumps

Tertiary pumps will be turned on as per building load, as it is a pressure boosting pump. Pumps status will be monitored for run, trip & Auto/manual status. Modulation of pump speed is achieved through VFD. In local-mode Tertiary pumps will be modulating based on set-point in pump logic controller. In Auto mode, tertiary pump speed will be set thru BMS based on diff. pressure transmitter. VFD will be communicating with BMS through soft integration over Modbus RS-485.

Pump on/off status:

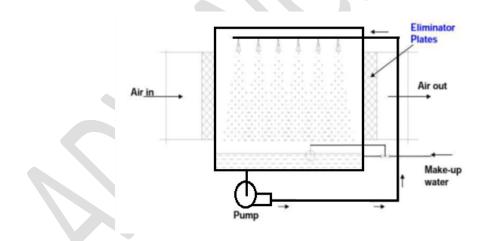


Pump VFD Set Point:

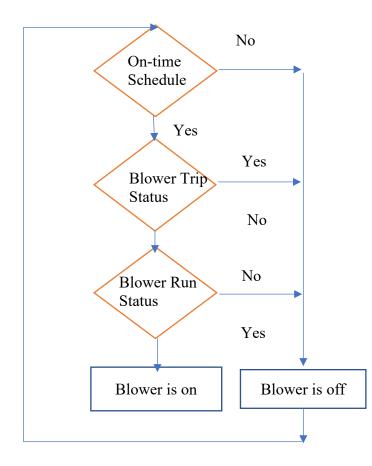


e) Air Washer

Air washer is used for conditioning of air. As shown in Fig, in an air washer air comes in direct contact with a spray of water and there will be an exchange of heat and mass (water vapor) between air and water.

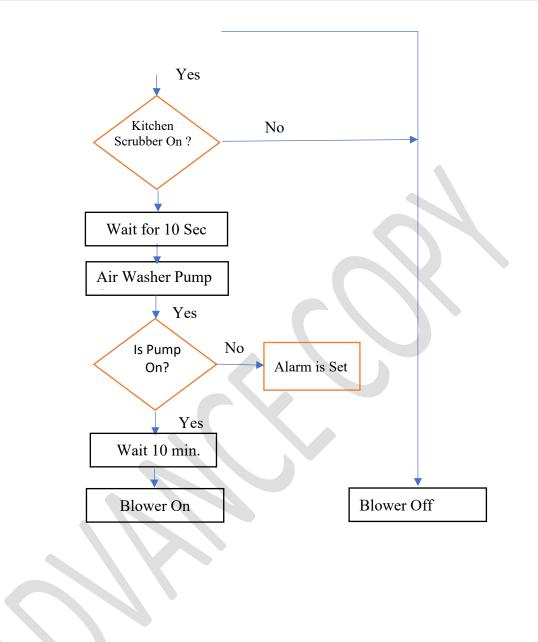


Air Washer units will be turned on based on On-time schedule & kitchen scrubber on status with a delay of 10 seconds. Air washer unit is monitored for run status & if command mismatch then alarm will be set. auto/manual status for blower & pumps will be monitored. Pump will be turned on & after a delay time of 10 mins, Air washer blower is turned on. Pump 'on' status will be monitored, if any mismatch an alarm will be raised. Blower On/Off status:

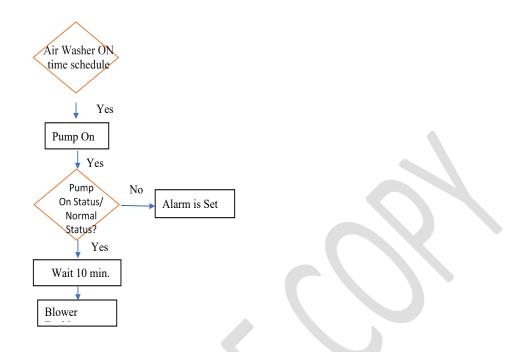


Blower On/Off Command:



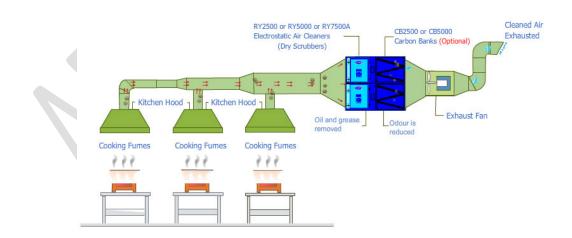


Blower Pump Enable:

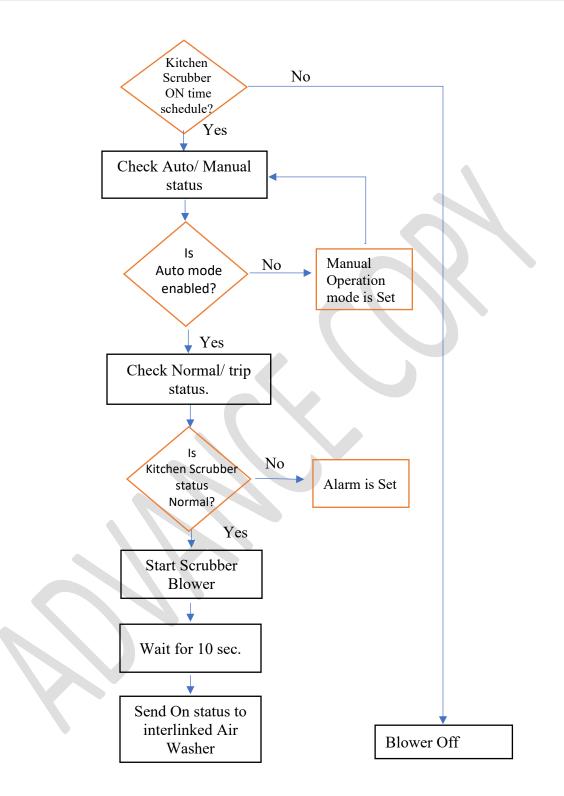


f) Kitchen Scrubber

Kitchen Scrubber will be enabled as per kitchen usage, & On schedule will be as per kitchen preparation schedule. As kitchen scrubber is turned on air washer status is also be turned on with a 10 seconds time delay. Kitchen Scrubber blower will be monitored for run status if any mismatch, alarm will be set. Kitchen scrubber will be monitored for auto/manual status, trip status.



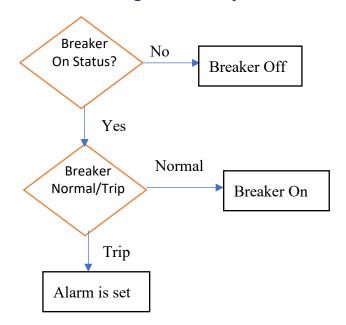
Blower On/Off Command:



g) Electrical Panel

For electrical Panel, incoming breaker on/off status, trip status is being monitored. Outgoing breaker on/off status & trip status is also monitored. If trip then an alarm pop-up is raised at BMS.

Other parameters such as Incoming Voltage, incoming current, power factor & KWH will be monitored on soft integration from panel



There is a combination of absorption, CHP Engine Geo-thermal system & cooling tower, with Plate type heat exchangers & 3-way diverting valve stations for taking condenser side heat rejection from Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine, efficient chiller & EFFICIENT CHILLERS AS ON SUPPLY DATE ODU. Efficient Chiller will be used to charge Radiant chiller during day time, that will be used during night time for Amenities air conditioning.

During day time Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine will be working & chilled water on evaporator side will be used for Amenities air conditioning. Condenser side hot water will be transferred to PHE for Geothermal and cooling tower based on load profile. EFFICIENT CHILLERS AS ON SUPPLY DATE ODUs heat rejection will also be done through Plate type heat exchanger.

There will be modulating valves on supply line for water circulation among Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engines & Geothermal & Cooling tower, which will operate based on supply water temp.

Winter operation with Water to Water Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine:

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During winter season, hot water produced from Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine on condenser side, will be transferred to Amenities block for winter heating through change-over valve station, between Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine condenser line & PHE-1 (connected towards Radiant chiller) supply/ return line. Chiller water available at Heat Pump and/or CHP Engine as per the approval by NU Engineer, the evaporator side will be transferred to Geothermal & cooling tower for heat gain. After heat gain the water at 12 deg. C will be supplied to ODUs for further EFFICIENT CHILLERS AS ON SUPPLY DATE heat gain.

a) CPM Operation

Chiller plant manager operation is explained as per below table.

Sr. No.	Mode	Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine	Chiller	Radiant chiller	Heat rejection from Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine
А	Daytime	Working	Working	Working	Working
1)	Summer/Monsoon	Working	Working	Working	Working
2)	Winter	Working	Working	Working	Working
		Working	Working	Working	Working
В	Night time	Working	Working	Working	Working
1)	Summer/ Monsoon	Working	Working	Working	Working
2)	Winter	Working	Working	Working	Working

Logic approval as per the design combination

b) Sequence of Operation

1. Normal Mode Operation

Chiller Plant Manager will perform below mentioned functions sequentially

Step 1: Check for Heating Load H_d, Cooling Load C_d demand for the building.

Step 2: Check for solar power input from Solar Power energy meter.

Step 3: Check for online/ offline mode, working hours of Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engines, Efficient Chillers, Pumps & Cooling Towers

Step 4: Check Ambient Temp. & Rh

Step 5: Check chilled water Supply & Return header temperature

Step 6: Check Hot water Supply & Return header temperature

Step 7: Check condenser Water supply & return header temperature

Step 8: Check Geothermal working time schedule

Step 9: Check Geothermal Inlet & outlet Water temperature

Step 10: Check CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL working, creating a %age scale in CPM based on CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL outlet temperature.

Chiller plant manager will keep on performing Step 1 to 9 for normal operation mode.

2. Summer & Monsoon operation (Day time)

During summer & Monsoon season, CPM will perform below mentioned functions sequentially

Step 1: CPM will check for isolation valve status for heating & cooling side for lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

Step 2: Open Isolation valve for heating & cooling side for lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine to connect it with heating circuit & cooling circuit.

Step 3: Check PS-06 Lead/lag function after checking working hours.

Step 4: Check Valve MV5 & MV6 open/close status.

Step 5: Open isolation Valve MV5 & MV6 to connect Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine evaporator side to PS04 &

PS03 variable pumping systems.

Step 6: Check Valve MV7 & MV8 open/close status.

Step 7: Open isolation Valve MV7 & MV8 to connect Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine condenser side to PS08 &

Geothermal, Cooling Tower circuit through PHE.

Step 8: Check PS-03 & PS-04 lead/lag function after checking working hours.

Step 9: Check PS-08 lead/lag function after checking working hours.

Step 10: Start PS-08 lead pump.

Step 11: Check PHE inlet & outlet water temp.

Step 12: Check PS-07 Lead/lag function after checking working hours.

Step 13: Start PS-07 lead pump.

Step 14: Check isolation Valve MV13 status

Step 15: Open on/off Valve MV13 to connect Geothermal with PHE

Step 16: Check PS-06 Lead/lag function after checking working hours.

Step 17: Start PS-06 lead pump.

Step 16: Check Geothermal inlet & outlet water temp.

Step 17: Check condition, Is PHE inlet temp. > 31 deg. C?

If yes,

Step 17.1: Modulate valve MV14 to connect Cooling tower to PHE circuit.

Step 17.2: Check Cooling Towers lead/lag function after checking working hours.

Step 17.2: Start Lead Cooling Towers.

Step 17.3: Check Condition, Is PHE inlet temp. > 31 deg. C?

If yes,

Start Lag Cooling Tower

If no,

Keep on running Lead Cooling Tower

If no,

Keep on running Geothermal with PHE.

Step 11: Start PS03 & PS-04 lead pump.

Step 12: Check Water flow status at lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

Step 13: Check Cooling load demand Cd.

Step 13: Check condition Is Cooing Load C_d demand less than 55 TR?

If yes,

Step 9.1: Start running Lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine

If no,

Step 9.2 Check Condition, Is Cooing Load C_d demand greater than 55 TR?

If yes,

Step 9.2.1 Start Lag Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine Sequence.

Step 9.2.2 Check isolation valves HPV status for lag Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

Step 9.2.3 Open isolation valves HPV for lag Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

Step 9.2.4 Check flow status at evaporator side.

Step 9.2.5 Check flow status at condenser side.

Step 9.2.6 Start lag Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

If no,

Keep on running lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

Step 10: Check Psol availability.

Step 11: Check Condition is $P_{sol} > P_{CHP PREFERABLY AND/OR CHILLER AS PER THE NU}$ APPROVAL DURING HVAC DESIGN APPROVAL?

If no,

Step 11.1: Check condition is CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL fully charged?

If no,

Start Partial CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL working.

If yes,

Direct available Power to utility.

If yes,

Step 11.2 Check condition is CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL fully charged?

If yes,

Direct available Power to utility.

If no,

Step 11.1.1 Start CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL Working mode.

Step 11.1.2 Check isolation valves MV1 & MV2 status.

Step 11.1.3 Open isolation valves to connect Efficient chillers circuit

Step 11.1.4 Check Lead/Lag function of efficient pump PS05.

Step 11.1.5 Check isolation valve status of lead PS05 pump.

Step 11.1.6 Open isolation valves of lead pump.

Step 11.1.7 Check 2-way isolation valve status MV11 & MV12.

Step 11.1.8 Open 2-way isolation valve MV11 & MV12.

Step 11.1.9 Start PS05 lead pump.

Step 11.1.10 Check flow status.

Step 11.1.11 Check lead/lag function of Efficient chiller after checking working

Hours.

Step 11.1.12 Check isolation valves of lead efficient chiller.

Step 11.1.13 Open isolation valve of lead efficient chiller.

Step 11.1.14 Check water flow status.

Step 11.1.15 Start Lead Efficient Chiller.

Step 12: CPM will continuously check Geothermal outlet temperature.

3. Summer & Monsoon Operation (Night time)

During Summer & Monsoon season Night time, CPM will perform below mentioned functions sequentially.

Step 1: CPM will check isolation valves MV3 & MV4 status.

Step 2: CPM will perform Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engines stage down sequence.

Step 3: Stop running lag Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

Step 4: Isolate lag Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine by closing isolation valves.

Step 5: Check flow status at lag Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

Step 6: Stop running lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

Step 7: Isolate lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine by closing isolation valves.

Step 8: Check flow status at lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine

Step 9: Check isolation valves for Lag PS03, PS04 pumps,

Step 10: Stop running Lag PS03, PS04 pumps.

Step 11: Isolate Lead PS03, PS04 pumps.

Step 12: Operate Isolation valves MV3 & MV4 to connect Plate type heat exchanger to main chilled water circuit.

Step 13: Check Isolation valve status MV1 & MV2.

Step 14: Open valves MV1 & MV2 to connect Radiant chiller to Pump PS05 through Plate type heat exchanger.

Step 15: Check Lead/Lag function for PS05, after checking working hours.

Step 16: Check isolation valve status for PS05 Lead Pump.

Step 17: Open isolation valve status for PS05 Lead Pump.

Step 18: Start running PS05 Lead Pump.

Step 19: Check PHE outlet temperature.

Step 20: Check condition, Is PHE outlet temp. > 7 deg. C

If yes,

Start PS05 lag pump sequence

If no,

Keep on running PS05 lead pump

4. Winter Season Operation

During Winter Season, CPM will perform below mentioned functions sequentially.

Step 1: CPM will check for isolation valve status for heating & cooling side for lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

Step 2: Check MV5 & MV6 3-way diverting valves status.

Step 3: Operate MV5 & MV6 3-way diverting valves to connect Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine evaporator side to Cooling Tower circuit through Plate type heat exchanger.

Step 4: Check MV7 & MV8 3-way diverting valves status.

Step 5: Operate MV7 & MV8 3-way diverting valves to connect Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine condenser side to Main Water circuit.

Step 6: Check MV3 & MV4 3-way diverting valves status.

Step 7: Operate MV3 & MV4 3-way diverting valves to connect Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine condenser side to Main water circuit.

Step 8: Check lead/lag function of PS08 PHE pump station after checking working Hours.

Step 9: Check PS08 isolation valves status for lead pump.

- Step 10: Open PS08 isolation valves for lead pump.
- Step 11: Start PS08 Lead pump.
- Step 12: Check flow status at lead PS08 pump
- Step 13: Check lead/lag function of PS02 Primary Pump station after checking working Hours.
- Step 14: Check PS02 isolation valves status for lead pump.
- Step 15: Open PS02 isolation valves for lead pump.
- Step 16: Start PS02 Lead pump
- Step 17: Check flow status at lead PS02 pump
- Step 18: Check lead/lag function of PS01 Secondary Pump station after checking working Hours.
- Step 19: Check PS01 isolation valves status for lead pump.

Step 20: Open PS01 isolation valves for lead pump.

Step 21: Start PS01 Lead pump

Step 22: Check flow status at lead PS01 pump

Step 23: Start Lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

Step 15: Check condition, is Heating load demand H_d > lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine Total tonnage

If yes,

Step 15.1: Start lag Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine sequence.

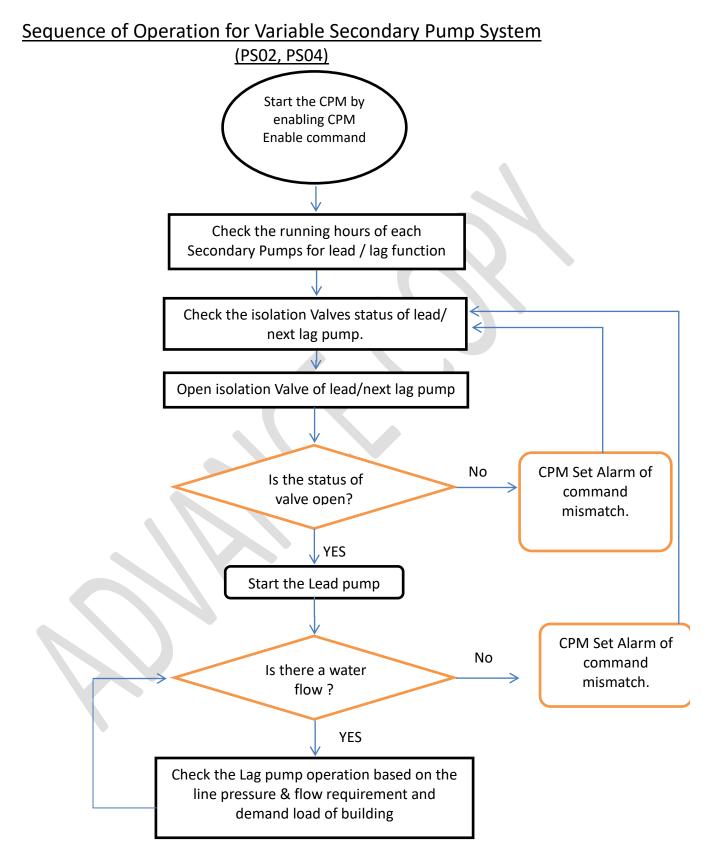
Step 15.2: Check lag Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine isolation valves status of both condenser & evaporator Side.

Step 15.3: Open lag Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine isolation valves for both condenser & evaporator side.

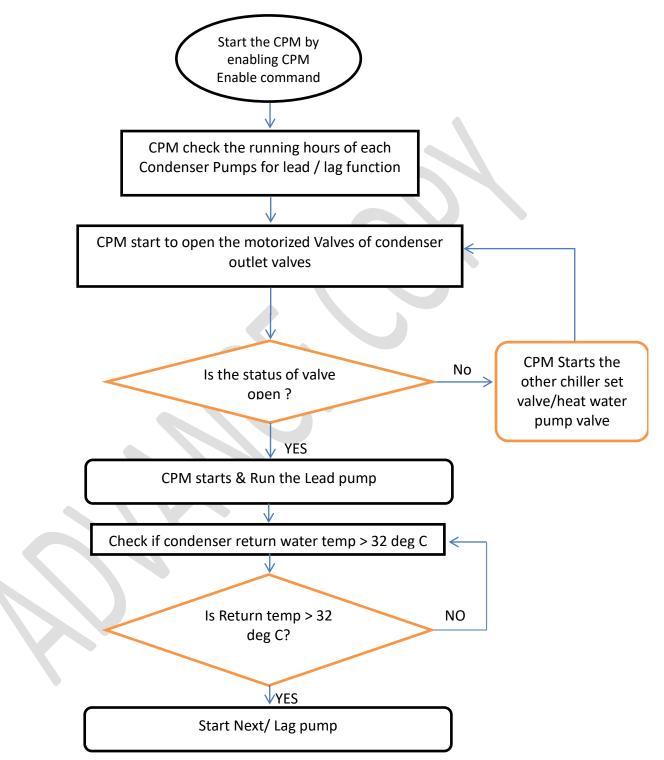
Step 15.4: Start Lag Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

If no,

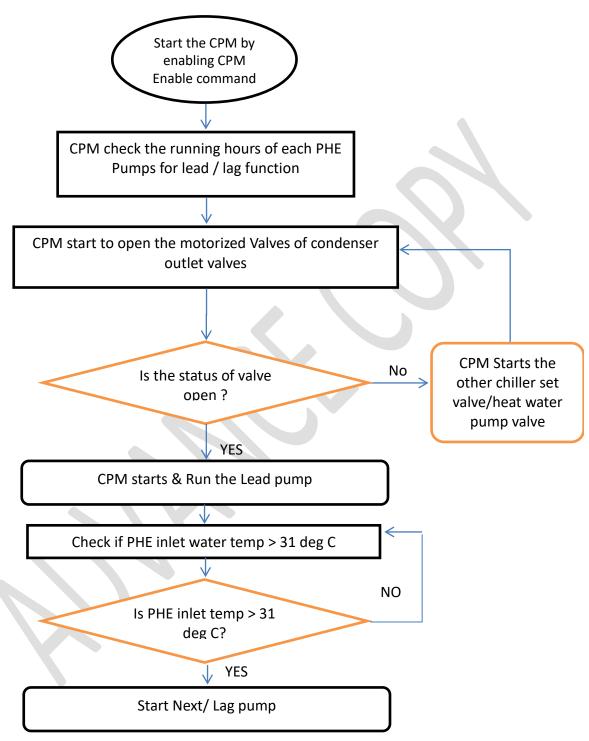
Keep on running Lead Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

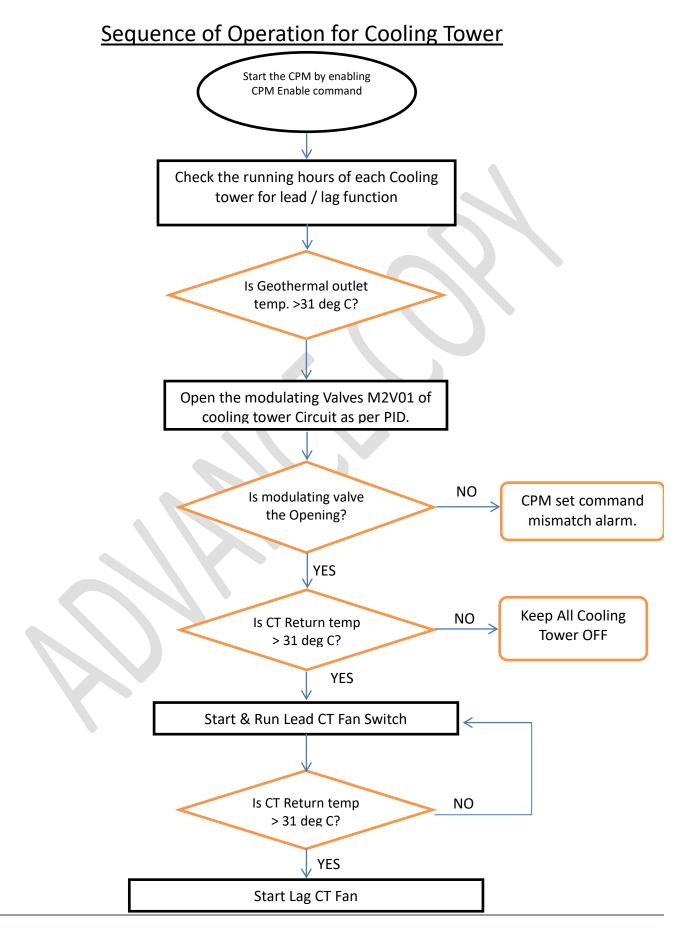


Sequence of Operation for Condenser pump PS08



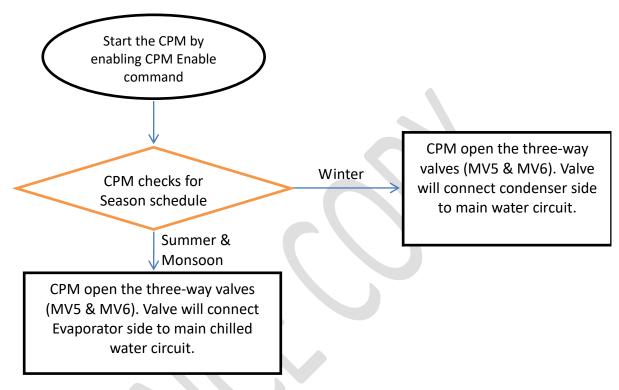
Sequence of Operation for PHE pump PS07

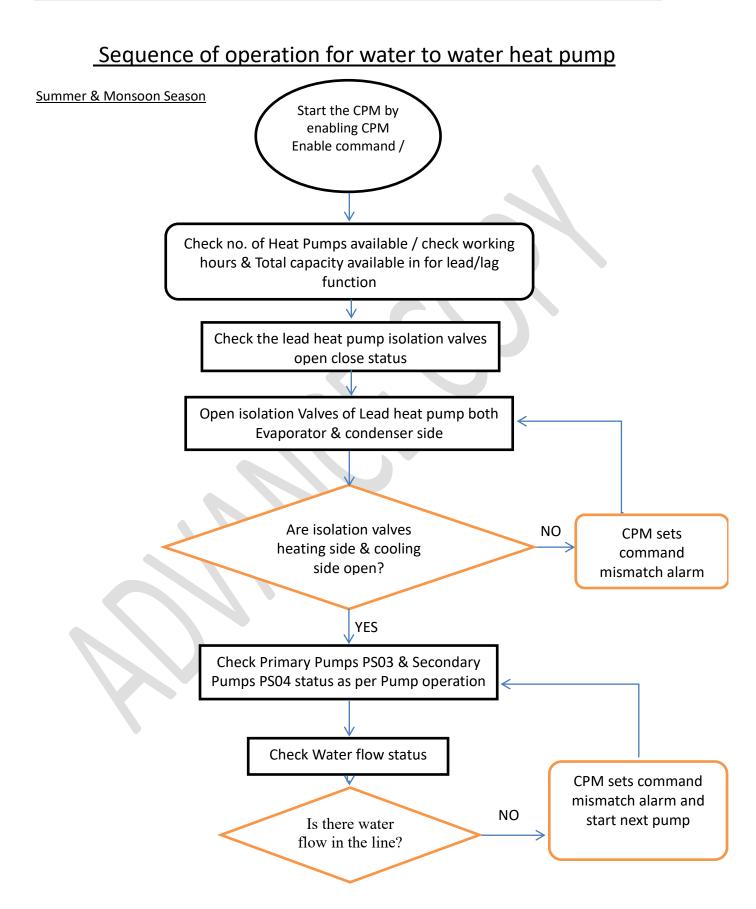


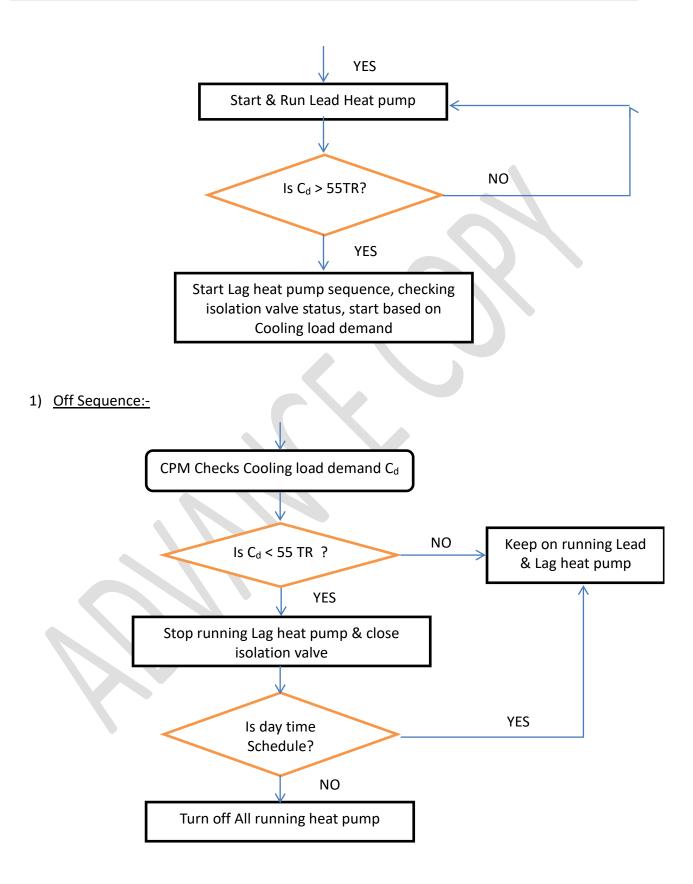


Sequence of Operation for Heat Pumps (MV05 & MV06)

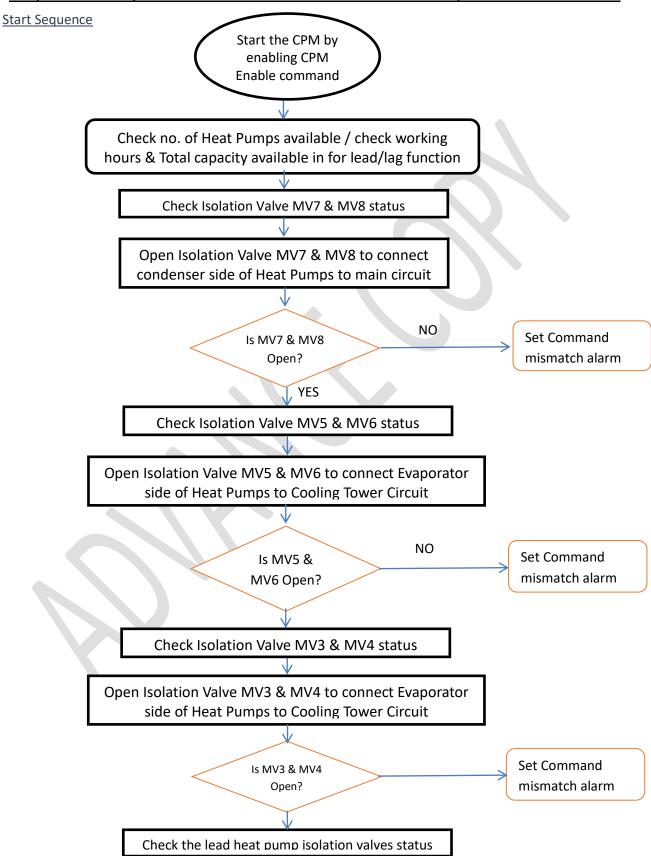
Summer & Monsoon / Winter Season

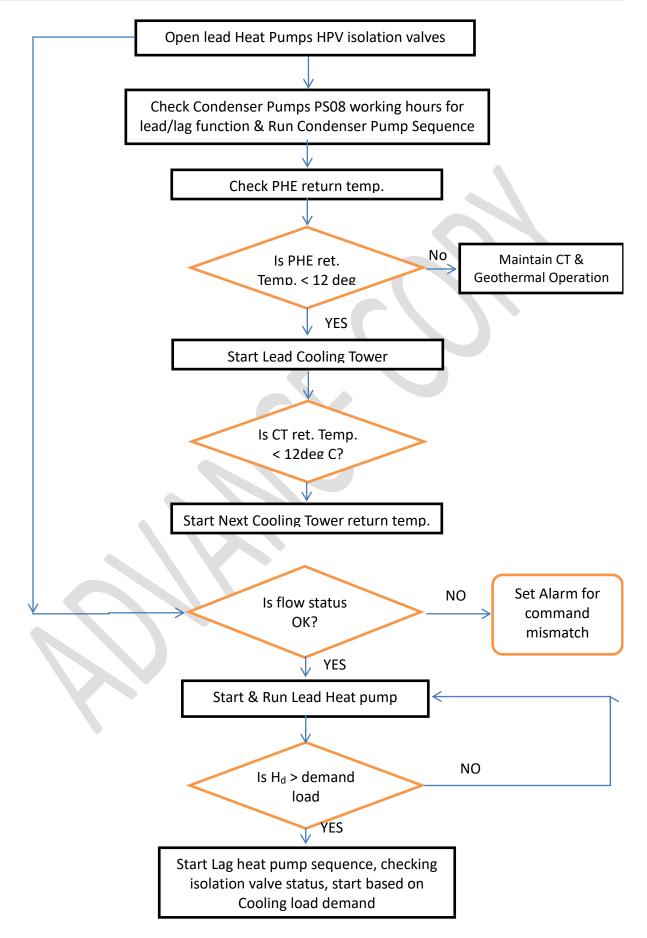




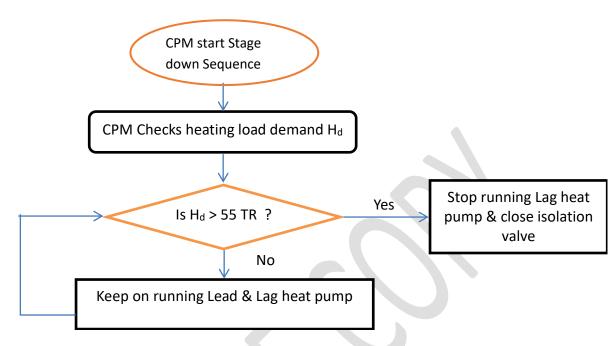


Sequence of operation for water to water heat Pump in Winter Season

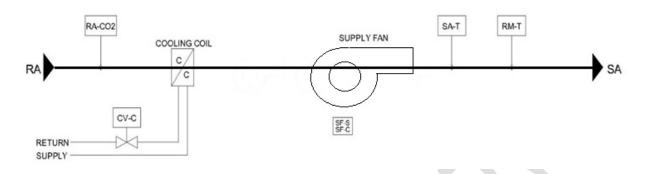




1) <u>Stage Down Sequence</u>



c) Air Handling Unit (with VFD drive)



SEQUENCE OF OPERATION

System Off:

System On/Off command:

The system is interlocked with Enable Command. The Dynamic Balancing cum control valve is interlocked with the supply fan status. When the supply fan status is off, the cooling valve is modulated to close position. When the System Enable is set to disable, the control system will be disabled.

Fan Control:

The Supply Fan Command is set to ON, BMS checks for Fan auto/manual status & Fan trip status. fan is turned on and status is turned to on once DP switch sends fan on status signal.

Supply Air Temperature Control:

When the supply fan status is on, Control Valve starts modulating to maintain the Supply Air Temperature (SA-T) at set point (SA-TSP). If the Supply Air Temperature exceeds the set-point then the valve shall be proportionally opened, and the reverse action shall take place when the temperature falls below the set point.

Return Air Temperature Control:

As the supply fan status is on, modulation of VFD is used to maintain the Return Air Temperature (RA-T) at set point (RA-TSP). If the Return Air Temperature exceeds the set-point then the VFD shall be operated proportionally to increase fan speed, and the reverse action shall take place when the temperature falls below the set point.

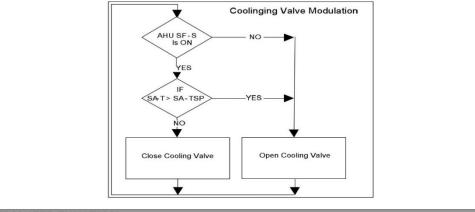
Alarm indication:

An alarm advisory is raised when any of the following occur:

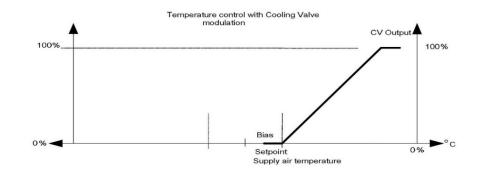
1) Supply Air Temperature, Return Air Temperature is out of the set limits.

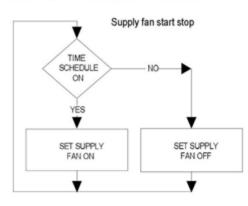
2) An alarm advisory is raised if there is a mismatch between the fan command and the fan status for more than 1 minute.

FLOW CHART- TEMPERATURE CONTROL

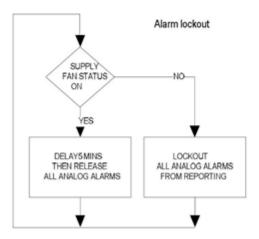


TRANSFER FUNCTION

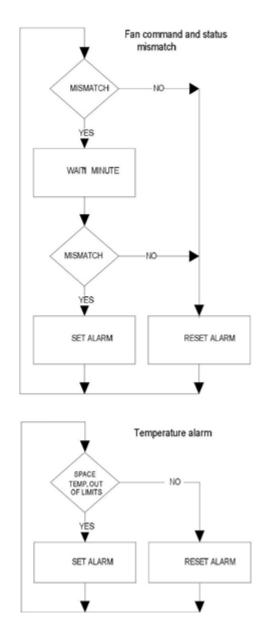




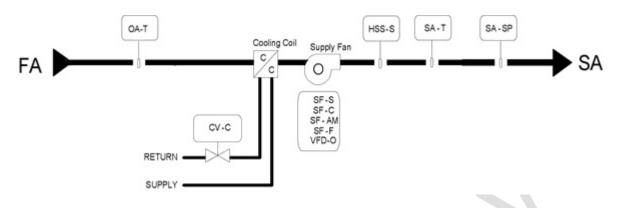




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d) Treated Fresh Air



System On/Off Control:

The system is interlocked with System Enable (SF-EN), TFA Auto/Man Status (SF-AM), TFA Trip Status (SFF) and High Static Shutdown (HSS-S). Control valve and Supply Fan VFD are interlocked with the supply fan status. When the supply fan status is off, the cooling valve is driven closed and supply fan speed driven to 0%. When the System Enable is set to disable or TFA is in Manual mode, or the supply fan trip, or the high static shutdown is on, the control system will be disabled.

Fan Control:

The Supply Fan Command is set to ON when the System Enable is set to Enable, AHU is in Auto mode and the supply Fan is not tripped and high static shutdown is off. Supply fan is turned off when the system is disabled.

Supply Air Temperature Control:

When the supply fan status is on, Control Valve starts modulating to maintain the Supply Air Temperature (SA-T) at set point (SA-TSP). If the Supply Air Temperature exceeds the set-point then the valve shall be proportionally opened, and the reverse action shall take place when the temperature falls below the set point.

Return Air Temperature control:

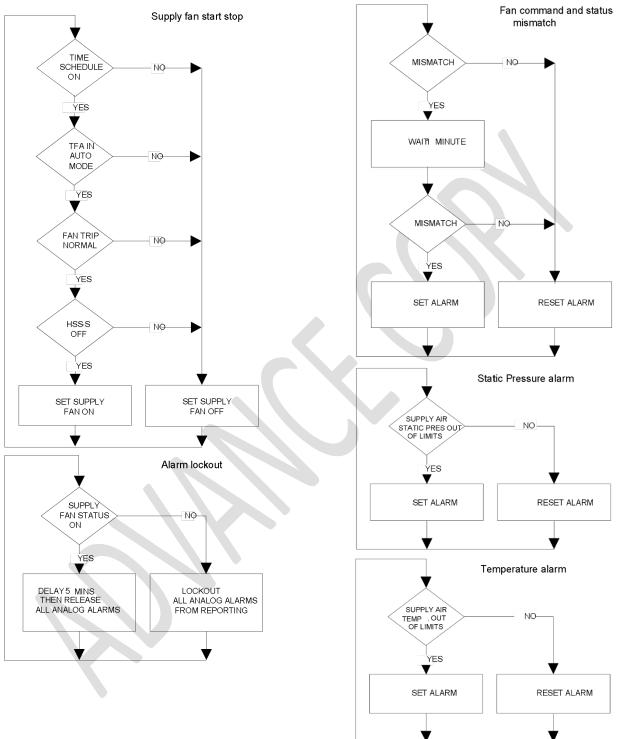
When the supply fan status (SF-S) is on, VFD is modulated to maintain the Return Air Temperature (RA-T) at Set point (RA-TSP). If the Return Air Temperature exceeds the set-point then the VFD Speed shall be proportionally increase Fan speed and the reverse action shall take place when the Return Air temperature falls below the set point.

Alarm indication:

An alarm advisory is raised when any of the following occur:

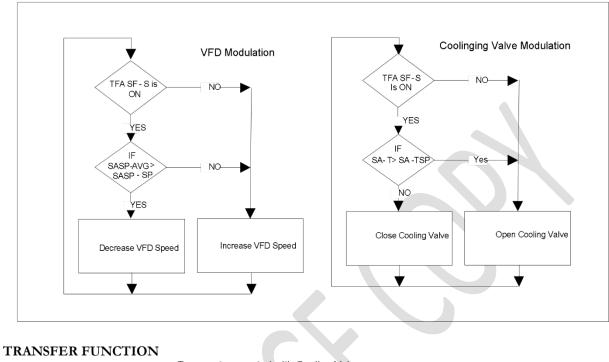
- 1) If there is a mismatch between the fan command and the fan status for more than 1 minute.
- 2) Supply Air Temperature, Return air Temperature is out of the set limits.
- 3) If there is a mismatch between the VFD command and the VFD feedback status.
- 4) If there is a mismatch between the Control Valve command and feedback.

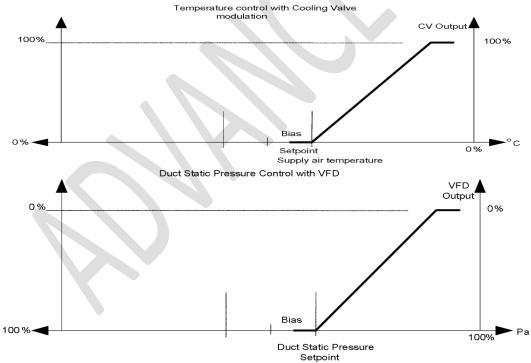
Below is the process control flow diagram for the Treated Fresh Air Unit



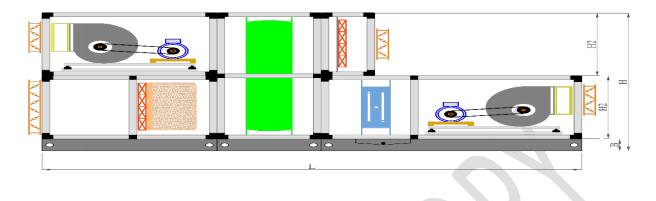
Flow Charts-Commands & Alarms

FLOW CHARTS- TEMPERATURE & STATIC PRESSURE CONTROL





e) Air Handling Unit with HRW



System On/Off command:

The system is interlocked with Enable Command. The Dynamic Balancing cum control valve is interlocked with the supply fan status. When the supply fan status is off, the cooling valve is modulated to close position. When the System Enable is set to disable, the control system will be disabled.

Fan Control:

The Supply Fan Command is set to ON, BMS checks for Fan auto/manual status & Fan trip status. fan is turned on and status is turned to on once DP switch sends fan on status signal.

Supply Air Temperature Control:

When the supply fan status is on, Control Valve starts modulating to maintain the Supply Air Temperature (SA-T) at set point (SA-TSP). If the Supply Air Temperature exceeds the set-point then the valve shall be proportionally opened, and the reverse action shall take place when the temperature falls below the set point.

Return Air Temperature Control:

As the supply fan status is on, modulation of VFD is used to maintain the Return Air Temperature (RA-T) at set point (RA-TSP). If the Return Air Temperature exceeds the set-point then the VFD shall be operated proportionally to increase fan speed, and the reverse action shall take place when the temperature falls below the set point.

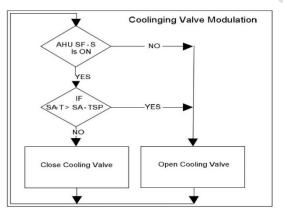
Humidity Wheel Command:

Humidity wheel is turned on & status is monitored using proximity sensor.

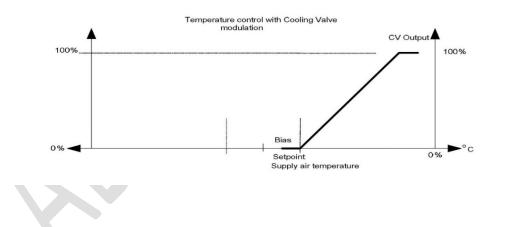
Alarm indication: An alarm advisory is raised when any of the following occur:

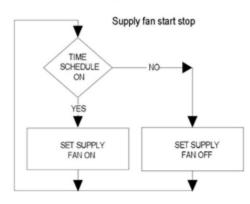
- 1) 1) If there is a mismatch between the fan command and the fan status for more than 1 minute.
- 2) Supply Air Temperature, Return air Temperature is out of the set limits.
- 3) If there is a mismatch between the VFD command and the VFD feedback status.
- 4) If there is a mismatch between the Control Valve command and feedback.

FLOW CHARTS- TEMPERATURE CONTROL

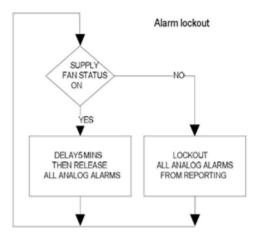


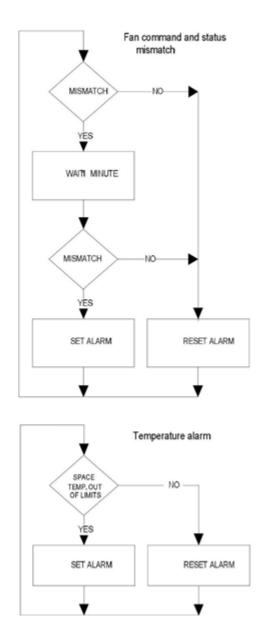
TRANSFER FUNCTION













3.2.1 Library Block

Library Block CPM consist of Efficient Chillers, Plate type Heat Exchanger & Radiant chiller & Cooling Tower. Efficient Chiller will be used to charge Radiant chiller.

Cooling tower, with Plate type heat exchangers is used for taking condenser side heat rejection from Efficient Chiller. Efficient Chiller will be used to charge Radiant chiller during day time. Radiant chiller once fully charged will be used during day time during Kitchen/Dining schedule for Breakfast, Lunch, Hi-tea etc. The Schdule will be provided by Nalanda University administration. Between day time running hours, Radiant chiller will be charged again for night time to be discharged during dinner time.

a) CPM Operation- to seek operation approval from NU

Chiller plant manager operation is explained as per below table.

Sr. No.	Mode	Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine	Efficient Chiller	Radiant chiller
А	Daytime			
1)	Summer/Monsoon	Working	Working in Working mode	Working/ Disworking

2)	Winter	-	-	-
В	Night time	Working	Working	
1)	Summer/ Monsoon	-		Disworking
2)	Winter	-	-	-

1. Normal Operation Mode

Chiller Plant Manager will Perform below steps for normal operation mode:

Step 1: Check for Heating Load H_d, Cooling Load C_d demand for the building.

Step 2: Check for solar power input from Solar Power energy meter.

Step 3: Check for online/ offline mode, working hours of Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine, Efficient Chillers, Pumps, & Cooling Towers

Step 4: Check Ambient temp. & Rh

Step 5: Check chilled water supply & return header temperature

Step 7: Check condenser Water supply & return header temperature

Step 8: Check CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL working, creating a %age scale in CPM based on CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL outlet temperature.

2.All Season operation (Day time)

During day time, CPM will perform below mentioned functions sequentially.

Step 1: Check solar power input

Step 2: Check isolation Valve status for Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engines

Step 3: Open Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine isolation valves

Step 4: Check for pump lead/lag function of hot water pumps

Step 5: Start lead hot water pump & check for water flow status

Step 6: CPM start Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine.

Step 7: Check condition, is Cooling demand $C_d > C_{HP}$?

If No,

Step 7.1 Keep on running Heat Pump and/or CHP Engine as per the approval by NU Engineer and/or CHP Engine

If Yes,

Step 7.2: Start CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL sequence

Step 8: Check Condition, is CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL fully charged?

If yes,

Step 8.1: Check Condition, is daytime kitchen run schedule on?

If yes,

Step 8.1.1: Start CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL Disworking Sequence. Step 8.1.2: Check Lead & Lag Efficient Chillers run status

Step 8.1.3: Stop running Lead & Lag Efficient Chillers

Step 8.1.4: Check MV01 & MV02 isolation valve status

 Step 8.1.5: Operate MV01 & MV02 isolation valve to isolate efficient chillers & connect CHP PREFERABLY AND/OR
 CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL to PHE.

Step 8.1.6: Close isolation valves for lead & lag chillers

Step 8.1.7: Check Lead/Lag pump PS04 after checking working hours

Step 8.1.8: Open Lead PS04 pump isolation valves

Step 8.1.9: Check Lead/Lag pump PS05 after checking working hours

Step 8.1.10: Open Lead PS05 pump isolation valves

Step 8.1.11: Start Lead pump PS04

Step 8.1.12: Check flow status

Step 8.1.13: Start Lead pump PS05

Step 8.1.14: Check flow status

If no,

 $Step \ 8.2 \ Check \ condition, \ Is \ Available \ Power \ Supply \ P_{sol} > P_{CHP \ PREFERABLY}$ and/or chiller as per the NU approval during hvac design approval

If no,

Step 8.2.1: Start CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL Partial working.

If yes,

Step 8.2.2: Check Lead/ Lag function of Efficient Chiller after checking working hours

Step 8.2.3: Check Isolation Valve MV01 & MV02 status

Step 8.2.4: Operate Isolation Valve MV01 & MV02 to Connect CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL & PS01

Step 8.2.5: Check Lead/Lag function of Pump PS01

Step 8.2.6: Open Lead PS01 isolation valves

Step 8.2.7: Check Lead/Lag function of Pump PS02

Step 8.2.8: Open Lead PS02 isolation valves

Step 8.2.9: Open Lead Efficient Chiller isolation valves

Step 8.2.10: Start Lead Pump PS01

Step 8.2.11: Check Flow status

Step 8.2.12: Start Lead Pump PS02

Step 8.2.13: Check Flow status

Step 8.2.14: Start Lead Efficient Chiller

Step 8.2.15: Check Condition, is CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL Out temp > 0 deg. C

If yes,

Step 8.2.15.1: Start Lag Chiller

If no,

Step 8.2.15.2: Keep on running Lead Chiller

Step 8.3 Check Condition, is CT outlet temp.> 32 deg.

If yes,

Step 8.3.1: Check Lead/Lag function of Cooling towers after checking Working hours.

