32-SDMS-11

Rev.2

SPECIFICATIONS FOR MV SMART RING MAIN UNIT-SRMU UP TO 38 KV

SPECIFICATIONS FOR MV SMART RING MAIN UNIT UP TO 38 KV

Revision History

#	Date	Revision No.	Revised By	Major Revision Description
1	**01-02- 2021**	**Rev.01**	**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
2	19/**0**5/2025	**Rev.02**	**Engineering Development Department -HQ** **Smart Grid Dept. HQ** **Distribution protection Dept.**	• Updating the cross-reference standard and specifications, at clause no.3. • Add the clause no.5.1.8. • Add the clause no.5.3.1.3. • Update the clause no.5.3.1.4. • Update the clause no.5.3.1.7. • Update the clause no.5.4. • Update the clause no.5.5. • Add the clause no.5.6. • Add the clause no.5.6.9. • Update the clause no.5.8. • Update the clause no.5.9. • Update the clause no.5.10. • Update the clause no.5.11. • Update the clause no.5.14. • Add the clause no.5.20 • Add the clause no.5.16. • Add the clause no.6.1.7. • Add the clause no.6.1.8. • Add the clause no.9. • Update the clause no.5.19. • Update the clause no.12.

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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, SMART ring main unit (SRMU), intended to be used in 13.8 kV and 33 kV medium voltage system of the Saudi Electricity Company (SEC) in Saudi Arabia with the conjunction specifications SDMS (11 SDMS-03, 32 SDMS 01, 32 SDMS-07, 50-SDMS-01, DES-P03). This SRMU will be used for Distribution Automation System so that the SRMU 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 SPECIFICATON. In case of conflict, the CONTRACTOR may propose equipment / materials conforming to one group of industry codes and standards quoted here under 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 earthling 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.
• 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
• 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	Distribution Protection Material Specification (Protective Relays)
• DBURAL	Unified List of Approved Relays for SEC Distribution Network – latest
• DES-P03	Protection System Requirements for SEC Distribution s/s
• DES-P04 NW	Relay Setting & Coordination Guidelines for SEC Distribution
• 31-SDMS-11	SPECIFICATIONS FOR TERMINAL BLOCKS FOR PRIMARY S/S
• 50-SDMS-01	Current Transformers up to 36 KV.
• 37-SDMS-04	Interface low voltage main circuit breaker.
• 50-TMSS-03	POTENTIAL TRANSFORMERS.
• 11-SDMS-01	Low Voltage Power and Control Cables

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 smart ring main unit shall be indoor / outdoor use, ground/skid mounted and SF6 insulated, remote/local 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.

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, with refilling valve facility, if the supplier is deviate for the gas refilling facility it shall be provide a life time warranty on the tank's gas leakage on the manufacturing tank defect.

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 safe operations/maintenance 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 SRMU 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 (LBS1- C.B - LBS2) :** 3ways
- **3L1T (LBS1- LBS2-C. B - LBS3) :** 4ways
- **2L2T (LBS1-C. B 1- C.B 2- LBS2) :** 4ways
- **3L (LBS1-LBS2-LBS3):** switching RMU 3ways self-power SRMU
- **4L (LBS1-LBS2-LBS3-LBS4):** switching RMU 4ways self-power SRMU
- **2L1T (LBS1- C.B - LBS2) with ATS:** SRMU with integrated ATS

ATS: (Automatic Transfer switch)
The SRMU with integrated ATS, in addition to being Smart RMU (3ways: 2L1T), shall ensure ATS function as per described in the ATS appendix.

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 SRMU, for both LBS and CB, are given in the related technical data schedule.

5. Design and construction

5.1. General

5.1.1 The SRMU 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 SRMU is well ventilated to protect from moisture and has a space heater if needed. The complete SRMU-(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 SRMU 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), SRMU 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 SRMU 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 functions of the SRMU 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.

5.1.7 All terminals/contacts shall be silver plated, minimum 20-micron thickness as per 1-SDMS-01 description.

5.1.8 The SRMU shall be equipped with Local / Remote selector switch with facility of lockout tagout (to be suitable for 9 mm shackle lockout hasp) and independent lock/unlock selector switch for each switching compartments (LBS and CB), all selector switch shall be key free, as not allow to use a key to switch the selector from a position to another.

5.1.9 All used SRMU labels shall be engraved fixed by a screw, as all stickers' labels are not accepted even inside the SRMU control box, or on the SRMU front.

5.1.10 SRMU switching compartments shall be labeled as per the mentioned above sequence, by engraved labels with proper size and font, or to be laser printing.

5-1-11 All SRMU, SLD, plungers, equipment's identifications on panel front shall be with laser printing, or engraved labels.

5-1-12 the mechanical operation handle shall be a one handle for all the mechanical operations open/close, even for the mechanical CB spring charge.

5-1-13 main SRMU earth shall be from a backside in the lower corner, and to be a tine coated, with proper earthing stud.

5-1-14 SEC logo and dangerous monogram shall be installed on the panel front side and backside.

5-1-14 all SRMU, SLD shall be equipped with a mimic indication for all the switching compartments with a color background as per SEC requirements.

5-1-15 The SRMU shall be with a mechanical operation system, local electrical operation system independent from the RTU modules and a remote operation system.

5-1-16 panel wiring for supply, Protection, Control, and RTU compartments:

- RED/YELLOW/BLUE/BLACK Colors-Coded wires shall be utilized for, CT Circuits, PT Circuits wires sizing shall follow the DPED regulations and standards.
- DC Supply is RED (+)/BLACK (-), colors not less than as mentioned below, or up to the sizing of the panel DC loads.
- AC Supply/control/protection function is using gray color wires not less than as mentioned below, or up to DPED recommendations.
- Alarms/telecommunication/RTU signaling, using blue color.
- Grounding is yellow-green color, as per COMPANY Standards and Practices.

For Panel Internal Wiring the wires size shall be not less than the following:

- CT Circuits - 4.0mm2
- PT Circuits - 2.5mm2
- DC Supply –2.5mm2
- AC Supply –2.5mm2
- Control Circuits –1.5mm2
- Trip Circuits –2.5mm2

- Alarm - 1.5mm2.
- Grounding – 1.5 mm2
- All panel wire sizing schedules and drawing shall be provided every inspection for prequalification's or PO release.

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 the technical data schedule, small inductive or capacitive currents involved in disconnecting unloaded transformers and cables or overhead lines.

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 mechanically 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 associate Relays with necessary contactors for, local electrical/remote operations. Equipment shall be provided with motorized facilities.

5.2.5 The motorized units shall have facilities for remote control suitable for interfacing to SEC's SCADA system Remote Terminal Unit (RTU).

5.2.6 The total electrical operation time for open or close command/command execution shall not exceed 3.0 sec even in electrical local, or remote operation commands.

5.2.7 C. B opening time shall be not exceed 50 m sec (3 cycle).

5.3. Tee-Off Circuit

Tee-off circuit protection shall be by circuit breaker as described below:

5.3.1 Circuit Breaker

5.3.1.1 The Circuit breaker shall be of fixed type and designed for short circuit breaking current as per 1-SDMS01.

5.3.1.2 The insulation medium shall be SF6/or equivalent environmental gas, and the interruption medium can be either SF6 or vacuum or equivalent environmental gas.

5.3.1.3 Opening of the circuit breaker shall be by local manual mechanical trip button, electrical through trip signal from the protection relay/locally electrical push bottom and by remote tripping signal through the RTU.

5.3.1.4 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 and independent of the operator action and shall provide three positions; circuit breaker 'ON', circuit breaker and isolator 'OFF' and earthing switch 'Earth', the earth switch shall be fully interlocked with the isolator and C.B position to prevent any mall operation lead to close the earth switch while the isolator is in on position and vice versa, the earthing shall be a single point earth even before or after the C.B toward the MV outgoing cables , and it is **preferable to be below** the breaker towards the outgoing MV cables.

5.3.1.5 Circuit breaker operating mechanism shall have geared **DC** motor mechanism and associated closing and opening coils with necessary contactors for remote and automatic operations in the distribution network, the operation scheme/mechanism for the C.B control shall be fully **DC** control, and AC mechanism is not accepted.

