37-SDMS-05

Rev.04

SPECIFICATION FOR EXTERNAL CIRCUIT BREAKER

CONTENTS

1. SCOPE 4
2. CROSS REFERENCES 4
3. APPLICABLE CODES AND STANDARDS 4
4. SERVICE CONDITIONS 6
5. DESIGN AND CONSTRUCTION 6
6. ELECTRICAL REQUIREMENTS 13
7. MARKING OF EXTERNAL CIRCUIT BREAKER 15
8. PACKING & SHIPPING 16
9. GUARANTEE 17
10. SUBMITTALS 18
11. TESTING 19
12. TESTING METHOD 23
13. OTHER REQUIREMENTS 26
14. TECHNICAL DATA SCHEDULE 27
15. CONNECTION ARRANGEMENT 30
16. APPENDIX (A) 34
17. APPENDIX (B) 51
18. APPENDIX (C) 57

LIST OF TABLE

Table 1: ECB Logic Design 11
Table 2: ECB overall dimensions 11
Table 3: Terminal Block & Control cable 13
Table 4: Short Circuit breaking Capacity & rated Service Breaking capacity for different voltages 14
Table 5: Test items 23
Table 6: Design and Construction Requirements 28

Revision History

#	Date	Revision No.	Major Revision Description
1	20-09-2022	02	Following requirements added to the specification • Physical RJ-45 interface • Cat5e cable with RJ-45 connectors • Light indicator for “ON” status • Electrically or electronically controlled circuit power supply shall be provided from ECB internally • Electrically or electronically controlled circuit min. operating voltage • Listed ECB Accessories in its box • Connection Arrangement • Communication protocol(MODBUS) • Labeling of Input and Output terminals of ECB Following requirements excluded from the specification • Electrically or electronically controlled circuit power externally(S1, S2) • Control Connection C and NC
2	10-11-2022	03	Following requirement added to the specification • ECB Current Rating 150Amps Following requirement excluded from the specification • ECB Current Rating 160Amps
3	24-10-2023	04	Following requirement added to the specification • ECB Current Rating 125Amps • List of Fixes • ECB FW upgrade process • ECB Test Cases

1. SCOPE

This Saudi Electricity Company Distribution Materials Specification (SDMS) describes the minimum technical requirements for design, materials, manufacturing, test, performance and supply of **external circuit breaker** intended to be used join with the electronic meters (and also controlled by meter) in the distribution system of Saudi Electricity Company (hereinafter referred to as COMPANY).

2. CROSS REFERENCES

2.1. This specification shall be read in conjunction with SEC General Specification No. 01-SDMS-01 (latest revision) titled "General Requirements for all Equipment / Materials" considered as an integral part of this specification.

2.2. This specification shall be read in conjunction with SEC Specification No. 40-SDMS-02A and 40-SDMS-02B (latest revision) and titled "Technical requirement for the electronic revenue meter" considered as an integral part of this specification.

2.3. This specification shall be read in conjunction with SEC General Specification No. 37-SDMS-01 and (latest revision) titled "Low Voltage Molded Case Circuit Breakers for Service Connections" considered as an integral part of this specification.

2.4. This specification shall be read in conjunction with SEC Distribution construction standard No. SDCS-02 Part 7 (latest revision) and titled "installation of KWH meter boxes inside meter rooms" (the external circuit breaker shall be designed in order to be able to be installed condition indicated in this specification) considered as an integral part of this specification.

2.5. This specification shall be read in conjunction with SEC Specification No. 11-SDMS-06 (latest revision) and titled "Specification for Control Cable with RJ-45 connectors for External Circuit Breaker" considered as an integral part of this specification.

2.6. This specification shall also be read in conjunction with COMPANY purchase order requirements.

3. APPLICABLE CODES AND STANDARDS

The external circuit breaker shall be suitable for operation in COMPANY's distribution system conditions as per the latest revision of General Specification No.01-SDMS-01. The external circuit breaker shall be deemed to meet the requirements without any adverse effect over the life cycle. COMPANY is looking for a Circuit Breaker, not necessarily a Molded Case Circuit Breaker. Solutions are open to the Contractor and will be reviewed by the Company for validation and compliance.

The latest revision of the following codes and standards shall be applicable for the equipment / material covered by this specification. In case of any deviation, the Vendor may propose equipment / material conforming to equivalent alternative codes and standards. However, the provisions of COMPANY's standards shall supersede the provisions of these standards in case of any conflict.

IEC 60068-2-1 Environmental testing – Part 2-1: Tests – Test A: Cold

IEC 60068-2-2	Environmental testing – Part 2-2: Tests – Test B: Dry heat
IEC 61000-4-2	Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test
IEC 61000-4-3	Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test
IEC 61000-4-4	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test
IEC 61000-4-5	Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test
IEC 61000-4-6	Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
IEC 61000-4-8	Electromagnetic compatibility (EMC) - Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test
IEC 61000-4-11	Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests
IEC 60664	Insulation coordination within Low Voltage System including clearances and creep-age distance for equipment
IEC 60695-2-11	Fire Hazard Testing - Part 2-11: Glowing/Hot-Wire Based Test Methods
IEC 60898	Protection for domestic and similar installations.
IEC 60947-1	Low Voltage Switchgear and Control gear General Rules.
IEC 60947-2	Low Voltage Switchgear and Control gear for Circuit Breakers.
IEC 60947-7-1	Test requirements of Terminal Blocks
IEC 60947-4-1	Low-voltage switchgear and control gear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters
IEC 60529	Degrees of Protection provided by Enclosure IP Classification Designation
IEEE C62.41	Recommended Practice on Surge Voltage in Low-Voltage AC Power Circuits
ASTM D-4098	Thermosetting Resins
ASTM D-3935	Polycarbonate Resins
ASTM B633	Electro-deposited Coatings of Zinc on Iron and Steel
ISO/IEC 15416	Automatic identification and data capture techniques — Bar code

	print quality test specification — Linear symbols
ISO/IEC 15415	Information technology — Automatic identification and data capture techniques — Bar code symbol print quality test specification — Two-dimensional symbols
MODBUS	Modbus Application Specification Protocol Specification V1.1b3
IEEE 802.3at	Power over Ethernet+

4. SERVICE CONDITIONS

4.1. The external circuit breaker will be installed indoor and / or outdoor as referred to the latest revision of General Specification No. 01-SDMS-01. In outdoor installations, the external circuit breaker shall be installed inside the meter box. The air temperature inside the external circuit breaker box may be regarded as 75°C due to direct solar radiation, plus the effect of any internal heating.

4.2. Temperature range:

4.2.1. Limit range for storage and transportation -10°C to 85°C

4.2.2. Limit range for operation -10°C to 75°C

4.2.3. Maximum relative humidity 95%

4.3. Reference Temperature 55°C

4.4. Reference frequency 60Hz

5. DESIGN AND CONSTRUCTION

5.1. General

5.1.1. The external circuit breaker shall be compact, rugged and reliable in design.

5.1.2. The external circuit breaker shall be designed and constructed in such a way as to avoid introducing any danger to the meter in use and under normal conditions, so as to ensure specially personnel safety against electric shock.

5.1.3. All parts of the external circuit breaker, which are subject to corrosion under normal working conditions, shall be protected effectively. Any protective coating shall not be liable to damage by ordinary handling or damage due to exposure to air, under normal working conditions.

5.1.4. All internal and external wiring required to install the external circuit breaker shall be governed in a way to completely avoid any conflict with the connections of power cables and control cables.

5.1.5. The components shall be the same ones as those used and tested during the Type Test. All the components shall keep high reliability required during the external circuit breaker life time.

5.1.6. The cables used shall be easily replaceable, and have the sheathed wiring cables with non-flammable characteristics.

5.1.7. Magnetic Coil and Auxiliary contacts for the external circuit breaker shall be easily replaceable. (optional)

5.1.8. The external circuit breaker shall be equipped with a “push to trip” button in front to test operation and the opening of the poles.

5.1.9. The external circuit breaker poles shall operate simultaneously for circuit breaker opening, closing and tripping.

5.1.10. It is required that the external circuit breaker shall be equipped with a locking system to ensure disconnection during maintenance or bad payers customers. Solutions for the locking system are open to the Contractor, subject to the COMPANY’s evaluation and approval.

Connect/Disconnect shall be managed remotely as well as Locally. Please note that the LOCKING SYSTEM IS LOCALLY OPERATED and it is NOT OPERATED or MANAGED REMOTELY. At the same time it is required that the lock shall be operable from the front of the external circuit breakers.

5.1.11. The case of the external circuit breaker shall be three pole and it shall contain case with sealed cover permanently attached to the base, thermal and magnetic releases, arc suppression devices, operating handle, lock, terminal covers, and an arrangement for three (3) incoming and three (3) outgoing terminals as specified in this Specification.

5.1.12. Thermal interaction shall not unduly affect the performance of any component.

5.1.13. All bolted electrical joints shall be secured by means of corrosion proof steel nuts and bolts. All bolts, nuts and washers shall be plated to type II of ASTM B633.

5.2. Case

5.2.1. The case of the external circuit breaker shall be made of non-metallic material. It shall be made of non-flammable phenol or high-grade polycarbonate resin.

5.2.2. The external circuit breaker shall have an adequate dust proof and moisture proof case and also the terminal cover shall avoid dust and moisture, which can be sealed in such a way that the internal parts of the external circuit breaker are accessible only after breaking the seals. The degree of protection shall be IP-30 or better.

5.2.3. The Electrically or electronically controlled circuit assembly for remote and manual operation must have higher degree of protection than IP30. The external circuit breaker’s electronics shall have a layer of special coating applied to provide sealing

against dust, water, and vermin and to ensure high humidity resistance performance and coating thickness shall be as per IEC standard.

5.2.4. Top and bottom mountings shall be metallic with anti-rust coating. Thickness of these mountings shall not be less than 1.5 mm bolted / riveted to the external circuit breaker case. Plastic mountings may also be acceptable provided the thickness of the mountings is enough to withstand the mounting pressure.

5.2.5. Adequate sealing provision shall be provided in different parts of the external circuit breaker, i.e., terminal cover, control terminal cover, auto/ manual mode selector, external circuit breakers cover if used.

5.2.6. Contractor shall propose the type of screws suitable for their own ECB subject to COMPANY's approval.

5.2.7. The external circuit breaker case shall have the protective structure against outer EMI (Electro Magnetic Interference).

5.2.8. The external circuit breaker shall have protection against over current and short circuit.

5.3. Terminals

5.3.1. Terminals shall be made of copper treated with electrically conducting coating such as tin/silver etc.

5.3.2. The terminal covers shall be removable in the field easily without removing any other wires outside the power supply terminals covers.

5.3.3. The incoming terminals shall be suitable for both copper and aluminium conductors of sizes given for the following different ratings:

- For ECBs rated 125,150, 200 and 250 Amps, terminals shall be suitable for copper conductor up to 120mm² without the use of cable lugs.
- The incoming supply terminals connctions shall be as per drawing No. SEC/ECB-S-01 & 02 for ECB having current ratings 125A and 150A .
- For ECBs rated 300, 400, 500, 600, 800, and 1000 Amps, terminals shall be suitable for copper/aluminium conductor up to 300mm² with the use of cable lugs.
- For ECB rated 300, 400, 500, 600, 800, and 1000 Amps, spreader terminals shall be used to increase the pole pitch and to make provision for connection of two cables on these terminals with cable lugs.

5.3.4 The Outgoing terminals shall be suitable for both copper and aluminium conductors of sizes given for the following different ratings:

- For ECBs rated 125,150, 200 and 250 Amps, terminals shall be suitable for copper conductor up to 120mm² without the use of cable lugs.

- For outgoing terminals 300 and 400 Amps rated ECB, outgoing terminals, shall be box type for direct connection without the use of cable lugs and suitable for copper conductors up to 185 and 240 mm².

- For Outgoing terminals 500, 600, 800 and 1000 Amps rated ECBs, outgoing terminals shall be suitable for direct connection of tinned copper bus bar by mean of bolts and nuts.

- The outgoing supply terminals connections shall be as per drawing No. SEC/ECB-S-03 for ECB having current ratings 200A and above.

5.4. External circuit breakers shall be provided with self-fitting knock out type terminal covers for incoming and outgoing terminals with built in separators. There should be facilities for sealing these covers using any standard seals.

5.4.1. The terminal covers shall be removable in the field easily without removing any other wires outside the power supply terminal covers.

5.5. Operating Mechanism

Connection arrangements including the meter-ECB connection signal control cable in the cases of WC and CT meters are included in 37-SDMS-05 REV. 04-clause no. 15(Connection Arrangement)

Additionally, to the operation by the meter, the external circuit breakers must be able for local manual operation. Technical solutions to manage local and manual operation of the ECB are open for the Contractor. Solutions will be subject to COMPANY's evaluation and approval. The solution shall operate all poles simultaneously to close or trip the breaker.

5.5.1. The external circuit breaker must be designed to communicate (Open/Close, status feedback, etc) using the RS-485 wire interface available in the meters.