Step 8.3.2: Start Lead Cooling Tower

Step 8.3.3: Check condition, is CT outlet temp > 32 deg. C?

If yes,

Step 8.3.3.1: Start lag cooling Tower

If no,

Step 8.3.3.2: keep on running lead Cooling Tower.

If no,

Step 8.3.4: Keep all Cooling Tower Fan Off.

3.All Season operation (Night time)

During night time, CPM will perform below mentioned functions sequentially.

Step 1: Check Lead/ Lag function of Efficient Chiller after checking working hours

Step 2: Check Isolation Valve MV01 & MV02 status

Step 3: Operate Isolation Valve MV01 & MV02 to connect CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL & PS01

Step 4: Check Lead/Lag function of Pump PS01

Step 5: Open Lead PS01 isolation valves

Step 6: Check Lead/Lag function of Pump PS02

Step 7: Open Lead PS02 isolation valves

Step 8: Open Lead Efficient Chiller isolation valves

Step 9: Start Lead Pump PS01

Step 10: Check Flow status

Step 11: Start Lead Pump PS02

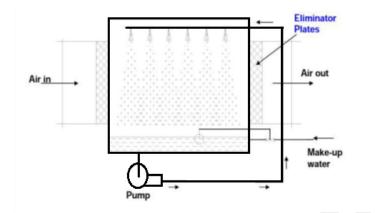
Step 12: Check Flow status

Step 13: Start Lead Efficient Chiller

Step 14: Check Condition, is CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN APPROVAL Out temp > 0 deg. C

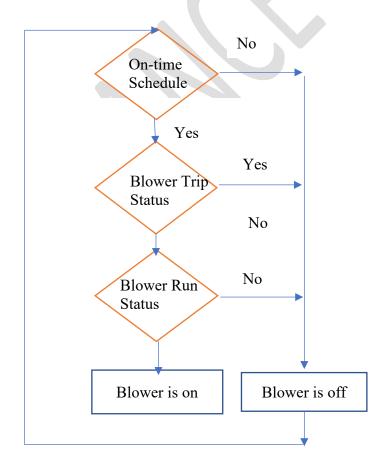
b) Air Washer

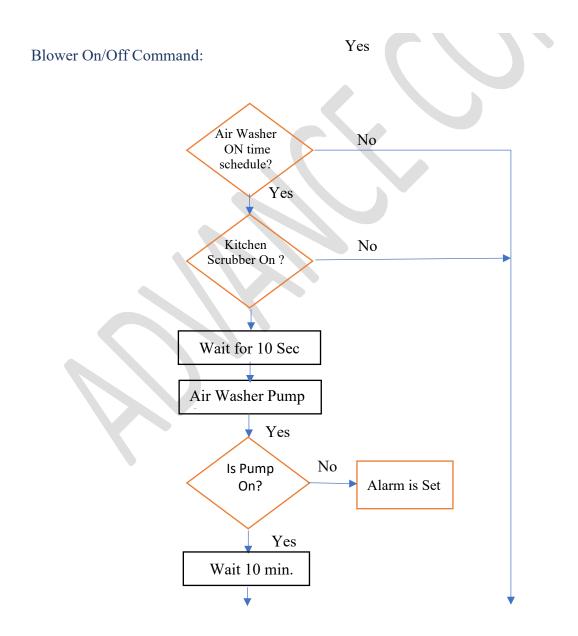
Air washer is used for conditioning of air. As shown in Fig, in an air washer air comes in direct contact with a spray of water and there will be an exchange of heat and mass (water vapor) between air and water.

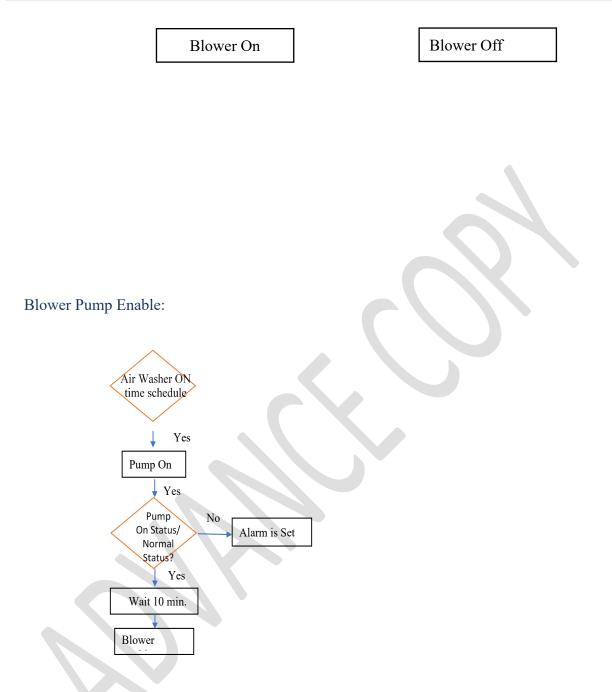


Air Washer units will be turned on based on On-time schedule & kitchen scrubber on status with a delay of 10 seconds. Air washer unit is monitored for run status & if command mismatch then alarm will be set. auto/manual status for blower & pumps will be monitored. Pump will be turned on & after a delay time of 10 mins, Air washer blower is turned on. Pump 'on' status will be monitored, if any mismatch an alarm will be raised.

Blower On/Off status:

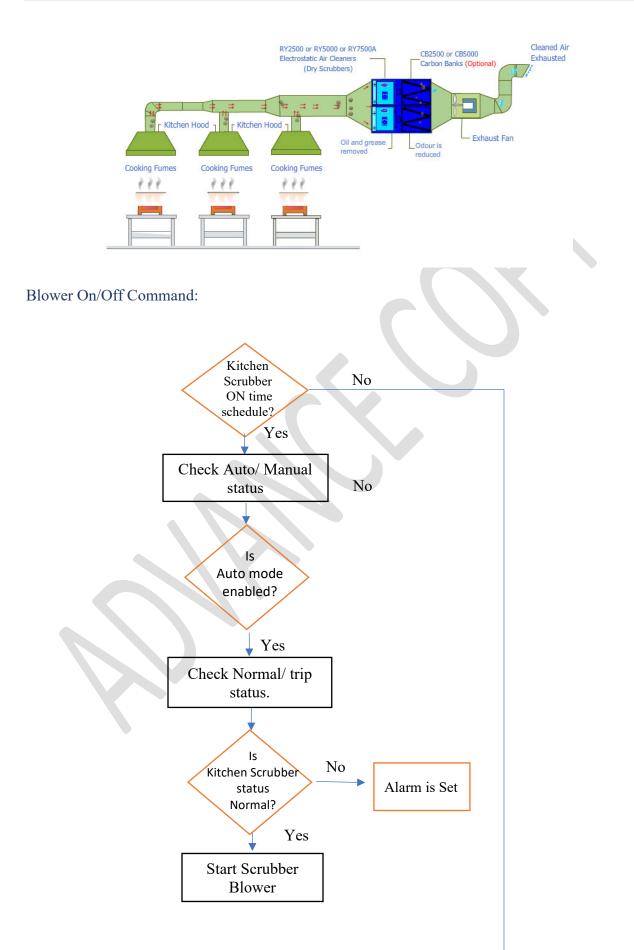


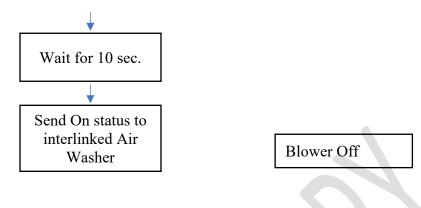




c) Kitchen Scrubber

Kitchen Scrubber will be enabled as per kitchen usage, & On schedule will be as per kitchen preparation schedule. As kitchen scrubber is turned on air washer status is also be turned on with a 10 seconds time delay. Kitchen Scrubber blower will be monitored for run status if any mismatch, alarm will be set. Kitchen scrubber will be monitored for auto/manual status, trip status.

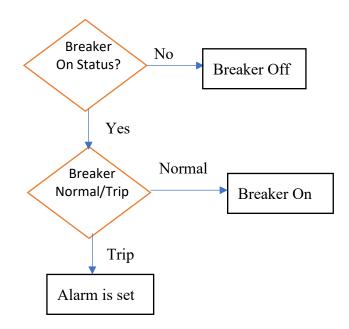




d) Electrical Panel

For electrical Panel, incoming breaker on/off status, trip status is being monitored. Outgoing breaker on/off status & trip status is also monitored. If trip then an alarm pop-up is raised at BMS.

Other parameters such as Incoming Voltage, incoming current, power factor & KWH will be monitored on soft integration from panel



3.3 Residential Block

Residential Block consist of three blocks namely Student Yogas, Librarys & Library. Each flat in Student Yogas has one unit of Indoor unit (IDU), which is connected to a EFFICIENT CHILLERS AS ON SUPPLY DATE Outdoor unit (ODU). All the HVAC and each components along with centrally located HVAC plant, HVAC Plant for Yoga comprises of Plate type heat exchangers, Cooling Towers & Geothermal loop will function from respective units in circulation and automatic drives.

3.3.1 Yoga /library Block

Yoga Block HVAC Plant for circulating cooling water to ODUs is centrally located. Geothermal loop is used initially for circulating 31 deg. C to the Plate type heat exchanger. As the heat load increases, water circulation demand also increases. As water outlet water temp. from Geothermal surpass 31 deg. C, Valve M2V01 will modulate to connect cooling towers into the circuit.

a) HVAC Plant Operation

HVAC Plant will follow below sequence of operation:

Step 1: Check for online/ offline mode, working hours of Pumps & Cooling Towers

Step 2: Check supply & return header water temperature

Step 3: Check Cooling Tower Water supply & return header temperature

Step 4: Check Geothermal supply & return water temperature

Step 5: Check, is PHE Supply water temp. > 31 deg. C?

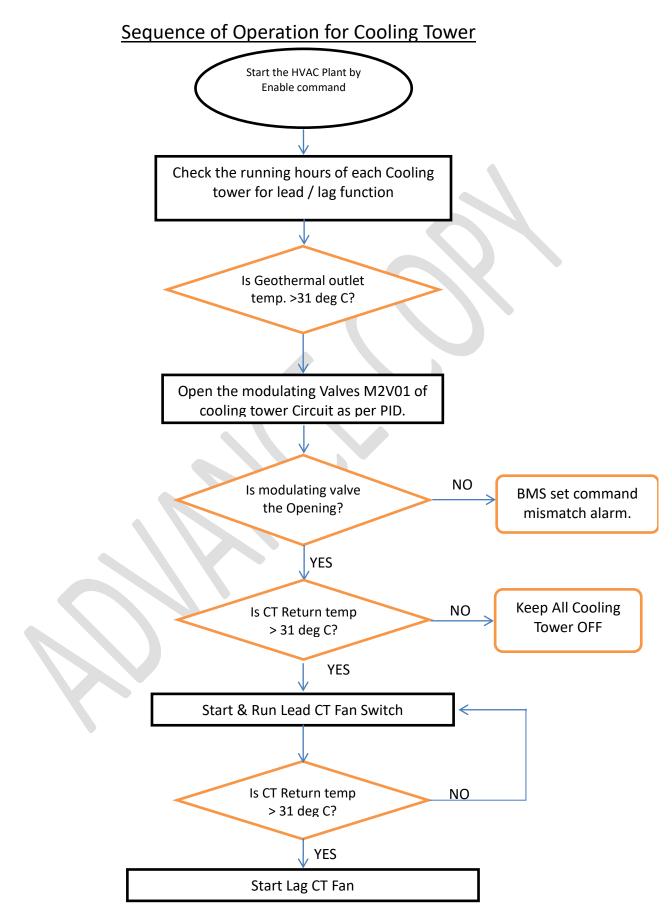
If no,

Keep on circulating water through Geothermal.

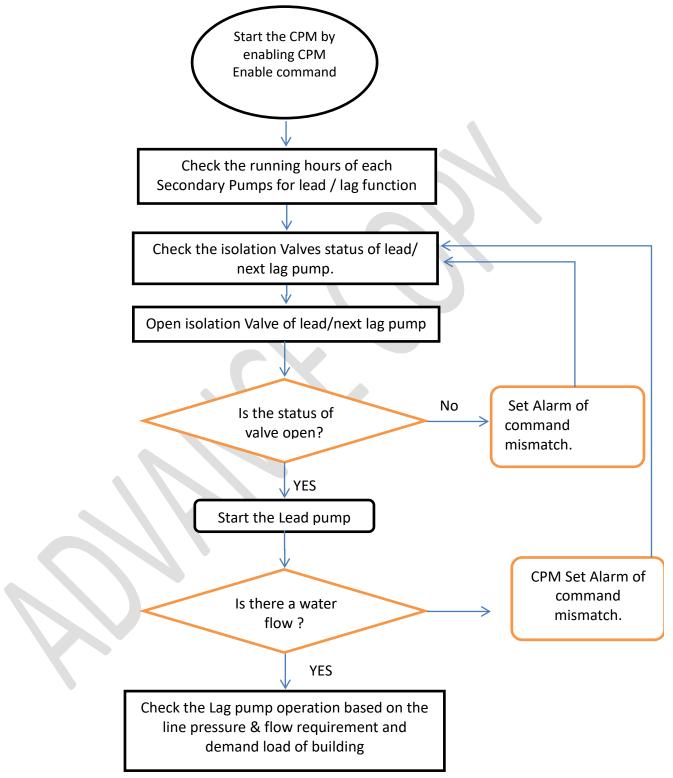
If yes,

Step 5.1: Start Modulating M2V01 to circulate water through Cooling Tower.

Step 5.2: Start Cooling Tower sequence.



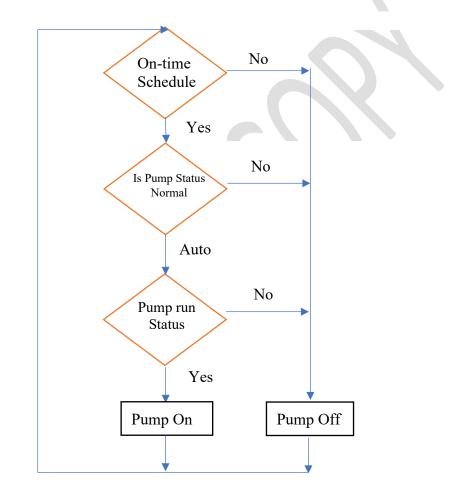
Sequence of Operation for Variable Secondary Pump System



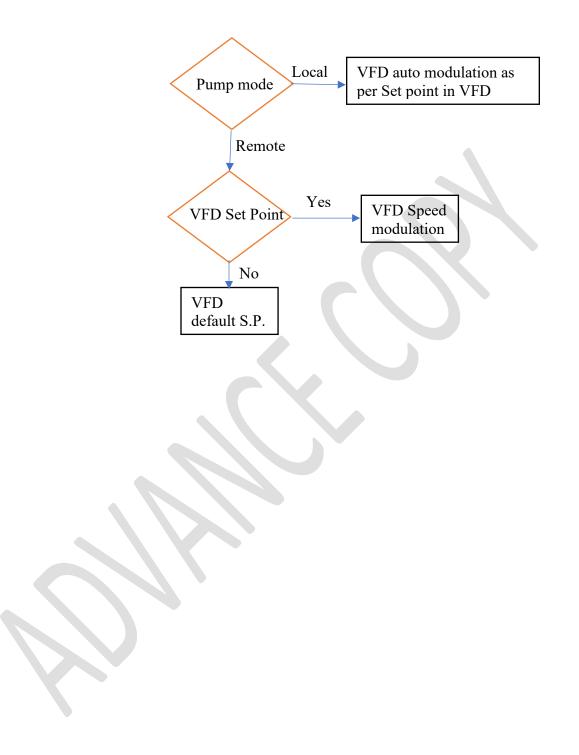
b) Tertiary Pumps

Tertiary pumps will be turned on as per building load, as it is a pressure boosting pump. Pumps status will be monitored for run, trip & Auto/manual status. Modulation of pump speed is achieved through VFD. In local-mode Tertiary pumps will be modulating based on set-point in pump logic controller. In Auto mode, tertiary pump speed will be set thru BMS based on diff. pressure transmitter. VFD will be communicating with BMS through soft integration over Modbus RS-485.

<u>Pump on/off status</u>:



Pump VFD Set Point:



3.3.2 Librarys Block

Library Block consists of clusters of building for residential purpose of faculties, visiting dignitaries & University inviworking. There are 3 types of Librarys i.e. Type Type1B, Type 2 & Type 3. Type 1B will be installed with 6 nos. 1.5 TR FCUs, while Type 2 will have 5 nos. 1.5 TR FCUs & Type 3 with 4 nos. 1.5 TR FCUs. All the FCUs are connected to ODUs at the terrace & each wing will have 4 nos. 6 TR Out door units. In total there are 136 nos. of water-cooled Outdoor unit (ODU) installed within Library Block.

Cooling water to ODUs will be circulated from centrally located HVAC Plant. HVAC Plant will have PHE, Cooling Tower which will supply water at 32 deg. C from the Plate type heat exchanger to ODUs.

There are Tertiary pumps in between provided to maintain required water flow to ODU.

a) HVAC Plant Operation

HVAC Plant will follow below sequence of operation:

Step 1: Check for online/ offline mode, working hours of Pumps & Cooling Towers

Step 2: Check supply & return header water temperature

Step 3: Check Cooling Tower Water supply & return header temperature

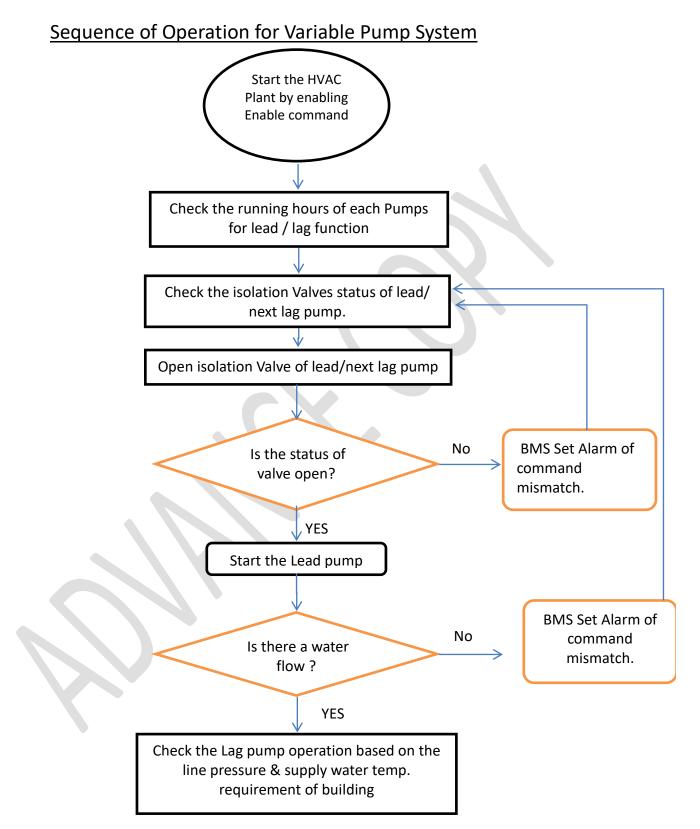
Step 4: Check, if ODU Supply water temp. > 32 deg. C

If no,

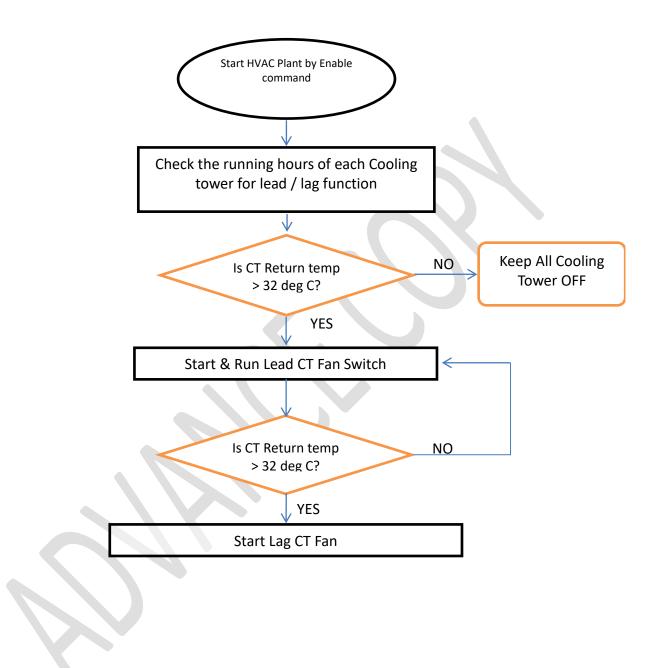
Keep on running Lead cooling tower.

If yes,

Start Lag cooling tower.



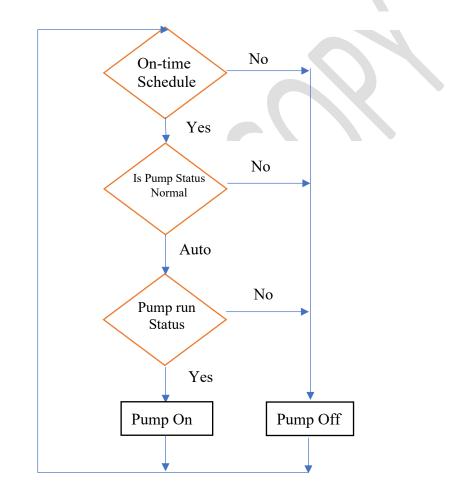
Sequence of Operation for Cooling Tower



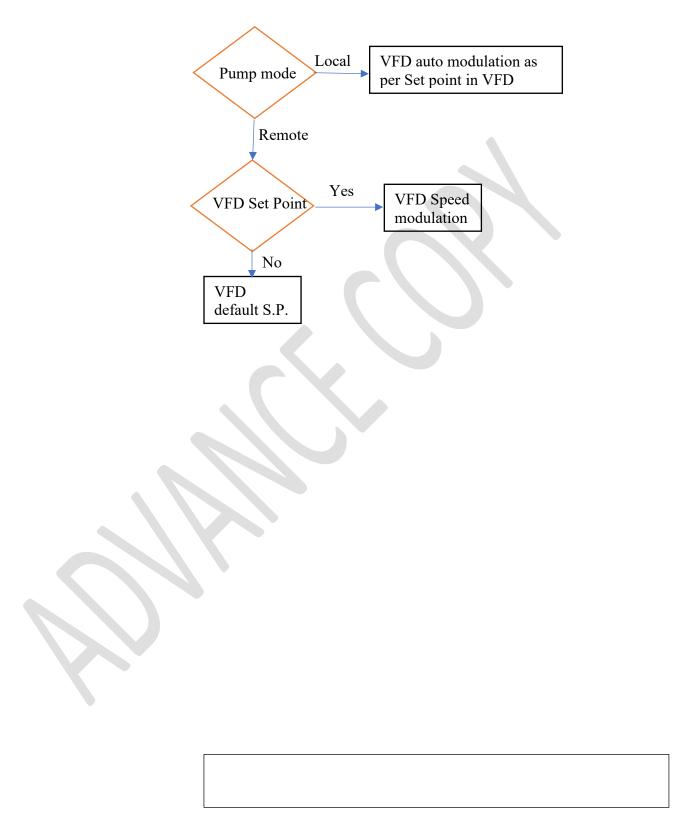
b) Tertiary Pumps

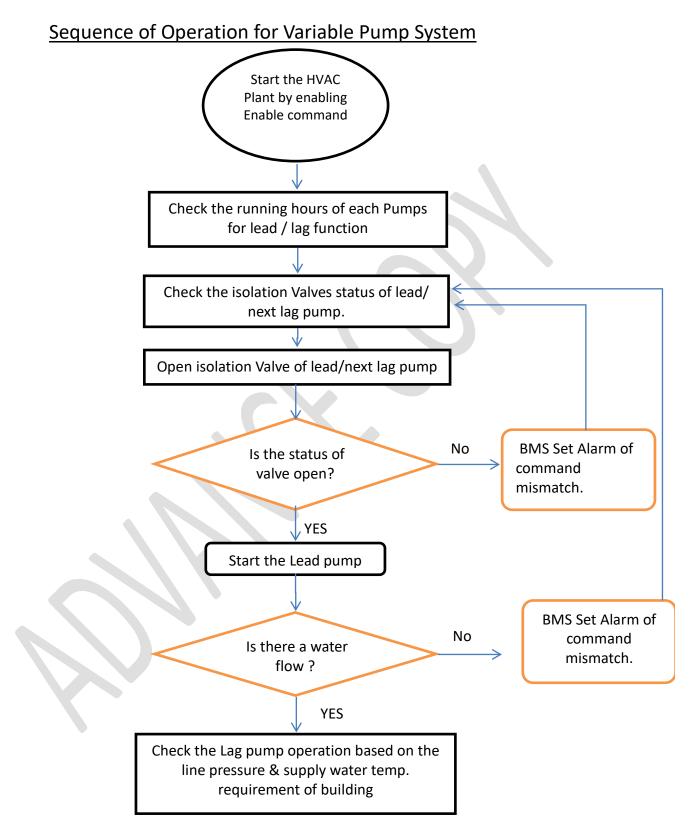
Tertiary pumps will be turned on as per building load, as it is a pressure boosting pump. Pumps status will be monitored for run, trip & Auto/manual status. Modulation of pump speed is achieved through VFD. In local-mode Tertiary pumps will be modulating based on set-point in pump logic controller. In Auto mode, tertiary pump speed will be set thru BMS based on diff. pressure transmitter. VFD will be communicating with BMS through soft integration over Modbus RS-485.

<u>Pump on/off status</u>:

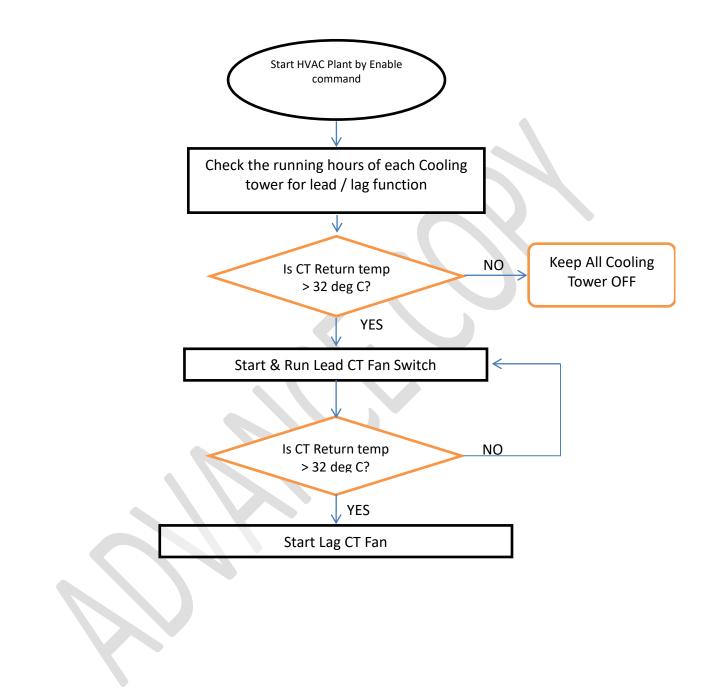


Pump VFD Set Point:





Sequence of Operation for Cooling Tower

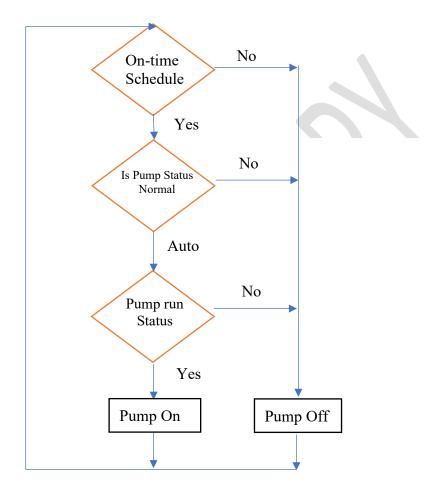


b) Tertiary Pumps

Tertiary pumps will be turned on as per building load, as it is a pressure boosting pump. Pumps status will be monitored for run, trip & Auto/manual status.

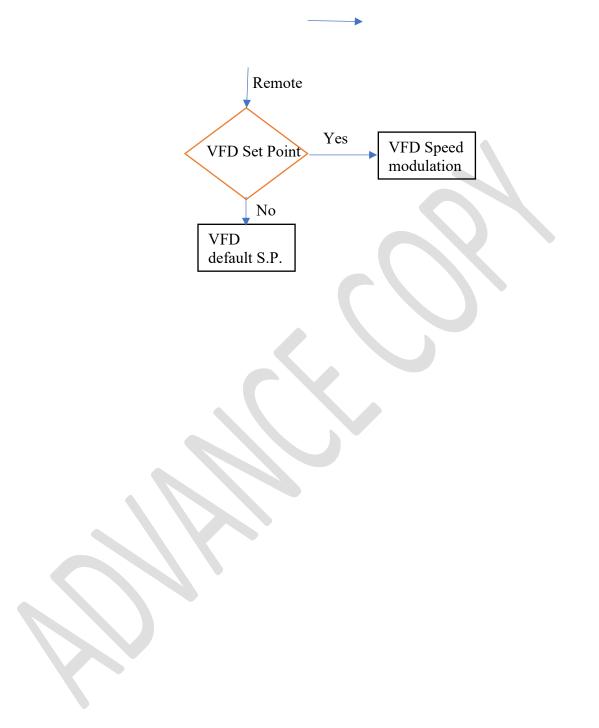
Modulation of pump speed is achieved through VFD. In local-mode Tertiary pumps will be modulating based on set-point in pump logic controller. In Auto mode, tertiary pump speed will be set thru BMS based on diff. pressure transmitter. VFD will be communicating with BMS through soft integration over Modbus RS-485.

Pump on/off status:



Pump VFD Set Point:





5. Functional Specifications

5.1 Use Case

User Case 01	Cooling Towers & Geothermal interlock switching for School &
	Yoga block (Cricket & Stadium Geothermal works)
Primary Actor(s)	Geothermal system is working & condenser supply temp. is less than
• • • • • • • • • • • • • • • • • • • •	32 deg C
Stakeholders and	Geothermal System, Chiller Plant system, BMS
Interest	
Trigger	Condenser supply water temp. $> 32 \text{ deg. } C$
Pre-conditions	Geothermal system is used for condenser water cooling cycle. Chiller
	Plant Manager will operate valve manifold & stage Cooling Tower
	sequence. Water distribution between cooling tower and Geothermal
	will be in ratio of 60%:40% in full load condition.
Post-conditions	Cooling Towers as per load condition will start operating.
	Geothermal system will keep on operating.
Main Success	1. Geothermal System – ON (if not in Cool-off period)
Scenario	2. Cooling Tower staging ON
	3. Condenser supply temp. is monitored
	4. Water temp is maintained $\leq 32 \deg C$.
Extensions	If CT 1 not an antional, then CT 2 is made an antional
Extensions	If CT-1 not operational, then CT-2 is made operational.
	If optimum temp. is not achieved next CT is initiated. Geo Thermal
	System has a cool off period/regeneration time and will be isolated
	from the condenser water circuit during cool of period.
Priority	Geothermal System is turned on initially & will take precedence
Special	Soothermal System is tai nea on initially & will take procedence
Requirements	
Etc as per the NU	
Engineer	
User Case 02	For Cooling Towers

Primary Actor(s)	Screw Chiller & Cooling Tower						
Stakeholders and	Screw Chiller & Cooling Tower, Chiller Plant system, BMS						
Interest	Seren Chiller & Cooling Tower, Chiller T land System, Diris						
Trigger	When CPM will enable lead Screw chiller staging.						
Pre-conditions	Screw Chiller will be enabled.						
Post-conditions	Screw Chiller is operational, Cooling Towers is operational. And						
1 Ost-conditions	Condenser pump will keep on operating.						
Main Success	<i>1. Screw chiller – ON</i>						
Scenario	2. Cooling Tower staging ON						
	3. Condenser supply temp. is monitored						
	4. Water temp is maintained $\leq 32 \deg C$.						
Extensions	If CT-1 not operational, then CT-2 is made operational						
	If SET TEMP. is not achieved next CT is initiated.						
Priority	CPM has enabled Screw Chiller.						
Special							
Requirements							
Etc as per the NU							
Engineer							
	Efficient Chillers Operation						
User Case 03							
Primary Actor(s)	Solar Energy, Efficient Chillers, Radiant chiller.						
	Sour Liver Sy, Lijverent Chiners, Rumani ennier,						

Stakeholders and	<i>Efficient Chiller, Radiant chiller, Solar Energy, Chiller Plant System,</i>					
Interest	BMS					
Trigger	Day Schedule, Solar Energy Availability, Radiant chiller outlet temp					
	is gtr than 0 deg.C.					
Pre-conditions	Solar Energy Availability at CPM, CPM will start Efficient Chiller					
	stage up sequence, and start working Radiant chiller.					
Post-conditions	Efficient chillers are operational Radiant chiller in Working Mode.					
Main Success	Success 1. Lead, Lag Efficient Chillers – ON					
Scenario	2. Radiant chiller – Working Mode					
Extensions	If Lead efficient chiller offline or fault then, next online available					
	chiller is enabled					
Priority						
Special						
Requirements						
Etc as per the NU						
Engineer						

TT C 04				
User Case 04	For Screw Chiller Operation			
Primary Actor(s)	Screw Chiller, Condenser Pump, Cooling Tower.			
Stakeholders and	Screw Chiller, Chiller Plant system, BMS			
Interest				
Trigger	1. 540>Consumption load < 813TR,			
	2. Day time			
Pre-conditions	CPM will Enable Chiller Stage up sequence.			
Post-conditions	onditions Screw Chiller will operate, Condenser pump & Cooling Towers as pe			
	load condition will start operating.			
Main Success 1. Lead Screw Chiller-ON				
Scenario	2. Cooling Tower staging- ON			
	3. Condenser Pump-ON			
Extensions	If Lead Screw Chiller is not operational, then next lead Screw Chiller			
	is made operational			
Priority				
Special				
Requirements				
Etc as per the NU				
Engineer				

5.2 Button, links, lcons

As per NU approval

5.3 Login & Security Access Level

Button, Link, Icon Label	On Click Event	Other Event	Visible	Enabled Vs Disabled	Navigate To	Validation	Dependencies
Login button at home- screen	Verify if user name and password are correct. If yes, log the user into the system.		Yes, always	Enabled. entering username or password field.	User Dashboard page	Verify if Username is a valid user ID and user name and password match with registry data.	Disable the New user functionality on subsequent pages than user logs in through this button. Casual users will log off after 15 mins. (customised) Idle time
Home button at User Dashboard	Will take to home screen user dashboard.	Hovering mouse will highlight text	Yes, always	Enabled on clicking	User Dashboard page		
HVAC button over header ribbon	Will take to HVAC home page	Hovering mouse will highlight text	Yes, always	Enabled on clicking	User Dashboard page		
Chiller button over header ribbon	Will take to Chiller Plant Manager home page	Hovering mouse will highlight text	Yes, always	Enabled on clicking	User Dashboard page		
EFFICIENT CHILLERS AS ON SUPPLY DATE system button over header ribbon	Will take to EFFICIENT CHILLERS AS ON SUPPLY DATE button home page	Hovering mouse will highlight text	Yes, always	Enabled on clicking	User Dashboard page		
Energy dashboard button over header ribbon	Will take to energy dashboard page	Hovering mouse will highlight text	Yes, always	Enabled on clicking	User Dashboard page		

The CCC system will be provided with up to six levels of security providing varying degrees of access to system operation and configuration functions. Each operator will be assigned a user profile that defines the following:

- a) Security Level (1-5)
- b) Control Level (1-255)
- c) Operator Identifier
- d) Unique Password

System will have the capacity to create unlimited user profiles & login credentials. Any actions initiated by the operator shall be logged in the Event database by operator identifier with date & time stamp. In addition, any control actions to a given point shall only be allowed if the control level configured in the operator's profile exceeds the level assigned to the controlled point. Utilities shall be provided to allow administration of the operator passwords.

5.4 Password Authentication

Password format supports unlimited length. The system will provide a facility to allow all operators to change their own passwords at any time by proper validation method.

All human users are uniquely identified Admin logon password management Imported User Accounts are disabled by default Certificate functionality for - HTTPS connections

Self-signed certificates Default certificates Certificate Authority certificates

Password policies can be enforced with following services/options

- a) Days until password expires
- b) Minimum number of characters
- c) Minimum number of lowercase characters
- d) Minimum number of numeric characters
- e) Minimum number of special characters
- f) Number of consecutive unique passwords before reuse
- g) No more than three repeating identical characters

Although Password policies are secured by default having Factory settings as below

a) Days until password expires: Enabled: 90 days

- b) Minimum number of characters: 8
- c) Minimum number of lowercase characters: 1
- d) Minimum number of numeric characters: 1
- e) Minimum number of special characters: 1
- f) Number of consecutive unique passwords before reuse: 6
- g) Do now allow more than three repeating identical characters: Enabled

System will also have Force Admin password change features, which will prompt user to change admin password on first login.

Password blacklist (non-editable): Certain key characters are defined as blacklist passwords and can't be used by the users.

123 admin Admin admin1 Admin1 Admin1! password Password PaSsWoRd Password1!

5.5 Confidentiality

As an added security against cyber threats data transmission is encrypted of data

- a) HTTPS using TLS 1.0, HTTPS using TLS 1.1, TLS 1.2, SFTP using TLS 1.2
- b) EWS Encrypted Logon,
- c) Disable use of MD5 configuration option
- d) SNMPv3 support
- e) SmartX server: SSHv2
- f) Redirect web clients to HTTPS configuration option
- g) SMTPS secure email notification support
- h) Clickjacking protection options

Password data is obscured from view Passwords are stored and transmitted securely to CA certified central log storage with secure key management & data at rest protection.

It should be possible to support Microsoft Windows Active Directory with Single Sign-On operator station would typically use the multi-user password.

A minimum of 100 unique passwords will be supported. Operators will be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on. Operators shall be further limited to only access, command, and modify those buildings, systems, and subsystems for which they have responsibility.

The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules.

5.5 Data Exchange

Interfacing to Another System: The BMS shall have the capability to interface to the point database of other similar BMSs (ie nodes) on a TCP/IP network. This shall enable both the acquiring of point data and issuing control outputs to other BMS systems.

Data Exchange with a Relational Database:

The CCC system will be provided with Open source & secure relational data source PostgreSQL with capabilities of Timescale DB which is used for running complex SQL Queries in a much simpler & faster manner.

a) Oracle

b) Access

c) Microsoft SQL

It shall be possible to transfer data either periodically (ie scheduled), when an event occurs or on demand by the operator.

Data Exchange with Microsoft Excel:

The system must be capable of exporting bulk data to Microsoft Excel. Windows Dynamic Data Exchange (DDE) is not an acceptable method to use. As a minimum the following shall be supported:

- a) Allow retrieval of data either periodically or snapshot
- b) Allow retrieval of data via POINT. PARAMETER requests.
- c) Allow retrieval of tag names, descriptions etc.
- d) Allow retrieval historical data
- e) Writing of values from Excel back to the supervisory

6. System Configurations

6.1 Reporting Requirements

BMS system shall produce monthly report for the system generated alarms, TR load consumption for the month, hourly ambient Temperature & relative humidity data. Reports shall, at a minimum, be able to provide:

- 1. Trend comparison data
- 2. Alarm status and prevalence information
- 3. Energy Consumption data
- 4. System user data

6.2 Alarm Management

Through the browser interface, a live alarm viewer identical to the alarm viewer on the Administration and Programming workstation is presented, if the user's password allows it. Users will receive alarms, silence alarms, and acknowledge alarms through a browser. If desired, specific operator text can be added to the alarm record before acknowledgement, attachments are viewable, and alarm checklists are available.

For each system point, alarms can be created based on high/low limits or in comparison to other point values. All alarms are tested on each scan of the NSC and can result in the display of one or more alarm messages or reports. There is no limit to the number of alarms that can be created for any point Alarms can be configured to be generated based upon a single system condition or multiple system conditions.

Alarms will be generated based on an evaluation of the alarm conditions and can be presented to the user in a fully configurable order, by priority, by time, by category, etc. These configurable alarm views will be presented to a user upon logging into the system regardless of whether the log in takes place at a WorkStation or a Webstation.

The alarm management system supports the ability to create and select cause and action notes to be selected and associated with an alarm event. Checklists are possible in order to present to an operator a suggested mode of troubleshooting. When acknowledging an alarm, it is possible to assign it to a user of the system

such that the user is notified of the assignment and is made responsible for the alarm resolution.

6.3 Alarm Handling Sequence

All alarms reported to the BMS front end supervisor have 3 priorities as detailed below:-

Alarm	Priority	Description
Category		
Low	100	Maintenance level alarms. No immediate risk to plant or personnel. (Dirty filter is an example)
High	50	Alarms that need to be attended to during day shift. Left unattended this could pose a risk to plant operation.
Urgent	10	Immediate risk to plant operation or personnel. Loss of life support systems or conditions required for clinical purposes.

6.4 Alarm Filtering

The Alarm Summary will be able to be filter the alarms displayed to the operator. The filtering criteria will be as per below criterion:

- 1. Individual Priorities (i.e. Urgent, High, Low)
- 2. Ranked Priorities (i.e. Urgent only, Urgent & High only, Urgent, High & Low)
- 3. Unacknowledged Alarms only
- 4. Individual Areas only

6.5 BMS Alarms Table

BMS Alarms as detailed below:-

ltem	Alarm Description	Low Limit Set point	High Limit Set point	Alarm Type	Alarm Priority	Alarm Message	Returned to Normal Message
1.	Supply Air Temperature Alarm	Setpoint -2°C	Not Applicable	Software	100	Supply Air Temperature Alarm Low Limit	Supply Air Temperature Alarm Return to Normal

ltem	Alarm Description	Low Limit Set point	High Limit Set point	Alarm Type	Alarm Priority	Alarm Message	Returned to Normal Message
2.	Supply Air Temperature Alarm	Not Applicable	Setpoint +2°C	Software	100	Supply Air Temperature Alarm High Limit	Supply Air Temperature Alarm Return to Normal
3.	Supply Air Temperature Sensor Fail Alarm	Open Circuit	Open Circuit	Software	100	Supply Air Temperature Sensor Fail Alarm Is In Alarm	Supply Air Temperature Sensor Fail Alarm Return to Normal
4.	Cooling Coil Temperature Sensor Alarm	Setpoint -1°C	Not Applicable	Software	100	Cooling Coil Temperature Sensor Alarm Low Limit	Cooling Coil Temperature Sensor Alarm Return to Normal
5.	Cooling Coil Temperature Sensor Alarm	Not Applicable	Setpoint +1°C	Software	100	Cooling Coil Temperature Sensor Alarm High Limit	Cooling Coil Temperature Sensor Alarm Return to Normal
6.	Cooling Coil Temperature Sensor Fail Alarm	Open Circuit	Open Circuit	Software	100	Cooling Coil Temperature Sensor Fail Alarm Is In Alarm	Cooling Coil Temperature Sensor Fail Alarm Return to Normal
7.	Fire Alarm Status Alarm	Not Applicable	Not Applicable	Digital	10	Fire Alarm Status Alarm Is In Alarm	Fire Alarm Status Alarm Return to Normal
8.	Low Temperature Alarm	Setpoint -1°C	Not Applicable	Digital	50	Low Temperature Alarm Is In Alarm	Low Temperature Alarm Return to Normal
9.	Supply Air Filter Status Alarm	Not Applicable	Not Applicable	Digital	100	Supply Air Filter Status Alarm Is In Alarm	Supply Air Filter Status Alarm Return to Normal
10.	Control Panel Normal/ Trip Status Alarm	Not Applicable	Not Applicable	Digital	50	Control Panel Normal/Trip Switch Status Alarm Is In Alarm	Control Panel Normal/trip Switch Status Alarm Return to Normal
11.	Return Air Temperature Sensor Fail Alarm	Open Circuit	Open Circuit	Software	100	Return Air Temperature Sensor Fail Alarm Is In Alarm	Return Air Temperature Sensor Fail Alarm Return to Normal
12.	Supply Fan Status Fail Off Alarm	Not Applicable	Not Applicable	Digital	50	Supply Fan Status Fail Off Alarm Is In Alarm	Supply Fan Status Fail Off Alarm Return to Normal
13.	Supply Fan Status Fail Off Alarm	Not Applicable	Not Applicable	Digital	50	Supply Fan Status Fail Off Alarm Is In Alarm	Supply Fan Status Fail Off Alarm Return to Normal
14.	Return Air/Exhaust Air Filter Status Alarm	Not Applicable	Not Applicable	Digital	100	Return Air/Exhaust Air Filter Status Alarm Is In Alarm	Return Air/ Exhaust air Filter Status Alarm Return to Normal
15.	DX Unit Fault Alarm	Not Applicable	Not Applicable	Digital	100	DX Unit Fault Alarm Is In Alarm	DX Unit Fault Alarm Return to Normal
16.	Supply Air Fan Command Forced by Operator Alarm	Not Applicable	Not Applicable	Digital	100	Supply Air Fan Command Forced by Operator Alarm Is In Alarm	Supply Air Fan Command Forced by Operator Alarm Return to Normal
17.	Return Air Fan Command Forced by Operator Alarm	Not Applicable	Not Applicable	Digital	100	Return Air Fan Command Forced by Operator Alarm Is In Alarm	Return Air Fan Command Forced by Operator Alarm Return to Normal
18.	DEVAP Fan Failed On Alarm	Not Applicable	Not Applicable	Software	100	Fan Failed ON Alarm Is In Alarm	Fan Failed On Alarm Return to Normal
19.	Return Fan Status Fail Off Alarm	Not Applicable	Not Applicable	Digital	50	Return Fan Status Fail Off Alarm Is In Alarm	Return Fan Status Fail Off Alarm Return to Normal
20.	Return Fan 02 Status Fail Off Alarm	Not Applicable	Not Applicable	Digital	50	Return Fan 02 Status Fail Off Alarm Is In Alarm	Return Fan 02 Status Fail Off Alarm Return to Normal
21.	Supply Air Fan Command Forced by Operator Alarm	Not Applicable	Not Applicable	Digital	100	Supply Air Fan Command Forced by Operator Alarm Is In Alarm	Supply Air Fan Command Forced by Operator Alarm Return to Normal
22.	Fire Damper Failed To Close Alarm	Not Applicable	Not Applicable	Software	100	Fire Damper Failed To Close Alarm Is In Alarm	Fire Damper Failed To Close Alarm Return to Normal

Item	Alarm Description	Low Limit	High Limit	Alarm	Alarm	Alarm Message	Returned to Normal
		Set point	Set point	Туре	Priority		Message
23.	Fresh Air Damper Failed To Close Alarm	Not Applicable	Not Applicable	Software	100	Fresh air Damper Failed To Close Alarm Is In Alarm	Fresh air Damper Failed To Close Alarm Return to Normal
24.	Air Washer Pump fail status	Not Applicable	Not Applicable	Software	50	Air Washer Pump failed to Start. Alarm is in Alarm	Air Washer Pump failed to Start. Alarm Return to Alarm
25.	Kitchen Scrubber Fan Fail to start status	Not Applicable	Not Applicable	Digital	100	Kitchen Scrubber Fan Failed On Alarm Is In Alarm	Kitchen Scrubber Fan Failed On Alarm Return to Normal
26.	TFA with HRW Supply air Temperature Low Alarm	Setpoint - 2°C	Not Applicable	Software	100	TFA with HRW supply air temp low Alarm is in Alarm	TFA with HRW supply air temp low Alarm Return to Normal
27.	TFA with HRW Supply air Temperature High Alarm	Not Applicable	Setpoint +2°C	Software	100	TFA with HRW supply air temp low Alarm is in Alarm	TFA with HRW supply air temp low Alarm Return to Normal
28.	TFA with HRW filter chocked	Not Applicable	Not Applicable	Digital	100	TFA with HRW supply air temp low Alarm is in Alarm	TFA with HRW supply air temp low Alarm Return to Normal

7. Integration Requirements

7.1 Point to Point Checkout

Each I/O device (both field mounted as well as those located in FIPs shall be inspected and verified for proper installation and functionality. A checkout sheet itemizing each device shall be filled out, dated and approved by the Project Manager for submission to the owner or owner's representative.

7.2 Controller and Workstation Checkout

A field checkout of all controllers and frontend equipment (computers, printers, modems, etc.) shall be conducted to verify proper operation of both hardware and software. A checkout sheet itemizing each device and a description of the associated tests shall be prepared and submitted to the owner or owner's representative by the completion of the project.

Control loops will be exercised by inducing a setpoint shift of at least 10% and observing whether the system successfully returns the process variable to setpoint. Record all test results and attach to the Test Results Sheet.

Test each alarm as mentioned in alarm handling sequence and validate that the system generates the appropriate alarm message, that the message appears at all prescribed destinations (workstations or printers), and that any other related actions occur as defined (i.e. graphic panels are invoked, reports are generated, etc.). Submit a Test Results Sheet to the owner.

Perform an operational test of each unique graphic display and report to verify that the item exists, that the appearance and content are correct, and that any special features work as intended. Submit a Test Results Sheet to the owner. Perform an operational test of each third-party interface that has been included as part of the automation system. Verify that all points are properly polled, that alarms have been configured, and that any associated graphics and reports have been completed. If the interface involves a file transfer over Ethernet, test any logic that controls the transmission of the file, and verify the content of the specified information.

