

**SPECIFICATIONS FOR MV AUTOMATED
RING MAIN UNIT UP TO 36KV****Issue Date: 02/2021****Page: 1 of 56****32-SDMS-11 REV.1****32-SDMS-11****Rev.1****SPECIFICATIONS FOR MV AUTOMATED RING MAIN UNIT
UP TO 36KV**

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#	Date	Revision No.	Revised By	Major Revision Description
1	01-02- 2021	Rev.1	Smart Grid Dept. HQ Jalel Aissaoui Mohammad Yahia	Adding the following to SPECS: : • Smart RMU with ATS • Switching RMU 3L • Switching RMU 4L • Standard Data base
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1. Scope

This document specifies the minimum technical requirements for design, engineering, manufacturing, testing and performance of indoor/outdoor gas (SF6) insulated, automated ring main unit (RMU), intended to be used in 13.8 kV and 33 kV medium voltage system of the Saudi Electricity Company (SEC) in Saudi Arabia as per attached SDMS (11 SDMS-03, 32 SDMS 01, 32 SDMS-07). This RMU will be used for Distribution Automation System so that the RMU shall be remotely controllable using integrated communication devices such as a RTU and a Modem.

2. Documents incorporated by reference

This material standard specification shall be read in conjunction with SEC specification No. 01- SDMS-01 (latest revision) for 'General Requirement for All Equipment / Materials', which shall be considered as an integral part of this SDMS (SEC DISTRIBUTION MATERIALS SPECIFICATION). This SDMS shall also be read in conjunction with all SEC latest Standard Distribution Material Specifications SDMS and Purchase Order (PO) requirements.

3. Applicable codes and standards

The latest revision / amendments of the following codes and standards shall be applicable for the equipment / materials covered in this SPECIFICATION. In case of conflict, the CONTRACTOR may propose equipment / materials conforming to one group of industry codes and standards quoted hereunder without jeopardizing the requirements of this SPECIFICATION.

- IEC 62271-100 High-voltage alternating-current circuit breakers.
- IEC 62271-101 High Voltage Switchgear and control gear.
- IEC 62271-102 Alternating current disconnectors and earthing switch.
- IEC 62271-103 High-voltage switchgear and control gear - Switches for rated voltages above 1 kV up to and including 52 kV
- IEC 62271-200 AC metal-enclosed switchgear and control gear for rated voltage above 1 kV and up to and including 52 kV.
- IEC 62271-206 High-voltage switchgear and control gear – Voltage presence indicating systems for rated voltages above 1 kV and up to and including 52 kV
- IEC 60255 Measurement relays and protection equipment.

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- IEC 60947-5-1 Control switches (low-voltage switching devices for control and auxiliary circuits, including contactor relays). - Part 1: General requirements
- IEC 60376 Specification of technical grade sulfur hexafluoride (SF6) for use in electrical equipment.
- IEC 60529 Degrees of protection provided by enclosures (IP Code).
- IEC 61869 Instrument transformers
- IEC 60068 Environmental Testing
- IEEE 386 Separable Insulated Connector Systems
- ISO 2063 Metallic coatings – protection of iron and steel against corrosion – metal spraying of Zinc and Aluminum.
- 12 SDMS-01 Termination , joints & accessories up to 36 kV
- 11-SDMS-03 XLPE Insulated Power Cables for Rated Voltages From 15kV up to 36 KV (Um).
- 01 SDMS 01 General requirements for equipment/material
- 32 SDMS 01 Non extensible SF6 RMU 17.5 kV
- 32 SDMS 04 Motorized Non extensible SF6 RMU
- 32 SDMS 07 Non extensible SF6 RMU 36 kV
- DPMS-02 R0 Complete Protection IED Specifications & CTs for Automatic RMU

In case of any deviation from the listed standards, it should be indicated in the list of deviations submitted by the supplier.

4. General characteristics and ratings

4.1 General

The ring main unit shall be indoor / outdoor use, ground/skid mounted and SF6 insulated, remote controllable type.

It shall be constructed for operation in service conditions and the degree of protection as given in SEC specification 01-SDMS-01 latest revision.

Additionally, the indoor unit shall be provided with adequate protection for entry of dust to the operating mechanism. Ring main unit complete with all fittings and attachments shall be capable of withstanding the effects of direct solar radiation at its installed location. The temperature of metal surfaces exposed to direct solar radiation shall be regarded as 75 Celsius degrees.

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The terminals of the switches shall be suitable for installation, operation and maintenance of cable sizes as given in SEC specification 11-SDMS-03 latest revision.

All live parts of the switchgear and bus bars assembly shall be grouped together and SF6 gas insulated in a gas-tight stainless steel chamber, and sealed for life.

It is not the intent to specify herein complete details of design and construction. The offered equipment shall conform to the relevant standards and be of high quality, sturdy, robust and of good design and workmanship complete in all respects and capable to perform continuous and satisfactory operations in the actual service conditions at site and shall have sufficiently long life in service as per requirements.

Indoor design ring main unit if provided with enclosure for outdoor application shall have adequate atmospheric protection. Manufacturer may use special design louvers / double-roof / double-walls or combination of these or any other proven means in order to make their design withstand severe service conditions.

The RMU shall be Front panel or side cable panel design Ring Main Units Functions

The Equipment offered by the Vendor shall be three and four way ring main switchgear units having various configurations non-extensible:

- **2L1T** : 3ways
- **3L1T** : 4ways
- **2L2T** : 4ways
- **3L** : switching RMU 3ways
- **4L** : switching RMU 4ways
- **2L1T with ATS** : Smart RMU with integrated ATS (Automatic Transfer switch)

The Smart RMU with integrated ATS, in addition to being Smart RMU (3ways: 2L1T), shall ensure the ATS function as follows:

- If it is placed in a NOP point and fed by feeder#1 and feeder#2 is open: As soon as there is no voltage on feeder#1 it will automatically balance on feeder#2
- If it is placed in a NOP point and fed by feeder#2 and feeder#1 is open: As soon as there is no voltage on feeder#2 it will automatically balance on feeder#1
- ATS additional hard equipment:

CVI contact (DI) to RTU - Switch ON/OFF - indications lamps ATS ON/OFF

-Additional Soft:

See Appendix.1 for the Smart RMU with ATS design (logic-functions & testing procedures)

Comprising of the following switchgear functions:

- 1) Switch-disconnector unit (Load Break Switch: L)
- 2) Circuit Breaker unit: T

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4.2 Rating

The ring main unit shall be suitable to operate under system parameters given in SEC specification 01- SDMS-01 latest revision. The ratings of RMU, for both LBS and CB, are given in the related SDMS latest revision.

5. Design and construction**5.1. General**

5.1.1 The RMU shall be installed inside a building on the ground. It consists of feeder switch/, cable compartments and base frame. Protection level of main compartment is over IP54 which is prescribed by IEC 60529. Inside of RMU is well ventilated to protect from moisture and has a heater if needed. The complete RMU-(including RTU) enclosure shall be of degree of protection IP 54 or better. The degree of protection of the inner enclosure (main tank) shall be IP 67 or better.

5.1.2 Each part of RMU completed with all fittings and attachments is capable of withstanding the effects of direct solar radiation at its installed location. It is proof against mechanical stress in case of operation, electromagnetic force in case of short circuit. It will not be opened and closed by gravitation, vibration and so on.

5.1.3 A cable connection to bushing in RMU shall use IEEE 386 standard cable connector which does not expose a part of electric conduction.

5.1.4 The Switchgear and switchboard shall be designed such that the position of the different devices shall be visible to the operator on the front of switchboard and easy to operate & prevent access to all live parts during operation without the use of tools. There shall be no access to exposed conductors.

5.1.5 For operator safety (and for the public when installed outdoor), RMU shall have 4-sides internal arc protection, conforming to IEC internal arc fault withstand classification ALFR, whether the unit is used indoor / outdoor.

5.1.6 Voltage Indicator

The RMU shall be equipped with a voltage indication for each circuit. There should be a facility to check the synchronization of phases with the use of external device. It shall be possible for each of the function of the RMU to be equipped with a permanent voltage indication as per IEC 62271-206 to indicate whether or not there is voltage on the cables.

The capacitive dividers will supply low voltage power to sockets at the front of the unit, an external lamp must be used to indicate live cables. Three outlets can be used to check the synchronization of phases with the use of an ordinary device.

The voltage indication is requested in the RMU for operation and in the RTU to be available in the Control center.

5.1.7 All terminals/contacts shall be silver plated, minimum 20 micron thickness.

5.1.8 Local Remote/lock unlock

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Each RMU unit shall be provided with a separate Local/Remote switch.

Lock unlock switch shall be provided by circuit for each RMU

5.2.LBS (Load Break Switch)

5.2.1 LBS shall be load breaking and fault-making type. Ring switches shall be designed for interrupting full rated current as stated in clause 4.3 above, small inductive or capacitive currents involved in disconnecting of unloaded transformers and cables or overhead lines. It shall be suitable for making current rating specified in 4.3

5.2.2 LBS shall consist of a moving contact assembly with three positions; 'ON', 'OFF', and 'Earth'. Two independent manual operating mechanisms for ring and earth switches are also acceptable. The design shall prevent simultaneous closing of the main switch contacts and the earth switch contacts. The earth switch shall be naturally interlocked to prevent the main and earth switch being switched 'ON' at the same time. The earth switch contacts shall be designed to close into a fault and shall have the same short circuit capacity as the main contacts.

5.2.3 The switching operation shall be manual by means of an operating handle and independent fast acting operating mechanism. Closing and opening speeds of the switch shall be independent of the speed with which the operating handle is moved.

5.2.4 LBS operating mechanism shall have geared motor mechanism and associated Relays with necessary contactors for remote operations. Equipment shall be provided with motorized facilities

The motorized units shall have facilities for remote control suitable for interfacing to SEC's SCADA system Remote Terminal Unit (RTU). Motorized equipment and control shall operate at 24 VDC or 48 VDC.

5.3.Tee-Off Circuit Protection

Tee-off circuit protection shall be by circuit breaker.

5.3.1 Circuit Breaker

The Circuit breaker shall be of fixed type and designed for short circuit breaking current as per SDMS. The insulation medium shall be SF6 gas and the interruption medium can be either SF6 or vacuum. Opening of the circuit breaker shall be by local manual trip button, by protective relay circuit and by remote tripping signal. Closing movement charges the opening mechanism of the circuit breaker.

Earthing of tee-off circuit shall be by an off load isolator switch having the same fault make capacity as the Ring switches. Operating mechanism shall be trip free, fast acting

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and independent of the operator action and shall provide three positions; circuit breaker 'ON', circuit breaker and isolator 'OFF' and earthing switch 'Earth'.

Circuit breaker operating mechanism shall have geared motor mechanism and associated closing and opening coils with necessary contactors for remote and automatic operations in the distribution network.

5.3.2 The motor mechanism shall automatically charge the springs once the auxiliary voltage is turned on without need for any manual charging. Auxiliary switches shall be provided for remote tripping and closing of circuit breaker and for indication of local/remote and trip/close status

5.3.3 Protective Relay

The protection relay and allied conventional CT specifications shall be as per latest RMU SDMS DPMS-02 rev.0

All available protection digital data shall be transmitted to the RTU..

Remote Accessibility & Management of Protection relay Fault Records shall be available in order to be managed remotely by the Distribution automation system

5.4.CT-VT Sensors

VT: The specified quantity will be one set of (3VTs) per RMU.

- Technology for voltage measurement shall be justified by Vendor (resistive or capacitive); VT shall comply with IEC 61869.
- The VT shall be installed always in the transformer circuit (TRX1) and highly recommended bushing mounted VT instead of the pole mounted VT
- VT accuracy shall be less than 1% in order to meet the requirement to have an accuracy of 1% for the whole chain (Sensor-RTU).
- VT ratios shall be compatible with the provided RTU

CT: The specified quantity will be (N-1) set of (3CTs) per RMU; (N is the number of RMU circuits); In addition, there shall be CT dedicated for the protection as per protection specifications.

- Technology shall be justified by Vendor; CT shall comply with IEC 61869.
- CTs shall be bushing mounted CTs
- CT accuracy shall be less than 1% in order to meet the requirement to have an accuracy of 1% for the whole chain (Sensor-RTU).
- CT ratios shall be compatible with the provided RTU

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VT & PT for switching RMU (3L-4L):

For the switching RMU (3L & 4L), The VT shall be busbar mounted or bushing mounted.

The AUTOMATED 3L and 4L shall not require any external auxiliary AC power supply for operation and control.

This power supply shall be obtained from a cast resin insulated voltage transformer connected to bus-bar side.

One of the voltage transformers on the source side shall be designed as PT (power voltage transformer).

The power voltage transformer, which combines the attributes of an inductive voltage transformer with the application of a small power transformer, shall provide windings for measurement,

The rated continuous output power shall be calculated and selected as per consumption present, with safety margin of 20%.

5.5.Operation

The smart RMU shall be ready for operation as follows:

- Manually (open-close-earth- etc. ...)
- Electrically: open/close Locally with pushbutton and green/red Status indications
- From RTU: open/close from laptop through RTU
- Remotely : open/close control from distribution control center (SCADA-ADMS)

All operating positions shall be on the front of the unit. The Switchgear and Switchboards shall be designed such that the position of the different devices is visible to the operator on the front of the Switchboard and operations are visible.