The communication signal comes from the meter RJ-45 Port. Characteristics and communication protocol are described in 40-SDMS-02A latest revision (CT AND CT-VT METER), & 40-SDMS-02B latest revision (WC METER), and Appendix A of this specification.

5.5.2. A thermal and magnetic automatic trip and a quick make quick break mechanism which is mechanically trip free shall be provided. This shall include thermal overload trip elements and magnetic short circuit non-adjustable (fixed) trip elements. The values for thermal and magnetic protection trip will be according to the corresponding ECB rating.

5.5.3. The external circuit breakers position identifications, that is, "ON"-"TRIPPED"-"OFF", shall be indicated by the handle position on top, centre and bottom respectively for a vertical mounted breaker. The "ON" and "OFF" positions, at top and bottom of the handle position respectively, shall be engraved/indelible marked "ON" and "OFF". All the positions shall be clearly visible from the front and shall be covered by transparent window to avoid dust and water.

5.5.4. A locking system shall be fitted to the right or left side of the external circuit breakers to lock the mechanism in an "OFF" position. The lock shall be operable from the front of the external circuit breakers. This locking solution is open to the Contractor, subject to COMPANY's evaluation and approval.

5.5.5. ECB logic design shall be as per below Table1 below

Modes	ECB Initial status	Functions	Operations	ECB Final status
Manual	ON	On to Off (Manual)	With manual tool/handle, provided with ECB	OFF
	OFF	Off to ON (remote reconnect)	DISABLE (Remote Command by HES/Smart Meter)	OFF
	OFF	Off to on (Manual)	With manual tool/handle, provided with ECB)	ON
	OFF	Manual Connect (OFF to ON) @ DISCONNECT Command Issued from Meter/HES	With manual tool/handle, provided with ECB	OFF > 5 Secs
	ON	Push to Trip	With External Push Button	TRIP
	TRIP	Auto Re-Connect after TRIP. Two-step function (from TRIP to OFF and then OFF to ON)	DISABLE Remote operation (NC to NO & then NO to NC)-	TRIP
	ON	(on to Off) Remote	Enable (remote command by HES (on to off only)	OFF
Auto	ON	Auto Disconnect (ON to OFF)	By Remote Command by HES/Smart Meter	OFF
	OFF	Manual Connect (OFF to ON) @ DISCONNECT Command Issued from Meter/HES	With manual tool/handle, provided with ECB (clock-wise rotation)	OFF > 5 Secs
	OFF	Auto Connect (OFF to ON)	By Remote Command by HES/Smart Meter	ON
	ON	Push to Trip	With External Push Button	TRIP
	TRIP	Auto Re-Connect after TRIP 2-step function (from TRIP to OFF and then OFF to ON)	Remote operation (NC to NO & then NO to NC)	ON

Modes	ECB Initial status	Functions	Operations	ECB Final status
	OFF & LOCK	The ECB shall reconnect remotely after unlocking without any manual operation in auto mode.	Enable	ON
Lock (Key)	OFF	Manual Connect (OFF to ON)	DISABLE	OFF
	OFF	Auto Connect (OFF to ON)	DISABLE	OFF
	OFF	Push to Trip	DISABLE	OFF

Table 1: ECB Logic Design

[Note]

a) The ECB shall be in trip condition before final packing from manufacturing unit.
b) The ECB shall take remote commands in auto mode after unlocking (key) without any manual intervention.`

5.6. The contacts shall be fitted with arc suppression devices. The contacts shall be constructed such that all the poles close, trip, and open simultaneously for a fault on any pole.

5.7. Each external circuit breaker shall be equipped with brass or corrosion proof steel bolts of sufficient length for mounting the breaker on un-threaded 3 mm thick steel sheets, polyester sheets or steel rails. The size of bolts shall be M4.

5.8. The external circuit breaker shall be equipped with fixed setting thermal and magnetic releases up to 400 Amps, external circuit breakers with electronic releases may be accepted as optional for 500, 600, 800 and 1000 Amps.

The maximum overall dimensions of the external circuit breaker shall be as given in Table 2 below

ECB Rating	Width (mm)	Length (mm)		Depth (mm)
		Without Terminal cover	With Terminal cover	
125A to 250A	110	165	210	140
Up to 400A	140	260	400	140
Up to 600A	210	300	500	175
Up to 1000A	210	330	500	205

Table 2: ECB overall dimensions

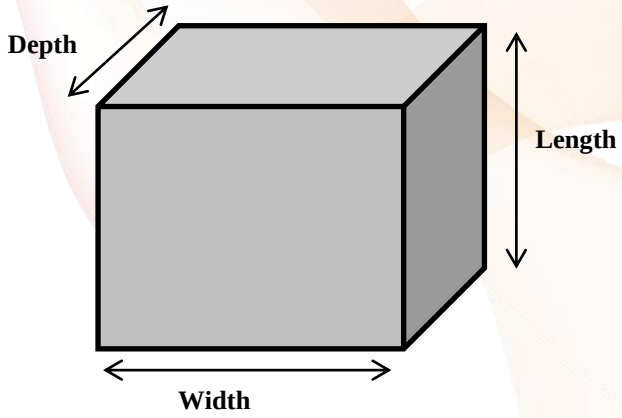


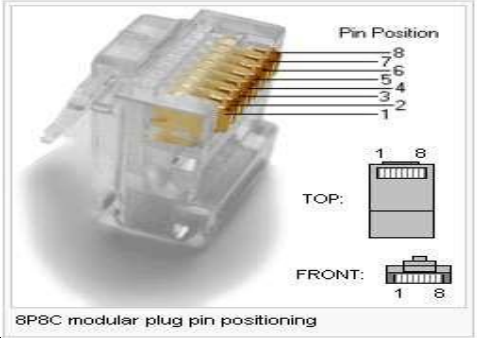
Figure 1: ECB dimension

5.9. The terminal block shall include additional connection terminals for the control cables from the meter as described in the following terminal block table 3.

ECB Rating (Current)	**125A,150A, 200A and 250A**	**300A, 400A, 500A,600A**	**800A, 1000A**
Terminals	Terminals shall be suitable for **copper conductor** up to **120mm²** without the use of **cable lugs**. Bigger sections must use cable lugs. Bidders shall propose the type of screws suitable for their own ECB subject to SEC approval.	Terminals shall be suitable for **copper/aluminum conductor** up to **300mm²** with the use of **cable lugs** for which dimensions are given in spec. No. 12- SDMS-02 latest revision. Spreader terminals shall be used to increase the pole pitch and to make provision for connection of two cables on these terminals with cable lugs. Bidders shall propose the type of screws suitable for their own ECB subject to SEC approval. The Outgoing terminals shall be suitable for both copper and aluminum conductors of sizes given for the following different ratings: 1- For outgoing terminals 300 and 400 Amps rated ECB, outgoing terminals, shall be box type for direct connection without the use of cable lugs and suitable for copper conductors up to 185 and 240 mm². 2- For Outgoing terminals 500, 600, 800 and 1000 Amps rated ECBs, outgoing terminals shall be suitable for direct connection of tinned copper bus bar by means of bolts and nuts.	
Manual Tool for operating ECB(on/off)	Insulated Hex L-Key (5 millimeters)	Insulated Hex L-Key (10 millimeters)	
Control Cable length	The control cable length of 1 meter		The control cable length of 4 meters

<table>
<tr><td>ECB Rating (Current)</td><td colspan="2">125A,150A, 200A and 250A</td><td>300A, 400A, 500A,600A</td><td colspan="4">800A, 1000A</td></tr>
<tr><td>Control Cable (ECB to Meter)</td><td colspan="7">The ECB shall be equipped with RS-485 interface having one (1) physical RJ-45 terminals.RJ-45 terminals shall be protected by using appropriate protection caps or covers(retractable recommended), which are at least IP-54 rated for dust ingress protection, and adequate sealing provision shall be provided for RJ-45.RJ-45 pin-out configuration
<table>
<tr><td>Pin No</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td></tr>
<tr><td>Pinout</td><td colspan="2">(12 Vdc+) From meter</td><td>N C</td><td>RS-485(+)</td><td>RS-485 (-)</td><td>NC</td><td colspan="2">GND (Vdc-) from meter</td></tr>
</table>
The power supply from the meter to the ECB for communication shall have the electrical characteristics of 12Vdc (± 5%), over 5W. The control cable which can be used for power supply shall be capable of reliably supplying the required power of 12Vdc (± 5%), over 5W.

The control cable including connectors for RS-485 communications shall be outdoor STP Cat5e grey colored cable or better inserted with a cable tie and shall be provided by the vendor. The control cable shall have protection against any electromagnetic interference, electric shock, and high temperature and shall be inflammable.

8P8C modular plug pin positioning</td></tr>
</table>

Table 3: Terminal Block & Control cable

6. ELECTRICAL REQUIREMENTS

6.1. All electrical requirements shall be referred to General Specification No. 01-SDMS-01.

6.2. The external circuit breaker must have three (3) poles (three-phase) – three (3) wires, with the neutral solidly grounded.

6.3. Minimal switching Power 30 kVA by phase.

6.4. Minimal switching Voltage 400V.

6.5. Rated ultimate short circuit breaking capacity Icu will be according to the ECB Rated Current In (at 55ºC) and operation Voltage.

6.6. Continuous Rated Current In (at 55ºC) / rated ultimate Short-circuit breaking capacity Icu – Rated Service breaking capacity Ics for the different operation Voltages shall be as given in Table 4 below

RATINGS (In at 55°)	Operation Voltage ± 5%	Short-circuit breaking capacity Icu	Rated Service breaking capacity Ics (%Icu)
125 A	230/133 V	25 kA	100% Icu
	400/230 V	20 kA	
150 A	230/133 V	25 kA	
	400/230 V	20 kA	
200 A	230/133 V	25 kA	
	400/230 V	20 kA	
250 A	230/133 V	25 kA	
	400/230 V	20 kA	
300 A	230/133 V	25 kA	
	400/230 V	20 kA	
400 A	230/133 V	25 kA	
	400/230 V	20 kA	
500 A	230/133 V	65 kA	
	400/230 V	40 kA	
600 A	230/133 V	65 kA	
	400/230 V	40 kA	
800 A	230/133 V	65 kA	
	400/230 V	40 kA	
1000 A	230/133 V	65 kA	
	400/230 V	40 kA	

Table 4: Short Circuit breaking Capacity & rated Service Breaking capacity for different voltages

6.7. Contact resistance shall not be more than 700 μΩ for 125A ECB and not more than 500μΩ for other ECB ratings

6.8. Rated Impulse withstand voltage 8kV (at sea level).

6.9. Rated insulation Voltage 1000 Volts, AC (Ui).

6.10. Insulation resistance at any point ≥ 1MΩ.

6.11. Dielectric Strength between contacts ≥ 2000 VAC.

6.12. Dielectric Strength between contact and coil (60 Hz) ≥ 3000 VAC.

6.13. Dielectric Strength between contacts assembly ≥ 4000 VAC.

6.14. Short circuit characteristic according to IEC 60947-2 Utilization category A.

6.15. It will be installed in LV supplies of 230/400 V, at 60 Hz frequency for domestic and general use customers. The power supply will be three phase with asymmetric load or single phase load and the voltage shall range from -5% to +5%.

6.16. The Electrically or electronically controlled circuit assembly for remote and manual operation shall have a light indicator that specifies the “motor assembly electronic and electromechanical health” status in the field.

6.17. The Electrically or electronically controlled circuit power supply shall be provided from ECB internally such that it shall be able to be deployed for already installed distribution equipment and wiring.

7. MARKING OF EXTERNAL CIRCUIT BREAKER

7.1. External circuit breaker shall be provided with a suitable size of nameplate. Information on this nameplate shall be bilingual (Arabic and English). These shall be laser print clearly, indelibly and readable.

7.2. Name-plate shall include the following information:

7.2.1. The Manufacturer's name or trademark (logo) only.

7.2.2. Place of manufacturing.

7.2.3. Designation and type.

7.2.4. Manufacturing standards the breaker complies with

7.2.5. The number of phases and the number of wires for which the external circuit breaker is designed

7.2.6. Year of manufacture

7.2.7. External Circuit Breaker ID (as per Appendix C)

7.2.8. The reference voltage in the form of the nominal voltage of the system or the secondary voltage of the instrument transformer to which the external circuit breaker is to be connected.

7.2.9. The reference frequency in Hertz, for example: 60 Hz

7.2.10. The reference temperature, if different from 55°C

7.2.11. "Property of SEC"

7.2.12. SEC Monogram

7.2.13. SEC purchase order number

7.2.14. SEC item number

7.2.15. Circuit Breaker normal rating (In).

7.2.16. Rated service short-circuits breaking capacity (Ics) at corresponding rated voltage (Ue).

7.2.17. Rated ultimate short circuit breaking capacity (Icu) at corresponding rated voltage (Ue).

7.2.18. IP Code.

7.2.19. Utilization category.

7.2.20. Reference to SEC specification.

7.2.21. Weight in kilograms.

7.2.22. QR (2D) Bar code for breaker ID

7.2.23. Instruction Markings for General operation

7.2.24. Input and output terminals

7.2.25. Any other information required by COMPANY shall also print on nameplate.

8. PACKING & SHIPPING

8.1. Each external circuit breaker shall be packed in an individual carton capable of withstanding the rigorous conditions of transportation by Air or Sea or Truck. Other packing / shipping requirements shall be given in General Specification 01-SDMS-01 (latest revision).