7.3 Integration Protocols

Below is the table of Communication protocols over which IBMS will be communicating with other systems

Sr. No.	Equipment/ Systems	Communication Protocol	Communication Bus
1.	Chiller Plant Manager	BACNet	TCP/IP

2.	Variable Refrigerant	BACNet	TCP/IP
	System – Outdoor unit		
3.	Variable Frequency	Modbus	RS-485
	Drives		
4.	Variable Air Volume	BACNet	TCP/IP
	System		
5.	Variable Secondary	Modbus	RS-485
	Pumping System		
6.	Diesel Gensets	Modbus	TCP/IP
7.	UPS	Modbus	RS-485
8.	Hydropneumatic Pumps	Modbus	RS-485
	PLC		
9.	Lifts	Modbus	RS-485
10.	Fire Alarm System	BACNet	TCP/IP
11.	DEVAP	Modbus	RS-485

7.4 Protocol Integration Architecture

All the required systems are communicating over open protocol such as TCP/IP communication bus is established using CAT6/CAT6A cables, while RS-485 communication bus is established using 2 core x 1.5 mm², shielded ATC cable. Ethernet TCP/IP bus has limit of up to 90 mtrs, after that it either requires a repeater or router to boost the signal, while an RS-485 communication bus can run up to 1200 mtrs. All RS-485 communication buses within a block will run need to be connected to a FRTU converter which can convert the communication protocol to IP bus, which then can be connected to network switch. Below is the Communication protocols integration architecture over which CCC will be communicating with other systems

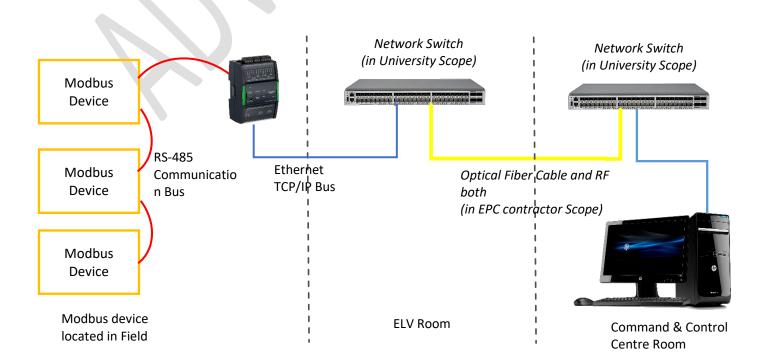


Fig: Modbus over RS-485 communication protocol integration

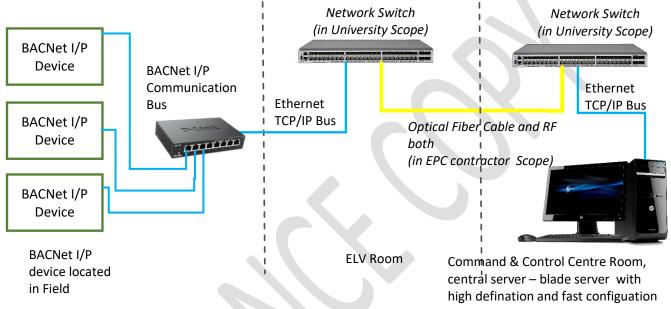


Fig: BACNet over IP communication protocol integration

8. Graphic user interface

Specimen for the Graphical user interface for Building management system

8.1 Home page

: Chiller Plant Manager Functional Sequence (All Season Day & Night both – 24x7 time)

: CPM (Academic Spine) - Schematic layout with sensor



: CPM - Schematic layout with sensor

: Alarm Checklist (for review)

Identifier	Alarm Condition & Action steps	Checkbox
Alarm-001	Chilled Water Supply High temp Alarm	
	Action	
1	Check Power to the chiller	
2	Check that Chilled Water Mixing Valve is operational	
3	Call technician for the Central Plant - call Person: Contact No. 98XXXXXXX	
Alarm-002	Supply Air Temperature Alarm	
	Action	
1	Check Temperature sensor installation	
2	Re-install temperature sensor	
3	Check signal status at BMS	
Alarm-003	Supply Air Temperature Sensor Fail Alarm	
	Action	
1	Check if sensor is broken.	
2	Check Sensor connection is OK	
3	Reinstall new sensor in the position	
4	If Problem persist, Please call Person: Contact no. 98XXXXXXX	
Alarm-004	Cooling Coil Temperature Sensor Alarm	
	Action	
1	Check Temperature sensor installation	
2	Re-install temperature sensor after servicing	
3	Check signal status at BMS	
Alarm-005	Cooling Coil Temperature Sensor Fail Alarm	
	Action	
1	Check if sensor is broken.	
2	Check Sensor connection is OK	
3	Reinstall new sensor in the position	
4	If Problem persist, Please call Person: Contact no. 98XXXXXXX	
Alarm-006	Supply Air Static Pressure Alarm	
	Action	

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Air filter clogged Alarm Action	
Air filter clogged Alarm	
Check signal status at BMS	
Re-install temperature sensor after servicing	
Check Temperature sensor installation	
Action	
TFA with HRW Supply air Temperature	
If Problem persist, Please call Person: Contact no. 98XXXXXXX	
Check Fan motor Cable termination is OK.	1
Action	
Kitchen Scrubber Fan Fail to start status	
If Problem persist, Please call Person: Contact no. 98XXXXXXX	
Check Pump motor Cable termination is OK.	1
Action	
Air Washer Pump fail status	
If Problem persist, Please call Person: Contact no. 98XXXXXXX	
Check Limit Switch connection is OK.	
Check Damper Cable termination is OK.	
Action	
Fresh Air Damper Failed To Open/Close Alarm	
If Problem persist, Please call Person: Contact no. 98XXXXXXX	
Check DP Switch connection is OK.	
Check Fan motor Cable termination is OK.	
Action	
Supply Fan Status Fail Off Alarm	
If Problem persist, Please call Person: Contact no. 98XXXXXXX	
Reinstall new sensor in the position	
Check Sensor connection is OK	
Check if sensor is broken.	-
Action	
· · ·	-
•	
	Check if sensor is broken. Check Sensor connection is OK Reinstall new sensor in the position If Problem persist, Please call Person: Contact no. 98XXXXXXX Supply Fan Status Fail Off Alarm Action Check Fan motor Cable termination is OK. Check DP Switch connection is OK. If Problem persist, Please call Person: Contact no. 98XXXXXXX Fresh Air Damper Failed To Open/Close Alarm Action Check Damper Cable termination is OK. Check Limit Switch connection is OK. If Problem persist, Please call Person: Contact no. 98XXXXXXX Air Washer Pump fail status Action Check Pump motor Cable termination is OK. If Problem persist, Please call Person: Contact no. 98XXXXXXX Air Washer Pump fail status Action Check Pump motor Cable termination is OK. If Problem persist, Please call Person: Contact no. 98XXXXXXX Fresh Air Damper Faile To Statt status Action Check Fan motor Cable termination is OK. If Problem persist, Please call Person: Contact no. 98XXXXXXX Fresh Air Damper Faile To Start status Action Check Fan motor Cable termination is OK. If Problem persist, Please call Person: Contact no. 98XXXXXXX Fresh HRW Supply air Temperature Action Check Temperature sensor installation Re-install temperature sensor after servicing

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	3 Check	filter status at BMS		
	View Actions Window			Colorida Colorida
Build	ling Operation 🖽		9 ?	Schnecked to: Server 1 A admin - Schneider
← · →		larm Control Panel ► Alarm Handling ► Checklists ►		Search 🔍 🤇
iystem Tree	L	· × Checklists × · + ℓ		Zedit Checklist ? ×
4 34 Serv	rer 1 Svistem	Checklist	Date modified	Name: Chilled Water Supply High Temp Alarm
4	Alarm Control Panel	Chilled Water Supply High Temp Alarm	4/16/2020 2:22:34 PM	Description:
	Alarm Handling Section Notes	Supply Air Temperature Alarm Supply Air Temperature Sensor Fail Alarm	10/7/2020 8:11:00 PM 10/7/2020 8:11:00 PM	
	Cause Notes	Cooling Coll Temperature Sensor Alarm	10/7/2020 8:11:00 PM	Step Action 1 Check power to the chiller
	Checklists Alarm Styles	Cooling Coil Temperature Sensor Fail Alarm Supply Air Static Pressure Alarm	10/7/2020 8:11:00 PM 10/7/2020 8:11:00 PM	2 Check that Chilled Water Mixing Valve is operational
D	Audio Backup and Restore	Return Air Temperature Sensor Fail Alarm	10/7/2020 8:11:00 PM	3 Call technician for the Central Plant - call Mark Larson: 214-555-1234
Þ	Binding Templates	Supply Fan Status Fail Off Alarm Fresh Air Damper Failed To Open Close	10/7/2020 8:11:00 PM 10/7/2020 8:11:00 PM	-
Þ	Content Types	Air Washer Pump fail status	10/7/2020 8:11:00 PM	
	Domains EcoStruxure Web Services	Kitchen Scrubber Fan Fail to start status TFA with HRW Supply air Temperature	10/7/2020 8:11:00 PM 10/7/2020 8:11:00 PM	-
D D	Extended Permissions External Log Storage	Air filter clogged Alarm	10/7/2020 8:11:00 PM	
Þ	Firmware Hardware			
Þ	Interface Manager			
D	LonWorks Binding Profile			OK Cancel
Þ	NICs Notification Files			
D	Ports	*		
	Ċ			
	Ċ			
	S			
	5			
	S			
	S			

Radiant and others chiller and/or CHP integrated absorption chiller Yearly Load Profile

CPM IO summary as per requirement and NU approval

Minimum as per the CPWD confirming to the site requirement for fully automation and IBMS

Glossary:

TermsDefinitionDEVAP:Desiccant Enhanced Evaporative air conditioning system

EFFICIENT *As per the BEE and Supper Building with maximum COP* CHILLERS AS

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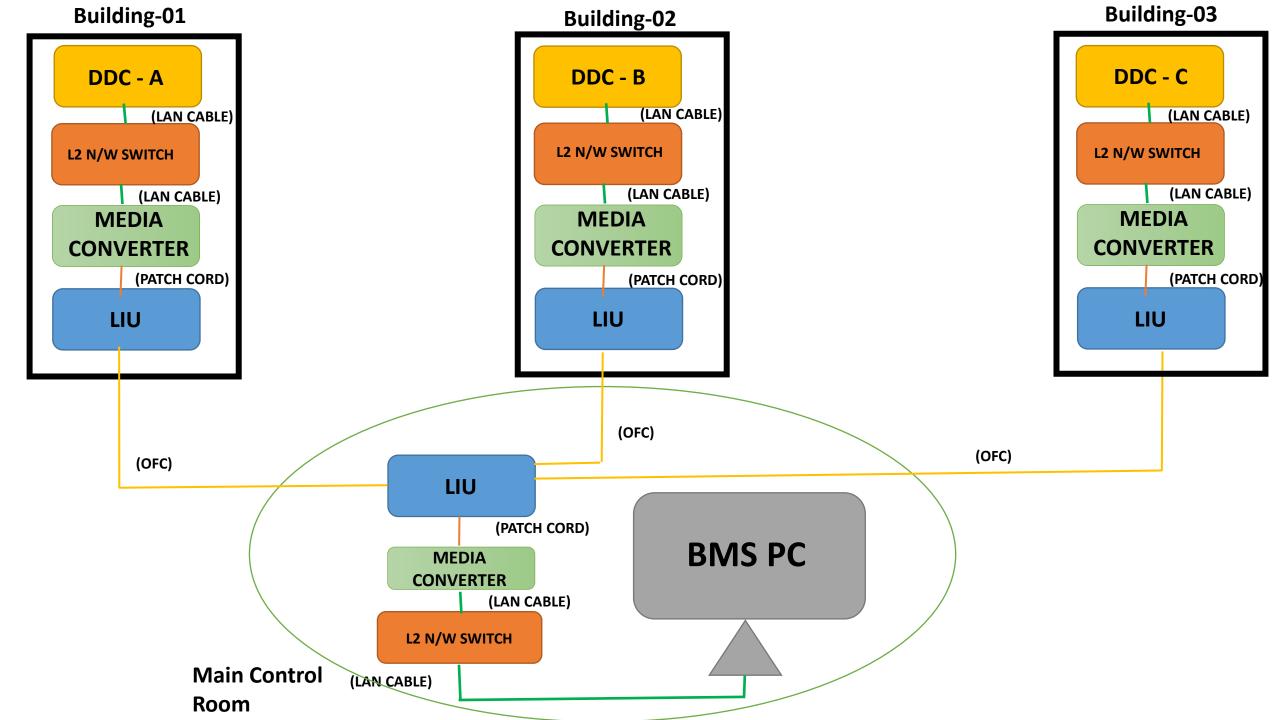
ON SUPPLY

- DATE:
 - VFD: Variable Frequency Drives
 - CPM: Chiller Plant Manager
 - BMS: Building Management System
 - **PP:** *Primary Pumps*
 - SP: Secondary Pumps
- SA-T: Supply Air Temperature
- RA-T: Return Air Temperature
- Amb-T: *Ambient temperature*
- Amb-rh: *Ambient relative humidity*
 - NSC: Network Supervisory Controller
 - FIP: Field Installed Panels
 - MV: Motorised Butterfly Valves for changeover
 - PHE: Plate type Heat exchanger

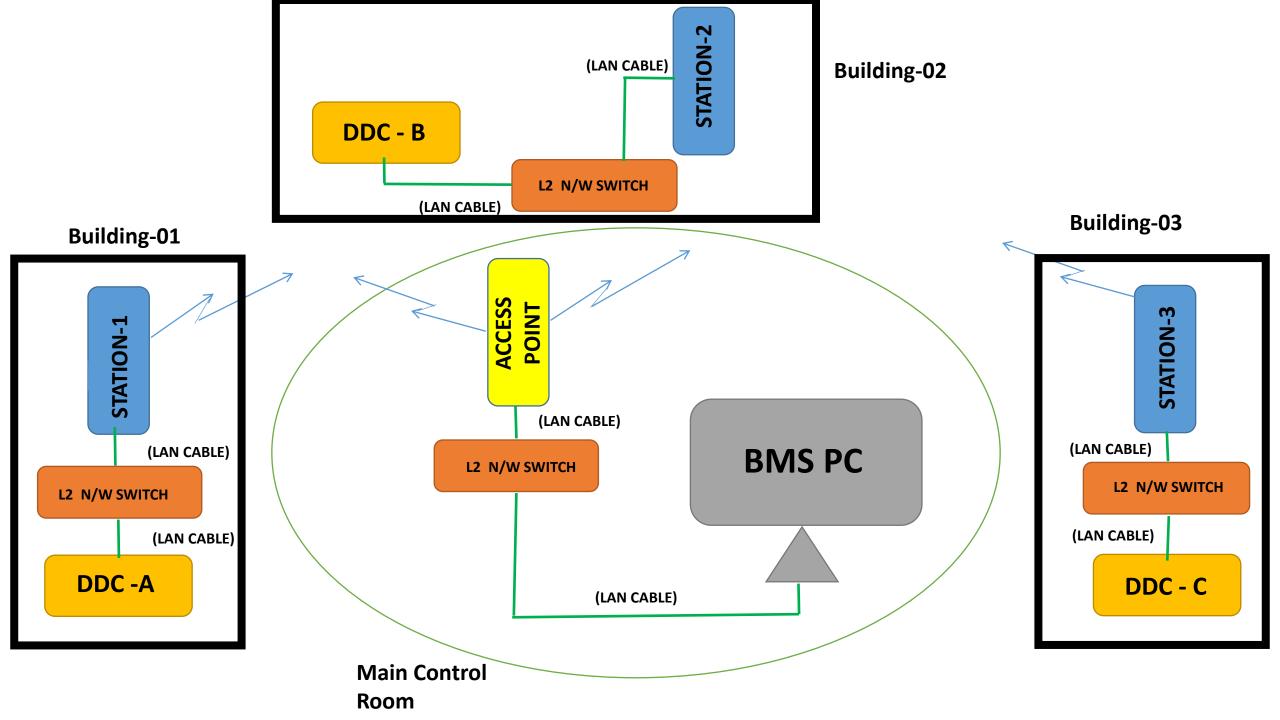
Combined heat and Power Engine CHP PREFERABLY AND/OR CHILLER AS PER THE NU APPROVAL DURING HVAC DESIGN **APPROVAL**: M2V: *Modulating 2-way Valve* CCC: Command & Control Center FRTU: Field Remote Terminal Unit FCU: Fan Coil Unit

PROVISION OF ALTERNATE WIRELESS NETWORK For BMS Communication

EXISTING WIRED NETWORK WITH OFC



WIRELESS NETWORK



Tentative BOQ For Wireless Network:

- 1. Antenna for station 1/2/3- 5 Nos.
- 2. Antenna for Access Point-5 Nos.

Note:

- 1. For BMS Communication on OFC a separate OFC (12core through HDD, 1 Pair) should be used.
- 2. This OFC Pair will transfer BMS data from separate L2 Switch/above. No other system should be connected to this L2 Switch.
- 3. If other system will be connected, we need to calculate required bandwidth.
- 4. For that selection of antenna (for station & Access point) will be changed accordingly.
- 5. It will be an alternate wireless (RF) network & will work on Line of Sight (LoS).

CHAPTER-18

BUILDING MANAGEMENT SYSTEM

18.1 SCOPE

The Building Management System (BMS) to be provided shall perform the following general functions:

- i) Building Management and Control
- ii) Monitoring and Control of Controllers, Remote Devices and Programmable Logic Controllers
- iii) Operator Interface
- iv) Video display integration
- v) Data collection, Historization, Alarm Management & Trending
- vi) Report Generation
- vii) Network Integration
- viii) Data exchange and integration with a diverse range of other computing and facilities systems using industry standard techniques.

The scope of BMS here is for Air-conditioning applications only. It should be expanded type to connect it with other building services in future. The BMS software and supervising should have the capability to expand the system at least upto 50% of the present capability.

18.2 SYSTEM ARCHITECTURE

The system offered shall be completely modular in structure and freely expandable at any stage with 3 level architecture

- i) The Management Level
- ii) The Automation Level
- iii) The Field Level

Each level of the system shall operate independently of the next level up.

The system shall fully be consistent with the latest industry standards, operating on Windows 2000 or Windows NT or later, allowing the user to make full use of the features provided with these operating systems.

To provide maximum flexibility and to respond to changes in the building use, the system offered shall support the use of BACnet, LON, Profibus and Ethernet TCP/IP communication technologies.

All plant and equipment requiring control and / or monitoring functions shall be fitted with all necessary interfacing equipment readable by the BMS network.

18.2.1 The Management Level

The management level and operation of the plant shall include process visualization, data analysis, and exchange of data. At the management level, it shall be possible for communication to flow in all directions, across networks and via direct connections. The management level of the system shall consist of one and shall be capable of handling more management station PCs and the associated software modules. The total number of management station PCs shall be as described elsewhere in the specifications.

18.2.2 The Automation Level

The level at which the actual processing takes place based on the logic written on the DDC. The processes are carried out at the DDC controllers for stand-alone control of all plant.

18.2.3 The Field Level

Individual room controllers for autonomous room – by – room comfort control, based on application specific logic written on the controllers.

18.3 INTERFACE AND INTEGRATION

18.3.1 Maintenance Management

i) <u>Integrated</u>

The system shall provide an integrated Maintenance Management function. The Maintenance Management function shall use specified breakdown alarms, equipment run hours or analog values from the BMS.

ii) Third Party

The system shall be capable of integrating with external maintenance systems such as MS Excel, MS Access. This integration shall consist of transferring specified breakdown alarms and equipment run hours from the BMS to the external maintenance system.

18.4 DIGITAL CONTROLLERS

18.4.1 General

Digital Control Processors / Direct Digital Controller (DDC) shall be as specified with capacity to accommodate input/ output (I/O) points required for the application plus spare points specified.

Each DDC will be a truly standalone controller with its own Input-Output capacity, control logic capability, time programming and energy management capabilities. All field equipment including the sensing element (inputs) and control elements (outputs) would be wired to the respective DDC. It shall be possible to hook up a DDC to a Portable Operator Terminal (POT) to enable monitoring and control of the DDC.

DDC shall be designed for complex DDC and energy management applications, true peer-to-peer communications with other DDC and with the Central Operator Stations. The DDC will be networked on a truly distributed intelligence concept where each DDC shall be a self-sustained intelligent device capable of all its functionality's without dependence on other devices

18.4.2 DDC Hardware:

- Digital Control Processors (DDC) shall be 16 bit microprocessor types with Electrical Erasable Program Read Only Memory (EEPROM) based Operating System (OS) and shall use EEPROM or flash memory for all data file and control programs (DDC Programs) and using RAM only for operating data.
- ii) Each DDC shall have Nickel cadmium Lithium battery to support complete operation of the RAM for unto 30 days in the event of a power failure to the DDC. A low battery voltage status will generate an alarm condition.
- iii) DDC shall have internal real-time clocks with 30-day battery backup power. All time-based controls (time scheduling, integrations and other real-time based controls) shall be performed with this real-time resident clock. Clock synchronization of the DDC on the whole bus will be automatic

DDC using clocks generated by software or timers for clocking shall not be accepted.

- iv) The battery backup power shall support the real-time clock. Upon power restoration all clocks shall synchronize automatically.
- v) The DDC's shall be capable of supporting 8 to 48 I/Os preferably in a combination of 8 AI (Analog input), 2 DI(Digital input), 4 AO(Analog output), 2 DO(Digital output) with minimum of 10% spares of each type per DDC.
- vi) The DDC would be dedicated standalone in nature and would be placed near the instrument they are controlling to reduce the installation and wiring cost.
- vii) Analogue input support of the following minimum types shall be provided:
 0/4-20mA
 0-10 volts
 0-5 volts
 0/2-10 volts
 Resistance signals (Pt3000, Pt1000, Pt100, Ni1000)
- viii) Digital Inputs type shall be, but not limited to the following types: Normally open discrete contacts Normally closed discrete contacts
- 18.4.3 DDC POT functionality shall be as follows:
 - i) There will be an electrical socket/port in every DDC for accessing the data points and real time information via a portable plug-in type Portable Operator Terminal (POT).
 - a) The POT shall not have any EEPROM and shall not require any programming.
 - b) The POT will plug into the DDC for its power and data. The POT which are not plugged in to the DDC but are hard wired from the

Interface unit, PC station or any other device shall not be acceptable.

- ii) The connection of the POT to a controller shall not affect normal operation of the controller or the bus communication in any way.
- iii) The connection of the POT to any controller on a bus shall provide display access to all controllers on the bus. Each DDC shall have provision for plugging of the POT.
- iv) It shall be possible for the POT to be connected to any controller on the bus to view and control any point on any other controller on the bus under password protected menus. POTs in which only a predefined number & set of points are available shall not be accepted.
- A failure of any DDC on the bus, Interface unit or Central PC station or any other device of the system shall not affect the operation of the POT.

Systems in which the POT is connected to only a single interface master port and hard wired to other controllers are not acceptable.

- vi) Use of a POT at DDC shall allow the user to display software information and via password control, modify DDC software.
- vii) All displays on the POT shall be in English language text and data points shall have customised descriptions as per application requirement.
- viii) The POT shall be equipped with a multiple lines (with minimum of 4 lines of 20 characters each) backlit alphanumeric LCD display and a control keypad. The keypad would include Command keys, data entry keys and cursor control keys
- ix) Access shall be through self-prompting menus with cursor controls for moving through the menus. Menu selection would be with arrow key controls for moving to next/previous menu and to step forward backward within a menu

18.5 FIELD DEVICES

18.5.1 Electronic Data Inputs and Outputs

Input/output sensors and devices shall be matched to the requirements of the respective connected controller panel for accurate, noise-free signal input/ output. Control input response shall be high sensitivity and matched to the loop gain requirements for precise and responsive control.

18.5.1.1 Temperature Sensors

Temperature sensors shall be Resistance Temperature Detector types of Pt3000, Pt1000, Pt100 or Ni1000. These shall be two wire type sensors and shall conform to following:

- i) Space temperature sensors shall be wall/surface mounted and shall be provided with blank commercial type looking covers
- ii) Duct temperature sensors shall be rigid stem or averaging type as specified and shall be suitable for duct installation
- iii) Immersion temperature sensors shall be provided with matching Stainless steel thermo- well of lengths as specified.
- iv) Outdoor air temperature sensors shall have weatherproof enclosures and shall be directly wall/surface mounted
- v) Outside air, return air, discharge air, return air, space and well sensors shall have <u>+</u> 0.55 degrees C accuracy between 0 degree and 100 degree C.
- 18.5.1.2 Relative Humidity Sensors :
 - i) Relative humidity sensors shall be capacitance type with an effective sensing range of 10% to 90%.
 - ii) Accuracy shall be +/-5% or better
 - iii) Duct mounted humidity sensors shall be provided with a sampling chamber. Wall mounted sensors shall be provided with covers identical to temperature sensors. Sensor housing shall plug into the base such that the same can be easily removed without disturbing the wiring.
- 18.5.1.3 Differential and Static Pressure Switches
 - A. Differential pressure switches-air :
 - i) They shall have field adjustable set-point capability for the specified range.
 - ii) They shall provide a built-in switching differential at the set-point over the specified range.
 - iii) Switches shall be piped to fan discharge except where fans operate at less than 25mm WC(water column), they shall be piped across the fan.
 - iv) Maximum pressure rating shall be at least 300 mm WC.
 - v) The electrical contacts shall provide dry contacts as specified and shall be rated for at least 300V A pilot duty @ 240V AC
 - B) Differential pressure switches-water :
 - i) Switches shall be adjustable differential pressure type as specified in the sequence of operation or data point summary.
 - ii) Devices shall be 10 kg/ sq.cm rated except chilled water flow switches shall be provided with totally sealed vapor tight switch enclosure on 20 kg/sq.cm body.
 - iii) Differential pressure switches shall have valved manifold for servicing.
 - iv) The electrical contacts shall provide dry contacts as specified and shall be rated for at least 300V A pilot duty @ 240V AC.
- 18.5.1.4 Differential Pressure Sensors
 - A) Air Flow / Pressure sensors

- i) Air flow and duct static pressure analog sensors shall be high accuracy suitable for the low pressures to be encountered, be selected for approximately 50% over range, and have a 4 to 20 ma/ 0-10 VDC output.
- ii) Air flow measuring station sensors shall be with valved lines for testing and calibration, and shall have adjustments for zero and span.
- B) Water flow Sensors
- i) Water flow analog sensors shall be provided complete with flow element and shall be an all solid state precision industrial type with stainless-steel body, maximum error of not more than 0.5% of span.
- ii) Sensor shall be rated for 17 kg/sq.cm minimum and installed in strict accordance to the manufacturer's instructions complete with three-valve manifold for calibration and maintenance.
- 18.5.1.5 Water Hardness Analyser
 - i) The water hardness analyzer shall be on-line conductivity type and shall provide analog output proportional to specified range.
 - ii) Control relays and analog output transducers shall be compatible with controller output signals. Relays shall be suitable for the loads encountered. Analog output transducers shall be designed for precision closed loop control with pneumatic repeatability error no greater than 2%.
- 18.5.1.6 Level Measurement
 - A) Level Switches
 - i) Level switches shall be directly vessel mounted type either top mounted or side mounted as required.
 - ii) These shall be float type unless specified. Process connection shall be flanged. Wetted parts shall be made of stainless steel (SS316).
 - B) Level Sensors
 - i) Level sensors shall be capacitance probe type.
 - ii) It shall be possible to mount the transmitter unit integral to the probe on the vessel or field mounted away from the probe
 - iii) Unless specified probe insulation shall be of PTFE and probe rod material SS316
 - iv) Process connection shall be flanged or BSP connections as specified.
- 18.5.2 Automatic Control Valves
 - i) Automatic control valves upto 50mm and smaller shall be screwed type, and valves of 65 mm and larger shall be flanged type.
 - ii) Valves shall be ANSI-rated to withstand the pressures and temperatures encountered. Valves shall have stainless-steel stems and spring loaded Teflon packaging with replaceable discs.
 - iii) All modulating straight-through water valves shall be provided with equal-percentage contoured throttling plugs. All three-way valves shall be provided with linear throttling plugs such that the total flow through the valve shall remain constant regardless of the valve's position.

- iv) Valves shall be sized as specified for a pressure drop equal to the coil they serve but not to exceed 0.2 kg/ sq.cm.
- All modulating steam valves shall have linear characteristic for 90% of the closing stroke and equal-percentage for the final 10%. Valves shall be sized for 0.68kg/ sq.cm entering steam and 0.2 kg/ sq.cm pressure drop through valves.
- vi) All automatic control valves shall be actuated by a directly coupled proportional electric actuator. Eccentric linkages are not acceptable.

18.5.3 Electric Actuators for Valves and Dampers

- Unless specified, the electric actuator shall accept proportional input signal of 0/2- 10VDC or 0/4-20mA. Unless specified actuators shall provide modulating control. Actuators shall be powered 24VAC or 240VAC as specified.
- ii) The actuators shall be designed to deliver the required torque and have close off pressure ratings as required by the specified process data
- iii) The actuator shall incorporate magnetic coupling to ensure torque limitation which shall be independent of voltage supply.
- iv) Unless specified, in case of power failure the actuator shaft position will remain stay-put at the last position just before power off.
- It shall be possible to replace the actuator / remove the actuator / dismantle it from the valve body without having to remove the valve body.
- vi) The actuator shall have a built in electronic switch to enable switchover of direct / reverse action of valve/damper. It shall be possible to change the direct/reverse action of valve without having to remove the actuator from valve body or change linkage assemblies.

18.6 BMS I-O (Input-Output) Summary

Table-1 gives Input-Output summary for a typical BMS application involving 1 no. chilling unit, 2 nos. primary chilled water pumps, 4 nos. secondary chilled water pumps, 2 nos. condenser water pumps, 2 nos. cooling towers & 12 nos. AHUs.

TABLE-1

BMS I-O (Input - Output) Summary

						Foint	Func	10115		
S.	Description	AI	DI	AO	DO	Mon-	Cont-	Ala-	Filed devices	Type of I/O
No.						itor	rol	rm		-
Α	HVAC Equipment									
	HIGH SIDE									
1.	Chilling Machines									
a.	Chiller On/ OFF				1		Х		Relay	Potential Free contact
									Contact	in Chiller Panel
b.	Chiller Run Status		1			X		Х		Potential Free contact
										in Chiller Panel
c.	Chiller Auto/		1			X		Х		Potential Free contact
	Manual Status									in Chiller Panel
d.	Chiller-Water Temp			1			Х			0-10 VDC signal from
	Reset									chiller panel

Point Functions

e.	Chiller trip/ fault		1			X				Potential Free contact in Chiller Panel
f.	Chiller chilled water supply temp in (1) + out	2				X			Immersion type sensor	Suitable Insertion provision
g.	Ambient Temperat- ure	1				X			Outside air temp. &	Suitable Installation Provision
h.	Ambient RH	1				X			RH sensor	Suitable Installation Provision
	Sub Total	4	3	1	1					
2.	Chill ed Water Pumps									
a.	Primary Chilled Water Pump On/ OFF				2		X		Relay output	Potential Free contact in Pump Starter Panel
b.	Primary Chilled Water pump run Status		2			X		X		Potential Free contact in Pump Starter Panel
C.	Primary Chilled Water pump flow status		2			X			Differential pressure switch (water)	Suitable Insertion Provision
d.	Secondary CHW Pump On/ Off				4		X		0-10 VDC signal from controller	Potential Free contact in Pump Starter Panel
e.	Secondary CHW pump run Statue		4			X		X		Potential Free contact in Pump Starter Panel
f.	Secondary CHW pump flow status		4			X			Differential Pressure Switch (water)	Suitable Insertion Provision
g.	Secondary CHW variable speed control			4						Provision of VFD for pumps
3.	Sub Total Condenser Water Pumps	0	12	4	6					
a.	Condenser pump On/ Off				2		X		Relay output	Potential free contact in starter panel
b.	Cooling tower air flow status		2			X		X	Air flow switch	Suitable Installation provision
C.	Cooling tower sump low water		2			X		X	Low level switch	Suitable Insertion provision
d.	Cooling tower `IN' valves/ status		2		2	X	X	X	Motorised B/F valves	Suitable Installation provision
e.	Water Temp.	2				X		X	Immersion type sensor	Suitable Insertion provision
f.	Fire signal input					X		X		Potential free contact from the fire panel
	Sub Total	2	6	0	4					

Table-1 contd...

S. No	Description	AI	DI	AO	DO	Mon-	Cont-	Ala-	Filed devices	Type of I/O
						itor	rol	rm		

В.	LOW SIDE								
1.	Air Handling units								
a.	AHU speed fan On/ Off				12		X	Relay contact	Potential free contact in the AHU panel
b.	AHU air flow status		12			X		Differential Pressure switch	Suitable Insertion provision
C.	AHU filter status		12			X		Differential pressure switch	Suitable Insertion provision
d.	Return Air Temperature	12				X		Duct Temp. Sensor	Suitable Insertion provision
e.	Motorised valve cooling			12			X	2 way motorised valve	Suitable Insertion provision
f.	Fan speed control			12				Variable speed drive	6-10 volt signal to VFD
g.	AHU Auto/ Manual status		12			X			Potential free contact from the fire panel
	Sub Total	12	36	24	12				
	Grand Total	18	57	29	23				

SUMMARY SHEET OF IO SCHEDULE

Revison- 00

SI. No	Station Code	Panel Names	Description	and Deve	lopment	of New SC/	ith existing ADA in cas Yoga Cento	e of New		WIT	TH 30% SP	ARE			MODULI	E COUNT	
				SOFT	DI	DO	AI	AO	SOFT	DI	DO	AI	AO	DI	DO	AI	AO
1	MRSS	PLC-1	EXISTING MAIN RECEIVING STATION- For	90	197	34	0	0	117	257	45	0	0	17	3	0	0
			STATUS and integration with existing				-	-				-	-		-	-	-
2	SSSS	PLC-2	Existing Solar Station	4	75	14	0	0	6	98	19	0	0	7	2	0	0
3	CRSS	PLC-3	Exiting Central Station from where the 11KV ring line, from diffirent geography/side of the campus, will be created by EPC contrcator	77	150	28	0	0	101	195	37	0	0	13	3	0	0
4	ACSS	PLC-4	Exiting SUSBTATION-01 ACADEMIC	24	199	55	0	0	32	259	72	0	0	17	5	0	0
5	SCSS	PLC-5	EXISTING SUBSTATION-05 SportsComplex	27	175	47	0	0	36	228	62	0	0	15	4	0	0
6	ICSS	PLC-6	EXISTING SUBSTATION-02 INTERNATIONAL CEN	54	250	73	0	0	71	325	95	0	0	21	6	0	0
7	FHSS	PLC-7	EXISTING SUBSTATION-03 (Faculty Housing)- FO	20	213	59	0	0	26	277	77	0	0	18	5	0	0
8	SHSS	PLC-8	EXISTING SUBSTATION-04 (STUDENT HOUSING)	32	284	91	0	0	42	370	119	0	0	24	8	0	0
			FOR INTEGRATION	328	1543	401	0	0	431	2009	526	0	0	132	36	0	
9	CSSS	PLC-9	Central Library under this EPC tender	40	480	120	0	0	52	624	156	0	0	39	10	0	0
10	EPC1	PLC10	SUSBTATION-10 AUDITORIUM UNDER THIS EPC TENDER	125	120	120	995	275	163	156	156	1294	358	10	10	81	23
11	EPC2	PLC11	SUSBTATION-11 YOGA CENTER	125	120	120	995	275	163	156	156	1294	358				
12			TOTAL FOR DESIGN AND SITC UNDER EPC(PLC- 9+PLC10+PLC11) MULTIPLY BY N+2, N>2	290	720	360	1990	550	378	936	468	2588	716	49	20	81	23
13			FOR CENTRAL CONTROL (INTEGRATION + UNDER LIKE CSSS, PLC9,PLC10,PLC11)	618	2263	761	1990	550	809	2945	994	2588	716	181	56	81	23

Note: (1) The IO list is for 1 set of equipement just for the understanding which will be multiply by "N " wherein N>2 for works under this EPC tender (2) The Central Automation + Control Center will have Central control of all above in addition of the Local Centralised control center through Local Distribution and Building Managament Center - building wise