The position of each of the switches shall be displayed on a mimic diagram. Clear indicators showing 'ON', OFF' and 'Earth' positions shall be provided by metal painted labels not less than 15 mm in height and 1.5 mm thick (sticker type labels are not acceptable). Indicator windows shall not be less than 15 mm in diameter and shall be covered with transparent UV resistant material with adequate mechanical strength.

5.5.1 Indication

Indicator	Letter	Background
ON	White	Red
OFF	White	Green
EARTH	Black	Yellow

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5.5.2 The mechanisms for operating the switches shall be accessible by removing the front plate. The operating handle shall have anti-reflex action and shall be stored at the front of the unit. An anti-reflex mechanism on the operating lever shall prevent any attempts to re-open immediately after closing of the switch or earthing switch. All manual operations will be carried out on the front of the switchboard.

Common operating handle shall be used for all operations of both ring and tee-off switches. Operating handle inserts shall have marking as appropriate to avoid inserting the wrong end during switching operations. The handle shall be of such a length that it complies with the relevant internal arc protection requirements and extends beyond the enclosure to enable ease of operation. Physical effort required for operating any mechanism shall not exceed 400 Newton.

5.5.3 In order to prevent unauthorized access for the operation of ring main unit, operating handle entries for ring & tee-off switches and trip push button shall have padlocking provision. It shall be suitable for 9 mm shackle lockout hasp.

The padlocking provision material shall be adequately strong and compatible with the life of ring main unit.

5.6.Interlocks

An adequate mechanical interlock system shall be provided on the Equipment to prevent mal-operation and to ensure operator safety. The design of the interlock system must be such that it shall not be possible for the operator to physically override the interlock controls.

Interlocks shall be provided to make the following operations impossible:

5.6.1 Interlocks shall be provided to make the following operations impossible:

a) Operation of the ring switch or circuit breaker directly from “ON” to “Earth” or from “Earth” to “ON”.

The following additional requirements apply if the unit offered has two independent manual operating mechanisms for ring and earth switches:

- Operation of the “Earth ON / Earth OFF” mechanism of earth switch unless the “ON/OFF” mechanism of ring switch is in the “OFF” position.
- Operation of the “ON/OFF” mechanism of ring switch unless the “Earth ON / Earth OFF” mechanism of earth switch is in the “Earth OFF” position.
- b) Opening of the cable test cover (and/or cable test cover for units with separate test bushings) without the associated ring switch being in the “Earth” position.
- c) Closing ring switch to “ON” with the test plug inserted and /or the cover open.

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d) Insertion or withdrawal of the test plugs with the switch in any position other Than “Earth” position.

e) Opening cable termination box without the associated ring switch/tee off in the “Earth” position.

f) Switching the ring switch/tee off to ON position without associated cable termination box cover is properly closed.

5.6.2 Closing ring switch (Load Break Switch) to ‘ON’ with the test plug / probe inserted and /or the test cover open.

5.6.3 Insertion or withdrawal of the test plugs / probes with the associated switch in any position other than ‘Earth’ position.

5.7.Control functions

Each RMU shall be provided with an integrated RTU and communication device in order to provide capabilities for remote monitoring and control via the ADMS system. The ADMS system includes standard SCADA and FLISR functionality and advanced capabilities. RMUs shall be capable of supporting these SCADA and FLISR monitoring and control functions. SEC reserves the right to require a demonstration of the RMU/RTU capabilities to support ADMS SCADA and FLISR functionality. Please refer to the ADMS specification for ADMS SCADA and FLISR functionality requirements. Design for RMU/RTU configuration shall be approved before supply. following RTU Panel solutions shall be available :

- RTU On the top of the RMU (integrated)
- RTU Separated cabinet (with plug cable connector solution)

5.7.1 The digital I/O list of signals to be wired to the RTU includes:

Status information (Digital Input)

- | | |
|--------------------------------|--------------|
| ○ Close / Open (Per circuit) | Double Point |
| ○ Earth (Per circuit) | Double Point |
| ○ Lock / Unlock (Per circuit) | Double Point |
| ○ Local / Remote (Per RMU) | Double Point |
| ○ Gas Pressure (Per RMU) | Single Point |
| ○ Battery Status (Per RMU) | Single Point |
| ○ Control Power Fail (Per RMU) | Single Point |
| ○ Door Open (Per RMU) | Single Point |

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- | | |
|--|--------------|
| ○ Relay Fail / Healthy (wherever applicable) | Double Point |
| ○ Protection Relay operated / Normal | Double Point |

Control signal (Digital Output) to be wired to the RTU

- Close / Open
- Lock / Unlock

All the Data base (I/O lists) are illustrated in the appendix.2 as follows:

- 2L1T: 3ways
- 3L1T: 4ways
- 2L2T: 4ways
- 3L: 3ways switching RMU
- 4L: 4ways switching RMU
- 2L1T with ATS: Smart RMU with integrated ATS (Automatic Transfer switch)

5.7.2 The analog inputs to be wired to the RTU:

- Phase-to-ground Voltage ($A\phi$, $B\phi$, $C\phi$) for all voltage sensors
- Phase Current ($A\phi$, $B\phi$, $C\phi$, $N\phi$) from all current sensors

The voltages communicated to SCADA DMS shall be three phase-to-phase ($V\Phi-\Phi$).

And all logical calculated functions needed by an Advanced Distribution Automation System

5.7.3 The selected RTU shall have adequate protection against reversed polarity, over current/voltage and under voltage condition.

5.7.4 Remote operating time

When RTU receives the command from the ADMS SCADA, FLISR or any other authorized master device, the operation shall be done within three (3) seconds which exclude signal transmission time.

5.7.5 All digital inputs shall be time-stamped to 1ms accuracy.

5.7.6 The RTU shall include the following minimum safety features for control outputs:

- a. Select-and-execute sequence for control output.
- b. No control command shall be generated during power up or power down of RTU.
- c. No more than one control point shall be selected at any given time.

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When the control switch in the RMU is placed in the “local control” position, then control outputs of the RTU may be tested without activating the field device. The RTU shall send a status indication of the local/remote switch to the master station or SCADA.

5.7.7 Control Outputs

The RTU shall provide the capability for a master station (ADMS SCADA or FLISR functions) to set two control outputs which shall be provided for each controllable device after receiving the command using the check before execute sequence. The appropriate control output shall be operated for a preset time period which is adjustable for each point from 0.1 to 3 seconds.

5.7.8 Communication Ports and Protocols

The RTUs minimum requirement for communication ports is as follows:

- Two Ethernet ports
- Two RS232 ports.
- One port for the RTU maintenance and configuration computer.
- One port for local access to the data and connecting a printer.

The RTU shall respond to independent scans and commands from Master Station, maintenance and configuration computer, and the local access computer simultaneously. There shall be possible to change RTU setting and configuration remotely.

The RTU shall support the use of a different communication data exchange rate (bits per second) and scanning cycle on each port.

Communication protocols :

The required protocols regarding the RTU/Modem are as follows:

- IEC 60870-5-101/104
- IEC 61850
- DNP3.0 serial and Ethernet
- Modbus RTU and TCP

Communication Options :

The RTU's communication port to the Control center (DMS) shall make it possible to utilize different communication medias such as:

- 2G (GSM, GPRS, EDGE, CDMA)/3G (UMTS, CDMA)/4G (LTE)/5G (5G NR)
- eSIM (Digital SIM card)
- Fiber optics
- Wi-Fi
- Narrowband IoT (internet of things)
- Narrowband PLC and/or Broadband PLC
- UHF/VHF
- Mesh Wireless Networks

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Capability of time stamp and time synchronization shall be provided

In the case of using SIM Card for communication, the modem must be designed to fit SIM normal standard format size

5.7.9 Cyber security

The RTU shall support features and mechanisms to enable cyber security operations and be configured as follows:

- Application whitelisting shall be implemented on RTU to monitor and ensure that only authorized applications are executed without affecting operations.
- RTU shall be configured to produce and store event logs recording activities, exceptions, faults and information security events.
- RTU shall have the capability to log the following information and activities:
 - Timestamps for each event. System clocks shall be synchronized to a single reference time source to facilitate forensic analysis of actions taken on the device.
 - Incident management activities.
 - Utility programs that can override system and application controls.
 - Cryptographic key management related activities.
 - Logging mechanisms shall not adversely affect device critical functions and performance.
 - RTU shall recover to a secure state in the event of a disruption or failure.
 - RTU shall have access controls implemented at both the software level (such as operating system and applications level) and hardware/device level. Access controls shall be established with the following principles and capabilities:
 - a. *Least privilege* – access shall be limited to only information or resources that are necessary to accomplish a legitimate purpose.
 - b. *Privileged access* – access controls shall establish privileged and non-privileged levels for users and processes. Access controls shall prevent non-privileged users or processes from executing privileged functions (such as installing software or changing system configurations).

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- RTU shall at least enforce the following Password change, complexity, re-use, and lockout constraints for access control:

Minimum Age	Maximum Age	Minimum Length	Password Reuse	Complexity Requirements	Account Lockout Threshold	Account Unlock Action
1 day	2 years	10 characters	10 passwords remembered	4 of 4 (uppercase, lowercase, numbers, symbols)	25 invalid attempts within 1 hour	Admin or Supervisor unlock

Table 9: Password Requirement

- RTU shall lock the access after several authentication failures. Device shall be capable of sending an account lock alarm.
- All RTU shall implement and enable audit and logging capabilities when possible.
- RTU shall be up-to-date with the latest security related patches as much as it is operationally safe and feasible. When it is not possible, a justification shall be provided and countermeasures identified and implemented.
- Any security vulnerability Identified by SEC during RTU lifetime shall be remedied and patched.
- A list of identified potential security risks and best way to mitigate them shall be provided.
- RTU shall be secure by design. Security shall be integrated throughout each phase of systems lifecycle.
- Smart Device shall be properly hardened as per the guidelines provided below to harden networks, operating systems, applications and RTU.
- Appropriate security test cases shall be created to provide scenarios that detail both how the device is intended to be used and how it should not be used.
- Any time data is input by a user, it shall undergo input validation to ensure only proper authorized characters are accepted.
- RTU shall provide the capability to set outputs to a predetermined state if normal operation cannot be maintained because of an attack.
- RTU shall identify and handle error conditions in a manner such that effective remediation can occur without disclosing unnecessary information to an attacker.
- If session IDs are used on a Smart Device, it shall provide the capability to protect the integrity of sessions and reject any usage of invalid session IDs.

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- RTU shall support encryption on all supported protocols. If some protocols do not support encryption, then the smart device shall support secure IPsec VPN tunneling.
- Where mobile code is not required, it shall be disabled.
- Any mobile code that is necessary for application operation shall be presented to the Distribution Cyber Security for review and approval to ensure proper protections and restrictions are in place.
- Any approved mobile code shall require proper authentication and authorization of origin and its use shall be monitored.
- RTU shall be able to verify the integrity of the mobile code before allowing code execution.
- Where cryptography is determined to be required, RTU shall use cryptographic algorithms, key sizes, and mechanisms for key establishment and management according to commonly accepted security industry practices and recommendations.
- Established and tested encryption shall be employed to reduce risk of information leakage or tampering.
- RTU shall utilize established and tested encryption to protect sensitive data at-rest where required.
- RTU utilizing PKI shall provide the capability to operate it according to commonly accepted best practices.
- RTU utilizing PKI as part of their identification or authentication process shall employ validity checking of certificates.
- Certificates CA signature shall be verified to confirm that the certificate has not been tampered since it was first signed.
- RTU utilizing PKI shall consult with CRL or OCSP to determine the revocation status of all certificates.
- RTU shall be able to determine whether a given human, software process, or device user took an action based on the use of non-repudiation techniques.
- RTU shall be able to produce machine-readable report of deployed security settings.

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This document describes the minimum functionalities of the RTU. The minimum functions to be performed are:

- Data gathering. Collect digital status inputs, analog inputs, and information points from devices, relays and/or IED's. RTU shall be multi- center multi-protocol
- Receiving and processing digital and analog control commands from the master station or SCADA.
- RTU shall be compatible with protocol 61850 and 60870-5-101/104 for communication with relays or IEDs.
- RTU shall support Sequence of Events feature.
- RTU shall have an IEC 61131-3 logic engine or similar to allow customized automation schemes.
- RTU shall have internal battery backup for memory and data/time. The RTU shall send a status battery indicator to the master station or SCADA.
- RTU shall act as a data concentrator for acquiring data from slave RTU's and exercising supervisory control on slave RTU's
- RTU shall accept polling messages from at least two master stations simultaneously using separate logical databases for each master station.
- RTU shall Communicate simultaneously on all communication ports.
- The RTU shall have the option of redundant communication through the Ethernet ports.
- It shall be possible to export database to an excel or similar software application.
- Data transmission rates up to 9600 baud for serial ports and 10/100 Mbps for TCP/IP
- Ethernet ports.
- RTU shall have the capability of automatic re-start after a power outage.
- RTU shall be scalable. Supplier shall state how the scalability is achieved.
- The RTU shall be designed to perform with a minimum 15 relays or IED's connected with 200 points (variables) per device.
- The RTU shall be capable to calculate all logical functions needed by an Advanced Distribution Management System such as Power factor, Active & Reactive power

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- Distortion , harmonics; it shall be possible to send the output of the logical functions on request.
- The RTU shall determine and send earth fault indication to an Earth fault indication.
- lamp to be mounted in the front of the RMU. Earth fault indication shall be also sent to the control center.
- RTU and Control box shall be illuminated by a lamp for easy O&M.
- RTU shall be capable to report by exception in case of any change in the status.
- The RTU shall have Modem -with routing features if needed- in order to communicate wireless 3G/4G or fiber optics, in accordance with SEC telecommunication specifications; minimum 4 ports shall be provided

5.8.Power supply of control circuits

To supply power for RMU functions, an external power source from the LV panel of near the RMU shall be connected to the Control box with appropriate protective provisions in the Control Box. The external power source shall be a single phase AC220V (+/- 10%) /60Hz

The external power source shall properly charge the battery per RMU which can be integrated into the RMU

All functions of the RMU including switching, Monitoring, RTU and Control, shall be powered by the external power source and the battery will back up the power source.