8.2. Materials department shall be contacted for the details of COMPANY's packing requirements.

8.3. Each ECB with the following accessories shall be packed in a box as a complete unit/assembly and shall be delivered ready for use.

8.3.1. Mounting Screws and Washers

8.3.2. Mounting Frame if required

8.3.3. Seals with sealing wires

8.3.4. Terminals Spreader where required

8.3.5. Terminal Separator

8.3.6. Terminal Covers

8.3.7. Cat5e control grey-coloured cable including connectors having one (1) meter length inserted with a cable tie for 125A to 600A and four (4) meters length inserted with a cable tie for higher ratings more than 600A.

8.3.8. Installation guide/user manual

8.3.9. Keys should be supplied collectively in a separate box and must not be included in each ECB box. A minimum of one (1) key should be provided for every 50 units of ECB supplied.

8.3.10. ECB Manual tool/handle shall be supplied collectively in a separate box with quantity marked and must not be included in each ECB box. A minimum of two (2) Manual tool/handle should be provided for every 50 units of ECB supplied.

8.4. If any damage happens to the external circuit breaker during transportation and storage, the Vendor shall take a full responsibility for the damage caused by the inappropriate packing.

9. GUARANTEE

9.1. The Vendor shall guarantee the external circuit breaker against all defects arising out of faulty design or workmanship or defective material for a period of four (4) years from the date of commissioning or four (4) years from the date of delivery whichever comes first. COMPANY certificates for date of commissioning shall be accepted.

9.1.1. During warranty period, the Vendor shall resolve the problem by using any applicable methods, if any malfunction or faulty operation caused by the external circuit breaker itself arises.

9.1.2. After warranty period, the Vendor shall support technical support requested by COMPANY. In this case, the expense shall be reasonable price under mutual agreement, like to repair for defect or fault components during operation.

9.2. The external circuit breakers shall be subjected to Routine Test in the COMPANY's testing facility or the Manufacturer's factory / laboratory to satisfy all the requirements given in this specification. The testing venue will be determined through discussion with COMPANY.

9.3. The Vendor shall guarantee the external circuit breaker to have more than a 15-year life time (All materials used for the external circuit breaker manufacturing shall be guaranteed by original manufacturer's data sheet at least 15-year continuous operation). Also, the detail test reports shall be submitted to get COMPANY' approval for the following tests.

EMC Tests (IEC 60947-2 annex N)

9.3.2. Damp heat cycle test with shall be conducted as per IEC 60947-1 with 4 cycles instead of 2 cycles with temperature 55°C

Dry heat test at 75°C as per IEC 60947-1

Cold test at -10°C as per IEC 60947-1

Endurance test shall be per IEC 60947-2 clause 7.2.4.2

9.4. The Routine Test shall be carried out on a sample basis. COMPANY shall specify the method of testing and test reports, and certificates shall be acceptable by the manufacturer.

9.5. Even though the Vendor passed the routine test executed by COMPANY, it is the Vendor's responsibility of quality assurance for the relevant items and functions of contract conditions and the responsibility cannot be exempt.

10. SUBMITTALS

The following documents shall be submitted by the Vendor along with the bidding document:

10.1. Clause-By-Clause Compliance Statement, List of different options or List of deviations (if any).

10.2. Filled in data sheets.

10.3. Original / clear copy of catalogues for offered item(s).

10.4. Copy of the certificate of Type Test and detail reports of Type Test for the offered / identical external circuit breaker. The certificate and the Type Test report shall be obtained from an independent testing agency prior to delivery.

10.5. Operation / maintenance / troubleshooting manuals and specifications for all offered items

10.5.1. Electrical characteristics, circuit drawings

10.5.2. Interface circuits and characteristics

10.5.3. List of major components and parts

10.5.4. Installation, testing (procedure), operation and maintenance

10.6. Drawing for the following items:

10.6.1. Connection diagram (terminals, powers, communications, outputs)

10.6.2. Overall dimensions and structure (external circuit breaker body, outside)

10.6.3. Mounting details

10.7. Sealing arrangement

10.8. Name-plate

10.9. Terminal cover and external circuit breaker cover (shape, dimensions)

10.10. Reference List, experience, and certification. The external circuit breakers shall be fabricated in a plant that has an established and credible past record of manufacturing external circuit breaker of similar ratings for a period of not less than ten (10) years, and that holds an ISO 9001: 2008 certifications for quality management. The Vendor shall submit these related documents.

10.11. At least ten (10) sample external circuit breaker s for each type shall be submitted before delivery for final approval.

10.12. Copy of original manufacturer's data sheet guaranteeing at least 15-year continuous operation for all materials (or components) used for the external circuit breaker manufacturing as per the operation conditions of 01-SDMS-01.

10.13. Industrial Propriety rights of the external circuit breaker (design, patent)

10.14. Vendor shall warrant that any equipment, delivered and/or developed by Vendor under this technical specification shall not infringe any valid patent, copyright or trade secret owned or controlled by any other party. Vendor shall defend, indemnify, and hold COMPANY harmless from any claims, losses, expenses, or damages arising out of or incurred by reasons of any actual or alleged infringement of any patent, copyright or trade secret.

10.15. Schedule and plan (design, manufacturing, testing, training, technical support plan, warranty, software upgrade, etc.).

10.16. Technical support organization, manpower operation, installation, testing, operation and maintenance.

10.17. Detail training contents, time/duration, training materials (all training cost shall be included in the contract price).

10.18. If additional checking is necessary, COMPANY will request the submission of the related documents to the Vendor, the Vendor shall submit those by the specified date to the COMPANY.

11. TESTING

11.1. A sample external circuit breaker of a particular type from a Vendor shall be declared acceptable by COMPANY, only if the external circuit breaker satisfies this specification and the following tests in all respects. This acceptance will be notified by issuing a written approval letter to the Vendor. In case of any conflict (either not clears parts in IEC standards, this specification, or different opinions), the decision of COMPANY shall be final.

11.2. Type Test

11.2.1. Type Test of the external circuit breaker shall include but not limited to the following test items in Table No.3 and related clauses.

11.2.2. It is Vendor's responsibility to arrange for the Type Test and receive the Type Test certificate which shall be submitted to the COMPANY. The designated lab for type testing should be approved by COMPANY.

11.2.3. Test Quantity (if needed, the Vendor shall provide sufficient external circuit breaker quantity for the Type Test):

- Insulation, electrical, mechanical, marking: 3 EA
- Effect of the climatic: 3 EA
- Electromagnetic compatibility: 3 EA
- Input / Output: 3 EA (including contactor test)
- Functional: 4 EA
- Field Test: 4 EA (Actual load, 1 month, all log files)

11.2.4. The performance testing or checking of specific components or materials is impossible or difficult in an assembled state, the testing will be replaced with quality assurance (or verifiable documents) of the Vendor. Details shall be discussed with COMPANY; the decision of COMPANY shall be final and be accepted by the Vendor.

11.3. Factory Test

11.3.1. Certified and complete Factory Test reports for each external circuit breaker shall be submitted for COMPANY review/approval before COMPANY start the Routine Test.

11.3.2. The manufacturer's seal shall be taken as an indication that each external circuit breaker has been properly tested and is conformed to this specification and related IEC specifications.

11.4. Routine Test

11.4.1. Routine Test shall be performed to verify if the manufactured external circuit breakers conform to this specification prior to (or after) the delivery to COMPANY-designated place. The Routine Test may be done in the COMPANY's testing facility or the manufacturer's factory / laboratory upon Company's request. In case the test is performed in the manufacturer's factory / laboratory, the Vendor shall provide COMPANY personnel with necessary assistance while the test is performed.

11.4.2. The contracted quantity of external circuit breakers shall be delivered on delivery batch basis. Whenever the external circuit breakers in a delivery batch are ready to be shipped, the Vendor shall submit a list of external circuit breaker serial numbers in the delivery batch.

11.4.3. Some test items of the Routine Test may be performed on sample basis with reception of COMPANY's approval. If the implementation of the sample test is allowed by COMPANY, the test quantity shall be at least 5% of delivered quantity, and the minimum quantity of external circuit breakers to be tested is ten (10) units. The number of external circuit breakers in a delivery batch and sample ratio may be changed according to the sampling method defined in IEC 62058-11 as per COMPANY's discretion. COMPANY will choose serial numbers of the sample external circuit breakers and give the list of serial numbers to the Vendor. Then the Vendor shall deliver the sample external circuit breakers to COMPANY-designated place according to the

list.

11.4.4. If any single external circuit breaker of the tested external circuit breakers in a certain delivery batch fails to pass the Routine Test, all the external circuit breakers in the delivery batch shall be rejected.

11.5. Interim Test may be performed by COMPANY to ensure the manufactured external circuit breakers' quality performance with sample external circuit breakers of the delivered batch, whenever the external circuit breakers' quality, compared with the certified qualification level, is decreased considerably. COMPANY will select three (3) sample external circuit breakers from the delivered batch randomly and test the external circuit breakers at least once a year. This Interim Test may be commissioned to third party (an international test organization).

Test Item	Type Test	Routine Test	Related clauses
Tests of insulation properties			
Impulse voltage test	O		IEC-60947-1
Tests of electrical requirements			
Tests Sequence I : General performance characteristics	O		IEC-60947-2
Tripping limits and characteristics	O	O	8.3.3.2 IEC-60947-2
Dielectric properties	O		8.3.3.3 IEC-60947-2
Mechanical operation and operational performance capability	O		8.3.3.4 IEC-60947-2
Overload performance (where applicable)	O		8.3.3.5 IEC-60947-2
Verification of dielectric withstand	O		8.3.3.6 IEC-60947-2
Verification of temperature-rise	O		8.3.3.7 IEC-60947-2
Verification of overload releases	O		8.3.3.8 IEC-60947-2
Verification of under voltage and shunt releases (if applicable)	O		8.3.3.9 IEC-60947-2
Verification of main contact position (for circuit-breakers suitable for isolation)	O		8.3.3.10 IEC-60947-2
Tests Sequence II+III	O		
Rated service short-circuit breaking capacity	O		8.3.4.2 IEC-60947-2
Verification of operational performance capability	O		8.3.4.3 IEC-60947-2
Verification of dielectric withstand	O		8.3.4.4 IEC-60947-2
Verification of temperature-rise	O		8.3.4.5 IEC-60947-2
Verification of overload releases (1.45In)	O		8.3.4.6 IEC-60947-2
Verification of overload releases (2.5In)	O		8.3.5.5 IEC-60947-2
Test of insulation	O	O	8.3.3.3 IEC-60947-2
Test of Contact resistance	O		Clause 6.7 of this spec.
Tests for electromagnetic compatibility (EMC)			
Test of Immunity	O		IEC-60947-2(Annex N)
Test of immunity to electrostatic discharges	O	O	IEC-60947-2(Annex N)
Tests of radiated RF electromagnetic fields	O		IEC-60947-2(Annex N)
Test of Electrical fast transients/bursts (EFT/B)	O		IEC-60947-2(Annex N)
Surge immunity test	O		IEC-60947-2(Annex N)

Conducted disturbances introduced by EF fields(Common Mode)	O		IEC-60947-2(Annex N)
Voltage dips and interruptions	O		IEC-60947-2(Annex N)
Test of Conducted RF disturbances (150 kHz to 30 MHz)	O		IEC-60947-2(Annex N)
Test of Radiated RF disturbances (30 MHz to 1 000 MHz)	O		IEC-60947-2(Annex N)
Tests of the effect of the climatic environments			
Dry heat test	O		Table Q.1 IEC-60947-1
Cold test	O		Table Q.1 IEC-60947-1
Damp heat, cyclic test	O		Table Q.1 IEC-60947-1 & 9.3.2 of this Spec.
Salt Mist test	O		Table Q.1 IEC-60947-1
Mechanical tests			
General mechanical requirements	O		01-SDMS-01 & IEC 60947
Vibration test	O		Table Q.1 IEC-60947-1
Shock test	O		Table Q.1 IEC-60947-1
Test of Mechanical properties of terminals	O	O	D.8.3 IEC 60947-2
Tests of protection against penetration of dust and water	O		IEC 60529
Test of materials to abnormal heat and fire	O		9.2.2 IEC-60947-1
Alternate tests	O		Clause 9.3 of this spec.
Functional tests			
Interoperability with meters	O	O	5.5.4 & Specs for ECB
Auto Operation	O	O	5.5.4
Manual operation	O	O	5.5.4
Lock/unlock	O	O	5.5.4
Packing			
Marking of external circuit breaker			
Name-plate	O	O	7 & Table 13 IEC-60947-2
Terminal Cover / External circuit breaker Cover	O	O	5, 7
Testing Method	O	O	12

Table 5: Test items

12. TESTING METHOD

12.1. Structure Inspection

12.1.1. The external circuit breaker selected for inspection shall be visually examined in order to verify that they belong to the same type, that their specified markings are correct and that none of them shows signs of damage. The external circuit breakers shall be in

conformity with the type approval and they shall have the same voltage and current characteristics.