		Construction of the local division of the lo	Conductory Report	Accession in the second s	Alexand Real Annual Annual Annual	DE	VICE		n	172							Historic
	oment Tag E	Equipment Name	Equipment Type	EXISTING MAIN RECEIVING STATION- For STAT	Signal Type FROM TO US and Integration with existing	MODBUS	IED	Modbus	IEC 61850	DI DO	AL AG	10 Tag Stucture	Tag Name	Tag Description	Event Logging	Historial Recording	resolutions/Freq
1.00 MRSS 333	IXV_HT	IN01	INCOMMING BREAKER	33 KV HT PANEL 33KV HT FEEDER-01 - Incomer-1													
1.02 MRSS 339	IKV_HT IKV_HT IKV_HT	IND1 IND1 IND1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	un switch Remote Position On Status Off Status	VFC VFC	-	-	-		1	Þ	UR ON OFF	MRSS_33KV_HT_IND1_LR MRSS_33KV_HT_IND1_ON MRSS_33KV_HT_IND1_OFF				
	IXV. HT	INO1 INO1	INCOMMING BREAKER INCOMMING BREAKER	Trip Status Sprint Charte	VFC VFC					1		TRP SC	MRSS_33KV_HT_IND1_CFT MRSS_33KV_HT_IND1_TRP MRSS_33KV_HT_IND1_SC				
1.05 MRSS 333	IKV HT	IN01 IN01	INCOMMING BREAKER INCOMMING BREAKER	Ready to Close (RTC) Service Position	VFC VFC					1		RTC SER	MRSS 33KV HT IND1 RTC MRSS 33KV HT IND1 SER				
1.08 MRSS 338 1.09 MRSS 338	IKV_HT IKV_HT	IN01 IN01	INCOMMING BREAKER INCOMMING BREAKER	Test Position Earth	VFC VFC	-				1	E	TST ER	MRSS_33KV_HT_IND1_TST MRSS_33KV_HT_IND1_ER				
1.10 MRSS 338 1.11 MRSS 338	KV_HT	IN01 IN01 IN01	INCOMMING BREAKER	Control Supply Healthy Emergency Trip	VFC VFC					1			MRSS_33KV_HT_IND1_CSH MRSS_33KV_HT_IND1_E_TRP				
1.12 MRSS 338 1.13 MRSS 339 1.14 MRSS 339 1.15 MRSS 339	IKV_HT	IND1 IND1 IND1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	DC Status Trip Crouit Healthy Under Voltage Trip	IEC 61850 IEC 61850 IEC 61850				1			DC TRP_CH UV_TRP	MRSS_33KV_HT_IND1_DC MRSS_33KV_HT_IND1_TRP_CH MRSS_33KV_HT_IND1_UV_TRP				
1.15 MRSS 339 1.16 MRSS 339	IKV_HT IKV_HT	IND1 IND1	INCOMMING BREAKER INCOMMING BREAKER	Earth Fault PT Fuse Failure	IEC 61850 IEC 61850				1			EF 2TEF	MRSS_33KV_HT_IND1_EF MRSS_33KV_HT_IND1_PTFF				
1.17 MRSS 339 1.18 MRSS 339	IXV_HT	IN01	INCOMMING BREAKER	Protection Relay Multifunction Meter	IEC 61850 RS 485	1	1						MRSS_33KV_HT_IND1_ MRSS_33KV_HT_IND1_				
1.19 MRSS 339 1.20 MRSS 339 1.21 MRSS 339	IXV_HT IXV_HT	IND1 IND1	INCOMMING BREAKER	R PAHSE TO NEUTRAL VOLATGE Y PAHSE TO NEUTRAL VOLATGE	Modbus:RS-485 Modbus:RS-485			1				V_YN	MRSS_33KV_HT_IND1_V_RN MRSS_33KV_HT_IND1_V_YN				
1.20 MRSS 339 1.21 MRSS 339 1.22 MRSS 339 1.23 MRSS 339		IN01 IN01 IN01	INCOMMING BREAKER	B PAHSE TO NEUTRAL VOLATGE RY VOLTAGE YB VOLTAGE	Modbus 85-485 Modbus 85-485 Modbus 85-485			1				V_RY	MRSS_33KV_HT_IND1_ MRSS_33KV_HT_IND1_V_RY MRSS_33KV_HT_IND1_V_RB				
1.23 MRSS 338 1.24 MRSS 338 1.25 MRSS 338 1.26 MRSS 338	IKV_HT	IN01 IN01 IN01	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	YB VOLTAGE BR VOLTAGE R PHASE LINE CURRENT	Modbus:RS-485 Modbus:RS-485 Modbus:RS-485			1				V_Y5	MRSS_33KV_HT_IND1_V_YB MRSS_33KV_HT_IND1_ MRSS_33KV_HT_IND1_I_R				
	INV HT	1NO 1	INCOMMING BREAKER	Y PHASE LINE CLIRRENT	Modbus #5-485 Modbus #5-485			1				L.Y	MRSS_33KV_HT_IND1_I_Y MRSS_33KV_HT_IND1				
1.27 MRSS 339 1.28 MRSS 339 1.29 MRSS 339 1.30 MRSS 339	IXV_HI	IND1 IND1 IND1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	B PHASE LINE CURRENT NEUTRAL LINE CURRENT POWER FACTOR (Q1)	Modbus RS-485 Modbus RS-485			1					MRSS_33KV_HT_IN01_ MRSS_33KV_HT_IN01_PF1				
1.31 MRSS 338	KV HT	IN01 IN01	INCOMMING BREAKER INCOMMING BREAKER	POWER FACTOR (02) POWER FACTOR (03) AVERAGE POWER FACTOR (04)	Modbus RS-485 Modbus RS-485			1				PF2 PF3	MRSS_33KV_HT_IN01_PF2 MRSS_33KV_HT_IN01_PF3				
	IKV_HT IKV_HT	IN01 IN01 IN01	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	AVERAGE POWER FACTOR (QA) FREQUENCY METER TEMPERATURE	Modbus 85-485 Modbus 85-485 Modbus 85-485			1				FR MT TEMP	MRSS_33KV_HT_IND1_ MRSS_33KV_HT_IND1_FR MRSS_33KV_HT_IND1_MT_TEMP				
1.35 MRSS 338	THE YOU	10/01	INCOMMING BREAKER INCOMMING BREAKER	ACTIVE TOTAL IMPORT-KWhT01 ACTIVE TOTAL EXPORT-KWhT(E)	Modbus RS-485 Modbus RS-485			1				kwbTi	MRSS 33KV_HT_IN01_kWhTi MRSS_33KV_HT_IN01_kWhE				
1.37 MRSS 338 1.38 MRSS 339	KV_HT KV_HT	IN01 IN01 IN01	INCOMMING BREAKER INCOMMING BREAKER	REACTIVE TOTAL IMPORT-kVArb(I) REACTIVE TOTAL EXPORT- kVArb(I)	Modbus:RS-485 Modbus:RS-485			1				kVArh_I kVArh_E	MRSS_33KV_HT_IND1_KVArh_E MRSS_33KV_HT_IND1_KVArh_E				
1.32 MRSS 333	IXV_HT	IND1 IND1		CUMULATIVE POWER ON MINUTES CUMULATIVE POWER OFF MINUTES	Modbus #S-485 Modbus #S-485			1					MRSS_33KV_HT_IN01_ MRSS_33KV_HT_IN01_				
1.41 MRSS 339 1.42 MRSS 339 1.43 MRSS 339	IKV_HT	IND1 IND1 IND1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	CUMULATIVE LOAD ON MINUTES CUMULATIVE LOAD OFF MINUTES On Command	Modbus RS-485 Modbus RS-485			1		1		CMD_ON	MRSS_33KV_HT_IN01_ MRSS_33KV_HT_IN01_ MRSS_33KV_HT_IN01_CMD_ON				
	KV_HT	IN01 IN01 IN01	INCOMMING BREAKER	Off Command Trin Coll	VFC VFC IFC 61850				1	1		CMD_OFF	MRSS_33KV_HT_IND1_CMD_OFF MRSS_33KV_HT_IND1_TRP_C				
		IN01 IN02	INCOMMING BREAKER INCOMMING BREAKER	Emergency Trip 33KV HT FEEDER-02 (Incomer-2)	IEC 61850				1			E_TRP	MRSS_33KV_HT_IND1_E_TRP				
	KV_HT	IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER	LR Switch Remote Position On Status	VFC VFC					1		LR ON	MRSS_33KV_HT_IN02_LR MRSS_33KV_HT_IN02_ON				
2.03 MR55 333	IXV_HT	IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER	Off Status Trip Status	VFC VFC					1 1		OFF TRØ	MRSS_33KV_HT_IN02_OFF MRSS_33KV_HT_IN02_TRP				
2.05 MRSS 338 2.05 MRSS 338 2.06 MRSS 338	IKV_HT IKV_HT	IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER	Spring Charge Ready to Close (RTC)	VFC VFC					1		SC RTC	MRSS_33KV_HT_IN02_SC MRSS_33KV_HT_IN02_RTC				
2.07 MRSS 338 2.08 MRSS 338	KV_HT	IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Service Position Test Position Earth	VFC VFC VFC	-		-		1		SER TST ER	MRSS_33KV_HT_IND2_SER MRSS_33KV_HT_IND2_TST MRSS_33KV_HT_IND2_ER				
2.10 MRSS 338	KV HI	IN02 IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER	Earth Control Supply Healthy Emergency Trip	VFC VFC	E	L	L		1		CSH E_TRP	MRSS_33KV_HT_IN02_CSH MRSS_33KV_HT_IN02_E_TRP				
2.12 MRSS 338 2.13 MRSS 339	IKV HT	IN02	INCOMMING BREAKER INCOMMING BREAKER	DC Status Tein General Maniferr	FC 61850 IEC 61850				1	E	E	TRP CH	MRSS 33KV_HT_IN02_DC MRSS 33KV_HT_IN02_TRP_CH				
2.14 MRSS 338 2.15 MRSS 339	IKV HT	IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER	Under Voltage Trip Earth Fault	IEC 61850 IEC 61850				1	E		EF	MRSS_33KV_HT_IN02_UV_TRP MRSS_33KV_HT_IN02_EF		-		
2.16 MRSS 339 2.17 MRSS 339	HKV_HT HKV_HT	IN02 IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER	PT Fuse Failure Protection Relay	IEC 61850 IEC 61850 R5 485		1		1		Ħ	PTEF	MRSS_33KV_HT_IN02_PTFF MRSS_33KV_HT_IN02_ MRSS_33KV_HT_IN02_				
2.19 MRSS 339	IXV_HT	IN02	INCOMMING BREAKER	Multifunction Meter R PAHSE TO NEUTRAL VOLATGE Y PAHSE TO NEUTRAL VOLATGE	Modbus:RS-485	1		1			F	V_RN V_YN	MRSS_33KV_HT_IN02_V_RN				
	KV HT	IN02 IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Y PAHSE TO NEUTRAL VOLATOE B PAHSE TO NEUTRAL VOLATOE RY VOLTAGE	Modbus RS-485 Modbus RS-485 Modbus RS-485		-	1		+			MRSS_33KV_HT_IND2_V_YN MRSS_33KV_HT_IND2_V_BN MRSS_33KV_HT_IND2_V_RY				
2.22 MRSS 338 2.23 MRSS 338 2.24 MRSS 338	IKV_HI	IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER	YB VOLTAGE BR VOLTAGE	Modbus RS-485 Modbus RS-485 Modbus RS-485	L	L	1				V_RY V_YB V_BR	MRSS_33KV_HT_IN02_V_RY MRSS_33KV_HT_IN02_V_YB MRSS_33KV_HT_IN02_V_BR				
2.25 MRSS 338 2.26 MRSS 339	IKV_HT IXV_HT	IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER	R PHASE LINE CURRENT Y PHASE LINE CURRENT	ModburR5485 ModburR5485	E	L_	1			E	I.R I.Y	MRSS_33KV_HT_IN02_L_R MRSS_33KV_HT_IN02_L_Y				
2.27 MRSS 338 2.28 MRSS 339	IXV_HT IXV_HT	IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER	B PHASE LINE CURRENT NEUTRAL LINE CURRENT	Modbus:RS-485 Modbus:RS-485	-	<u> </u>	1		E		V_B L_N	MRSS_33KV_HT_IN02_V_B MRSS_33KV_HT_IN02_I_N				
2.29 MRSS 338 2.30 MRSS 338	IXV_HT	IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER	POWER FACTOR (Q1) POWER FACTOR (Q2)	Modbus:RS-485 Modbus:RS-485	<u> </u>	-	1			Ħ		MRSS_33KV_HT_IN02_PF1 MRSS_33KV_HT_IN02_PF2				
2.31 MRSS 338 2.32 MRSS 338 2.33 MRSS 338 2.34 MRSS 338	IKV_HT	IN02 IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	POWER FACTOR (Q3) AVERAGE POWER FACTOR (QA) FREQUENCY	Modbus RS-485 Modbus RS-485 Modbus RS-485	-		1				PF3 APF FR	MRSS_33KV_HT_IN02_PF3 MRSS_33KV_HT_IN02_APF MRSS_33KV_HT_IN02_FR				
2.33 MRSS 338 2.34 MRSS 338 2.35 MRSS 338	KV_HT	IN02 IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	I REQUENCY METER TEMPERATURE ACTIVE TOTAL IMPORT-kWhT(I)	Modbus:RS-485 Modbus:RS-485 Modbus:RS-485	-		1		Ħ	FF-	PR MT_TEMP kwhTi	MRSS_33KV_HT_IND2_FR MRSS_33KV_HT_IND2_MT_TEMP MRSS_33KV_HT_IND2_KWhTI				
2.35 MR55 338 2.36 MR55 338 2.37 MR55 338 2.38 MR55 338	IKV_HT	IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER	ACTIVE TOTAL EXPORT-kWhT(E) REACTIVE TOTAL IMPORT-kVArb(I)	Modbus:RS-485 Modbus:RS-485			1				kWhE kWArh_I	MRSS_33KV_HT_IN02_kWHE MRSS_33KV_HT_IN02_kVArh_I				
	KV_HT	IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER	REACTIVE TOTAL EXPORT- WAYNII CUMULATIVE POWER ON MINUTES	Modbus #5-485 Modbus #5-485			1				kVArh_E	MRSS_33KV_HT_IN02_kVA/h_E MRSS_33KV_HT_IN02_				
2.40 MR55 339 2.41 MR55 339	IKV_HT IKV_HT	IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER	CUMULATIVE POWER OFF MINUTES CUMULATIVE LOAD ON MINUTES	Modbus 85-485 Modbus 85-485			1					MRSS 33KV HT IN02 MRSS 33KV HT IN02				
2.43 MRSS \$38	IKV HT IKV HT IKV HT	IN02 IN02 IN02	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	CUMULATIVE LOAD OFF MINUTES On Command Off Command	Modbus RS-485 VFC			1		1		CMD_ON CMD_OFF	MRSS 33KV HT IND2 MRSS 33KV HT IND2 CMD ON MRSS_33KV HT_IND2_CMD_OFF				
2.45 MRSS 338	KV_HT	IN02 IN02	INCOMMING BREAKER	Trip Coll Emergency Trip	IEC 61850 IEC 61850				1	_		TRP_C	MR55_33KV_HT_IN02_TRP_C MR55_33KV_HT_IN02_ETRP				
3.00 MRSS 338	KV HT	BC BC	BUS COUPLER BUS COUPLER	BUSCOUPLER LR Switch Remote Position	vřc					1			MRSS_33KV_HT_BC_LR				
3.03 MRSS 338	IKV_HT	BC BC	BUS COUPLER BUS COUPLER	On Status Off Status	VFC VFC					1		ON	MRSS_33KV_HT_BC_ON MRSS_33KV_HT_BC_OFF				
3.04 MRSS 338 3.05 MRSS 338	KV_HT	BC BC	BUS COUPLER BUS COUPLER	Trip Status Spring Charge	VFC VFC					1		189 5C	MRSS_33KV_HT_BC_TRP MRSS_33KV_HT_BC_SC				
3.05 MR55 338 3.05 MR55 338 3.07 MR55 338 3.08 MR55 338	INV HT	BC BC BC	BUS COUPLER BUS COUPLER BUS COUPLER	Ready to Close (RTC) Service Position	VFC					1		RTC SER	MRSS_33KV_HT_BC_RTC MRSS_33KV_HT_BC_SER MRSS_33KV_HT_BC_TST				
3.08 MRSS 339 3.09 MRSS 339 3.10 MRSS 339	KV_HT	BC BC BC	BUS COUPLER BUS COUPLER	Test Position Control Supply Healthy Trip Circuit Healthy	VFC VFC					1		CSH	MRSS_33KV_HT_BC_CSH MRSS_33KV_HT_BC_TRP_CH				
3.11 MRSS 338 3.12 MRSS 338	KV_HT KV_HT	BC BC	BUS COUPLER BUS COUPLER	Under Voltage Trip Emergency Trip	VFC VFC					1		UV_TRP E_TRP	MRSS_33KV_HT_BC_UV_TRP MRSS_33KV_HT_BC_E_TRP				
	IXV_HT	BC BC	BUS COUPLER BUS COUPLER	DC Status PT Fuse Failure	VFC VFC					1		DC PTFF	MRSS_33KV_HT_BC_DC MRSS_33KV_HT_BC_PTFF				
3.15 MRSS 339	IKV_HT	BC BC	BUS COUPLER BUS COUPLER BUS COUPLER	Earth On Command	VFC VFC					1			MRSS_33KV_HT_BC_ER MRSS_33KV_HT_BC_CMD_ON				
3.17 MRSS 338 3.18 MRSS 338 3.19 MRSS 338	KV HT	BC BC	BUS COUPLER	Off Command Trip Coll	VFC					1		CMD_OFF TRP_C E_TRP	MRSS 33KV HT BC CMD OFF MRSS 33KV HT BC TRP C MRSS 33KV HT BC E TRP				
4.00 MRSS 338	KV HT	BC TR1_OG1 TR1_OG1	BUS COUPLER OUTGOING BREAKER OUTGOING BREAKER	TRANSFORMER-1 33KY OG-1	vic					1		C_INP	MIGS_33AV_HI_BC_C_IRP				
	INV. HT	TR1_061 TR1_061	OUTGOING BREAKER	On Status	vic							19	MREE 2007 NT TRI OVIL 18				
4.05 MRSS 338			OUTGOING BREAKER	Off Status	VFC					1		LR ON OFF	MRSS_33KV_HT_TR1_0G1_LR MRSS_33KV_HT_TR1_0G1_ON MRSS_33KV_HT_TR1_0G1_OFF				
4.05 MRSS 338	KV_HT KV_HT	TR1_061 TR1_061	OUTGOING BREAKER OUTGOING BREAKER	Trip Status Spring Charge	VFC VFC VFC					1 1 1 1		LR ON OFF TRP SC	MRSS 33KV HT TR1 OG1 ON MRSS 33KV HT TR1 OG1 OFF MRSS 33KV HT TR1 OG1 TRP MRSS 33KV HT TR1 OG1 SC				
4.07 MRSS 338	IKV_HT IKV_HT IKV_HT	TR1_OG1 TR1_OG1 TR1_OG1	OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER	Trip Status Spring Charge Ready to Close (RTC) Service Position	VFC VFC VFC VFC VFC					1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		LR ON OFF SC RTC SER SER	MISS 38KV HT TRL 061 0N MISS 38KV HT TRL 061 OFF MISS 38KV HT TRL 061 TRP MISS 38KV HT TRL 061 SC MISS 38KV HT TRL 061 SC MISS 38KV HT TRL 061 SE				
4.07 MRSS 338 4.08 MRSS 338 4.09 MRSS 338	IKV_HT IKV_HT IKV_HT IKV_HT IKV_HT	TR1_0G1 TR1_0G1 TR1_0G1 TR1_0G1 TR1_0G1 TR1_0G1	OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER	Tris Status Spring Charge Ready to Close (RTC) Service Position Test Position Earth Earth	VIC VIC VIC VIC VIC VIC VIC VIC VIC VIC					1		189 52 8TC	MMSS 38XV HT TRI OGL ON MMSS 38XV HT TRI OGL OFF MMSS 38XV HT TRI OGL OFF MMSS 38XV HT TRI OGL 52 MMSS 38XV HT TRI OGL 52 MMSS 38XV HT TRI OGL 52R MMSS 38XV HT TRI OGL 52R MMSS 38XV HT TRI OGL 52R MMSS 38XV HT TRI OGL 52R				
4.07 MRSS 338 4.08 MRSS 338 4.09 MRSS 338 4.00 MRSS 338 4.10 MRSS 338 4.11 MRSS 338 4.11 MRSS 338	KV_HT KV_HT KV_HT KV_HT KV_HT KV_HT KV_HT	TR1_OG1 TR1_OG1 TR1_OG1 TR1_OG1 TR1_OG1 TR1_OG1 TR1_OG1 TR1_OG1	OUTGOING BHEAKER OUTGOING BHEAKER OUTGOING BHEAKER OUTGOING BHEAKER OUTGOING BHEAKER OUTGOING BHEAKER OUTGOING BHEAKER OUTGOING BHEAKER OUTGOING BHEAKER	Tris Status. Spring Charge Ready to Close (RTC) Sarrole Position Rest Position Earth Earth Earth Earth Digstream breaker Trip Contect Sonekh teathbu	VFC							189 5C 8TC 5ER 15T ER E_TRP UB_TRP CGH	MRS5 3380/ HT TRL 052 0H MRS5 3380/ HT TRL 051 0H MRS5 3380/ HT TRL 051 3H MRS5 3180/ HT TRL 051 5C MRS5 3180/ HT TRL 051 ARC MRS5 3180/ HT TRL 051 5R MRS5 3180/ HT TRL 051 5T MRS5 3180/ HT TRL 051 E MRS5 380/ HT TRL 051 E MRS5 380/ HT TRL 051 E MRS5 380/ HT TRL 051 CH				
4.07 MRSS 338 4.08 MRSS 338 4.00 MRSS 338 4.10 MRSS 338 4.11 MRSS 338 4.12 MRSS 338 4.12 MRSS 338	KV_HT KV_HT KV_HT KV_HT KV_HT KV_HT KV_HT	TR1_OG1 TR1_OG1 TR1_OG1 TR1_OG1 TR1_OG1 TR1_OG1 TR1_OG1 TR1_OG1	OUTGOING BHEAKER OUTGOING BHEAKER OUTGOING BHEAKER OUTGOING BHEAKER OUTGOING BHEAKER OUTGOING BHEAKER OUTGOING BHEAKER OUTGOING BHEAKER OUTGOING BHEAKER	Trie Statun Spring Charge Ready to Corea (RC) Instructo Position Instruction Inst Position Learn Learn Instruction	vfc vfc Mothwr8545 vfc	1		1		1		180 5C RTC 55R 151 ER E TRP UB_TRP CSH V.8N	MRS5 3380/ HT TRL 052 0H MRS5 3380/ HT TRL 051 0H MRS5 3380/ HT TRL 051 3H MRS5 3180/ HT TRL 051 5C MRS5 3180/ HT TRL 051 ARC MRS5 3180/ HT TRL 051 5R MRS5 3180/ HT TRL 051 5T MRS5 3180/ HT TRL 051 E MRS5 380/ HT TRL 051 E MRS5 380/ HT TRL 051 E MRS5 380/ HT TRL 051 CH				
4.07 MRSS 338 4.08 MRSS 338 4.00 MRSS 338 4.10 MRSS 338 4.11 MRSS 338 4.12 MRSS 338 4.12 MRSS 338	TW_VXI TW_VXI TW_HT TW TW TW TW TW TW TW TW TW TW TW TW TW T	TR1.0G1 TR1.0G1 TR1.0G1 TR1.0G1 TR1.0G1 TR1.0G1 TR1.0G1 TR1.0G1 TR1.0G1 TR1.0G1 TR1.0G1 TR1.0G1	OUTGOING REARER OUTGOING REARER	The Street Event Charge Class 2010 Service Faultion Learly Teacher Learly Teacher Learly Teacher Learly Teacher Mailfordiet, Street Mailfordiet, Medite Mailfordiet, Medite Panet Class Victorias, Vicalities Travast Data Victorias, Vicalities Panet St Data Victorias, Vicalities	Modbus R5-485 Modbus R5-485 Modbus R5-485	1		1 1 1		1		18P 5C 8TC 5ER 75T ER ER ER ER ER ER CSH V.8N V.8N V.8N	AMES 3814 HT 181 001 0M MASS 3814 HT 181 001 0H MASS 3814 HT 181 001 1H MASS 3814 HT 181 001 1H MASS 3814 HT 181 001 12 MASS 3814 HT 181 001 141 MASS 3814 HT 181 001 141 MASS 3814 HT 181 001 141 MASS 3814 HT 181 001 48 MASS 3844 HT 181 0				
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6.01	MRSS	33KV_HT 33KV_HT	TR2_062 TR2_062	OUTGOING BREAKER OUTGOING BREAKER	Trip Coll Emergency Trip	IEC 61850 IEC 61850			1			TRP_C E_TRP	MISS 33KV HT TR2 O02 THP C MISS 33KV HT TR2 O02 THP C MISS 33KV HT TR2 O02 E THP	
6.01 6.02	MRSS MRSS	11KV_HT 11KV_HT	TR1_IN1	INCOMMING BREAKER	11 KV HT PANEL TRANSFORMER-1 (Incomer-1)					_				
	MRSS	11KV HT	T81 IN1	INCOMMING BREAKER	LR Switch Remote Position On Status	VFC VFC				1		LR. ON	MRSS_11KV_HT_TR1_N1_LR MRSS_11KV_HT_TR1_N1_CN	
6.03	MRSS MRSS	11KV_HT 11KV_HT 11KV_HT	TR1_IN1 TR1_IN1 TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Off Status Trip Status	VFC				1		OFF 182	MR55 110V HT TR1 IN1 CN MR55 110V HT TR1 IN1 CH MR55 110V HT TR1 IN1 CHF	
6.05	MRSS	11KV_HT	TR1_IN1	INCOMMING BREAKER	Spring Charge Ready to Close (RTC)	vfc vfc				1		SC RTC	MRSS 11KV HT TR1 IN1 SC MRSS 11KV HT TR1 IN1 RTC	
6.07	MRSS MRSS	11KV_HT 11KV_HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER	Service Position Test Position	VFC				1	EF	SER	MRSS 142V HT TRI INI SER MRSS 142V HT TRI INI SER	
6.09	MRSS	11KV_HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER	Earth Control Supply Healthy	VFC		E	_	1	T	ER CSH	MRSS_11KV_HT_TR1_IN1_ER MRSS_11KV_HT_TR1_IN1_C5H	
6.11 6.12	MRSS MRSS	11KV_HT 11KV_HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER	Emergency Trip DC Status	VFC IEC 61850		E	1	1		E_TRP DC	MRS_11XV_HT_TR1_N1_E_TRP MRS5_11XV_HT_TR1_N1_E_TRP	
6.13	MRSS	11KV_HT 11KV_HT	TR1_IN1 T81_IN1	INCOMMING BREAKER	Trip Circuit Healthy Under Voltage Trip	IEC 61850 IEC 61850		_	1			TRP_CH UV_TRP	MRSS_11KV_HT_TR1_N1_TR0_CH MRSS_11KV_HT_TR1_N1_UV_TR0	
6.15	MRSS MRSS	11KV_HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER	Earth Fault	IEC 61850			1			EF	MRSS_11KV_HT_TR1_N1_EF MRSS_11KV_HT_TR1_N1_PTFF	
6.17	MRSS	11KV_HT 11KV_HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER	PT Fuse Failure Protection Relay Multifunction Meter	IEC 61850 RS 485	1	1					MISS_11XV_HT_TR1_N1_ MISS_11XV_HT_TR1_N1_	
6.19	MRSS	11KV_HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER	R PAHSE TO NEUTRAL VOLATGE	Modbus:RS-485		1				V_8N	MRSS_11XV_HT_RL_NL_V_RN MRSS_11XV_HT_RL_NL_V_RN MRSS_11XV_HT_RL_NL_V_RN	
6.21	MRSS	11KV_HT	181_IN1	INCOMMING BREAKER	Y PAHSE TO NEUTRAL VOLATGE 8 PAHSE TO NEUTRAL VOLATGE	Modbus:RS-485 Modbus:RS-485		1				V_BN	MRSS_11KV_HT_TR1_N1_V_BN	
6.22	MRSS	11KV_HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER	RY VOLTAGE YB VOLTAGE	Modbus:RS-485 Modbus:RS-485		1				V_RY V_YB	MRS5_11KV_HT_TR1_N1_V_BY MRS5_11KV_HT_TR1_N1_V_YB	
6.24	MRSS MRSS	11KV_HT 11KV_HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER	BR VOLTAGE R PHASE LINE CURRENT	Modbus:RS-485 Modbus:RS-485		1				V_88 I_R	MRS5_11KV_HT_TR1_N1_V_BR MRS5_11KV_HT_TR1_N1_L_R	
6.22	MRSS	11KV_HT 11KV_HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER	Y PHASE LINE CURRENT B PHASE LINE CURRENT	Modbus:RS-485 Modbus:RS-485		1				LY V_B	NR55.1107 HT TR1 IN1.1 Y NR55.1107 HT TR1 IN1.2 V B NR55.1107 HT TR1 IN1.2 N	
6.28	MRSS MRSS	11KV_HT 11KV_HT	TR1_IN1 TR1_IN1 TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	B PHASE LINE CURRENT NEUTRAL LINE CURRENT POWER FACTOR (Q1)	Modbus:RS-485 Modbus:RS-485		1				LN PF1	MKSS_11KV_HT_TR1_N1_1_N MKSS_11KV_HT_TR1_N1_PF1	
6.30	MRSS MRSS	11KV_HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER	POWER FACTOR (Q2) POWER FACTOR (Q3)	Modbus:RS-485 Modbus:RS-485		1				PF2 2F3	MRS5_11KV_HT_R1_N1_FF2 MRS5_11KV_HT_R1_N1_FF2	
	MRSS MRSS		TR1_IN1 TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER	AVERAGE POWER FACTOR (QA) FREQUENCY	Modbus RS-485 Modbus RS-485		1				APE	MRSS 124V HT TR1 IN1 APF MRSS 124V HT TR1 IN1 APF MRSS 124V HT TR1 IN1 FR	
6.34	MRSS	11KV HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER	ACTIVE TOTAL IMPORT-KWhT(I)	Modbus RS-485 Modbus RS-485		1				MT_TEMP kWbTI	MISS_LIXY_HT_TRLING_MT_TEMP MISS_LIXY_HT_TRLING_MT_TEMP	
6.35	MRSS	11KV_HT	TR1_IN1 TR1_IN1 TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	ACTIVE TOTAL IMPORT-RWHTIII ACTIVE TOTAL EXPORT-RWHTIEI REACTIVE TOTAL IMPORT-RVArh[]	Modbus:RS-485 Modbus:RS-485 Modbus:RS-485		1				kWhE	MRSS 11KV HT TRI INI KW6E	
6.37	MRSS	11KV_HT 11KV_HT 11KV_HT	181_IN1 T81_IN1	INCOMMING BREAKER	REACTIVE TOTAL EXPORT- kVArh[i]	Modbus:RS-485		1				KVArh_L kVArh_E	MRSS_11KV_HT_TR1_IN1_KVArh_E MRSS_11KV_HT_TR1_IN1_KVArh_E	
	MRSS	11XV_HT 11XV_HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER	CUMULATIVE POWER ON MINUTES CUMULATIVE POWER OFF MINUTES	Modbus:RS-485 Modbus:RS-485		1					MRSS_11KV_HT_TR1_N1_ MRSS_11KV_HT_TR1_N1_	
		11KV_HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER	CUMULATIVE LOAD ON MINUTES CUMULATIVE LOAD OFF MINUTES	Modbus:RS-485 Modbus:RS-485		1					MRSS_11KV_HT_TR1_N1_ MRSS_11KV_HT_TR1_N1_	
6.43	MRSS MRSS	11KV_HT 11KV_HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER	0Ti WTi	VFC VFC				1		on wh	MRSS_11KV_HT_TR1_N1_OTI MRSS_11KV_HT_TR1_N1_WTi	
6.45	MRSS MRSS	11KV_HT 11KV_HT 11KV_HT	TRL_IN1 TRL_IN1 TRL_IN1		Buchholz relay PRV	VFC VFC		E	_	1		BCH_R PRV	NR55_11CV HT_IR1_NR1_WTI NR55_11CV HT_IR1_NR1_BCH R NR55_11CV HT_IR1_NR1_BCH R	L
		11KV_HT 11KV_HT	TR1_IN1 TR1_IN1	INCOMMING BREAKER	MOG On Command	VFC VFC				1		MOG CMD_ON	MISS_11KV_HT_TR1_N1_MOG MISS_11KV_HT_TR1_N1_CMD_ON	-
6.49	MRSS	11KV_HT 11KV_HT	TR1_IN1 TR1_IN1 TR1_IN1	INCOMMING BREAKER	Off Command Trip Coll	VFC VFC IEC 61850			1	- -	41	CMD_OFF TRP_C	MRS_11XV_HT_R1_N1_ME_CMU_OFF MRSS_11XV_HT_R1_N1_CMU_OFF	-
6.51	MRSS	11KV HT	T81 IN1	INCOMMING BREAKER	Emergency Trip	IEC 61850			1	+	+	E_TRP	MESS_11KV_HT_TR1_N1_ETRP	
7.01	MRSS	11KV_HT 11KV_HT	TR2_IN2 TR2_IN2 TR2_IN2	INCOMMING BREAKER	TRANSFORMER-2 (Incomer-2) LR Switch Remote Position	VFC				1	$^{++}$	LR CN	MRSS_11KV_HT_TR2_IN2_UR	
7.02	MRSS	11KV_HT	TR2_IN2 TR2_IN2	INCOMMING BREAKER INCOMMING BREAKER	On Status Off Status	VFC				1		ON OFF	MRSS_11XV_HT_TR2_IN2_ON MRSS_11XV_HT_TR2_IN2_OF MRSS_11XV_HT_TR2_IN2_OFF	
7.04	MRSS MRSS	11KV_HT 11KV_HT 11KV_HT	TR2_IN2 TR2_IN2	INCOMMING BREAKER	Trip Status Spring Charge	VFC		1		1		500 SC	MRSS_11KV_HT_TR2_N2_TRP MRSS_11KV_HT_TR2_N2_SC	
7.05	MRSS	11KV_HT 11KV_HT	TR2_IN2 TR2_IN2	INCOMMING BREAKER INCOMMING BREAKER	Ready to Close (RTC) Service Position	VFC				1		RTC SER	MRSS_11KV_HT_TR2_N2_KTC MRSS_11KV_HT_TR2_IN2_SER	-
7.08	MRSS MRSS	11KV_HT 11KV_HT	TR2_IN2 TR2_IN2 TR2_IN2	INCOMMINS BREAKER INCOMMINS BREAKER INCOMMINS BREAKER	Test Position Earth	VIC		1		1		TST ER	NRSS 111V HT TRO INC TST MRSS 111V HT TRO INC TST MRSS 111V HT TRO INC 51H MRSS 111V HT TRO INC 55H	
7.11	MRSS	11KV. HT	T82 IN2	INCOMMING BREAKER	Control Supply Healthy Ementency Trip	VFC				1	Ш	CSH E_TRP	MRSS 11KV HT TR2 IN2 E TRP	<u> </u>
7.12 7.13	MRSS MRSS	11KV_HT 11KV_HT	T82_IN2 T82_IN2	INCOMPANY DECAYED	DC Elabore	IEC 61850 IEC 61850		E	1	_	ШF	DC TRP_CH	MRSS_11KV_HT_TR2_IN2_DC MRSS_11KV_HT_TR2_IN2_TR9_CH	
7.14	MRSS		TR2_IN2 TR2_IN2 TR2_IN2	INCOMMING BREAKER INCOMMING BREAKER	Trip Grout Healthy Under Voltage Trip Earth Fault	IEC 61850 IEC 61850			1	+	F	LIV_TRP EF	MISS_11XV_HT_TR2_N2_EF	
7.16	MRSS	11KV HT	TR2_IN2 TR2_IN2 TR2_IN2	INCOMMING BREAKER	Earth Fault PT Fuse Failure Protection Relay	IEC 61850 IEC 61850			1	+	++	PTFF	MRSS_11KV_HT_TR2_IN2_PTFF MRSS_11KV_HT_TR2_IN2	-
7.18	MRSS MRSS	11KV_HT 11KV_HT 11KV_HT	TR2_IN2 TR2_IN2 TR2_IN2	INCOMMING BREAKER	Wultifunction Meter R PAHSE TO NEUTRAL VOLATGE	RS 485 Modbus RS-485	1	1		+	++	V_8N	NNES_11VV_HT_IRL_NZ_ NNES_11VV_HT_IRL_NZ_ NNES_11VV_HT_IRL_NZ_V_NN	-
7.20	MRSS MRSS	11KV_HT	TR2_IN2 TR2_IN2 TR2_IN2	INCOMMING BREAKER	R PAHSE TO NEUTRAL VOLATGE Y PAHSE TO NEUTRAL VOLATGE 8 PAHSE TO NEUTRAL VOLATGE	Modbus:RS-485 Modbus:RS-485 Modbus:RS-485		1		+	+	V_NN V_NN V_BN	MM55_11XV HT_M52_MNMNMNMNMN	
7.22	MRSS	11KV_HT 11KV_HT 11KV_HT	T82_IN2	INCOMMING BREAKER	RY VOLTAGE	Modbus:RS-485		1		\pm	$^{++}$	V_8Y	MRSs_11KV_HT_TR2_IN2_V_RY	
			T82_IN2 T82_IN2	INCOMMING BREAKER	YB VOLTAGE BR VOLTAGE	Modbus:RS-485 Modbus:RS-485		1		\pm	$^{++}$	V_YB V_BR	MRS5_11KV_HT_TR2_IN2_V_YB MRS5_11KV_HT_TR2_IN2_V_BR MRS5_11KV_HT_TR2_IN2_V_BR	
7.25	MRSS MRSS	11KV_HT 11KV_HT 11KV_HT	T82_IN2	INCOMMING BREAKER	R PHASE LINE CURRENT Y PHASE LINE CURRENT	Modbus RS-485 Modbus RS-485		1		\pm			MRSS_11KY_HT_TR2_IN2 + R MRSS_11KY_HT_TR2_IN2 + R MRSS_11KY_HT_TR2_IN2 + Y	
			TR2_IN2 TR2_IN2	INCOMMING BREAKER INCOMMING BREAKER	B PHASE LINE CURRENT NEUTRAL LINE CURRENT	Modbus:RS-485 Modbus:RS-485		1		_	Ш	V_B L_N	MRSS_11KV_HT_TR2_N2_V_B MRSS_11KV_HT_TR2_N2N	
7.29	MRSS	11KV_HT	TR2_IN2 TR2_IN2	INCOMMING BREAKER INCOMMING BREAKER	POWER FACTOR (Q1) POWER FACTOR (Q2)	Modbus:RS-485 Modbus:RS-485		1		_	±Τ	PF1 PF2	MRS5_11KV_HT_TR2_IN2_9F1 MRS5_11KV_HT_TR2_IN2_9F2	
7.32	MRSS	11KV_HT 11KV_HT 11KV_HT	T82_IN2 T82_IN2	INCOMMING BREAKER INCOMMING BREAKER	POWER FACTOR (Q3) AVERAGE POWER FACTOR (QA)	Modbus:RS-485 Modbus:RS-485		1		Ŧ	F	PF3 APF	MRS5_11KV_HT_TR2_IN2_PF3 MRS5_11KV_HT_TR2_IN2_40E	<u> </u>
7.33 7.34	MRSS MRSS	11KV_HT 11KV_HT	TR2_IN2 TR2_IN2	INCOMMING BREAKER INCOMMING BREAKER	FREQUENCY METER TEMPERATURE	Modbus:RS-485 Modbus:RS-485		1				FR MT TEMP	MRSS_11XV_HT_TR2_IN2_FR MRSS_11XV_HT_TR2_IN2_FR FR	
7.35	MRSS	11KV_HT 11KV_HT	T82_IN2 T82_IN2	INCOMMING BREAKER	ACTIVE TOTAL IMPORT-KWhT(I) ACTIVE TOTAL EXPORT-KWhT(E)	Modbus RS-485 Modbus RS-485		1				KW15TI KW15E	MISS 11KV HT TR2 IN2 KMBT MISS 11KV HT TR2 IN2 KMBE	
7.37		11KV HT	TR2_IN2 TR2_IN2	INCOMMING RREAKER	REACTIVE TOTAL IMPORT-kVArbiti REACTIVE TOTAL EXPORT- kVArbiti	Modbus R5-485		1				kVArh_I	MRSS 11XV HT TR2 INZ WARh I MRSS 11XV HT TR2 INZ WARh E	
7.39	MRSS	11KV HT	T82_IN2	INCOMMING BREAKER	CUMULATIVE POWER ON MINUTES	Modbus RS-485 Modbus RS-485		1				KKAYD_E	MRSS 11KV HT TR2 IN2	
7.41	MRSS MRSS	11KV HT	TR2_IN2 TR2_IN2 TR2_IN2	INCOMMING BREAKER	CUMULATIVE POWER OFF MINUTES CUMULATIVE LOAD ON MINUTES CUMULATIVE LOAD OFF MINUTES	Modbus RS-485 Modbus RS-485 Modbus RS-485		1		+	++		MRSS_11XV_HT_TR2_IN2_ MRSS_11XV_HT_TR2_IN2_ MRRS_11XV_HT_TR2_IN2_	
7.42	MRSS MRSS	11KV_HT 11KV_HT 11KV_HT	TR2_IN2 TR2_IN2 TR2_IN2	INCOMMING BREAKER	OTI	Modbus:RS-485 VFC		1		1	++	OTI	MR55.11XV HT IR2.ND_ MR55.11XV HT IR2.ND_ MR55.11XV HT IR2.ND_OT	L
				INCOMMING BREAKER	WTI Buchholz relay	VFC				1	$^{++}$	WTI BCH_R	MRS5_11KV_HT_R2_N2_W11 MRS5_11KV_HT_R2_N2_BCH_R	
7.47	MRSS MRSS	11KV_HT	TR2_IN2 TR2_IN2	INCOMMING BREAKER	MOG	VFC				1		PRV MOG CMD_ON	MRSS_S1XV_HT_TR2_IN2_PRV MRSS_S1XV_HT_TR2_IN2_PRV MRSS_S1XV_HT_TR2_IN2_MOG	
7.49	MRSS	11KV_HT 11KV_HT	T82_IN2 T82_IN2	INCOMMING BREAKER	On Command Off Command	VFC		1				CMD OFF	MRS5_11KV_HT_TR2_IN2_CMD_ON MRS5_11KV_HT_TR2_IN2_CMD_OFF	
7.50	MRSS MRSS	11KV_HT 11KV_HT	TR2_IN2 TR2_IN2	INCOMMING BREAKER	Trip Coil Emergency Trip	IEC 61850 IEC 61850			1	_		TRP_C E_TRP	MR55_11KV_HT_TR2_IN2_TRP_C MR55_11KV_HT_TR2_IN2_E_TRP	
8.00	MRSS	11KV_HT 11KV_HT	SOL1_IN1 SOL1_IN1	INCOMMING BREAKER	SOLAR STATION-1 (Incomer-3) LR Switch Remote Position	VFC				1	T	LR	MRSS_11KV_HT_SOL1_IN1_LR	
8.02	MRSS MRSS	11KV_HT	SOL1_IN1 SOL1_IN1	INCOMMING BREAKER INCOMMING BREAKER	On Status Off Status	VFC				1		ON OFF	NR55_111V_HT_SOL1_NL_ON NR55_111V_HT_SOL1_NL_ON NR55_111V_HT_SOL1_NL_OFF	-
8.04	MRSS	11KV_HT	SOL1_IN1	INCOMMING BREAKER	Trip Status	VFC				1		182		
8.05	MRSS	11KV_HT	SOL1_IN1 SOL1_IN1										MRSS_11KV_HT_SOL1_IN1_TRP	
8.08	MRSS	1100_111		INCOMMING BREAKER	Spring Charge Ready to Close (RTC)	VFC VFC				1		RTC	MRSS_11KV_HT_SOL1_IN1_TRP MRSS_11KV_HT_SOL1_IN1_SC	
\$ 10		11KV_HT 11KV_HT 11KV_HT	SOL1_IN1	INCOMMING BREAKER	Ready to Close (RTC) Service Position Test Position	VFC VFC VFC VFC				1 1		RTC SER TST	MRS.110/H 50.1 HI.10/P MRS.110/H 50.1 HI.10/P MRS.110/H 50.1 HI.10/P MRS.110/H 50.1 HI.10/H 50.1 HI.10/H MRS.110/H 50.1 HI.10/H 50.1 HI.10/H 50.1 HI.10/H MRS.110/H 50.1 HI.10/H 50.1 HI.	
e.10	MRSS	11KV_HT 11KV_HT	SOL1_IN1 SOL1_IN1	INCOMMING BREAKER INCOMMING BREAKER	Ready to Close (RTC) Service Position Test Position Earth Control Supple Healthy	VFC VFC VFC VFC VFC VFC				1		SER TST ER CSH	MISS.110 H 75 GAL R0.10 HP MISS.110 H 75 GAL R0.5 MISS.110 H 75 GAL R0.5 MISS.110 H 75 GAL R0.5 MISS.110 H 75 GAL R0.5 MISS.110 H 75 GAL R0.10 MISS.110 H 75 GAL R0.111 MISS.110 H 75 GAL R0.111 MISS.110 H 75 GAL R0.115 MISS.110 H 75 GAL R0.115	
8.11 8.12	MRSS MRSS MRSS MRSS	11KV_HT 11KV_HT 11KV_HT 11KV_HT 11KV_HT	SOLI_INI SOLI_INI SOLI_INI SOLI_INI SOLI_INI	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Ready to Close (RTC) Service Polition Test Position Earth Control Supply Healthy Emergency Tip DC Status	VFC VFC VFC VFC VFC VFC VFC VFC VFC				1		SER TST ER CSH E_TRP DC	Data 10 million 10 million	
8.11 8.12 8.13 9.14	MRSS MRSS MRSS MRSS MRSS	11KV_HT 11KV_HT 11KV_HT 11KV_HT 11KV_HT 11KV_HT 11KV_HT	SOL1_IN1 SOL1_IN1 SOL1_IN1 SOL1_IN1 SOL1_IN1 SOL1_IN1 SOL1_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	handy to Close (RC) Savire Position Test Position Test Position Test Position Test Construction Interpreter Vision Co Status This Central Healthy Under Vallase Trin	VFC VFC VFC VFC VFC VFC VFC VFC FC 51850 FC 51850 FC 61850				1		SER TST ER CSH	Mass, Lion H, Son, Jan J, Wa Mass, Lion H, Son, Ma JA Mass, Lion H, Son, Ma Ma Mass, Lion H, Son, Ma Mass, L	
8 11 8 12 8 13 8 14 8 15 8 16	MRSS MRSS MRSS MRSS MRSS MRSS MRSS MRSS	11KV HT 11KV HT 11KV HT 11KV HT 11KV HT 11KV HT 11KV HT 11KV HT 11KV HT	SOL1 IN1 SOL1 IN1 SOL1 IN1 SOL1 IN1 SOL1 IN1 SOL1 IN1 SOL1 IN1 SOL1 IN1 SOL1 IN1	INCOMMING BRAKER INCOMMING BRAKER INCOMMING BRAKER INCOMMING BRAKER INCOMMING BRAKER INCOMMING BRAKER INCOMMING BRAKER INCOMMING BRAKER	handy to Close (RC) Service Position Earth Control Scamby Houlthy Timetency Trin Control Scamby Houlthy Uniter Vallage Trin Face Cross Healthy Under Vallage Trin Earth Fac	IEC 61850 IEC 61850 IEC 61850				1		SER IST ER CSH E_TRP DC IBP_CH	Mass. Lite of AGA. Ray 100	
8 11 8 12 8 13 8 14 8 15 8 16 8 16 8 17 8 18	MRSS MRSS MRSS MRSS MRSS MRSS MRSS MRSS	11KV HT 11KV HT	SOL1 IN1 SOL1 IN1	INCOMMING BRAKER INCOMMING BRAKER INCOMMING BRAKER INCOMMING BRAKER INCOMMING BRAKER INCOMMING BRAKER INCOMMING BRAKER INCOMMING BRAKER INCOMMING BRAKER	Rendy to Conse (RC) Service Position Test Position Carbot	IEC 61850 IEC 61850 IEC 61850 IEC 61850 R5 485	1	1		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		5ER 15T ER CSH E TRP DC TRP DC TRP EF PTFF	Statistical Control Contron Control Control Control Control Control Control Con	
8.11 8.12 8.13 8.14 8.15 8.16 8.17 8.18 8.19	MRSS MRSS MRSS MRSS MRSS MRSS MRSS MRSS	11KV HT 11KV HT	SOL1 IN1 SOL1 IN1 SOL1 IN1 SOL1 IN1 SOL1 IN1 SOL1 IN1 SOL1 IN1 SOL1 IN1 SOL1 IN1 SOL1 IN1	INCOMMENG BEACE INCOMMENG BEACE INCOMMENG BEACE INCOMMENG BEACE INCOMMENG BEACE INCOMMENG BEACE INCOMMENG BEACE INCOMMENG BEACE INCOMMENG BEACE INCOMMENG BEACE	Nandy to Count (RC) Service Position Text Position Carbot Control Social Heighty Control Social Heighty Immersion 76 a Di Status Di Status Di Status Tion Grant Heighty Linder Volkere Ten Service Ten	IEC 61850 IEC 61850 IEC 61850 IEC 61850		1		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		5ER 15T ER CSH E TRP DC TRP DC TRP EF PTFF	Mass. Liter of Soci. Raf. 100	
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10.17 MRK	I 11KV_HT I 11KV_HT I 11KV_HT	SPARE_IN SPARE_IN SPARE_IN	INCOMMING BREAKER	Under Voltage Trip Earth Fault PT Fuse Failure	IEC 61850 IEC 61850 IEC 61850					1 1		EF PTFF	MRSS_11KV_HT_SPARE_IN_UV_TBP MRSS_11KV_HT_SPARE_IN_EF MRSS_11KV_HT_SPARE_IN_PTF			
10.18 MRS	S 11KV_HĬ	SPARE_IN SPARE_IN	INCOMMING BREAKER INCOMMING BREAKER	Protection Relay Multifunction Meter	IEC 61850 RS 485			1	1				MRSS_11KV_HT_SPARE_IN_ MRSS_11KV_HT_SPARE_IN_			
10.19 MRSS 10.20 MRSS 10.31 MRSS	3 11KV_HT 3 11KV_HT 4 11KV_HT	SPARE_IN SPARE_IN	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	R PAHSE TO NEUTRAL VOLATGE Y PAHSE TO NEUTRAL VOLATION	Modbus RS-485 Modbus RS-485 Modbus RS-485	_	-		1		Ħ	V_RN V_YN V_RN	MRSS_11KV_HT_SPARE_IN_V_RN MRSS_11KV_HT_SPARE_IN_V_YN	1	t	t
10.22 MRS 10.23 MRS	8 11KV_HT 8 11KV_HT 8 11KV_HT	SPARE_IN SPARE_IN SPARE_IN	INCOMMING BREAKER	B PAHSE TO NEUTRAL VOLATGE RY VOLTAGE YB VOLTAGE	Modbus RS-485 Modbus RS-485 Modbus RS-485				1			V_RY V_YB	MRSS_11KV_HT_SPARE_IN_V_BN MRSS_11KV_HT_SPARE_IN_V_RY MRSS_11KV_HT_SPARE_IN_V_YB			
10.24 MRS 10.25 MRS 10.26 MRS	3 11KV HT	SPARE IN	INCOMMING BREAKER INCOMMING BREAKER	BR VOLTAGE R PHASE LINE CURRENT	Modbus RS-485 Modbus RS-485				1			V_88	MRSS_11KV_HT_SPARE_IN_V_BR MRSS_11KV_HT_SPARE_IN_I_R			
10.27 MR55	5 11KV_HT	SPARE_IN SPARE_IN	INCOMMING BREAKER INCOMMING BREAKER	Y PHASE LINE CURRENT B PHASE LINE CURRENT	Modbus RS-485 Modbus RS-485				1			UY V_B	MRSS_11KV_HT_SPARE_IN_V_B MRSS_11KV_HT_SPARE_IN_V_B			
10.28 MRS 10.29 MRS 10.30 MRS	1101 HT	SPARE IN	includes in party date and the	NEUTRAL LINE CURRENT POWER FACTOR (01)	Modbus RS-485 Modbus RS-485				1			LN Pf1	MRSS_11KV_HT_SPARE_IN_I_N MRSS_11KV_HT_SPARE_IN_PF1 MRSS_11KV_HT_SPARE_IN_PF1			
10.30 MRS 10.31 MRS 10.32 MRS	8 11KV_HT 8 11KV_HT 8 11KV_HT	SPARE_IN SPARE_IN SPARE_IN	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	POWER FACTOR (Q2) POWER FACTOR (Q3) AVERAGE POWER FACTOR (QA)	Modbus:RS-485 Modbus:RS-485 Modbus:RS-485				1			PF3 40F	MRSS_TIKV_HT_SPARE_IN_PF2 MRSS_TIKV_HT_SPARE_IN_PF3 MRSS_TIKV_HT_SPARE_IN_APF			
10.33 MRS 10.34 MRS	8 11KV_HT 8 11KV_HT		INCOMMING BREAKER INCOMMING BREAKER	FREQUENCY METER TEMPERATURE	Modbus:RS-485 Modbus:RS-485				1			FR MT_TEMP	MRSS_11KV_HT_SPARE_IN_FR MRSS_11KV_HT_SPARE_IN_MT_TEMP			
10.35 MRS 10.36 MRS	8 11KV_HT 8 11KV_HT	SPARE_IN SPARE_IN	INCOMMING BREAKER INCOMMING BREAKER	ACTIVE TOTAL IMPORT-kWhT(I) ACTIVE TOTAL EXPORT-kWhT(E)	Modbus:RS-485 Modbus:RS-485				1			kWhTi kWhE	MRSS_11KV_HT_SPARE_IN_kWHTI MRSS_11KV_HT_SPARE_IN_kWHE			
10.37 MRS 10.38 MRS	8 11KV_HT 8 11KV_HT 8 11KV_HT	SPARE_IN SPARE_IN SPARE_IN	INCOMMING BREAKER	REACTIVE TOTAL IMPORT-kVArb(I) REACTIVE TOTAL EXPORT- kVArb(I)	Modbus:RS-485 Modbus:RS-485				1			kVArh_L kVArh_E	MRSS 11KV HT SPARE IN KVARh I MRSS 11KV HT SPARE IN KVARh E MRSS 11KV HT SPARE IN			
10.39 MRS 10.40 MRS 10.41 MRS	3 11KV_HT	SPARE_IN	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	CUMULATIVE POWER ON MINUTES CUMULATIVE POWER OFF MINUTES CUMULATIVE LOAD ON MINUTES	Modbus RS-485 Modbus RS-485 Modbus RS-485				1				MRSS_11XV_HT_SPARE_IN_ MRSS_11XV_HT_SPARE_IN_ MRSS_11XV_HT_SPARE_IN_			
10.41 MRS 10.42 MRS 10.43 MRS		SPARE_IN SPARE_IN	INCOMMING BREAKER INCOMMING BREAKER	CUMULATIVE LOAD OFF MINUTES OTI	Modbus:RS-485 VFC				1	1		στι	MRSS_11KV_HT_SPARE_IN_ MRSS_11KV_HT_SPARE_IN_OTI			
10.44 MRSS 10.45 MRSS	8 11KV_HT	SPARE_IN SPARE_IN	INCOMMING BREAKER INCOMMING BREAKER	WTI On Command	VFC VFC					1	1	WTI CMD_ON	MRSS_11KV_HT_SPARE_IN_WTI MRSS_11KV_HT_SPARE_IN_CMD_ON			
10.46 MRS 10.47 MRS 10.48 MRS	8 11KV_HT 8 11KV_HT	SPARE_IN SPARE_IN SPARE_IN	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Off Command Trip Coll	VFC IEC 61850					1	1	CMD_OFF TRP_C	MRSS_11KV_HT_SPARE_IN_CMD_OFF MRSS_11KV_HT_SPARE_IN_TRP_C MRSS_11KV_HT_SPARE_IN_TRP_C			
10.45 MRS 11.00 MRS 11.01 MRS	S 11KV_HT S 11KV_HT S 11KV_HT	BC BC	BUS COUPLER BUS COUPLER	BUSCOUPLER 18 Switch Remote Position	IEC 61850							18	MRSS_11KV_HT_SPARE_IN_E_TRP MRSS_11KV_HT_BC_LR			
11.02 MRSS 11.03 MRSS	5 11KV_HT	BC BC	BUS COUPLER BUS COUPLER BUS COUPLER	LR Switch Remote Position On Status Off Status	VFC					1		ON	MRSS 11KV HT BC ON MRSS 11KV HT BC OFF			
11.04 MRSS	8 11KV HT	BC BC	BUS COUPLER	Trip Status Excises Channes	VFC VFC					1		189 SC	MRSS_11KV_HT_BC_TRP			
11.06 MRS 11.07 MRS 11.08 MRS	8 11KV_HT 8 11KV_HT	BC BC BC	BUS COUPLER BUS COUPLER BUS COUPLER	Ready to Close (RTC) Service Position	VFC							RTC SER	MRSS 11KV HT BC SER MRSS 11KV HT BC SER MRSS 11KV HT BC SER			
11.08 MRS 11.09 MRS 11.10 MRS	8 11KV_HT 8 11KV_HT 8 11KV_HT	BC BC	BUS COUPLER BUS COUPLER BUS COUPLER	Test Position Control Surply Healthy	VFC VFC					1		CSH TRP CH	MRSS_11KV_HT_BC_TST MRSS_11KV_HT_BC_CSH MRSS_11KV_HT_BC_CH			
11.10 MRS 11.11 MRS 11.12 MRS	3 11KV_HT	BC BC	BUS COUPLER BUS COUPLER BUS COUPLER	Trip Circuit Healthy Under Voltage Trip Emergency Trip	VFC					1		UV_TRP E_TRP	MRSS_11KV_HT_BC_UV_TRP MRSS_11KV_HT_BC_E_TRP			
11.13 MRS 11.14 MRS	11KV_HT 3 11KV_HT	BC	BUS COUPLER	PT Fuse Failure On Command	VFC					1	1	PTFF CMD_ON	MRSS_11KV_HT_BC_PTFF MRSS_11KV_HT_BC_CMD_ON			
11.15 MRSS 11.16 MRSS	8 11KV_HT 8 11KV_HT	BC BC	BUS COUPLER BUS COUPLER BUS COUPLER	Off Command Trip Col	VFC VFC							CMD_OFF TRP_C	MRSS_11KV_HT_BC_DMD_DFF MRSS_11KV_HT_BC_TRP_C			
11.17 MRS 12.00 MRS		SPARE_TR		Emergency Trip TRANSFORMER (Spare)	VFC						1	E_TRP	MRSS_11KV_HT_BC_E_TRP			
12.01 MR51 12.02 MR51	3 11KV_HT	SPARE_TR SPARE_TR	INCOMMING BREAKER	LR Switch Remote Position On Status	VFC VFC					1		LR ON	MRSS_11KV HT_SPARE_TR_LR MRSS_11KV HT_SPARE_TR_DN			
12.03 MRS 12.04 MRS 12.05 MRS	1101 HT	SPARE_TR SPARE_TR SPARE_TR SPARE_TR	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Off Status Trip Status Spring Charge	VFC VFC	_	-			1 1 1		189 5C	MRSS_11KV_HT_SPARE_TR_OFF MRSS_11KV_HT_SPARE_TR_TRP MRSS_11KV_HT_SPARE_TR_SC			
12.05 MRS 12.06 MRS 12.07 MRS	3 11KV_HT	SPARE_TR SPARE_TR	INCOMMING BREAKER INCOMMING BREAKER	Ready to Close (RTC) Service Position	VFC VFC					1		RTC	MRSS_11KV_HT_SPARE_TR_KTC MRSS_11KV_HT_SPARE_TR_SER		L	<u> </u>
12.07 MRS 12.08 MRS 12.09 MRS	3 11KV_HT	SPARE_TR SPARE_TR	INCOMMING BREAKER INCOMMING BREAKER	Test Position Earth	VFC VFC					1		TST ER	MRSS_11KV_HT_SPARE_TR_TST MRSS_11KV_HT_SPARE_TR_ER	<u> </u>		
12.10 MRSS 12.11 MRSS	8 11KV_HT	SPARE_TR SPARE_TR	INCOMMING BREAKER	Control Supply Healthy Emergency Trip DC Status	VFC VFC			$\vdash \neg$		1		CSH E_TRP	MRSS_11KV_HT_SPARE_TR_CSH MRSS_11KV_HT_SPARE_TR_E_TRP	-	<u> </u>	
12.12 MRS 12.13 MRS 12.14 MRS		SPARE_TR SPARE_TR SPARE_TR	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	DC Status Trip Circuit Healthy Under Voltage Trip	IEC 61850 IEC 61850	1		⊨_Ī		1		DC TRP_CH	MRSS 11KV HT SPARE TR DC MRSS 11KV HT SPARE TR TRP_CH MRSS 11KV HT SPARE TR_UV_TRP			
12.15 MRSS	3 11KV HT	SPARE TR	INCOMMING BREAKER	Earth Fault PT Fuse Failure	IEC 61850 IEC 61850 IEC 61850	_	-			1	нt	EF DTEE	MRSS 11KV HT SPARE TR EF			
12.16 MRS 12.17 MRS 12.18 MRS	11XV_HT	SPARE_TR SPARE_TR SPARE_TR		PT Fuse Failure Protection Relay Multifunction Meter	IEC 61850 IEC 61850 RS 485	_+		1	1	_	EH	1.17	MMSS 11KV HT SPARE TR PIFF MMSS 11KV HT SPARE TR MMSS 11KV HT SPARE TR		L	
12.10 MRS 12.20 MRS 12.21 MRS	3 11KV_HT 3 11KV_HT	SPARE_TR SPARE TR	INCOMMING BREAKER	R PAHSE TO NEUTRAL VOLATGE Y PAHSE TO NEUTRAL VOLATGE	Modbus RS-485 Modbus RS-485				1		Æ	V_SN V_YN	MRSS_11KV_HT_SPARE_TR_V_RN MRSS_11KV_HT_SPARE_TR_V_YN	L	<u> </u>	<u> </u>
12.22 MR55	3 11KV_HT	SPARE_TR SPARE_TR	INCOMMING BREAKER INCOMMING BREAKER	B PAHSE TO NEUTRAL VOLATGE RV VOLTAGE	Modbus:RS-485 Modbus:RS-485	_			1			V_BN V_RY V_YB	MRSS_11KV_HT_SPARE_TR_V_BN MRSS_11KV_HT_SPARE_TR_V_RY	1	<u> </u>	
12.23 MRS 12.24 MRS 12.25 MRS	8 11KV_HT 8 11KV_HT	SPARE_TR	INCOMMING BREAKER INCOMMING BREAKER	YB VOLTAGE BR VOLTAGE R PHASE LINE CURRENT	Modbus:RS-485 Modbus:RS-485 Modbus:RS-485	1		⊨_Ī	1		НĒ	V_YB V_BR	MRSS_LIKV_HT_SPARE_TR_V_Y8 MRSS_LIKV_HT_SPARE_TR_V_8R MRSS_LIKV_HT_SPARE_TR_V_8R			
12.26 MRSS	3 11KV_HT	SPARE_TR	INCOMMING BREAKER	Y PHASE LINE CURRENT	Modbus:RS-485	-			1		H	LR LY V R	MRSS_11KV_HT_SPARE_TR_I_Y		-	
12.27 MRS 12.28 MRS 12.29 MRS	S 11KV_HT	SPARE TR	INCOMMING BREAKER	B PHASE LINE CURRENT NEUTRAL LINE CURRENT POWER FACTOR (Q1)	Modbus RS-485 Modbus RS-485 Modbus RS-485	_	-		1	-		*_0 1_N 9f1	MRSS_11KV_HT_SPARE_TR_V_B MRSS_11KV_HT_SPARE_TR_V_B MRSS_11KV_HT_SPARE_TR_PF1			
12.30 MRSS 12.31 MRSS	8 11KV_HT 8 11KV_HT	SPARE_TR	INCOMMING BREAKER INCOMMING BREAKER	POWER FACTOR (Q2) POWER FACTOR (Q3)	Modbus RS-485 Modbus RS-485 Modbus RS-485				1		ШŦ	2F2 2F3	MRSS_11KV_HT_SPARE_TR_PF2 MRSS_11KV_HT_SPARE_TR_PF3		<u> </u>	<u> </u>
12.32 MRS 12.33 MRS	8 11KV_HT 8 11KV_HT	SPARE_TR SPARE_TR	INCOMMING BREAKER INCOMMING BREAKER	AVERAGE POWER FACTOR (QA) FREQUENCY	Modbus:RS-485 Modbus:RS-485				1		ΕÐ	40 F FR	MRSS_11KV_HT_SPARE_TR_APF MRSS_11KV_HT_SPARE_TR_FR			
12.34 MRS 12.35 MRS	S 11KV_HT	SPARE_TR SPARE_TR		METER TEMPERATURE ACTIVE TOTAL IMPORT-kWhT(I)	Modbus:RS-485 Modbus:RS-485				1			MT_TEMP kWhTi	MRSS_11KV_HT_SPARE_TR_MT_TEMP MRSS_11KV_HT_SPARE_TR_kWhTi			
12.36 MRS 12.37 MRS 12.38 MRS	S 11KV_HT S 11KV_HT S 11KV_HT	SPARE_TR SPARE_TR SPARE_TR	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	ACTIVE TOTAL EXPORT-kWhT(E) REACTIVE TOTAL IMPORT-kVArb(I) REACTIVE TOTAL EXPORT- kVArb(I)	Modbus:RS-485 Modbus:RS-485				1			kWhE kVArh_I	MRSS_11KV_HT_SPARE_TR_kWhE MRSS_11KV_HT_SPARE_TR_kWarh_1 MRSS_11KV_HT_SPARE_TR_kWarh_E			
12.38 MRS 12.39 MRS 12.40 MRS	8 11KV_HT 8 11KV_HT 8 11KV_HT	SPARE_TR SPARE_TR SPARE_TR	INCOMMING BREAKER	REACTIVE TOTAL EXPORT- KVAHUI CUMULATIVE POWER ON MINUTES CUMULATIVE POWER OFF MINUTES	Modbus RS-485 Modbus RS-485 Modbus RS-485				1			KVArh_E	MRSS_11KV_HT_SPARE_TR_ MRSS_11KV_HT_SPARE_TR_ MRSS_11KV_HT_SPARE_TR_			
12.41 MRSS 12.42 MRSS	8 11KV_HT 8 11KV_HT	COARE TR	INCOMMING BREAKER	CUMULATIVE LOAD ON MINUTES	Modbus RS-485 Modbus RS-485				1				MRSS 11KV HT SPARE TR MRSS 11KV HT SPARE TR			
12.43 MRSS 12.44 MRSS	8 11KV_HŤ 8 11KV_HŤ	SPARE_TR SPARE_TR		Buchholz relay PRV	VFC VFC					1		BCH_R PRV	MRSS 11KV HT SPARE TR BCH R MRSS 11KV HT SPARE TR PRV			
12.45 MRS 12.46 MRS	3 11KV HT	SPARE_TR SPARE_TR SPARE_TR	INCOMMING BREAKER INCOMMING BREAKER	MOG	VFC VFC					1		MOG OTI	MRSS_11KV_HT_SPARE_TR_MOG MRSS_11KV_HT_SPARE_TR_OTI			
12.47 MRS 12.48 MRS	3 11KV_HT 3 11KV_HT	SPARE_TR	INCOMMING BREAKER	WTI On Command	VFC VFC					1	1	WTI CMD_ON	MRSS_11KV_HT_SPARE_TR_WTI MRSS_11KV_HT_SPARE_TR_CMD_ON MRSS_11KV_HT_SPARE_TR_CMD_OFF			
12.49 MRS 12.50 MRS 12.51 MRS		SPARE_TR SPARE_TR SPARE_TR	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Off Command Trip Coll Emersence Trin	VFC IEC 61850 IEC 61850					1	1	CMD_OFF TRP_C F_TRP	MRSS_11KV_HT_SPARE_TR_CR0_CHF MRSS_11KV_HT_SPARE_TR_TRP_C MRSS_11KV_HT_SPARE_TR_E_TRP			
13.00 MRS 13.01 MRS	3 11KV_HT	CR55_061	OUTGOING BREAKER	Central Station -1 (Outpoing) LR Switch Remote Position	VFC					1		LR	MRSS 11KV HT CRSS OCI 18			
13.02 MRS 13.03 MRS 13.04 MRS	5 11KV HT	CR55_061 CR55_061	OUTGOING BREAKER OUTGOING BREAKER	On Status Off Status	VFC VFC							ON OFF	MRSS_11KV_HT_CRSS_OG1_ON MRSS_11KV_HT_CRSS_OG1_OFF			
13.04 MRS 13.05 MRS 13.06 MRS	3 11KV_HI	065_061	OUTGOING BREAKER	Trip Status Spring Charge	VFC					1		18.9 SC	MRSS_11KV_HT_CRSS_0G1_RP MRSS_11KV_HT_CRSS_0G1_SC			
13.07 MRS	3 11KV_HT	CR55_0G1	OUTGOING BREAKER	Ready to Close (RTC) Service Position	VFC					1 1		RTC SER	MRSS_11KV_HT_CRSS_0G1_RTC MRSS_11KV_HT_CRSS_0G1_SER			
13.08 MRS 13.09 MRS 13.10 MRS	5 11KV HT	CRSS_061 CRSS_061 CRSS_061	OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER	Test Position Earth Emergency Trip	VFC					1		ER F TRP	MBS_11KV_HT_ORS_001_BT MRSS_11KV_HT_ORS_001_ER MRSS_11KV_HT_ORS_001_E			
13.11 MRS 13.12 MRS	3 11KV_HT	CR55_0G1 CR55_0G1 CR55_0G1	OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER	DC Status Control Supply Healthy	IEC 61850 IEC 61850					1		DC CSH	MR55_11KV_HT_CR55_0G1_E_TRP MR55_11KV_HT_CR55_0G1_0C MR55_11KV_HT_CR55_0G1_CSH			
13.13 MR5 13.14 MR5	IS 11KV_HT	0855-061	OUTGOING BREAKER OUTGOING BREAKER	Trip Circuit Healthy Under Voltage Trip	IEC 61850 IEC 61850							TRP_CH UV_TRP	MRSS_11KV_HT_CRSS_0G1_TRP_CH MRSS_11KV_HT_CRSS_0G1_UV_TRP			
13.15 MRS 13.16 MRS	5 11KV_HT	CRSS_0G1 CRSS_0G1	OUTGOING BREAKER OUTGOING BREAKER	Earth Fault PT Fuse Failure	IEC 61850 IEC 61850					1		EF PTFF	MRSS 11KV HT CRSS OG1 EF MRSS 11KV HT CRSS OG1 PTFF			
13.17 MRS 13.18 MRS 13.19 MRS	8 11KV_HT 8 11KV_HT		OUTGOING BREAKER OUTGOING BREAKER	Multifunction Meter R PAHSE TO NEUTRAL VOLATGE	RS 485 Modbus RS-485 Modbus RS-485				1			V_8N	MRSS 11KV HT CRSS OG1 MRSS 11KV HT CRSS OG1 V RN			
13.19 MRS 13.20 MRS 13.21 MRS	3 11KV_H1	CRSS_061 CRSS_061 CRSS_061	OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER	Y PAHSE TO NEUTRAL VOLATGE B PAHSE TO NEUTRAL VOLATGE NY VOLTAGE	Modbus RS-485 Modbus RS-485 Modbus RS-485				1			V_NN V_BN V_RY	MR55_11KV_HT_CR55_0G1_V_NN MR55_11KV_HT_CR55_0G1_V_NN MR55_11KV_HT_CR55_0G1_V_NN			
13.22 MRS 13.23 MRS 13.24 MRS 13.25 MRS	8 11KV_HT 8 11KV_HT	CRSS_OG1	OUTGOING BREAKER	VB VOLTAGE BR VOLTAGE	Modbus:RS-485 Modbus:RS-485				1			V_YB V_BR	MRSS_11XV_HT_CRSS_001_V_YB MRSS_11XV_HT_CRSS_001_V_YB			
		CRSS_0G1 CRSS_0G1	OUTGOING BREAKER OUTGOING BREAKER	R PHASE LINE CURRENT Y PHASE LINE CURRENT	Modbus:RS-485 Modbus:RS-485				1			LR LY	MRSS_11KV_HT_CRSS_OG1_L_R MRSS_11KV_HT_CRSS_OG1_L_Y			
13.26 MRS 13.27 MRS	8 11KV_HT 8 11KV_HT	CR55_061 CR55_061	OUTGOING BREAKER	B PHASE LINE CURRENT NEUTRAL LINE CURRENT	Modbus RS-485 Modbus RS-485 Modbus RS-485				1			V_B LN	MRSS_11KV_HT_CRSS_0G1_V_B MRSS_11KV_HT_CRSS_0G1_I_N MRSS_11KV_HT_CRSS_0G1_FF1			
13.28 MRS 13.29 MRS	8 11KV_HT 8 11KV_HT	CR55_0G1 CR55_0G1	OUTGOING BREAKER OUTGOING BREAKER	POWER FACTOR (Q1) POWER FACTOR (Q2)	Modbus:RS-485				1			PF1 PF2	MR55_11KV_HT_0R55_061_PF2			
13.30 MRS 13.31 MRS	8 11KV_HT 8 11KV_HT	CR55_061	OUTGOING BREAKER OUTGOING BREAKER	POWER FACTOR (Q3) AVERAGE POWER FACTOR (QA)	Modbus:RS-485 Modbus:RS-485 Modbus:RS-485				1			APF APF	MRS.11KV_HT_CRS_0G1_PF3 MRS_11KV_HT_CRS_0G1_APF MRS_11KV_HT_CRS_0G1_APF			
13.32 MRS 13.33 MRS 13.34 MRS	8 11KV_HT 8 11KV_HT 8 11KV_HT	CR55_061 CR55_061	OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER	FREQUENCY METER TEMPERATURE ACTIVE TOTAL IMPORT-kWhT(I)	Modbus RS-485 Modbus RS-485 Modbus RS-485				1			MT_TEMP	MBS5_11KV_HT_CRS5_0G1_RR MBS5_11KV_HT_CRS5_0G1_MT_TEMP MBS5_11KV_HT_CRS5_0G1_WhTI			
13.34 MRS 13.35 MRS 13.36 MRS 13.37 MRS	5 11KV_HT 5 11KV_HT	CR55_061 CR55_061 CR55_061 CR55_061 CR55_061	OUTGOING BREAKER OUTGOING BREAKER	ACTIVE TOTAL IMPORT-KWHI(I) ACTIVE TOTAL EXPORT-KWHI(E) REACTIVE TOTAL IMPORT-KWA/b(I)	Modbus:RS-485 Modbus:RS-485				1			kWhE kVArh_I	MRS5_11KV_HT_CRS5_001_kWhE MRS5_11KV_HT_CRS5_001_kWah_I		L	<u> </u>
13.36 MRS 13.37 MRS 13.38 MRS 13.39 MRS			OUTGOING BREAKER OUTGOING BREAKER	REACTIVE TOTAL IMPORT-REARING REACTIVE TOTAL EXPORT- KVAHJ) CUMULATIVE POWER ON MINUTES	Modbus:RS-485 Modbus:RS-485				1		ШŦ	kVArh_E	MRSS_11KV_HT_CRSS_0G1_KVArh_E MRSS_11KV_HT_CRSS_0G1_		<u> </u>	<u> </u>
13.39 MRS 13.40 MRS 13.41 MRS	8 11KV_HT 8 11KV_HT	CR55_061 CR55_061	OUTGOING BREAKER OUTGOING BREAKER	CUMULATIVE POWER OFF MINUTES CUMULATIVE LOAD ON MINUTES	Modbus:RS-485 Modbus:RS-485			$\vdash \neg$	1	-F	ΗŦ		MRSS_11KV HT_CRSS_0G1_ MRSS_11KV HT_CRSS_0G1_	-	<u> </u>	
		CR55_061 CR55_061	OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER	CUMULATIVE LOAD OFF MINUTES Protection Relay On Command	Modbus RS-485 IED	-		1	1		ЦĒ	(gab	MRSS_11KV_HT_CRSS_0G1_ MRSS_11KV_HT_CRSS_0G1_ MRSS_11KV_HT_CRSS_0G1_CMD_0N			
13.43 MRS 13.44 MRS 13.45 MRS 13.45 MRS	5 11KV_HT 5 11KV_HT 5 11KV_HT	CR55_061 CR55_061 CR55_061	OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER	On Command Off Command Trip Coll	VFC VFC IEC 61850	_	-			1	1	CMD_ON CMD_OFF TRP_C	MB55_118V_HT_CB55_0G1_CMD_ON MB55_118V_HT_CB55_0G1_CMD_OFF MB55_118V_HT_CB55_0G1_TBP_C			
13.46 MRS 14.00 MRS	5 11KV_HT 5 11KV_HT 5 11KV_HT	CRSS_OG1 CRSS_OG2	OUTGOING BREAKER OUTGOING BREAKER	Imp Col Emergency Trip Central Station -2 (Outpoing)	IEC 61850					1	ШŦ	TRP_C E_TRP	MRSS_11KV_HT_CRSS_OG1_E_TRP		<u> </u>	<u> </u>
14.00 MRS 14.01 MRS 14.02 MRS		CR55_0G2 CR55_0G2	OUTGOING BREAKER OUTGOING BREAKER	LR Switch Remote Position On Status	VFC VFC					1	Æ	LR ON	MRSS_11KV_HT_CRSS_OG2_LR MRSS_11KV_HT_CRSS_OG2_ON	L	<u> </u>	
14.02 MRS 14.03 MRS 14.04 MRS 14.05 MRS	3 11KV_HT 3 11KV_HT	CR55_062 CR55_062	OUTGOING BREAKER	Off Status Trip Status	VFC VFC			$\vdash \neg$		1		OFF TRP	MRSS_11KV_HT_CRSS_OG2_OFF MRSS_11KV_HT_CRSS_OG2_TRP	-	<u> </u>	
14.05 MRS 14.06 MRS 14.07 MRS		CR55_DG2 CR55_DG2 CR55_DG2	OUTGOING BREAKER OUTGOING BREAKER	Spring Charge Ready to Close (RTC) Evenies Parities	VFC VFC	-				1		SC RTC	MRSS_11KV_HT_CRSS_OG2_SC MRSS_11KV_HT_CRSS_OG2_RTC MRSS_11KV_HT_CRSS_OG2_RTC	1	<u> </u>	
14.07 MRS 14.08 MRS 14.09 MRS	3 11KV_HT	CR55_0G2	OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER	Service Position Test Position Farth	v/c VFC VFC	-	_			1		TST ER	MBS_11KV_HT_CRS_0G2_SER MBS_11KV_HT_CRS_0G2_TST MBS_11KV_HT_CRS_0G2_R	1		
14.10 ****	5 11KV_HT 5 11KV_HT 5 11KV_HT	CR55_062 CR55_062	OUTGOING BREAKER OUTGOING BREAKER	Emergency Trip DC Status	VFC VFC IEC 61850	_+			_	1	EH	E_TRP DC	MRS5_11KV_HT_CRS5_002_E_TRP MRS5_11KV_HT_CRS5_002_DC		L	L
14.11 MP**	S 11KV H [™]	CR55_062	OUTGOING BREAKER	Control Supply Healthy	IEC 61850					1		CSH TRP_CH	MRSS 11KV HT CRSS OCC CSH		<u> </u>	<u> </u>
14.10 MRS 14.11 MRS 14.12 MRS 14.13 MRS	S 11KV_HT		OUTGOING BREAKER OUTGOING BREAKER	Trip Circuit Healthy Under Voltage Trip Earth Fault	IEC 61850 IEC 61850 IEC 61850	_				1	ΗĒ	UV_TRP EF	MRSS_11KV_HT_CRSS_0G2_TMP_CH MRSS_11KV_HT_CRSS_0G2_UV_TRP MRSS_11KV_HT_CRSS_0G2_EF	1	<u> </u>	
14.12 MRS 14.13 MRS 14.14 MRS 14.15 MRS	5 11KV_HT 5 11KV_HT 8 11KV_HT 8 11KV_HT		OUTGOING BREAKER	PT Fuse Failure	IEC 61850 R5 485			$\vdash \neg$	1	1	ΗŦ	PTFF	MRSS_11KV_HT_CRSS_002_PTFF MRSS_11KV_HT_CRSS_002_	-	<u> </u>	
14.12 MRS3 14.13 MRS3 14.14 MRS3 14.15 MRS3 14.16 MRS3 14.16 MRS3	5 11KV_HT 5 11KV_HT 5 11KV_HT 5 11KV_HT 5 11KV_HT 5 11KV_HT	CRSS_DG2 CRSS_DG2 CRSS_DG2	OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER	Multifunction Meter	modbus:RS-485				1		нH	V_RN V_YN V_RN	MBSS_118V_HT_CRSS_0G2_V_NN MBSS_118V_HT_CRSS_0G2_V_NN MBSS_118V_HT_CRSS_0G2_V_NN	1	1	
14.12 MRS3 14.13 MRS3 14.14 MRS3 14.15 MRS3 14.15 MRS3 14.16 MRS3 14.17 MRS3 14.18 MRS3 14.19 MRS3	3 11kV,HI 15 11kV,HT 11kV,HT 11kV,HT 11kV,HT 11kV,HT 11kV,HT 11kV,HT 11kV,HT 11kV,HT 11kV,HT 11kV,HT 11kV,HT 11kV,HT	CHSS_062 CHSS_062 CHSS_062 CHSS_062 CHSS_062	OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER	Multifunction Meter R PAHSE TO NEUTRAL VOLATGE Y PAHSE TO NEUTRAL VOLATGE	Modbus:RS-485 Modbus:RS-485				1			*_074 V_8Y	MRS_11KV_HT_CRSS_0G2_V_BN MRSS_11KV_HT_CRSS_0G2_V_RY	1	1	1
14.12 MRS3 14.13 MRS3 14.14 MRS3 14.15 MRS3 14.16 MRS3 14.17 MRS3 14.19 MRS3 14.19 MRS3 14.19 MRS3 14.20 MRS3	5 11KV_HT 5 11KV_HT 5 11KV_HT 5 11KV_HT 5 11KV_HT 5 11KV_HT 5 11KV_HT 5 11KV_HT 5 11KV_HT 5 11KV_HT	CHSS_062 CHSS_062 CHSS_062 CHSS_062 CHSS_062 CHSS_062 CHSS_062	OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER OUTGOING BREAKER	Multifunction Meter R PAHSE TO NEUTRAL VOLATGE Y PAHSE TO NEUTRAL VOLATGE B PAHSE TO NEUTRAL VOLATGE RY VOLTAGE	Modbus:RS-485				1		1 1 1					
14.12 MRSS 14.13 MRSS 14.15 MRSS 14.15 MRSS 14.16 MRSS 14.16 MRSS 14.17 MRSS 14.19 MRSS 14.20 MRSS 14.20 MRSS 14.21 MRSS 14.22 MRSS 14.22 MRSS	3 11kv_HT 5 11kv_HT 8 11kv_HT 5 11kv_HT	085_062 085_062 085_062 085_062 085_062 085_062 085_062 085_062	OUTGOING BEFARER OUTGOING BEFARER OUTGOING BEFARER OUTGOING BEFARER OUTGOING BEFARER OUTGOING BEFARER OUTGOING BEFARER OUTGOING BEFARER OUTGOING BEFARER	Multifunction Mater RPARES TO NEUTRAL VOLATGE YPARES TO NEUTRAL VOLATGE B PARES TO NEUTRAL VOLATGE NY VOCTAGE EN VOLTAGE EN VOLTAGE EN VOLTAGE EN YASELING CURRENT	Modbus/RS-485 Modbus/RS-485 Modbus/RS-485 Modbus/RS-485 Modbus/RS-485				1			V BR	MRSS 11KV HT CRSS 002 V /8 MRSS 11KV HT CRSS 002 V /8 MRSS 11KV HT CRSS 002 1 /8			
14.12 MRSS 14.13 MRSS 14.13 MRSS 14.15 MRSS 14.15 MRSS 14.17 MRSS 14.17 MRSS 14.19 MRSS 14.19 MRSS 14.20 MRSS 14.21 MRSS 14.21 MRSS 14.22 MRSS 14.22 MRSS 14.22 MRSS 14.22 MRSS 14.24 MRSS	5 1100, HT	0455 062 0455 062 0455 062 0455 062 0455 062 0455 062 0455 062 0455 062 0455 062 0455 062	OUTGOING BEFARER OUTGOING BEFARER OUTGOING BEFARER OUTGOING BEFARER OUTGOING BEFARER OUTGOING BEFARER OUTGOING BEFARER OUTGOING BEFARER OUTGOING BEFARER	Multifucction Mater 8 Anexist To NUTRAL VOLATION 9 Parks TO NUTRAL VOLATION 8 Anexist To NUTRAL VOLATION INV VOLTAGE INV VOLTAGE INV VOLTAGE 8 MVOTTAGE 8 ANOSE INFO COMPENT 1 PARASE INFO COMPENT 1 PARASE INFO COMPENT 1 PARASE INFO COMPENT 1 PARASE INFO COMPENT	Modbus:RS-485 Modbus:RS-485 Modbus:RS-485 Modbus:RS-485				1			V 88 1_8 1_Y V 8	MRSS_11KV_HT_CRSS_OG2_V_YB MRSS_11KV_HT_CRSS_OG2_V_BR			
14.12 MRSS 14.13 MRSS 14.14 MRSS 14.15 MRSS 14.15 MRSS 14.16 MRSS 14.17 MRSS 14.10 MRSS 14.20 MRSS 14.20 MRSS 14.21 MRSS 14.21 MRSS 14.21 MRSS 14.22 MRSS 14.22 MRSS 14.22 MRSS 14.24 MRSS 14.26 MRSS 14.26 MRSS	1100 HT	OKS 062	OUTGOING BREAKER OUTGOING BREAKER	Antifiancion Meter Antifiancion Meter Provesto Naturina vocanos y pares to Naturina vocanos el vocanos el vocanos la vocano	Modbur 85-485 Modbur 85-485 Modbur 85-485 Modbur 85-485 Modbur 85-485 Modbur 85-485 Modbur 85-485 Modbur 85-485								MMS_11XV H1 MSS_10X V H3 MMS_11XV H1 MSS_10X V H1			
14.12 MPS3 14.14 MPS3 14.14 MPS3 14.15 MPS3 14.15 MPS3 14.15 MPS3 14.17 MPS3 14.19 MPS3 14.20 MPS3 14.20 MPS3 14.21 MPS3 14.21 MPS3 14.22 MPS3 14.24 MPS3 14.25 MPS3 14.25 MPS3 14.25 MPS3 14.25 MPS3 14.26 MPS3 14.26 MPS3 14.27 MPS3	1100, HI	CHSS 062	OUTGOING BREAKER OUTGOING BREAKER	Autification Mater Parent's IN NUTRA VICATOR ' Parent's IN NUTRA ' Parent's IN CONTRACT ' Parent's INF CONTRACTOR'S INF CONTRACT ' Parent's INF CONTRACTOR'S INF CONTR	Modbur R5-485 Modbur R5-485				1				MISS_114V_HF_GRS_GG2_V_HB MISS_114V_HF_GRS_GG2_V_HB MISS_114V_HF_GRS_GG2_1_B MISS_114V_HF_GRS_GG2_V_F MISS_114V_HF_GRS_GG2_V_F MISS_114V_HF_GRS_GG2_FF MISS_114V_HF_GRS_GG2_FF MISS_114V_HF_GRS_GG2_FF MISS_114V_HF_GRS_GG2_FF MISS_114V_HF_GRS_GG2_FF MISS_114V_HF_GRS_GG2_FF			
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44.12 MRS 24.12 MRS 24.14 MRS 24.14 MRS 24.15 MRS 24.14 MRS 24.15 MRS 24.14 MRS 24.15 MRS 24.14	1100, HI 1100, HI 5	065 062 065	OUTCOME BEAARS OUTCOME BEAARS	And Research Marker Analysis of the Mirker Veral Advised Tarkers To Mirker Veral Advised Tarkers To Mirker Veral Advised Tarkers To Mirker Veral Advised The Veral Advised Tarkers Advised The Veral Advised Tarkers Advised Tarkers (1) and Construct Advised Tarkers Advised Tarkers Advised	Medburs/83-485 Medburs/83-485 Medburs/83-485 Medburs/83-485 Medburs/83-485 Medburs/83-485 Medburs/83-485 Medburs/83-485 Medburs/83-485 Medburs/83-485 Medburs/83-485 Medburs/83-485				1			PF2 PF3 APF FR MT_TEMP KWDT	MBS_1100_071_0705_000_V MB MBS_11100_071_0705_001_V MB MBS_11100_071_0705_000_V MB MBS_11100_071_0705_000_V MB MBS_11100_071_0705_000_V MB MBS_11100_071_0705_000_V MB			
14.12 MMSS 14.13 MMSS 14.34 MMSS 14.34 MMSS 14.14 MMSS 14.14 MMSS 14.14 MMSS 14.12 MMSS 14.12 MMSS 14.21 MMSS 14.21 MMSS 14.21 MMSS 14.21 MMSS 14.22 MMSS 14.22 MMSS 14.22 MMSS 14.23 MMSS 14.23 MMSS 14.24 MMSS 14.25 MMSS	5. 1100 HI 5. 110	0455 (662 0455 (662 0456 (662	OUTCOME BELACES OUTCOME DELACES OUTCOME DELACES	Sentencies bater Sentencies bater Senten Die Miller Veraffel Freed To NUTINE Veraffel Freed To NUTINE Veraffel Bis Verhalt Bis Verhalt Bis Verhalt Bis Verhalt Bis Verhalt Die Verhalt Bis Verhalt Die Ve	Medburn 85-485 Medburn 85-485				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			PF2 PF3 APF FR MT_TEMP kwhT kwhE kwhE	MBS. LUCK of DIS. OD V M MBS. LUCK of DIS. OD V M MBS. LUCK of DIS. DIV. M MBS. LUCK DIS. DIV. M			
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24.3.2 MHSS 24.3.3 MHSS 24.3.4 MHSS 24.3.4 MHSS 24.3.4 MHSS 24.3.6 MHSS 24.3.6 MHSS 24.3.6 MHSS 24.2.6 MHSS 24.2.7 MHSS 24.2.2 MHSS 24.2.2 MHSS 24.2.2 MHSS 24.2.2 MHSS 24.2.2 MHSS 24.2.1 MHSS 24.2.1 MHSS 24.2.3 MHSS 24.3.3	3 1100 min 5 1100 min 6 1100 min </td <td>055 062 055</td> <td>COLORDOR, BEARING, BARRING, BARRING, BARRING, BARRING, BARRING, CONTOCOME, BEARRING, CONTOCOM</td> <td>And Andreas Marker Andreas Marker Annuel The Multites VicaA Hark In Annuel The Multites VicaA Hark In Annuel The Multites VicaA Hark In Annuel In Multites VicaA Hark In Annuel In Annuel In Annuel I In Annuel Information The Multites Information Product And Constant Annuel Information Product And Constant Annuel Information Product And Constant Annuel Information Annuel Information Annuel</td> <td>Medburn 85-485 Medburn 85-485</td> <td></td> <td></td> <td></td> <td>1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1</td> <td></td> <td></td> <td>PF2 PF3 APF FR MT TEMP KWbTI KWbE KVArh_I KVArh_E</td> <td>BBS_11000 of DBS_000 v BB BBS_11000 of DBS_000 v BB <td></td><td></td><td></td></td>	055 062 055	COLORDOR, BEARING, BARRING, BARRING, BARRING, BARRING, BARRING, CONTOCOME, BEARRING, CONTOCOM	And Andreas Marker Andreas Marker Annuel The Multites VicaA Hark In Annuel The Multites VicaA Hark In Annuel The Multites VicaA Hark In Annuel In Multites VicaA Hark In Annuel In Annuel In Annuel I In Annuel Information The Multites Information Product And Constant Annuel Information Product And Constant Annuel Information Product And Constant Annuel Information Annuel	Medburn 85-485 Medburn 85-485				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			PF2 PF3 APF FR MT TEMP KWbTI KWbE KVArh_I KVArh_E	BBS_11000 of DBS_000 v BB BBS_11000 of DBS_000 v BB <td></td> <td></td> <td></td>			
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24.1.2 Miles 24.2.2 Miles 24.2 Miles	3 1.120, HT 5 1.120, HT 6	data 0.02 data <td></td> <td>And Andreas Marker Andreas Marker Annuel The Multites VicaA Hark In Annuel The Multites VicaA Hark In Annuel The Multites VicaA Hark In Annuel In Multites VicaA Hark In Annuel In Annuel In Annuel I In Annuel Information The Multites Information Product And Constant Annuel Information Product And Constant Annuel Information Product And Constant Annuel Information Annuel Information Annuel</td> <td>Medihar 85-485 Medihar 85-485 Mediha</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>PF2 PF3 APF FR MT_TEMP KWhT KWHE KVArh_I KVArh_E CMD_ON CMD_ON CMD_OF</td> <td>Bits (1) (0) // 150, 00 v /8 Bits (1) (0) // 150, 00 v /8</td> <td></td> <td></td> <td></td>		And Andreas Marker Andreas Marker Annuel The Multites VicaA Hark In Annuel The Multites VicaA Hark In Annuel The Multites VicaA Hark In Annuel In Multites VicaA Hark In Annuel In Annuel In Annuel I In Annuel Information The Multites Information Product And Constant Annuel Information Product And Constant Annuel Information Product And Constant Annuel Information Annuel	Medihar 85-485 Medihar 85-485 Mediha							PF2 PF3 APF FR MT_TEMP KWhT KWHE KVArh_I KVArh_E CMD_ON CMD_ON CMD_OF	Bits (1) (0) // 150, 00 v /8			
24.1.2. Miles 24.2.2. Miles 24.2.2. Miles 24.2.2. Miles 24.2.3. Miles 24.2.4.1.3. Miles 24.2.4.1.3. Miles 24.2.4.1.4. Miles 24.2.4.1.4.1.5. Miles 24.2.4.1.5. Miles 24.2.6. Miles 24.4.6. Miles 24.6. Mi	30 1130, HT 31 1130, HT 3 1120, HT 4 1120, HT 5 1120, HT	data 0.001 data 0.001 </td <td></td> <td>And Andreas Marker Manifestion Marker Service To Work Network Service Service To Work Network Service Service To Work Network Service Service To Work Network Service</td> <td>Medihan 85-485 Medihan 85-485</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>PF2 PF3 APF R MT_TEMP KWhT KWhT KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/H_</td> <td>BBS_11000 of DBS_000 v BB BBS_11000 of DBS_000 v BB <td></td><td></td><td></td></td>		And Andreas Marker Manifestion Marker Service To Work Network Service Service To Work Network Service Service To Work Network Service Service To Work Network Service	Medihan 85-485 Medihan 85-485							PF2 PF3 APF R MT_TEMP KWhT KWhT KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/H_	BBS_11000 of DBS_000 v BB BBS_11000 of DBS_000 v BB <td></td> <td></td> <td></td>			
14.12 Milesel	3 1320, MT 4 1320, MT 5 1420, MT 6 1320, MT 5 1320, MT </td <td>0.052, 0.012 0.055, 0.012 0.055, 0.022 0.055, 0.022 0.</td> <td></td> <td>Sandhanan bahar Sandhanan bahar Sanga Da Sandhan Sandha Sanga Da Sandhan Sandha Sanga Da Sandhan Ba Sandha Ba Sandha Sandhan Sandha Sandhan Sandha Sa</td> <td>Medihar 85-485 Medihar 85-485 Mediha</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>PF2 PF3 APF R MT_TEMP KWhT KWhT KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/H_</td> <td>BBS_11000 of DBS_000 v BB BBS_11000 of DBS_000 v BB <td></td><td></td><td></td></td>	0.052, 0.012 0.055, 0.012 0.055, 0.022 0.055, 0.022 0.		Sandhanan bahar Sandhanan bahar Sanga Da Sandhan Sandha Sanga Da Sandhan Sandha Sanga Da Sandhan Ba Sandha Ba Sandha Sandhan Sandha Sandhan Sandha Sa	Medihar 85-485 Medihar 85-485 Mediha							PF2 PF3 APF R MT_TEMP KWhT KWhT KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/H_	BBS_11000 of DBS_000 v BB BBS_11000 of DBS_000 v BB <td></td> <td></td> <td></td>			
14.12 MIRSEN 14.13 MIRSEN 14.13 MIRSEN 14.14 MIRSEN 14.15 MIRSEN 14.16 MIRSEN 14.17 MIRSEN 14.18 MIRSEN 14.19 MIRSEN 14.11 MIRSEN 14.12 MIRSEN 14.13 MIRSEN 14.14 MIRSEN 14.15 MIRSEN 14.16 MIRSEN 14.17 MIRSEN 14.18 MIRSEN 14.19 MIRSEN 14.24 MIRSEN 14.25 MIRSEN 14.24 MIRSEN 14.25 MIRSEN 14.26 MIRSEN 14.27 MIRSEN 14.28 MIRSEN 14.30 MIRSEN 14.31 MIRSEN 14.32 MIRSEN 14.34 MIRSEN 14.35 MIRSEN 14.34 MIRSEN <td>3. 3.<</td> <td>0.053, 00.01 0.055, 00.01 0.</td> <td></td> <td>Andhesenske skale Andhesenske skale Andhesenske skale Andhesenske skale Andere Statuenske ska</td> <td>Medihar 85-485 Medihar 85-485 Mediha</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>PF2 PF3 APF R MT_TEMP KWhT KWhT KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/H_</td> <td>Bits: 1.100 of 1.001 are 0.00 or 0.00 Bits: 1.100 of 1.001 are 0.00 or 0.0 Bits: 1.100 of 1.001 are 0.00 or 0.000 or 0.0 Bits: 1.100 of 1.001 are 0.00 or 0.000 or 0.0 Bits: 1.100 of 1.001 are 0.00 or 0.000 or 0.</td> <td></td> <td></td> <td></td>	3. 3.<	0.053, 00.01 0.055, 00.01 0.		Andhesenske skale Andhesenske skale Andhesenske skale Andhesenske skale Andere Statuenske ska	Medihar 85-485 Medihar 85-485 Mediha							PF2 PF3 APF R MT_TEMP KWhT KWhT KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/h_E KWA/H_	Bits: 1.100 of 1.001 are 0.00 or 0.00 Bits: 1.100 of 1.001 are 0.00 or 0.0 Bits: 1.100 of 1.001 are 0.00 or 0.000 or 0.0 Bits: 1.100 of 1.001 are 0.00 or 0.000 or 0.0 Bits: 1.100 of 1.001 are 0.00 or 0.000 or 0.			
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14.12 Miles 24.12 14.13 Miles 24.14 14.13 Miles 24.14 14.13 Miles 24.14 14.14 Miles 24.14 14.15 Miles 24.14 14.15 Miles 24.14 14.15 Miles 24.14 14.15 Miles 24.14 14.15 Miles 24.14 14.12 Miles 24.14 14.14 Miles 2	3.3 1.320, HT 5.4 1.320, HT 5.4 1.320, HT 5.4 1.320, HT 5.4 1.320, HT 5.5 1.320, HT 5.6 1.320, HT 5.7 1.320, HT 5.8 1.320, HT 5.4 1.320, HT 5.5 1.320, HT 5.6 1.320, HT 5.7 1.320, HT 5.8 1.320, HT 5.4 1.320, HT 5.5 1.320, HT 5.6 1.320, HT 5.7 1.320, HT 5.8 1.320, HT 5.4 1.320, HT 5.5 1.320, HT 5.6 1.320, HT 5.7 1.320, HT 5.8 1.320, HT 5.4 1.320, HT 5.5 1.320, HT 5.6 1.320, HT 5.7 1.320, HT 5.8 1.320, HT 5.8 1.320, HT 5.8	0.05: 0.01 0.05: 0.02 0.05:		And Andreas Material Manufactures Material Servers 10 Note: 10 Noo	Medihar 85-485 Medihar 85-485 Mediha							F2 F3 APT F8 MT TEMP ENT ENT ENT ENT ENT ENT ENT ENT ENT ENT	BDS_1100 of JDS1000 V B BDS11100 of JDS100 V B <td< td=""><td></td><td></td><td></td></td<>			
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	3.3 1.1287 HT 3.4 1.1287 HT 3.5 1.1287 HT 3.6	035.002 045.002 045.002 <		Nonlinearia bater Nonlinearia bater Nonlinearia bater Nonlinearia bater Nonlinearia Presti To Unifika vocatise Nonlinearia Presti To Unifika vocatise Nonlinearia Presti Nonlinearia Presti Nonlinea	Mathaba 454							F2 F3 APT F8 MT TEMP ENT ENT ENT ENT ENT ENT ENT ENT ENT ENT	Box 1.100 of 1201.000 v 30. Box 1.100 of 1201.000 v 30. Box 1.000 of 1.000 v 30.			
	3.3 1.1287 HT 3.4 1.1287 HT 3.5 1.1287 HT 3.6	000 001 001 000 001		ManBacket bolz ManBacket bolz Sample To MUTRA VEATRAL Proget To MUTR	Mashan Soft Sector Mashan							P22 P73 P74 P75 P75 P77 P77 P77 P77 P77 P77 P77 P77	Box 1, 100 of 120, 000 v 80 Box 1, 100 of 120, 000 v 81 Box 1, 100 of 120, 000 v 84 Box 1, 100 of 120, 000 v 84 </td <td></td> <td></td> <td></td>			

