

SPECIFIC PROCUREMENT NOTICE

ADDENDUM #1

to

REQUEST FOR QUOTATION (RFQ)

for

Supply and Delivery of Three Phase 4 Wire LT CT Connection Smart Meters for Liberia Electricity Corporation (LEC)

Addendum Date: October 30, 2019	Ref# Number: 4A30/PSD/004
RFQ Date: October 17, 2019	Project Name: Energy Project
Country: Liberia	Funding Agency: Millennium Challenge Corporation
City/Locality: Monrovia	Employer: Millennium Challenge Account – Liberia (MCA-Liberia)

The following changes are hereby made to the above-mentioned Request for Quotation (RFQ):

1. Annex 1, Technical Specifications:

Delete Annex 1, Technical Specifications in entirety and replace it with Annex 1, Technical Specifications as attached to this Addendum #1 as **Appendix 1**.

2. All other items and paragraphs of the subject RFQ Document remain unchanged.

Yours Sincerely,

**Mr. Monie R. Captan
Chief Executive Officer
Millennium Challenge Account – Liberia**

Appendix 1

Annex 1, Technical Specifications: Three Phase 4 Wire LV CT Connected Smart Prepayment/Switch Meter Enclosure fitted with a Smart MCCB

Annex 1

Technical Specifications

3-Phase 4 Wire LV CT Connected Smart Prepayment/Switch Meter Enclosure fitted with a Smart MCCB

1. Scope

This specification covers the design, manufacturing, testing, supply and delivery of AC, 3 Phase, 4 Wire, -/5 Amps, CT operated fully Static and AMR compatible Tri - Vector Energy Meters for measurement of different electrical parameters listed elsewhere in this document including Active Energy (kWh/MWh), Reactive Energy (kVArh/MVArh), Apparent Energy (kVAh/MVAh) etc. for Energy Accounting and Audit purpose.

The bidder's scope MUST cover all items most especially the cabinet which must be of high security and tamper proof and be prewired internally with test block, prepaid meter, breaker and CT's of required sizes.

The prepaid meter, TTB, CT's and auto-breaker are to be provided and pre-wired inside the high security cabinet (metering panel).

It should be noted that as per LEC requirement, all LV CT meters are to be prepaid meters with the ability to switch to post-paid functionality when required in the present future.

2. Application

Large power customer

3. Standards to which Meters Shall Comply

- 3.1** IEC 62052-11 Electricity metering equipment (AC) –General requirements, tests and test conditions -Part 11: Metering equipment;
- 3.2** IEC 62053-22 Electricity metering equipment (AC) –Particular requirements - Part-22: Static Meters for Active Energy (Class 0.5S);
- 3.3** IEC 62053-23 Electricity metering equipment (AC) –Particular requirements - Part-23: Static Meters for Reactive Energy;
- 3.4** IEC62055-41 Electricity Metering-Payment systems Part41: Standard transfer specification (STS) Application layer protocol for one-way token carrier systems

- 3.5 IEC62055-51 Electricity Metering-Payment systems-Part51: Standard transfer specification (STS)-Physical layer protocol for one-way numeric and magnetic card token carriers
- 3.6 IEC62056-46 Electricity metering–Data exchange for meter reading, tariff and load control–Part46: Data link layer using HDLC protocol
- 3.7 IEC62056-47 Electricity metering–Data exchange for meter reading, tariff and load control–Part47: COSEM transport layer for IP networks
- 3.8 IEC 62056-21 Electricity metering: Data exchange for meter reading, tariff and load control- Part 21: Direct local data exchange;
- 3.9 IEC 62056-61 Electricity metering: Data exchange for meter reading, tariff and load control- Part 61: Object identification system (OBIS).
- 3.10 IEC62056-62 Electricity metering–Data exchange for meter reading, tariff and load control–Part 62: Interface classes
- 3.11 IEC60044-1 Part 1: Current Transformers, Instrument Transformers
- 3.12 IEC62262-1 Degrees of Protection provided by Enclosures for electrical equipment against external mechanical impacts (IK Code)
- 3.13 IEC 60529:2001 Degrees of Protection provided by Enclosures (IP Code)