A power outlet (AC220V/60Hz) shall be installed in the Control Box to power a portable O&M device such as Lap-top computer.

Smart RMU shall be provided with LV cable (12 meters length and 2.5 mm² section) with suitable, resistant & waterproof conduct for OH & UG as per 11-SDMS-01 :

Conductor size (mm ²)	Material	Design	Insulation	Shape
2.5	Copper	Control 2 core	PVC	Round
2.5	Copper	Control 12 core	PVC	Round

The battery shall be capable to back up the monitoring, communication and operation of the RTU for 8 hours without AC source. The battery shall be capable of providing

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power to perform at least 50 operation cycles (open-close) without AC source. The supplier shall size the battery per RMU, specifying the lifetime and the duty cycle of such period of life.

Batteries shall be maintenance free and sealed. No lead acid batteries are allowed.

Battery shall be rechargeable and shall be suitable for temperature of 70 Degree centigrade. The battery charger shall have temperature compensated to maximize battery life and usable capacity.

The charger shall have filter to provide 2% or better ripple voltage when operated on a resistive load (from 5 to 100% full load). The charger shall be provided with protection against overcharging. The supplier shall specify the proposed charging time. It shall be possible to test the battery.

All the alarms related to Charger & battery shall be wired to the RTU in order to be transmitted to the control center

Power supply for Switching RMUs (3L & 4L):

The AUTOMATED 3L and 4L shall not require any external auxiliary AC power supply for operation and control.

This power supply shall be obtained from a cast resin insulated voltage transformer connected to bus-bar side.

Its secondary output shall be 24 VDC and capacity shall be adequate for spring charging motors, switching operations, status indications, RTU components , charge the battery, necessary contactors for control and monitoring of ring switches .

The power source shall be a single phase AC220V (+/- 10%) /60Hz

One of the voltage transformers on the source side shall be designed as PT (power voltage transformer).

The rated continuous output power shall be calculated and selected as per consumption present, with safety margin of 20%.

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5.9.Termination /cable boxes

- 5.9.1. Termination in the Ring switches shall be suitable for dry type cable terminations. Dry-type inside cable boxes suitable for accepting three core Aluminum or Copper, XLPE insulated cables of outside diameter of 70-110 mm. Each cable box shall have a bottom plate and cable clamp. Bottom plate shall be in two halves with cable entry hole of 115 mm diameter. Cable clamp shall be detachable semi-circular halves suitable to hold the cable inside the cable box without cable glands. Suitable rubber grommets or bushings shall be supplied fitted to each cable entry hole to cater for the cables in order to prevent cables from coming in contact with the edges of the gland plate hole.
- 5.9.2. Cable termination for tee-off shall be dry-type, inside cable box, and suitable for accepting 3-core armored cable (60-70 mm outside diameter) or three 1-core unarmored cables (25-30 mm outside diameter), copper or aluminum, XLPE insulated. Each cable box shall have split-type removable bottom plates and cable clamps to facilitate cable installation. Three cable entry holes shall be provided with rubber grommets to suit the required size of cable (whichever is actually used during termination, 3-core or 1-core). Respective cable clamps (installed inside the box) shall be detachable semi-circular halves.
- 5.9.3. Terminal bushings for ring and tee-off switches shall be Interface C type, with M16 bolted contact for terminating cables with the use of screened premolded separable connectors or elbows. However, tee-off bushings may be required to be supplied with brass M16/M12 reducer studs with nuts and washers to suit cable termination with M12 lugs
- 5.9.4. Distance between terminal bushing and cover of cable box shall not be less than 160 mm to suit premolded separable elbows approved by SEC. For ring switch, inter-distance between terminal bushings shall not be less than 125 mm.
- 5.9.5. Vertical distance from the top of cable clamp to the centerline of cable bushings shall be suitable for all type of terminations mentioned above and not less than 750 mm.
- 5.9.6. The design of the cable boxes shall be such that the cable box shall allow enough access during cable termination. Removal and installation of cable box cover shall be with minimum number of bolts.
- 5.9.7. The cable box and bus bar compartment shall be arc resistant as per IEC 62271-200 amended up to date. The internal arc fault test on cable box and bus bar compartment shall be carried out for 13.8 kV system for 21 kA for 1 second and 25 KA for 1 second for 33 KV system.
- 5.9.8. At left-hand side ring switch cable box, bottom plate entry hole with rubber bushing shall be provided for Fault Indicator's remote indicator (if provided as alternative for outside boundary wall installation) and auxiliary supply AC voltage cables.

**SPECIFICATIONS FOR MV AUTOMATED
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Indoor/Outdoor Ring main unit shall have a tamperproof and weatherproof steel enclosure which cover whole body of the RMU and Control Box. The door of the enclosure shall have a relay to observe its status remotely. Enclosure shall be provided with lockable doors, door handles, doorstoppers, hasp for padlocking, ventilation louvers and lifting hooks. The degree of protection shall be IP 54 or better as specified in IEC 60529. All panel bolts of enclosure shall be accessible from outside. All nuts, bolts and washers shall be stainless steel or hot dipped galvanized.

The enclosure shall be adequately protected against corrosion and painted as per relevant clauses of SEC specification 01-SDMS-01 latest revision. Finish color shall be Cement Gray RAL 7035 as per ASTM D1535. SEC may consider alternative methods of protection against corrosion.

The enclosure should have a pocket or provision inside to store the instruction documents and other relevant information.

5.11. Dimensions

Overall sizes (Enclosure) shall be as per SDMS (RTU on the top of RMU)

As a reference overall maximum size of the ring main unit shall be:

For Automated RMU 13.8 KV:

Type	3-way	4-way
Width (W)	1500	1850
Depth (D)	1100	1100
Height (H)	1850	1850
Cable termination box width	400 (minimum)	
Operating mechanism height	1300 (maximum)	

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For Automated RMU 33 KV:

Type	3-way	4-way
Width (W)	1600	2200
Depth (D)	1200	1200
Height (H)	2100	2100
Cable termination box width	400 (minimum)	
Operating mechanism height	1300 (maximum)	

5.12. Earthing

A ground bar of not less than 25 x 5 mm copper strip shall be provided bolted to the frame. It shall be located so as to facilitate earthing of cable sheaths and earthing devices.

When several units of the RMU (Extra LBS / Breakers) are mounted adjoining to each other, the earth bus shall be made continuous and necessary connectors and clamps for this purpose shall be included in the scope of supply.

In addition, a terminal having M12 stud and nut shall be provided in the back of the panel with clear grounding mark.

5.13. SF6 Gas Pressure Indicator & Refilling Provision

The SF6 gas pressure inside the tank shall be constantly monitored by a temperature compensating gas pressure indicator offering a safe/ not safe indication. The gas pressure indicator shall be provided with green pressure and red pressure zones. The safe operating zone shall correspond to a temperature range of -10 C to +50 C. There shall be one Non – return valve to fill up the gas. The manufacturer shall give guarantee for maximum leakage rate of SF6 gas will be lower than 0.1 % / year.

A SF6 gauge shall be provided for visual indication of SF6 gas pressure inside the switchgear chamber. The SF6 gauge shall be readily visible from the front of the unit without the necessity to remove any covers and be clearly marked to indicate the normal gas pressure by a green area on the gauge face and the low gas pressure by a red area on the gauge face.

A separate low pressure SF6 gas switch shall be provided for low pressure alarm. The low pressure switch is to be set to operate at pressure which will indicate loss of

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SF6 within switchgear and will not generate false alarms as the SF6 gas pressure drops due to the ambient temperature drop or change. The pressure at which the switch is activated (in bar or kPa) shall be greater than atmospheric pressure.

Refilling/re-pressurizing inlet valve if provided shall be easily accessible for field refilling.

5.14. Over-pressure Release

In order to ensure maximum personal safety, Ring Main Unit shall be designed to withstand any overpressure due to an internal fault by rupture of a gas escape membrane located at the rear or bottom of the enclosure. The gas shall be led out through a flap in the rear panel to the bottom of the enclosure.

5.15. Nameplate

Ring main unit shall be provided with Aluminum /Stainless steel / Brass nameplate showing the following information indelibly marked in Arabic and English:

1. Manufacturer's Name
2. Country of Origin
3. Type/Model
4. Vendor's Name
5. Reference of SEC specification
6. Manufacturer's Serial Number
7. SEC Purchase Order Number
8. SEC Item Number
9. Year of Manufacture
10. Voltage Rating (KV)
11. Current Rating (A)
12. BIL (KV)
13. Short Circuit Rating / Duration (KA)
14. Rated Frequency (60 Hz)
15. Rated Making Current (Peak) (KA)
16. Gross Weight (Kg)
17. (Reported IEC 62271-1 rated voltage series1)

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5.16. Circuits

The circuits configuration, numbering order and labels are as follows:

	2L1T			3L1T				2L2T				3L			4L			
Circuit Configuration	L	T	L	L	L	T	L	L	T	T	L	L	L	L	L	L	L	L
Circuit Number from left to right	1	2	3	1	2	3	4	1	2	3	4	1	2	3	1	2	3	4

L: LBS

T: Transformer

Circuit Labels:

Ring and Tee-off switches shall be provided with circuit number plates of dimension 150 x 50 mm. without inscription. Plate shall be made of three-layer traffolyte material (white/black /white) of 3 mm thickness as per drawing No. SEC-01- 03.

5.17. Monograms and Danger Plates

Danger plate and SEC monogram as per SEC drawings No. SEC-01-01 and SEC-01-02 respectively shall be provided and installed at the front (on SEC approved location) of the ring main unit using M5 hot dipped galvanized /stainless steel / brass fasteners (oval head rounded neck bolts with nuts and external tooth lock washers) not removable / accessible from the front i.e. without opening the door / front cover.

SEC shall approve location and samples of danger & monogram plates prior to installation.

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6. Testing and inspection

- 6.1 All equipment shall be successfully type tested at SEC approved laboratory in accordance and witnessed by an authorized SEC representative with the latest standards and as specified herein and test report shall be submitted for SEC review and approval.

The switchgear offered shall meet the type test requirements of at least the standards listed below:

6.1.1 High-voltage switches per IEC 62271-103

- ☐ Dielectric Tests
- ☐ Temperature Rise Tests
- ☐ Making and Breaking Tests
- ☐ Peak and Short Circuit Withstand Current Tests
- ☐ Operation and Mechanical Endurance Tests
- ☐ Internal arc test.

6.1.2 Circuit-breaker per IEC 62271-100

- ☐ Dielectric Tests
- ☐ Temperature Rise Tests
- ☐ Measurement of the resistance of the main circuit
- ☐ Short-time and Peak Withstand Current Tests
- ☐ Mechanical and Environmental Tests
- ☐ Making and Breaking Tests
- ☐ Short-circuit Tests

6.1.3 Measurement Unit as per IEC 61869-2 and 3

- ☐ Power Frequency Withstand Voltage Tests
- ☐ Accuracy test

6.1.4 Control panel and parts as per IEC 60068-2-1 and 60068-2-2

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6.1.5 Degree of protection as per IEC 60529 and SEC specification no. 01-SDMS-01 latest revision

6.1.6 The cable box and bus bar compartment shall be arc resistant as per IEC 62271-200 amended up to date. The internal arc fault test on cable box and bus bar compartment shall be carried out for short circuit current.

6.2 The switchgear offered shall meet the routine test requirements of the standards listed below:

6.2.1 High-voltage switches per IEC 62271-103

- ☐ Power Frequency Voltage Tests
- ☐ Voltage Tests on Auxiliary Circuits
- ☐ Measurement of Resistance of Main Circuit
- ☐ Operation Tests
- ☐ Operation and Mechanical Endurance Tests

6.2.2 Circuit breaker per IEC 62271-100

- ☐ Power Frequency Voltage Tests
- ☐ Voltage Withstand Tests on Control and Auxiliary Circuits
- ☐ Measurement of Resistance of Main Circuit
- ☐ Mechanical Operating Tests

6.2.3 Measurement Unit as per IEC 61869. Other applicable standard are acceptable depending on the type of sensor.

6.2.4 Control panel as per IEC60068-2-1 and 60068-2-2

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6.2.5 Each and Every frame equipped with protection relay a primary current injection test shall be conducted.