15.19	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	8 PAHSE TO NEUTRAL VOLATGE	Modbus:RS-485			1			V		MRSS_11KV_HT_SPARE_OG_V_BN
15.20	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	RY VOLTAGE	Modbus:RS-485			1			ν.		MRSS_11KV_HT_SPARE_OG_V_RY
15.21	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	YB VOLTAGE	Modbus:RS-485			1			ν.	YB	MRSS_11KV_HT_SPARE_OG_V_YB
15.22	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	BR VOLTAGE	Modbus:RS-485			1			ν.		MRSS_11KV_HT_SPARE_OG_V_BR
15.23	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	8 PHASE LINE CURRENT	Modbus:RS-485			1			U 10	t	MRSS_11KV_HT_SPARE_OG_L_R
15.24	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	Y PHASE LINE CURRENT	Modbus:RS-485			1			0	(MRS5_11KV_HT_SPARE_OG_LY
15.25	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	B PHASE LINE CURRENT	Modbus:RS-485			1			ν.	8	MRSS_11KV_HT_SPARE_OG_V_B
15.26	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	NEUTRAL LINE CURRENT	Modbus:RS-485			1			- U	N	MRS5_11KV_HT_SPARE_OG_LN
15.27	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	POWER FACTOR (Q1)	Modbus:RS-485			1			PF	1	MRS5_11KV_HT_SPARE_OG_PF1
15.28	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	POWER FACTOR (Q2)	Modbus:RS-485			1			PF	2	MRSS_11KV_HT_SPARE_OG_PF2
15.29	MRSS	11KV_HT	SPARE OG	OUTGOING BREAKER	POWER FACTOR (Q3)	Modbus:RS-485			1			PF	3	MRSS 11KV HT SPARE OG PF3
15.30	MRSS	11KV_HT	SPARE OG	OUTGOING BREAKER	AVERAGE POWER FACTOR (QA)	Modbus:RS-485			1			فم	4	MRSS 11KV HT SPARE OG APF
15.31	MRSS	11KV_HT	SPARE OG	OUTGOING BREAKER	FREQUENCY	Modbus:RS-485			1			FR		MRSS 11KV HT SPARE OG FR
15.32	MRSS	11KV HT	SPARE OG	OUTGOING BREAKER	METER TEMPERATURE	Modbus:RS-485			1			M	T. TEMP	MRSS 11KV HT SPARE OG MT TEMP
15.33	MRSS	11KV HT	SPARE OG	OUTGOING BREAKER	ACTIVE TOTAL IMPORT-kWhT01	Modbus:RS-485			1			kv	VbTI	MRSS 11KV HT SPARE OG kWhTI
15.34	MRSS	11KV HT	SPARE OG	OUTGOING BREAKER	ACTIVE TOTAL EXPORT-kWhTIE)	Modbus:RS-485			1			kv	VhE	MRSS 11KV HT SPARE OG kWhE
15.35	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	REACTIVE TOTAL IMPORT-kVArb(I)	Modbus:RS-485			1			kv	Wrh_J	MRSS_11KV_HT_SPARE_OG_kVAth_I
15.36	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	REACTIVE TOTAL EXPORT- kVArhJI)	Modbus:RS-485			1			kv		MRS5_11KV_HT_SPARE_OG_kVA/h_E
15.37	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	CUMULATIVE POWER ON MINUTES	Modbus:RS-485			1					MRSS_11KV_HT_SPARE_OG_
15.38	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	CUMULATIVE POWER OFF MINUTES	Modbus:RS-485			1					MRSS_11KV_HT_SPARE_OG_
15.39	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	CUMULATIVE LOAD ON MINUTES	Modbus:RS-485			1					MRSS_11KV_HT_SPARE_OG_
15.40	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	CUMULATIVE LOAD OFF MINUTES	Modbus:RS-485			1					MRSS_11KV_HT_SPARE_OG_
15.41	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	Protection Relay	IED				1				MRSS_11KV_HT_SPARE_OG_
15.42	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	On Command	VFC					1	C3.	AD_ON	MRSS_11KV_HT_SPARE_OG_CMD_ON
15.43	MRSS	11KV_HT	SPARE_OG	OUTGOING BREAKER	Off Command	VFC					1	Ch.	AD_OFF	MRSS_11KV_HT_SPARE_OG_CMD_OFF