4. Service Conditions

The meter shall be required to operate satisfactorily and continuously under the following tropical conditions:

- 4.1 Working Temperature: 25°C to +70°C
- 4.2 Storage Temperature: 40°C to +85°C
- 4.3 Average Daily Ambient Temperature Range: 25°C to +70°C
- 4.4 Maximum Relative Humidity: 95% non-condensing
- 4.5 Altitude Range: ≤2.200 metres above sea level
- 4.6 Fast Transient Burst: 4Kv
- 4.7 Static Discharge: 8Kv Contact/15Kv (Air discharge)
- 4.8 Impulse Voltage: 6Kv, 1.2/50µs pulse

5. Accuracy

The meter shall be of accuracy class 0.2s, 0.5s and 1 as per IEC 62056-22

6. General Technical Specification

- 6.1 **System of Supply:** 3 Phase 4 Wire
- 6.2 **Connection Type:** Transformer Operated
- 6.3 **Rated Voltage:** 240/415V
- 6.4 **Basic Current:** 5 Amps
- 6.5 **Maximum Current:** 10 Amps
- 6.6 **CT Current Ratings:** 100A, 200A, 300A, 500A, 800A

The rating for this meter is Ib 5A, I_{max} 100A. They are not CT meters but direct connected meters for customers that can't be place on normal 3-Ph meter nor can the customer be placed on 100/5A CT metering.

As for the CT meters, the ratings are:

100/5A
200/5A
300/5A
500/5A

The CT's to be provided along with each prepaid meter MUST match the CT rating programmed into the meters.

- 6.7 Meter shall be suitable for measurement of active energy (kWh), reactive energy (kVARh), apparent energy (kVAh) and power demands (kW, kVAR, kVA) with balanced and unbalanced loads over a power factor range from zero (lagging) through unity to zero (leading).
- 6.8 The meter shall be suitable to carry continuously and work accurately at 10 Amperes.
- 6.9 **Power Supply Variation**
The meter should be suitable for working with following supply system variations without damage and without degradation of its metrological characteristics.
 - 6.9.1 **Voltage:** -70% to +20%
 - 6.9.2 **Frequency:** 47.5Hz to 52.5Hz
 - 6.9.3 **Power Factor:** Zero (Lag) – Unity – Zero (Lead)

6.10 Power Consumption

6.10.1 Voltage Circuit

6.10.1.1 The active power consumption in each voltage circuit including the power supply of meter at reference voltage; reference temperature and reference frequency shall not exceed 1Watts per phase.

6.10.1.2 The apparent power consumption shall not exceed 2.5VA per phase at leading power factor

6.10.2 Current Circuits

The apparent power taken by each Current circuit at basic Current, reference frequency and reference temperature shall not exceed 0.1VA per phase.

6.11 Starting Current

The meter shall start registering the energy at <0.01% of basic current.

6.12 Meter shall not register any energy when the voltage is applied with no current flowing in the measurement circuit.

6.13 The meter shall be capable of withstanding 240V continuously across the voltage circuit without degrading its metrological properties.

6.14 The meter shall be capable of withstanding surges and voltage spikes by providing necessary isolation and/or suppression system built-in the meter. The manufacturer shall furnish the details of immunity values of the surges and spikes along with the meter.

6.15 The meter should be capable of withstanding 6kV 1.2/50 micro-second impulse voltage immunity test in case of open circuit voltage and 8/20 micro second in case of short circuit current as per IEC 61000-4 Standard

7. General Mechanical Requirements

7.1 The energy meter shall be suitable for outdoor (which MUST be housed in a CT Metering Enclosure) installation.

7.2 The meter shall conform to degree of protection IP53 (as specified in IEC 60529 (2001)) for protection against ingress of dust, moisture and spraying water.

7.3 All the material and electronic power components used in the manufacture of the meter shall be of highest quality and reputed make to ensure higher reliability, longer life and sustained accuracy.