- 6.3 SEC reserves the right to visit the factory during manufacture of any or all items covered by this specification, for inspection of material or witness of tests. Accordingly, the manufacturer shall give SEC adequate notice of manufacturing and testing schedule.
The testing shall be classified into the accreditation test and acceptance test. The manufacturer should submit the test reports for the accreditation test which are tested in a reputable international test institute.

7. Packing and shipment

- 7.1 All units have to be supplied from same manufacturer for each tender ordered by SEC to achieve full installation compatibility. Each unit shall be delivered ready for installation.
- 7.2 Each unit shall be individually packed in non-returnable cases as per packing /shipping requirements in relevant clauses of 01-SDMS-01.
- 7.3 For container shipment, each unit bolted on wood pallet is acceptable.
- 7.4 Units shall be delivered with handles, fixing bolts, earthing nuts, leaflet pocket with installation & operating manuals, test plugs and bill of materials for all loose items.

8. Guarantee

- 8.1 Guarantee for the automatic RMU and RTU shall be against all defects arising out of faulty design or workmanship or defective material for a period of five (5) years from the date of final acceptance of the project
- 8.2 Warranty period for gas tightness (seal pressure system) shall conform to IEC 62271- The CONTRACTOR shall assume full responsibility for no gas leakage during the service life.

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9. Technical data schedule
AUTOMATED RING MAIN UNIT

(Sheet 1 of 3)

SEC Inquiry No. _____ Item No.....

No.	Description	SEC Specified Values	Vendor Values
5.0	DESIGN AND CONSTRUCTION REQUIREMENTS		
5.1	GENERAL		
	1. RMU Type	Outdoor & Indoor	
	2. RMU Configuration	3-Way / 4-Way	
	3. Tee-off	Circuit Breaker	
	4. Terminal Fastener for Ring Switch	M16	
	5. Terminal Fastener for Ring Switch	M16/M12	
5.2	RING SWITCH (LBS)		
	1. Service Voltage	13.8 KV, 33 KV	
	2. Maximum Operating Voltage	17.5 KV, 36 KV	
	3. Rated Frequency	60 Hz	
	4. Rated Current	400 A	
	5. Short Circuit Withstand Current, 1 sec	21 KA , 25 KA	
	6. Rated Making Current (peak)	54.6 KA , 65 KA	
	7. Rated Making Current of Earthing Switch (peak)	54.6 KA , 65 KA	
	8. Impulse Withstand Voltage	110 KV , 200 KV	
	9. Power Frequency Withstand Voltage, 1 min. (Ref. 01-SDMS-01)	45 KV rms , 80 KV rms	
	9. Internal Arc Fault Withstand Current for 1 sec	21 KA , 25 KA	

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SEC Inquiry No. _____ Item No.....

No.	Description	SEC Specified Values	Vendor Values
5.3.1	CIRCUIT BREAKER		
	1. Service Voltage	13.8 KV, 33 KV	
	2. Maximum Operating Voltage	17.5 KV, 36 KV	
	3. Rated Frequency	60 Hz	
	4. Rated Current	200 A , 100 A	
	5. Rated Short Circuit Level, 1 sec	21 KA , 25 KA	
	6. Rated Making Current	54.6 KA , 65 KA	
	7. Re-striking Voltage Ratio	1.4	
	8. Duty Cycle	O-t ₁ -CO-t ₂ -CO	
	9. Making Time	ms	
	10. Opening Time	ms	
	11. Arc Duration	ms	
	12. Total Breaking Time	ms	
	13. Operating Mechanism	Spring charged	
5.8	TERMINATIONS/CABLE BOX		
	Cable Box Size (w x h x depth)	mm	
	Vertical Distance Between Terminal Bushings to Top of Clamp		
	Ring Switch	mm	
	T-Off	mm	
5.9	ENCLOSURE		
	Overall Dimensions (W x D x H)	mm	
	Degree of Protection	As per 01-SDMS-01	
	Finish Color	RAL 7035	

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SEC Inquiry No. _____ Item No.....

**A. ADDITIONAL TECHNICAL INFORMATION OR FEATURES SPECIFIED
BY SEC:****B. ADDITIONAL SUPPLEMENTARY DATA OR FEATURES PROPOSED BY
BIDDER/VENDOR/SUPPLIER:****C. OTHER PARTICULARS TO BE FILLED UP BY BIDDER/VENDOR/
SUPPLIER:****D. LIST OF DEVIATIONS & CLAUSES TO WHICH EXCEPTIONS ARE
TAKEN BY THE BIDDER/VENDOR/SUPPLIER: (USE SEPARATE SHEET IF
NECESSARY)****MANUFACTURER****VENDOR / SUPPLIER**

Name of Company		
Location and Office Address		
Name and Signature of Authorized Representative		
Official Seal / Stamp		

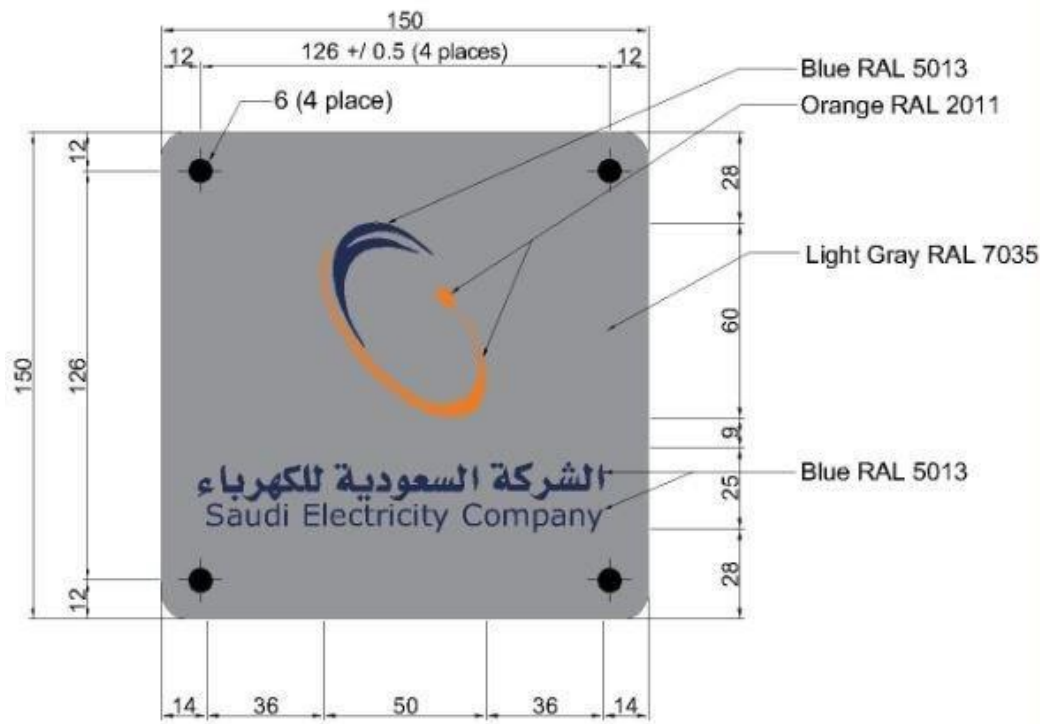
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10. Drawings



Note:

- 1) All Dimension are in millimeters.
- 2) 150 X 150 X 1.5 thick, aluminum plate with three (3) color monogram.
- 3) Specimen for color shades shall be obtain from SEC.
- 4) Size of symbols and lettering shall be proportion to the overall dimension of the monogram.

MONOGRAM FOR EQUIPMENT MOUNTING

DRAWING NO.

SEC-01-01

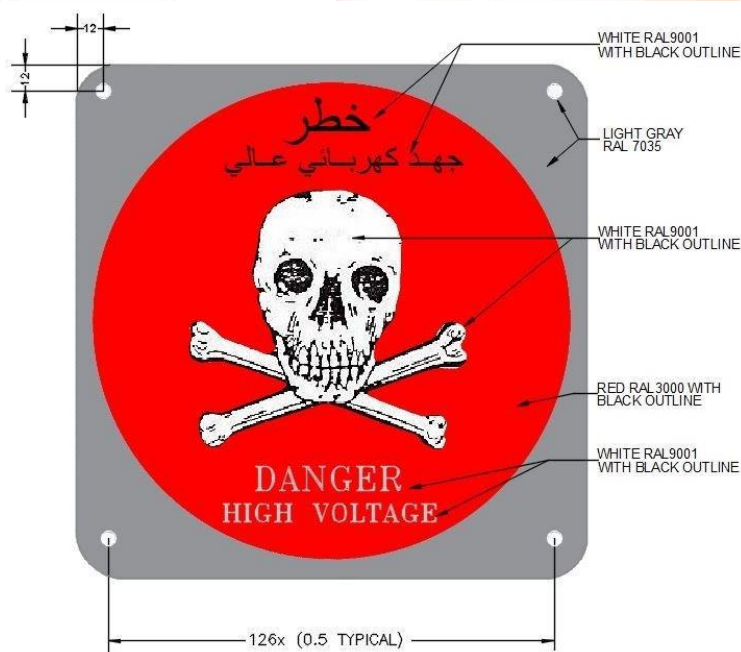
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DANGER SIGN FOR EQUIPMENT



Note:

- 1) All dimension are in millimeters.
- 2) 150 x 150 x 1.5 Thick, Aluminum plate for equipment mounting.
- 3) Specimen for color shoes shall be obtained from SCE.
- 4) High gloss enamel paint.
- 5) Size of symbol and lettering shall be proportional to the overall dimension of the sign.
- 6) For the installation of this sign on the parameter fence and gate of the Transmission substation. The size of the sign shall be 510 x 510 and 255x255 respectively, where in the hole centers will be 25 & 15 & hole diameters will be 10 & 6 respectively.
- 7) The sign plate shall have rounded corners and NO sharp rough edges.

DANGER SIGN FOR EQUIPMENT

DRAWING NO.

SEC-01-02

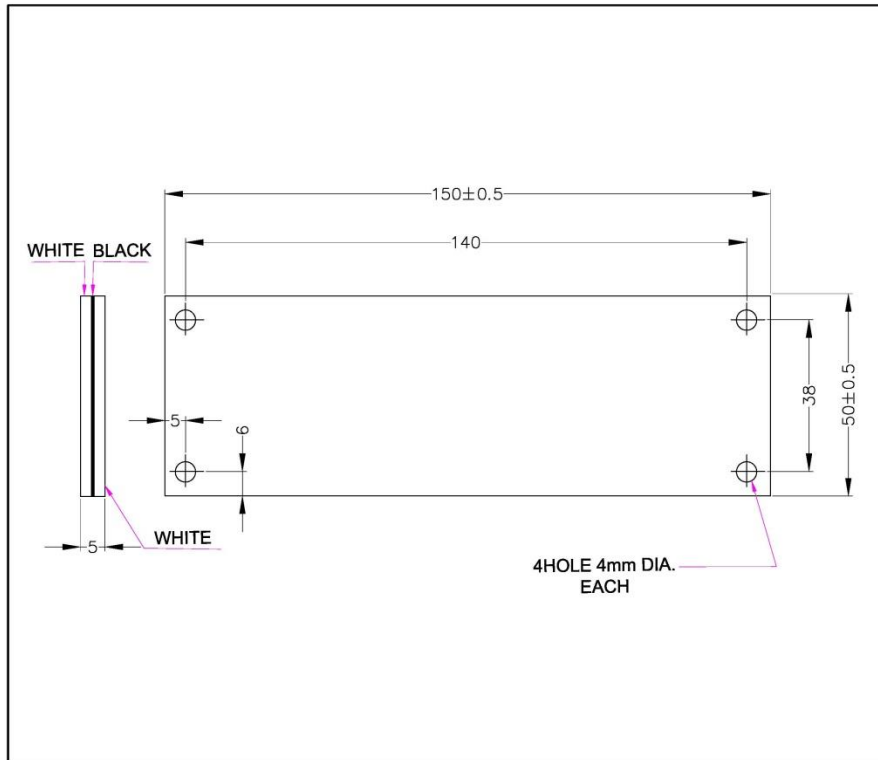
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CIRCUIT LABEL PLATE



Note:

- 1) Dimension are in millimeters.
- 2) Material Traffolyte white – black – white Thickness 3mm.
- 3) This plate will be used to engrave letters and numbers by using Engraving machine.