5.3.1.6 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

5.3.1.7 All the control mechanism supply should be DC system.

5.3.1.8 Connection of all the CB AUX Contacts shall be through Separate Terminal Block.

5.4 Protection Requirements

5.4.1 Relay Selection

Protection Relay to be used in SRMU shall be selected from the latest version of SEC-DBU Unified List of Approved Relays and in compliance with the latest specification of Distribution Protection Material Specifications (DPMS-02).

5.4.2 Protection Relay Type is Dual Powered Relays. However, Company may require the use of Auxiliary Powered Relays in special cases.

5.4.3 Main Signals related to smart RMU protection system, which shall be transmitted through the RTU include:

- Current measurements
- WATCHDOG (relay error, relay faulty, protection in service, protection healthy…etc.) shall be configured to the RTU through hardware connection and through rear port communication.
- Segregated Phase and Earth fault Protection Operated Signals shall be configured to the RTU via Hard-wired Connection & Serial Communication.

5.4.4 Protection DC backup Supply shall be provided through separate DC MCB.

5.4.5 CB Status (i.e. OPEN & CLOSE) shall be wired to Relay Inputs.

5.4.6 Tripping shall be provided through two paths:

1) Relay Trip Output Contact connected to CB Striker.
2) Relay Output Contact connected to CB Tripping coil.

5.4.7 Protection Current Transformer

a. Each Phase Protection CTs shall be Circuit Breaker BUSHING MOUNTED to cover cable termination faults. Installation of Protection CTs at Cable side is not acceptable.

b. Protection CTs shall be provided separately for each phase for ease of maintenance and each Phase CT must have a separate unit according to latest DPMS-02:

- 13.8 kV level :200/1, 5P10, 2.5VA
- 33 kV level :100/1, 5P10, 2.5VA

  Note: In case the used Protection Relay Burden is equal to or less than 2VA, 33kV Level CT Burden can be selected as 2VA, however, it is subject to approval by the Company.
- Specification mentioned above is subject to change based on SEC Requirements.

c. Proper CT Shorting & Isolation Facility should be provided.

d. CT Shorting & Isolation Instructions i.e. Steps to be adopted along with CT Terminal Blocks to be Opened OR Closed, should be clearly mentioned on the Relevant Plate.

e. CT circuitry terminals lugs shall be Ring Type (screw type) terminal lugs at CT Terminals & Protection Relay. Pin Type lugs are not recommended.

5.5 Voltage and current sensors (CTs & VTs):

- All requirements are defined by IEC standards (dielectric, temperature, short-time, power frequency, transient, etc.).
- Long-term compatibility with different IEDs •
- Standardized connectors with defined pinout
- Standards specify basic requirements on material, design and construction.
- Sensor designs are type tested, preferably in accredited laboratories.
- Sensors are tested together with cable connectors.
- Every piece is routine tested before dispatch.

5.5.1 Voltage sensors VTS:

The specified quantity will be one set of (3 VTS) per RMU.

- Complies with IEC 60044-7, IEC 61869-11 standards
- Technology for voltage measurement shall be justified by Vendor (resistive or capacitive); and from the approved vendor list, approved to install and operate inside the KSA.
- The VTS shall be installed always in the transformer circuit (TRX1) and highly recommended bushing mounted VTS instead of the pole mounted VTS
- VTS accuracy shall be less than 1% in order to meet the requirement to have an accuracy of 1% for the whole chain (Sensor-RTU).
- VTS ratios shall be compatible with the provided RTU.
- VTS connection shall be wired directly to RTU without any terminal Test block

5.5.2 Currant sensors CTS:

- The specified quantity will be (N-1) set of (3 segregated CTS) per RMU; (N is the number of RMU circuits); for measurements.
- Technology shall be justified by Vendor; and from approved vendor list, approved to install and operate inside the KSA.
- Complies with IEC 61869-10 standard
- CTS shall be bushing mounted CTS
- CTS installed in the LBS Bushing shall provide correct current measurements at maximum fault level (i.e. 21kA for 13.8kV and 25kA for 33kV & 34.5 KV) without saturation.
- CTS accuracy shall be less than 1% in order to meet the requirement to have an accuracy of 1% for the whole chain (Sensor-RTU).
- CTS ratios shall be compatible with the provided RTU, and protection requirements.

5.5.3 CPT (Capacitive Power Transformer or power transformer) for switching RMU (3L-4L) self-power SRMU:

- The CPT shall be bus bar mounted in a safe isolated location, shall not be in RMU circuit or in outside independent Box
- The SRMU 3L / 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 power voltage transformer connected to bus-bar side.
- The AC load calculation for the mention SRMU shall be provided and submitted to SEC in the prequalification stage, also the CPT burden shall be matched and complied to that AC calculation with safety margin at least 25% extra burden, and the installed AC plug inside the panels control box shall be tagged with a red caution labels mention the max. allowable load to be connect through.
- The AC circuit for CPT shall be protected by a suitable MCB with compatible burden to the CPT burden as mentioned in the previous clues.
- CPT shall be supplied from approved SEC vendors if any.
- CPT ratio shall be supplied in the secondary side a 230 VAC/60 HZ whatever the primary side is 13.8KV or 33.0 KV or 34.5 KV with tolerance 10% max.
- CPT primary connection could be phase to phase or single phase to ground connection.
- CPT access should be guaranteed and secure for the maintenance purpose, with a mention labels with caution red mark and dangerous logo.
- CPT technical data shall be added to SRMU main name plate like CPT connection, burden, ratio…. etc.
- Primary side connection for the CPT shall be protected through an MV fuse.

5.5 SRMU Operations:

5.6.1 SRMU must be equipped with:

1- A single Selector switch for local/remote with locking facility (lockout/tagout)-key free common for all units.
2- Selector switch for lock/unlock for every unit independent (LBS/CB) with locking facility (lockout/tagout)-key free.
3- Push bottom for ON operation for every unite independent (LBS/CB) with a feedback light indication on the control box front side with a RED LED color, also a pushbutton with self-light indication is accepted.
4- Push bottom for OFF operation (LBS/CB), with a feedback light indication on the control box front side with a GREEN LED color, also a pushbutton with self-light indication is accepted.
5- All pushbutton, indication LED, selector switch for lock/unlock and selector switch for the local /remote shall be labeled with an engraved label fixed by screws or by a laser

printing facility indicate the labels sequence for LBS1, CB, LBS2 and so on, no any stickers labels will be accepted.

6- The front of the SRMU control box shall be equipped with a 2 LED for the gas alarming and blocking alarming, as the 1st one will be with yellow LED color for warning that SF6 gas is going to low stage but still the operation could be(equivalent to the yellow color zone on the SF6 gas pressure indicators), and the 2nd one will be a RED LED color for the blocking operation(equivalent to the RED color zone on the SF6 gas pressure indicators), as the SF6 gas is going to a blocking level which is preventing/blocking any electrical operation locally or remotely.

7- Identified Cable trunk for External power supply 230V AC.
8- The antenna shall be available and should be inside Enclosure in the RTU cabinet
9- LED Light inside the Control Box (link to RTU door position (open/close)
10- 70 degrees 'temperature, certificate for all control panel equipment's are required (Battery, charger, RTU…etc.)
11- Provide MCB's with name tag in proper (230V AC Supply, 24V DC Battery Supply, 24V DC RTU Supply, 24V DC Control Supply, 24V DC Motor Supply, 24 V DC protection supply).
12- MCB 24V DC Control Supply (D.C fail alarm), 24V DC Battery Supply (Battery low alarm).
13- All panel front side indications shall be LED.

5.6.2 **The smart SRMU shall be ready for operation as follows:**

- Local/Manually as a mechanical operation by handle (open-close-earth- etc. ...)
- Local/Electrically, open/close with pushbutton, with fully independent operation away from the RTU modules.
- through the RTU modules open/close while it connected to maintenance laptop.
- Remote/fully function access and operation control from distribution control center (SCADA-ADMS) through the RTU modules.

5.6.3 All operating positions shall be in 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.

5.6.4 The position of each of the switches (ES/LBS)/CB 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, indication as described in the below tables.

5.6.5.Indication colors for the mimic:

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

5.6.6 LED back indication for CB, LBS and SF6 status:

Green LED for OFF status independent for each unit.

Red LED for ON status independent for each unit, and SF6 Gas blocking operation.