7.4 The meter shall be compact and reliable in design, rugged for rough handling during transport.

7.5 The meter shall have a case made of unbreakable high grade, fire resistant, reinforced polycarbonate or equivalent high-grade engineering plastic which

can be sealed in such a way that the internal parts of the meter are accessible only after breaking the Meter Cover seals.

- 7.6** The meter cover shall be fully transparent made of transparent polycarbonate material for easy reading of all the displayed values/parameters, nameplate details and observation of operation indicator.
- 7.7** The meter dimension shall be 277mm x 175mm x 89mm (Extended terminal Cover)
- 7.8** The window dimension shall be 90mm x 120mm.
- 7.9** The meter base and meter cover shall be ultrasonically welded fully in a seamless manner. In addition, providing self-lockable feature for top cover like press-fit mechanism or unidirectional screws is desirable.
- 7.10** Arrangement shall be provided to record the opening of meter cover with date and time of opening with snapshot for kWh reading. Once the meter cover is opened, the LCD shall display only "C-OPEN" or "TAMPER", on display and stop the display sequence in Auto display mode. However, the meter shall continue to register the energy consumption and it shall be possible to view the data in push button mode as well as data download to CMRI/Laptop through optical communication port.
- 7.11** The meter case shall have at least three mounting holes. Two holes for mounting screws on the terminal block sealed beneath the terminal over and one for hanging screw on the top.
- 7.12** All parts, 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. Meter shall withstand solar radiation.
- 7.13** All insulating material used in the construction of the meter shall be non-hygroscopic, non-aging and of tested quality.
- 7.14** The terminal block, terminal cover, meter cover and meter case shall ensure reasonable safety against the spread of fire. They shall not be ignited by thermal overload of live parts in contact with them.
- 7.15** Meter shall be designed and constructed in such a way as to avoid introducing any danger in use and under normal conditions so as to ensure specially:
 - 7.15.1** Personnel safety against electric shock
 - 7.15.2** Personnel safety against effects of excessive temperature.
 - 7.15.3** Protection against spread of fire
 - 7.15.4** Protection against penetration of solid objects, dust and water.

- 7.16 Type test certificates shall be provided in support of the above.
- 7.17 Detailed dimensional drawing of the meter is to be furnished along with the meter.

8. Metering Components

- 8.1 The meter shall use 3 No's of high accuracy CTs; all for the phases.
- 8.2 Meter shall be manufactured using SMT (Surface Mount Technology) components and by deploying automatic SMT pick and place machine and re-flow solder process.
- 8.3 It is preferable to have the electronic components integrated into single chip. The integrated chip may consist of metrology engines, LCD drivers, I/Os, RTC, communication port, program memory and data memory etc.
- 8.4 The calibration of meter must be carried out digitally and in-house only. It shall not be possible to calibrate the meter without opening the meter cover once the meter passes the above tests.

9. Display

- 9.1 The meter shall have a minimum 2 lines 8-digits pin type built-in Liquid Crystal Display (LCD) with few more digits for legends. It is preferable to have decimal digit slightly smaller than the integer digits.
- 9.2 The energy (except in high resolution mode) shall be displayed with one decimal digit.
- 9.3 The minimum size of each digit shall be 8mm (Height) x 4.2mm (Width).
- 9.4 The LCD shall be STN/ transfective type industrial grade with extended temperature range. The LCD may be subjected to 65°C temperature for at least 72 Hours. The display shall be visible and readable after the test.
- 9.5 The LCD shall have STN type with horizontal viewing angle of $\pm 50^\circ$ and vertical viewing angle of $+60^\circ/-35^\circ$.
- 9.6 The display module shall be well protected from the external ultraviolet radiations.
- 9.7 The LCD shall be with backplane with LED illumination. The LCD shall be bright and with uniform backlit.
- 9.8 It shall be possible to display contents of relevant parameters/tamper events with another digit displaying legend for identification.

9.9 The meter should have facility for a manual mode where the parameters can be read by push button operation. The manual display shall switch over to auto-display mode automatically after 30 idle minutes.

9.10 The electronic display of parameter need not be visible, when meter is not energized.

10. Battery

10.1 The battery provided shall be of Lithium Thionyl Chloride (LiSOCl₂) with 20 years of useful life and a minimum of 3 years shelf life.