CIRCUIT LABEL PLATE

**DRAWING NO.
SEC-01-03**

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Appendix.1

ATS design

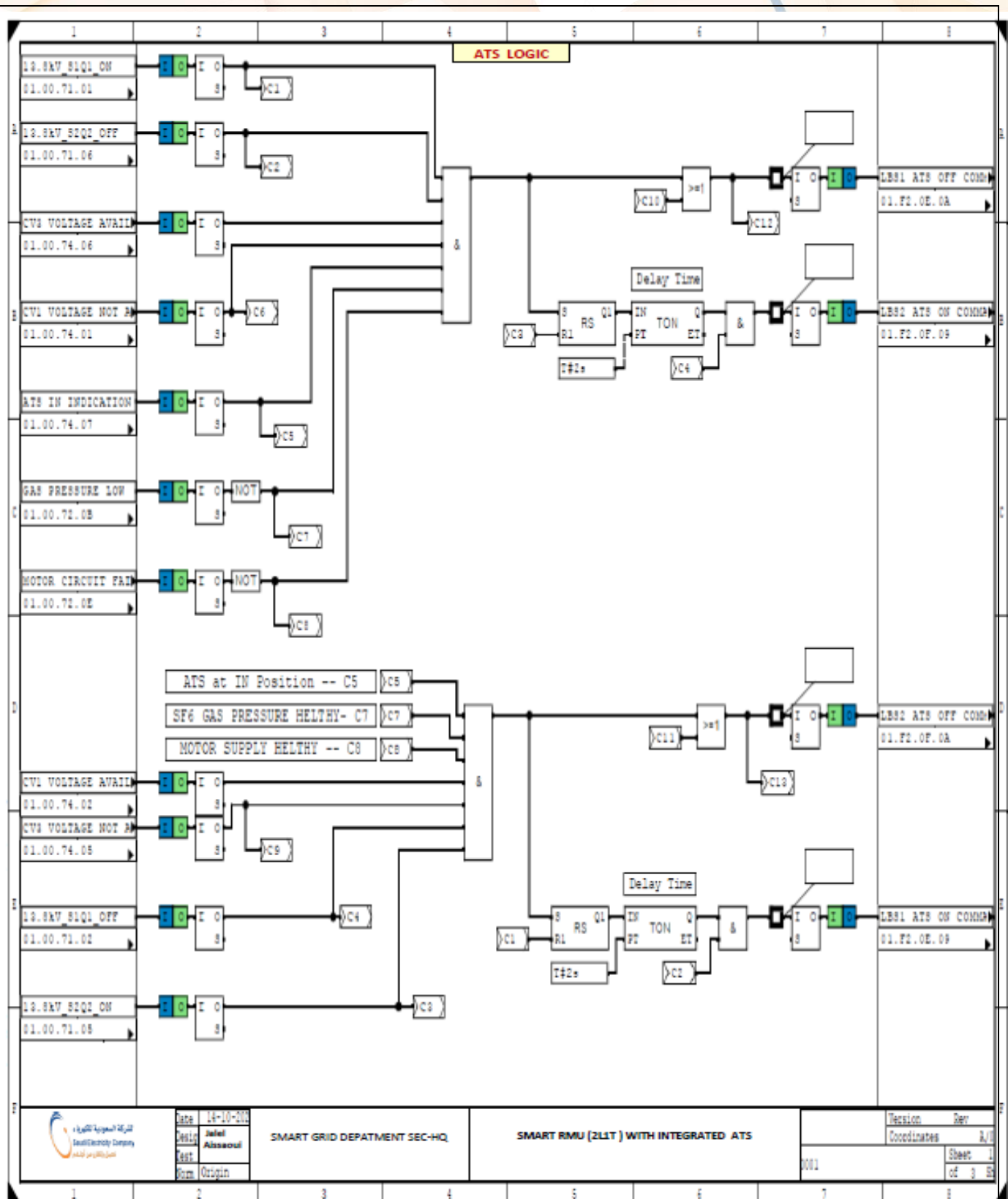
- ATS logic
- ATS functions
- ATS testing procedure

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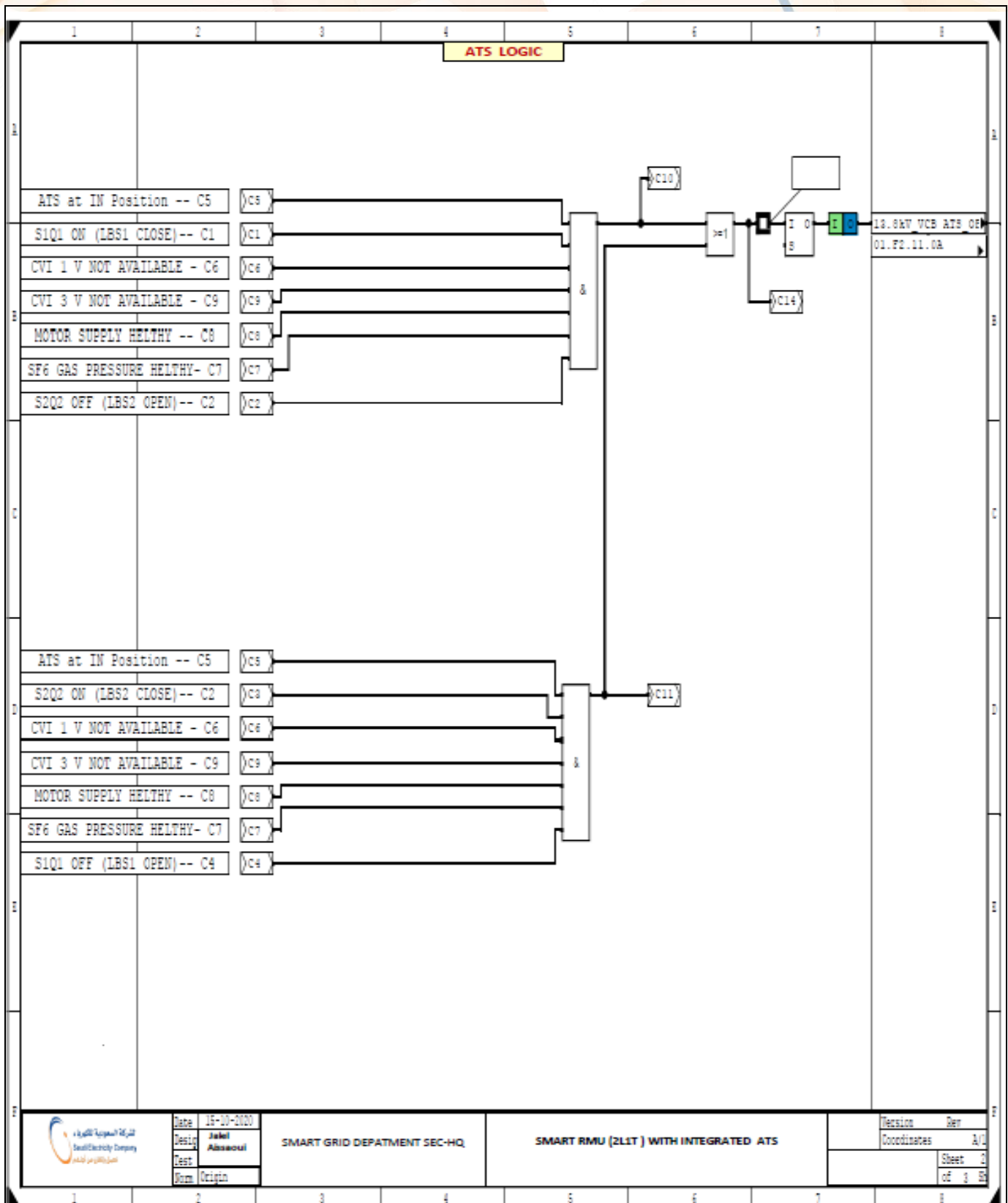


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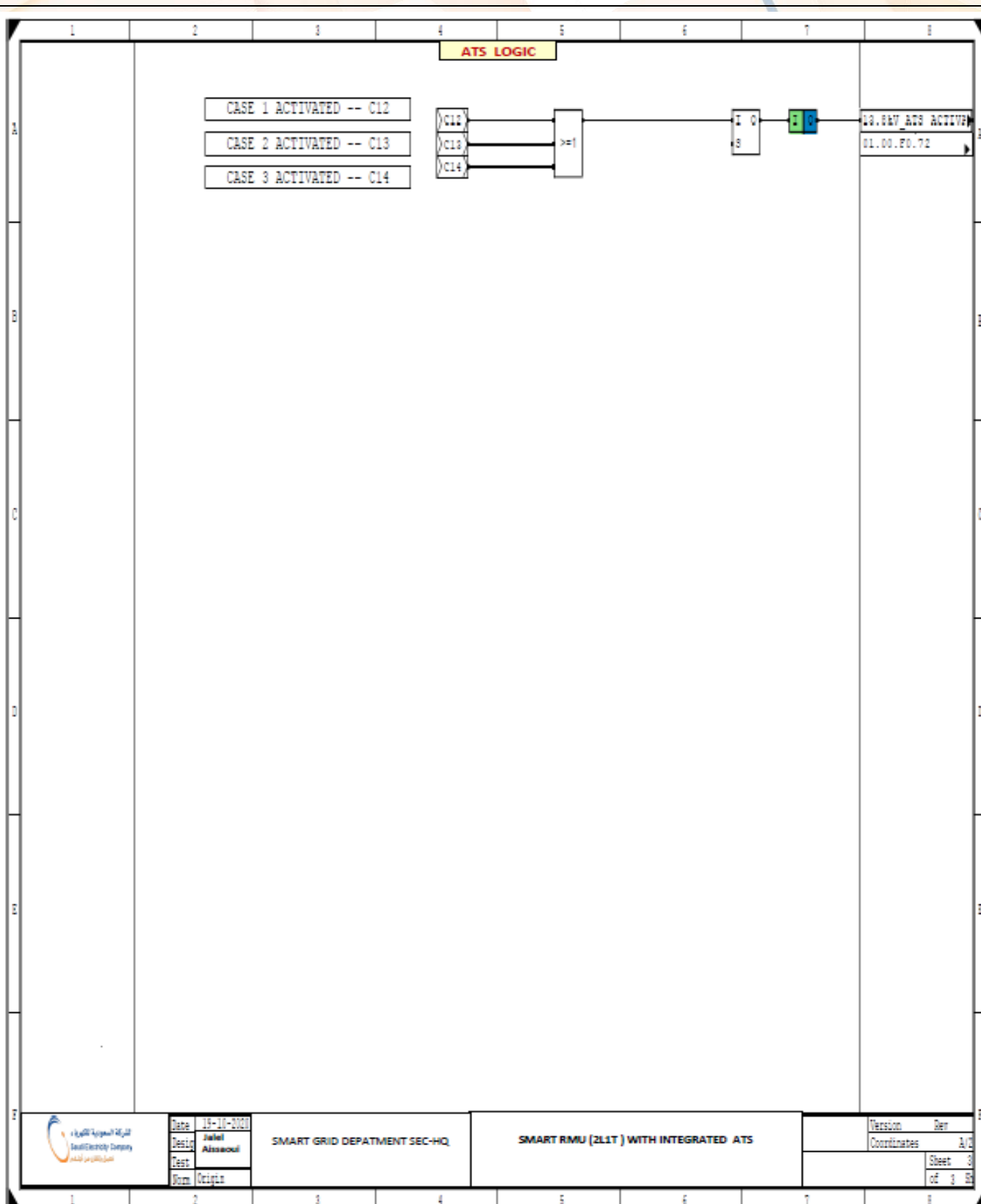


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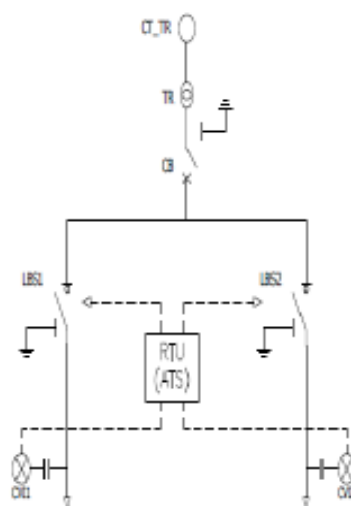
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ATS FUNCTIONS

ELECTRICAL DIAGRAM OF THE AUTOMATED RMU WITH INTEGRATED ATS



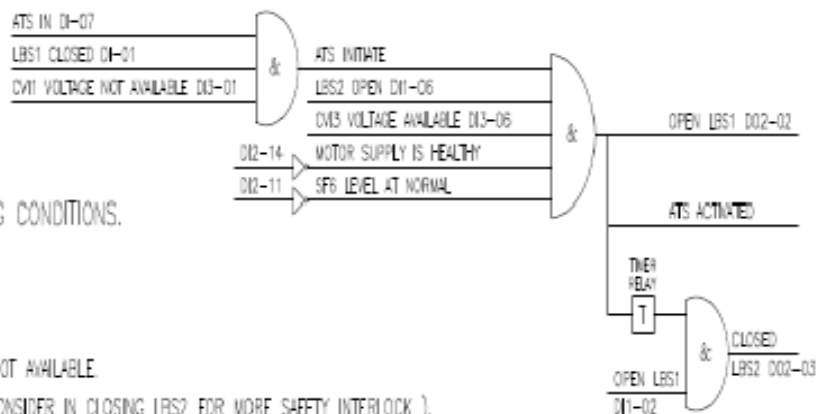
ATS FUNCTION

CASE - A : LBS1 CLOSED & LBS2 OPEN:
ATS FUNCTION WILL INITIATE CONSIDER FOLLOWING CONDITIONS.

1. ATS SELECTOR SWITCH AT IN POSITION.
2. LBS1 IN CLOSED POSITION.
3. CV1 LOCATED AT LBS1 GIVE SIGNALS THAT VOLTAGE IS NOT AVAILABLE.
4. LBS2 IN OPEN POSITION (NOTE-HARDWARE INTERLOCK CONSIDER IN CLOSING LBS2 FOR MORE SAFETY INTERLOCK).
5. CV2 LOCATED AT LBS2 GIVE SIGNAL THAT VOLTAGE AVAILABLE AT FEEDER-2.
6. MOTOR SUPPLY IS HEALTHY AT LBS2 & SF6 LEVEL AT NORMAL STATUS.

