32-SDMS-12

REV.02

SPECIFICATIONS FOR MV SMART METERED RING MAIN UNIT FOR BULK LOAD (400A&630A) UP TO 36KV

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1 Scope

This SEC Distribution Materials Specification specifies the minimum technical requirement for design, materials, manufacturing, testing, inspection and performance for indoor type medium voltage smart metered ring main unit (MRMU) up to 36 KV with load management facility, to be used for bulk loads (400A&630A) in the medium voltage distribution network of the Saudi Electricity Company (SEC) in Saudi Arabia. This MRMU will be used for Distribution Automation System so that the SMART MRMU will be remotely controllable using integrated communication devices such as a RTU and a Modem.

2 Cross references to other SEC standards

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. This SDMS shall also be read in conjunction with SEC Purchase Order (PO) requirements

3 Applicable codes and standards

The latest revision of the following codes and standards shall be applicable for the equipment/materials covered in this specification. In case of any deviation, the vendor/manufacturer may propose equipment/materials conforming to alternate codes or standards. However, the provisions of SEC standards shall supersede the provisions of these alternate standards in case of any difference.

Standard #	Title
IEC 62271-100	High-voltage alternating-current circuit breakers
IEC 62271-172	HV Alternating current disconnectors and earthing switch
IEC 61869-1	Instruments transformers
IEC 61869-2	Current Transformers
IEC 61869-3	Voltage Transformers
IEC 60255	Electric Relays
IEC 60265	High-voltage switches
IEC 62271-200	AC metal-enclosed switchgear and control gear for rated voltage above 1 kV and up to and including 52 kV
IEC 60337	Control switches (low-voltage switching devices for control and auxiliary circuits, including contactor relays)
IEC 60376	Specification and acceptance of new Sulphur hexafluoride
IEC 60420	High-voltage alternating current fuse-switch combination and fuse-circuit-breaker combination
IEC 60529	Classification of degree of protection provided by enclosures

Standard #	Title
IEC 60694	Common specifications for HV switchgear and control gear standards
ISO 2063	Metallic coatings – protection of iron and steel against corrosion – metal spraying of Zinc and Aluminum
01-SDMS-01	General requirements for equipment/material
50-SDMS-01	Current Transformers
50-SDMS-03	PRIMARY SUBSTATION POTENTIAL TRANSFORMERS 11KV THROUGH 69KV
32-SDMS-11	Smart RMU up to 36kV
12 SDMS-01	Termination, joints & accessories up to 36 kV
11-SDMS-04	Specification for Aluminum Unarmored XLPE/LLDPE Insulated Power Cables For Rated Voltages From 15kv Up To 36kv
DPMS-02 R0	Complete Protection IED Specifications & CTs for Automatic RMU
11-SDMS-03	XLPE Insulated Power Cables for Rated Voltages From 15kV up to 36 KV (Um).
DES-P03	Protection System Requirements for SEC Distribution s/s
DES-P04	Relay Setting & Coordination Guidelines for SEC Distribution NW
31-SDMS-11	SPECIFICATIONS FOR TERMINAL BLOCKS FOR PRIMARY S/S
37-SDMS-04	Interface low voltage main circuit breaker.
38-SDMS-03	Low Voltage Digital Panel Meters.
11-SDMS-01	Low Voltage Power and Control Cables
32-SDMS-05	630 AMPERS MV METERED RING MAIN UNIT UP TO 36 KV
32-SDMS-06	630 AMPERS MV METERED RING MAIN UNIT UP TO 38 KV
DPMS-02	Distribution Protection Material Specification (Protective Relays)
DBURAL	Unified List of Approved Relays for SEC Distribution Network – latest
40-SDMS-02A	Specifications for Electronic Revenue CT and CT-VT Meter (latest revision)
40-SDMS-02A	Supplementary (SEC DLMS/COSEM OBIS Code Specification) For Electronic Revenue CT and CT/VT Meter

Table 1: List of applicable standards

4 Material, design and construction requirements

4.1. General

4.1.1 The smart MRMU shall consist of two load break switches and one circuit breaker. The circuit breaker panel shall be in the middle. One additional load break switch panel may be added to either side if requested in the tender.

The Equipment offered by the Vendor shall be switchgear units having various configurations non-extensible:

- **SMRMU 2L1T (LBS1- C.B - LBS2) : 3ways**
- **SMRMU 2L1T with ATS:** Smart RMU with integrated ATS (Automatic Transfer switch), the manufacture shall ensure the ATS function will be as per descript in appendix 1.
- **SMRMU 3L1T:4ways,** arrangements should be (LBS1 + CB + LBS2 + LBS3)

4.1.2 The Smart MRMU shall be indoor, metal-enclosed, single bus-bar type.

4.1.3 Insulation medium shall be Air or SF6 gas for the MV bus bar, and fault interruption medium shall be either SF6 gas or vacuum for the equipped CB, and it must clearly mention on the SMRMU name plate, which interruption medium is used, referring to the C.B identifications.

4.1.4 Degree of protection of the panels shall be class IP-41 as per SEC specification No. 01-SDMS-01 for indoor application. All access to the mechanism shall be protected against dust and moisture.

4.1.5 Humidity and moisture condensation control elements with activation and deactivation thermal switch shall be provided in each panel, the installation of the elements shall be in secure and easy access places inside the compartments.

4.1.6 The maximum width of the panels shall be 1000 mm for breaker panel and 750 mm for each load break switch panel. Depth of the panels shall be suitable for 600 mm wide cable trench. The height shall not exceed 2400 mm.

4.1.7 The operating mechanisms shall be lockable at each position with padlocks (provided by SEC) having 9 mm shackle diameter and 25 mm clearance. The maximum physical effort required for operating any mechanism shall not exceed 400 Newton. The maximum height of the mechanism operating access shall not exceed 1.5 m.

4.1.8 The operating handle shall have anti-reflex action for load break switches and shall be stored in a proper place at the front or side of the unit. Operating handle inserts shall have marking as appropriate to avoid inserting the wrong end during switching operations. It is preferred to have one common handle for all switches, single operating handle shall be used for all the compartment.

4.1.9 All parts of equal size and shape shall be inter-changeable.

4.1.10 All bolted electrical joints shall be secured by fasteners of corrosion-proof materials.

4.1.11 For Protection & Control Panels, Color Coded Cables shall be utilized for DC Supply, CT Circuits, PT Circuits, Alarms, AC Supply, Grounding, etc. as per COMPANY Standards and Practices.

4.1.12 The SMRMU shall be equipped with a voltage indication for each circuit.

4.1.13 The SMRMU 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.

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

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

4.1.16 All SMRMU, SLD, plungers, equipment's identifications on panel front shall be with laser printing, or engraved labels.

4.1.17 the mechanical operation handle shall be a one handle for all the mechanical operations open/close, even for the mechanical CB spring charge, if the CB didn't have the self -attached non-removable charging handle.

4.1.18 main SMRMU earthing shall be from a backside in the lower corner, and to be a tine coated, with proper earthing stud.

4.1.19 SEC logo and dangerous monogram shall be installed in the panel front side and backside.

4.1.20 The SMRMU shall be with mechanical operation system, local electrical operation system independent from the RTU modules and a remote operation system.

4.1.21 all SMRMU, SLD shall be equipped with a mimic indication for all the switching compartments with a color background as per SEC requirements.