10.2 It is preferable that the battery is of cylindrical type with more than 800mAh capacity and rated output voltage of 3.6V.

10.3 The battery shall support powering up the meter in the event of mains power failure. This battery shall support meter reading through meter display as well as complete meter data download through CMRI.

10.4 Meter reading through battery shall be restricted to 5 times only for a maximum duration of 30 minutes in a month.

10.5 The datasheet or/and the test certificates shall be provided for the same along with the meter.

11. Output Devices

11.1 The meter shall have a suitable test output device for testing of meter. The blinking LED or other similar device shall be provided. Test output should also work as operating indicator for meter.

11.2 The device shall be suitable for use with sensing probe used with test benches or reference standards.

11.3 The test output device shall have constant pulse rate i.e. number of impulses per kWh and impulses per kVAh and their values should be indelibly printed on the name plate.

11.4 It is preferable that two separate output devices, one for active energy and second for reactive energy are provided.

12. Meter Constant

12.1 The relation between test output and the indication in the display shall comply with the marking on the nameplate.

12.2 The meter constant shall be preferably 10000 imp/kWh or kVAh or kVAh.

- 12.3 Set parameters 400 – 20000imp/kWh programmable through PC software which will be effective after configuration.
- 12.4 The manufacturer shall state necessary number of pulse/counts to ensure a measuring accuracy of at least 1/10 of the accuracy class at different test points.

13. Real Time Clock

- 13.1 The meter shall have a real time clock based on a quartz crystal with a battery totally independent of power supply.
- 13.2 The accuracy of the clock shall be $<0.5s$ per 24hours
- 13.3 The time measurement shall be independent of line frequency.
- 13.4 A lithium maintenance free battery of long life (minimum twenty years) shall be provided for operation of time clock.
- 13.5 It shall be possible to select the various time zones for various seasons of the year through suitable software built into the electronic register.
- 13.6 It shall be possible to synchronize Real Time Clock (RTC) of the meter through AMR through explicit software command. The software module with password protection specifically to reset/correct RTC shall be provided.
- 13.7 The drift in RTC shall not be more than ± 3 minutes in a year.

14. Memory

- 14.1 The meter shall have non-volatile memory, so that the registered parameters will not be affected by loss of power.
- 14.2 The non-volatile memory shall have a minimum retention time of 15 years.
- 14.3 The memory shall have sufficient capacity to store energy data, load survey data and tamper data as per the relevant clauses of this specification.

15. Communication Facilities

- 15.1 The meter shall be equipped with a galvanically isolated optical communication port with removable cover and with locking arrangement so that it can be easily connected to an MRI/laptop for data transfer or transfer of data through remote metering device such as modem / multiplexer etc.
- 15.2 In addition, the meter shall be provided with:

Local Communication: Optical/Infrared, RS232, RS485, PLC, RF (433/866MHz)

Remote Communication: GPRS/GSM, Wi-fi, Ethernet
Communication Protocol: DLMS/COSEM, IEC62056-21, MODBUS

- 15.3 The optical communication port shall also have a sealing provision.
- 15.4 The details of speed at which data is to be downloaded from meter to MRI/laptop shall be provided. Also, the maximum time the meter will take to download following sets of data form meter to MRI/Laptop shall be provided.
 - 15.4.1 Energy values
 - 15.4.2 Energy Values and Tamper data
 - 15.4.3 Energy values and load survey data
 - 15.4.4 Load Survey data
 - 15.4.5 Tamper data
 - 15.4.6 Entire data set including energy values, load survey, tamper and transaction data
- 15.5 The meter manufacturer would be responsible for ensuring that the data extracted from the meter using manufacturer specific algorithms in the software up to downloading to the BCS remains secure during the process.