Yellow LED for earth ON independent for each unit, and SF6 gas warning (SF6 Gas alarm indication)

5.6.7 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.

5.6.8 Common operating handle for LBS/CB spring charging, shall be used for all operations of both ring and tee-off switches. Operating handle inserts shall have marked 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.

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

5.6.10 The padlocking provision material shall be adequately strong and compatible with the life of ring main unit, if that provide by the manufacture.

5.6.11 The panel main door shall be secured by a main strong padlocking provision.

5.6.12 A stainless-steel name plate with engraved typing black color. Fixed on the panel outside cover, in front side upper-right side, and it shall include the manufacture name/logo with a clear font plate/size, and the main panel name plate is below the name of the manufacture/vendor, contain all the required technical data mention in this specification, the manufacture/vendor name plat and main name plate , shall be anti-fade/UV resistance, readable on the direct sun light, fixed by screws, the manufacture logo/name could be merge upper the main technical name plate.

5.7 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 should be provided to make the following operations impossible:

5.7.1 Interlocks should 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.
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.

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

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

5.7.4 cable testing facility door shall be with independent interlocking same as the main MV cable door philosophy.

5.7.5 operation instruction shall be provided on the panel front side visible clear for the operators as a quick guide, stickers instructions are not accepted, it shall be laser print painted or engraved instruction plate.

5.7.6 the interlocking shall be mechanically with electrical will be better, only electrical interlocking is not accepted.

5.7.7 for the SF6 gas blocking stage it shall be electrically blocked all the operations for the unit.

5.8 RTU system requirements and Control functions

Each SRMU 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 request 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. The following RTU Panel solutions shall be available:

- RTU on the top of the RMU (integrated)
- RTU Separated cabinet (with plug cable connector solution)
- RTU are connected / link to MODEM for communication.

5.8.1 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) Single Point
- Lock / Unlock (Per circuit) Single Point
- Local / Remote (Per RMU) Double Point
- ATS (IN/OUT) Single 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
- Relay Fail / Healthy Single Point
- Over current Protection Single Point
- Earth Fault Protection Single 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)

5.8.2 The analog inputs to be wired to the RTU:

- Phase-to-ground Voltage (Aø, Bø, Cø) for all voltage sensors
- Phase Current (Aø, Bø, Cø , Nø) from all current sensors

The voltages communicated to SCADA DMS shall be three phase-to-phase (VΦ-Φ).

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

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

5.8.4 Remote operating time

When RTU receives 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.

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

5.8.6 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.

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.

5.8.7 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 executing 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.

5.8.8 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 computers, 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

RTU Type Test (to be provide):

- IEC 60870-5-101 KEMA Test or equivalent
- IEC 60870-5-104 KEMA Test or equivalent
- IEC 61850 KEMA Certification or equivalent
- IEC 62351 cyber Security test certification

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

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

5.8.9 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 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).

- 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 should 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.
- 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.

5.8.10 **RTU Functions**

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. Suppliers 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
- 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.

5.9 AC auxiliary Power supply and back up battery for the non-self-power SRMU.

5.9.1 AC Power supply:

- An external AC power source is required, from the nearest LV panel for the SRMU, AC LV cable must be connected through one of the auxiliary MCCB at LV panel , it shall be connected to the Control box with appropriate protective provisions in the Control Box, this protective provision must be from the same material of the main body of the SRMU, and follow the same standard of galvanizations, painting and color, also cable glanding should be provide, and the main entrance for that cable shall be tagged and labeled as the main AC supply inlet.

- The external power source shall be a single-phase AC 220V (+/- 10%) /60Hz, wired to a terminal block suitable for 10mm² standard wiring from approved SEC vendor list. Protected with 2 poles miniature circuit breakers shall be provided in the circuit after the terminal-block, with prober rated currant up to the SRMU internal AC load calculations (manufacture shall provide the panel AC calculations to confirm the AC MCB rate).

- The external power source shall properly charge the battery equipped inside the SRMU, so it can handle all the functions of the SRMU including operations switching, Monitoring, RTU and Control, and protection relay and if it loses for a while the backup battery will tack over to supply this function, and the aux. supply is recovered.

- The SRMU must be equipped with a 230V three pin socket outlet, completed with plug top and labeled with the appropriate voltage. The position of the socket outlet shall not impede cable installation or termination. Wiring shall be done by 4mm² copper, 85ºC black PVC insulation with crimping type connectors.

- SRMU shall be provided with LV cable (12 meters length with minimum 2.5 mm^2 section) with suitable, resistant & waterproof conduct for OH & UG compatible with the specifications of 11-SDMS-01.

- 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.

5.9.2 self- Power supply for SRMU (3L & 4L):

The SRMU 3L/4L shall not require any external auxiliary AC power supply for operation and control.
The supply will be through the CPT as per described above in 5.4.3.

5.9.3. Battery:

- Battery for Smart RMU shall be 24 VDC with capacity at least 24 Ampere-hour.
- The backup battery shall be type Solid crystal, Gel type or equivalent technology (fulfill the mentioned conditions and requirements of SEC).
- Battery warranty 5 years from the date of panels delivery.
- Battery location shall be 20% bigger (Height - length- width) than the battery size in order to fit all other batteries of the same category.
- Battery shall be capable to back up the monitoring, communication and operation of the RTU for at least 8 hours autonomy without AC source.
- Battery shall be capable of providing power to perform at least 50 operation cycles (open close) without AC source.
- Battery shall be sized specifying the lifetime and the duty cycle of such a period of life.
- Battery shall be maintenance free and sealed. No lead acid batteries are allowed.
- Battery maintenance shall be possible without power source cut off.
- Battery should be rechargeable and shall be suitable for temperature of 75 Degree centigrade.
- The battery charger shall have temperature compensated to maximize battery life and usable capacity.
- The battery load profile/capacity/burden test certificate shall be provided.
- Battery temperature compatibility test certificate shall be provided.
- Battery data sheets shall be provided, including charging/discharging curves and all battery technical data.
- Battery leads shall be marked with a RED/BLACK cap, as a mark and a protective means for lead touching.

- The battery technical data name plate shall be fully described and fixed on a visible front side fixed target, not on the battery, stickers identification is not accepted, it shall be engraved name plate.

5.10 Termination /cable boxes

5.10.1 Elbow termination & voltage sensor:

1- Elbow termination & voltage sensor for 13.8KV:
- Solution #1: The MV Voltage -sensor (short/long format) shall fit with all SEC qualified Elbow terminations (asymmetrical/symmetrical)
- Solution #2: Built-in (integrated within the RMU)

2- Elbow termination & voltage sensor for 33KV & 34.5 KV:
- Solution: the voltage sensor must be Built-in (integrated within the RMU).

5.10.2 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.

5.10.3 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.

5.10.4 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 pre-molded 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

5.10.5 Distance between terminal bushing and cover of cable box shall not be less than 160 mm to suit pre-molded separable elbows approved by SEC. For ring switch, inter-distance between terminal bushings shall not be less than 125 mm.

5.10.6 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.

5.10.7 The design of the cable boxes should be such that the cable box should allow enough access during cable termination. The removal and installation of cable box cover shall be with minimum number of bolts.

5.10.8 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 & 34.5 KV system.

5.10.9 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.

5.11.10 All necessary bolts, nuts and washers for fixing the cable on the bushings shall be provided with each unit.

5.11 Enclosure

5.11.2 Indoor/Outdoor Ring main unit shall have a tamperproof and weatherproof steel enclosure which covers 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.

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

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

5.12 Dimensions

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

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

5.12.2 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)	

5.12.3 For Automated RMU 33 KV & 34.5 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)	

5.13 Earthing:

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

5.13.3 When several units of the RMU (Extra LBS / Breakers) are mounted adjoining 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.

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

5.14 SF6 Gas Pressure Indicator & Refilling Provision

5.14.2 The SF6 gas pressure inside the tank shall be constantly monitored by a temperature compensating gas pressure indicator offering a safe- green area color /warning - yellow area color / not safe - red area color (blocking) indication.

5.14.3 The gas pressure indicator shall be provided with green pressure for safe, yellow for warning and red pressure zones for block operation. 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.

5.14.4 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.