WHEN FULFILL ALL ABOVE CONDITION RTU OUTPUT WILL GENERATE FOLLOWING ORDER.

- OPEN LBS1
- CLOSED LBS2 AFTER CONFIGURE TIME DELAY.(TO BE PROVIDE BY SEC.)



						DSN BY:		PROJECT:		TITLE:		 الشركة السعودية للكهرباء Saudi Electricity Company نعمل بآفاق من أجلكم	SCALE: NTS 1 of 3 sheets
						Jalel Allassoul		SEP					
20.10.20						SMART GRID DEPARTMENT SEC-HQ		INTEGRATED ATS LOGIC AUTOMATED RMU					
IND	DATE	NATURE OF REVISION	IND	DATE	NATURE OF REVISION								
1			2										

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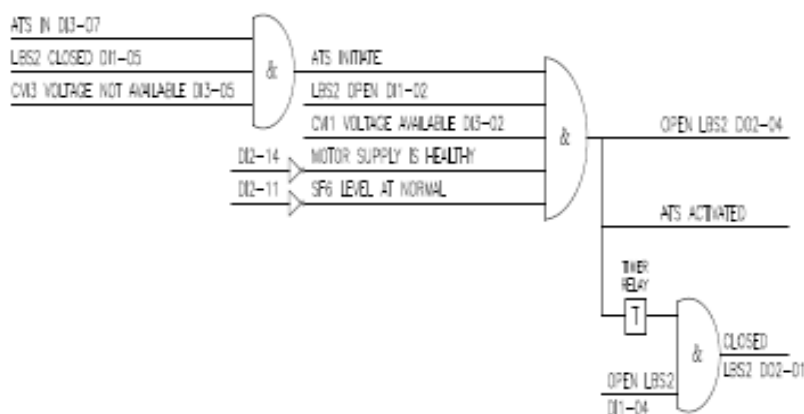
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ATS FUNCTIONS

ATS FUNCTION



CASE - B : LBS1 OPEN & LBS2 CLOSED:

ATS FUNCTION WILL INITIATE CONSIDER FOLLOWING CONDITIONS.

1. ATS SELECTOR SWITCH AT IN POSITION.
2. LBS2 IN CLOSED POSITION.
3. CV12 LOCATED AT LBS2 GME SIGNALS THAT VOLTAGE IS NOT AVAILABLE.
4. LBS1 IN OPEN POSITION (NOTE-HARDWARE INTERLOCK CONSIDER IN CLOSING LBS1 FOR MORE SAFETY INTERLOCK).
5. CV11 LOCATED AT LBS1 GME SIGNAL THAT VOLTAGE AVAILABLE AT FEEDER-1.
6. MOTOR SUPPLY IS HEALTHY AT LBS2 & SF6 LEVEL AT NORMAL STATUS.

WHEN FULFILL ALL ABOVE CONDITION RTU OUTPUT WILL GENERATE FOLLOWING ORDER.

- OPEN LBS2
- CLOSED LBS1 AFTER CONFIGURE TIME DELAY(TO BE PROVIDED BY SEC.)

						DSN BY: Saeed Alabsoul	PROJECT: SEC	TITLE: INTEGRATED ATS LOGIC AUTOMATED RMU	 الشركة السعودية للكهرباء Saudi Electricity Company نعمل بإنفاق من أجلكم	SCALE: MTS	
	20.10.20					SMART GRID DEPARTMENT SEC-HQ					2 of 3 sheets
IND	DATE	NATURE OF REVISION	IND	DATE	NATURE OF REVISION						
1			2					5	7	8	

**SPECIFICATIONS FOR MV AUTOMATED
RING MAIN UNIT UP TO 36KV**

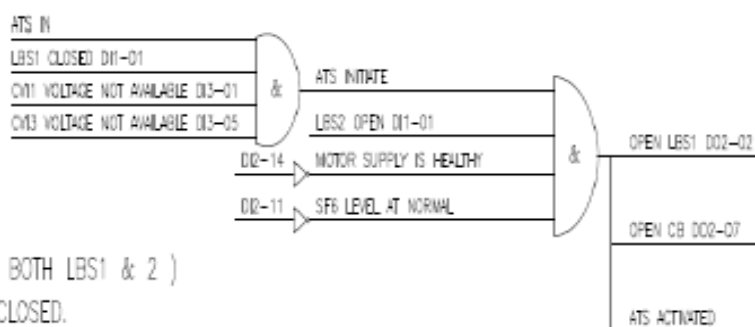
Issue Date: 02/2021

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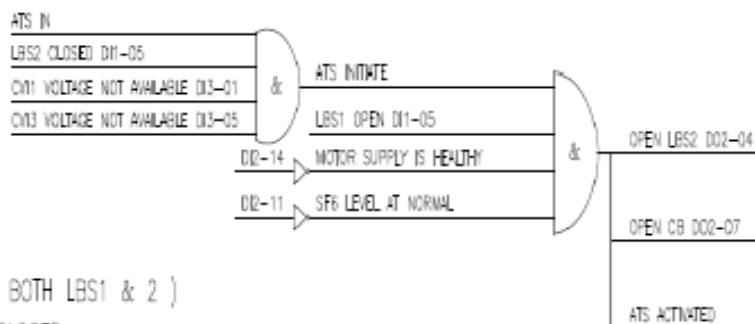
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ATS FUNCTIONS

ATS FUNCTION



1. ATS SELECTOR SWITCH AT IN POSITION.
2. LBS1 IN CLOSED POSITION.
3. NO VOLTAGE AVAILABLE SHOULD AT LBS1 & LBS2.
4. MOTOR SUPPLY IS HEALTHY AT LBS1 & SF6 AT NORMAL STATUS.
5. OPEN LBS1 & OPEN TRANSFORMER VCB AND ATS BLOCK.



1. ATS SELECTOR SWITCH AT IN POSITION.
2. LBS2 IN CLOSED POSITION.
3. NO VOLTAGE AVAILABLE SHOULD AT LBS1 & LBS2.
4. MOTOR SUPPLY IS HEALTHY AT LBS2 & SF6 AT NORMAL STATUS.
5. OPEN LBS2 & OPEN TRANSFORMER VCB AND ATS BLOCK.

						DSN BY: Saleh Alsaoud		PROJECT: SPT		TITLE:		 الشركة السعودية للكهرباء Saudi Electricity Company نعمل بإنفاق من أجلكم		SCALE: NTS
20.10.20						SMART GRID DEPARTMENT SEC-HQ		INTEGRATED ATS LOGIC AUTOMATED RMU		3 of 3 sheets				
NO	DATE	NATURE OF REVISION	NO	DATE	NATURE OF REVISION									
1			2											

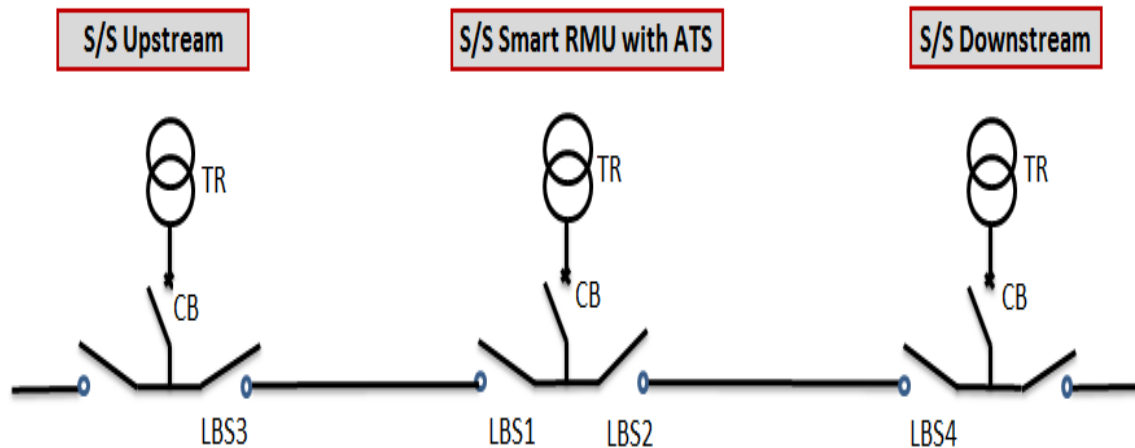
**SPECIFICATIONS FOR MV AUTOMATED
RING MAIN UNIT UP TO 36KV**

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ATS TESTING ON SITE : MV NETWORK



TESTS PROCEDURES :

1- Automation :

Test : Test the Automate RMU : all the I/O list locally & Remotely according to SEC standard data base .

2- ATS :

Situation#1 : The smart RMU is NOP and supplied by S/S upstream : **LBS3 closed - LBS1 closed - LBS2 open- LBS4 closed**

Test : **Open LBS3** then the ATS will automatically **open LBS1** and **close LBS2**.

Situation#2 : The smart RMU is NOP and supplied by S/S downstream : **LBS3 closed - LBS1 open - LBS2 closed- LBS4 closed**

Test : **Open LBS4** then the ATS will automatically **open LBS2** and **close LBS1**.

Situation#3 : The smart RMU is NOP and supplied by S/S upstream : **LBS3 closed - LBS1 closed - LBS2 open- LBS4 open**

Test : **Open LBS3** then there is no voltage both sides and the ATS will automatically **open LBS1** and **open CB smart RMU**.

Note: To create the situation , the ATS shall be out and put it in before test



Appendix.2

STANDARD DATA BASE I/O list

- 2L1T : 3ways
- 3L1T : 4ways
- 2L2T : 4ways
- 3L : switching RMU 3ways
- 4L : switching RMU 4ways
- 2L1T with ATS : Smart RMU with integrated ATS (Automatic Transfer switch)

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DISTRIBUTION AUTOMATION PROGRAM SMART FIELD EQUIPMENT DATA POINTS LIST FOR 2L1T SMART RMU (LVL)



Bay / CIRCUIT no.	Point name / Message	IOA / IEC OBJECT ADDRESS	REMARKS
DIGITAL OUTPUT (DO) COMMANDS			
CIRCUIT1 (LBS)	CLOSE COMMAND	1	
CIRCUIT1 (LBS)	OPEN COMMAND	1	
CIRCUIT2 (TRx)	CLOSE COMMAND	5	
CIRCUIT2 (TRx)	OPEN COMMAND	5	
CIRCUIT3 (LBS)	CLOSE COMMAND	9	
CIRCUIT3 (LBS)	OPEN COMMAND	9	
DIGITAL INPUT (DI) GENERAL ALARMS / INDICATIONS			
CIRCUIT1 (LBS)	CLOSE INDICATION	11000	
CIRCUIT1 (LBS)	OPEN INDICATION		
CIRCUIT1 (LBS)	LOCK/UNLOCK INDICATION	1000	
CIRCUIT1 (LBS)	GROUND INDICATION	1001	
Circuit2 (TRx)	CLOSE INDICATION	11001	
Circuit2 (TRx)	OPEN INDICATION		
Circuit2 (TRx)	LOCK/UNLOCK INDICATION	1002	
Circuit2 (TRx)	GROUND INDICATION	1003	
CIRCUIT3 (LBS)	CLOSE INDICATION	11002	
CIRCUIT3 (LBS)	OPEN INDICATION		
CIRCUIT3 (LBS)	LOCK/UNLOCK INDICATION	1004	
CIRCUIT3 (LBS)	GROUND INDICATION	1005	
COMMON	REMOTE	11004	Alarm
	LOCAL		Alarm
COMMON	Battery low	1008	Alarm
COMMON	Gas Low	1009	Alarm
COMMON	AC power fail	1010	Alarm
COMMON	Door open	1011	Alarm
COMMON	DC power fail	1012	Main DC power for charger/Circuit Breaker
COMMON	Motor CIRCUIT fail	1013	Regrouped information for all circuits (Spring charger, DC motor)
COMMON	RTU Self diagnostic (RTU alarm)	1277	Alarm
COMMON	EFI (FAULT INDICATION)	1278	Alarm
COMMON	Protection Health (Normal/Fail)	1279	Alarm
COMMON	Protection Trip (Earth fault)	1280	Alarm
COMMON	Protection Trip (Phase fault)	1281	Alarm