16. Terminal Block

- 16.1 The terminal block shall be of high grade non-hygroscopic, low tracking property fire resistant, reinforced polycarbonate (Non-Bakelite) or equivalent high-grade engineering plastic which shall form an extension of the meter case and have terminal holes and shall be of sufficient size to accommodate minimum 2.5sqmm solid/stranded copper conductors.
- 16.2 The manner of fixing the terminals shall ensure adequate and durable contact such that there is no risk of loosening or undue heating. Detailed drawing of the terminal arrangements shall be provided.
- 16.3 Two screws shall be provided in each terminal for effectively clamping the conductor or thimbles. Each clamping screw shall engage at least 3 threads in the terminal after insertion of the cables.
- 16.4 The terminals and connections shall be suitable to carry up to 200% of I_b continuously and shall be capable of passing the test given in ISO75 for temperature of 135°C and a pressure of 1.8MPa. The test certificate in support of the same shall be provided along with Meter.
- 16.5 The terminals shall have suitable construction with barriers to prevent short circuit inside the meter.

- 16.6 The potential link shall not be provided outside on meter terminal block. Internal solid link having adequate capacity shall be provided.
- 16.7 All parts of each terminal shall be such that the risk of corrosion resulting from contact with any other metal part is minimized.
- 16.8 The terminals shall be marked properly on the terminal block for giving external connections.
- 16.9 Detailed drawings of the terminal block shall be provided along with Meter.

17. Terminal Cover

- 17.1 The terminal cover shall be made of transparent high-quality polycarbonate
- 17.2 The terminal cover and meter base shall be extended such that when the terminal cover is placed in position, it is not possible to approach the connections or connecting wires
- 17.3 Suitable cut-outs to be provided for cable entry
- 17.4 The following shall be marked on the terminal cover
 - 17.4.1 Manufacturer's name or Logo
 - 17.4.2 Connection diagram
- 17.5 The marking shall be indelible, distinct & readable from outside the meter.
- 17.6 Detailed drawings of the terminal cover and sealing arrangement on the meter shall be provided.
- 17.7 The terminal cover shall be separate from the meter body and shall be of removable type for ease of installation/maintenance.

18. Sealing Arrangement

- 18.1 The meter cover shall not be removable without breaking the seal and leaving the significant evidence. In case of opening of the cover, necessary indication is required to be appeared on the display. The meter cover shall have at least two sealing arrangements on either side, each having two sealing holes for applying polycarbonate seals. If sealing screws are provided, the same shall be made of brass and capable of being tightened from the rear.
- 18.2 Separate sealing arrangements shall be provided for terminal cover and communication port.
- 18.3 The sealing arrangement on meter shall be suitable for application of polycarbonate seals as well as hologram seals. Adequate plain surface shall

be made available on the sides of the meter to facilitate application of hologram seals.

- 18.4** The manufacturer shall provide one polycarbonate seal on Meter. The seal shall be applied on the left side of the meter.
- 18.5** The manufacturer shall provide one hologram / stick seal on meter. The seal shall be applied on the right side of the meter.

19. Nameplate and Marking

- 19.1** Meter shall have a nameplate clearly visible and effectively secured against removal, indelibly and distinctly marked with all essential particulars as per relevant standards.
- 19.2** The rating plate of the meter shall have distinct background color so as to be differentiated from other classes/ratings of the meter.
- 19.3** The marking on meter shall be in accordance with IEC:62053-11:2003. In addition to the standard, following shall be marked on the nameplate.

19.3.1 Manufacturer's name and place of manufacture

19.3.2 Meter type

19.3.3 Number of phases and wires

19.3.4 Alphanumeric serial number (It shall have letter height of minimum 5mm)

19.3.5 Bar code (Code 128/ Type 3 of 9) of the serial number

19.3.6 IEC mark

19.3.7 Month and Year of manufacture

19.3.8 Reference voltage & frequency

19.3.9 Principal unit in which the meter reads (kWh, kVAh, kVAh)

19.3.10 Rated Current (Basic current & Maximum current)

19.3.11 CT Ratio

19.3.12 Meter constant (Imp/kWh & Imp/kVAh)

19.3.13 Accuracy Class of the meter

19.3.14 Symbol of Ultrasonic Welding

19.3.15 Sign of Double square for Insulation encased meter

19.4 The marking shall be indelible, distinct & readable from outside the meter.

20. Connection Diagram

20.1 Meter shall be indelibly marked with connection diagram showing the phase/neutral sequence for which it is intended and shall be attached to the inner side of the extended terminal block cover.