5.14.5 A separate low pressure SF6 gas switches shall be provided for low pressure alarm/low gas blocking. The low-pressure switch is to be set to operate at pressure which will indicate loss of 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, this alarm/block in contacts should be offered a facility to send the alarm/block signals/ to the RTU, and light up the warning LED/blocking LED for SF6 gas pressure low as mentioned above in the clues of back indication.

5.14.6 Refilling/re-pressurizing inlet valve shall be provided shall be easily accessible for field refilling, and to be a visible marking.

5.14.7 The digital gas indicator is not accepted.

5.14.8 The gas indicator shall be labeled, and marked with a caution indicate the action in status of warning or blocking as a quick guide for the operators in both English/Arabic in the panel front and near the gas indicator, stickers are not accepted.

5.15 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.

5.16 Cable testing facility for the LBS:

- The Cable testing facility is for 13.8 KV units only
-Smart Ring main (SRMU) 13.8 KV units shall equipped by the testing bushing facility with the below requirements (for the LBSs):

1- A separate test bushings facility to carry out HV tests or other maintenance work.
2- The testing pushing facility shall be independent from cable compartment.
3- The testing pushing facility door shall have a fully interlocking system with the earth switch, LBS and C.B to fully guarantee the safety operation and maintenance.
4- The testing bushing door shall be tagged with a red caution label (caution cable testing door).
5- The testing facility door should be equipped with handle-key free, for closing and opening.

Smart RMU 33 KV & 34.5 KV: No cable testing facility required
The cable testing operation shall be conducted through Elbow termination (safety)

5.17 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 (110 KV for 13.8 KV and 200 KV for 33.0 KV) (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)
18. CPT data for the self-power SRMU.

19. Protection CT data
20. Sensor CT/VT data

5.18 Circuits

5.18.1 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

5.18.2 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.

5.19 Monograms, Danger Plates and Asset Tag No:

5.19.1 Danger plate, SEC monogram and Asset Tag No as per SEC drawings No. SEC-01-01, SEC-01-02 and, SEC-01-04 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.

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

5.20 Foundation Mounting:

RMU fixing holes shall suit SEC concrete foundation, with not less than 50 mm distance from foundation wall edges (Reference: SEC Distribution Construction Standard SDCS-02).

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

- Environmental test

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.

6.1.7 CT and VT equipped inside the SRMU type test.

6.1.8 CPT type test, and FAT test.

6.1.9 Battery type tests as per SEC recommendations.

6.1.10 RTU type tests.

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

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

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 SRMU 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.

8.3 The backup battery with a warranty at least **5** years

8.4 No Refill gas shall be providing a Commitment letter for the tank gas leakage for lifetime or at least 30 years warranty.

9. Submittals

The vendor shall provide the following (hard and soft/pdf copies) along with Tender Quotation:

• Summary in table form with the following information: list of items offered, manufacturer, country of origin, catalogue number, and drawing number.

• Clause-by-clause compliance to this specification.

• Technical data schedule per Clause 9 of this specification.

• Drawing showing the full constructional details and dimensions of RMU, cable boxes, and all associated accessories.

• Drawing of mounting/fixing details with respect to SEC unified concrete foundation and the positions of cables.

• Installation, operation and maintenance instructions in both English and Arabic languages.

• Comprehensive list of manufacturer's recommended spare parts.

• Copy of type test reports.

• Descriptive leaflet and literature of RMU offered and its accessories.

• Checklist of quotation request.

• List of customers in case of new manufacturer/vendor.

9.2. The vendor shall submit the following after receipt/acceptance of purchase order:

• As-built drawings (layout and electrical) for SEC final review/approval.

• Prototype for SEC inspection/approval prior to mass production.

• FAT/Routine testing in the presence of SEC representative and final inspection prior to delivery.

• Routine test reports.

• SRMU control and protection connection scheme.

10. 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 C. B	M16/M12	
5.2	**RING SWITCH (LBS)**		
	1. Service Voltage	13.8 KV, 33 KV,34.5 KV	
	2. Maximum Operating Voltage	17.5 KV, 36 KV, 38 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	

AUTOMATED RING MAIN UNIT

(Sheet 2 of 3)

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,34.5 KV	
	2. Maximum Operating Voltage	17.5 KV, 36 KV, 38 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	

AUTOMATED RING MAIN UNIT

(Sheet 3 of 3)

SEC Inquiry No. _____ *Item No*……

A. ADDITIONAL TECHNICAL INFORMATION OR FEATURES SPECIFIED BY SEC:

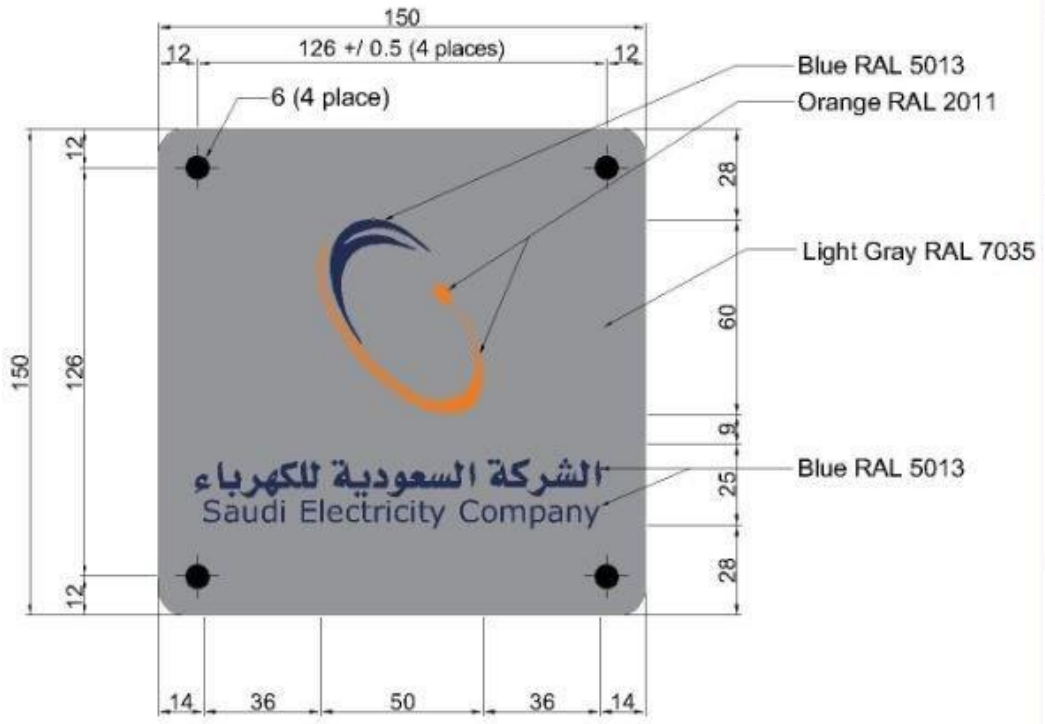
B. ADDITIONAL SUPPLEMENTARY DATA OR FEATURES PROPOSED BY BIDDER/VENDOR/SUPPLIER:

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		

11. Drawings



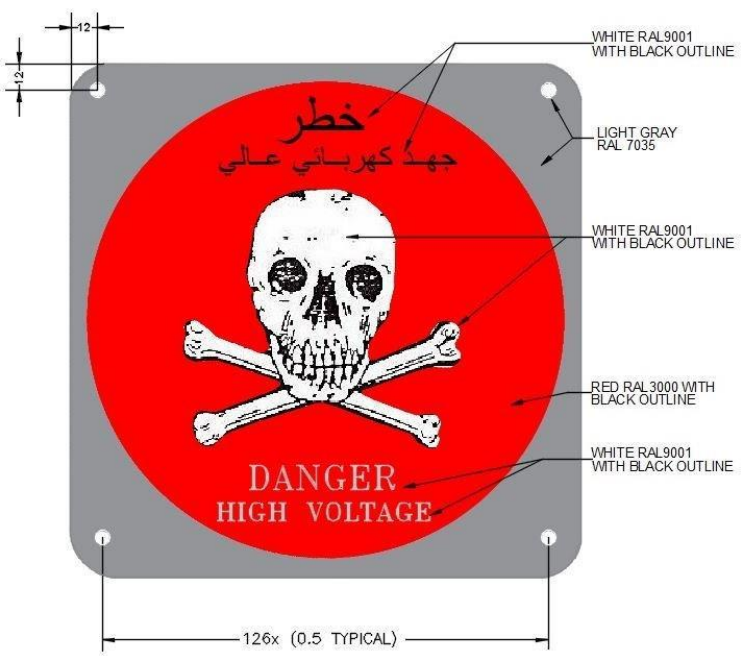
Note:

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

DANGER SIGN FOR EQUIPMENT

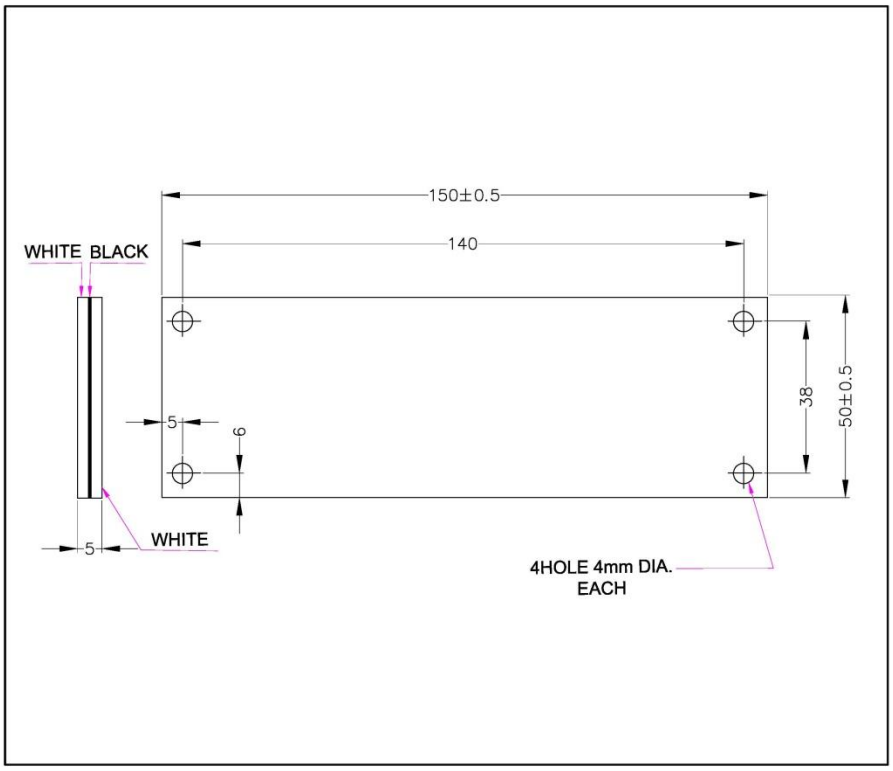


Note:

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

CIRCUIT LABEL PLATE

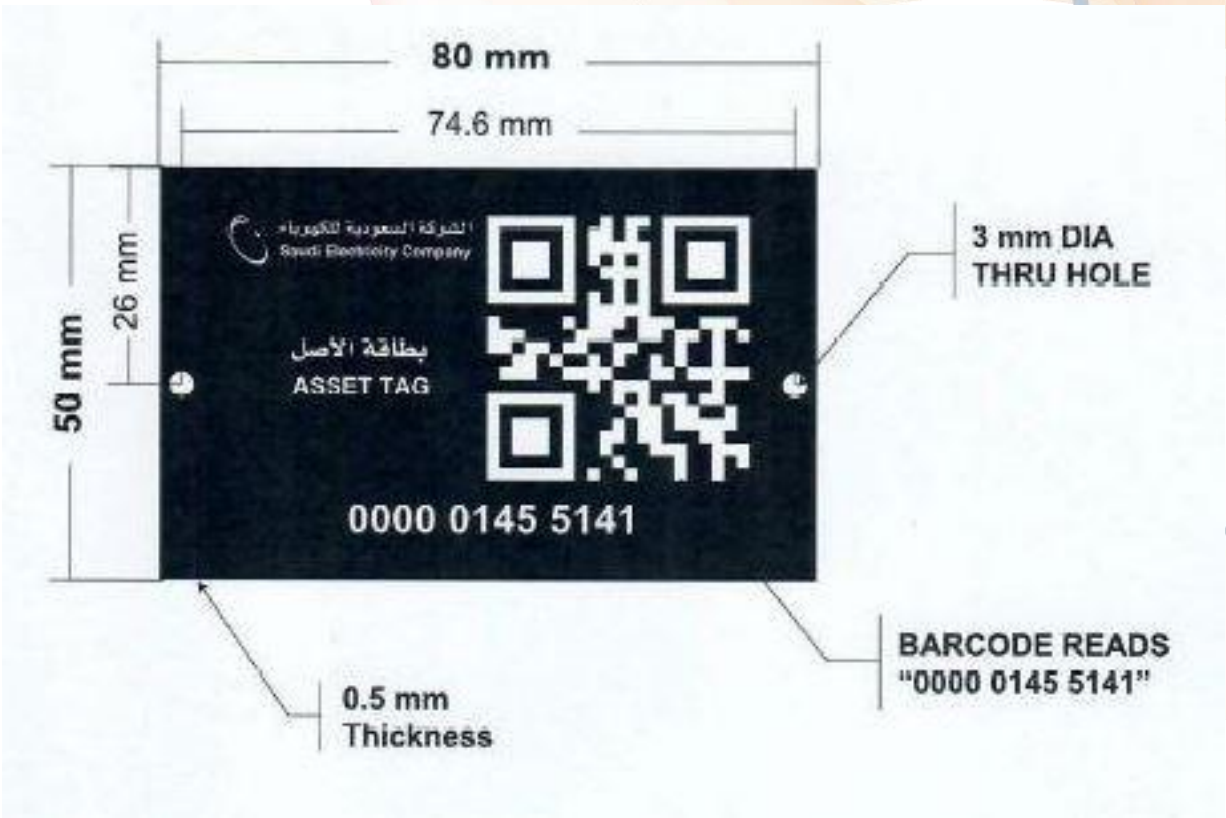


Note:

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



Note:

1) Aluminum Plate
2) Multi Protected Layered (Nano Coating)
3) Black / Matt Finish
4) Variable (Numbering QR)
5) Company Name with LOGO
6) Durability 10 Years Minimum
7) Double Sided Tape at the Back 3M 468MP or 3M 9472

LABEL ASSET TAG

Drawing No.
SEC-01-04

Appendix.1

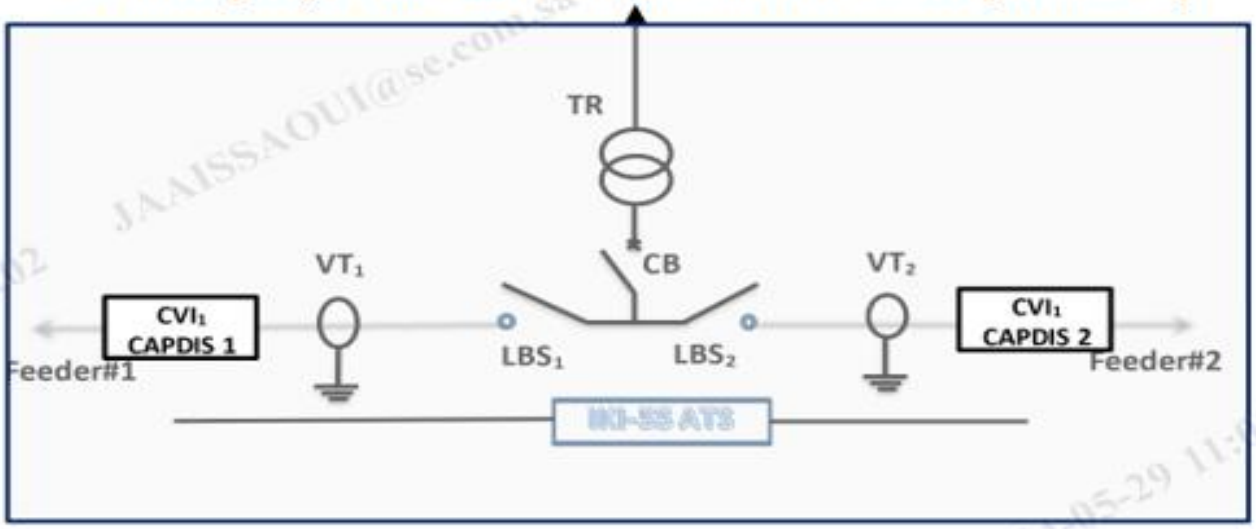
ATS design

- ATS design
- ATS description
- ATS testing on site (MV network)