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ANALOG INPUT (AI) MEASUREMENTS			
Circuit1 (LBS)	I_Current (A)	13015	
Circuit1 (LBS)	I_Current (B)	13016	
Circuit1 (LBS)	I_Current (C)	13017	
Circuit1 (LBS)	I_Current (N)	13018	
Circuit1 (LBS)	S (KVA)	13057	Calculated from power factor and voltage value from TRx
Circuit1 (LBS)	P (KW)	13058	
Circuit1 (LBS)	Q (KVAR)	13059	
Circuit2 (TRx)	I_Current (A)	13019	
Circuit2 (TRx)	I_Current (B)	13020	
Circuit2 (TRx)	I_Current (C)	13021	
Circuit2 (TRx)	I_Current (N)	13022	
Circuit2 (TRx)	V_voltage (A-B)	13060	Phase to phase
Circuit2 (TRx)	V_voltage (B-C)	13061	Phase to phase
Circuit2 (TRx)	V_voltage (C-A)	13062	Phase to phase
Circuit2 (TRx)	V_voltage (N)	13063	
Circuit2 (TRx)	S (KVA)	13064	
Circuit2 (TRx)	P (KW)	13065	
Circuit2 (TRx)	Q (KVAR)	13066	
Circuit2 (TRx)	Power Factor	13067	
Circuit3 (LBS)	I_Current (A)	13023	
Circuit3 (LBS)	I_Current (B)	13024	
Circuit3 (LBS)	I_Current (C)	13025	
Circuit3 (LBS)	I_Current (N)	13026	
Circuit3 (LBS)	S (KVA)	13068	Calculated from power factor and voltage value from TRx
Circuit3 (LBS)	P (KW)	13069	
Circuit3 (LBS)	Q (KVAR)	13070	
Common	Temperature (External) of Transformer if available	13100	
Common	Internal Temperature of RMU/SS	13101	

*** Please be noted that there is one circuit (LBS) has no measurements and it will be calculated in ADMS in control center (power flow)**

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DISTRIBUTION AUTOMATION PROGRAM SMART FIELD EQUIPMENT DATA POINTS LIST FOR 3L1T SMART RMU (LLVL)

Bay / CIRCUIT no.	Point name / Message	IOA / IEC OBJECT ADDRESS	REMARKS
DIGITAL OUTPUT (DO) COMMANDS			
Circuit1 (LBS)	CLOSE COMMAND	1	
Circuit1 (LBS)	OPEN COMMAND	1	
Circuit2 (LBS)	CLOSE COMMAND	5	
Circuit2 (LBS)	OPEN COMMAND	5	
Circuit3 (TRx)	CLOSE COMMAND	9	
Circuit3 (TRx)	OPEN COMMAND	9	
Circuit4 (LBS)	CLOSE COMMAND	13	
Circuit4 (LBS)	OPEN COMMAND	13	
DIGITAL INPUT (DI) GENERAL ALARMS / INDICATIONS			
Circuit1 (LBS)	CLOSE INDICATION	11000	
Circuit1 (LBS)	OPEN INDICATION		
Circuit1 (LBS)	LOCK/UNLOCK INDICATION	1000	
Circuit1 (LBS)	GROUND INDICATION	1001	
Circuit2 (LBS)	CLOSE INDICATION	11001	
Circuit2 (LBS)	OPEN INDICATION		
Circuit2 (LBS)	LOCK/UNLOCK INDICATION	1002	
Circuit2 (LBS)	GROUND INDICATION	1003	
Circuit3 (TRx)	CLOSE INDICATION	11002	
Circuit3 (TRx)	OPEN INDICATION		
Circuit3 (TRx)	LOCK/UNLOCK INDICATION	1004	
Circuit3 (TRx)	GROUND INDICATION	1005	
Circuit4 (LBS)	CLOSE INDICATION	11003	
Circuit4 (LBS)	OPEN INDICATION		
Circuit4 (LBS)	LOCK/UNLOCK INDICATION	1006	
Circuit4 (LBS)	GROUND INDICATION	1007	
COMMON	REMOTE	11004	Alarm
	LOCAL		
COMMON	Battery low	1008	Alarm
COMMON	Gas Low	1009	Alarm
COMMON	AC power fail	1010	Alarm
COMMON	Door open	1011	Alarm
COMMON	DC power fail	1012	Main DC power for charger/Circuit Breaker
COMMON	Motor CIRCUIT fail	1013	Regrouped information for all circuits (Spring charger, DC motor)
COMMON	RTU Self diagnostic (RTU alarm)	1277	Alarm
COMMON	EFI (FAULT INDICATION)	1278	Alarm
COMMON	Protection Health (Normal/Fail)	1279	Alarm
COMMON	Protection Trip (Earth fault)	1280	Alarm
COMMON	Protection Trip (Phase fault)	1281	Alarm

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ANALOG INPUT (AI) MEASUREMENTS			
Circuit1 (LBS)	I_Current (A)	13015	
Circuit1 (LBS)	I_Current (B)	13016	
Circuit1 (LBS)	I_Current (C)	13017	
Circuit1 (LBS)	I_Current (N)	13018	
Circuit1 (LBS)	S (KVA)	13057	Calculated from power factor and voltage value from TRx
Circuit1 (LBS)	P (KW)	13058	
Circuit1 (LBS)	Q (KVAR)	13059	
Circuit2 (LBS)	I_Current (A)	13019	
Circuit2 (LBS)	I_Current (B)	13020	
Circuit2 (LBS)	I_Current (C)	13021	
Circuit2 (LBS)	I_Current (N)	13022	
Circuit2 (LBS)	S (KVA)	13060	Calculated from power factor and voltage value from TRx
Circuit2 (LBS)	P (KW)	13061	
Circuit2 (LBS)	Q (KVAR)	13062	
Circuit3 (TRx)	I_Current (A)	13023	
Circuit3 (TRx)	I_Current (B)	13024	
Circuit3 (TRx)	I_Current (C)	13025	
Circuit3 (TRx)	I_Current (N)	13026	
Circuit3 (TRx)	V_voltage (A-B)	13063	Phase to phase
Circuit3 (TRx)	V_voltage (B-C)	13064	Phase to phase
Circuit3 (TRx)	V_voltage (C-A)	13065	Phase to phase
Circuit3 (TRx)	V_voltage (N)	13066	
Circuit3 (TRx)	S (KVA)	13067	
Circuit3 (TRx)	P (KW)	13068	
Circuit3 (TRx)	Q (KVAR)	13069	
Circuit3 (TRx)	Power Factor	13070	
Circuit4 (LBS)	I_Current (A)	13027	
Circuit4 (LBS)	I_Current (B)	13028	
Circuit4 (LBS)	I_Current (C)	13029	
Circuit4 (LBS)	I_Current (N)	13030	
Circuit4 (LBS)	S (KVA)	13071	Calculated from power factor and voltage value from TRx
Circuit4 (LBS)	P (KW)	13072	
Circuit4 (LBS)	Q (KVAR)	13073	
Common	Temperature (External) of Transformer if available	13100	
Common	Internal Temperature of RMU/SS	13101	

*** Please be noted that there is one circuit (LBS) has no measurements and it will be calculated in ADMS in control center (power flow)**

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DISTRIBUTION AUTOMATION PROGRAM SMART FIELD EQUIPMENT DATA POINTS LIST FOR 2L2T SMART RMU (LVVL)



Bay / CIRCUIT no.	Point name / Message	IOA / IEC OBJECT ADDRESS	REMARKS
DIGITAL OUTPUT (DO) COMMANDS			
Circuit1 (LB5)	CLOSE COMMAND	1	
Circuit1 (LB5)	OPEN COMMAND	1	
Circuit2 (TRx1)	CLOSE COMMAND	5	
Circuit2 (TRx1)	OPEN COMMAND	5	
Circuit3 (TRx2)	CLOSE COMMAND	9	
Circuit3 (TRx2)	OPEN COMMAND	9	
Circuit4 (LB5)	CLOSE COMMAND	13	
Circuit4 (LB5)	OPEN COMMAND	13	
DIGITAL INPUT (DI) GENERAL ALARMS / INDICATIONS			
Circuit1 (LB5)	CLOSE INDICATION	11000	
Circuit1 (LB5)	OPEN INDICATION		
Circuit1 (LB5)	LOCK/UNLOCK INDICATION	1000	
Circuit1 (LB5)	GROUND INDICATION	1001	
Circuit2 (TRx1)	CLOSE INDICATION	11001	
Circuit2 (TRx1)	OPEN INDICATION		
Circuit2 (TRx1)	LOCK/UNLOCK INDICATION	1002	
Circuit2 (TRx1)	GROUND INDICATION	1003	
Circuit3 (TRx2)	CLOSE INDICATION	11002	
Circuit3 (TRx2)	OPEN INDICATION		
Circuit3 (TRx2)	LOCK/UNLOCK INDICATION	1004	
Circuit3 (TRx2)	GROUND INDICATION	1005	
Circuit4 (LB5)	CLOSE INDICATION	11003	
Circuit4 (LB5)	OPEN INDICATION		
Circuit4 (LB5)	LOCK/UNLOCK INDICATION	1006	
Circuit4 (LB5)	GROUND INDICATION	1007	
COMMON	REMOTE	11004	Alarm
	LOCAL		
COMMON	Battery low	1008	Alarm
COMMON	Gas Low	1009	Alarm
COMMON	AC power fail	1010	Alarm
COMMON	Door open	1011	Alarm
COMMON	DC power fail	1012	DC power fail for charger/circuit breaker
COMMON	Motor CIRCUIT fail	1013	Regrouped information for all circuits (Spring charger, DC motor)
COMMON	RTU Self diagnostic (RTU alarm)	1277	Alarm
COMMON	EFI (FAULT INDICATION)	1278	Alarm
COMMON	Protection#1 Health (Normal/Fail)	1279	Alarm : Protection#1 for circuit#2
COMMON	Protection#1 Trip (Earth fault)	1280	Alarm
COMMON	Protection#1 Trip (Phase fault)	1281	Alarm
COMMON	Protection#2 Health (Normal/Fail)	1282	Alarm : Protection#2 is for circuit#3
COMMON	Protection#2 Trip (Earth fault)	1283	Alarm
COMMON	Protection#2 Trip (Phase fault)	1284	Alarm

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ANALOG INPUT (AI) MEASUREMENTS			
Circuit1 (LBS)	I_Current (A)	13015	
Circuit1 (LBS)	I_Current (B)	13016	
Circuit1 (LBS)	I_Current (C)	13017	
Circuit1 (LBS)	I_Current (N)	13018	
Circuit1 (LBS)	S (KVA)	13057	Calculated from power factor and voltage value from TRx
Circuit1 (LBS)	P (KW)	13058	
Circuit1 (LBS)	Q (KVAR)	13059	
Circuit2 (TRx1)	I_Current (A)	13019	
Circuit2 (TRx1)	I_Current (B)	13020	
Circuit2 (TRx1)	I_Current (C)	13021	
Circuit2 (TRx1)	I_Current (N)	13022	
Circuit2 (TRx1)	S (KVA)	13060	
Circuit2 (TRx1)	P (KW)	13061	
Circuit2 (TRx1)	Q (KVAR)	13062	
Circuit3 (TRx2)	I_Current (A)	13023	
Circuit3 (TRx2)	I_Current (B)	13024	
Circuit3 (TRx2)	I_Current (C)	13025	
Circuit3 (TRx2)	I_Current (N)	13026	
Circuit3 (TRx2)	V_voltage (A-B)	13063	Phase to phase
Circuit3 (TRx2)	V_voltage (B-C)	13064	Phase to phase
Circuit3 (TRx2)	V_voltage (C-A)	13065	Phase to phase
Circuit3 (TRx2)	V_voltage (N)	13066	
Circuit3 (TRx2)	S (KVA)	13067	Calculated from power factor and voltage value from TRx 1
Circuit3 (TRx2)	P (KW)	13068	
Circuit3 (TRx2)	Q (KVAR)	13069	
Circuit3 (TRx2)	Power Factor	13070	
Circuit4 (LBS)	I_Current (A)	13027	
Circuit4 (LBS)	I_Current (B)	13028	
Circuit4 (LBS)	I_Current (C)	13029	
Circuit4 (LBS)	I_Current (N)	13030	
Circuit4 (LBS)	S (KVA)	13071	Calculated from power factor and voltage value from TRx
Circuit4 (LBS)	P (KW)	13072	
Circuit4 (LBS)	Q (KVAR)	13073	
Common	Temperature (External) of Transformer if available	13100	
Common	Internal Temperature of RMU/SS	13101	

*** Please be noted that there is one circuit (LBS) has no measurements and it will be calculated in ADMS in control center (power flow)**

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DISTRIBUTION AUTOMATION PROGRAM SMART FIELD EQUIPMENT DATA POINTS LIST FOR 3L SMART RMU