4.1.22 all the Panel Internal Wiring the wiring size as follows:

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

4.2 Current rating

4.2.1 Busbars shall be of electrolytic high-grade copper. It shall withstand the mechanical stresses of the rated short circuit current. The continuous current rating at the maximum ambient temperature given in SEC specification 01-SDMS-01 shall be 400A or 630A for ring switches and breaker panels.

4.3 Ring switches

4.3.1. Ring switches shall be full load break and fault-making type. Ring switches shall be designed for interrupting full rated current as stated in clause 4.2 above, small inductive or capacitive currents involved in disconnecting of unloaded transformers, cables or overhead lines. It shall be suitable for full fault-making current.

4.3.2. Ring switch 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 contacts shall be designed to close into a fault and shall have the same short circuit capacity as the main contacts.

4.3.3 The switching operation shall be manual mechanical / manual local/remote by means of an operating handle/local pushbutton/through the RTU with 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.

4.3.4 Ring switch operating mechanism shall have provision for on-site installation (retrofitting) of geared motor mechanism fully DC supply mechanism and associated closing and opening coils with necessary contactors for remote and future tele-control operations in the distribution network.

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

4.4 Circuit Breaker

4.4.1 Circuit breaker shall be of fixed type, interruption medium could be Vacuum or SF6, or any other an environmental gas with better technology, for the interruption medium.

4.4.2 Circuit breaker shall be designed to open, close and trip by local push buttons, or by remote signals also availability to trip/open through the protection relay equipped inside the SMRMU. Local and remote operation selection shall be by a selector switch on the front panel with lock out tag out facility.

4.4.3 Circuit breaker shall be provided with manual and electrical switching operation. Geared motor mechanism for spring charging and associated closing and opening coils with necessary contactors for remote and tele-control operations shall be included, fully operation supply shall be DC operating system.

4.4.4 Earthing of C.B 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 , 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.

4.4.5 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.

4.4.6 The CB shall fulfill all the interlocking safety of operation without using any weak points on the interlock system like steel wires or plastic parts on the locking mechanism, as the CB shall directly locked to the DS, ES and the door compartment**.**

4.4.7 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

4.4.8 local/ remote and trip/close status

4.4.9 The using of keys on the interlock is not accepted.

4.4.10 All the control mechanism supply should be DC system.

4.4.11 Operating mechanism shall be fast acting and independent of the operator action when operating manually and shall indicate the following positions:

a. Circuit breaker ON in (red indication) and OFF in (green indication).

b. Off-Load Isolator ON (red indication) and OFF (green indication).

c. Earthing ON with yellow back indication and OFF for green indication

All indication shall be on the mimic indication adjacent to the mechanical operation plunger, and on the door for the control cabinet for the SMRMU, with an indication LED with the same mention color above.

4.4.12 If circuit breaker panel equipped with an off-load isolator switch, it shall be fully interlocked with the circuit breaker.

4.5 Protection Requirements

4.5.1 Relay selection:

Protection Relay to be used in Smart MRMU 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). The DC supply of the relay and protection circuits shall be 24V DC. Furthermore, the ordering code of the relay shall be selected based on the following specifications:

a. Rear Port Communication (Communication Protocol shall be IEC 60870-5-103 / 104, DNP 3.0 or as required by the company).
b. 24 DC voltage supply.

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

a. Current measurements
b. WATCHDOG (relay error, relay faulty, protection in service…etc.) shall be configured to the RTU either through hardware connection or through rear port communication (preferably both).
c. Segregated Phase and Earth fault Protection Operated Signals shall be configured to the RTU via Hard-wired Connection & Serial Communication.
d. Cable Incipient Fault Alarm Signal shall be configured to the RTU via Hard-wired Connection & Serial Communication.
e. Protection DC Supply Fail. (Can be provided via DC MCB & Supervision Function).
f. Trip Circuit Faulty.
g. Protection Settings, Events and DFRs Records.

4.5.3 Protection Relay DC Supply shall be provided via separate DC MCB and the DC loop shall be supervised by a DC supervision relay with alarming contact coupling with the RTU.

4.5.4 LBS Phase Overcurrent and LBS Earth Fault operation shall be configured in the RTU and send to Distribution Automation Control Center.

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

4.5.6 Trip Circuit Supervision Relay shall be provided to supervise Trip Coil in Pre Trip and Post Trip Conditions. In case the Trip Circuit is Faulty and alarm shall be communicated to the Distribution Operation Control Center.

4.6 Instrument Transformers

4.6.1 Three single phase voltage transformers are required to be provided by connection, which means a (3) phase voltage with neutral in secondary. It must be compatible with CT/VT smart meter connection facility according to 40-SDMS-02A with latest revision, the VT shall be made according to IEC 61869-3 shall be fitted at the feeder side of the circuit breaker for metering purposes They shall be dry type, epoxy encapsulated rated/accuracy/Burden shall be as per 40-SDMS-02A.

	Smart MRMU 400 A	**Smart MRMU 630 A**
Voltage	13.8 KV / 120 V OR 33 KV / 120 V	13.8 kV / 120 V OR 33 KV / 120 V
Frequency	60Hz	60Hz
Burden	25VA	25VA
Class	0.2/3P	0.2/3P
VF	1.9 Un	1.9 Un

Table 3: VT Rated

4.1.1 Dual-ratio primary current transformers for protection and metering according to IEC 61869-2 and SEC specification 50-SDMS-01 shall be fitted in the circuit breaker panel. They shall be dry type, epoxy encapsulated, the metering core accuracy must be compatible with the accuracy/rated/ratio/burden required by CT/VT smart meter specification 40-SDMS-02A, the protection CT shall be meet all protection DPED requirements.

4.1.2 All the used CT/VT shall be from the approved SEC vendor list.

4.1.3 Proper CT Shorting & Isolation Facility should be provided.

4.1.4 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.

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

4.1.6 Auxiliary relays, Terminal Blocks, Test Blocks & Test Switches shall be provided from the latest Unified List of Approved Relays.

4.1.7 The current Transformer shall be selected from approved manufacturer.

4.1.1 The voltage transformer shall be connected to the analog voltage inputs of the Protection Relay.

4.1.2 The voltage transformer shall be installed after the Current Transformer such that any failure in the voltage transformer to be detected by the current transformer.

4.1.3 Current Transformer Specification shall be as follows:

	Smart MRMU 400 A	**Smart MRMU 630 A**
Current ratio	400/200/1-1 A	600/300/1-1 A
Burden for protection	15 VA	15 VA
Burden for metering	5 VA	5 VA
Class for protection	5P20	5P20
Class for metering	0.2FS5	0.2FS5

4.2 Terminal blocks

4.2.1 the CT and VT connections for the smart meter shall be terminated in a proper terminal blocks as per SEC standard and from approved vendor list, as the VT terminal shall be protected by a 3 pole MCB marked with METRING VT connection for smart meter, with proper rated matched with the smart meter specifications, also the CT connection shall be wired to a CT terminal with shorting facility, and shorted by a metal short link for the 4 wire inside the CT TB, and marked with red caution labeled as a (CT terminal block assigned for the smart meter CT connection, please remove the metal link after connect the CT wires to the smart meter)(, all the wiring for the CT/VT shall comply with DPED and smart meter specification and requirements.

4.2.2 Terminal blocks for remotely installed smart-meter shall be provided, identified and clearly marked. These terminal blocks shall have CT shorting and isolate facility and voltage disconnection facility without disturbing the wiring connections as per DES-P03, all this connection for that (internal wiring) TB must be cross matching with the latest specifications for smart meter with the latest revision 40-SDMS-02A.