12.1.2. The inspection test for structure, shape, size, colour, etc. shall be performed for Clause 5. If it is difficult to perform the inspection test with a certain item required for material analysis or component destroy, the item can be tested with the verifiable documents submitted by the manufacturer.

12.2. **Insulation Performance Test**

12.2.1. Impulse voltage test: impulse waveform 1.2/50μs, source impedance / energy 8 kV at 40~50Ω / 400~420J and as per IEC 60947-1.

12.3. **Electrical Requirements Test**

12.3.1. Tests Sequence I: General performance characteristics: as per IEC 60947-2.

12.3.2. Tests Sequence II+III: as per IEC 60947-2.

12.3.3. Test of insulation: as per IEC 60947-2.

12.3.4. Test of Contact resistance: not more than 500μΩ.

12.4. **Electromagnetic Compatibility (EMC) Test**

12.4.1. Immunity test: as per IEC 60947-2(Annex N)

12.4.2. Test of immunity to electrostatic discharges: as per IEC 60947-2(Annex N).

12.4.3. Test of immunity to electromagnetic RF fields: frequency range 80 to 2000 MHz, unmodulated test field strength 10V/m with operation current, unmodulated test field strength 30V/m without operation current, and as per IEC-60947-2(Annex N).

12.4.4. Fast transient burst test: as per IEC-60947-2(Annex N)

- Cable length between coupling device and tested external circuit breaker: 0.5m±0.05m

12.4.5. Surge immunity test: as per IEC-60947-2(Annex N)

12.4.6. Conducted disturbances introduced by EF fields (Common Mode): as per IEC-60947-2(Annex N)

12.4.7. Voltage dips and interruptions as per IEC-60947-2(Annex N)

12.4.8. Conducted RF disturbances Test: frequency range 150 kHz to 30 MHz and as per IEC-60947-2(Annex N)

12.4.9. Radiated RF disturbances Test: Frequency range 30 MHz to 1 000 MHz as per IEC-60947-2(Annex N)

12.5. **Climatic conditions and tests**

12.5.1. Dry heat test: as per clause 4 of this technical specification, and as per IEC-60947 standard.

12.5.2. Cold test: as per clause 4 of this technical specification and as per IEC-60947-1 standard (Table Q.1)

12.5.3. Damp heat cyclic test: as per clause 9.3.2 of this technical specification and as per IEC-60947-1 standard.

12.5.4. Salt Mist test: as per clause 4 of this technical specification and as Salt Mist test: as per clause 8.5 of IEC-60947-2

12.6. **Mechanical tests**

12.6.1. General mechanical requirements: as per related clauses of 01-SDMS-01and as per IEC 60947

12.6.2. Case: as per as per clause 5.1 of this technical specification and clause 8 of IEC 60947-1

12.6.3. Vibration test: as per clause 8.5 of IEC-60947-2

12.6.4. Shock test: as per clause 8.5 of IEC-60947-2

12.6.5. Terminals–Terminal block(s) – Protective earth terminal: as per 7.1.7 IEC 60947-2

12.6.6. Clearance and creepage distances as per clause 7.1.4 IEC 60947-2.

12.6.7. Insulating encased external circuit breaker as per IEC 60.947-1

12.6.8. Protection against penetration of dust and water test: as per IEC 60529: IP30 or better.

12.6.9. Materials to abnormal heat and fire: as per clause 9.2.2 IEC 60947-1

12.7. **Function Tests**

12.7.1. Interoperability with meters: as per this specification clause 5.5.4, Supplementary (Communication Protocol) Specification For External Circuit Breaker

Auto Operation: as per this specification clause 5.5.4

Manual Operation: as per this specification clause 5.5.4

12.7.4. Lock/Unlock Operation: as per this specification clause 5.5.4

12.7.5. After testing 5500 times (reference one time: on-off-on), the external circuit breaker shall operate normally, and contactor temperature shall be less than 27°C (at ambient

temperature 23°C). (applicable for contactors)

12.7.6. On/off operating time: within 50 ~ 100ms. (applicable for contactors)

13. OTHER REQUIREMENTS

13.1. Delivery Scope

13.1.1. External circuit breaker Hardware and its fittings (control cables connected to meter, screws, etc.).

13.1.2. Technical support for the quantity and inspection check, performance test and trial operation.

13.1.3. Training for installation, operation and maintenance.

13.1.4. Others written in contract documents.

13.1.5. General Instructions

13.1.6. The Vendor is expected to have understood COMPANY’s whole AMR/AMM system operation environment including used meters and communication networks in KSA.

13.1.7. The Vendor shall be responsible for the technical support and the presence to the external circuit breaker installation and inspection test (if requested).

13.1.8. The Vendor shall comply to this technical specification, contract documents, related laws and regulations.

13.1.9. The Vendor shall perform the responsibilities of manufacturing, factory inspection, delivery, training and warranty.

13.1.10. If there are differences of understanding the control signal between the external circuit breaker and meter or there are required other specifications not defined to be resolved for the control between the external circuit breaker and meter, the Vendor shall accept COMPANY's interpretation of the issues and functions to fulfil these requirements.

14. TECHNICAL DATA SCHEDULE

SEC Inquiry No: Item No:

No.	Description	SEC Specified Values(*)	Vendor Purposed Values(**)
1	**General**		
1.1	ECB Rated Operational Current at 55°C, *Ie*	*	
1.2	Rated Operational Voltage, *Ue* (3-Pole)	230V ±5% 400V ±5%	
1.3	Rated Duty	Uninterrupted	
1.4	Rated Insulation Voltage, *Ui*	1000V	
1.5	Rated Impulse Withstand Voltage, *Uimp*	*	
1.6	Rated Frequency, *f*	*	
1.7	Rated ultimate Short-Circuit Breaking Capacity ,*Icu*	*	
2	**Casing**		
2.1	Case is sealed and not openable	Yes	
2.2	Material	Resin	
2.3	Temperature Index	75°C	
2.4	Sealing arrangements(Terminals covers, auto/ manual mode selector)	Yes	
3	**Incoming Terminals**		
3.1	ECBs Rated 125A,150A (Box-Type Terminals)	Suitable for direct connection of at least 70mm² cable	
3.2	ECBs Rated 200A up to 250A (Box-Type Terminals)	Suitable for direct-connection of 120mm² cable	
3.3	ECBs Rated 300A up to 1000A	Suitable for connection of cables up to 300mm² with cable lugs	
3.4	Material (ECB Main Terminal)	Copper with electrically conducting coating such as tin/silver etc. Tin coating ≥ 5 microns Silver coating ≥ 1.0 microns	
3.5	Terminal Covers Provided	Yes / No	
3.6	Terminal Spreader Provided	Yes / No	
3.7	Bolts for Terminal Spreader Provided	Yes	
3.8	Phase Barrier Provided	Yes	
4	**Releases**		

No.	Description	SEC Specified Values(*)	Vendor Purposed Values(**)
4.1	Type of Releases	Fixed-Setting Thermal and Magnetic	
4.2	Tripping Time Setting Characteristics	Inverse Time-Delay	
5	**Electrically or electronically controlled circuit Assembly**		
5.1	Standby Current	**	
5.2	Operational Current(During ON/OFF operation)	**	
5.3	Operating Voltage	Dual Voltages (133/230V and 230/400V)	
5.4	Max. operating voltage	*	
5.5	Min. operating voltage	190 Ph-Ph	
6	**Dimensions, mm**	L x W x D	
7	**Testing**		
7.1	Product is Type Tested	Yes	
7.2	SEC Approved Laboratory	**	
7.3	Date Tested	**	
7.4	Manufacturer	**	
7.5	Model/Type	**	
7.6	Country of Origin	**	
7.7	Submittals Required with Tender/Inquiry Included or Not?	**	

Table 6: Design and Construction Requirements

(*) – Values to be provided/proposed by the Vendor
(**) – Please provide explanation for deviations, if any

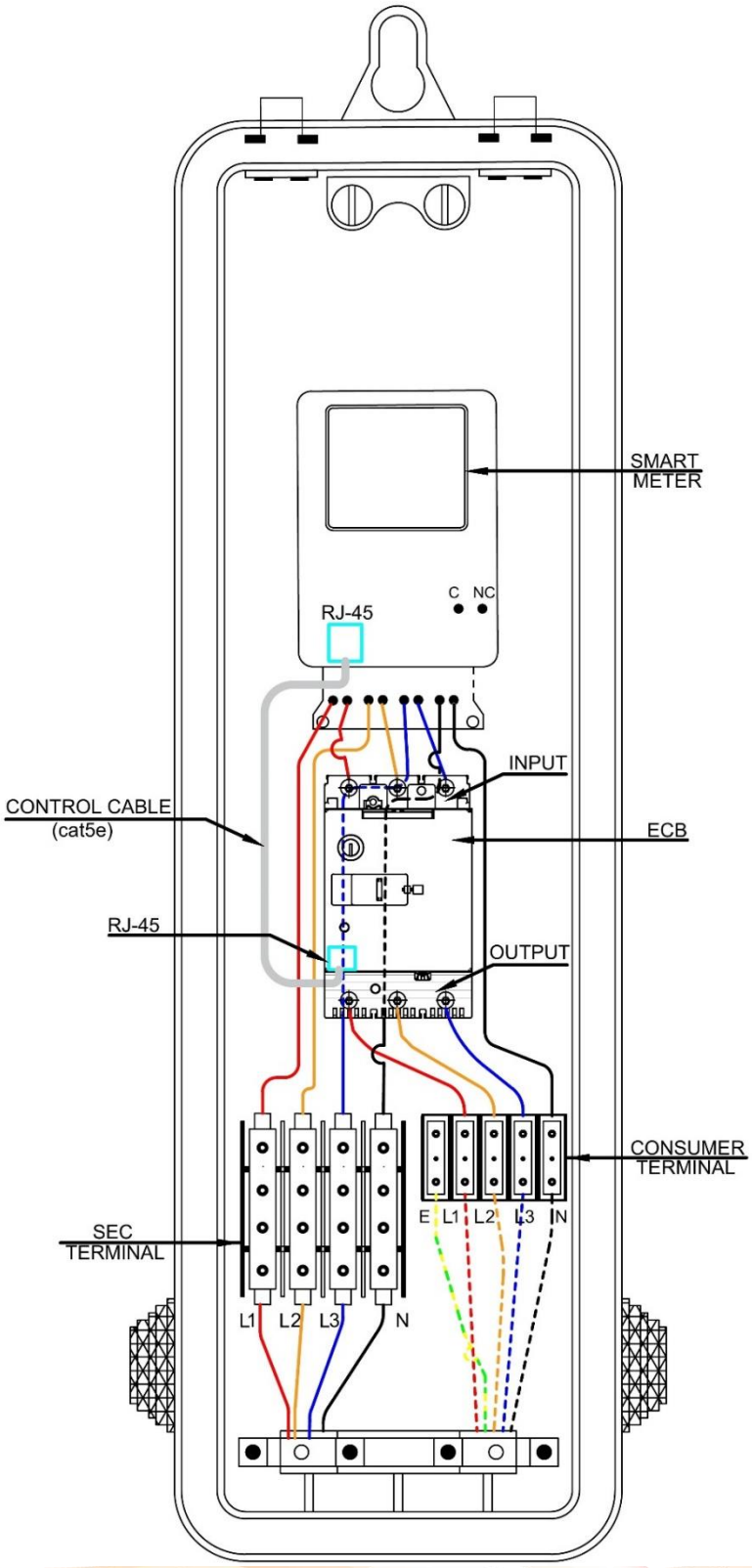
External Circuit Breaker (ECB)

SEC Inquiry No: Item No:

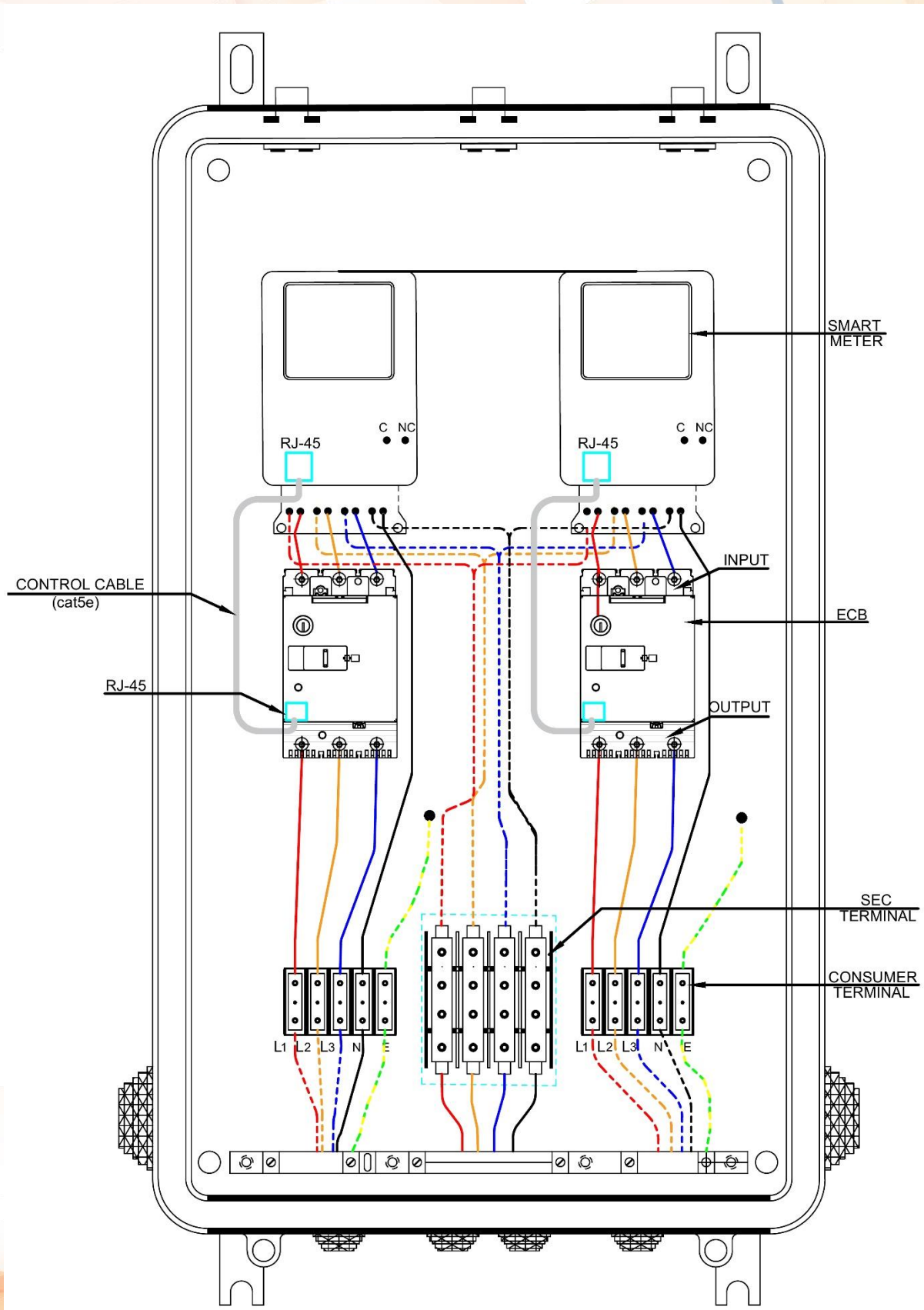
- Additional Technical Information or Features Specified by SEC
- Additional Supplementary Data or Features Proposed by Bidder/Vendor/Supplier.
- Other Particulars to be filled-up by the Bidder/Vendor/Supplier.
- List of Deviations and Clauses to which exception is taken by the Bidder/Vendor/Supplier.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

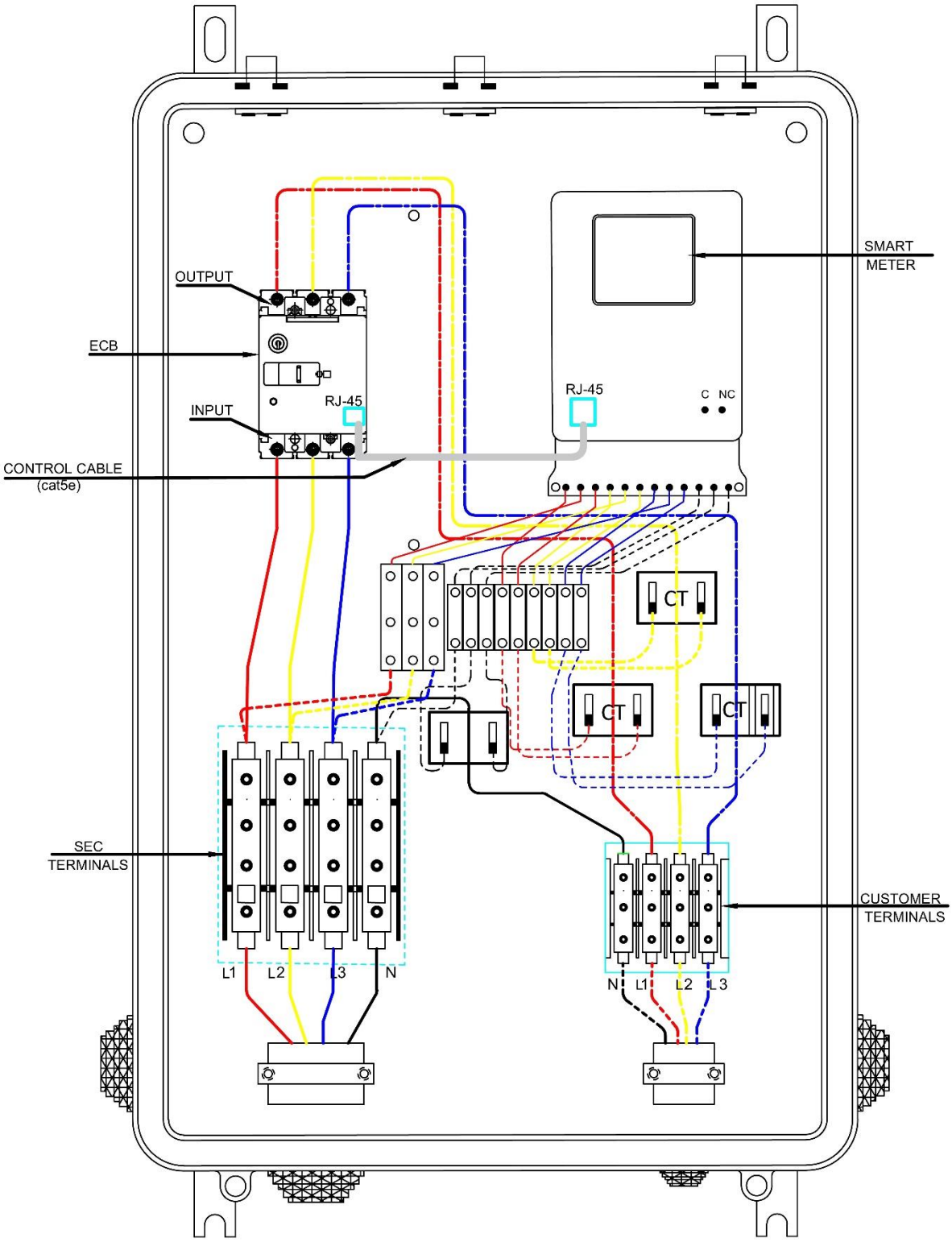
15. CONNECTION ARRANGEMENT



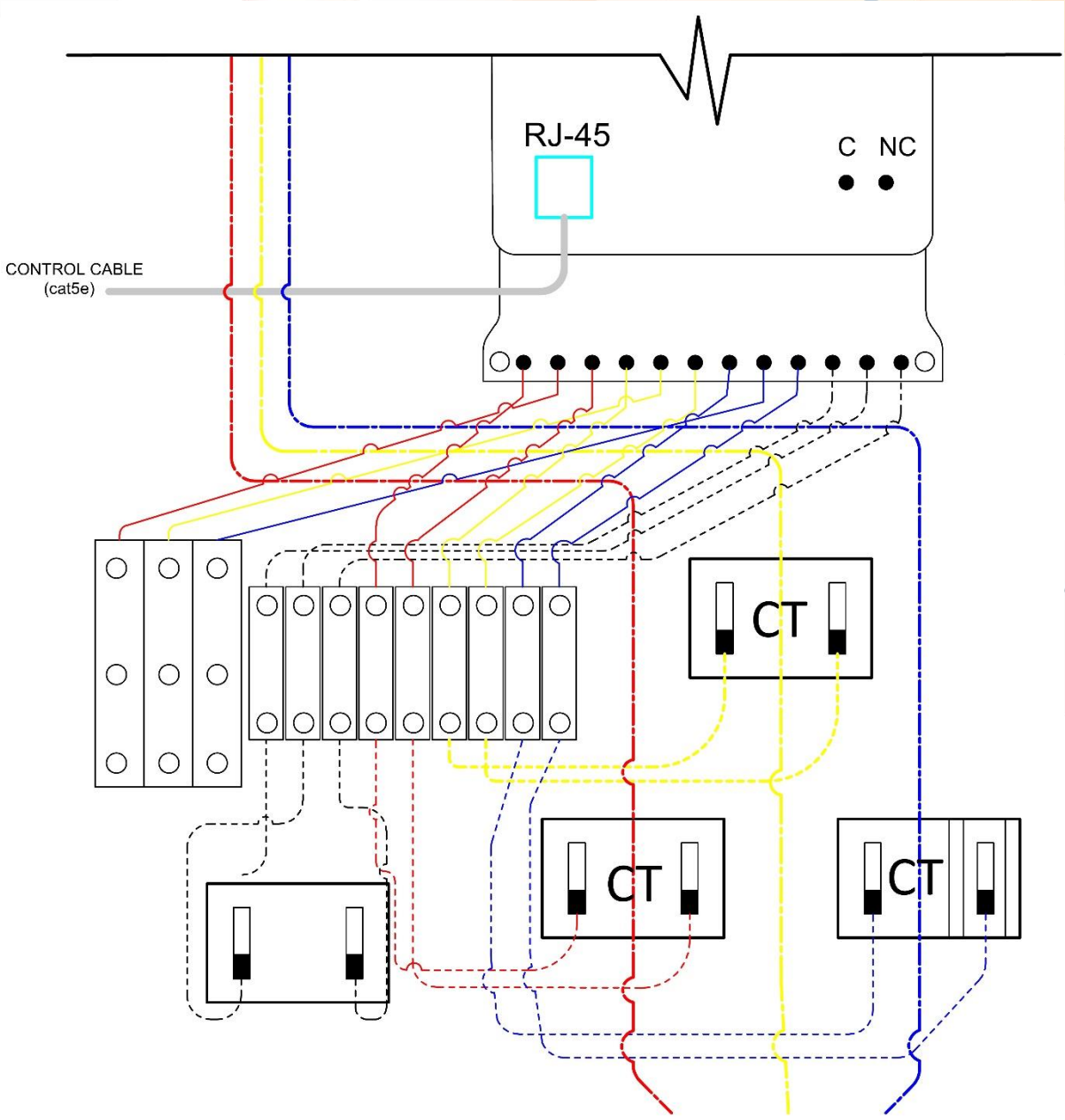
CONNECTION ARRANGEMENT FOR WC METER RATED>100A (SINGLE METER BOX)
Drawing No. SEC/ECB-S-01



CONNECTION ARRANGEMENT FOR WC METER RATED>100A (DOUBLE METER BOX)
Drawing No. SEC/ECB-S-02



CONNECTION ARRANGEMENT FOR CT OPERATED ELECTRONIC KWH METER
Drawing No. SEC/ECB-S-03



CONNECTION ARRANGEMENT FOR CT OPERATED ELECTRONIC KWH METER
Drawing No. SEC/ECB-S-04

16. APPENDIX (A)

ECB COMMUNICATION PROTOCOL

16.1. GENERAL DESCRIPTION

16.1.1. Protocol Description

MODBUS is an application layer messaging protocol for client/server communication between devices connected on different types of buses or networks. The MODBUS protocol defines a simple protocol data unit (PDU) independent of the underlying communication layers. The mapping of MODBUS protocol on specific buses or network can introduce some additional fields on the application data unit (ADU).

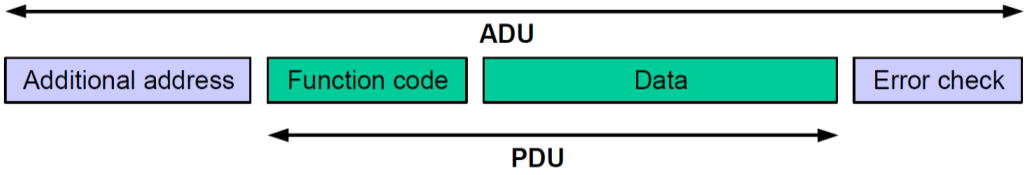


Figure 3: General MODBUS frame

Additional address:1Byte

Function code:1byte

`Data: Length(1Byte)+value(length Bytes)

Error check:2 Bytes

When the server responds to the client, it uses the function code field to indicate either a normal (error- free) response or that some kind of error occurred (called an exception response). For a normal response, the server simply echoes to the request the original function code.

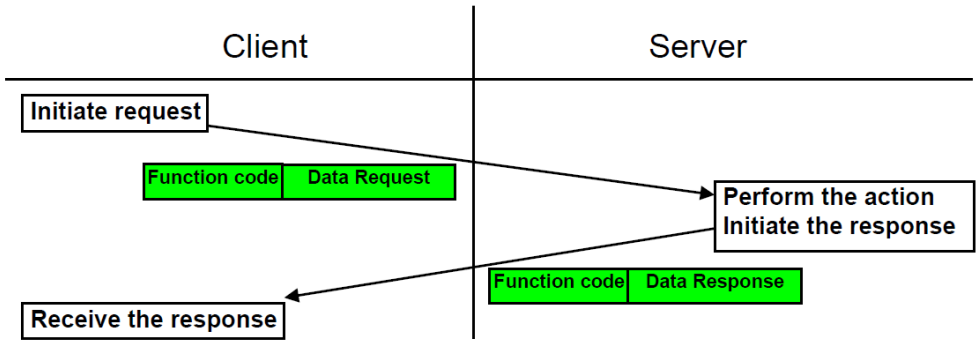


Figure 4: MODBUS transaction (error free)

For an exception response, the server returns a code that is equivalent to the original function code from the request PDU with its most significant bit set to logic 1.