Bay / CIRCUIT no.	Point name / Message	IOA / IEC OBJECT ADDRESS	REMARKS
DIGITAL OUTPUT (DO) COMMANDS			
CIRCUIT1 (LBS)	CLOSE COMMAND	1	
CIRCUIT1 (LBS)	OPEN COMMAND	1	
CIRCUIT2 (LBS)	CLOSE COMMAND	5	
CIRCUIT2 (LBS)	OPEN COMMAND	5	
CIRCUIT3 (LBS)	CLOSE COMMAND	9	
CIRCUIT3 (LBS)	OPEN COMMAND	9	
DIGITAL INPUT (DI) GENERAL ALARMS / INDICATIONS			
CIRCUIT1 (LBS)	CLOSE INDICATION	11000	
CIRCUIT1 (LBS)	OPEN INDICATION		
CIRCUIT1 (LBS)	LOCK/UNLOCK INDICATION	1000	
CIRCUIT1 (LBS)	GROUND INDICATION	1001	
Circuit2 (LBS)	CLOSE INDICATION	11001	
Circuit2 (LBS)	OPEN INDICATION		
Circuit2 (LBS)	LOCK/UNLOCK INDICATION	1002	
Circuit2 (LBS)	GROUND INDICATION	1003	
CIRCUIT3 (LBS)	CLOSE INDICATION	11002	
CIRCUIT3 (LBS)	OPEN INDICATION		
CIRCUIT3 (LBS)	LOCK/UNLOCK INDICATION	1004	
CIRCUIT3 (LBS)	GROUND INDICATION	1005	
COMMON	REMOTE	11004	Alarm
	LOCAL		Alarm
COMMON	Battery low	1008	Alarm
COMMON	Gas Low	1009	Alarm
COMMON	AC power fail	1010	Alarm
COMMON	Door open	1011	Alarm
COMMON	DC power fail	1012	Main DC power for charger/Circuit Breaker
COMMON	Motor CIRCUIT fail	1013	Regrouped information for all circuits (Spring charger, DC motor)
COMMON	RTU Self diagnostic (RTU alarm)	1277	Alarm
COMMON	EFI (FAULT INDICATION)	1278	Alarm
COMMON	Protection Health (Normal/Fail)	1279	Alarm
COMMON	Protection Trip (Earth fault)	1280	Alarm
COMMON	Protection Trip (Phase fault)	1281	Alarm

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ANALOG INPUT (AI) MEASUREMENTS			
Circuit1 (LBS)	I_Current (A)	13015	
Circuit1 (LBS)	I_Current (B)	13016	
Circuit1 (LBS)	I_Current (C)	13017	
Circuit1 (LBS)	I_Current (N)	13018	
Circuit1 (LBS)	S (KVA)	13057	Calculated from power factor and voltage value from PT on the busbar
Circuit1 (LBS)	P (KW)	13058	
Circuit1 (LBS)	Q (KVAR)	13059	
Circuit2 (LBS)	I_Current (A)	13019	
Circuit2 (LBS)	I_Current (B)	13020	
Circuit2 (LBS)	I_Current (C)	13021	
Circuit2 (LBS)	I_Current (N)	13022	
Common	V_voltage (A-B)	13060	Phase to phase
Common	V_voltage (B-C)	13061	Phase to phase
Common	V_voltage (C-A)	13062	Phase to phase
Common	V_voltage (N)	13063	
Circuit2 (LBS)	S (KVA)	13064	Calculated from power factor and voltage value from PT on the busbar
Circuit2 (LBS)	P (KW)	13065	
Circuit2 (LBS)	Q (KVAR)	13066	
Common	Power Factor	13067	
Circuit3 (LBS)	I_Current (A)	13023	
Circuit3 (LBS)	I_Current (B)	13024	
Circuit3 (LBS)	I_Current (C)	13025	
Circuit3 (LBS)	I_Current (N)	13026	
Circuit3 (LBS)	S (KVA)	13068	Calculated from power factor and voltage value from PT on the busbar
Circuit3 (LBS)	P (KW)	13069	
Circuit3 (LBS)	Q (KVAR)	13070	
Common	Temperature (External) of Transformer if available	13100	
Common	Internal Temperature of RMU/SS	13101	

* Please be noted that there is one circuit (LBS) has no measurements and it will be calculated in ADMS in control center (power flow)

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DISTRIBUTION AUTOMATION PROGRAM SMART FIELD EQUIPMENT DATA POINTS LIST FOR 4L SMART RMU



Bay / CIRCUIT no.	Point name / Message	IOA / IEC OBJECT ADDRESS	REMARKS
DIGITAL OUTPUT (DO) COMMANDS			
Circuit1 (LBS)	CLOSE COMMAND	1	
Circuit1 (LBS)	OPEN COMMAND	1	
Circuit2 (LBS)	CLOSE COMMAND	5	
Circuit2 (LBS)	OPEN COMMAND	5	
Circuit3 (LBS)	CLOSE COMMAND	9	
Circuit3 (LBS)	OPEN COMMAND	9	
Circuit4 (LBS)	CLOSE COMMAND	13	
Circuit4 (LBS)	OPEN COMMAND	13	
DIGITAL INPUT (DI) GENERAL ALARMS / INDICATIONS			
Circuit1 (LBS)	CLOSE INDICATION	11000	
Circuit1 (LBS)	OPEN INDICATION		
Circuit1 (LBS)	LOCK/UNLOCK INDICATION	1000	
Circuit1 (LBS)	GROUND INDICATION	1001	
Circuit2 (LBS)	CLOSE INDICATION	11001	
Circuit2 (LBS)	OPEN INDICATION		
Circuit2 (LBS)	LOCK/UNLOCK INDICATION	1002	
Circuit2 (LBS)	GROUND INDICATION	1003	
Circuit3 (LBS)	CLOSE INDICATION	11002	
Circuit3 (LBS)	OPEN INDICATION		
Circuit3 (LBS)	LOCK/UNLOCK INDICATION	1004	
Circuit3 (LBS)	GROUND INDICATION	1005	
Circuit4 (LBS)	CLOSE INDICATION	11003	
Circuit4 (LBS)	OPEN INDICATION		
Circuit4 (LBS)	LOCK/UNLOCK INDICATION	1006	
Circuit4 (LBS)	GROUND INDICATION	1007	
COMMON	REMOTE	11004	Alarm
	LOCAL		
COMMON	Battery low	1008	Alarm
COMMON	Gas Low	1009	Alarm
COMMON	AC power fail	1010	Alarm
COMMON	Door open	1011	Alarm
COMMON	DC power fail	1012	Main DC power for charger/Circuit Breaker
COMMON	Motor CIRCUIT fail	1013	Regrouped information for all circuits (Spring charger, DC motor)
COMMON	RTU Self diagnostic (RTU alarm)	1277	Alarm
COMMON	EFI (FAULT INDICATION)	1278	Alarm
COMMON	Protection Health (Normal/Fail)	1279	Alarm
COMMON	Protection Trip (Earth fault)	1280	Alarm
COMMON	Protection Trip (Phase fault)	1281	Alarm

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ANALOG INPUT (AI) MEASUREMENTS			
Circuit1 (LBS)	I_Current (A)	13015	
Circuit1 (LBS)	I_Current (B)	13016	
Circuit1 (LBS)	I_Current (C)	13017	
Circuit1 (LBS)	I_Current (N)	13018	
Circuit1 (LBS)	S (KVA)	13057	Calculated from power factor and voltage value from PT on the busbar
Circuit1 (LBS)	P (KW)	13058	
Circuit1 (LBS)	Q (KVAR)	13059	
Circuit2 (LBS)	I_Current (A)	13019	
Circuit2 (LBS)	I_Current (B)	13020	
Circuit2 (LBS)	I_Current (C)	13021	
Circuit2 (LBS)	I_Current (N)	13022	
Circuit2 (LBS)	S (KVA)	13060	Calculated from power factor and voltage value from PT on the busbar
Circuit2 (LBS)	P (KW)	13061	
Circuit2 (LBS)	Q (KVAR)	13062	
Circuit3 (LBS)	I_Current (A)	13023	
Circuit3 (LBS)	I_Current (B)	13024	
Circuit3 (LBS)	I_Current (C)	13025	
Circuit3 (LBS)	I_Current (N)	13026	
COMMON	V_voltage (A-B)	13063	Phase to phase
COMMON	V_voltage (B-C)	13064	Phase to phase
COMMON	V_voltage (C-A)	13065	Phase to phase
COMMON	V_voltage (N)	13066	
Circuit3 (LBS)	S (KVA)	13067	Calculated from power factor and voltage value from PT on the busbar
Circuit3 (LBS)	P (KW)	13068	
Circuit3 (LBS)	Q (KVAR)	13069	
COMMON	Power Factor	13070	
Circuit4 (LBS)	I_Current (A)	13027	
Circuit4 (LBS)	I_Current (B)	13028	
Circuit4 (LBS)	I_Current (C)	13029	
Circuit4 (LBS)	I_Current (N)	13030	
Circuit4 (LBS)	S (KVA)	13071	Calculated from power factor and voltage value from PT on the busbar
Circuit4 (LBS)	P (KW)	13072	
Circuit4 (LBS)	Q (KVAR)	13073	
Common	Temperature (External) of Transformer if available	13100	
Common	Internal Temperature of RMU/SS	13101	

*** Please be noted that there is one circuit (LBS) has no measurements and it will be calculated in ADMS in control center (power flow)**

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DISTRIBUTION AUTOMATION PROGRAM SMART FIELD EQUIPMENT DATA POINTS LIST FOR 2L1T SMART RMU (LVL) with integrated ATS



Bay / CIRCUIT no.	Point name / Message	IOA / IEC OBJECT ADDRESS	REMARKS
DIGITAL OUTPUT (DO) COMMANDS			
CIRCUIT1 (LBS)	CLOSE COMMAND	1	
CIRCUIT1 (LBS)	OPEN COMMAND	1	
CIRCUIT2 (TRx)	CLOSE COMMAND	5	
CIRCUIT2 (TRx)	OPEN COMMAND	5	
CIRCUIT3 (LBS)	CLOSE COMMAND	9	
CIRCUIT3 (LBS)	OPEN COMMAND	9	
COMMON	ATS SWITCH IN/OUT	17	
DIGITAL INPUT (DI) GENERAL ALARMS / INDICATIONS			
CIRCUIT1 (LBS)	CLOSE INDICATION	11000	
CIRCUIT1 (LBS)	OPEN INDICATION		
CIRCUIT1 (LBS)	LOCK/UNLOCK INDICATION	1000	
CIRCUIT1 (LBS)	GROUND INDICATION	1001	
CIRCUIT1 (LBS)	CVI (ATS voltage presence)	2000	
Circuit2 (TRx)	CLOSE INDICATION	11001	
Circuit2 (TRx)	OPEN INDICATION		
Circuit2 (TRx)	LOCK/UNLOCK INDICATION	1002	
Circuit2 (TRx)	GROUND INDICATION	1003	
Circuit2 (TRx)	CVI (ATS voltage presence)	2001	
CIRCUIT3 (LBS)	CLOSE INDICATION	11002	
CIRCUIT3 (LBS)	OPEN INDICATION		
CIRCUIT3 (LBS)	LOCK/UNLOCK INDICATION	1004	
CIRCUIT3 (LBS)	GROUND INDICATION	1005	
CIRCUIT3 (LBS)	CVI (ATS voltage presence)	2002	
COMMON	REMOTE	11004	Alarm
	LOCAL		Alarm
COMMON	Battery low	1008	Alarm
COMMON	Gas Low	1009	Alarm
COMMON	AC power fail	1010	Alarm
COMMON	Door open	1011	Alarm
COMMON	DC power fail	1012	Main DC power for charger/Circuit Breaker
COMMON	Motor CIRCUIT fail	1013	Regrouped information for all circuits (Spring charger, DC motor)
COMMON	RTU Self diagnostic (RTU alarm)	1277	Alarm
COMMON	EFI (FAULT INDICATION)	1278	Alarm
COMMON	Protection Health (Normal/Fail)	1279	Alarm
COMMON	Protection Trip (Earth fault)	1280	Alarm
COMMON	Protection Trip (Phase fault)	1281	Alarm
COMMON	ATS SWITCH IN/OUT	2004	
COMMON	ATS TRIP (Act / Deact)	2005	

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ANALOG INPUT (AI) MEASUREMENTS			
Circuit1 (LBS)	I _{Current} (A)	13015	
Circuit1 (LBS)	I _{Current} (B)	13016	
Circuit1 (LBS)	I _{Current} (C)	13017	
Circuit1 (LBS)	I _{Current} (N)	13018	
Circuit1 (LBS)	S (KVA)	13057	Calculated from power factor and voltage value from TRx
Circuit1 (LBS)	P (KW)	13058	
Circuit1 (LBS)	Q (KVAR)	13059	
Circuit2 (TRx)	I _{Current} (A)	13019	
Circuit2 (TRx)	I _{Current} (B)	13020	
Circuit2 (TRx)	I _{Current} (C)	13021	
Circuit2 (TRx)	I _{Current} (N)	13022	
Circuit2 (TRx)	V _{voltage} (A-B)	13060	Phase to phase
Circuit2 (TRx)	V _{voltage} (B-C)	13061	Phase to phase
Circuit2 (TRx)	V _{voltage} (C-A)	13062	Phase to phase
Circuit2 (TRx)	V _{voltage} (N)	13063	
Circuit2 (TRx)	S (KVA)	13064	
Circuit2 (TRx)	P (KW)	13065	
Circuit2 (TRx)	Q (KVAR)	13066	
Circuit2 (TRx)	Power Factor	13067	
Circuit3 (LBS)	I _{Current} (A)	13023	
Circuit3 (LBS)	I _{Current} (B)	13024	
Circuit3 (LBS)	I _{Current} (C)	13025	
Circuit3 (LBS)	I _{Current} (N)	13026	
Circuit3 (LBS)	S (KVA)	13068	Calculated from power factor and voltage value from TRx
Circuit3 (LBS)	P (KW)	13069	
Circuit3 (LBS)	Q (KVAR)	13070	
Common	Temperature (External) of Transformer if available	13100	
Common	Internal Temperature of RMU/SS	13101	

* Please be noted that there is one circuit (LBS) has no measurements and it will be calculated in ADMS in control center (power flow)