0 1								DEV	VICE	-		DPE				Restance Restance Restance Restance
++	Station Code	Louipment Tag Equipment Nat	THE Equipment Type	Description Existing Solar Station 11 LY HT PANEL	Signal Type	FROM	то	MODBUS	ED	IEC 6185	0 01	00	AI	AD	10 Tag Stucture	Tag Name Tag Description Event Logging Historial Recording Presiduation
2	MISS MISS MISS	118V_HT TR1_IN1 118V_HT TR1_IN1 118V_HT TR1_IN1 118V_HT TR1_IN1	INCOMMING BREAKTR INCOMMING BREAKTR INCOMMING BREAKTR	Transformer -1 (Incomer-1) UR Switch Remote Position On Status	VEC	-	Ħ			-	1		-		LR ON	MISS_ILEV.VIT_TRI_NIL_LR MISS_ILEV.VIT_TRI_NIL_LON
4	MILSS MILSS MILSS MILSS	1180/ HT TR1 IN1 1180/ HT TR1 IN1 1180/ HT TR1 IN1 1180/ HT TR1 IN1	INCOMMING BILAKER INCOMMING BILAKER INCOMMING BILAKER	Off Status Trip Status Soring Charge Ready to Close (RTC)	VTC VTC						1				OFF TBP SC	MM5.1104/07.718.00.0 MM5.1104/07.118.0.07 MM5.1104/07.118.00.77
7	MISS MISS MISS	11KV_HT TR1_IN1 11KV_HT TR1_IN1 11KV_HT TR1_IN1 11KV_HT TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Service Position Test Position	VTC VTC VTC						1				RTC SER TST ER	MMS_11AV_HT_TRL_NR_HTC MMS_11AV_HT_TRL_NR_LT MMS_11AV_HT_TRL_NR_LT
10 11 12	MILSS MILSS	11KV_HT 11KV_HT TR1_IN1 11KV_HT TR1_IN1	INCOMMING BREAKER	Emergency Trip Upstream breaker Trip Control Supply Healthy	VFC VFC						1				E_TRP UB_TRP CSH	1200 / III. (J. 100 / III.) 1200 / III. (J. 100 / III.) MMS (1100 / III.) TR (III. CHI
13 14 15	MILSS MILSS MILSS	11KV_HT TR1_IN1 11KV_HT TR1_IN1 11KV_HT TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Multifunction Meter Earth Fault DC Status	85.485 IEC 61850 IEC 61850			1		1					EF DC	AMER TION OF THE BUT PE
16 17 15	MILSS MILSS MILSS	11KV_HT TR1_IN1 11KV_HT TR1_IN1 11KV_HT TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Trip Circuit Healthy Under Voltage Trip Protection Relay	IEC 61850 IEC 61850 IEC 61850				1	1					TRP_CH UV_TRP	MRS2 TIRO NL JUE WI POLICE MRS2 TIRO NL JUE WI POLICE MRS2 TIRO NL JUE WI POLICE
19 20 21	MILSS MILSS MILSS	11KV_HT TR1_IN1 11KV_HT TR1_IN1 11KV_HT TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	PT Fuse Falure 011 WTI	VEC 61850 VEC					1	1				DIE DIE MUI	MISS_1100 /rT_TRL[N0_PTF MISS_1100 /rT_TRL[N0_PT MISS_1100 /rT_TRL[N0_PTF
22 23 24	MISS MISS MISS	11KV_HT TR1_IN1 11KV_HT TR1_IN1 11KV_HT TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Buchholz relay PRV MOG	VTC VTC VTC						1 1				BCH_R PRV MOG	MAGE_LINE()/(T_TAL_(MADEC))/ MAGE_LINE()/(T_TAL_(MADEC))/ MAGE_LINE()/(T_TAL_(MADMADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/(T_TAL_(MADAC))/ MAGE_LINE()/
25 26 27	MILSS MILSS MILSS	11KV_HT TR1_IN1 11KV_HT TR1_IN1 11KV_HT TR1_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	On Command Off Command Trip Coll	VTC VTC IEC 61850					1		1			CMD_ON CMD_OFF TBP_C	MISS_1100_HT_TRL[M1_CMD_OF MISS_1100_HT_TRL[M1_CMD_OFF MISS_1100_HT_TRL[M1_CMD_OFF
1	MILSS MILSS MILSS	11KV_HT TR1_IN1 11KV_HT TR2_IN2 11KV_HT TR2_IN2	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Emergency Trip Transformer -2 (Incomer-2) LR Switch Remote Position	VEC 61850					1	1				E_TRP LR	MISS_1100/m_7m1/N1_k_TB9 MISS_1100/m_7m2_N2_K
3	MILSS MILSS MILSS	11KV HT TR2_IN2 11KV_HT TR2_IN2 11KV_HT TR2_IN2 11KV_HT TR2_IN2 11KV_HT TR2_IN2	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	On Status Off Status Trip Status	VFC VFC						1				ON OFF TRP	MISS_1100 /rT_TR2_[N2_OFF MISS_1100 /rT_TR2_[N2_OFF MISS_1100 /rT_TR2_[N2_TRP
5 6 7 8	MILSS MILSS MILSS	11KV_HT TR2_IN2 11KV_HT TR2_IN2	INCOMMING BREAKER INCOMMING BREAKER	Spring Charge Ready to Close (RTC) Service Position	VFC VFC VFC	_					1	_	_		SC RTC SER	MMS1, 1100, /rt, 712, 404, 24 MMS1, 1100, /rt, 712, 404, 217 MMS2, 1100, /rt, 712, 404, 217 MMS1, 1100, /rt, 712, 404, 217
9	MILSS MILSS MILSS	11KV_HT TR2_IN2 11KV_HT TR2_IN2 11KV_HT TR2_IN2 11KV_HT TR2_IN2 11KV_HT TR2_IN2	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Test Position Earth Emergency Trip Upstream breaker Trip	VFC						1				LSI ER L_TRP US TRP	0002_100_01_02_02_01 MMS_110_01_07_02_02_10 MMS_110_01_07_02_02_1_070
12	MILSS MILSS MILSS	11KV_HT TR2_IN2 11KV_HT TR2_IN2 11KV_HT TR2_IN2	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Control Supply Healthy Multifunction Meter Earth Fault	VFC 85.485 IEC 61850			1		1	i				CSH EF	MIS_1101/H_TR_012_CH
15	MILSS MILSS MILSS	11KV_HTTR2_IN2 11KV_HTTR2_IN2 11KV_HTTR2_IN2	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	DC Status Tris Circuit Healthy Under Voltage Trip	IEC 61850 IEC 61850 IEC 61850					1 1 1					DC TRP_CH UV_TRP	MISS_110V}/m_TR2_[N2_DC MISS_110V}/m_TR2_[N2_TRP_CH MISS_110V}/m_TR2_[N2_TRP_CH
15 19 20	MILSS MILSS MILSS	11KV_HT TR2_IN2 11KV_HT TR2_IN2 11KV_HT TR2_IN2	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Protection Relay PT Fune Falure OTI	IEC 61850 IEC 61850 VFC				1	1	1				PTIF	M85_110/,H7_TR1_R0_P7FF M85_110/,H7_TR1_R0_P7FF
21 22	MILSS MILSS MILSS	11KV_HT TR2_IN2 11KV_HT TR2_IN2 11KV_HT TR2_IN2	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	WTI Buchholz relay PRV	VTC VTC						1				WTI BOL_R PRV	MISS_1100_IT_TR2_N2_WT1 MISS_1100_IT_TR2_N2_DCH_R
24 25 26	MILSS MILSS MILSS	11KV_HT TR2_IN2 11KV_HT TR2_IN2 11KV_HT TR2_IN2	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	MOS On Command Off Command	VFC VFC VFC						1	1			MOG CMD_ON CMD_OFF	MAG_1101/01_T01_00_MAG MAG_1101/01_T01_00_MAG MAG_1101/01_T01_00_MAG MAG_1101/01_T01_00_MAG
27 28	MILSS MILSS MILSS	11KV_HT TR2_IN2 11KV_HT TR2_IN2 11KV_HT TR2_IN3	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Trip Col Emergency Trip Transformer -3 (incomer-3)	IEC 61850 IEC 61850					1					TBP_C E_TRP	MISS_1100_HT_TR2_N2_THP_C MISS_1100_HT_TR2_N2_C_THP
1 2 3	MILSS MILSS MILSS	118V_HT TR2_IN3 118V_HT TR2_IN3 118V_HT TR2_IN3	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	LR Switch Remote Position On Status Off Status	VFC VFC VFC	<u> </u>					1	-	-		LR ON	MM5_1102 (m_172_00_15 MM5_1102 (m_172_00_27) MM5_1102 (m_172_00_27)
5	MILSS MILSS MILSS MILSS	118V_HT TR2_IN3 118V_HT TR2_IN3 118V_HT TR2_IN3 118V_HT TR2_IN3	INCOMMING BELAKER INCOMMING BELAKER INCOMMING BELAKER	Trip Status Spring Charge Ready to Close (RTC) Comine Dealtion	VFC VFC VFC	-				-	1	-	1-	-	TRP SC RTC	MRS5_11KV_HT_TR2_IN1_TRP
5 9	MILSS MILSS	118V_HT TR2_IN3 118V_HT TR2_IN3 118V_HT TR2_IN3 118V_HT TR2_IN3 118V_HT TR2_IN3	INCOMMING BELAKER INCOMMING BELAKER INCOMMING BELAKER	Service Position Test Position Earth	VFC VFC VFC	-				-	1	-	1-	-	SER TST ER	900, 1202 (F, 120, 20, 10) MID, 1202 (F, 120, 20, 10) MID, 1202 (F, 120, 20, 10) MID, 1202 (F, 120, 20, 11) MID, 1202 (F, 120, 20, 15) MID, 1202 (F, 120, 15) MI
10 11 12	MILSS MILSS MILSS MILSS	118V_HT TR2_IN3 118V_HT TR2_IN3 118V_HT TR2_IN3 118V_HT TR2_IN3	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Emergency Trip Upstream breaker Trip Control Supply Healthy Multifunction Meter	VFC VFC	E-	Ħ			-	1	-	-	-	E_TRP UB_TRP CSH	MMS_1101/m1718_201_0_101 MMS_1101/m1718_201_0_m1PP MMS_1101/m1718_201_C8H
14	MILSS MILSS MILSS MILSS	11KV_HT TR2_IN3 11KV_HT TR2_IN3 11KV_HT TR2_IN3 11KV_HT TR2_IN3 11KV_HT TR2_IN3	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Multifunction Meter Earth Fault DC Status Trip Circuit Healthy	85.485 IEC 61850 IEC 61850 IEC 61850	-	Ħ	1		1	F	-	1		EF DC TIP_CH	MM55_1100/m1782_M81_0F MM55_1100/m1782_M81_0C MM55_1100/m1782_M81_0C
17	MILSS MILSS MILSS	118V_HT TR2_IN3 118V_HT TR2_IN3 118V_HT TR2_IN3	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Trip Circuit Healthy Under Voltage Trip Protection Relay PT Fuse Fallure	EC 61850 EC 61850 EC 61850 EC 61850	-	Ħ		1	1	F		-		TBP_CH UV_TBP PTEF	MISS_1100_HT_TR2_NIL_U_TRP
20 21	MILSS MILSS MILSS	11KV_HT TR2_N3 11KV_HT TR2_N3 11KV_HT TR2_N3 11KV_HT TR2_N3 11KV_HT TR2_N3	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	PT Fuxe Falure OTI WTI Buchholz relay	VTC VTC VTC	-	Ħ			È	1		-		PTSF OTI WTI BCH_R	MMS_1160/IT_TU_MC_FFF MMS_1160/IT_TU_MC_FF MMS_1160/IT_TU_MC_FF
23	MILSS MILSS MILSS	11KV_HT TR2_IN3 11KV_HT TR2_IN3 11KV_HT TR2_IN3 11KV_HT TR2_IN3 11KV_HT TR2_IN3	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	PW/ MOG On Command	VTC VTC VTC	-	Ħ			-	1	,	-		PRV MOG CMD ON	MIS_110_/FT_TR2_NI_MOG
26 27 25	MILSS MILSS MILSS	11KV_HT TR2_IN3 11KV_HT TR2_IN3 11KV_HT TR2_IN3	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Off Command Trip Col Emergency Trip	VFC IEC 61850 IEC 61850					1	E				CMD_DIF CMD_DIF TAP_C E_TRP	1005_1101_01_1121_010_200_000 1005_1101_01_1121_010_200_000 1005_1101_01_1121_010_200_000
2	MILSS MILSS MILSS	118V HT BC 118V_HT BC 118V_HT BC	BUS COUPLER BUS COUPLER BUS COUPLER	BUSCOUPLER I.R. Switch Remote Position On Status	VEC	E				Ē	1	E		Ľ.	LR ON	
3 4 5	MILSS MILSS MILSS	11KV_HT BC 11KV_HT BC 11KV_HT BC	BUS COUPLER BUS COUPLER BUS COUPLER	Off Status Trip Status Spring Charge	VTC VTC VTC						1				01F TBP 5C	800_1107_110_11 800_1107_110_10_1 800_1107_110_10_1 800_1107_110_10_1 800_1107_110_10_1 800_1107_110_10_1 800_1107_110_10_1 800_1107_110_10_1 800_1107_110_10_1 800_1107_10_10_1 800_100_10_1 800_100_10_1 800_100_10_10_1 800_100_10_10_10_1 800_100_10_10_10_10_10_10_10_10_10_10_10_
6	MILSS MILSS MILSS	11KV_HT BC 11KV_HT BC 11KV_HT BC	BUS COUPLER BUS COUPLER BUS COUPLER	Ready to Close (RTC) Service Position Text Position	VFC VFC VFC						1				RTC SER TST	MMS_1100/HT_BC_HTC MMS_1100/HT_BC_HT MMS_1100/HT_BC_HT
9 10 11 12	MILSS MILSS MILSS	11KV_HT BC 11KV_HT BC 11KV_HT BC	BUS COUPLER BUS COUPLER BUS COUPLER	Control Supply Healthy Trip Circuit Healthy Under Voltage Trip	VFC VFC						1				CSH TRP_CH UV_TRP	MMS_1100/1F_8C_CH MMS_1100/1F_8C_TH2_FT MMS_1100/1F_8C_TH2_FT MMS_1100/1F_8C_TH2_FT
13	MISS MISS MISS	11KV_HT BC 11KV_HT BC 11KV_HT BC	BUS COUPLER BUS COUPLER BUS COUPLER	Emergency Trip DC Status Earth	VFC VFC						1				E_TRP DC ER	
16 17	MILSS MILSS MILSS	11KV_HT BC 11KV_HT BC 11KV_HT BC	BUS COUPLER BUS COUPLER BUS COUPLER	On Command Off Command Trip Coll	VFC VFC							1			CMD_ON CMD_OIT TIP_C E_TRP	000_1110_1116_11 000_1110_1116_11 000_1110_111
1	MILSS MILSS MILSS	11KV_HT BC 11KV_HT MR51_IN1 11KV_HT MR51_IN1 11KV_HT MR51_IN1	BUS COUPLER INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Emergency Trip Main Receiving Station-1 (Incomer-1) IR Switch Remote Position On Status	VEC						1				L, INF	MESS THAY HT MESS INT HE
3	MILSS MILSS	11KV_HT MR51_IN1 11KV_HT MR51_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Off Status Trip Status	VFC VFC						1				OFF TBP	MMS_110X_/FT_MMS_1NL_0FT MMS_110X_/FT_MMS_1NL_0FT MMS_110X_/FT_MMS_1NL_0FT MMS_110X_/FT_MMS_1NL_0FT
6	MILSS MILSS MILSS	11KV_HT MR51_IN1 11KV_HT MR51_IN1 11KV_HT MR51_IN1 11KV_HT MR51_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Spring Charge Ready to Close (RTC) Service Position	VFC VFC						1				SC RTC SER	MISS_LINV_HT_MISS_LINU_NTC MISS_LINV_HT_MISS_LINU_SET
9	MILSS MILSS MILSS	11KV HT MHS1 IN1 11KV HT MHS1 IN1 11KV HT MHS1 IN1 11KV HT MHS1 IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Earth Control Supply Healthy Emenancy Trip	VTC VTC						1				ER CSH E_TRP	MMS_1140/17 MMS_1141_21 MMS_1140/17 MMS_1141_21 MMS_1140/17 MMS_1141_21
12 13 14	MILSS MILSS MILSS	11KV_HTMR51_IN1 11KV_HTMR51_IN1 11KV_HTMR51_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	DC Status Trip Circuit Healthy Under Voltare Trip	EC 61850 EC 61850					1 1					DC TIP_CH UV_TRP	MISS_110/JHT_MISS_NA_DC MISS_110/JHT_MISS_NA_TBP_CH
15 16 17	MILSS MILSS MILSS	11KV_HT MR51_IN1 11KV_HT MR51_IN1 11KV_HT MR51_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Earth Fault PT Fuxe Failure Protection Belay	EC 61850 EC 61850				1	1					bitte Et	WR27100/LUWR2101/LU WR27100/LWR2101/LU WR27100/LWR2101/LU
19	MILSS MILSS MILSS	11KV_HT MR51_IN1 11KV_HT MR51_IN1 11KV_HT MR51_IN1 11KV_HT MR51_IN1	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Multifunction Meter On Command Off Command	85.485 VFC VFC			1				1			CMD_ON CMD_OIF	MISS, JIAV, HT, MISI, HAI, EAND, DN MISS, JIAV, HT, MISI, BIA, EAND, DT MISS, JIAV, HT, MISI, BIA, THY C.
22	MILSS MILSS MILSS	11KV_HT MR51_IN1 11KV_HT MR51_IN1 11KV_HT MR52_IN2	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Trip Coll Emergency Trip Main Receiving Station-2 (Incomer-2)	IEC 61850 IEC 61850					1					TBP_C E_TRP	MISS_1102_0T_MISS_NL_F_TRP
1 2 3 4	MILSS MILSS MILSS MILSS	11KV_HT MR52_IN2 11KV_HT MR52_IN2 11KV_HT MR52_IN2 11KV_HT MR52_IN2 11KV_HT MR52_IN2	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	LR Switch Remote Position On Status Off Status Tris Status	VFC VFC						1				LR ON OFF	MMSS_1102/HT_MMS2/N22/HT MMSS_1102/HT_MMS2/N2_ON MMSS_1102/HT_MMS2/N2_OFF
5	MILSS MILSS	11KV HT MR52 IN2 11KV HT MR52 IN2	INCOMMING BREAKER INCOMMING BREAKER	Sprine Charee Ready to Close (RTC)	VFC VFC						1				TRP SC RTC SZR	INDE
5 9	MILSS MILSS MILSS	11KV_HT MR52_IN2 11KV_HT MR52_IN2 11KV_HT MR52_IN2 11KV_HT MR52_IN2 11KV_HT MR52_IN2	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Service Position Test Position Earth Control Supply Healthy	VFC VFC						1				SER TST ER CTN	MISS_1102_VIMISS_102_VI_
11 12	MILSS MILSS MILSS MILSS	11KV_HT MR52_IN2 11KV_HT MR52_IN2 11KV_HT MR52_IN2 11KV_HT MR52_IN2 11KV_HT MR52_IN2	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Control Supply Healthy Emergency Trip DC Status Trip Circuit Healthy	VEC IEC 61850	-	Ħ			1	1	-			CSH E_TRP DC TRP_CH	MMS5_110X_0/F_3MMS2_1042_CHA MMS5_110X_0/F_3MMS2_1042_CFAP MMS5_110X_0/F_3MMS2_1042_CFAP MMS5_110X_0/F_3MMS2_1042_FAP
15	MILSS MILSS MILSS	11KV_HT MI52_IN2 11KV_HT MI52_IN2 11KV_HT MI52_IN2	INCOMMING BILACE INCOMMING BILACE INCOMMING BILACE INCOMMING BILACE	Under Voltage Trip Earth Fault PT Fune Failure	EC 61850 EC 61850 EC 61850	E	E		E	1	E			L	199_C11 UV_TRP EF PTFF	MMS_110()17(MMS_102()19) MMS_110()17(MMS_102()19) MMS_110()17(MMS_102()19) MMS_110()17(MMS_102()19) MMS_110()17(MMS_102()19) MMS_110()17(MMS_102()19) MMS_110()17(MMS_102()19) MMS_110()17(MMS_102()19) MMS_110()17(MMS_102()19) MMS_110()17(MMS_102()19) MMS_110()17(MMS_102()19) MMS_110()17(MMS_102()19) MMS_110()17(MMS_102()19) MMS_110()17(MMS_102()19) MMS_110()17(MS_102()19)MMS_110()17(MS_102()19)MMS_110()17(MS_102()19)MMS_110()17(MS_102()19)MMS_110()17(MS_102()19)MMS_110()17(MS_102()19)MMS_110()17(MS_102()19)MMS_110()17(MS_102()19)MMS_110()17(MS_102()19)MMS_110()17(MS_102()19)MMS_110()17(MS_102()19)MMS_110()17(MS_102()19)MMS_110()17(MS_102()19)MMS_110()17(MS_102()19)MMS_110()17(MS_1
18	MILSS MILSS MILSS	11KV_HT MR52_IN2 11KV_HT MR52_IN2 11KV_HT MR52_IN2	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Protection Relay Multifunction Meter On Command	85 485 VTC	E		1	1	Ē	E	1		Ľ.	CMD_ON	MISS_110/_JIT_MIS2_ING_CMD_ON
19 20 21 22	MILSS MILSS MILSS	11KV_HT MR52_IN2 11KV_HT MR52_IN2 11KV_HT MR52_IN2	INCOMMING BREAKER INCOMMING BREAKER INCOMMING BREAKER	Off Command Trip Coll Emergency Trip	VTC IEC 61850 IEC 61850					1		1			CMD_OFF TBP_C t_TRP	MISS_1102/117_MISS_100_CMD_C07 MISS_1102/117_MISS_100_2700_C MISS_1102/11/MISS_100_2707_C
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Rev Sr.No. Station Code	Equipment Tag Equipment Name	Equipment Type Description Exiting Central Station from where the 1121 ring law, from different accurrent/v/del of			0 IEC 62850 DI	TIPE DO AI	10	10 Tag Stachare	Tag Name	Tag Description	Event Logging Historial Recording Historic resolutions/Freq.
	21KV, HT 21KV, HT 21KV, HT 21KV, HT 21KV, HT 21KV, HT 21KV, HT	biling Cartol Retrien from where the 110 ring laws, from different programby/dole the common, will be created by PE control 111/V 17 MMR. Provides become Fram Oil Ration - 1 Free Ultrain herein heriton Contains Of Status Thy Solan Song Charge.	67-51 VFC VFC VFC VFC VFC VFC		1			LR DN OFF TRP SC RTC			
6 CR55 7 CR5 8 CR55 9 CR55 10 CR55 11 CR55 11 CR55 11 CR55 12 CR55 13 CR55 13 CR55 14 CR55 15 CR55 16 CR55 17 CR55 18 CR55 19 CR55 10 CR55 11 CR55	21KV,HT 21KV,HT 21KV,HT 21KV,HT 21KV,HT 21KV,HT 21KV,HT 21KV,HT	lenging Closel (ETC) lenging Paraton Lenging Constraint Careff Capyly Healthy Careff Capyly Healthy Emergency Trop O Clatala Trip Circuit Healthy	VFC VFC VFC VFC VFC VFC VFC EC61850 EC61850 EC61850		1 1 1 1 1 1 1 1			nrc 195 195 197 197 197 294 201 197 202 197 202 197 204 197 204 197 204 197 204 197 204 197 204 204 204 204 204 204 204 204 204 204			
14 085 14 085 15 085 16 085 17 085 18 085 19 085 20 085	11kV,3ft 11kV,3ft 11kV,3ft 11kV,3ft 11kV,3ft 11kV,3ft 11kV,3ft 11kV,3ft	Chy Costa Walkery Chadr Voluger Typ Earlt Sada P1 Son Faller Protection Mary Mahlurction Mare Chadronated Chadronated Chi Contrand	IC 61850 IC 61850 IC 61850 IC 61850 IC 61850 IC 61850 IS 645 VYC VYC	1		1		E_TRP PTEF CMD_CN CMD_GFF			
21 085 22 085 1 085 2 085 3 085 4 085 5 085	218V, HT 218V, HT 218V, HT 218V, HT 218V, HT 218V, HT 218V, HT 218V, HT	Ing Lots Emergency Trg Fronders Income From CHI Station-2 Al South Incode Voution Constates Of States Of States Englishing Cargo mention Spring Cargo mention	8C 61850 97C 97C 97C 97C 97C 97C 97C		1			119_2 C E_1T9 LR ON DGF T19 E			
6 085 7 085 8 085 9 085 10 085 11 085 12 085 13 085	218V_30 218	Rearly to Close (RTC) Service Toxition Test Proton Earth Correr of Logip Healthy Correr of Logip Healthy Energency Top OC Mains Pro Creat Healthy	994 VFC VFC VFC VFC VFC VFC VFC VFC VFC VFC		1			III. SR TS CSH CSH EC_TIPP BC CSH CSH CSH CSH CSH CSH CSH CSH CSH CS			
14 CR55 15 CR55 16 CR55 17 CR55 18 CR55 19 CR55 20 CR55 21 CR55 23 CR55	2182,30 2182,30 2182,30 2182,30 2182,30 2182,30 2182,30 2182,30 2182,30 2182,30	Under Voltage Trip Earth East P Tour Fahre P Tours Fahre Multifuction Mater On Command Of Command Prip Call	IIC 61150 IIC 61150 IIC 61150 IIC 61150 IIC 61150 IIC 61150 VVFC VVFC VVFC VVFC	1		1		17 9177 CMD_ON CMD_GFF 170_C - 120			
	11kV_JIT MRS1_N1 I 11kV_JIT MRS1_N1 I	NICHAMBA BERATA NICHAMBA BERATA SAbah Penerah Nakar NICHAMBA BERATA NICHAMBA B	VFC VFC VFC VFC VFC VFC VFC VFC					2007 2017 2017 2017 2017 2017 2017 2017	005_1140_1/1_M051_01_1 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0 005_1140_1/1_M051_01_0\\ 005_1140_1/1_M051_00_1/107_0		
	1100/01 MID104 (1000) 1100/01 MID104 (1000)	NCERMING BERARD Card Set Constru- NCERMING BERARD Card Set Constru- NCERMING BERARD Card Set Constru- NCERMING BERARD Construction of the NCERMING BERARD CONSTRUCTION OF THE NCERMING CONSTRUCTION OF THE NCERMING BERARD CONSTRUCTION OF THE NCERMING C	VFC VFC VFC VFC VFC EC 61850 EC 61850 EC 61850 EC 61850 EC 61850 EC 61850					nn 115 127 128 129 129 129 129 121 121 121 121 121 121	COLLEGATION (11, 11, 11, 11, 11, 11, 11, 11, 11, 11		
12 005 16 065 17 065 18 065 19 065 20 065 21 065 21 065 22 065	1107.01 MR1.04 1107.01 MR5.104 I 1107.07 MR5.104 I	NCENMOS ERIAZE PT Los Saras NCENMOS ERIAZE Preseños háry NCENMOS ERIAZE Autores Mare NCENMOS ERIAZE Autores Mare NCENMOS ERIAZE O (Form and NCENMOS ERIAZE O (Form and NCENMOS ERIAZE Tor Col NCENMOS ERIAZE Integrangen Tra	IIC 61850 IIC 61850 VFC VFC IIC 61850 IIC 61850 IIC 61850	1	1	1		CMD_ON CMD_OFF TRP_C T TRD	CRS_11XV_HT_MRS1_N1_CMD_CN CRS_11XV_HT_MRS1_N1_CMD_CFF CRS_11XV_HT_MRS1_N1_TRP_C CRS_11XV_HT_MRS1_N1_TRP_C		
1 085 2 085 4 085 5 085 6 085 8 085 8 085 8 085	11KV.JHT MHS2_HQ I 11KV.JHT MHS2_HQ I	INCOMMO BEALTS A Select Annual Autors INCOMMO BEALTS Of Select INCOMMO BEALTS Of Select INCOMMO BEALTS Of Select INCOMMO BEALTS Prof Select INCOMMO BEALTS Select Of Select INCOMMO BEALTS Select Of Select INCOMMO BEALTS Frequency OF SELECT	VFC VFC VFC VFC VFC VFC VFC VFC VFC		2 2 2 2 2 2 2 2 2 2 3 3 3			iR ON OFF 1799 62 8175 1757	Conception (1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1		
9 CR55 10 CR55 11 CR55 12 CR55 11 CR55 14 CR55 15 CR55 16 CR55	11KV.JHT MHS2_HQ I 11KV.JHT MHS2_HQ I	NICHAMAG BEALT Set NICHAMAG BEALT Set NICHAMAG BEALT Correl Gogly Healthy NICHAMAG BEALT Correl on the NICHAMAG BEALT OF The NICHAMAG BEALT OF THE NICHAMAG BEALT OF THE NICHAMAG BEALT SHOP	VTC VTC VTC EC 61850 EC 61850 EC 61850 EC 61850 EC 61850 EC 61850					1121 1122 1132 11 11 11 11 11 11 11 11 11 11 11 11 11	005_110()/1_ME2_ND_01 005_110()/1_ME2_ND_02N 005_110()/1_ME2_ND_02N 005_110()/1_ME2_ND_02N 005_110()/1_ME2_ND_02N 005_110()/1_ME2_ND_02N 005_110()/1_ME2_ND_02N 005_110()/1_ME2_ND_03N 005_110()/1_ME2ND_03N 005_100()/1_ME2ND_03N 005_100()/1_ME2ND_03N 005_100()/1_ME2		
17 085 18 085 29 085 21 085 21 085 22 085 22 085 1 085 22 085	11KV_JIT MIS2_N0_1 11KV_JIT MIS2_N0_1 11KV_JIT MIS2_N0_1 11KV_JIT MIS2_N0_1 11KV_JIT MIS2_N0_1 11KV_JIT MIS2_N0_1 11KV_JIT MIS2_N0_1 11KV_JIT	NICOMMEND BITATE Protection filmy NICOMMEND BITATE In Unified Meter NICOMMEND BITATE In Unified Meter NICOMMEND BITATE OF Command NICOMMEND BITATE OF Command NICOMMEND BITATE Prof.of NICOMMEND BITATE Prof.of Prof	8C61850 85485 VFC VFC 8C61850 8C61850 8C61850 8C61850 8C61850	1	1	1			CR55_1107_JHT_MR52_JN2_CMD_CN CR55_1107_JHT_MR52_JN2_CMD_CR5 CR55_1107_JHT_MR52_JN2_CMD_CF5 CR55_1107_JHT_MR52_JN2_CT89		
2 CR55 3 CR55 4 CR55 5 CR55 6 CR55 7 CR55 9 CR55 9 CR55	21XV,HT 21XV,HT 21XV,HT 21XV,HT 21XV,HT 21XV,HT 21XV,HT 21XV,HT 21XV,HT	On Statum Of Statum Try System Saring Charge Bearge To Charge (TC) Bearge To Charge To C	VFC VFC VFC VFC VFC VFC VFC VFC VFC					08 067 179 50 80 80 80 175 175 18			
10 CR55 11 CR55 12 CR55 13 CR55 14 CR55 14 CR55 15 CR55 16 CR55 17 CR55	21XV_HT 21XV_HT 21XV_HT 21XV_HT 21XV_HT 21XV_HT 21XV_HT 21XV_HT 21XV_HT	Control Scopply Healthy Emergency Try DS Statist Try Cricial Healthy Under Voltage Try Earth Faith P FLow Faith P FLow Faith P FLow Faith	VFC VFC EC 61850 EC 61850 EC 61850 EC 61850 EC 61850 EC 61850 EC 61850	1	1 1 1 1 1 1			k k k k k k k k k k k k k k k k k k k			
18 CRSS 29 CRSS 20 CRSS 21 CRSS 22 CRSS 085 1 CRSS 2 CRSS	11kV,9fT 11kV,9	MultiPaction Meter On Conversed Off Conversed Trip Col Emergency Trip BLS COUPLER IN Sector Herecte Position BLS COUPLER IN Sector Herecte Position BLS COUPLER IN Sector Herecte Position	85.485 VFC VFC EC6.1850 EC6.1850 VFC VFC VFC	1	1 1	1		CMD_ON CMD_OFF TIP_C E_TFP IR ON	CR5_1107_HT_BC_18 CR5_1107_HT_BC_08		
	Disc, HT BC 11kv, HT BC	BUS COUFIER Off Statum BUS COUFIER Trp Statum BUS COUFIER Strate Charge BUS COUFIER Strate Charge BUS COUFIER Strate Dear BTCO BUS COUFIER Strate Dearbon BUS COUFIER Cover Strate Strate BUS COUFIER Cover Strate Strate BUS COUFIER Cover Strate Strate BUS COUFIER Cover Strate Strate	VFC VFC VFC VFC VFC VFC VFC VFC						CBS_110(9)178_CH CBS_110(9)178_COH CBS_110(9)178_COH CBS_110(9)178_COH CBS_110(9)178_CFH CBS_110(9)178_		
11 085 12 085 13 085 14 085 15 085 15 085 16 085 17 085 18 085	28 TH VALL 29 TH VALL 29 TH VALL 29 TH VALL 20 TH	BLSCOOFEE Adder values Tro BLSCOOFEE Enverson-Tro BLSCOOFEE Extension BLSCOOFEE Extension BLSCOOFEE Extension BLSCOOFEE Fines failure BLSCOOFEE Of Command BLSCOOFEE Of Command BLSCOOFEE Tro Col	VTC VTC VTC VTC VTC VTC VTC VTC VTC			1		R PTFF CMD_ON CMD_OFF	CBS_110V_VIT_BC_DR CBS_110V_VIT_BC_PTF CBS_110V_VIT_BC_PTFF CBS_110V_VIT_BC_CMD_ON CBS_110V_VIT_BC_CMD_OFF CBS_110V_VIT_BC_TMD_CFF CBS_110V_VIT_BC_TMD_C		
10 CR55 11 CR55 2 CR55 3 CR55 4 CR55 5 CR55 6 CR55	11KV HT BC 11KV HT 11KV HT 11KV HT 11KV HT 11KV HT 11KV HT 11KV HT	BLIS COURTER Extrements The SUBSTATION 51 ACAAAAGC (CUTGOING-LI) LIS dark hereste Position Of Status Of Status Tels Status Schrie Charge Beschis Charge ITCO	VTC VTC VTC VTC VTC VTC VTC VTC			1		E_TEP LR ON OFF TEP	085_110_04_06_0_TP		
7 085 9 085 10 085 11 085 11 085 11 085 11 085 12 085	11KV HT 11KV HT 11KV HT 11KV HT 11KV HT 11KV HT 11KV HT 11KV HT	Service Particion Test Particion Central Scatter Healthy Enversion Tra DCS Man Use Crust Healthy Usedar Values Tra	VTC VTC VTC VTC VTC TC 61850 EC 61850 EC 61850 EC 61850		2 2 2 2 2 2 2 2 2			с Атс Аят Тят Тят Сан Е., тэр Бос Тэр, сы VV, тэр			
15 CR55 16 CR55 17 CR55 18 CR55 19 CR55 20 CR55 21 CR55 21 CR55	TH VALL TH VALL	Earth Earth Protection Marr Multifuention Mean On Constant Of Constant Tris Coll Expression Tris CONTOCIME BERATE Same (CONTOCIME-3)	IC 61850 IC 61850 IS 485 VTC IC 61850 IC 61850 IC 61850	1	1	1		IF CMD_ON CMD_OFF ITP_C E_TIP			
1 CR55 2 CR55 3 CR55 4 CR55 5 CR55 6 CR55 7 CR55 1 CR55 1 CR55	AD ABARS TH VIII AD ABARS TH VIII AD ADARS ATH VIII AD ADARS TH VIII	UTICOME BEARTE AL Solution OUTICOME BEARTE AL Solution UTICOME BEARTE OF Statum OUTICOME BEARTE OF Statum OUTICOME BEARTE Solution UTICOME BEARTE Solution OUTICOME BEARTE Solution OUTICOME BEARTE Solution OUTICOME BEARTE Solution	VTC VTC VTC VTC VTC VTC VTC VTC VTC					SC RTC SER TST	DES_110/J1T_SPARE_OG_UR DES_110/J1T_SPARE_OG_UN DES_110/J1T_SPARE_OG_UP DES_110/J1T_SPARE_OG_UP DES_110/J1T_SPARE_OG_UP DES_110/J1T_SPARE_OG_UP DES_110/J1T_SPARE_OG_UP DES_110/J1T_SPARE_OG_UP DES_110/J1T_SPARE_OG_UPT		
9 (855 10 (855 11 (855 12 (855 11 (855 11 (855 14 (855 15 (855 16 (855	114V. HT 114V. HT 500.28642 114V. HT 500.4642 500.200 114V. HT 500.4662 500.200 114V. HT 500.4602 500.4602	OUTCOME REPARTS Reads CONTROL REPARTS Reads OUTCOME REPARTS Reparts OUTCOME REPARTS Reparts OUTCOME REPARTS Reparts OUTCOME REPARTS Repairs OUTCOME REPARTS Repairs	VTC VTC VTC EC 618/0 EC 618/0 EC 618/0 EC 618/0 EC 618/0 EC 618/0 EC 618/0	1				R CSH 5,759 OC 179_CH 179_CH 170 TBP	CES_11W/JH_SHAE_GG_FR CES_11W/JH_SHAE_GG_SH CES_11W/JH_SHAE_GG_SH CES_11W/JH_SHAE_GG_FR CES_11W/JH_SHAE_GG_FR CES_11W/JH_SHAE_GG_FR CES_11W/JH_SHAE_GG_FR CES_11W/JH_SHAE_GG_FR		
17 CBS 18 CBS 20 CBS 21 CBS 21 CBS 1 CBS 1 CBS 1 CBS 2 CBS	114V HT \$200 2800 200 114V HT \$200 200 114V HT 114V HT 114V HT	OLTIGONG BERATE Authorition Meter OLTIGONG BERATE On Command OLTIGONG BERATE OF Command OLTIGONG BERATE Into Col SUBSTITUTION OF AUTOMATION OF AUTOMATION SUBSTITUTION OF AUTOMATION OF AUTOMATION IS don't Remark Publics OLTIGONG COMMANDER	85.485 VTC UTC EC 61850 EC 61850 UTC VTC VTC VTC	1	1	1		CMD_OFF TTP_C E_TTP LR	CRES_31XV_JHT_SPARE_OG_CMD_ON CRES_31XV_JHT_SPARE_OG_CMD_OF CRES_31XV_JHT_SPARE_OG_STRP_C CRES_31XV_JHT_SPARE_OG_S_TRP		
3 CR55 4 CR55 5 CR55 6 CR55 7 CR55 8 CR55 9 CR55 10 CR55	218V HT 218V HT 218V HT 218V HT 218V HT 218V HT 218V HT 218V HT	Off Status Trio Status Schrief Charge Rashtin Charge Rashtin Charge (TEC) Senter Pasition Test Pasition Last Control Scattor Healthy	VFC VFC VFC VFC VFC VFC VFC VFC VFC					ON OFF TIP EC EC ER ER ER ER ER ER ER ER ER ER ER			
11 085 12 085 14 085 15 085 16 085 17 085 18 085 18 085	218V HT 218V HT 218V HT 218V HT 218V HT 218V HT 218V HT 218V HT	Engeneration From DC Status Triss Cristal Handhar Linder V Johane Tris Linder Fault Protection Mary Multifuention Mary Multifuention Mary On Command	VTC EC 61850 EC 61850 EC 61850 EC 61850 EC 61850 EC 61850 EC 61850 ES 485 VTC	1				CTUP DC TTUP_CAL UV_TUP DF CAMD_CAN CAMD_CAN			
19 085 20 085 21 085 1 085 2 085 2 085 3 085 4 085	11W HT 11W HT 11W HT 11W HT 11W HT 11W HT 11W HT 11W HT 11W HT	Off command This Call Enversors The Mexics One California Substantion (course of States Of States Of States Of States	VFC EC 61850 EC 61850 VFC VFC VFC VFC VFC					179_C E_TR9 UR ON OFF			
5 0855 7 0855 8 0855 9 0855 10 0855 11 0855 11 0855 12 0855 12 0855 12 0855 13 0855 14 0855 15 0855 16 0855 17 0855 18 0855 10 0855	110V HT 110V HT 110V HT 110V HT 110V HT 110V HT 110V HT 110V HT	Satura Charan Benaha Charan Satura Patisan Yang Patisan Kathan Kathan Carrend Ganak Kasha Kathan Kathan Kathan	VTC VTC VTC VTC VTC VTC VTC VTC VTC VTC					SC SR TS TS CN E TBP DC DC			
11 085 14 085 15 085 16 085 17 085 18 085 19 085 20 085	218V HT 218V HT 218V HT 218V HT 218V HT 218V HT 218V HT 218V HT	from Crunic Handber Under Volkmanne Thim Farth Fash Protection Balar Multifraction Malar Die Command Die Command Die Command Fasi Coll	IC 61850 IC 61850 IC 61850 IC 61850 IC 61850 IC 61850 VFC VFC VFC	1		1		199_04 UV_THP EF CMD_0FF CMD_0FF THP_C			
21 085 685 2 085 3 085 4 085 5 085 6 085	218V HT 218V HT 218V HT 218V HT 218V HT 218V HT 218V HT 218V HT	Exercision Tra Searce (OFFC016-3) 18 South Renote Position OF Status Of Status Too Status Too Status Exercise Court RTD	NEC 61850 VTC VTC VTC VTC VTC VTC VTC					E_TEP IR ON OSF TEP SC RTC			
7 CRSS 9 CRSS 20 CRSS 11 CRSS 12 CRSS 12 CRSS 13 CRSS	11KV HT 11KV HT 11KV HT 11KV HT 11KV HT 11KV HT 11KV HT	Senten Pasikon Test Pasikon Santh Control Sounde Healthy Engenerator Tris De Satus Test Circuit Healthy	05- VTC VTC VTC VTC VTC IC 61850 IC 61850		1			118 C199 C21 C31 C31 C31 C31 C31 C31 C31 C31 C31 C3			

14	085	11XV_HT			Under Voltage Trip	EC 61850					1					UV_TRP
15	085	11XV_HT			Earth Fault	EC 61850					1					EF
16	CRSS	11KV_HT			Protection Relay	EC 61850				1						T
27	CRSS	11XV_HT			Multifunction Meter	RS 485			1							L
15	CRSS	11XV_HT			On Command	VFC							1			CMD_ON
29	CRSS	11XV_HT			Off Command	VFC							1			CMD_OFF
20	CRSS	11XV_HT			Trip Col	IEC 61850					1					TRP_C
21	CRSS	11XV_HT			Emergency Trip	EC 61850					1					E_TEP
	CRSS	11XV_HT			SUBSTATION-04 STUDENT HOUSING (OUTGOIL											L
1	CRSS	11XV_HT			LR Switch Remote Position	VFC						1				LR
2	CRSS	11XV_HT			On Status	VFC						1				ON
3	085	11XV_HT			Off Status	VEC						1				OFF
4	CRSS	11XV_HT			Trip Status	VFC						1				TRP
5	CRSS	11XV_HT			Spring Charge	VFC						1				sc
6	CRSS	11XV_HT			Ready to Close (RTC)	VFC						1				RTC
7	CRSS	11XV_HT			Service Position	VFC						1				SER
	CRSS	11XV_HT			Test Position	VFC		L	I			1		1	1	TST
9	CRSS	11XV_HT			Earth	VFC		I	I			1		1	1	ER
30	CRSS	11XV_HT			Control Supply Healthy	VFC		I	I			1		1	1	CSH
11	085	11KV HT			Emergency Trip	VEC		I	I			1		1	1	E_TEP
12	085	11KV HT			DC Status	EC 61850		I	I		1			1	1	DC
13	085	11KV HT			Trip Circuit Healthy	EC 61850		I	I		1			1	1	TRP_CH
14	085	11KV HT			Under Voltage Trip	EC 61850		I	I		1			1	1	UV_TRP
15	085	11KV HT			Earth Fault	EC 61850		L	I		1			1	1	E.F
16	CRSS	11KV HT			Protection Relay	IEC 61850				1						L
17	CR55	11KV HT			Multifunction Meter	RS-485			1							L
16	CR55	11KV HT			On Command	VFC							1			CMD_ON
19	CR55	11KV HT			Off Command	VFC							1			CMD_OFF
20	CR55	11KV HT			Trip Col	IEC 61850					1					TRP_C
21	CR55	11KV HT			Emergency Trip	IEC 61850					1					E_TEP
	CR55	11KV HT	TR OG7	OUTGOING BREAKER	TRANSFORMER (OUTGOING-7)											
1	CR55	11KV HT	TR OG7	OUTGOING BREAKER	LR Switch Remote Position	VFC						1				LR
2	CR55	11KV HT	TR OG7	OUTGOING BREAKER	On Status	VFC						1				ON
3	CR55	11KV HT	TR OG7	OUTGOING BREAKER	Off Status	VFC						1				OFF
4	CR55	11KV HT	TR OG7	OUTGOING BREAKER	Trip Status	VFC						1				TRP
5	CR55	11KV HT	TR OG7	OUTGOING EREAKER	Spring Charge	VFC						1				sc
6	CR55	11KV HT	TR OG7	OUTGOING EREAKER	Ready to Close (RTC)	VFC						1				RTC
7	085	11KV HT	TR OG7	OUTSCING BREAKER	Service Position	VFC						1				SER
	CR55	11KV HT	TR OG7	OUTGOING EREAKER	Test Position	VFC						1				TST
9	085	11KV HT	TR OG7	OUTSCING BREAKER	Earth	VFC						1				ER
10	085	11KV HT	TR OG7	OUTSCING BREAKER	Emergency Trip	VFC						1				E_TEP
11	085	11KV HT	TR OG7	OUTSCING BREAKER	Upstream breaker Trip	VFC						1				UB_TRP
12	085	11KV HT	TR OG7	OUTSCING BREAKER	Control Supply Healthy	VFC						1				CSH
13	085	11KV HT	TR OG7		Multifunction Meter	15485			1							1
14	085	11KV HT	TR OG7	OUTSCING BREAKER	Carth Fault	EC 61850					1					E.F.
15	085	11KV HT	TR OG7	OUTSCING BREAKER	DEStatus	EC 61850					1					DC
16	085	11KV HT	TR OG7	OUTSCING BREAKER	Trip Circuit Healthy	EC 61850					1					TRP_CH
17	CR55	11KV HT	TR OG7	OUTGOING BREAKER	Under Voltage Trip	IEC 61850	1				1				1	UV TRP
15	CRSS	11KV HT	TR OG7	OUTGOING BREAKER	Protection Relay	EC 61850				1						T
20	CRSS	11KV HT	TR OG7	OUTGOING BREAKER	on	VEC						1				OTI
21	CRSS	11KV HT	TR OG7	OUTGOING BREAKER	WTI	VEC						1				WTI
22	CRSS	11KV HT	TR OG7	OUTGOING BREAKER	On Command	VEC							1			CMD ON
21	(1955	11KV HT	TR 067	OUTSOING BREAKER	Off Command	VEC							1			CMD OFF
24	(1955	11KV HT	TR 067	OUTSOING BREAKER	Trip Col	IEC 61850					1					TRP C
	(1955	LINY MT	TR OG7	OUTGOING BREAKER	Emergency Trip	IEC 61850								1	1	E TEP

 $\begin{array}{c} (0,1,10,0) \neq (1,0,00,1,1)\\ (0,1,10,1) \neq (1,0,0,0)\\ (0,1,10,1,0,0)\\ (0,1,10,1) \neq (1,0,0,0)\\ (0,1,10,1,0,0)\\ (0,1,10,1,0)$

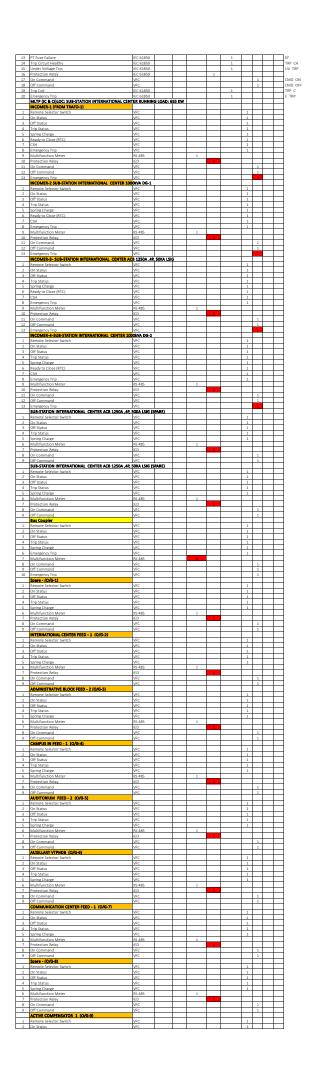
Sr.No.	Description	Signal Type FROM	то м	DEVICE	D IEC 6185		E DD AI AC	10 Tag Stucture	Tag Name	Tag Description	Event Logging	Historial Recording	Historic resolutions/Freq.
	Exiting SUSBTATION-01 ACADEMIC 11KV HT PANEL DISTRIBUTION SUBSTATION INCOMER-1 FROM CENTRAL SUBSTATION												<u> </u>
2	LR Switch Remote Position On Status Off Status	VFC VFC				1		IR ON					
4	Trip Status Spring Charge	VFC VFC				1		TRP SC					
7	Ready to Close (RTC) Service Position Test Position	VFC VFC VFC				1		RTC SER TST					
9	Earth Emergency Trip Upstream breaker Trip	VFC VFC VFC				1		ER E_TRP UB_TRP					
12	Control Supply Healthy Multifunction Meter PT Fuse Failure	VFC RS 485 IEC 61850		1	1	1		CSH PTEF					
15 16	Earth Fault DC Status	IEC 61850 IEC 61850 IEC 61850			1			EF DC					
18 19	Under Voltage Trip Protection Relay	IEC 61850 IEC 61850			1			UV_TRP					
23	Off Command INCOMER-2 (TIE FEEDER INCOMER SUBSTATION-05	VFC VFC Sports Complex)					1	CMD_OFF					
2	LR Switch Remote Position On Status Off Status	VFC VFC				1		ON OFF					
4	Trip Status	VFC VFC VFC				1		TRP SC					
7	Service Position Test Position	VFC VFC				1		SER TST					
11	Earth Emergency Trip Upstream breaker Trip	VFC VFC VFC				1		ER E_TRP UB_TRP					
12	Control Supply Healthy Multifunction Meter PT Fuse Failure	VFC RS 485 IEC 61850		1	1	1		CSH PTFF					
15 16	Earth Fault DC Status Trip Circuit Healthy	IEC 61850 IEC 61850 IEC 61850			1			EF DC					
18	Under Voltage Trip Protection Relay	IEC 61850 IEC 61850		1	1								
23	On Command Off Command BUSCOUPLER	VFC VFC					1	CMD_OFF					
1 2 3	LR Switch Remote Position On Status Off Status	VFC VFC VFC	_	_=		1 1		LR ON OFF					
4	Trip Status Spring Charge	VFC				1		TRP SC RTC					
7	Ready to Close (RTC) Service Position Test Position	VFC VFC				1 1		SER TST					
9 10 11	Control Supply Healthy Trip Circuit Healthy Under Voltage Trip	VFC VFC				1		CSH TRP CH UV TRP					
12	Emergency Trip DC Status Earth	VFC VFC VFC											
15	PT Fuse Failure Transfomer 1 (OUTGOING-1)	VFC VFC				1	EE	PTFF					
2	LR Switch Remote Position On Status Off Status	VFC VFC				1		OFF					
4 5 6	Trip Status Spring Charge Ready to Close (RTC)	VFC VFC VFC				1		TRP SC RTC					
7	Service Position Test Position Earth	VFC VFC				1		SER TST FR					
10	Emergency Trip Upstream breaker Trip	VFC VFC				1		E_TRP UB_TRP					
13	Earth Fault	VFC RS 485 IEC 61850		1	1	_		EF					
16	DC Status Trip Circuit Healthy Under Voltage Trip	IEC 61850 IEC 61850 IEC 61850			1			DC TRP CH					
18	PT Fuse Failure Protection Relay	IEC 61850 IEC 61850 VFC		1	1								
21	WTI Buchholz relay	VFC											
23 24 25	MOG On Command	VFC VFC VFC					1						
27	Off Command Trip Coll Emergency Trip	VFC IEC 61850 IEC 61850		_	1		1						
1	Transformer 2 (OUTGOING-2) LR Switch Remote Position On Status	VFC VFC	_			1		LR CN					
3	Off Status Trip Status	VEC VEC				1		OFF TRP					
6	Spring Charge Ready to Close (RTC) Service Position	VFC				1		SL RTC SER					
9	Emergency Trip	VFC VFC VFC				1 1		TST ER E_TRP					
12	Upstream breaker Trip Control Supply Healthy Multifunction Meter	VFC VFC RS 485		1		1		UB_TRP CSH					
14 15	Earth Fault DC Status	IEC 61850 IEC 61850 IEC 61850			1 1 1			EF DC					
17	Under Voltage Trip PT Fuse Failure	IEC 61850 IEC 61850			1			UV_TRP PTFF					
20	UTI WTI	IEC 61850 VFC VFC		1									
22 23 24	Buchholz relay PRV MDG	VFC VFC		_		1		PRV					
25 26	Dri Command Dfi Command Trip Coll	VFC VFC IEC 61850			1	Ē	1	CMD_ON CMD_OFF TRP_C					
28	Emergency Trip MLTP (ACADAMIC SUBSTATION)	IEC 61850			1		ĦĒ	E_TRP					
2	INCOMER-1 FROM TRANSFORMER-1 Remote Selector Switch On Status	VFC VFC											
4	Off Status Trip Status Spring Charge	VFC VFC VFC				1							
6	Ready to Close (RTC) CSH Emergency Trip	VFC VFC VFC				1		+					
9 10	Multifunction Meter Protection Relay	RS 485		1			1	Ť					
12 13	Off Command Emergency Trip	VFC VFC VFC					1	ļ					
2	INCOMER-2 (DG1-750KVA) Remote Selector Switch On Status	VFC VFC				1		ŧ					
4	Off Status Trip Status Spring Charge	VFC VFC VFC	$- \square$	=		1		ł					
6	Ready to Close (RTC) CSH Emergency Trip	VFC VFC VFC VFC				1							
9 10	Multifunction Meter Protection Relay	RS 485 IED		1			1						
12	On Command Off Command Emergency Trip	VFC					1	1					
1	BUSCOUPLER Remate Selector Switch On Status	VFC VFC	$- \square$			1							
3	Off Status Trip Status	VFC VFC				1		I I I					
6		VFC VFC RS 485		1				t					
9 10	On Command Off Command Emergency Trip	VFC VFC VFC					1	ł					
1	INCOMER-3 FROM TRANSFORMER-2 Remote Selector Switch On Status	VFC VFC				1	i						
3	Off Status Trip Status	VFC VFC				1		1					
6	Spring Charge Ready to Close (RTC) CSH	VFC VFC VFC				1		ł					
8	Emergency Trip	VFC RS 485 IED		1		1							
11	On Command Off Command	VFC VFC				-	1	ļ					
13	Emergency Trip INCOMER-4 DG2 Remote Selector Switch	VFC		+		1	1						
2	On Status Off Status Trip Status	VFC VFC VFC	\neg			1							
5	I'ND Status Spring Charge Ready to Close (RTC) CSH	VFC VFC VFC VFC				1		Ī					
		VFC				1		t					

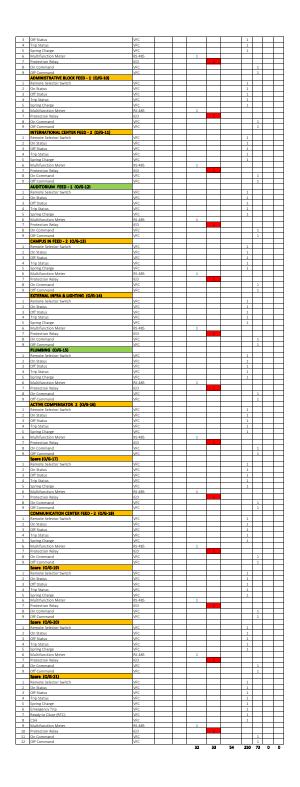
9	Multifunction Meter	RS 485		1	1	1	1			r
10	Protection Relay On Command	IED VFC				1		1		
12 13	Off Command Emergency Trip	VFC VFC						1		
1	SPARE (O/G-1) Remote Selector Switch On Status	VFC					1			_
3	Off Status Trip Status	VFC					1			
5	Spring Charge Ready to Close (RTC)	VFC					1		-	
7	CSH Multifunction Meter	VFC RS 485			1		1			
10 11	Protection Relay On Command	IED VFC				1		1		
12	Off Command MLTP ACADEMIC FEED - 1 (0/G-2)	VFC						1		
1	Remote Selector Switch On Status	VFC VFC					1			
3	Off Status Trip Status Spring Charge	VFC					1	_		
6	Spring Charge Ready to Close (RTC) CSH	VFC VFC VFC					1			
9	Multifunction Meter Protection Relay	RS 485 IED			1	1	-			
11 12	On Command Off Command	VEC						1	_	
1	HVAC Plant Room Feed 2 (O/G-3) Remote Selector Switch	VFC					1			
2 3	On Status Off Status	VFC VFC					1			
4	Trip Status Spring Charge	VEC					1			
6	Ready to Close (RTC) CSH Multifunction Meter	VFC VFC RS 485					1			
10	Protection Relay On Command	IED VFC			1	1		1		
12	Off Command ACADEMIC UPPER SPINE TTP PANEL (O/G-4)	VFC						1	_	
1	On Status Off Status	VFC VFC					1			
3	Trip Status Spring Charge	VFC VFC					1			
5	Multifunction Meter Protection Relay	RS 485 IED		_	1	1				
7	On Command Off Command	VFC VFC						1		E
1	Auxiliary DB (O/G-5) On Status Off Status	VEC		<u> </u>			1			
3	Trip Status	VFC VFC VFC					1			
5	Spring Charge Multifunction Meter Protection Relay	VFC RS 485 IED		-	1					F
7	On Command Off Command	VFC					L	1		E
1	External Infra & Lighting (O/G-6) On Status	VFC		ĺ .			 1			E
2	Off Status Trip Status	VFC VFC					1	H		-
4	Spring Charge Multifunction Meter	VFC RS 485			1		1			E
6	Protection Relay On Command	VFC					_	1		E
1	Off Command BALANCING TANK-B TO KAMAL SAGAR-B (O/G-7) On Status	VFC					,	1		F
2	Off Status Trip Status	VFC VFC VFC					 1 1			F
4	Spring Charge Multifunction Meter	VFC RS 485			1		1		-	
6	Protection Relay On Command	IED VFC				1		1		
8	Off Command Active Compansator 1 (O/G-8)	VFC						1		
1	On Status Off Status	VFC VFC					1			
3	Trip Status Spring Charge	VEC					1			
6	Multifunction Meter Protection Relay	RS 485 IED			1	1		1		
8	On Command Off Command Spare (O/G-9)	VFC VFC						1		
1	On Status Off Status	VFC					1			
3 4	Trip Status Spring Charge	VFC VFC					1			
5 6	Multifunction Meter Protection Relay	RS 485 IED			1	1		_		
7 8	On Command Off Command	VFC VFC						1		
1	Spare (O/G-10) Remote Selector Switch	VFC					1			
3	On Status Off Status Trip Status	VFC VFC VFC					1			
5	Spring Charge Ready to Close (RTC)	VFC					1			
7	CSH Multifunction Meter	VFC RS 485			1		1			
10 11	Protection Relay On Command	IED VFC				1		1		
12	Off Command MLTP Acedmic Feed 2 (O/G-11)	VEC						1		
1	Remote Selector Switch On Status	VFC VFC					1			
4	Off Status Trip Status	VFC VFC					1			
5	Spring Charge Ready to Close (RTC)	VFC VFC		<u> </u>			1			
7 9 10	CSH Multifunction Meter Protection Belay	VFC RS 485 IED			1		1			
11 12	Protection Relay On Command Off Command	VFC VFC						1		F
1	HVAC Plant Feed 1 (0/G-12) Remote Selector Switch	VFC					1			E
2 3	On Status Off Status	VFC VFC					1			
4	Trip Status Spring Charge	VFC VFC		<u> </u>			1			E
6	Ready to Close (RTC) CSH	VFC VFC					1			
9 10 11	Multifunction Meter Protection Relay On Command	RS 485 IED VEC			1	1		-		E
11	On Command Off Command Active Compensator 2 (0/G-13)	VEC						1	H	-
1	Remote Selector Switch On Status	VFC VFC					1			E
3	Off Status Trip Status	VFC VFC					1	F	2	E
5	Spring Charge Multifunction Meter	VFC RS 485			1		1	H		F
7	Protection Relay On Command	IED VFC		-				1		L
9	Off Command Fire Fighting Panel (O/G-14) Remote Selector Switch	VEC		-			,	1		F
2	On Status Off Status	VFC VFC VFC		-			1			
4	Trip Status Spring Charge	VFC VFC					1			_
6	Multifunction Meter Protection Relay	RS 485 IED		-	1	1				E
8 9	On Command Off Command	VEC VEC						1		
	Spare (O/G-15) Remote Selector Switch	VFC					1			
1	On Status Off Status	VEC					1			-
1 2 3		VFC VFC RS 485					1			E
1 2 3 4 5	Trip Status Spring Charge				1	1		1		F
6 7	Spring Charge Multifunction Meter Protection Relay	IED					t	1		
6 7 8 9	Spring Charge Multifunction Meter	IED VFC VFC								
6 7 8 9	Spring Charge Multifunction Meter Protection Relay On Command Off Command	IED VFC					1			
6 7 8 9	Spring Charge Muldifunction Meter Protection Belay On Command Seare (054-30) Remote Selector Switch On Status Of Status Of Status	IED VFC VFC VFC VFC VFC VFC					1 1 1 1 1 1			
6 7 8 9 1 2 3	Spring Charge Multifunction Meter Protection Belay On Command Seare 10/0-10 Bernarde Selector Switch On Status Of Status Of Status Trip Status Spring Charge Ready to Lose (BTC)	IED VFC VFC VFC VFC VFC VFC VFC VFC					1 1 1 1 1			
6 7 8 9 1 2 3 4 5 6 7 9	Serie Charge Multifaction Meer Protection Rely Co. Command Serie (00-51) Serie (00-51) Named Select Series On Balan Trip Selata Serie Charge Series Charge S	IED VFC VFC VFC VFC VFC VFC VFC VFC			1		1 1 1 1 1 1			
6 7 8 9 1 2 3 4 5 6 7 9 10 11	Series Charge Multifaction Meer Protection Relay On Command Of Command Serie (Monto) Series (Monto) Series (Monto) Series (Monto) Tra Datus Series Charge Ready to Cose (REC) CM	IED VFC VFC VFC VFC VFC VFC VFC VFC			1		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1		