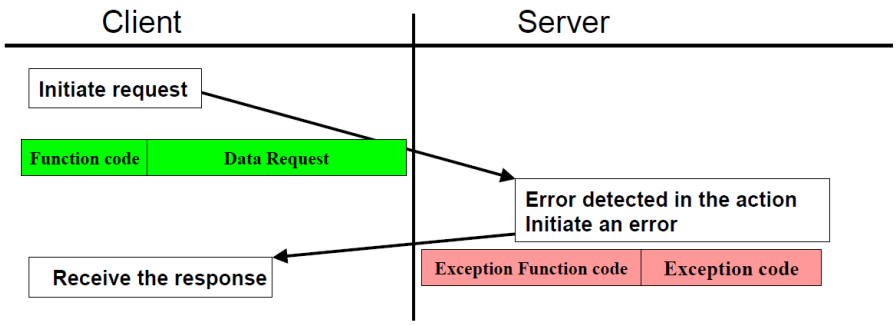


Figure 5: MODBUS transaction (exception response)

16.1.2. Additional address

Additional address is used to show server address (ECB address) , ECB default address：0x01

16.1.3. Function Code

ECB Status: 0x01

ECB FW Version: 0x02

ECB Serial Number: 0x03

Meter Action: 0x05

16.1.4. Exception Function Code

exception-function_code = [1 byte] MODBUS function code + 0x80

16.1.5. Exception Code

exception_code = [1 byte] MODBUS Exception Code Defined in below:

0x01-ILLEGAL FUNCTION

0x02-ILLEGAL DATA ADDRESS

0x03-ILLEGAL DATA VALUE

0x04-SERVER DEVICE FAILURE

0x05-ACKNOWLEDGE

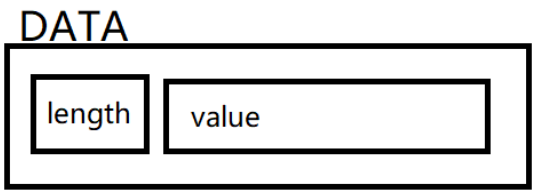
0x06-SERVER DEVICE BUSY

0x08-MEMORY PARITY ERROR

0x0A-GATEWAY PATH UNAVAILABLE

0x0B-GATEWAY TARGET DEVICE FAILED TO RESPOND

16.1.6. Data Structure



ECBStatus: length 1

{

Open: 0x01

Close: 0x02

Tripped: 0x03

Tamper: 0x04

}

MeterAction: length 1

{

OpenECB: 0x01

CloseECB: 0x02

}

MSB	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	LSB	Value	ECB status
0	0	1	0	1	0	0	0	28H	Disconnected & Auto
0	1	0	0	1	0	0	0	48H	Connected & Auto
1	0	0	0	1	0	0	0	88H	Tripped & Auto
0	0	1	1	0	0	0	0	30H	Disconnected & Manual
0	1	0	1	0	0	0	0	50H	Connected & Manual
1	0	0	1	0	0	0	0	90H	Tripped & Manual
0	0	1	0	1	0	0	1	29H	Malfunction & Disconnected
0	1	0	0	1	0	0	1	49H	Malfunction & Connected
1	0	0	0	1	0	0	1	89H	Malfunction & Tripped

Value Table — ECB status, etc.

16.2. MECHANISM

16.2.1. ECB registration with Smart Meter

Each ECB has unique 16-bit ID number. Meter will register ECB serial number and will communicate with this ID.

16.2.2. Smart Meter sends Command to ECB

After the meter receives a command from HES to control ECB, the meter will send the command to ECB by Smart Meter RS-485 port.

16.2.3. Meter inquiry ECB status

Smart Meter inquires ECB status by communicating via RS-485 port every 5 seconds, and Smart Meter will know if ECB status is open/closed/trip/tamper, etc.

16.2.4. Tamper Detection

If smart meter does not receive the status after 3 times (3*5 seconds) inquiry continuously, the Smart Meter will consider ECB as tampered.

16.3. EXAMPLES

16.3.1. Smart Meter send “OpenECB” Command to ECB

Send: 01 05 01 01 XX XX

01-ECB

05-MeterAction

01-Length Of Data

01-OpenECB

XX XX-Error check

Receive: 01 05 00 XX XX

01-ECB

05-MeterAction

00-Length Of Data

XX XX-Error check

16.3.2. Meter send “CloseECB” command to ECB

Send: 01 05 01 02 XX XX

01-ECB

05-MeterAction

01-Length Of Data

02-OpenECB

XX XX-Error check

Receive: 01 05 00 XX XX

01-ECB

05-MeterAction

00-Length Of Data

XX XX-Error check

16.3.3. Meter inquiry ECB status, ECB reply ”Open”

Send: 01 01 00 XX XX

01-ECB

01-ECBStatus

00-Length Of Data

XX XX-Error check

Receive: 01 01 01 01 XX XX

01-ECB

01-ECBStatus

01-Length Of Data

01-Open

XX XX-Error check

16.3.4. Meter inquiry ECB status, ECB reply “Close”

Send: 01 01 00 XX XX

01-ECB

01-ECBStatus

00-Length Of Data

XX XX-Error check

Receive: 01 01 01 02 XX XX

01-ECB

01-ECBStatus

01-Length Of Data

02-Close

XX XX-Error check

16.3.5. Meter inquiry ECB status,ECB reply “Trip”

Send: 01 01 00 XX XX

01-ECB

01-ECBStatus

00-Length Of Data

XX XX-Error check

Receive: 01 01 01 03 XX XX

01-ECB

01-ECBStatus

01-Length Of Data

03-Trip

XX XX-Error check

16.3.6. Meter inquiry ECB status, ECB reply"Tamper"

Send: 01 01 00 XX XX

01-ECB

01-ECBStatus

00-Length Of Data

XX XX-Error check

Receive: 01 01 01 04 XX XX

01-ECB

01-ECBStatus

01-Length Of Data

04-Tamper

XX XX-Error check

16.3.7. Meter inquiry ECB status, ECB reply "Auto "

Send: 01 01 00 XX XX

01-ECB

01-ECBStatus

00-Length Of Data

XX XX-Error check

Receive: 01 01 01 05 XX XX

01-ECB

01-ECBStatus

01-Length Of Data

05-auto mode

XX XX-Error check

16.3.8. Meter inquiry ECB status, ECB reply “Manual ”

Send: 01 01 00 XX XX

01-ECB

01-ECBStatus

00-Length Of Data

XX XX-Error check

Receive: 01 01 01 06 XX XX

01-ECB

01-ECBStatus

01-Length Of Data

06-manual mode

XX XX-Error check

16.3.9. Meter inquiry ECB status, ECB reply "ECB Serial Number"

Send:01 03 00 XX XX

01-ECB

03-ECBNum

00-Length Of Data

XX XX-Error check

Receive:01 03 01 10 XX XX

01-ECB

03-ECBNum

10-Length Of Data

XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX -ECB serial Number

XX XX-Error check

byte 1	byte 2	byte 3	byte 4	byte 5	byte 6	byte 7	byte 8	byte 9	byte 10	byte 11	byte 12	byte 13	byte 14	byte 15	byte 16
Manufacturer identifier			Year (xx)		Type (xxx)			ECB serial number (Octet-string : 8 bytes)							

[Note]

1. Each ECB has unique 16-bit ID number. Smart Meter will register ECB serial number and will communicate only with this ID.
2. The ECB and Smart Meter shall have the capability to cater all types of required functions and alarms. The mechanism to detect functions and alarms shall be prepared and submitted for COMPANY approval.

16.3.10. Meter inquiry "ECB FW Version"

Send: 01 02 00 XX XX

01-ECB

02-ECB FW Version

00-Length Of Data

XX XX-Error check

Receive: 01 02 10 XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX

01-ECB

02-ECB FW Version

10-Length Of Data

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX -ECB FW Version

XX XX-Error check

Byte	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Char	P	X	X	X	X		Y	Y	Y	Y	-	M	M	-	D	D

- XXX.X: Version number
- YYYY: Year
- MM: Month
- DD: Day
- P: Provider
- Byte 11 means ‘space’.

[Note] The format of “Firmware version” value may be different from different manufacturers. The format shown above is recommended by COMPANY, but the different format of the firmware version may be acceptable.

16.4. ECB FIRMWARE UPGRADE PROCESS

Function code include：DDH, AAH, BBH, CCH

16.4.1. The host notifies ECB to active IAP mode： （Function code：0xDD）

01 DD 02 5A A5 FCS_LSByte FCS_MSByte

The slave is ready：01 DD 01 00 FCS_LSByte FCS_MSByte

16.4.2. The host sends firmware information： （Function code：0xAA）

01 AA 00 1B XX XX+25 bytes(file name) FCS_LSByte FCS_MSByte

Slave agrees to update：01 AA 01 00 FCS_LSByte FCS_MSByte

Size of file error： 01 AA 01 01 FCS_LSByte FCS_MSByte

File name error： 01 AA 01 02 FCS_LSByte FCS_MSByte

Command error： 01 AA 01 03 FCS_LSByte FCS_MSByte

ECB is busy： 01 AA 01 04 FCS_LSByte FCS_MSByte

The firmware does not match the hardware： 01 AA 01 05 FCS_LSByte FCS_MSByte

[Note] XX XX represents the size of bin file，this two bytes should be Hex

25 bytes of file name：ECB-0250-C01-202209021FCB

ECB：fixed

0250：the type of ECB（this field can be 0250 or 0400 or 1600）；

C01：the version of Hardware

202209021FCB：provided by the supplier

Type of file：*.bin

16.4.3. The host send data package： （Function code：0xBB）

01|BB|Package number MSByte|Package Number LSByte|size of data MSByte|size of data LSByte|data|FCS_LSByte|FCS_MSByte

Slave receive success： 01 BB 01 00 FCS_LSByte FCS_MSByte

Package Number error：01 BB 01 01 FCS_LSByte FCS_MSByte

Flash error： 01 BB 01 02 FCS_LSByte FCS_MSByte

Command error: 01 BB 01 03 FCS_LSByte FCS_MSByte

[Note]

Package Number start form 0，each package contain 256 bytes，the last package need to be adjust by remain data in bin file.

16.4.4. The host send completion instructions：（Function code：0xCC）

01 CC 00 02 FF FF FCS_LSByte FCS_MSByte

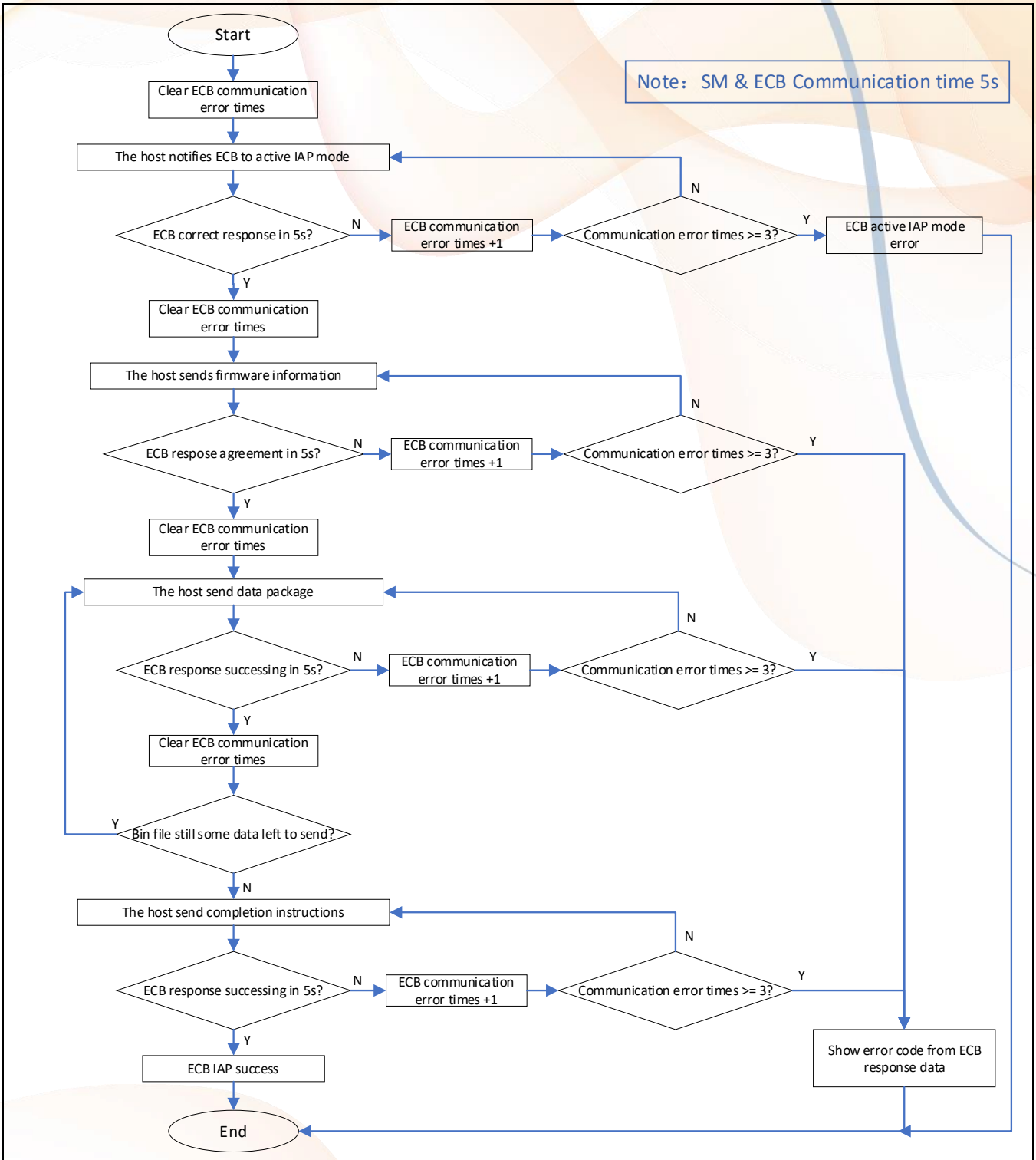
Slave response success：01 CC 01 00 FCS_LSByte FCS_MSByte