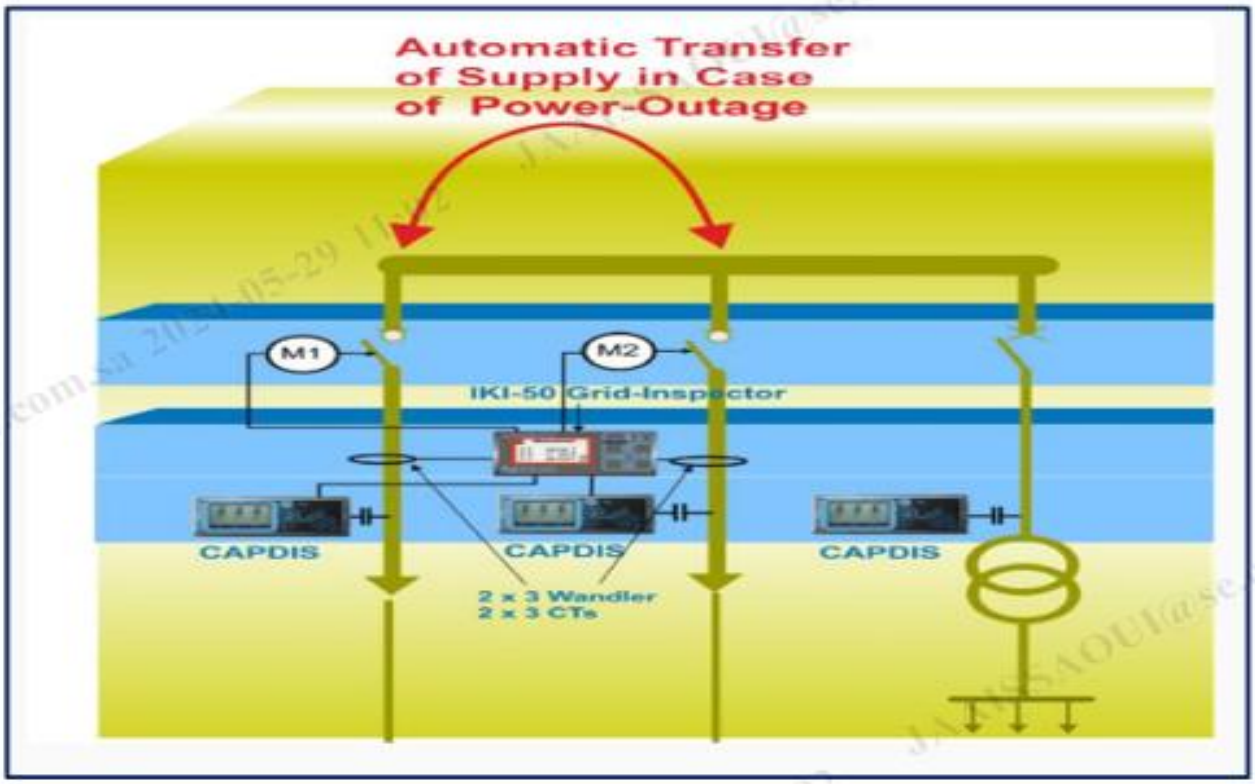
الشركة السعودية للكهرباء Saudi Electricity Company

HQ: Project engineering & control Dept.
إدارة هندسة ومراقبة المشاريع

UPDATED (ATS) DESIGN: AUTOMATIC TRANSFER SWITCH (01-06-2024)



Smart RMU with integrated ATS



(ATS) DESIGN DESCRIPTION

1) LEGEND:

- ATS: (Automatic transfer switch) and is composed of two functions: Voltage (presence/Absence) and power quality (Voltage Drop).
- LBS: Load break Switch.
- CB: Circuit breaker.
- TR: Transformer.
- VT: Voltage sensor for measurement - Phases: VA-VB-VC
- CVI: Capacitive voltage indication - Phases: VA-VB-VC
- t: time out

2) ATS (Device)

- Recommended device: IKI-55 (with 6 ports) from "Kries" manufacturer.
- The manufacturer is working to display the priority selection on the screen.

3) FUNCTIONS:

- ATS solution is a combination of **Absence of voltage and drop of voltage** (voltage quality).
- ATS has no sense when the SRMU is not NOP point and ATS selector shall be (out).
- If the RTU or the modem are not functional, The ATS shall operate normally.
- The ATS should not depend on RTU, should only report to RTU.
- If ATS selector is "IN" Only IKI-55 is controlling and no local or remote control.
  If ATS selector is "OUT" Only local or remote control working and IKI-55 is disabled.
- If ATS selector is "IN" and the two LBS are both closed, the IKI-55 shall not operate.
- If ATS selector is "IN" and the CB is open, the IKI-55 shall not operate.
- The ATS shall be controlled remotely to "OUT" position from control center in order to execute commands; and when the remote maneuvers are completed It shall be switched to "IN" position remotely: It is a DO (digital output) with DI signal locally and to control center.
- The ATS (in/out) has local indication green and red.
- ATS solution will be applied to SRMU and SMRMU as well (same solution)

4) CT & VT sensors

- All the voltages are communicated from ATS to RTU.
- The Circuit#1 currents measurement shall be communicated from CTs to ATS.
- The ATS will calculate the power factor & power values and communicate them to RTU.

- The ATS is only capable of handling one current circuit (measurement).
- The CB (load currents) from Protection to RTU (recommended)

5) SETTING PARAMETERS:

Parameters & Values to determine & program in the **IKI -55**:

- ATS **(in/out)** through selector switch next to the IKI-55.
- Priority **(Yes/No):** IF yes, to determine the main feeder & the Backup feeder (LBS1-LBS2).
- To set **α%** (voltage drop percentage): Maximum Percentage acceptable regarding Voltage Drop from which the feeder balance transfer is executed.
- Feeder Priority: Activate /deactivate the automatic restoration **(Yes/No):**
  - If priority is activated (Yes): define the main and the backup feeders and there is automatic restoration from the back up feeder to the main feeder
  - If priority is activated (No): There is no main and backup feeders and there is no automatic restoration.
- To set **(t1): time (min)** after which the power is restored back automatically to initial situation (when power supply is back and stable) and (when automatic restoration is activated)
- To set **(t2): time (min)** after which the power is balanced automatically from main supply feeder to second feeder (when the voltage is instable: Voltage drop) to make sure that instability is not fugitive.
- t1 & t2 shall be Reset after each action

6) ATS DESIGN:

a) ATS: Voltage (Absence/presence): Based on CVI

- LBS1 is main supply feeder and LBS2 is the open feeder (LBS1 closed and LBS2 open)

If CVI_1=0 (absence of **one or more** of voltage indication for phases (VA_1-VB_1-VC_1)) ***And***
If CVI_2 ≠0 (presence of **all** the voltage indication for phases (VA_2-VB_2-VC_2)) ***And***
If LBS1 is closed, LBS2 is open
Then
Open LBS1 and close LBS2 (LBS2 shall close only when LBS1 is open & CVI1=0)

- LBS2 is main supply feeder and LBS1 is the open feeder (LBS2 closed and LBS1 open)

If CVI_2=0 (absence of **one or more** of voltage indication for phases (VA_2-VB_2-VC_2)) And
if CVI_1 ≠0 (presence of **all** the voltage indication for phases (VA_2-VB_2-VC_2)) ***And***
If LBS1 is closed, LBS2 is open
Then
Open LBS2 and close LBS1 (LBS1 shall close only when LBS2 is open & CVI2=0)

b) ATS Voltage drop: (Power quality Based on CVI using voltage measurement)

- LBS1 is the main supply feeder and LBS2 is the open feeder (LBS1 closed and LBS2 open)

If one or more of voltage Drop values for phases (VA1-VB1- VC1) > α% ***And***
If CVI2 ≠0 (presence of all the voltage indication for phases (VA2-VB2-VC2) ***And***
If all the voltage Drop for phases (VA2-VB2-VC2) < α%
And
If LBS1 is closed, LBS2 is open
And
Counter t2 is completed
Then
(LBS2 shall close only when LBS1 is open and one or more (VA1-VB1- VC1) drop > α%) Open LBS1 and close LBS2:

- LBS2 is main supply feeder and LBS1 is open feeder (LBS2 closed and LBS1 open)

If one or more of voltage Drop values for phases (VA2-VB2- VC2) > α% ***And***
If CVI1 ≠0 (presence of all the voltage indication for phases (VA1-VB1-VC1) ***And***
If all the voltage Drop for phases (VA1-VB1-VC1) < α%
And
If LBS2 is closed, LBS1 is open
And
Counter t2 is completed
Then
Open LBS2 and close LBS1:
(LBS1 shall close only when LBS2 is open and one or more (VA2-VB2- VC2) drop > α%)

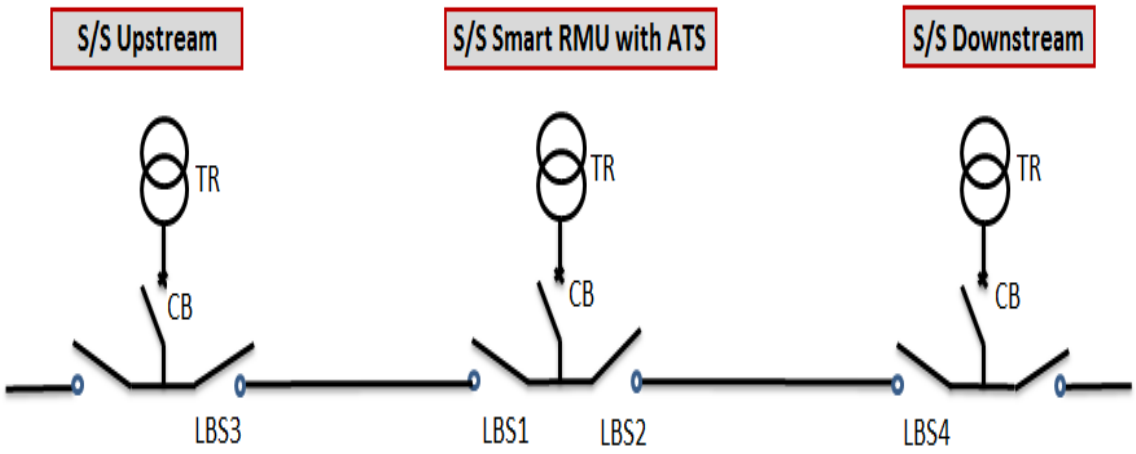
c) Automatic Transfer from backup feeder to main feeder (back to normal situation)

- **IF Priority (Yes/No) is activated:**

If there is voltage in the main CVI ≠0
And: All the voltage Drop for main feeder phases (VA1-VB1-VC1) < α%
And: Counter t_1 is completed
Then: Open LBS backup feeder and close LBS main feeder

- **IF the automatic restoration from the back up feeder to the main feeder is deactivated**
Nothing happens and restoration shall be done only locally or remotely from control center.

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

ATS functionally testing/general conditions:

-SEC reserves the rights for ATS functionality test up the recommendations and the requirements, manufactures shall follow up the sequence for ATS testing which are provided on the SEC ATS testing formats.

-ATS enable/disable mode shall be controllable by a pushbutton locally and could be changed remotely.

-As long as the ATS is enabled, it must block any electrical switching operation locally/remote, except the CB operation.

- An in/out LEDs indication for ATS enable/disable status, shall be provided in the panel front side with visibility clearly marked with engraved labels (ATS on mode)/ (ATS off mode), RED LED color for ON mode and yellow color LED for off mode.

-If the panel is in local mode the remote control to change the ATS status must be prohibited.

- The overall time for switching operations shall not exceed the min. required time for LBSs operations (max. time is 6.0 sec).

-ATS shall check the initial status while it is turning on which are:

a- At least 1 LBS are closed and healthy.

b- A main CB is closed and healthy.

c- No SF6 gas blocking.

- ATS must not perform any switching operation if any blocking conditions below is exist:

1- Main CB is open.

2- ATS is in off/disable mode.

3- The 2 LBS are open in the same time, as initial status.

4- Protection operated.

5- Protection not healthy.

Appendix.2

STANDARD DATA BASE I/O list

- 2L1T: 3ways
- 3L1T: 4ways
- 2L2T: 4ways
- 3L: Switching RMU 3ways (self-power supply)
- 4L: Switching RMU 4ways (self-power supply)
- 2L1T with ATS: Smart RMU with integrated ATS (Automatic Transfer switch)

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

Bay / CIRCUIT no.	Point name / Message	IOA / IEC OBJECT ADRESS	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	DC power fail for the whole RMU
COMMON	Motor CIRCUIT fail	1013	Regrouped information for all circuits (Spring charger, DC motor)
COMMON	RTU Self diagnostic (RTU alarm)	1277	Alarm
COMMON	Fault Indication (from FI device)	1278	Alarm
COMMON	Protection Health (Normal/Fail)	1279	Alarm
COMMON	Protection Trip (Earth fault)	1280	Alarm
COMMON	Protection Trip (Phase fault)	1281	Alarm
COMMON	Fault Indication (from RTU)	1285	Alarm

ANALOG INPUT (AI) MEASURMENTS			
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 measurments and it will be calculated in ADMS in control center (power flow)**

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

الشركة السعودية للكهرباء
Saudi Electricity Company
HQ. : Smart Grid Dept.
المركز الرئيس : إدارة الشبكات الذكية

Bay / CIRCUIT no.	Point name / Message	IOA / IEC OBJECT ADRESS	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	DC power fail for the whole RMU
COMMON	Motor CIRCUIT fail	1013	Regrouped information for all circuits (Spring charger, DC motor)
COMMON	RTU Self diagnostic (RTU alarm)	1277	Alarm
COMMON	Fault Indication (from FI device)	1278	Alarm
COMMON	Protection Health (Normal/Fail)	(Ctrl)	Alarm
COMMON	Protection Trip (Earth fault)		Alarm
COMMON	Protection Trip (Phase fault)	1281	Alarm
COMMON	Fault Indication (from RTU)	1285	Alarm

ANALOG INPUT (AI) MEASURMENTS			
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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 measurments and it will be calculated in ADMS in control center (power flow)**

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

الشركة السعودية للكهرباء
Saudi Electricity Company
HQ. : Smart Grid Dept.
المركز الرئيس : إدارة الشبكات الذكية

Bay / CIRCUIT no.	Point name / Message	IOA / IEC OBJECT ADRESS	REMARKS
DIGITAL OUTPUT (DO) COMMANDS			
Circuit1 (LBS)	CLOSE COMMAND	1	
Circuit1 (LBS)	OPEN COMMAND	1	
Circuit2 (TRx1)	CLOSE COMMAND	5	
Circuit2 (TRx1)	OPEN COMMAND	5	
Circuit3 (TRx2)	CLOSE COMMAND	9	
Circuit3 (TRx2)	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 (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 (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	DC power fail for the whole RMU
COMMON	Motor CIRCUIT fail	1013	Regrouped information for all circuits (Spring charger, DC motor)
COMMON	RTU Self diagnostic (RTU alarm)	1277	Alarm
COMMON	Fault Indication (from FI device)	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
COMMON	Fault Indication (from RTU)	1285	Alarm

ANALOG INPUT (AI) MEASURMENTS			
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 measurments and it will be calculated in ADMS in control center (power flow)**

DISTRIBUTION AUTOMATION PROGRAM
SMART FIELD EQUIPMENT
DATA POINTS LIST FOR 3L SMART SWITCHING RMU (LLL)

الشركة السعودية للكهرباء
Saudi Electricity Company
HQ. : Smart Grid Dept.
المركز الرئيس : إدارة الشبكات الذكية