J	Description	Signal Type	FROM TO	DEVICE				TYPE		
- 10	XISTING SUBSTATION-05 Sports			MODBUS	IED	IEC 61850	DI	DO	AI	AD
2 0	ncomer-1 (From/To SUB-STATION 1 ACADEMIC SP R Switch Remote Position In Status If Status	VFC VFC VFC	_=	=			1 1 1			
5 5	rip Status pring Charge eady to Close (RTC)	VFC VFC VFC					1 1			
8	ervice Position est Position arth mergency Trip	VFC VFC VFC VFC					1 1 1 1 1			
12 0 13 1 14 1	ontrol Supply Healthy fultifunction Meter T Fuse Failure	VFC RS 485 IEC 61850		1		1	1			
15 1 16 1	arth Fault C Status rio Circuit Healthy	IEC 61850 IEC 61850 IEC 61850				1				
19 1	Inder Voltage Trip rotection Relay In Command Iff Command	IEC 61850 IEC 61850 IEC 61850 IEC 61850			_	1 1 1 1 1				
1	ncomer-1 (From/To CSS LIBRARY AREA) R Switch Remote Position In Status Iff Status	VFC VFC					1			
4 1	rip Status pring Charge	VFC VFC VFC			_		1 1			
	eadvite Close (RTC) envice Position est Position arth	VFC VFC VFC VFC					1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
10 12 13	mergency Trip ontrol Supply Healthy fultifunction Meter	VFC VFC RS 485		1			1			
15 I 16 I	T Fuse Failure arth Fault C Status In Circuit Machteu	IEC 61850 IEC 61850 IEC 61850 IEC 61850			=	1	_			
18	rip Circuit Healthy Inder Voltage Trip rotection Relay In Command	IEC 61850 IEC 61850 IEC 61850 VFC		_	1	1				
23	ff Command Ius Coupler B Switch Remote Position	VFC VFC				1	1			
2 (In Status Iff Status	VFC VFC VFC			_		1			-
	rip Status pring Charge eady to Close (RTC) arth memerory Trin	VFC VFC VFC	=	_			1			
	mergency Trip C Status ransformer - 1 (0/6-1) B Switch Remote Position In Status	VFC VFC		_			1			
	rip Status pring Charge	VFC VFC VFC					1 1 1			
6 7 8	eady to Close (RTC) ervice Position est Position	VFC VFC VFC VFC		_	=		1 1 1			
9 10 11 11	arth mergency Trip ipstream breaker Trip	VFC VFC VFC VFC					1 1			
12 0 13 1 14 1	ontrol Supply Healthy fultifunction Meter arth Fault	VFC RS 485 IEC 61850		1		1	1			-
16 17 18	IC Status rio Circuit Healthy Inder Voltage Trip rotection Relay	IEC 61850 IEC 61850 IEC 61850 IEC 61850		_	1	1 1 1				
19 0 20 1	ITI VTI uchholz relav	VFC VFC VFC					1 1 1			
22 1 23 1 24 0	RV IOG In Command	VFC VFC VFC			=		1	1		
26 27	ff Command rip Coll mergency Trip PARE TRANSFORMER (MOBILE / ON WHEEL) - (OJ	VFC IEC 61850 IEC 61850 G-2)		_	=	1 1		1		
2 0	R Switch Remote Position In Status Iff Status	VFC VFC VFC					1 1 1			
5 5	rip Status pring Charge eady to Close (RTC) envice Position	VFC VFC VFC		_	_		1 1 1 1 1 1			
9	envice Position est Position anth mergency Trip	VFC VFC VFC VFC		_			1 1 1 1 1 1			
11 12 13	Ipstream breaker Trip ontrol Supply Healthy fultifunction Meter	VFC VFC RS 485		1			1			
14 15 16	arth Fault C Status rip Circuit Healthy	IEC 61850 IEC 61850 IEC 61850	$=\pm$			1 1 1				
18 1 19 0 20 1	(T)	IEC 61850 IEC 61850 VFC VFC		_	1	1	1			
21 0	In Command Iff Command rin Coll	VFC VFC VFC IEC 61850				1		1		
24	mergency Trip	IEC 61850	$=\pm$			1	_			
	INCOMER-LIFEON TRAFG-11 emote Selector Switch In Status rip Status	VFC VFC VFC VFC		_	=		1 1 1 1 1 1			
6	pring Charge eady to Close (RTC) SH	VFC VFC VFC VFC					1 1 1			_
8 9 10	mergency Trip fultifunction Meter rotection Relay	VFC RS 485 IED		1	1		1			
11 0	In Command Iff Command	VFC VFC VFC	=					1		
1 2 0	NCOMEA-2 (1000kVA DG Set) emote Selector Switch In Status If Status	VFC VFC VFC		_+			1 1 1			
4 5 9	IT Satus If Status pring Charge eady to Close (RTC) SH SH	VFC VFC VFC		-			1 1			
7 0 8 1 9 1	SH mergency Trip duffunction Meter rotection Relay in Command	VFC VFC RS 485 IFD	=	1			1			
10 11 0 12 0 13 1	rotection Relay In Command Iff Command memency Trip	IED VFC VFC VFC						1		
1	merzency Trio PORTS CENTER FEED - 1 (0/G-1) emote Selector Switch In Status	VFC VFC					1			
4	rff Status rip Status pring Charge Nutifunction Meter	VFC VFC VFC RS 485					1 1			
8 0	rotection Relay In Command	IED VFC VFC		* 	1			1		
1	PORTS CENTER FEED -2 (O/G-2) emote Selector Switch In Status	VFC VFC		-			1			
3 (rin Status	VFC VFC VFC RS 485	====	1			1			
7 8	pring Charge fultifunction Meter rotection Relay in Command iff Command	IED VFC VFC			1			1		_
1 1	ACULTY CLUB FEED - 1 (0/G-3) emote Selector Switch	VFC VFC					1			-
3 0	If Satus rip Status ofina Charae Julifunction Meter rotection Relay	VFC VFC VFC R5 485	$\pm \pm$				1 1			
9 (in Command Iff Command	IED VFC VFC	_++	-	1			1		
1	ACULTY CLUB FEED - 2 (0/G-4) emote Selector Switch In Status	VFC VFC					1			
3 0	ff Status rip Status pring Charge	VFC VFC VFC					1 1			
6 7 8 0	Nutifunction Meter rotection Relay In Command	RS 485 IED VFC	=+	1	1			1		
9	ff Command UXILIARYY TPN DB (O/G-5) emote Selector Switch	VFC VFC			=		1	1		
2 0	In Status Iff Status rip Status pring Charge	VFC VFC VFC		+			1 1 1			
6 1	n Januar pring Charge fultifunction Meter rotection Relay in Command	RS 485 IED VFC		1	1		*	1		
		lane.			_			1	-	
0 1	COMMERCIAL CENTER FEED - 1 (O/G-6) emote Selector Switch	VFC					1			
9 0 1 1 2 0 3 0	If Command South Centra FED - 1 (0/G-6) emote Selector Switch in Status If Status pring Status pring Charge Guffunction Meter	VFC VFC VFC VFC VFC VFC					1 1 1 1			

			r			n			r		n
9	Off Command COMMERCIAL CENTER FEED - 2 (O/G-7)	VFC							1		
2	Remote Selector Switch On Status	VFC VFC						1			
3	Off Status Trip Status	VFC VFC						1			
5	Spring Charge Multifunction Meter	VFC RS 485			1			1			
7	Protection Relay On Command	IED			1	1					
9		VFC VFC							1		
1	SCHOOL FEED - 1 (O/G-8) Remote Selector Switch	VFC						1			
2	On Status Off Status	VFC VFC						1			
4	Trip Status Spring Charge	VEC						1			
6	Multifunction Meter Protection Relay	RS 485 IED			1						
8	On Command	VEC							1		
à	SCHOOL FEED - 1 (0/6-9)										
2	Remote Selector Switch On Status	VFC VFC						1			
3	Off Status Trip Status Spring Charge	VFC VFC						1			
5	Spring Charge Multifunction Meter	VFC RS 485			1			1			
7	Protection Relav On Command	IED. VFC				1			1		
9	Off Command CAMPUS AMENITIES FEED - 1 (O/G-10)	VFC							1		
1	Remote Selector Switch	VFC						1			
3	Off Status	VFC						1			
4	Trip Status Spring Charge	VFC VFC						1			
6 7	Multifunction Meter Protection Relay	RS 485 IED			1	1					
8	On Command Off Command	VFC VFC							1		
1	CAMPUS AMENITIES FEED - 2 (O/G-11) Remote Selector Switch	VFC			_			1		-	
2	Remote Selector Switch On Status Off Status	VEC						1			
4	Trip Status Spring Charge	VFC VFC						1			
n 6 1	Multifunction Meter	VFC RS 485 IED			1						
7	Protection Relay On Command	IED VFC							1		
9	EXTERNAL INFRA & LIGHTING (O/G-12)	VFC							1		
1	Remote Selector Switch On Status	VFC VFC						1			
3	Off Status Trio Status	VFC VFC		-				1			
5	Trio Status Spring Charge Multifunction Meter	VFC RS 485			1			1			
7	Protection Relay On Command	IED VFC				1			1		
9	Off Command EXTERNAL INFRA & LIGHTING (0/G-13)	VFC							1		
1	Remote Selector Switch	VFC						1			
2	On Status Off Status	VFC VFC						1			
4 5	Trip Status Spring Charge Multifunction Meter	VFC VFC RS 485						1			
6	Multifunction Meter Protection Relav	RS 485 IED			1	1					
8	On Command Off Command	VFC VFC							1		
1	Plumbing Spare (O/G-14) Remote Selector Switch	VFC						1			
2	Remote Selector Switch On Status Off Status	VFC VFC						1			
4	Trip Status Spring Charge	VFC						1			
6	Multifunction Meter Protection Relay	RS 485			1						
8	Protection Relay On Command	IED VFC							1		
9	Off Command FIRE FIGHTING PANEL (O/G-15)	VFC							1		
2	Remote Selector Switch On Status	VFC VFC						1			
3	Off Status Trip Status	VFC VFC						1			
5	Spring Charge Multifunction Meter	VFC RS 485			1			1			
7	Protection Relay On Command	IED VFC	-		-	1	-	-	1		
9	Off Command ACTIVE COMPENSATOR (0/G-16)	VFC							1		
1	Remote Selector Switch On Status	VEC						1			
3	On Status Off Status Trip Status	VFC						1			
5	Spring Unarge	VFC VFC						1			
ь 7	Multifunction Meter Protection Relay	RS 485 IED			1	1					
8 9	On Command Off Command	VFC VFC							1		
1	Spare (O/G-17) Remote Selector Switch	VFC						1			
2	On Status Off Status	VFC VFC		-				1			
4	Trip Statur	VFC VFC	-		-			1			
6	Soring Charge Multifunction Meter Protection Relay	RS 485			1	_					
8	On Command Off Command	VFC		-					1		
	Scere (O/G-18) Demote Selector Switch	VFC									
2	Seare (O/6-18) Remote Selector Switch On Status	VFC						1			
3	Trip Status	VFC VFC						1			
5	Spring Charge Multifunction Meter Protection Relay	VFC RS 485			1			1			
7	Protection Relay On Command	IED VFC							1		
	OffCommand	VFC	-		-			-	1		
9	Spare (O/G-19)							1			
9	Soare (O/G-19) Remote Selector Switch On Status	VEC							t	1	
9	Remote Selector Switch On Status Off Status	VFC VFC						1			
9	Remote Selector Switch On Status Off Status Trip Status Sopring Charge	VFC VFC VFC VFC						1			
9 1 2 3 4 5 6 7	Remote Selector Switch On Status Off Status Trip Status Spring Charge Ready to Close (RTC) CSH	VFC VFC VFC VFC VFC VFC						1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
9 1 2 3 4 5 6 7 9 10	Remote Selector Switch On Status Off Status Top Status Spring Charge Ready to Close (RTC) CCH Mathfuncton Meter Protection Relay	VFC VFC VFC VFC VFC			1	1		1			
9 1 2 3 4 5 6 7 9 10 11 12	Remote Selector Switch On Status Off Status Trip Status Spring Charge Ready to Close (RTC)	VFC VFC VFC VFC VFC VFC RS 485			1	1	27	1 1 1 1 1 1 175	1 1 47		

sr.No.	Description	Signal Type	FROM	то	DEV	ICE		T	PE		10 Tag Stucture Tag Name Tag Description Event Logging Historial Recording Historial
	EXISTING SUBSTATION-02 INTERNATIONAL CENTER or 11KV HT PANEL DISTRIBUTION S/S			-10	MODBUS	IED	IEC 61850	DI	DO		10 Tag Stasture Tag Name Tag Description Event Logging Historial Recording Historia Recording Historial Recording Historial Re
	LOC:INTERNATIONAL CENTER ZONE INCOMER-1 (FROM/TO CSS LIBRARY)- INCOMER 11kv	CABLE LINE	TO BE LAID	BY EPC	CONTRO	TOR TO	COMPLET	E THE P	ING NET	WORK	
2	IR Switch Remote Position On Status Off Status	VFC VFC VFC	E					1 1 1			2 N FF
4	Irip Status Spring Charge Ready to Close (RTC)	VFC VFC						1 1 1	\square	+	** 27 17
7 8	Service Position Fest Position	VFC VFC VFC						1			ER ST
10	Earth Emergency Trip Control Supply Healthy	VFC VFC VFC						1			R TRP SH
12 13	PT Fuse Failure Earth Fault	IEC 61850 IEC 61850					1				TFF
15	Frip Circuit Healthy Under Voltage Trip Multifunction Meter	IEC 61850 IEC 61850 RS 485			1		1				RP CH V TRP
17 18	Protection Relay On Command	IEC 61850 IEC 61850					1				MD ON
20 21	Off Command Frip Coll Emergency Trip	IEC 61850 IEC 61850 IEC 61850					1 1				ND OFF RP C TRP
1	NCOMER-2 (FROM/TO EXISTING ORC SUB-STATION) R Switch Remote Position	VFC						1			3
3	On Status Off Status Trip Status	VFC VFC VFC						1 1 1			N FF RP
6	Spring Charge Ready to Close (RTC) Service Position	VFC VFC VFC						1			C TC ER
8 9	Fest Position Earth	VFC VFC						1	-		ST R
1	Emergency Trip Control Supply Healthy PT Fuse Failure	VFC VFC IEC 61850					1	1			TRP 5H FF
3	Fir Facilit Frip Circuit Healthy	IEC 61850 IEC 61850					1 1		-		Ε Ε μ
6	Under Voltage Trip Multifunction Meter	IEC 61850 RS 485			1		1				V TRP
8 9	Protection Relay On Command Dff Command	IEC 61850 IEC 61850 IEC 61850					1		Ħ		ND ON ND OFF
) 1	Irip Coil Emergency Trip FRANSFORMER - 1 (O/G-1)	IEC 61850 IEC 61850		_			1	1			RP C TRP
	R Switch Remote Position On Status	VFC						1	Ħ	E	8 N
	Off Status Frip Status Spring Charge	VFC VFC VFC				-		1 1 1		+	66 89 2
7	Ready to Close (RTC) Service Position	VFC VFC VFC						1			TC SEA
9	Test Position Earth Emergency Trip	VFC VFC VFC	\square					1 1	\square	╞	ST R TRP
1	Upstream breaker Trip Control Supply Healthy	VFC VFC						1			IRP B TRP SH
3 4	Multifunction Meter Earth Fault DC Status	RS 485 IEC 61850 IEC 61850			1	<u> </u>	1	-		+	F C
6 7	Trip Circuit Healthy Under Voltage Trip	IEC 61850 IEC 61850					1 1	-		I	v TRP
9	Protection Relay DTI WTI	VFC VFC	\vdash			1		1	\square	+	n m
4 5	On Command Off Command	VFC VFC							1		ND ON
7	Irip Coil Emergency Trip TRANSFORMER - 2 (O/G-2)	IEC 61850 IEC 61850	\vdash			-	1	-	\square	+	RP C TRP
2	R Switch Remote Position On Status	VFC						1		I	2 N
	Off Status Frip Status Spring Charge	VFC VFC VFC				<u> </u>		1 1		+	FF 69 C
6 7	Ready to Close (RTC) Service Position	VFC VFC						1			TC ER
9	Fest Position Earth Emergency Trip	VEC VEC VEC						1 1			ST R TRP
11 12	Upstream breaker Trip Control Supply Healthy	VFC VFC						1			B TRP SH
14	Multifunction Meter Earth Fault DC Status	RS 485 IEC 61850 IEC 61850			1		1				F C
17	Frip Circuit Healthy Under Voltage Trip Protection Relay	IEC 61850 IEC 61850 IEC 61850				1	1				RP CH V TRP
19 20	ITC	VFC VFC						1			n m
22	On Command Off Command Trip Coll	VFC VFC IEC 61850					1		1		MD ON MD OFF #P C
24	Emergency Trip	IEC 61850					1				TRP
1	RMU01 - SS OUTREACH SUB-STATION - 02 (Internation R Switch Remote Position On Status	VFC VFC						1			ξ Ν
4	Off Status Frip Status	VFC VFC						1			FF PP C
6 7	Spring Charge Ready to Close (RTC) Service Position	VFC VFC						1			TC ER
8 9	Fest Position Earth Emergency Trip	VFC VFC VFC	\square					1 1 1	\square	╞	ST R TRP
1	Control Supply Healthy Earth Fault	VFC IEC 61850		_			1	1		+	SH
3 4	PT Fuse Failure Trip Circuit Healthy Under Voltage Trip	IEC 61850 IEC 61850 IEC 61850				-	1 1 1	1	Ħ	+	F PCCH V TRP
6 7	Protection Relay On Command	IEC 61850 VFC				1	*	-	1	-	MD on
9	Off Command Trip Coll Emergency Trip	VFC IEC 61850 IEC 61850				<u> </u>	1	-	1		MD 0FF NP C TRP
	RMU01 - SS OUTREACH CENTRAL SUB-STATION R Switch Remote Position	VFC					-	1	Ħ	╞	R
	On Status Off Status Frip Status	VFC VFC VFC				-		1 1		+	N FF RP
	Spring Charge Ready to Close (RTC)	VFC VFC						1	Ħ	╞	c TC
' .	Service Position Fest Position Earth	VFC VFC VFC	E			L		1 1	Ħ	+	ER ST R
D 1	Emergency Trip Control Supply Healthy	VFC VFC						1		Ŧ	TRP SH
3	Earth Fault PT Fuse Failure Trip Circuit Healthy	IEC 61850 IEC 61850 IEC 61850				-	1 1 1	1	Ħ	+	re F G
5	Under Voltage Trip Protection Relay	IEC 61850 IEC 61850				1	1				V TRP
8 9	On Command Off Command Trip Coll	VFC VFC IEC 61850				E	_1	L	1		MD ON MD OFF IP C
)	Emergency Trip RMU01 - SS OUTREACH Spare 1	IEC 61850					1		Ħ	╞	TRP
	.R Switch Remote Position On Status Off Status	VEC VEC VEC				-		1 1 1		+	2 N FF
	Frip Status Spring Charge	VFC VFC						1	\square	╞	RP C
+	Ready to Close (RTC) Service Position Fest Position	VFC VFC VFC	E			L		1 1 1			TC ER ST
	Earth Emergency Trip	VFC VFC					-	1			R TRP
	Control Supply Healthy Earth Fault PT Fuse Failure	VFC IEC 61850 IEC 61850				<u> </u>	1	1		+	54 FF F
5	Frip Circuit Healthy Under Voltage Trip	IEC 61850 IEC 61850					1 1				P CH V TRP
7	Protection Relay On Command Dff Command	VFC VFC	\vdash			1		-	1	+	MD ON MD OFF
9 0	Trip Coll	VFC IEC 61850 IEC 61850				E	1			E	MU UPP PP C TRP
1	RMU01 - SS OUTREACH Spare 2 IR Switch Remote Position On Status	VFC	\square			\vdash		1		+	R N
3	Off Status Frip Status	VFC VFC VFC						1		I	FF RP
5	Spring Charge Ready to Close (RTC) Service Position	VFC VFC VFC				<u> </u>		1 1 1		+	C TC SR
7			1		1	1		1			ST
7 8 9	Fest Position Earth Emergency Trip	VEC						1			R TRP

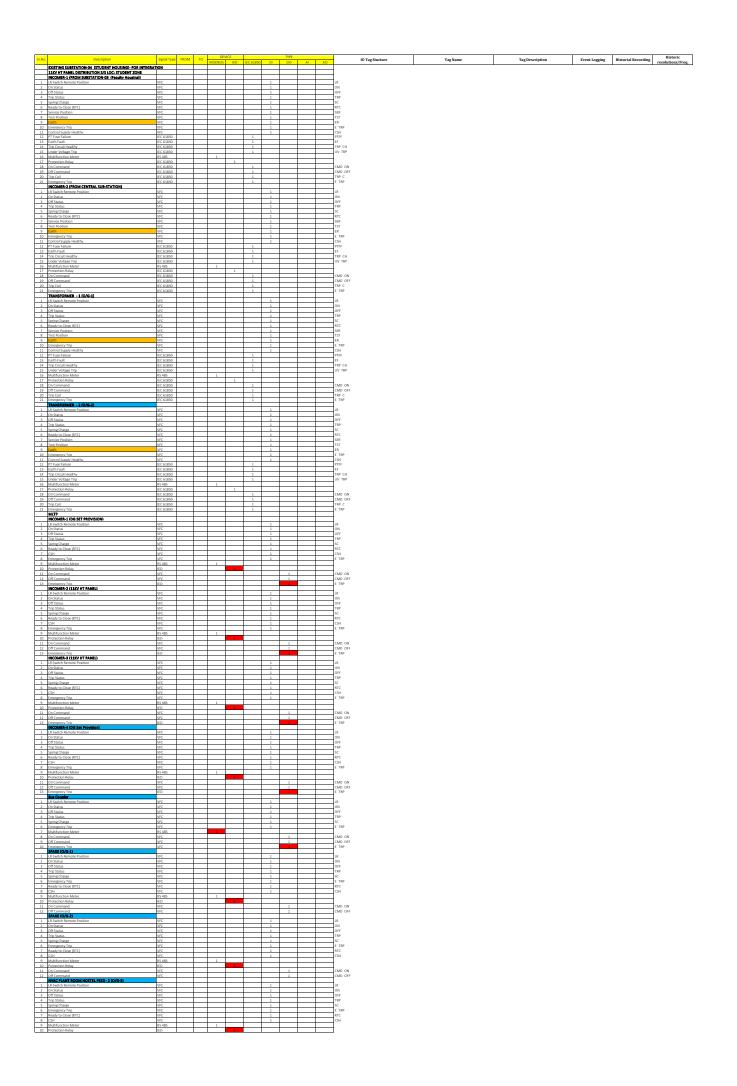


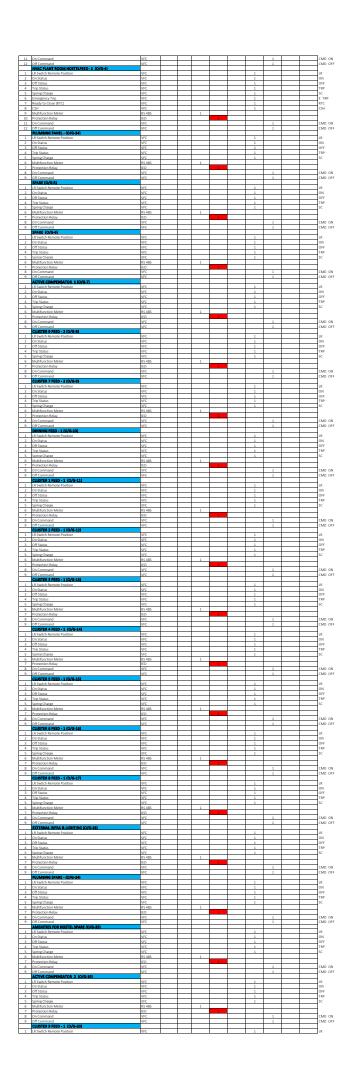


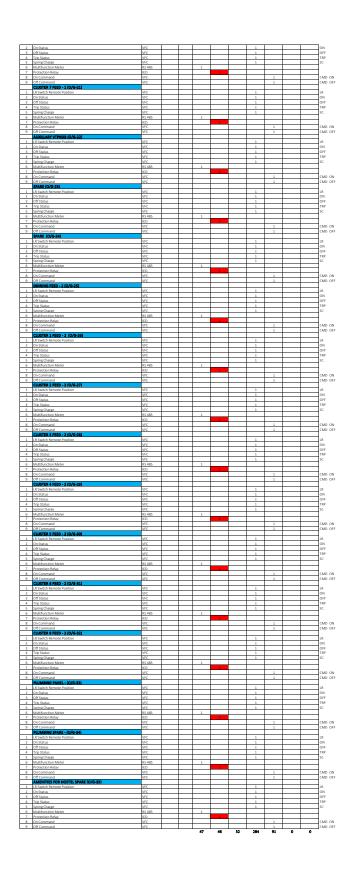
Sr.No.	Description	Signal Type	FROM	TO	DI	EVICE			TYPE		
	EXISTING SUBSTATION-03 (Feculty Housing)- FOR INTEGRATION 11KV HT PAMEL DISTRIBUTION \$/5 LOC: FACULTY HOUSING ZONE	Silling (194	THOM	10	MODBUS	IED	IEC 61850	DI	DO	Al	AD
1	IRCOMERT [FROM CENTRAL SUBSTATION] LR Switch Remote Position On Status	VFC						1			
	Off Status Trip Status Soring Charge	VFC VFC VFC						1			
7	Spring Charge Ready to Close (RTC) Service Position Test Position	VFC VFC						1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
9 10	Earth Emergency Trip	VFC VFC VFC						1 1 1 1 1			
11	Control Supply Healthy PT Fuse Failure Earth Fault	VFC IEC 61850 IEC 61850					1	1			
	Trip Circuit Healthy Under Voltage Trip Multifunction Meter	IEC 61850 IEC 61850					1				
17	Protection Relay On Command	RS 485 IEC 61850 IEC 61850			1	1	1				
19 20 21	Off Command Trip Coll Femaratery Trip	IEC 61850 IEC 61850 IEC 61850					1 1				
1	INCOMER-1 (FROM/TO SUBSTATION-05 - Student Housing) LR Switch Remote Position	VFC						1			
2	On Status Off Status Trio Status	VFC VFC VFC						1 1			
5	Spring Charge Ready to Close (RTC)	VFC VFC						1			
8	Service Position Test Position Earth	VFC VFC VFC						1			
10	Emergency Trip Control Supply Healthy PT Fuse Fallure	VFC VFC IEC 61850					1	1			
13	Earth Fault	IEC 61850 IEC 61850					1				
15 16	Trio Circuit Healthy Under Voltage Trip Multifunction Meter Protection Relay	IEC 61850 RS 485 IEC 61850			1	1	1				
18	On Command Off Command Trip Coll	IEC 61850 IEC 61850					1				
21	Trip Coll Emergency Trip TRANSFORMER - 1 (0/0-1)	IEC 61850 IEC 61850					1				
	On Status Off Status	VFC VFC						1			
4	Trip Status Soring Charge	VFC VFC VFC						1			
6	Anny Choise (RTC) Service Position Test Position	VFC VFC						1			
10	Emergency Trip	VFC VFC	L	E	L	L		1	L	L	
11	Upstream breaker Trip Control Supply Healthy Multifunction Meter	VFC VFC RS 485		F	<u> </u>	—		1			
14	Earth Fault	IEC 61850 IEC 61850	L	E	1	L	1		L	L	
16 17	Under Voltare Trip Under Voltare Trip Protection Relay	IEC 61850 IEC 61850			-		1		-		
10	WTI	IEC 61850 VFC VFC	L	E	E	Ľ		1	L		
24 25 26	Of Command Off Command Trip Coll	VFC VFC IEC 61850			-	1	1		1		
27	Emergency Trip	IEC 61850 IEC 61850		E	E	L	1		L		
1	Un Status Off Status	VFC VFC VFC			-	1		1	-		
4	Trip Status Socion Chorne	VFC						1			
6 7 8	Rady to Close (RTC) Service Position Test Position	VFC VFC VFC	<u> </u>	<u> </u>	<u> </u>			1	-		
10	Careta and Tala	VFC						1			
11	Underweite Virio Upstream breaker Trip Control Supply Healthy Multifunction Meter	VFC VFC RS 485						1			
		IEC 61850 IEC 61850					1				
16 17	Charlos Hack CS status Trip Circuit Agaithy Under Voltaga Trip Protection Relay CPL	IEC 61850 IEC 61850 IEC 61850				1	1				
20	90	VFC VFC						1			
24 25	On Command Off Command Off Command	VFC VFC IEC 61850							1		
	Trip Coll Emergency Trip MLTP - SUB-STATION FACULTY HOUSING RUNNING LOAD: 1845 KW	IEC 61850					1				
1	INCOMER-1 (DG SET PROVISION) Remote Selector Switch On Status Of Castus Of Castus	VEC						1			
4	Trin Status	VFC						1			
6	Spring Charge Ready to Close (RTC) CSH	VFC VFC VFC						1			
8	Emergency Trip Multifunction Meter	VFC RS 485			1			1			
10	Protection Relay On Command Off Command	VFC VFC				1			1		
13	Emergency Trip	IED							1		
2	Remote Selector Switch On Status Of Status Of Status	VFC VFC						1 1			
5	Trip Status Sorine Charge	VFC VFC						1			
8	Ready to Close (RTC) CSH Emergency Trip	VFC VFC						1 1			
9	Multifunction Meter	RS 485 IED VFC	<u> </u>		1	-			1		
	Off Command Off Command Emergency Trip	VFC							1		
		VFC						1 1 1	-		
3	Informatic's United Inducts Informatis Alexandro Of Status Of Status Spring Charge Spring Charge	VFC						1			
		VFC VFC VFC	<u> </u>	<u> </u>	_	-		1 1			
8	NBAPY TO LOSGE (HTL) CSH Emergency Trip Multifunction Meter Protection Relay	VFC RS 485		E	1			1			
40 11 12	Provection Netay On Command Off Command	VFC VFC	L	L	L	E			1		
13	1 Accession refer Commission Off Commission Designatory (Fig INCOMERT, IGG SET PROVISION) INCOMENT, IGG SET PROVISION INCOMENT	VFC		-	-	-			1		
2	Remote Selector Switch On Status Off Status	VFC	<u> </u>					1 1 1 1 1 1			
4	Un Status Of Status Trijo Status Sorina Charene Ready to Close (RTC)	VFC VFC VFC			-			1 1	<u> </u>		
7	CSH Emergency Trip	VFC			-	-		1			
9 10 13	Neary to Clave (NC) Congressery Try Multifunction Neter Protection Neter On Command On Command	RS 485 IED VFC	1	1	1			_	1		
	Un Command Off Command Emergency Trip Des Couler Parts Collector Switch	VFC VFC							1		
1	Bus Coupler Remote Selector Switch On Status	VFC	<u> </u>	<u> </u>		<u> </u>		1			
		VFC VFC						1 1 1			
5 6 7	Um Saldos Trig Status Spring Charge Emeratency Trio Multifunction Meter	VFC VFC RS 485		L				1	L		
9	Of Command Off Command	VFC VFC							1		
10	Emergency Trip SPARE (O/G-1) Remote Selector Switch	VFC	<u> </u>	<u> </u>	_	-		1	1		
2	On Status Off Status	VFC VFC						1			
4 5 6	Trip Status Sorine Charpe	VFC VFC VFC	<u> </u>	<u> </u>	_	-		1 1			
7	Ready to Close (RTC) CSH	VFC VFC						1			
9 10	Lang percent reserves Kang to Clove (RTC) CAH Mathurction Meter Protection Neter On Command	RS 485 IED VFC			1			_	1		
12	SPARE (O/G-2)	VFC							1		
1	Remote Selector Switch On Status Off Status	VFC VFC VFC		E	-			1 1	-		
2	Utt Status Trip Status Spring Charge	VFC						1			
4	spring charge	VFC VFC	<u> </u>	<u> </u>	<u> </u>			1 1			
4	ppming change Emergency Trip Ready to Close (RTC) 75H	VEC	i	1	1	1		4			
4 5 7 8	Emergency Trip Ready to Close (RTC) CSH	VFC RS 485 IED		L		1					
4 5 7 8 9 10 11 12	Emergency (Trp Beady to Cloce (RTC) CSH Multifunction Meter Protection Relay On Command Off Command	VFC RS 485 IED VFC VFC				1			1		
4 5 7 8 9 10 11 12	Emergency (Trp Beady to Cloce (RTC) CSH Multifunction Meter Protection Relay On Command Off Command	VFC RS 485 IED VFC VFC VFC VFC						1	1		
4 5 7 8 9 10 11 12 1 2 3	Integracy Top Control	VFC RS 485 IED VFC VFC VFC VFC VFC VFC VFC						1 1	1		
4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7	Emergency (Trp Beady to Cloce (RTC) CSH Multifunction Meter Protection Relay On Command Off Command	VFC RS 4885 IED VFC VFC VFC VFC VFC RS 485 IED			1			1	1		

1									
2	Remote Selector Switch On Status	VFC VFC					1		
3 4	Off Status Trip Status	VFC VFC					1		
5	Spring Charge Emergency Trip	VFC VFC					1		
8	Ready to Close (RTC) CSH Multifunction Meter	VFC VFC RS 485					1		
10	Protection Relay On Command	IED VEC				1		1	
	Off Command FACULTY HOUSING 1B FEED -1 (0/G-5)	VFC						î	
1	Remote Selector Switch On Status	VFC VFC					1		
3	Off Status Trip Status	VFC VFC					1		
5 6	Sorine Charge Emergency Trip	VFC VFC					1		
7	Ready to Close (RTC) CSH	VFC VFC					1		
9	Multifunction Meter Protection Relav On Command	RS 485			1	1			
11	Off Command SPARE (0/G-6)	VFC VFC						1	
		VFC VFC					1		
3	On Status Off Status Trip Status	VFC VFC					1		
5 6	Sorine Charee Multifunction Meter	VFC RS 485			1		1		
7 8 9	Protection Relay On Command	VFC VFC				1		1	
1	Off Command FACULTY HOUSING 1C FEED - 2 (O/G-7) Remote Selector Switch	VFC					1		
2	Off Status Off Status	VFC VFC					1		
4	Trip Status Sorine Charge	VFC VFC					1		
6 7	Emergency Trip Ready to Close (RTC)	VFC VFC					1		
8 9 10	CSH Multifunction Meter	VFC RS 485			1		1		
11	Protection Relay On Command Off Command	VFC VFC						1	
1	FACULTY HOUSING 1D FEED - 2 (0/G-8) Remote Selector Switch	VFC					 1	Ē	_
2	On Status Off Status	VFC VFC	-	-	-		1	-	-
4 5	Trip Status Spring Charge	VFC VFC					 1		
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9 10	CSH Multifunction Meter Protection Relay	VFC RS 485 IED			1		1		
11	On Command	VFC VFC					 	1	_
1	AUXILLARY VTPM DB(O/G-9) Remote Selector Switch	VFC					 1		
3	On Status Off Status	VPL VFC	-				 1		
5	Trip Status Spring Charge Multifunction Meter	VFC VFC RS 485	-	-	1		1		
7	Multifunction Meter Protection Relay On Command	IED VFC	L	Ŀ	_	1		1	_
9	Off Command	VFC				<u> </u>	 	1	
1 2	Remote Selector Switch On Status	VFC VFC			_		1	_	_
3 4 0	Off Status Trio Status Spring Charge	VFC VFC VFC					 1		
6	Spring Charge Multifunction Meter Protection Relay	VFC RS 485 IED			1		1		
8	On Command Off Command	VFC VFC	L	L	_			1	_
1	MLTP - SPARE (O/G-11) Remote Selector Switch	VFC					1	È	
2	On Status Off Status	VFC VFC	-	-	-		1	-	-
5	Trip Status Spring Charge Multifunction Meter	VFC VFC PC APS	-		1		 1		
ь 7 о	Multifunction Meter Protection Relav On Command	IED VEC			1	1			
9	Off Command FACULTY HOUSING 1CFEED - 1 (0/3-12)	VFC						1	
1 2	Remote Selector Switch On Status	VFC VFC			_		1	_	-
3 4	Off Status Trip Status	VFC VFC					 1		
5 6 7	Spring Charge Emergency Trip Readv to Close (RTC)	VFC VFC VFC	-				 1		
8	GH Multifunction Meter	VFC RS 485			1		1		
10	Protection Relay On Command	IED VFC				1		1	
12	Off Command TO : MLTPFACULTY HOUSING 1DFEED - 1 (0/G-13) Remote Selector Switch	VFC VFC						1	
2	On Status Off Status	VEC					1		
		VFC							
4	Trip Status Spring Charge	VFC VFC VFC					1		
5	Trio Status Spring Charge Emergency Trip Ready to Close (RTC)	VFC VFC VFC VFC VFC					1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
5 6 7 8	Trio Status Spring Charge Emergency Trip Ready to Close (RTC) CSH MitiBurction Meter	VFC VFC			1	1	1 1 1 1 1		
5 6 7 8 9 10 11	The Status String Charge Energiance, Trig Energiance, Trig Energiance, Trig Energiance, ETCC Energiance, ETC	VFC VFC VFC VFC			1		1	1	
5 6 7 8 9 10 11 12	The Status Spring Charge Emergency Trip Ready to Close (RTC) CSH Multifunction Meter Protection Relay On Command	VFC VFC VFC RS 485 IED VFC			1		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	
5 6 7 8 9 10 11 12 12 3	The Select Attention of The Se	VFC VFC VFC RS 485 IED VFC VFC VFC			1	1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	
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5 6 7 8 9 10 11 12 3 4 5 6 7 7 8 9	The Galaxy International Content of the Content of	VFC VFC VFC R5.485 IED VFC VFC VFC VFC VFC VFC VFC VFC VFC VFC			1			1	
5 6 7 8 9 10 11 12 2 3 4 5 6 7 8 9 9	Tex Geno. In. Texas (an experise) Tey Texas (an experise) Tey Texas (an experise) Tey Texas (an experise) Texas (an ex	VFC VFC VFC VFC RS 485 IED VFC VFC VFC VFC VFC VFC VFC VFC VFC VFC			1		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	
5 6 7 8 9 10 11 12 2 3 4 5 6 7 8 9 9 1 2 3	Two Sectors - Tw	VFC VFC VFC RS 485 IED VFC VFC VFC VFC VFC VFC VFC VFC VFC VFC			1			1	
5 6 7 8 9 9 10 11 12 2 3 4 5 6 7 7 8 9 9 9 1 1 2 3 4 5 5 3 4 5 5	The Galo. In Action of	VFC VFC VFC VFC R5485 IED VFC			1		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	
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5 6 7 7 8 9 9 10 11 12 2 3 4 5 6 7 7 8 9 9 11 2 2 3 4 5 5 6 7 7 8 9 9 10 11 12 2 3 4 5 7 7 8 9 9 10 10 11 12 2 3 3 4 5 5 6 6 9 10 10 10 10 10 10 10 10 10 10 10 10 10	The data. The data. The data is a second of the data	VFC VFC VFC RS485 IED VFC			1		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1	
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5 6 7 8 9 9 10 11 12 2 3 4 4 5 6 7 7 8 9 9 11 1 12 2 3 4 4 5 6 7 7 8 9 9 9 10 11 12 2 3 4 4 5 5 6 7 7 8 9 9 9 9 9 11 12 2 3 4 4 5 5 6 7 7 8 9 9 9 9 9 9 9 9 9 9 9 9 9	Tea Gan. In Tea Gan. In Conceptor 160 Margin Conceptor 160 Mar	VVC VVC VVC VVC VVC VVC VVC VVC VVC VVC						1	
5 6 7 8 9 9 10 11 12 2 3 4 4 5 5 6 7 7 8 9 9 11 2 2 3 4 4 5 5 7 7 8 9 9 10 11 1 2 2 3 4 4 5 5 6 6 7 7 8 9 9 10 11 1 12 2 3 11 1 1 2 2 3 11 1 1 2 2 3 3 4 4 5 5 5 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	Tak data. Tak data. Despenya Jay Bangku Case (MC) Sola Despenya Jay Bangku Case (MC) Sola Despenya Jay Bangku Case (MC) Sola Despenya Jay Sola	VIC			1			1	
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5 6 7 7 8 9 10 11 12 3 4 4 5 6 7 7 8 9 9 1 1 2 3 3 4 4 5 6 6 7 7 8 9 9 20 3 21 1 22 2 1 1 22 3 4 5 6 7 11 2 3 4 5 6 7 8 6 7 8 8	Tak data. In the second	VIC						1	
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5 6 7 8 9 11 12 1 2 3 4 5 6 7 8	Tak Akab. In	974 974 974 975 975 975 975 975 975 975 975							
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		l.e.	-					-		-
	Trip Status	VFC					1			
5	Spring Charge	VFC					1			
6	Multifunction Meter	RS 485		1						
7	Protection Relay	IED								
8	On Command	VFC						1		
9	Off Command	VFC						1		
				30	27	20	213	59	0	0







sr.No.	Description	Signal Type FROM	то	MODBUS	VICE IED	IEC 61850 DI		A	Ţ
1	Central Library under this EPC tender RMU - INCOMING FROM SUBSTATION-05- LR Switch Remote Position On Status	THIS INCLUDES 11KV	CABLE NE	TWORK AND	D TAPING P	ANELS /RMUs			
3	On Status Off Status Trip Status Spring Charge	VFC VFC VFC							-
6	Ready to Close (RTC) Service Position Test Position	VFC VFC VFC							-
9	Earth Emergency Trip Control Supply Healthy	VFC VFC VFC VFC							
12 13	PT Fuse Failure Earth Fault Trip Circuit Healthy	IEC 61850 IEC 61850 IEC 61850				1 1			
15 16	Under Voltage Trip Multifunction Meter	IEC 61850 RS 485		1		1			
18 19	Protection Relay On Command Off Command	IEC 61850 IEC 61850 IEC 61850			1	1			
20	Trip Coll Emergency Trip TRANSFORMER - N Nos, N>2	IEC 61850 IEC 61850				1			+
1	LR Switch Remote Position On Status Off Status	VFC VFC VFC							
4	Trip Status Spring Charge	VFC VFC VFC							
7	Ready to Close (RTC) Service Position Test Position	VFC VFC							
9 10	Earth Emergency Trip Control Supply Healthy	VFC VFC VFC							
12	PT Fuse Failure Earth Fault Trip Circuit Healthy	IEC 61850 IEC 61850 IEC 61850				1			
15 16	Under Voltage Trip Multifunction Meter	IEC 61850 RS 485		1		1			
18	Protection Relay On Command Off Command	IEC 61850 IEC 61850 IEC 61850			1	1			
20 21	Trip Coll Emergency Trip	IEC 61850 IEC 61850				1			
2	MLTP LV Breaker (ACB) Remote Selector Switch On Status	VFC VFC							
4	Off Status Trip Status Spring Charge	VFC VFC VFC					L		
6	Ready to Close (RTC) CSH Multifunction Meter	VFC VFC RS 485		1					
10	Protection Relay On Command	IED VFC			1			1	
1	Off Command MLTP - ACB OF REQUISITE RATING +MIN 3 Remote Selector Switch	VFC	, SOKA LS	G				1	
2 3 4	On Status Off Status Trip Status	VFC VFC VFC	_				L		
5	Spring Charge Ready to Close (RTC) CSH	VFC VFC VFC					1		
9 10	Multifunction Meter Protection Relay	RS 485		1	1				
12	On Command Off Command MLTP - DG - "H" number which depend or understand the level of operation, the fin	VFC VFC n the design, the tent	etive list o	of the signal	is are being	provided for 1 tr		1 /DG set t	t
	understand the level of operation, the fin. N>2. Remote Selector Switch	VFC	the numb	er of feeder	rs (n+1 sou	ces, N+1 DG set as		6 laod + sp	re,
2	On Status Off Status	VFC VFC					1		
5	Trip Status Spring Charge Ready to Close (RTC)	VFC VFC VFC							-
7	CSH Emergency Trip Multifunction Meter	VFC VFC RS 485		1					
10 11	Protection Relay On Command	IED VFC			1			1	
13	Off Command Emergency Trip MLTP -Spare	VFC VFC						1	
1	Remote Selector Switch On Status Off Status	VFC VFC							
4	Trip Status Spring Charge	VFC VFC							
7	Ready to Close (RTC) CSH Multifunction Meter	VFC VFC RS 485		1					
10	Protection Relay On Command Off Command	IED VFC VFC			1			1	
1	MLTP - Aux VTPN DB Remote Selector Switch	VFC						1	
3	On Status Off Status Trip Status	VFC VFC VFC							
5	Spring Charge Ready to Close (RTC) CSH	VFC VFC VFC							
8 9	Emergency Trip Multifunction Meter	VFC RS 485		1					
11 12	Off Command	IED VFC VFC			-			1	-
13	Emergency Trip MLTP - External Infra & Lighting Remote Selector Selfth	VEC						1	
2	On Status Off Status	VFC VFC							
5	Trip Status Spring Charge Ready to Close (RTC)	VFC VFC VFC							
7	CSH Emergency Trip Multifunction Meter	VFC VFC RS 485		1					
10	Protection Relay On Command	IED VFC			1			1	
1	Off Command MLTP -Plumbing Spare Remote Selector Switch	VFC						1	
3	On Status Off Status Trip Status	VFC VFC VFC							
5	Spring Charge Ready to Close (RTC) CSH	VFC VFC					1		
8 9	Emergency Trip Multifunction Meter	VFC VFC RS 485		1					
11	Protection Relay On Command Off Command	IED VFC VFC			-			1	
1	MLTP - Active Companyator Remote Selector Switch On Status	VFC VFC							
3	Off Status Trip Status	VFC VFC					1		
6	Spring Charge Ready to Close (RTC) CSH	VFC VFC VFC	-				1		
9	Emergency Trip Multifunction Meter Protection Relay	VFC RS 485 IED		1					
11 12	On Command Off Command	VFC VFC						1	
1	MLTP - SPARE Remote Selector Switch On Status	VFC VFC							
3	Off Status Trip Status Spring Charge	VFC VFC VFC							
6	Ready to Close (RTC) CSH Emergency Trip	VFC VFC							
9 10	Multifunction Meter Protection Relay	VFC RS 485 IED		1				_+	+
11 12	On Command Off Command	VFC VFC						1	
1	Remote Selector Switch On Status	VFC VFC							t
		VFC VFC VFC						_+	+
4	Trip Status Spring Charge		T						1
3 4 5 6 7	Spring Charge Ready to Close (RTC) CSH	VFC VFC							
3 4 5 6 7 8 9 10	Spring Charge Ready to Close (RTC) CSH Emergency Trip Multifunction Meter Protection Relay	VFC VFC RS 485 IED		1	1				-
3 4 5 6 7 8 9 10 11 12	Spring Charge Ready to Core (RTC) CSH Emergency Trip Multifunction Meter Protection Relay On Command Off Command MLTP - SPARE	VFC VFC RS 485 IED VFC VFC		1	1			1	
3 4 5 6 7 8 9 10 11 12 1 2	Spring Charge Ready to Close (RTC) CSH Emergency Trip Multifunction Meter Protection Relay On Command	VFC VFC RS 485 IED VFC		1	1				

		_									
Ready to Close (RTC)	VFC						1				1
CSH	VEC						1				1
Emergency Trip	VFC						1				Í
Multifunction Meter	RS 485			1							í
Protection Relay	IED										Í
On Command	VFC							1			í
Off Command	VFC							1			Í
				60	8	\$	480	120	0	0	Multiple by N+
	Emergency Trip Multifunction Meter Protection Relay On Command	CSH VFC Emergency Trip VFC Multifunction Meter RS 485 Protection Relay IED On Command VFC	CSH VFC Emergency Trip VFC Multifunction Meter RS 485 Protection Relay BD On Command VFC	CH VFC Emergency Trip VFC Multifunction Meter R5 485 Protection Relay RD On Command VFC	Coll UTC Integratory Intergratory UTC Integratory Multifications Meter K8 485 1 Protection Relay B.D Integratory GA Command VFC Integratory GA Command VFC Integratory	CH VFC Imagency Trip Imagency Trip	Cut VfC Integroup Top VfC Multifaction Meter 85:485 3 Potestion Rely 8:0 1 On Command VfC 1 On Command VfC 1	Chi VEC 1 Intergeor Tip VEC 1 Multification Meter 65.455 1 Protection Metry 80 1 Or Commod VEC 0 Gl Gommad VEC 0	Cal. VEC 1 Impegno Tip VEC 1 Multification Meter 65.455 1 Vec 1 1 Antification Meter 65.455 1 Occommad VEC 1 On Commad VEC 1 Of Commad VEC 1	Cal. VFC I Intergency Tup VFC I Multification Meter ES 485 I Practation Netry ED I ObsCommad VFC I ObsCommad VFC I	Cyl. VfC 1 1 Integracy Tup VfC 1 1 1 Multipractica Meter 55.455 1 1 1 Potenticia Meter 56.455 1 1 1 1 Obcommad VfC 1 1 1 1 1 Obcommad VfC 1 1 1 1 1 1