4.2.3 Terminal blocks for current injection test facility for protective relay shall be provided, identified and clearly marked. Wiring to protection relay shall be wired through approved test blocks.

4.2.4 Terminal blocks for remotely installed alarm shall be provided, to indicate exceeding of the allowed load during the peak period.

4.3 Operations:

The SMRMU shall be ready for operation as follows:

4.3.1 Local/Manually as a mechanical operation by a handle (open-close-earth- etc. ...)

4.3.2 Local/Electrically, open/close with pushbutton, with fully independent operation away from the RTU modules.

4.3.3 Locally through the RTU modules open/close while it connected to maintenance laptop.

4.3.4 Remote/fully function access and operation control from distribution control center (SCADA-ADMS) through the RTU modules.

4.3.5 The antenna shall be available and should be inside Enclosure in the RTU cabinet

4.3.6 LED Light inside the Control Box (link to RTU door position (open/close)

4.3.7 70 degrees ‘temperature, certificate for the all control panel equipment’s are required (Battery, charger, RTU…etc.)

4.3.8 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).

4.3.9 Battery shall be Crystal, Gel Type or equivalent technology (fulfill the mention conditions and requirements of SEC), and provide Warranty certificate

4.3.10 Battery must be installed in Separate compartment (charger- battery- CB)

4.3.11 Electrically: open/close Locally with pushbutton for Each Circuit and green/red LED light Status indications

4.3.12 All operating positions shall be on the front of the unit and position of each of the switches shall be displayed on a mimic diagram. Clear indicators showing 'ON', OFF' and 'Earth' shall be provided on polycarbonate or metal painted labels not less than 15 mm in height and 1.5 mm thick (sticker type labels are not acceptable).

4.3.13 Indicator windows shall not be less than 15 mm in diameter and shall be covered with transparent UV resistant material with adequate mechanical strength.

Indicator	Letters	Background
ON	White	Red
OFF	White	Green
Earth	Black	Yellow

Table 2: Indicators

4.3.14

- 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.
- Yellow LED for earth ON independent for each unit.
- Yellow LED for SF6 gas warning alarm stage 1 for the used SF6 technology.
- Red LED for SF6 gas blocking alarm stage 2 for the used SF6 technology

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

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

4.3.17 Selector switch for local/remote shall be with lockout tagout facility.

4.3.18 Selector switch for lock/unlock for every unite independent (LBS/CB) with lockout tagout facility.

4.3.19 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 color, also a pushbutton with light indication is accepted.

4.3.20 Push bottom for OFF operation (LBS/CB), with a feedback light indication on the control box front side with a GREEN color, also a pushbutton with light indication is accepted.

4.3.21 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, stickers labels not accepted.

4.3.22 The front of the SMRMU control box shall be equipped with a 2 LED for the gas alarming and blocking of operation if the interrupter using SF6 gas technology, as the 1st one will be with yellow color to for warning that SF6 gas is going to low stage but still the operation could be, and the 2nd one will be a RED color for the blocking operation as the SF6 gas is going to a blocking level which is preventing any electrical operation locally or remotely.

4.3.23 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.

4.3.24 The panel main doors shall be secured by a main strong padlocking provision

4.4 Interlocks:

4.4.1 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. Operation of the ring switch or circuit breaker directly from 'ON' to 'Earth' or from 'Earth' to 'ON'.

4.4.2 For the LBS compartment, the LBS shall be locked with the main MV cable door as long as it is open or the LBS shall be mechanically locked to be not closed.

4.4.3 Interlocks shall block the operation of opening the ES to be opened as long as the MV cable door is open, mechanically interlocking for all the compartments.

4.4.4 for all the compartments the main door for the MV compartments shall be locked to close position and could not open until the ES is closed, and as long as the ES is off the door is mechanically locked to close position.

4.4.5 for all the compartments the main door for the MV compartments shall be locked to open position and could not closed until the ES is open.

4.4.6 for all the compartments the ES shall be locked in ON position as long as the main door for the MV compartments is open

4.4.7 For the CB compartment, The CB shall be locked to the DS position as long as the DS is open the CB shall be blocked to close.

4.4.8 For the CB compartment, The DS shall lock to the ES position as long as the DS is closed the ES shall be blocked and locked to off position.

4.4.9 For the CB compartment, The DS shall lock to off position as long as the ES is in ON position.

4.4.10 The CB shall be mechanically direct locking to the other relevant compartment equipment's (DS/ES/door), using steel wires or plastic parts on the interlocking not accepted.

4.4.11 SEC technical teams have the full rights to revised and verify the interlocking safety and operation mechanism in any time based on fulfill the safe of operation and maintenance.

4.5 Terminations / Cable compartments

4.5.1 Termination in the ring switches and circuit breaker units shall be dry-type inside cable compartment suitable for accepting three core Aluminum or Copper; XLPE insulated cables of outside diameter of 70-110 mm.

4.5.2 Each cable box shall have a bottom plate and cable clamp.

4.5.3 Bottom plate shall be in two halves and the number of cable entry shall be as the following:

	Smart MRMU 400 A	**Smart MRMU 630 A**
No. of Cable entry hole for each cable box	1 cable hole	2 cables hole

Table 2: No. of Cable entry hole

Suitable of 110 mm diameter equipped with rubber bushing. Cable clamp shall be detachable semi-circular halves suitable to hold the cable inside the cable box without cable glands.

4.5.4 Cable shall be terminated using single hole cable lugs suitable for bolt size of M16. Cable termination shall be by means of bolted connection on cable bushing/terminals with cold shrinkable, pre-molded and screened pre-molded termination with right angle/straight boots. Plug-in type termination shall not be used.

4.5.5 Cable bushing/ terminals shall be complete with brass or hot dipped galvanized fasteners (nuts, bolts and washers).

4.5.6 Vertical distance from the top of cable clamp to the centerline of cable bushings/terminals shall be suitable for all type of terminations as mentioned in 12-SDMS-01 (latest revision). The clearances in the ring and Tee- Off cable compartment shall be sufficient for cable maneuvering for termination applications.

4.5.7 The design of the cable compartments shall be such that their covers with sidewalls shall be removed to have full access during cable termination.

4.5.8 Removal and installation of cable compartment covers shall be with minimum number of bolts.

4.6 Earthing

A ground bar of not less than 25 x 5 mm copper strip tine coated shall be provided bolted to the frame. It shall be located so as to facilitate earthing of cable sheaths and earthing devices. In addition, a terminal having M12 stud and nut shall be provided in the back of the panel with clear grounding mark.

4.7 Voltage Indicators / Phase Comparators

Built-in push-button or continuous indication without push-button type neon voltage indicators shall be provided together with low voltage hot phasing facility on ring switches and circuit breaker panels. The lamps shall be powered by bushing type capacitive voltage dividers.

Internal wiring in cable boxes shall be covered with heat resistant tape/tube, to protect it against flame temperature of gas torch during the cable termination.

4.8 Earth Fault Indicator (EFI)

Earth fault indicator (SEC approved type) with automatic resetting on 220-230V single-phase AC supply, split core type sensor of internal diameter not less than 130 mm shall be supplied. EFI shall be protected inside separate sunshield cover with a mesh front (drawn from the same metal sheet). EFI shall be installed on the left-hand side line-feeder. It shall be with two auxiliary's contacts, one for light signal and the other for remote monitoring. Three-pin plug for testing of EFI by primary current injection shall be provided in separate compartment with screwed cover, below the EFI housing. SEC may require to supply the EFI loose in an outdoor box with 15 meters of control cable for installation on masonry wall. The EFI shall communicate with RTU.