File error check fail：01 CC 01 01 FCS_LSByte FCS_MSByte

Size of file error：01 CC 01 02 FCS_LSByte FCS_MSByte

Command error：01 CC 01 03 FCS_LSByte FCS_MSByte

16.4.5. Instruction Flow Chart


Start
Clear ECB communication error times
The host notifies ECB to active IAP mode
ECB correct response in 5s?
N
ECB communication error times +1
Communication error times >= 3?
N
Y
ECB active IAP mode error
Y
Clear ECB communication error times
The host sends firmware information
ECB respose agreement in 5s?
N
ECB communication error times +1
Communication error times >= 3?
N
Y
Y
Clear ECB communication error times
The host send data package
ECB response successing in 5s?
N
ECB communication error times +1
Communication error times >= 3?
N
Y
Y
Clear ECB communication error times
Bin file still some data left to send?
Y
N
The host send completion instructions
ECB response successing in 5s?
N
ECB communication error times +1
Communication error times >= 3?
N
Y
Y
ECB IAP success
Show error code from ECB response data
End
Note：SM & ECB Communication time 5s

16.4.6. FCS check algorithm

```
/*
* FCS lookup table as calculated by the table generator.
*/
int[] FCSTab = new int[]{
0x0000, 0x1189, 0x2312, 0x329b, 0x4624, 0x57ad, 0x6536, 0x74bf,
0x8c48, 0x9dc1, 0xaf5a, 0xbed3, 0xca6c, 0xdbe5, 0xe97e, 0xf8f7,
0x1081, 0x0108, 0x3393, 0x221a, 0x56a5, 0x472c, 0x75b7, 0x643e,
0x9cc9, 0x8d40, 0xbfdb, 0xae52, 0xdaed, 0xcb64, 0xf9ff, 0xe876,
0x2102, 0x308b, 0x0210, 0x1399, 0x6726, 0x76af, 0x4434, 0x55bd,
0xad4a, 0xbcc3, 0x8e58, 0x9fd1, 0xeb6e, 0xfae7, 0xc87c, 0xd9f5,
0x3183, 0x200a, 0x1291, 0x0318, 0x77a7, 0x662e, 0x54b5, 0x453c,
0xbdcb, 0xac42, 0x9ed9, 0x8f50, 0xfbef, 0xea66, 0xd8fd, 0xc974,
0x4204, 0x538d, 0x6116, 0x709f, 0x0420, 0x15a9, 0x2732, 0x36bb,
0xce4c, 0xdfc5, 0xed5e, 0xfcd7, 0x8868, 0x99e1, 0xab7a, 0xbaf3,
0x5285, 0x430c, 0x7197, 0x601e, 0x14a1, 0x0528, 0x37b3, 0x263a,
0xdecd, 0xcf44, 0xfddf, 0xec56, 0x98e9, 0x8960, 0xbbfb, 0xaa72,
0x6306, 0x728f, 0x4014, 0x519d, 0x2522, 0x34ab, 0x0630, 0x17b9,
0xef4e, 0xfec7, 0xcc5c, 0xddd5, 0xa96a, 0xb8e3, 0x8a78, 0x9bf1,
0x7387, 0x620e, 0x5095, 0x411c, 0x35a3, 0x242a, 0x16b1, 0x0738,
0xffcf, 0xee46, 0xdcdd, 0xcd54, 0xb9eb, 0xa862, 0x9af9, 0x8b70,
0x8408, 0x9581, 0xa71a, 0xb693, 0xc22c, 0xd3a5, 0xe13e, 0xf0b7,
0x0840, 0x19c9, 0x2b52, 0x3adb, 0x4e64, 0x5fed, 0x6d76, 0x7cff,
0x9489, 0x8500, 0xb79b, 0xa612, 0xd2ad, 0xc324, 0xf1bf, 0xe036,
0x18c1, 0x0948, 0x3bd3, 0x2a5a, 0x5ee5, 0x4f6c, 0x7df7, 0x6c7e,
0xa50a, 0xb483, 0x8618, 0x9791, 0xe32e, 0xf2a7, 0xc03c, 0xd1b5,
0x2942, 0x38cb, 0x0a50, 0x1bd9, 0x6f66, 0x7eef, 0x4c74, 0x5dfd,
0xb58b, 0xa402, 0x9699, 0x8710, 0xf3af, 0xe226, 0xd0bd, 0xc134,
```

```
0x39c3, 0x284a, 0x1ad1, 0x0b58, 0x7fe7, 0x6e6e, 0x5cf5, 0x4d7c,
0xc60c, 0xd785, 0xe51e, 0xf497, 0x8028, 0x91a1, 0xa33a, 0xb2b3,
0x4a44, 0x5bcd, 0x6956, 0x78df, 0x0c60, 0x1de9, 0x2f72, 0x3efb,
0xd68d, 0xc704, 0xf59f, 0xe416, 0x90a9, 0x8120, 0xb3bb, 0xa232,
0x5ac5, 0x4b4c, 0x79d7, 0x685e, 0x1ce1, 0x0d68, 0x3ff3, 0x2e7a,
0xe70e, 0xf687, 0xc41c, 0xd595, 0xa12a, 0xb0a3, 0x8238, 0x93b1,
0x6b46, 0x7acf, 0x4854, 0x59dd, 0x2d62, 0x3ceb, 0x0e70, 0x1ff9,
0xf78f, 0xe606, 0xd49d, 0xc514, 0xb1ab, 0xa022, 0x92b9, 0x8330,
0x7bc7, 0x6a4e, 0x58d5, 0x495c, 0x3de3, 0x2c6a, 0x1ef1, 0x0f78
};
/*
* Calculate a new FCS given the current fcs and the new data.
*/
private void Cal_FCS16(byte[] Indata, int usLen)
{
byte[] FCS16data = new byte[2];
int Index = 0,i=0;
int FCS = 0XFFFF;
for(i = 0; i < usLen; i++)
{
Index = (FCS ^ Indata[i]) & 0xFF;
FCS = (FCS >> 8) ^ FCSTab[Index];
}
FCS ^= 0xFFFF;
BindataCRC[0] = (byte)(FCS & 255);
BindataCRC[1] = (byte)((FCS >> 8) & 255);
```

16.4.7. ECB Upgrade event

After Upgrading ECB, meter will record the firmware upgrade event(same as

meter firmware upgrade event), and get the ECB version, if the new ECB version is different from the old ECB version.

[Note]

The error check in this communication protocol is FCS algorithm

16.5. ECB ERROR REGISTER IN SMART METER

16.5.1. The error registers are modeled by the "Data" IC (class id: 1, version: 0). These objects are used for self-diagnosis purposes and being recorded into the event logs. The error registers have to be defined together with the vendor

Classification	OBIS code						Interface Class
	A	B	C	D	E	F	
Error Register 10	0	0	97	97	9	255	Data (class id: 1, version: 0)

[Note]

The Event Notification function shall be activated by error registers above. Thus, when the errors defined in those error registers occur, the meter shall trigger the 'Push script table' (refer to Section 6.11 Push objects) to send the events to client without receiving request.

1) Attribute description of the objects "Error registers"

Data		Class_id = 1, version = 0			
Attributes	Data type & Description		Access right		
			A. 2	A. 3	A. 4
1. logical_name	octet-string		R	R	R
2. value	bit-string		R	R	R

[Note]

1. In event of relevant status, the corresponding bit will be set to 1 in binary system. When the error event is resolved, the corresponding bit is returned to zero.

2. These error registers are captured into the "Event Log" objects (Interface Class: Profile generic) whenever their status is changed (set to '1' and return to zero).

3. Each bit of Error Registers shall detect each error state separately (sharing the same sensor is not acceptable).

2) Bit-wise status mapping of the attribute "value" of each object

a) Error Register 10

MSB	bit6	bit5	bit4	bit3	bit2	bit1	LSB
ECB Tripped	ECB Connected	ECB Disconnected	ECB Manual	ECB Auto	ECB Tampered	ECB Normal Condition	ECB Malfunction

[Note]:

1. ECB Tampered: Wire cut (RS-485 and phase wire cut will be detected by meter.
2. ECB Malfunction: The ECB Electrical or Electronic circuit and motor are not working.
3. ECB Normal Condition: This bit will be high only when ECB Tampered bit is low.

ECB Critical Events(Alarms& high priority Events) List			
Sr.#	**Meter Data**	**Error Register**	**Push**
1	ECB Tripped	Error Register 10	Yes
2	ECB Manual	Error Register 10	Yes
3	ECB Tampered	Error Register 10	Yes
4	ECB Malfunction	Error Register 10	Yes
5	ECB Connected	Error Register 10	Yes
6	ECB Disconnected	Error Register 10	Yes
7	ECB Normal Condition	Error Register 10	Yes

17. APPENDIX (B)

17.1. ECB TEST CASES

17.2. Introduction

The test cases presented are based on the Functional Requirements. These test cases are extended or adapted in order to fulfill the requirements described in the Specifications and standards

[1] Supplementary OBIS Code for CT and CT-VT Meter_40-SDMS-02A (latest revision)
[2] Specifications for Electronic Revenue CT and CT-VT Meter_40-SDMS-02A (latest revision)
[3] Supplementary OBIS Code for WC Meter_40-SDMS-02B (latest revision)
[4] Specifications for Electronic Revenue WC Meter_40-SDMS-02B (latest revision)
[5] DLMS Blue Book

17.3. Abbreviations

HES: Head End System
DLMS: Device Language Message Specification
OBIS: Object Identification System
RJ-45: Registered Jack-45
SM: Smart Meter
FW: Firmware
Reg: Register
Err: Error

17.4. ECB Firmware Modifications

In the case of new firmware versions that improve the functionality of the ECB, there is a need to pass all tests again.

17.5. ECB Communication Protocol

The ECB Communication protocol is MODBUS (V1.1b3) having a fixed baud rate of 9600bps. The ECB is the slave (server) and the Smart meter is the master (client). The Smart Meter initiates communication for the status information as mentioned in Error Register 10 for every 5 seconds and SM will populate the Error Register 10.

17.6. Test Cases

17.6.1. ECB Error Register

The ECB error Register shall be populated as defined below

MSB	bit6	bit5	bit4	bit3	bit2	bit1	LSB
ECB Tripped	ECB Connected	ECB Disconnected	ECB Manual	ECB Auto	ECB Tampered	ECB Normal Condition	ECB Malfunction

17.6.2. ECB Tripped

The MSB Bit shall be high of error register 10 if tripping occurs due to a manual trip button or by short circuit or overload.

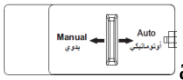
17.6.3. ECB Disconnected

The Bit 5 shall be high of the error register 10 if the disconnect command is set locally or remotely (HES).

17.6.4. ECB Connected.

The Bit 6 shall be high of error register 10 if the connection command is set locally or remotely (HES).

17.6.5. ECB Auto State

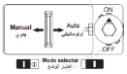
The error register 10 Bit 3 shall be high (error register 10) if the ECB shutter is in auto state 

and the ECB Key is in unlock position. 

[Note]: The error register 10 Bit 4 & Bit 3 must be toggled.