Description Desc	Description
Partner Partner Partner Partner Partner Partner Partner Part	ON-11 YOGA CENTER PANEL DISTRIBUTION SUBSTATION
	COMER- 1 WITH TAPING PANEL/R
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 <	
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Normal Normal<	sition
> Norm No	y Trip
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2) 2) 2) 2) 2) 2) 2) 2) </td <td>t Healthy</td>	t Healthy
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	-2 (TIE FEEDER INCOMER SUBSTAT
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a) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b) b)	sition ion
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	close (RTC) sition
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a b b b b b b b b b b b b b b b b b b b b b b b b b b b b c b b b b b b c b b b b b b c b b b b b b c b b b b b b c b b b b b b c b b b b b b c b b b b b b c b b b b b b c b b b b b b c b b b b b b c b b b b b b c b b b b b b c b b b b b b <td></td>	
1 March No. No. No. No. No. No. 10 March No. No. No. 10 March <	llose (RTC)
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11 Mathematicanto 11 No. No. No. No. 12 Mathematicanto 12 No. No. No. 13 Mathematicanto 12 No. No. No. 14 Mathematicanto 12 No. No. No. 15 Mathematicanto 12 No. No. No. 16 Mathematicanto 12 No. No. No. 17 Mathematicanto 12 No. No. No. 18 Mathematicanto 12 No. No. No. 19 Mathematicanto 12 No. No. No. 10 No. No. No. No. 10 No. No. No. No.	breaker Trip pply Healthy
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iii Andram iiii Andram iiii Andram iiii Andram	it Healthy
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	y Trip ADAMIC SUBSTATION)
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10 Note::::::::::::::::::::::::::::::::::::	tion Meter
instruct Normal Norma	and
1 Manda Sakoto Sakoto Manda Sakoto Sakoto Sakoto Manda Sakoto Sakoto Sakoto Sakoto Sa	y Trip -2 (DG1-750KVA)
4. Instand	elector Switch
6 Mode (MC) MC I I I I 0 Mode Code (MC) MC I I I I 0 Mode Code (MC) MC I I I I I 0 Mode Code (MC) MC I	s arge
Multiplection Moder 61 dist 0 <td>Close (RTC)</td>	Close (RTC)
10 0000mand 010 01 0	tion Meter 1 Relay
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5 Sirror (Ange) Vic 1 1 6 Bendy Cache and Sirror 1 1 1 7 Control (Control (Contro) (Control (Contro) (Control (Control (Contro (Contr	
8 [Interpret/Trip VFC 1 1]	arge
	tion Meter
10 Protectional production and produ	n Relay. and
12 Diff Command VFC 1 13 Emergency Trip VFC 0 0 NCMMER-0 62750XVA 0 0 0	y Trip
1 Rende Selecto Yalth VTC 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	elector Switch
3 Of Status VFC 1 1 4 Trip Status VFC 1 1 5 Spring Charge VFC 1 1	5

7 8 9 10 11 12 13 1 2 3	CSH Emergency Trip Multifunction Meter Protection Relay Concommand Off Command Emergency Trip SPARE (VG-1)	VFC VFC RS 485 IED VFC VFC VFC			1	1		1	1		
11 12 13 1 2 3	On Command Off Command Emergency Trip	VFC VFC				1			1		
13 1 2 3	Emergency Trip										
2		inc.							1		
	Remote Selector Switch On Status	VFC VFC						1			
4	Off Status Trip Status Spring Charge	VEC						1			
6	Spring Charge Ready to Close (RTC) CSH	VFC VFC VFC						1			
9 10	Multifunction Meter Protection Relay	RS 485 IED			1	1					
11 12	On Command Off Command	VFC VFC							1		
1	MLTP ACADEMIC FEED - 1 (0/G-2) Remote Selector Switch On Status	VFC						1			
3	Off Status Trip Status	VFC VFC						1			
5	Spring Charge Ready to Close (RTC)	VFC VFC						1			
7	CSH Multifunction Meter	VFC RS 485			1			1			
10 11 12	Protection Relay On Command Off Command	IED VFC VFC							1		
1	HVAC Plant Room Feed 2 (O/G-3) Remote Selector Switch	VFC						1			
2	On Status Off Status	VFC VFC VFC						1			
5	Trip Status Spring Charge Ready to Close (RTC)	VFC VFC VFC						1			
7	CSH Multifunction Meter	VFC RS 485			1			1			
	Protection Relay On Command	IED VFC				1			1		
12	Off Command ACADEMIC UPPER SPINE TTP PANEL (O/G-4)	VFC							1		
2	On Status Off Status Trip Status	VEC VEC VEC						1			
4	Spring Charge Multifunction Meter	VFC RS 485			1			1	-	H	_
6	Protection Relay On Command	IED VFC			_	1			1		E
8	Off Command Auxiliary DB (O/G-5)	VFC			-		-		1		
2	On Status Off Status Trip Status	VFC VFC VFC						1			-
4	Trip Status Spring Charge Multifunction Meter	VFC VFC RS 485			1			1			_
6	Protection Relay On Command	IED VFC		L	_	1		L	1		-
8	Off Command External Infra & Lighting (C/G-6)	VFC							i		L
1	On Status Off Status	VFC VFC						1	-		E
3	Trip Status Spring Charge	VEC						1			
5	Multifunction Meter Protection Relay On Command	RS 485 IED VFC			1	1		-	1		
8	On Command Off Command BALANCING TANK-B TO KAMAL SAGAR-B (O/G-7)	VEC							1		_
1	On Status Off Status	VFC						1			
3	Trip Status Spring Charge	VFC						1			
5	Multifunction Meter Protection Relay	RS 485 IED			1	1					
7 8	On Command Off Command	VFC VFC							1		
1	Active Companiator 1 (O/G-8) On Status	VFC						1			
2	Off Status Trip Status	VFC						1			
5	Spring Charge Multifunction Meter Protection Relay	VFC RS 485 IED			1			1			
7	On Command Off Command	VFC							1		
1	Spare (O/G-9) On Status	VFC						1			
2	Off Status Trip Status	VFC VFC						1			
4	Spring Charge Multifunction Meter	VFC RS 485			1			1			
6 7	Protection Relay On Command	IED VFC				1			1		
8	Off Command Spare (0/G-10)	VEC							1		
2	Remote Selector Switch On Status Off Status	VFC VFC VFC						1			
4	Trip Status Spring Charge	VFC						1			
6 7	Ready to Close (RTC) CSH	VFC VFC						1			E
9 10	Multifunction Meter Protection Relay	RS 485 IED			1	1		-	-		
11 12	On Command Off Command	VFC VFC							1		
1	MLTP Acedmic Feed 2 (0/G-11) Remote Selector Switch	VEC						1			-
2 3 4	On Status Off Status Trip Status	VEC VEC VEC						1			
4 5 6	Trip Status Spring Charge Ready to Close (RTC)	VFC VFC VFC						1 1			L
7	CSH Multifunction Meter	VFC RS 485			1			1			E
10	Protection Relay On Command	IED VFC							1		
12	Off Command HVAC Plant Feed 1 (0/G-12)	VFC							1		
2	Remote Selector Switch On Status Off Status	VEC VEC VEC						1			-
3 4 5	Off Status Trip Status Spring Charge	VFC VFC VFC						1			_
6	Ready to Close (RTC) CSH	VFC VFC						1			-
9 10	Multifunction Meter Protection Relay	RS 485			1			L			L
11	On Command Off Command	VFC VFC						-	1		E
1	Active Compensator 2 (O/G-13) Remote Selector Switch	VFC						1			
2	On Status Off Status Tele Status	VFC VFC						1			_
4 5 6	Trip Status Spring Charge Multifunction Meter	VFC VFC RS 485			1			1	-		
6 7 8	Protection Relay On Command	RS 485 IED VEC			1	1			1		_
9	Off Command Fire Fighting Panel (O/G-14)	VFC							1		F
1 2	Remote Selector Switch On Status	VFC VFC	<u> </u>					1			E
3	Off Status Trip Status	VFC VFC						1			
5	Spring Charge Multifunction Meter	VFC RS 485			1			1			
7 8 9	Protection Relay On Command Off Command	VFC VFC							1		
9 1	Off Command Spare (O/G-15) Remote Selector Switch	VEC						1			-
2	On Status Off Status	VFC VFC						1	E		L
4	Trip Status Spring Charge	VFC VFC						1			_
6 7	Multifunction Meter Protection Relay	RS 485 IED			1	1					_
8 9	On Command Off Command	VFC VFC			_				1		
1	Spare (O/G-16) Remote Selector Switch	VFC						1			
2	On Status Off Status	VEC						1	_		_
3	Trip Status	VFC						1			
4	Spring Charge	VEC									
	Spring Charge Ready to Close (RTC) CSH	VFC VFC RS 485			1			1			
4 5 6 7 9 10	Spring Charge Ready to Close (RTC)				1	1		1	1		

_	Description	Signal Type FRI	M TO	DEVI	Œ		TYPE	
Sr.No.	SUSBEATION-10 AUDITORIUM UNDER THIS EPC TEN			MODBUS	IED IEC 6185	0 DI	DO	AI AC
	11KV HT PANEL DISTRIBUTION SUBSTATION	CENTRAL SUBSTATIO	OR UBRARY C	R NORTH DE	END ON DESIGN A		IMUM REDUND	
2	LR Switch Remote Position On Status Off Status	VFC VFC				1 1		
4	Trip Status Spring Charge	VFC VFC	-			1 1		
7	Service Position	VFC VFC				1		
9 10	Earth Emergency Trip	VFC VFC VFC				1 1		
12	Control Supply Healthy	VFC VFC RS 485		1		1		
15	Earth Fault	IEC 61850 IEC 61850 IEC 61850			1			
17	Trip Circuit Healthy	IEC 61850 IEC 61850 IEC 61850			1			
19	Protection Relay On Command	IEC 61850			1		1	
23	Off Command INCOMER-2 WITH TAPING PANEL /RMU (LIBRARY AI LR Switch Remote Position	VFC		DEPEND ON		NUM RE	DUNDANCY)	+
2	On Status Off Status	VFC				1		
4	Trip Status Spring Charge	VFC VFC	\pm	$+ \neg$		1 1 1		
7	Service Position Test Position	VFC VFC				1		
9 10	Earth Emergency Trip	VFC VFC				1		
11 12	Upstream breaker Trip Control Supply Healthy	VFC VFC RS 485	_	1		1		
14 15	PT Fuse Failure Earth Fault	IEC 61850 IEC 61850			1			
16 17	DC Status Trip Circuit Healthy	IEC 61850 IEC 61850			1			
19	Under Voltage Trip Protection Relay On Command	IEC 61850 IEC 61850 VFC	_	+	1	-	1	_
23	Off Command BUSCOUPLER	VFC					1	
2	LR Switch Remote Position On Status Off Status	VFC VFC VFC		$\downarrow = $		1		
4	Trip Status Spring Charge	VFC VFC				1		
6	Ready to Close (RTC) Service Position	VFC VFC VFC	\pm	$+ \neg$		1		
9 10	Control Supply Healthy Trip Circuit Healthy	VFC				1		
11 12	Under Voltage Trip Emergency Trip	VFC VFC VFC				1		-
14	DC Status Earth PT Fuse Failure	VFC VFC	—			1		
1	Transformer 1 (OUTGOING-1) LR Switch Remote Position	VEC	_			1		_
3	On Status Off Status Trip Status	VFC VFC VFC		+ - 1		1 1		
5	Spring Charge Ready to Close (RTC)	VFC VFC				1		
7		VFC VFC				1		
9 10	Earth Emergency Trip	VFC VFC	—	+		1 1		
12 13	Multifunction Meter	VFC VFC RS 485		1		1		-
14 15	Earth Fault DC Status	IEC 61850 IEC 61850			1			
17	Under Voltage Trip	IEC 61850 IEC 61850 IEC 61850			1 1 1			
19 20	Protection Relay OTI	IEC 61850 VFC			1	1		
21 22	WTI Buchholz relay	VFC VFC				1		
23 24	PRV MOG	VFC VFC	—	+		1		
26 27	Trip Coll	VFC VFC IEC 61850			1	L	1	
28	Emergency Trip Transfomer 2 (OUTGOING-2)	IEC 61850			1			
1	LR Switch Remote Position On Status	VFC VFC	+-	$+ \neg$		1		
4		VFC VFC	+			1		
6 7	Ready to Close (RTC) Service Position	VFC VFC VFC				1		
8 9	Test Position Earth	VFC VFC VFC	+-	$+ \neg$		1		
11	Upstream breaker Trip	VFC VFC	+			1		
13 14	Multifunction Meter Earth Fault	RS 485 IEC 61850		1	1			
16	Trip Circuit Healthy	IEC 61850 IEC 61850		+	1	1		_
18	PT Fuse Failure	IEC 61850 IEC 61850 IEC 61850	+		1	1		
20 21	оп wn	VFC VFC				1		
22 23	Buchholz relay PRV	VFC VFC				1		┢
24 25 26	On Command	VFC VFC	_	+		1	1	
27 28	Trip Coll Emergency Trip	VFC IEC 61850 IEC 61850			1		1	
	MLTP (ACADAMIC SUBSTATION) INCOMER-1 FROM TRANSFORMER-1		+-	$+ \neg$				
2		VFC VFC	_			1		
4	Trip Status Spring Charge	VFC VFC				1		
6	Ready to Close (RTC) CSH	VFC VFC	+-	$+ \neg$		1		+
8 9	Emergency Trip Multifunction Meter	VFC RS 485 IED	_	1	_	1		
11 12	On Command Off Command	VFC VFC				-	1	
13	Emergency Trip INCOMER-2 (DG1)	VFC					1	-
2	On Status	VFC VFC VFC	_	+		1	 [
4	Trip Status Spring Charge	VFC VFC VFC				1		_
6 7	Ready to Close (RTC) CSH	VFC VFC VFC				1		
8 9	Emergency Trip Multifunction Meter	VFC RS 485		1		1		
11	On Command	IED VFC VEC	_			-	1	_
13	Off Command Emergency Trip BUSCOUPLER	VFC	+			1	1	
1 2	Remote Selector Switch On Status	VFC VFC				1		
3	Off Status Trip Status	VFC VFC				1		
5	Spring Charge Emergency Trip	VFC VFC RS 485	_			1		
8	On Command	RS 485 VFC VFC	+			1	1	
10	Emergency Trip INCOMER-3 FROM TRANSFORMER-2	VFC					i	-
1 2	Remote Selector Switch On Status	VFC VFC				1		
3	Off Status Trip Status	VFC VFC				1		
6		VFC VFC	—	+		1		
8 9	Emergency Trip Multifunction Meter	VFC VFC RS 485	+	1		1		+
10 11	Protection Relay On Command	IED VFC			1	L	1	1
12 13	Off Command Emergency Trip	VFC VFC				E	1	
1	INCOMER-4 DG2- Remote Selector Switch	VFC		1		1	ļ f	
3		VFC VFC VFC				1		
5	Spring Charge	VFC VFC				1		_
	· · · · · · · · · · · · · · · · · · ·			· ·				

7 8 9 10 11 12 13 1 3 4 5 6	CSH Emergency Trip Multifunction Meter Protection Relay	VFC VFC								
10 11 12 13 1 1 2 3 4		RS 485			1		1		-	-
12 13 1 2 3 4	On Command	IED VFC				1		1		
	Off Command Emergency Trip	VFC VFC						1		
	SPARE (O/G-1) Remote Selector Switch	VFC					1			
	On Status Off Status Trip Status	VFC VFC VFC					1			
	Spring Charge Ready to Close (RTC)	VFC					1			
7	CSH Multifunction Meter	VFC RS 485			1		1			
10	Protection Relay On Command	IED VFC				1		1		
12	Off Command MLTP ACADEMIC FEED - 1 (O/G-2)	VFC						1		
2	Remote Selector Switch On Status	VFC					1			
3 4	Off Status Trip Status Spring Charge	VFC VFC VFC					1			
6	Ready to Close (RTC) CSH	VEC					1			
9 10	Multifunction Meter Protection Relay	RS 485 IED			1	1				
11 12	On Command Off Command	VFC VFC						1		
1	HVAC Plant Room Feed 2 (O/G-3) Remote Selector Switch	VFC					1			
3	On Status Off Status Trip Status	VEC					1			
5	Spring Charge Ready to Close (RTC)	VEC					1			
7	CSH Multifunction Meter	VFC RS 485			1		1			
10 11	Protection Relay On Command	IED VFC				1		1		
12	Off Command ACADEMIC UPPER SPINE TTP PANEL (O/G-4) On Status	VEC						1		
2	Of Status Off Status Trip Status	VFC					1			
4	Spring Charge Multifunction Meter	VEC VEC RS 485			1		1			
6	Protection Relay On Command	IED VFC				1		1	L	L
8	Off Command Auxiliary DB (O/G-S)	VFC		_	_	_	_	1	-	-
1	On Status Off Status	VFC VFC VFC					1			
3 4 r	Trip Status Spring Charge Multifunction Meter	VFC VFC RS 485			1		1			
э 6 7	Multifunction Meter Protection Relay On Command	RS 485 IED VFC				1	_	1		
8	Off Command External Infra & Lighting (O/G-6)	VFC						1		
1	On Status Off Status	VFC VFC		_	_	_	1			
3	Trip Status Spring Charge	VFC					 1			
5	Multifunction Meter Protection Relay On Command	RS 485 IED VFC			1	1	 	1	-	-
8	Off Command Off Command BALANCING TANK-B TO KAMAL SAGAR-B (O/G-7)	VFC						1	Ŀ	Ŀ
1	On Status Off Status	VFC VFC					1			
3	Trip Status Spring Charge	VFC VFC					1			
5	Multifunction Meter Protection Relay	RS 485			1	1				
8	On Command Off Command Active Companisator 1 (0/G-8)	VFC VFC						1		
1	On Status Off Status	VFC					1			
3	Trip Status Spring Charge	VFC VFC					1			
5	Multifunction Meter Protection Relay	RS 485 IED			1	1				
7	On Command Off Command	VEC						1		
1	Spare (O/G-9) On Status Off Status	VFC VFC					1			
3	Trip Status Spring Charge	VFC					1			
5	Multifunction Meter Protection Relay	RS 485 IED			1	1				
7	On Command Off Command	VFC						1		
1	Spare (O/G-10) Remote Selector Switch On Status	VFC VFC					1			
3	Off Status Trip Status	VEC					1			
5	Spring Charge Ready to Close (RTC)	VFC VFC					1			
7 9	CSH Multifunction Meter	VFC RS 485			1		1			
10	Protection Relay On Command	IED VFC				1		1		
12	Off Command MLTP Acedmic Feed 2 (0/G-11) Remote Selector Switch	VFC					1	1		
2	Remote Selector Switch On Status Off Status	VFC VFC VFC					1			
4	Trip Status Spring Charge	VFC VFC					1			
6	Ready to Close (RTC) CSH	VFC VFC					1			
9 10 11	Multifunction Meter Protection Relay On Command	RS 485 IED VFC			1	1	 	1		
11	Off Command HVAC Plant Feed 1 (O/G-12)	VEC						1	-	-
1	Remote Selector Switch On Status	VFC					1		E	E
3	Off Status Trip Status	VFC VFC					1			
5 6 7	Spring Charge Ready to Close (RTC) CSH	VFC VFC VFC					1		-	-
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2	On Status Off Status	VFC VFC					 1			
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7	Multifunction Meter Protection Relay On Command	RS 485 IED VFC			1	1	_	1		
9	Off Command Fire Fighting Panel (O/G-14)	VFC						1		
1	Remote Selector Switch On Status	VFC VFC		_	_	_	1			
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8	On Command Off Command	VFC VFC						1	F	F
1	Spare (0/G-15) Remote Selector Switch	VFC					1			
2	On Status Off Status	VFC VFC					1			
3	Trip Status Spring Charge	VFC VFC					1			
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5 6 7 8 9 1 2 3 4 5 6 7 9	off Command Spert (05:50) Remote Selector Saltch On Status Off Status Trip Status Spring Charge Ready to Clove (RTC) CSH Multifunction Meter	VFC VFC VFC VFC VFC VFC RS 485			1		1			
5 6 7 8 9 9 1 2 3 4 5 6 7	Off Command Description Emmands Emmands Emmands Emmands Emmands Off Status Off Status Trip Status Spring Charge Ready to Close (BTC) CSH	VFC VFC VFC VFC VFC VFC			1	1	1 1 1 1 1 1	1		

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Location EXISTING MAIN RECEIVING STATION-	Item 33KV HT PANEL	33KV HT FEEDER-01	✓ ✓ ✓ ✓ ✓ ✓			P C C C C C C C C C C C C C C C C C C C
EXISTING MAIN RECEIVING STATION-	33KV HT PANEL	33KV HT FEEDER-01 33KV HT FEEDER-02		<i><i>x</i></i> <i>x x x x x</i>	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·
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SUBSTATION-01 ACADEMIC	11KV HT PANEL DISTRIBUTION S/S	CENTRAL STATION HT PANEL	✓ ✓	$\checkmark \checkmark \checkmark \checkmark \checkmark \checkmark$		
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SUBSTATION-05 Sports Complex		SUB-STATION 1 ACADEMIC SPINE	~ ~	V V V V V		
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SUBSTATION-02 INTERNATIONAL CENTER	11KV HT PANEL					· · · · · · · · · · · · · · · · · · ·			×	
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EXISTING SUB-STATION	RMU01 - SS Outreach	SUB-STATION - 02 (International Center)	· · · · · · · · · · · · · · · · · · ·		1 4	~ ~ ~ ~ ~ ~				• • •
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SUBSTATION-03 (Faculty Housing)	11KV HT PANEL	CENTRAL SUB-STATION		~ ~ v		V V V V V		•	• • • •	
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SUBSTATION-04 (STUDENT HOUSING)	11KV HT PANEL	SUBSTATION-03 (Faculty Housing)	~ ~ ~ ~	~ ~ ~	1 1	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	/ / / / .	/		
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ACADEMIC SPINE UPPER ZONE	MLTP (ACADEMIC SUBSTATION)	ACB 1250A ,4P, 50KA LSIG	~~	~ ~	/ / / /	✓	~ ~ ~ ~	/	\checkmark \checkmark \checkmark \checkmark	~
		ACB 1000A ,4P, 50KA LSIG (DG1 - 750kVA)	~~~	< <	/ / / /	✓	~ ~ ~ ~	 Image: A set of the set of the	V V V V	· · · ·
		ACB 1000A ,4P, 50KA (Buscoupler)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	< <	1 1	✓	~ ~		\checkmark \checkmark \checkmark \checkmark	· · · ·
		ACB 1250A ,4P, 50KA LSIG	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	< <	/ / / /	✓	~ ~ ~ ~	✓	\checkmark \checkmark \checkmark \checkmark	· · · ·
		ACB 1000A ,4P, 50KA LSIG (DG2 - 750kVA)	~ ~ ~ ~ ~ ~ ~ ~	< <	/ / / /	✓	~ ~ ~ ~	I	\checkmark \checkmark \checkmark \checkmark	· · · · · · · · · · · · · · · · · · ·
		ACB 1000A ,4P, 50KA LSIG (Spare)	~ ~ ~ ~ ~ ~ ~ ~	< <	/ / / /		~ ~ ~ ~	I	\checkmark \checkmark \checkmark \checkmark	
		ACB 1000A ,4P, 50KA LSIG (MLTP Acedmic Feed 1)	~ ~ ~ ~ ~ ~ ~ ·	 	/ / / /		\checkmark \checkmark \checkmark		\checkmark \checkmark \checkmark \checkmark	
		ACB 1250A ,4P, 50KA LSIG (HVAC Plant Feed 2)	$\checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark$	 	/		\checkmark \checkmark \checkmark	 Image: A set of the set of the	$\checkmark\checkmark\checkmark\checkmark$	
		MCCB 125A ,4P, 50KA (Plumbing Spare)	$\checkmark \checkmark \checkmark \checkmark \checkmark \checkmark$	 	/ /		\checkmark \checkmark \checkmark	 Image: A set of the set of the	$\checkmark\checkmark\checkmark\checkmark$	
		MCCB 160A ,4P, 50KA (Auxilary DB)	$\checkmark \checkmark \checkmark \checkmark \checkmark \checkmark$	 			\checkmark \checkmark \checkmark	 Image: A set of the set of the	$\checkmark\checkmark\checkmark\checkmark\checkmark$	
		MCCB 125A ,4P, 50KA (External Infra & Lighting)	$\checkmark\checkmark\checkmark\checkmark\checkmark$		/ /		\checkmark \checkmark \checkmark		$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 250A ,4P, 50KA (Spare)	$\checkmark\checkmark\checkmark\checkmark\checkmark$	 ✓ 	/ /		\checkmark \checkmark \checkmark	 Image: A set of the set of the	$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 400A ,4P, 50KA (Active Compansator 1)	$\checkmark \checkmark \checkmark \checkmark \checkmark \checkmark$		/ /		\checkmark \checkmark \checkmark		$\checkmark \checkmark \checkmark \checkmark$	
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		ACB 1250A ,4P, 50KA LSIG (Spare)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~		/ / / /		\checkmark \checkmark \checkmark	•	$\checkmark \checkmark \checkmark \checkmark$	
		ACB 1000A ,4P, 50KA LSIG (MLTP Acedmic Feed 2)			/ / / /		~ ~ ~ ~		$\checkmark \checkmark \checkmark \checkmark$	
		ACB 1250A ,4P, 50KA LSIG (HVAC Plant Feed 1)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~		/ / / /		~ ~ ~ ~		~ ~ ~ ~ ~	
		MCCB 400A ,4P, 50KA (Active Compansator 2)	· · · · · · ·				~ ~ ~ ~		~ ~ ~ ~ ~	
		MCCB 250A ,4P, 50KA (Fire Fighting Panel)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~				~ ~ ~ ~		~ ~ ~ ~ ~	
		MCCB 250A ,4P, 50KA (Spare)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~				~ ~ ~ ~		~ ~ ~ ~	
		ACB 1000A ,4P, 50KA LSIG (Spare)	· · · · · · · ·		· · · ·		~ ~ ~ ~		~ ~ ~ ~	
Library Area	MLTP (Library)	ACB ,4P, 50KA LSIG			· · · ·	×	<u> </u>		<u> </u>	
	TO BE MULTIPLY BY N+2 NUMBER PANELS , N>2	ACB ,4P, 50KA LSIG (DG - 1250kVA)			/	×				
		MCCB ,4P, 50KA (Spare)							× × × × × × × ×	
		ACB ,4P, 50KA LSIG (Spare)							~ ~ ~ ~	
		ACB ,4P, 50KA LSIG (MLTP Library)							× × × × ×	
		MCCB ,4P, 50KA (Aux VTPN DB)							~ ~ ~ ~	
		MCCB, 4P, 50KA (External Infra & Lighting) MCCB, 4P, 50KA (Plumbing Spare)							~ ~ ~ ~	
		ACB ,4P, 50KA LSIG (Spare)							· · · · ·	
		ACB 4P, 50KA (Active Compansator)	~ ~ ~ ~ ~ ~ ~ ~				~~~			
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SUB-STATION FACULTY HOUSING	MLTP (FH)	ACB 1250A ,4P, 50KA LSIG (DG Set Provision)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~		1 1 1 1		~ ~ ~ ~		v v v v	
30B-STATION FACULT HOUSING		ACB 1250A ,4P, 50KA LSIG (DG SECFIOUSION) ACB 2000A ,4P, 50KA LSIG (TR-1)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~		1 1 1 1		\checkmark \checkmark \checkmark		\checkmark \checkmark \checkmark \checkmark	
		ACB 2000A ,4P, 50KA (Buscoupler)	V V V V V V		/ /	· •	v v	•	v v v v	
		ACB 1250A ,4P, 50KA LSIG	~ ~ ~ ~ ~ ~ ~ ~ ~ ~			· · ·	V V V N		V V V V	
		ACB 2000A ,4P, 50KA LSIG (TR-2)	V V V V V V		1 1 1 1	-	v v v		v v v v	
		ACB 1250A ,4P, 50KA LSIG (DG Set Provision)	V V V V V V	v v	1 1 1 1		v v v v	Image: A start of the start	V V V V	
		ACB 2000A ,4P, 50KA LSIG (Spare)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~		1 1 1 1		~ ~ ~ ~		V V V V	
		ACB 1000A ,4P, 50KA LSIG (Spare)	V V V V V V		1 1 1 1		v v v v		V V V V	
		MCCB 125A ,4P, 50KA (VB Bunglow Feed 1)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	× •	/ /		~ ~ ~ ~	 Image: A second s	v v v v	1
		ACB 2000A ,4P, 50KA LSIG (Faculty Housing 1A Feed 1)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	× •	/ / / /		~ ~ ~ ~	 Image: A set of the set of the	v v v v	
		ACB 1250A ,4P, 50KA LSIG (Faculty Housing 1B Feed 1)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	× •	/ / / /		~ ~ ~ ~	 Image: A set of the set of the	\checkmark \checkmark \checkmark \checkmark	
		MCCB 800A ,4P, 50KA (Spare)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	× •	1 1	-	~ ~ ~ ~	 Image: A set of the set of the	\checkmark \checkmark \checkmark \checkmark	

		ACB 1600A ,4P, 50KA LSIG (Faculty Housing 1C Feed 2)	~ ~ ~ ~ ~ ~ ~ ~ ~	$\checkmark \checkmark \checkmark \checkmark$		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark \checkmark$	
		ACB 1600A ,4P, 50KA LSIG (Faculty Housing 1D Feed 2)	· · · · · · · ·	$\checkmark \checkmark \checkmark \checkmark$		$\checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 125A ,4P, 50KA (Plumbing Spare)	$\checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark$	✓ ✓		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 800A ,4P, 50KA (Active Compansator 1)	$\checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark$	✓ ✓		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 160A ,4P, 50KA (Aux VTPN DB)	~ ~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		ACB 1600A ,4P, 50KA LSIG (Faculty Housing 1C Feed 1)	~ ~ ~ ~ ~ ~ ~ ~ ~	$\checkmark \checkmark \checkmark \checkmark \checkmark$		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		ACB 1600A ,4P, 50KA LSIG (Faculty Housing 1D Feed 1)	~ ~ ~ ~ ~ ~ ~ ~ ~	$\checkmark \checkmark \checkmark \checkmark \checkmark$		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 125A ,4P, 50KA (VB Bunglow Feed 2)	~ ~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		ACB 2000A ,4P, 50KA LSIG (Faculty Housing 1A Feed 2)	~ ~ ~ ~ ~ ~ ~ ~ ~	$\checkmark \checkmark \checkmark \checkmark$		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		ACB 1250A ,4P, 50KA LSIG (Faculty Housing 1B Feed 2)	~ ~ ~ ~ ~ ~ ~ ~ ~	$\checkmark \checkmark \checkmark \checkmark$		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 800A ,4P, 50KA (Active Compansator 2)	~ ~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 250A ,4P, 50KA (Spare)	~ ~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		ACB 2000A ,4P, 50KA LSIG (Spare)	~ ~ ~ ~ ~ ~ ~ ~ ~	$\checkmark \checkmark \checkmark \checkmark$		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		ACB 1000A ,4P, 50KA LSIG (Spare)	~ ~ ~ ~ ~ ~ ~ ~ ~	$\checkmark \checkmark \checkmark \checkmark$		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
SUB-STATION SPORTS COMPLEX	MLTP (SPORTS COMPLEX)	ACB 1250A ,4P, 50KA LSIG	~ ~ ~ ~ ~ ~ ~ ~ ~	$\checkmark \checkmark \checkmark \checkmark \checkmark$	~	$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		ACB 1600A ,4P, 50KA LSIG (1000kVA DG Set)	~ ~ ~ ~ ~ ~ ~ ~ ~	$\checkmark \checkmark \checkmark \checkmark$	~	$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		ACB 1250A ,4P, 50KA LSIG (Faculty Housing 1B Feed 2)	~ ~ ~ ~ ~ ~ ~ ~ ~	$\checkmark \checkmark \checkmark \checkmark$	~	$\checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 400A ,4P, 50KA (SPORTS CENTER FEED - 1)	~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 400A ,4P, 50KA (SPORTS CENTER FEED - 2)	~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark \checkmark$	
		MCCB 400A ,4P, 50KA (FACULTY CLUB FEED - 1)	~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark \checkmark$	
		MCCB 400A ,4P, 50KA (FACULTY CLUB FEED - 2)	~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark \checkmark$	
		MCCB 160A ,4P, 50KA (Auxilary VTPN DB)	~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark \checkmark$	
		MCCB 250A ,4P, 50KA (COMMERCIAL CENTER FEED - 1)	~ ~ ~ ~ ~ ~ ~ ~	v v		\checkmark \checkmark \checkmark \checkmark	V V V V	
		MCCB 250A ,4P, 50KA (COMMERCIAL CENTER FEED - 2)	~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark \checkmark$	
		MCCB 400A ,4P, 50KA (SCHOOL FEED - 1)	~ ~ ~ ~ ~ ~ ~ ~	v v		\checkmark \checkmark \checkmark \checkmark	V V V V	
		MCCB 400A ,4P, 50KA (SCHOOL FEED - 2)	~ ~ ~ ~ ~ ~ ~ ~	v v		\checkmark \checkmark \checkmark \checkmark	V V V V	
		MCCB 400A ,4P, 50KA (CAMPUS AMENITIES FEED - 1)	~ ~ ~ ~ ~ ~ ~ ~	v v		\checkmark \checkmark \checkmark \checkmark	V V V V	
		MCCB 400A ,4P, 50KA (CAMPUS AMENITIES FEED - 2)	Y Y Y Y Y Y Y	v v		\checkmark \checkmark \checkmark \checkmark	V V V V	
		MCCB 125A ,4P, 50KA (EXTERNAL INFRA & LIGHTING)	Y Y Y Y Y Y Y	v v		\checkmark \checkmark \checkmark \checkmark	\checkmark \checkmark \checkmark \checkmark	
		MCCB 125A ,4P, 50KA (Plumbing Spare)	~ ~ ~ ~ ~ ~ ~ ~	v v		\checkmark \checkmark \checkmark \checkmark	\checkmark \checkmark \checkmark \checkmark	
		MCCB 160A ,4P, 50KA (FIRE FIGHTING PANEL)	Y Y Y Y Y Y Y	v v		\checkmark \checkmark \checkmark \checkmark	V V V V	
		MCCB 400A ,4P, 50KA (ACTIVE COMPENSATOR)	~ ~ ~ ~ ~ ~ ~ ~	v v		Y Y Y Y	\checkmark \checkmark \checkmark \checkmark	
		MCCB 400A ,4P, 50KA (Spare)	~ ~ ~ ~ ~ ~ ~ ~	v v		Y Y Y Y	\checkmark \checkmark \checkmark \checkmark	
		MCCB 400A ,4P, 50KA (Spare)	~ ~ ~ ~ ~ ~ ~ ~	v v		Y Y Y Y	\checkmark \checkmark \checkmark \checkmark	
		ACB 1000A ,4P, 50KA LSIG (Spare)	Y Y Y Y Y Y Y	\checkmark \checkmark \checkmark \checkmark		\checkmark \checkmark \checkmark \checkmark	V V V V	
	SUB-STATION INTERNATIONAL CENTER							
			· · · · · · · ·	$\checkmark \checkmark \checkmark \checkmark$	~	~ ~ ~ ~	~ ~ ~ ~	
VILTP (IC & CI)		ACB 1250A ,4P, 50KA LSIG	· · · · · · · ·	Y Y Y Y	~	v v v v	y y y y	
		ACB 1600A ,4P, 50KA LSIG (1000kVA DG-1)			~			-
		ACB 1250A ,4P, 50KA (Buscoupler)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	V V		V V	~ ~ ~ ~	-
		ACB 1250A ,4P, 50KA LSIG	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	~ ~ ~ ~	~	· · · · ·	~ ~ ~ ~	-
		ACB 1600A ,4P, 50KA LSIG (1000kVA DG-2)	· · · · · · · · ·	~ ~ ~ ~	✓	· · · ·	v v v v v v v v	
		MCCB 630A ,4P, 50KA (Spare)	· · · · · · · · ·	v v	~	· · · ·		
		ACB 1000A ,4P, 50KA LSIG (Spare)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	~ ~ ~ ~	~	· · · · ·	~ ~ ~ ~	
		MCCB 630A ,4P, 50KA (INTERNATIONAL CENTER FEED - 1)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	~ ~		· · · ·	~ ~ ~ ~	
		MCCB 630A ,4P, 50KA (ADMINISTRATIVE BLOCK FEED - 2)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	~ ~		· · · · ·	~ ~ ~ ~	
		MCCB 630A ,4P, 50KA (CAMPUS IN FEED - 1)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	~ ~		~ ~ ~ ~	~ ~ ~ ~	
		MCCB 630A ,4P, 50KA (AUDITORIUM FEED - 2)	· · · · · · · ·	~ ~		~ ~ ~ ~	~ ~ ~ ~	
		MCCB 160A ,4P, 50KA (AUXILLARY VTPNDB)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	~ ~		~ ~ ~ ~	~ ~ ~ ~	
		MCCB 400A ,4P, 50KA (COMMUNICATION CENTER FEED - 1		~ ~		~ ~ ~ ~	~ ~ ~ ~	
		MCCB 630A ,4P, 50KA (Spare)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	~ ~		~ ~ ~ ~	~ ~ ~ ~	
		MCCB 400A ,4P, 50KA (ACTIVE COMPENSATOR 1)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	~ ~		~ ~ ~ ~	~ ~ ~ ~	
		MCCB 630A ,4P, 50KA (ADMINISTRATIVE BLOCK FEED - 1)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	~ ~		~ ~ ~ ~	~ ~ ~ ~	
		MCCB 630A ,4P, 50KA (INTERNATIONAL CENTER FEED - 2)	· · · · · · · ·	~ ~		~ ~ ~ ~	~ ~ ~ ~	
		MCCB 630A ,4P, 50KA (AUDITORIUM FEED - 1)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	~ ~		~ ~ ~ ~	~ ~ ~ ~	
		MCCB 630A ,4P, 50KA (CAMPUS IN FEED - 2)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	~ ~		~ ~ ~ ~	~ ~ ~ ~	
		MCCB 125A ,4P, 50KA (EXTERNAL INFRA & LIGHTING)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 125A ,4P, 50KA (PLUMBING)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 400A ,4P, 50KA (ACTIVE COMPENSATOR 2)	~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 630A ,4P, 50KA (Spare) MCCB 400A ,4P, 50KA (COMMUNICATION CENTER FEED - 2	$\checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark$	× × × ×		× × × × × × × ×	v v v v v v v	

> > >

			 	J J J J	✓	Y Y Y Y	JJJJ	✓
		ACB 1000A ,4P, 50KA LSIG (Spare) MCCB 630A ,4P, 50KA (Spare)	· · · · · · · · · · · · · · · · · · ·	× × × × × ×	•	× × × × × × × ×	× × × × × ×	•
SUB-STATION STUDENT Hostel	MLTP (SH)	ACB 1250A ,4P, 50KA LSIG (DG Set Provision)	V V V V V V	V V V V	~	V V V V	v v v v	~
SOB STATION STODENT HOSTER		ACB 2000A ,4P, 50KA LSIG	V V V V V V	V V V V	×	V V V V	\mathbf{v}	~
		ACB 2000A ,4P, 50KA (Buscoupler)	V V V V V V	v v	· ·	v v	\mathbf{v}	~
		ACB 2000A ,4P, 50KA LSIG	V V V V V V	V V V V	· ·	V V V V	V V V V	~
		ACB 1250A ,4P, 50KA LSIG (DG Set Provision)	4 4 4 4 4 4 4	Y Y Y Y	~	V V V V	\mathbf{v}	~
		ACB 1600A ,4P, 50KA LSIG (Spare)	V V V V V V	Y Y Y Y	~	V V V V	\mathbf{v}	~
		ACB 1000A ,4P, 50KA LSIG (Spare)	V V V V V V	V V V V	×	V V V V	\checkmark \checkmark \checkmark \checkmark	~
		MCCB 800A ,4P, 50KA (ACTIVE COMPENSATOR 1)	V V V V V V	v v	•	V V V V	\checkmark \checkmark \checkmark \checkmark	•
		Meeb book (4, 50kk (Aerive cominensation 1)		•••				
		ACB 1250A ,4P, 50KA LSIG (HVAC PLANT ROOM HOSTEL FEED - 2)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	~ ~ ~ ~	~	~ ~ ~ ~	~ ~ ~ ~	~
		MCCB 630A ,4P, 50KA (CLUSTER 9 FEED - 2)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	J J		Y Y Y Y	Y Y Y Y	
		MCCB 250A ,4P, 50KA (CLUSTER 7 FEED - 2)	· · · · · · · · · · · · · · · · · · ·	× × × ×		× × × ×	v v v v v v	
		MCCB 630A ,4P, 50KA (CLOSTER / TEED - 2) MCCB 630A ,4P, 50KA (DINNING FEED - 1)	· · · · · · · · · · · · · · · · · · ·	· · · ·		× × × × ×	· · · · · · · · · · · · · · · · · · ·	
			× × × × × × × × ×	V V V V		× × × × × × × ×	× × × × × ×	
		MCCB 250A ,4P, 50KA (CLUSTER 1 FEED - 1)		× × × ×		× × × × × × × ×	× × × × × ×	
		MCCB 250A ,4P, 50KA (CLUSTER 2 FEED - 1)		V V V V		× × × × × × × ×	× × × × × ×	
		MCCB 250A ,4P, 50KA (CLUSTER 3 FEED - 1)		V V V V		× × × × × × × ×	$\begin{array}{c} \mathbf{v} \mathbf{v} \mathbf{v} \mathbf{v} \mathbf{v} \mathbf{v} \mathbf{v} v$	
		MCCB 250A ,4P, 50KA (CLUSTER 4 FEED - 1)		V V V V		× × × × × × × ×	× × × × × ×	
		MCCB 250A ,4P, 50KA (CLUSTER 5 FEED - 1)		V V V V		× × × × × × × ×	× × × × × ×	
		MCCB 250A ,4P, 50KA (CLUSTER 6 FEED - 1)		V V V V		× × × × × × × ×	$\begin{array}{c} \mathbf{v} \mathbf{v} \mathbf{v} \mathbf{v} \mathbf{v} \mathbf{v} \mathbf{v} v$	
		MCCB 250A ,4P, 50KA (CLUSTER 8 FEED - 1)		× × × ×		× × × × × × × ×	× × × × × ×	
		MCCB 125A ,4P, 50KA (EXTERNAL INFRA & LIGHTING)		V V V V		× × × × × × × ×	$\begin{array}{c} \mathbf{v} \mathbf{v} \mathbf{v} \mathbf{v} \mathbf{v} \mathbf{v} \mathbf{v} v$	
		MCCB 125A ,4P, 50KA (PLUMBING SPARE)	$\begin{array}{c} \bullet \bullet$	V V V V		× × × × × × × ×		
		MCCB 125A ,4P, 50KA (AMENITIES FOR HOSTEL SPARE)		•••				
		ACB 1600A ,4P, 50KA LSIG (HVAC PLANT ROOM HOSTEL FEED - 1)	* * * * * * * *	~ ~ ~ ~	~	~ ~ ~ ~	~ ~ ~ ~	~
		MCCB 800A ,4P, 50KA (ACTIVE COMPENSATOR 2)	~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark$	~ ~ ~ ~	
		MCCB 630A ,4P, 50KA (CLUSTER 9 FEED - 1)	~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 250A ,4P, 50KA (CLUSTER 7 FEED - 1)	~ ~ ~ ~ ~ ~ ~ ~	✓ ✓		$\checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		MCCB 160A ,4P, 50KA (AUXILLARY VTPNDB)	$\checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark$	v v	_	$\checkmark \checkmark \checkmark \checkmark$	$\checkmark \checkmark \checkmark \checkmark$	
		ACB 1600A ,4P, 50KA LSIG (HVAC PLANT ROOM HOSTEL FEED - 2)	· · · · · · · ·	· · · ·	~	· · · · ·	~ ~ ~ ~	~
		, МССВ 630А ,4Р, 50КА (Spare)	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	v v		JJJJ	JJJJ	
		MCCB 250A ,4P, 50KA (Spare)	Y Y Y Y Y Y Y	V V		V V V V	V V V V	
		ACB 1600A ,4P, 50KA LSIG (Spare)	Y Y Y Y Y Y Y	V V V V	~	V V V V	Y Y Y Y	~
		MCCB 630A ,4P, 50KA (DINNING FEED - 2)	Y Y Y Y Y Y Y	V V		V V V V	V V V V	
		MCCB 250A ,4P, 50KA (CLUSTER 1 FEED - 2)	Y Y Y Y Y Y Y	44		Y Y Y Y	4444	
		MCCB 250A ,4P, 50KA (CLUSTER 2 FEED - 2)	4 4 4 4 4 4 4	44		Y Y Y Y	4444	
		MCCB 250A ,4P, 50KA (CLUSTER 3 FEED - 2)	4 4 4 4 4 4 4	44		Y Y Y Y	4444	
		MCCB 250A ,4P, 50KA (CLUSTER 4 FEED - 2)	Y Y Y Y Y Y Y	44		V V V V	V V V V	
		MCCB 250A ,4P, 50KA (CLUSTER 5 FEED - 2)	4 4 4 4 4 4 4	44		Y Y Y Y	4444	
		MCCB 250A ,4P, 50KA (CLUSTER 6 FEED - 2)	~ ~ ~ ~ ~ ~ ~ ~ ~	v v		Y Y Y Y	\checkmark \checkmark \checkmark \checkmark	
		MCCB 250A ,4P, 50KA (CLUSTER 8 FEED - 2)	~ ~ ~ ~ ~ ~ ~ ~	~ ~		V V V V	Y Y Y Y	
		ACB 1600A ,4P, 50KA LSIG (Spare)	~ ~ ~ ~ ~ ~ ~ ~	\checkmark \checkmark \checkmark \checkmark	~	V V V V	Y Y Y Y	~
AUDITORIUM UNDER EPC TENDER	MLTP (AUDITORIUM)	ACB ,4P, 50KA LSIG	< < < < < < <	V V V	×	V V V V	V V V	×
	TO BE MULTIPLY BY N+2 NUMBER	ACB ,4P, 50KA LSIG (DG - 1250kVA)	Y Y Y Y Y Y Y	V V V	×	V V V V	y y y y	~
	PANELS , N>2	MCCB ,4P, 50KA (Spare)	Y Y Y Y Y Y Y	V V		V V V V	V V V V	
		ACB ,4P, 50KA LSIG (Spare)	Y Y Y Y Y Y Y	V V V V		V V V V	V V V V	
		ACB ,4P, 50KA LSIG (MLTP Library)	~~	V V V V		V V V V	V V V V	
		MCCB ,4P, 50KA (Aux VTPN DB)	Y Y Y Y Y Y Y	V V		V V V V	V V V V	
		MCCB ,4P, 50KA (External Infra & Lighting)	~~	V V		V V V V	V V V V	
		MCCB ,4P, 50KA (Plumbing Spare)	~~	V V		V V V V	V V V V	
		ACB ,4P, 50KA LSIG (Spare)	~~	V V V V		V V V V	V V V V	
		ACB 4P, 50KA (Active Compansator)	~~	V V		V V V V	V V V V	
		SOLAR	~ ~ ~ ~ ~ ~ ~ ~ ~ ~	v v v	~	V V V V	v v v	~
				-				
YOGA UNDER EPC TENDER	MLTP (YOGA)	ACB ,4P, 50KA LSIG	v v v v v v	✓ ✓ ✓ ✓	✓	v v v	v v v	✓

TO BE MULTIPLY BY N+2 NUMBER	ACB ,4P, 50KA LSIG (DG - 1250kVA)	$\checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark \checkmark$	v v v v	v v v	v v v v
PANELS , N>2	MCCB ,4P, 50KA (Spare)	~~~	 ✓ 	v v v	~ ~ ~ ~
	ACB ,4P, 50KA LSIG (Spare)	~~~	v v v	v v v	~ ~ ~ ~
	ACB ,4P, 50KA LSIG (MLTP Library)	~~~	v v v	v v v	~ ~ ~ ~
	MCCB ,4P, 50KA (Aux VTPN DB)	~~~	v v	v v v	v v v v
	MCCB ,4P, 50KA (External Infra & Lighting)	v v v v v v v	✓ ✓	v v v	v v v
	MCCB, 4P, 50KA (Plumbing Spare)	v v v v v v v	✓ ✓	v v v	v v v
	ACB ,4P, 50KA LSIG (Spare)	v v v v v v v	V V V V	v v v	v v v
	ACB 4P, 50KA (Active Compansator)	v v v v v v v	V V	v v v	v v v
	SOLAR	~ ~ ~ ~ ~ ~ ~ ~ ~	v v v	v v v v	~ ~ ~ ~

Note: (1) The IO list is for 1 set of equipement just for the understanding which will be multiply by "N " wherein N>2 for works under this EPC tender (2) The Central Automation + Control Center will have Central control of all above in addition of the Local Centralised control center through Local Distribution and Building Managament Center - building wise

Schedule

Device	33kV Panel	11kV Panel	MLTP	CSS	Transfomer
VCB	O Control & Status	O Control & Status	* Not Applicable	* Not Applicable	* Not Applicable
Metering	@ Monitoring	@ Monitoring	@ Monitoring	@ Monitoring	* Not Applicable
Relay	# Monitoring & Status	# Monitoring & Status	* Not Applicable	# Monitoring & Status	* Not Applicable
RMU	O Control & Status	O Control & Status	* Not Applicable	O Control & Status	* Not Applicable
ACB	* Not Applicable	* Not Applicable	Control, Monitoring & Status	Control, Monitoring & Status	* Not Applicable
МССВ	* Not Applicable	* Not Applicable	Control, Monitoring & Status	* Not Applicable	* Not Applicable
Transfomer	* Not Applicable	* Not Applicable	* Not Applicable	# Monitoring & Status	# Monitoring & Status



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