4.9 AC auxiliary Power supply and back up DC battery

4.9.1 The SMRMU shall not require any external auxiliary AC power supply for operation and control.

4.9.2 Busbar mounted CPT will used for the purpose of self-power supply.

4.9.3 The burden for the CPT sufficient enough for the panel AC loads, based on the panel AC load calculation.

4.9.4 panel AC load calculation, shall be provided by the manufacturer to SEC for review and approval.

4.9.5 the secondary output shall for the CPT should be a single phase AC220V (+/- 10%) /60Hz, whatever the primary voltage be 13.8 or 33.0 KV, single phase primary connection or phase to phase connection.

4.9.6 the DC supply should be 24 VDC and capacity shall be adequate for spring charging motors, switching operations, status indications, RTU components, charge the battery, necessary contactors for control and monitoring of ring switches, the SMRMU with a safety margin at least 25% of the total CPT burden.

4.9.7 The rated continuous output power shall be calculated and selected as per consumption present, with safety margin of 25% from the total CPT burden, SRMU internal AC load calculations shall be provided to be compatible and matched with the CPT burden, for the equipped devices (as CB motor mechanism, AC light…etc.).

4.9.8 All functions of the SMART MRMU including switching, Monitoring, RTU, protection and Control, shall be powered by the DC supply from the UPS/charger and the battery will back up the power source.

4.9.9 The SMRMU must be equipped by 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, this plug-in connector shall be tagged with labels (red background) indicate the max. allowable load to be connected in A.

4.9.10 The backup battery shall be type lead crystal or equivalent technology with a warranty at least 5 years , with enough rated/burden to be capable to back up the monitoring, communication and operation of the RTU for 8 hours when the aux. AC power supply is lost, also The battery shall be handle to providing power to perform at least 50 operation cycles (open-close) for the operation units LBS/CB, The supplier shall size the battery per SRMU, specifying the lifetime and the duty cycle of such period of life.

4.9.11 The secondary wiring for the CPT shall be, 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 SMRMU internal AC load calculations.

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

4.9.13 Batteries shall be maintenance free and sealed. No lead acid batteries are allowed, Battery maintenance shall be possible without power source cut off.

4.9.14 Battery shall be rechargeable and shall be suitable for temperature of 70 Degree centigrade.

4.9.15 The battery charger shall have temperature compensated to maximize battery life and usable capacity.

4.9.16 The charger shall have filter to provide 2% or better ripple voltage when operated on a resistive load (from 5 to 100% full load).

4.9.17 The charger shall be provided with protection against overcharging. The supplier shall specify the proposed charging time.

4.9.18 It shall be possible to test the battery.

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

4.9.20 The charger/UPS shall be auto start if the main DC MCB is on.

4.9.21 CPT technical data shall be added to the panel name plate.

4.9.22 CPT safe maintenance access to be provided and marked with warning/caution tags (CPT inside)

4.10 Load Management System

The unit shall be equipped with an independent load management system that permits the control and monitoring of the consumer's load during normal conditions and peak time.

In normal conditions, and if the consumer exceeds the contracted load (in KVA), the system shall be capable of giving alarm then trips the breaker after a preset time delay.

During peak time, if the consumer exceeds the load previously determined by SEC, the system shall be capable of giving alarm and tripping / closing the breaker in a sequence and time delay provided by SEC. The system shall restore the power automatically after the peak period is over without the intervention of any operator.

The minimum setting to trip the breaker during peak period shall correspond to 500 KVA of consumer's load. Provide HMI digital display for Load management system

Load Management Functionality can be provided as built-in feature in the Protection Relay. Provision of such functionality is subject to the Approval from Distribution Protection Engineering Department.

4.11 Indicating meters

Digital Indicating meters approved from SEC for three phase current and voltage with phase selector switches shall be provided. Current indicating meters shall be provided with 15 minutes maximum demand indicator.

4.12 Over-pressure Release

In order to ensure maximum personal safety, Metered 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.

4.13 Nameplate

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

- Manufacturer's Name
- Country of Origin
- Type/Model
- Vendor's Name
- Reference of SEC specification
- Manufacturer's Serial Number
- SEC Purchase Order Number
- SEC Item Number
- Year of Manufacture
- Voltage Rating kV
- Current Rating Amps
- BIL kV
- Short Circuit Rating / Duration kA / Sec
- Rated Frequency 60Hz
- Rated Making Current kA
- Rated Breaking Current kA
- Gross Weight kg
- Insulation medium type:
- CT data.
- VT data.
- CPT rated voltage.
- CPT rated burden/currant.
- CPT voltage ratio.
- CPT class/ accuracy.
- CPT connection,

4.14 Circuit Labels

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

4.15 Monograms and Danger Plates

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

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

5 Automation and RTU requirements:

5.1 Control functions:

Each smart MRMU shall be provided with an integrated (Built in) RTU without changing the dimensions of smart MRMU 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.

smart MRMUs shall be capable of supporting these SCADA and FLISR monitoring and control functions. SEC reserves the right to require a demonstration of the smart MRMU/RTU capabilities to support ADMS SCADA and FLISR functionality. Please refer to the ADMS specification for ADMS SCADA and FLISR functionality requirements. Design for smart MRMU/RTU configuration shall be approved before supply.

RTU control panel shall be available for the following solutions:

- Main Design: RTU (integrated) built in
- Optional Design: RTU Separated cabinet (with plug cable connector solution)

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 SMART MRMU)	Double Point
Gas Pressure (Per SMART MRMU)	Single Point

Status information (Digital Input)	
Battery Status (Per SMART MRMU)	Single Point
Control Power Fail (Per SMART MRMU	Single Point
Door Open (Per SMART MRMU)	Single Point
Trip Circuit Faulty	Single Point
DC Circuit Faulty	Single Point
EFI Operated	Single Point
Phase Fault indication (from RTU)	Single Point
Earth Fault indication (from RTU)	Single Point
Over current Protection	Single Point
Earth Fault Protection	Single Point
Incipient Fault Detected at CB Circuit	Single Point
Load Management system operated/Normal	Double Point

Table 5: The digital I/O list

-The Control signal (Digital Output) to be wired to the RTU:

- Close / Open

-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 logical calculated functions needed by an Advanced Distribution Automation System P, Q, Power factor etc….

-Digital I/O LIST & TESTS

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

- SMRMU 2L1T: 3ways
- SMRMU with ATS: Smart MRMU with integrated ATS (Automatic Transfer switch)

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

-Remote operating time

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

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

-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 SMART MRMU 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.

-Control Outputs

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

-Communication Ports and Protocols

The RTUs minimum requirement for communication ports is as follows:

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

The RTU shall respond to independent scans and commands from Master Station, maintenance and configuration computer, and the local access computer simultaneously.

There shall be possible to change RTU setting and configuration remotely.