Bay / CIRCUIT no.	Point name / Message	IOA / IEC OBJECT ADRESS	REMARKS
DIGITAL OUTPUT (DO) COMMANDS			
CIRCUIT1 (LBS1)	CLOSE COMMAND	1	
CIRCUIT1 (LBS1)	OPEN COMMAND	1	
CIRCUIT2 (LBS2)	CLOSE COMMAND	5	
CIRCUIT2 (LBS2)	OPEN COMMAND	5	
CIRCUIT3 (LBS3)	CLOSE COMMAND	9	
CIRCUIT3 (LBS3)	OPEN COMMAND	9	
DIGITAL INPUT (DI) GENERAL ALARMS / INDICATIONS			
CIRCUIT1 (LBS1)	CLOSE INDICATION	11000	
CIRCUIT1 (LBS1)	OPEN INDICATION		
CIRCUIT1 (LBS1)	LOCK/UNLOCK INDICATION	1000	
CIRCUIT1 (LBS1)	GROUND INDICATION	1001	
Circuit2 (LBS2)	CLOSE INDICATION	11001	
Circuit2 (LBS2)	OPEN INDICATION		
Circuit2 (LBS2)	LOCK/UNLOCK INDICATION	1002	
Circuit2 (LBS2)	GROUND INDICATION	1003	
CIRCUIT3 (LBS3)	CLOSE INDICATION	11002	
CIRCUIT3 (LBS3)	OPEN INDICATION		
CIRCUIT3 (LBS3)	LOCK/UNLOCK INDICATION	1004	
CIRCUIT3 (LBS3)	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	DC power fail for the whole RMU
COMMON	Motor CIRCUIT fail	1013	Regrouped information for all circuits (Spring charger, DC motor)
COMMON	RTU Self diagnostic (RTU alarm)	1277	Alarm
COMMON	Fault Indication (from FI device)	1278	Alarm
COMMON	Fault Indication (from RTU)	1285	Alarm

ANALOG INPUT (AI) MEASURMENTS			
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 measurments and it will be calculated in ADMS in control center (power flow)**

DISTRIBUTION AUTOMATION PROGRAM
SMART FIELD EQUIPMENT
DATA POINTS LIST FOR 4L SMART SWITCHING RMU
(LLLL)

HQ. : Smart Grid Dept.
المركز الرئيس : إدارة الشبكات الذكية

Bay / CIRCUIT no.	Point name / Message	IOA / IEC OBJECT ADRESS	REMARKS
DIGITAL OUTPUT (DO) COMMANDS			
Circuit1 (LBS1)	CLOSE COMMAND	1	
Circuit1 (LBS1)	OPEN COMMAND	1	
Circuit2 (LBS2)	CLOSE COMMAND	5	
Circuit2 (LBS2)	OPEN COMMAND	5	
Circuit3 (LBS3)	CLOSE COMMAND	9	
Circuit3 (LBS3)	OPEN COMMAND	9	
Circuit4 (LBS4)	CLOSE COMMAND	13	
Circuit4 (LBS4)	OPEN COMMAND	13	
DIGITAL INPUT (DI) GENERAL ALARMS / INDICATIONS			
Circuit1 (LBS1)	CLOSE INDICATION	11000	
Circuit1 (LBS1)	OPEN INDICATION		
Circuit1 (LBS1)	LOCK/UNLOCK INDICATION	1000	
Circuit1 (LBS1)	GROUND INDICATION	1001	
Circuit2 (LBS2)	CLOSE INDICATION	11001	
Circuit2 (LBS2)	OPEN INDICATION		
Circuit2 (LBS2)	LOCK/UNLOCK INDICATION	1002	
Circuit2 (LBS2)	GROUND INDICATION	1003	
Circuit3 (LBS3)	CLOSE INDICATION	11002	
Circuit3 (LBS3)	OPEN INDICATION		
Circuit3 (LBS3)	LOCK/UNLOCK INDICATION	1004	
Circuit3 (LBS3)	GROUND INDICATION	1005	
Circuit4 (LBS4)	CLOSE INDICATION	11003	
Circuit4 (LBS4)	OPEN INDICATION		
Circuit4 (LBS4)	LOCK/UNLOCK INDICATION	1006	
Circuit4 (LBS4)	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 the whole RMU
COMMON	Motor CIRCUIT fail	1013	Regrouped information for all circuits (Spring charger, DC motor)
COMMON	RTU Self diagnostic (RTU alarr	1277	Alarm
COMMON	Fault Indication (from FI devi	1278	Alarm
COMMON	Fault Indication (from RTU)	1285	Alarm

ANALOG INPUT (AI) MEASURMENTS			
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 measurments and it will be calculated in ADMS in control center (power flow)**

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

الشركة السعودية للكهرباء
Saudi Electricity Company
HD. : Smart Grid Dept.
المركز الرئيس : إدارة الشبكات الذكية

Bay / CIRCUIT no.	Point name / Message	IOA / IEC OBJECT ADRESS	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	
CIRCUIT3 (LBS)	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)	1002	
Circuit2 (TRx)	CLOSE INDICATION	11001	
Circuit2 (TRx)	OPEN INDICATION		
Circuit2 (TRx)	LOCK/UNLOCK INDICATION	1003	
Circuit2 (TRx)	GROUND INDICATION	1004	
Circuit2 (TRx)	CVI (ATS voltage presence)	1005	
CIRCUIT3 (LBS)	CLOSE INDICATION	11002	
CIRCUIT3 (LBS)	OPEN INDICATION		
CIRCUIT3 (LBS)	LOCK/UNLOCK INDICATION	1006	
CIRCUIT3 (LBS)	GROUND INDICATION	1007	
CIRCUIT3 (LBS)	CVI (ATS voltage presence)	1008	
COMMON	REMOTE	11004	Alarm
	LOCAL		Alarm
COMMON	ATS SWITCH IN/OUT	1009	
COMMON	ATS Operate	1010	
COMMON	Battery low	1011	Alarm
COMMON	Gas Low	1012	Alarm
COMMON	AC power fail	1013	Alarm
COMMON	Door open	1014	Alarm
COMMON	DC power fail	1015	DC power fail for the whole RMU
COMMON	Motor CIRCUIT fail	1016	Regrouped information for all circuits (Spring charger, DC motor)
COMMON	RTU Self diagnostic (RTU alarm)	1017	Alarm
COMMON	Fault Indication (from FI device)	1018	Alarm
COMMON	Protection Health (Normal/Fail)	1019	Alarm
COMMON	Protection Trip (Earth fault)	1020	Alarm
COMMON	Protection Trip (Phase fault)	1021	Alarm
COMMON	Fault Indication (from RTU)	1285	Alarm

ANALOG INPUT (AI) MEASURMENTS			
Circuit1 (LBS)	I_Current (A)	13000	
Circuit1 (LBS)	I_Current (B)	13001	
Circuit1 (LBS)	I_Current (C)	13002	
Circuit1 (LBS)	I_Current (N)	13003	
Circuit1 (LBS)	V_voltage (A-B)	13004	Phase to Phase
Circuit1 (LBS)	V_voltage (B-C)	13005	Phase to Phase
Circuit1 (LBS)	V_voltage (C-A)	13006	Phase to Phase
Circuit1 (LBS)	V_voltage (N)	13007	
Circuit1 (LBS)	S (KVA)	13008	Calculated from power factor and voltage value from TRx
Circuit1 (LBS)	P (KW)	13009	
Circuit1 (LBS)	Q (KVAR)	13010	
Circuit2 (TRx)	I_Current (A)	13011	
Circuit2 (TRx)	I_Current (B)	13012	
Circuit2 (TRx)	I_Current (C)	13013	
Circuit2 (TRx)	I_Current (N)	13014	
Circuit2 (TRx)	V_voltage (A-B)	13015	Phase to Phase
Circuit2 (TRx)	V_voltage (B-C)	13016	Phase to Phase
Circuit2 (TRx)	V_voltage (C-A)	13017	Phase to Phase
Circuit2 (TRx)	V_voltage (N)	13018	
Circuit2 (TRx)	S (KVA)	13019	Calculated from power factor and voltage value from TRx
Circuit2 (TRx)	P (KW)	13020	
Circuit2 (TRx)	Q (KVAR)	13021	
Circuit2 (TRx)	Power Factor	13022	
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)	V_voltage (A-B)	13027	Phase to Phase
Circuit3 (LBS)	V_voltage (B-C)	13028	Phase to Phase
Circuit3 (LBS)	V_voltage (C-A)	13029	Phase to Phase
Circuit3 (LBS)	V_voltage (N)	13030	
Circuit3 (LBS)	S (KVA)	13031	Calculated from power factor and voltage value from TRx
Circuit3 (LBS)	P (KW)	13032	
Circuit3 (LBS)	Q (KVAR)	13033	
Common	Temperature (External) of Transformer available	13034	

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