17.6.6. ECB Manual State

The error register 10 Bit 4 shall be high in the following cases.

a. If the ECB shutter is in manual position/state. 
b. If the ECB Key position is in lock state. 
c. The following table is applicable

ECB Different States and Bits 4 & 3 Status						
	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6
ECB Manual State	1	0	0	1	1	1
ECB Auto State	0	1	1	1	1	0
ECB Key(Lock Position)	1	0	1	0	1	0
ECB Manual (Bit 4)	1	0	1	x	x	1
ECB Auto(Bit 3)	0	1	0	x	x	0

Table 7: ECB Different States and Bits 4 & 3 Status

17.6.7. ECB Tampered

The error register 10 Bit 2 shall be high in the following states

a. The RJ-45 port is disconnected.
b. If the ECB motor assembly supply is disconnected.(Phase line (230/400V cut)
c. If the meter does not receive the status after 3 times (3*5seconds) inquiry continuously from ECB.

[Note]: If the ECB communication wire is removed or cut, the ECB shall not make the operation disconnect immediately or after some time period.

17.6.8. ECB Normal Condition

The error register 10 Bit 1 will be high if all conditions in clause 17.6.7 are restored.

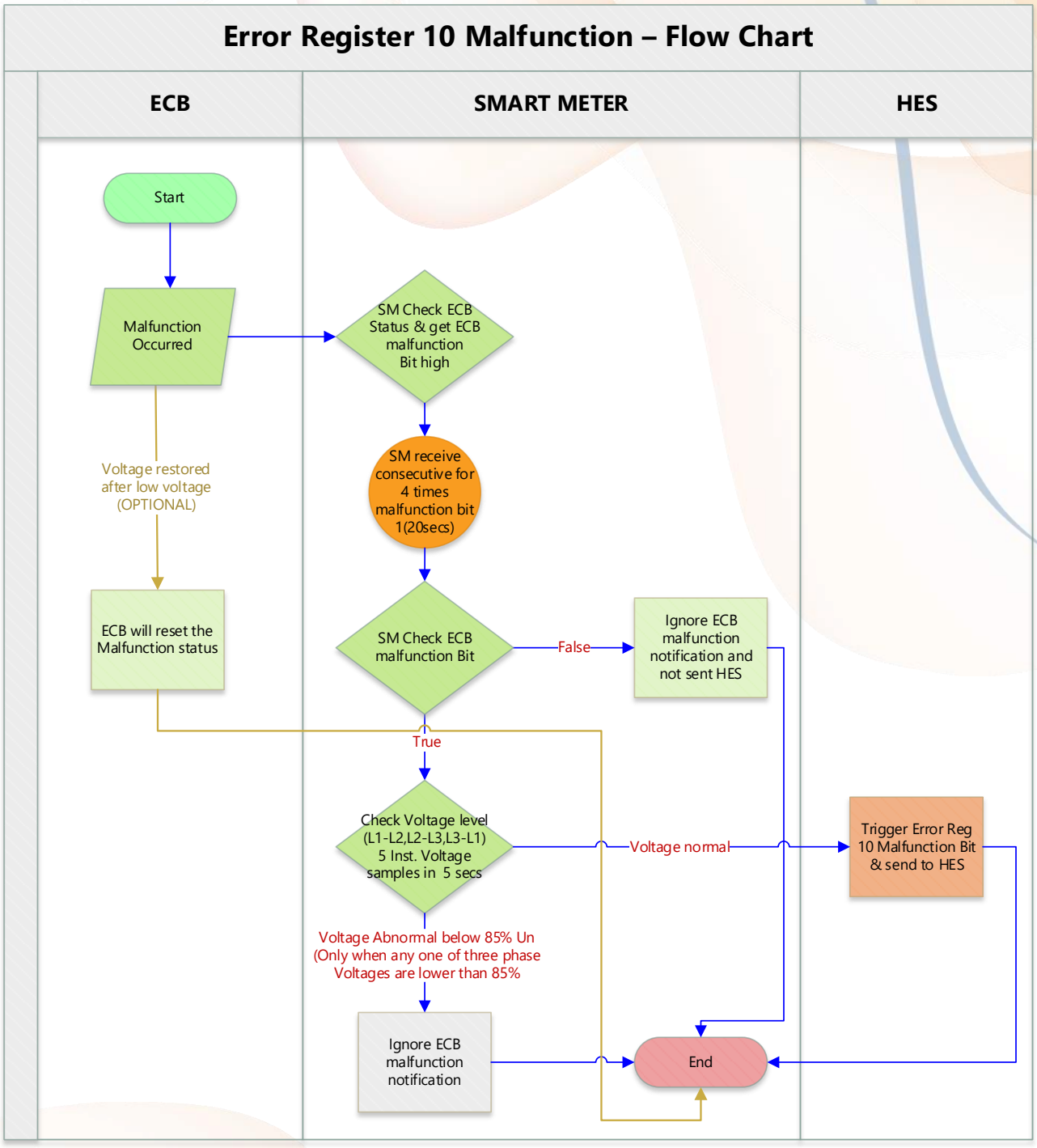
[Note]: The error register 10 Bit 2 & Bit 1 must be toggled.

17.6.9. ECB Malfunction

The error register 10 LSB Bit will be high from ECB in the following conditions

a. Connect to disconnect command is set but the error register 10 Bit5 is not high
b. Disconnect to Connect command is set but the error register 10 Bit 6 is not high
c. After the trip if the disconnect command is set but the error register 10 Bit 5 is not high
d. ECB power supply voltage is low
e. If any of the above conditions occur (locally or remotely), the ECB “healthy light indicator” remains off in any case except the ECB supply voltage recovers to normal as per ECB specification.
f. The ECB and meter will take the necessary action as per the below flow chart.

[Note]: The ECB will not detect “malfunction” status when it is deliberately operated manually(against existing position/state) due to human intervention.


Error Register 10 Malfunction – Flow Chart
ECB
SMART METER
HES
Start
Malfunction Occurred
Voltage restored after low voltage (OPTIONAL)
ECB will reset the Malfunction status
SM Check ECB Status & get ECB malfunction Bit high
SM receive consecutive for 4 times malfunction bit 1(20secs)
SM Check ECB malfunction Bit
False
Ignore ECB malfunction notification and not sent HES
True
Check Voltage level (L1-L2,L2-L3,L3-L1) 5 Inst. Voltage samples in 5 secs
Voltage normal
Trigger Error Reg 10 Malfunction Bit & send to HES
Voltage Abnormal below 85% Un (Only when any one of three phase Voltages are lower than 85%
Ignore ECB malfunction notification
End

17.6.10. ECB FW Upgrade process

It shall be according to the Remote Firmware Upgrade Process described in this document.

a. The Meter-ECB shall provide firmware upgrade functionality to be achieved immediately or on a scheduled basis both remotely and locally (meter optical or by RS-485 communication with PC emulator software) by DLMS client.
b. The Meter shall record an event when ECB firmware upgrade begins and ends. Also, failure indicated shall be generated if failed before FW uploading process by the meter to ECB. (due to any reason or disconnect of RJ-45 Cable)(as below table)
c. The ECB shall provide FW upgrade and downgrade version functionality.

Classification	Status	Value
Firmware Status	Upgrade Begin	1
	Upgrade Success	4
	Verify Failed	32
	Activation Failed	64

Table 8: Firmware status

17.6.11. ECB Event Log

a. ECB event log shall be as per below

Classification	OBIS code						Interface Class
	A	B	C	D	E	F	
ECB Event Log	1	0	99	98	18	255	Clock (Class id: 7, version: 1)

b. Capture Objects shall be as per below

Classification	Capture Objects	OBIS code	Interface Class	Attribute Index
ECB Event Log	Current date/time	0.0.1.0.0.255	Clock	2
	Error register 10	0.0.97.97.10.255	Data	2
	ECB Serial Number	0.0.96.1.6.255	Data	2
	ECB FW version	0.0.96.1.7.255	Data	2
	ECB Item Number	0.0.96.1.8.255	Data	2

17.6.12. ECB Real Status

The ECB shall maintain and communicate its real status as manual/auto, normal/ malfunction, connected /disconnected/tripped, and tampered.

17.6.13. ECB Abnormal Condition

In case of ECB is in abnormal condition, the MCU's watchdog timer shall be enabled to recover the ECB from non-response or undefined behavior automatically.

17.6.14. ECB other test scenarios

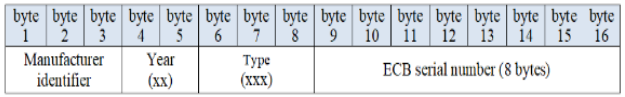
The ECB's other test scenarios can be tested as per the SEC requirements.

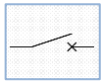
[Note]: After ECB tripping the two commands (disconnect and then reconnect) sent by HES within one script will be handled by HES and meters during User acceptance testing.

18. APPENDIX (C)

No.	Description	Clarification / Example	IEC Standard/ Specification	Arabic Translation	English	Arabic
1	External circuit breaker shall be provided with a suitable size of nameplate. Information on this nameplate shall be bilingual (Arabic and English). These shall be laser print/engraved clearly, indelibly and readable.		37-SDMS-05 Clause 7	N/A	N/A	N/A
2	The Manufacturer's name or trademark (logo) only. Also the place of manufacturing	For example: 	37-SDMS-05 Clause 7	No	N/A	
3	Place of manufacturing	For example: Made in Saudi Arabia صنع في السعودية	37-SDMS-05 Clause 7	Yes		
4	Designation and type		37-SDMS-05 Clause 7	Yes		
5	The number of phases and the number of wires for which the external circuit breaker is designed	For example: 3 Phase 3 Wire	37-SDMS-05 Clause 7	Yes		٣ أطوار ٣ أسلاك
6	Year of manufacture		37-SDMS-05 Clause 7			
7	The reference voltage is in the form of the nominal voltage of the system or the secondary voltage of the instrument transformer to which the external circuit breaker is to be connected.	For example: *Ue* 230V & 400V	37-SDMS-05 Clause 7	Yes	230V & 400V	

No.	Description	Clarification / Example	IEC Standard/ Specification	Arabic Translation	English	Arabic
8	The reference frequency in Hertz,		37-SDMS-05 Clause 7	Yes	60 Hz	٦٠ هرتز
9	The reference temperature if different from 55°C	For example: reference temperature 60°C	37-SDMS-05 Clause 7	Yes		
10	"Property of SEC"		37-SDMS-05 Clause 7	Yes	Property of SEC	ممتلكات الشركة السعودية للكهرباء
11	SEC Monogram	الشركة السعودية للكهرباء Saudi Electricity Company نعمل بإتقان من أجلكم	37-SDMS-05 Clause 7			
12	SEC purchase order number	For example: P.O No: 12345	37-SDMS-05 Clause 7	No		
13	SEC item number	For example, (400A ECB): SEC item No. 908375005	37-SDMS-05 Clause 7	No		
14	Circuit Breaker normal rating (In).	For example: In 200A	37-SDMS-05 Clause 7	No		

No.	Description	Clarification / Example	IEC Standard/ Specification	Arabic Translation	English	Arabic
15	Rated service short-circuits breaking capacity (I_{CS}) at corresponding rated voltage (Ue).	For example: I_{CS}=100%Icu or Ics=Icu	37-SDMS-05 Clause 7	No		
16	Rated ultimate short circuit breaking capacity (Icu) at corresponding rated voltage (Ue).	For example: Icu=25kA at 230V & 20kA at 400V	37-SDMS-05	No		
17	IP Code.	For example: IP 30	37-SDMS-05 Clause 7	No		
18	Utilization category	For example: Cat A	37-SDMS-05 Clause 7	No		
19	Reference to SEC specification.	37-SDMS-05 IEC 60947-2	37-SDMS-05 Clause 7	No		
20	Weight in kilograms.	For example: 2.5 Kg	37-SDMS-05 Clause 7	No		
21	Circuit Breaker ID 	E.g. ABC2200412345678 ABC: ECB manufacturer 22: year of manufacturing 004: Type 12345678: ECB Serial No.	37-SDMS-05 Clause 7	No		
22	QR (2D) Bar code for breaker ID		37-SDMS-05 Clause 7 & ISO/IEC 15415	No	ECB ID (16 Digits/letters)	
23	Instruction Markings for General operation		37-SDMS-05 Clause 7	Yes		
24	ECB position identification label	ON OFF TRIPPED	37-SDMS-05 Clause 5.5.2	Yes		

No.	Description	Clarification / Example	IEC Standard/ Specification	Arabic Translation	English	Arabic
25	Label of auto / manual mode selector and rotation indicator for manual operation		37-SDMS-05			
26	Lock and unlock key label		37-SDMS-05	No		
27	Terminals label		37-SDMS-05	Yes		
28	Torque value	For example: M10 12Nm	37-SDMS-05	No		
29	Push to Trip label		37-SDMS-05	Yes		
30	Breaker Symbol or name	 or External Circuit Breaker	IEC 60947-2	No		
31	The Electrically or electronically controlled circuit assembly with light indicator		37-SDMS-05	No		
32	RJ-45 connector		37-SDMS-05	No		
33	Any other information required by COMPANY shall also print on the nameplate.		37-SDMS-05 Clause 7			
34	Incoming Supply Terminals	LINE	37-SDMS-05 Clause 7			
35	Outgoing Supply Terminals	LOAD	37-SDMS-05 Clause 7			
36	Inbuilt motor supply (S1, S2) markings on Terminals					