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

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

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

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

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

In the case of using SIM Card for communication, the modem must be designed to fit SIM normal standard format size
Capability of time stamp and time synchronization shall be provided

5.2 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. Supplier shall state how the scalability is achieved.
- The RTU shall be designed to perform with a minimum 15 relays or IED's connected with 200 points (variables) per device.
- The RTU shall be capable to calculate all logical functions needed by an Advanced Distribution Management System such as Power factor, Active power , 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 SMART MRMU. 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- to communicate wireless 3G/4G or fiber optics, in accordance with SEC telecom specifications; minimum 4 ports shall be provided

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

5.3 Cyber security

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

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

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

Table 9: Password Requirement

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

5.4 CT/VT Sensors

CT and VT are for Measurement and shall comply to IEC 61869 standard.

CT Sensor:

Two (2) sets of CTs (Each set is composed of three phases CTs):

- 1 set of CTs for LBS
- 1 set of CTs for transformer: If it is possible to transfer the 3 phases transformer load from the meter CTs (real time with angle) to the RTU; **there is no need for the set of these CT's**.

The CT shall be Bushing mounted.
CT accuracy shall be less than 1% in order to meet the requirement to have an accuracy of 1% for the whole chain (Sensor-data cable-RTU).
CT ratios shall be compatible with the provided RTU.
In addition, there shall be CT dedicated for the protection as per protection specifications.

- CTs installed in the LBS Bushing shall provide correct current measurement at maximum fault level (i.e. 21kA for 13.8kV and 25kA for 33kV) without saturation.
- CTs installed in the LBS Bushing shall be utilized for measurement and fault detection purposes.
- Fault Detection shall be accomplished by Phase Overcurrent and Earth Fault built-in in the RTU.

VT Sensor:

One (1) set of VTs transformer MV side (Each set is composed of three phases VTs):
Technology for voltage measurement shall be justified (resistive or capacitive);
The VTs for measurement shall be bus bar VTs
VT accuracy shall be less than 1% in order to meet the requirement to have an accuracy of 2% for the whole chain (Sensor - data cable -RTU).
VT ratios shall be compatible with the provided RTU.

6 Testing and Inspection

All equipment shall be type tested at an independent laboratory from approved laboratory list for SEC. in accordance 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 the standards listed below:

High-voltage switches per IEC 60265

a. Dielectric Tests
b. Temperature Rise Tests
c. Making and Breaking Tests
d. Peak and Short Circuit Withstand Current Tests
e. Operation and Mechanical Endurance Tests
f. Internal arc test certificate

Circuit- breaker per IEC 60056

a. Dielectric Tests
b. Temperature Rise Tests
c. Measurement of the resistance of the main circuit
d. Short-time and Peak Withstand Current Tests
e. Mechanical and Environmental Tests
f. Making and Breaking Tests
g. Short-circuit Tests

Degree of protection IP41 per IEC 60529

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

High-voltage switches per IEC 60265

a. Power Frequency Voltage Tests
b. Voltage Tests on Auxiliary Circuits
c. Measurement of Resistance of Main Circuit
d. Operation Tests
e. Operation and Mechanical Endurance Tests

Circuit breaker per IEC 60056

a. Power Frequency Voltage Tests
b. Voltage Withstand Tests on Control and Auxiliary Circuits
c. Measurement of Resistance of Main Circuit
d. Mechanical Operating Tests

SEC reserve 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.

7 Packing and shipment

The switchgear shall be delivered ready for installation (three panels fitted together).

Switchgear shall be individually packed in non-returnable cases as per packing/ shipping requirements in relevant clauses of 01-SDMS-01.

For container shipment, switchgear bolted on wood pallet is acceptable.

Units shall be supplied complete with all operation and installation accessories.

8 Guarantee

Guarantee for the SMART MRMU 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 delivery.

Warranty period for gas tightness shall conform to clause 5.15.3 of IEC 60694. For the maintenance-free version the vendor / manufacturer shall assume full responsibility for no as leakage during the service life (25years).

In case of gas leak during the service life, all expenses for repairs and replacements shall be borne by vendor / manufacturer.

If no exception to this specification and no list of deviations are submitted, it shall be deemed that, in every respect, smart metered ring main unit offered shall conform to this specification. SEC interpretation of this specification shall be accepted.

9 Submittals

Vendor shall complete and return one copy of the attached Technical Data Schedule.

Vendor shall provide the following with the Quotation:

a. Clause by clause compliance with this specification.

b. Drawing showing the full constructional detail with dimensions of smart metered rings main unit and all associated accessories.

c. Drawing of mounting details with respect to the position of cables in the switchgear room.

d. Drawings of cable boxes.

e. Schematic Diagrams showing the SLD (control circuit, tripping circuit, closing circuit, voltage supply circuit, VT and CT connections, Alarms, Communication …etc.).

f. Installation and maintenance instructions of the smart metered ring main unit.

g. Comprehensive list of manufacturer's recommended spare parts. The quantities offered should be adequate for the initial 5 years of operation. Firm price and delivery period shall be quoted for each item.

h. Copy of type test report for all equipped dives which are required a type test as per SEC standard.

i. A certificate from the termination manufacturers that the cable box size in all respect (technical, cable handling and making termination) is suitable for heat & cold shrink and pre-mold terminations

j. Descriptive leaflet and literature of smart metered ring main unit offered.

k. Checklist of quotation request.

l. List of customers in case of new manufacture / vendor.

m. Provide connecting cables for (LMS, PROTACTION, RTU, and UPS).

Vendor shall provide the following after signing of purchase order:

a. Details of manufacturing and testing schedules.

b. Routine test reports.

10 Technical data schedule

SMART METERED RING MAIN UNIT 15KV / 36 KV
(Sheet 1 of 4)

SEC Inquiry No: Item No:

No	Description	SEC Specified Values (*)	Vendor Proposed Values (**)
1	**General**		
1.1	Design	Metal-Enclosed	*
1.2	Type	Indoor	*
1.3	Number of cubicles	3 or 4	*
1.4	Installation medium	SF6 OR AIR	*
1.5	Degree of Protection	IP-41	*
1.6	Rated Voltage	13.8 kV / 33 KV	*
1.7	Maximum Operating Voltage	15 kV / 36 KV	*
1.8	Rated Frequency	60 Hz	*
1.9	Rated Current	400 A or 630A	*
1.10	Short circuit withstand current for 1 second	21 A / 25 KA	*
1.11	Basic insulation level BIL	110 KV for rated voltage 13.8 KV & 200 KV for rated voltage 33.0 KV	*
1.12	Rated Making Current for Ring switches (peak)	-	*
1.13	Rated Making Current for Earthing Switches (peak)	-	*
1.14	Impulse Withstand Voltage	As per (01-SDMS-01)	*
1.15	Power Frequency Withstand Voltage (1 min.)	As given in (01-SDMS-01)	*
1.16	Internal Arc fault withstand for 1 second	21 kA / 25 KA	*
1.17	Operating handle anti-reflex type	Yes	*
1.18	Max. height of operating access	1.5 m	*
1.19	Max. physical effort required to operate any mechanism.	400 N	*
1.20	Cable testing facility (optional)	-	*
1.21	Interlocks as per clause 4.8	Yes	*
1.22	Provision of gas pressure gauge	-	*

SMART METERED RING MAIN UNIT 15KV / 36 KV
(Sheet 2 of 4)

SEC Inquiry No: Item No:

No	Description	SEC Specified Values (*)	Vendor Proposed Values (**)
2	**CIRCUIT BREAKER**		
2.1	Type	Fixed	*
2.2	Insulation medium	SF6 or Air	*
2.3	Interruption medium	SF6 or Vacuum	*
2.4	Rated Voltage	13.8 kV / 33 KV	*
2.5	Maximum Operating Voltage	15 kV / 36 KV	*
2.6	Rated Frequency	60 Hz	*
2.7	Rated Current of CB	400 A/630 A	*
2.8	Rated Short circuit level (1 s)	21 kA / 25 KA	*
2.9	Basic insulation level BIL	110 KV for rated voltage 13.8 KV & 200 KV for rated voltage 33.0 KV	*
2.10	Rated Making Current		*
2.11	Re-striking Voltage Ratio		*
2.12	Duty Cycle		*
2.13	Making time		*
2.14	Opening time		*
2.15	Arc Duration		*
2.16	Total breaking Time		*
2.17	Operating Mechanism	Spring Charged	*
2.18	Protective E/F & O/C relay	As per Latest version of SEC-DBU Unified List of Approved Relays	*
2.19	Provision of isolator switch	-	*
3	**TERMINATIONS / CABLE COMPARTMENTS**		
3.1	Cable compartment with bottom plate and cable clamp	yes	*
3.2	Two cables of 70-110 mm diameter shall be accepted	Yes or N\A	*
3.3	Two holes of 110 mm in the bottom plate in two halves	Yes or N\A	*
3.4	Fasteners supplied with bushing	yes	*
3.5	Type of termination	Dry type cold / pre-molded	*

3.6	Bolt size for cable termination	M16	*
3.7	Clearance between clamp and bushing	Suitable for cold / pre-molded of terminations	*

SMART METERED RING MAIN UNIT 15KV / 36 KV
(Sheet 3 of 4)

SEC Inquiry No: Item No:

No	Description	SEC Specified Values (*)	Vendor Proposed Values (**)
4	**ACCESSORIES**		
4.1	Ground bar 25x5 mm & M12 Stud	yes	*
4.2	Voltage indicator lamps	yes	*
4.3	Phase comparators	yes	*
4.4	Approved type EFI	yes	*
4.5	Auxiliary Powered Protection Relays	yes	*
4.6	Load management system	yes	*
4.7	Voltage transformers rated as per clause 4.15.1	yes	*
4.8	Current transformers rated as per clause 4.15.2	yes	*
4.9	Terminal blocks for KWH meter, relay testing and alarm provided	yes	*
4.10	Indicating meters	yes	*
4.11	Over-pressure release	yes	*
4.12	Name Plate	yes	*
4.13	Circuit labels	yes	*
4.14	SEC Monogram	yes	*
4.15	Danger Plate	yes	*
5	**CUBICLE**		
5.1	Maximum height	2400 mm	*
5.2	Max. width of CB panel	1000 mm	*
5.3	Max. width of LBS panel	750 mm	*
5.4	Depth suitable for 600 mm cable trench	Yes	*
5.5	Paint finish Method	M16	*
5.6	Finish Color	RAL 7035 (Front side, Right side, Left side)	*
6	**Communication**		
6.1	Communication Requirements	Conforming to specs	*

6.2	SIM Card Slot Available	YES/NO	*
6.3	SIM Card Size	Standard	*
6.4	Mobile/Cellular Network Type	GPRS/2G/3G/4G	*
6.5	Communication Protocols	IEC 60870-5-104/101 /DNP3.0 /IEC 61850	*
6.6	Communication Interface for external comm. modem	Yes (Specify) / No	*
7	**Cyber Security Requirements**		
7.1	Cyber Security Requirements	Fully Comply/Not Comply	*

(*) – Values to be provided/proposed by the Vendor

(**) – Please provide explanation for deviations, if any

SMART METERED RING MAIN UNIT 15KV / 36 KV
(Sheet 4 of 4)

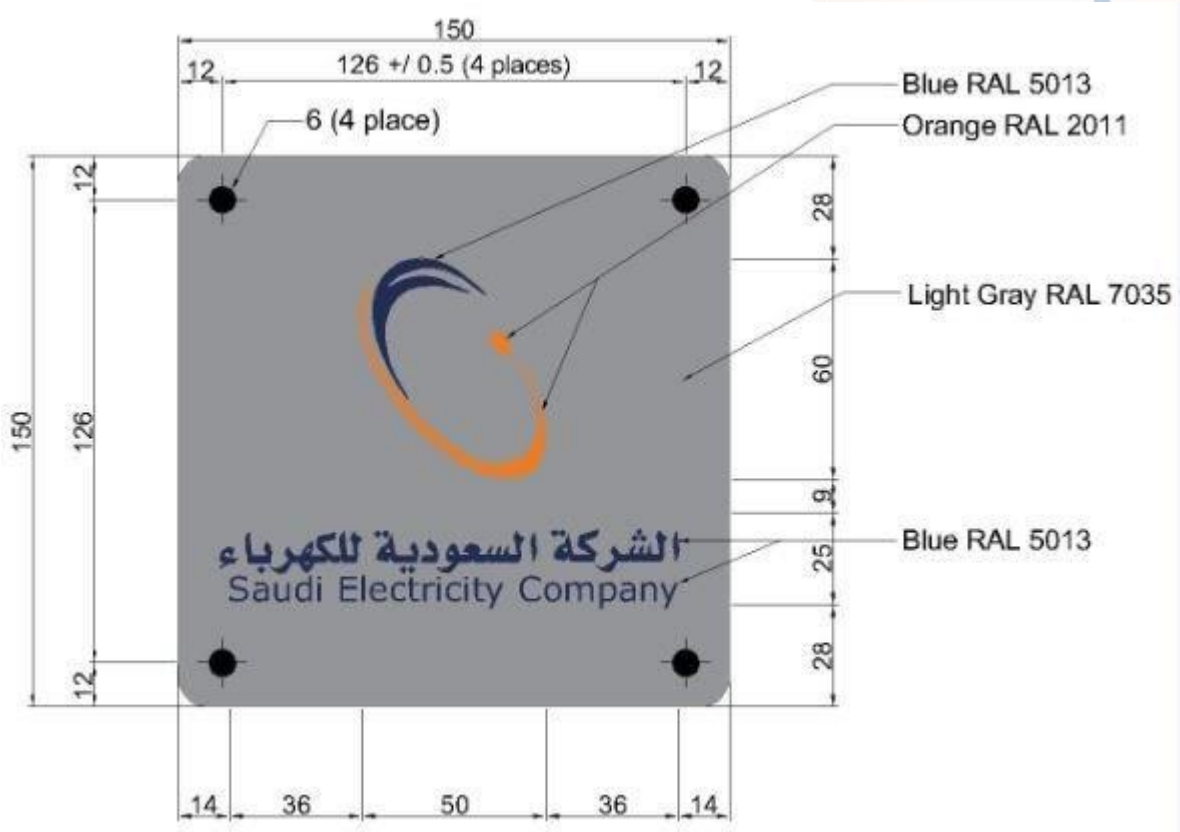
SEC Inquiry No: Item No:

- Additional Technical Information or Features Specified by SEC
- Additional Supplementary Data or Features Proposed by Bidder/Vendor/Supplier.
- Other Particulars to be filled-up by the Bidder/Vendor/Supplier.
- List of Deviations and Clauses to which exception is taken by the Bidder/Vendor/Supplier. (Use separate sheet, if necessary).

Description	Manufacturer of Material/Equipment	Vendor/Supplier
Name of Company		
Location and Office Address		
Name and Signature of Authorized Representative with Date		
Official Seal / Stamp		

11 Drawings

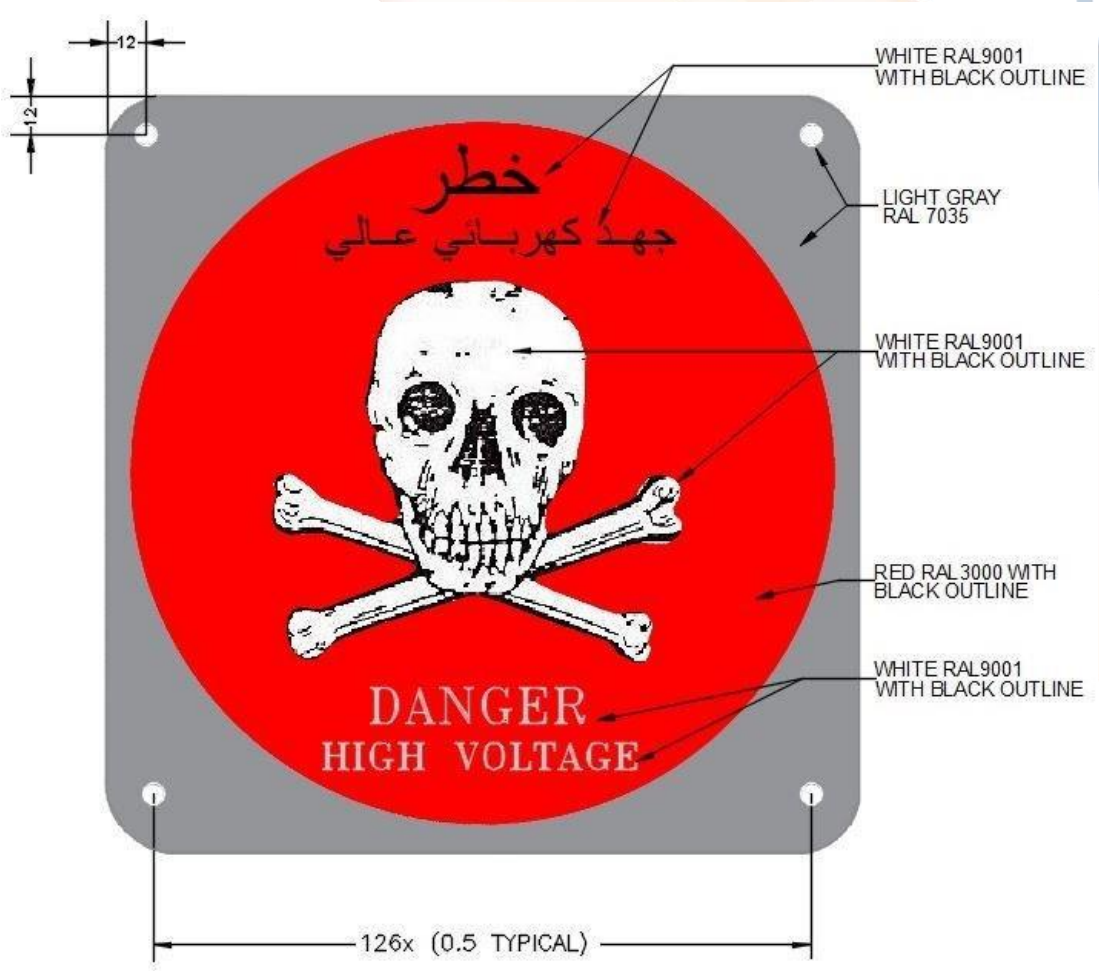
MONOGRAM FOR EQUIPMENT



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.

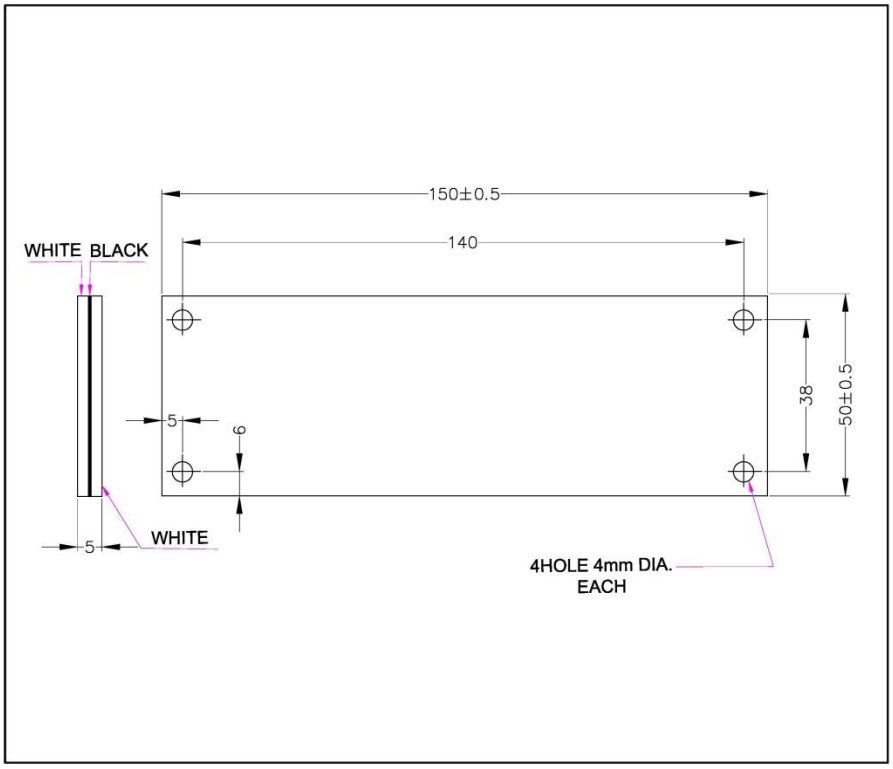
DANGER SIGN FOR EQUIPMENT



Note:

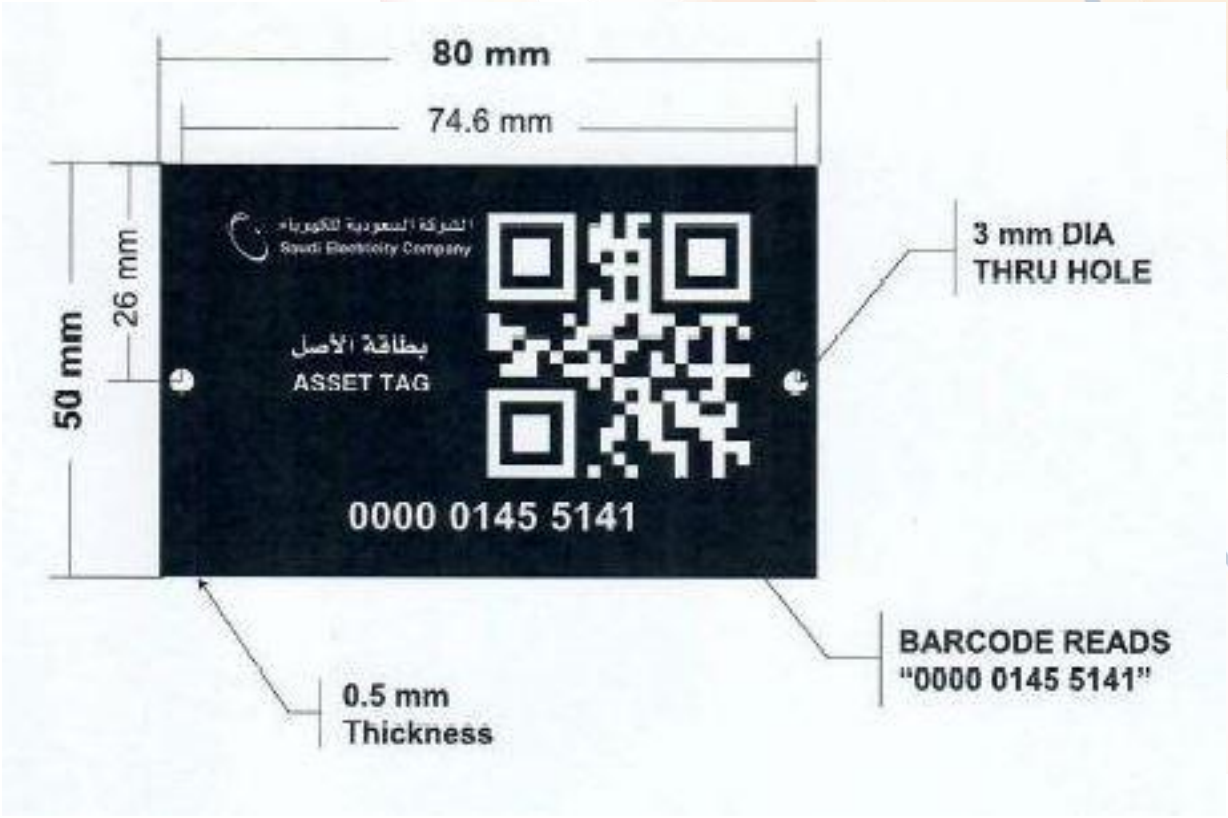
1) All dimension is in millimeters.
2) 150 x 150 x 1.5 Thick, Aluminum plate for equipment mounting.
3) Specimen for color shoes shall be obtained from SCE.
4) High gloss enamel paint.
5) Size of symbol and lettering shall be proportional to the overall dimension of the sign.
6) For the installation 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.

CIRCUIT LABEL PLATE



Note:

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



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

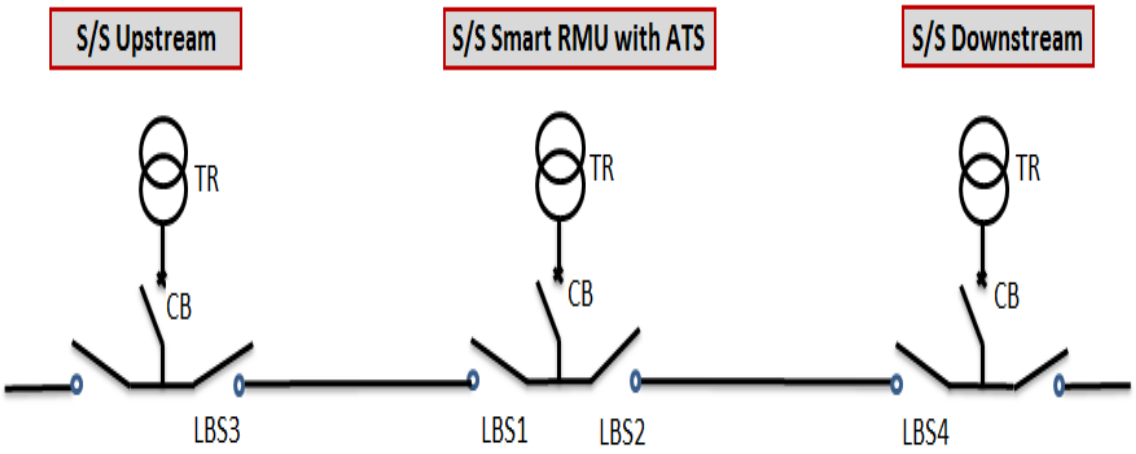
Drawing No.
SEC-01-04

Appendix.1

ATS design

- ATS logic
- ATS functions/logic requirements.

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:

ATS functionally testing/general conditions:

-SEC reserve 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 enable, 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 operation shall not exceed the min. required time for LBSs operations (max. time is 6.0 sec).

-ATS shall check the initial status while it 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 be 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 MRMU
- 2L1T : 3ways MRMU with integrated ATS

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

الشركة السعودية للكهرباء
Saudi Electricity Company
نعمل بإتقان من أجلكم

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
COMMON	LOCAL		Alarm
COMMON	Battery low	1008	Alarm
COMMON	Gas Low	1009	Alarm
COMMON	AC power fail	1010	Alarm
COMMON	Door open	1011	Alarm
COMMON	DC power fail	1012	Main DC power for charger/Circuit Breaker
COMMON	Motor CIRCUIT fail	1013	Regrouped information for all circuits (Spring charger, DC motor)
COMMON	RTU Self diagnostic (RTU alarm)	1277	Alarm
COMMON	EFI (FAULT INDICATION)	1278	Alarm
COMMON	Protection Health (Normal/Fail)	1279	Alarm
COMMON	Protection Trip (Earth fault)	1280	Alarm
COMMON	Protection Trip (Phase fault)	1281	Alarm
COMMON	Load Management system operate	1283	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 2L1T SMART MRMU (LVL)
with integrated ATS

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	
COMMON	ATS SWITCH IN/OUT	17	
DIGITAL INPUT (DI) GENERAL ALARMS / INDICATIONS			
CIRCUIT1 (LBS)	CLOSE INDICATION	11000	
CIRCUIT1 (LBS)	OPEN INDICATION		
CIRCUIT1 (LBS)	LOCK/UNLOCK INDICATION	1000	
CIRCUIT1 (LBS)	GROUND INDICATION	1001	
CIRCUIT1 (LBS)	CVI (ATS voltage presence)	2000	
Circuit2 (TRx)	CLOSE INDICATION	11001	
Circuit2 (TRx)	OPEN INDICATION		
Circuit2 (TRx)	LOCK/UNLOCK INDICATION	1002	
Circuit2 (TRx)	GROUND INDICATION	1003	
Circuit2 (TRx)	CVI (ATS voltage presence)	2001	
CIRCUIT3 (LBS)	CLOSE INDICATION	11002	
CIRCUIT3 (LBS)	OPEN INDICATION		
CIRCUIT3 (LBS)	LOCK/UNLOCK INDICATION	1004	
CIRCUIT3 (LBS)	GROUND INDICATION	1005	
CIRCUIT3 (LBS)	CVI (ATS voltage presence)	2002	
COMMON	REMOTE	11004	Alarm
COMMON	LOCAL		Alarm
COMMON	Battery low	1008	Alarm
COMMON	Gas Low	1009	Alarm
COMMON	AC power fail	1010	Alarm
COMMON	Door open	1011	Alarm
COMMON	DC power fail	1012	Main DC power for charger/Circuit Breaker
COMMON	Motor CIRCUIT fail	1013	Regrouped information for all circuits (Spring charger, DC motor)
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COMMON	Protection Health (Normal/Fail)	1279	Alarm
COMMON	Protection Trip (Earth fault)	1280	Alarm
COMMON	Protection Trip (Phase fault)	1281	Alarm
COMMON	Load Management system operate	1283	Alarm
COMMON	ATS SWITCH IN/OUT	2004	
COMMON	ATS TRIP (Act / Deact)	2005	

ANALOG INPUT (AI) MEASURMENTS			
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Circuit1 (LBS)	I_Current (B)	13016	
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Circuit2 (TRx)	S (KVA)	13064	
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