20.2 In case of any special precautions need to be taken at the time of testing the meter, the same may be indicated along with the circuit diagram.

20.3 Drawings of the connection diagram shall be furnished along with the meter.

21. Measurement of Energy

21.1 The meter shall be capable of measuring total energy consisting of fundamental energy and harmonic energy. Total displayed energy shall be including of harmonic energy i.e. Total Energy (Active, reactive or Apparent) = Fundamental Energy + Harmonic Energy

21.2 The details as to how harmonic energy is to be measured shall be provided.

21.3 KVAh calculation should be the vector sum of kWh, kVArh (Lag) and kVArh (Lead)

22. Power Quality

22.1 Meter should record under voltage and overvoltage and also power cut.

22.2 Events related to under voltage and overvoltage should be recorded in the meter. Threshold of under voltage (phase to null) is from 220 to 180 by 5V steps and for overvoltage (phase to null) is from 240 to 265 by 5V steps

22.3 These events won't be recorded unless they continue for equal or much more time than the time set for under voltage and overvoltage threshold. This time may adjust between 1 to 60 seconds (by 1 sec. steps).

22.4 For each under voltage, min. voltage during one period should be recorded and the phase which under voltage is happened should be detected and recorded.

22.5 For each overvoltage, max. Voltage during one period should be recorded and the phase which overvoltage is happened should be detected and recorded.

22.6 Moreover, meter should have 3 counters (T1, T2, T3) to read different under voltage and overvoltage periods as bellow:

- Overvoltage more than 15% nominal voltage for L1, L2 and L3 phases.
- Overvoltage more than 10% and less than 15% nominal voltage for L1, L2 and L3 phases.
- Under voltage more than -15% and less than -10% nominal voltage for L1, L2 and L3 phases.
- under voltage less than -15% nominal voltage for L1, L2 and L3 phases.
- T1, T2, T3 counters are defined and readable in following intervals (the intervals are per second):
 - $1 < T1 < 3$
 - $3 < T2 < 20$
 - $20 < T3 < 60$

22.7 Parameters related to threshold and duration of under voltage and overvoltage stability should be adjustable locally and remotely.

23. Maximum Demand Registration

23.1 The meter shall continuously monitor and calculate the average demand in kW and kVA during the integration period set and the maximum, out of these shall be stored along with date and time of occurrence in the meter memory.

23.2 The rising demand under the current integration period shall be displayed along with the elapsed time.

23.3 The meter shall memorize maximum demand data (together with date and time of occurrence) for last 12 months on FIFO basis.

23.4 The integration period shall be 30 minutes based on real time.

23.5 MD Reset

The meter shall have any and combinations of the following MD resetting options. It shall not be possible, in any case, to reset MD through push button.

23.5.1 Automatic reset on a particular day of the month.

23.5.2 At the end of every month i.e. 24:00 Hrs of last day of the month

23.5.3 On the last day of every month at 00:00 Hrs

23.5.4 Resetting through a hand held terminal or Computer capable of communicating with the meter with explicit password protection. The software module specifically for resetting MD through MRI / Computer shall be provided.

- 23.6** The time measurement shall be independent of line frequency.
- 23.7** The meter shall memorize the Cumulative Maximum Demand (CMD) and the same shall be available in meter display and BCS.
- 23.8** The meter shall also memorize and display the MD reset counts.

24. Time of Day (TOD) Tariff/Demand

- 24.1** The meter should be capable of registering time of day energy consumption on stand-alone basis.
- 24.2** The meter shall be suitable to measure and record kW/kVA demand and active and apparent energies consumed during various time blocks of the day. It should be actuated by an inbuilt real time clock which has the capability of being set to indicate time zones in a 24-hour cycle with adjustable duration of time zone. The registers shall indicate all parameters mentioned in this specification above for every time zone.
- 24.3** It shall be possible to set minimum of 8 time zones in a 24-hour cycle and two seasons in a year. TOD times and definition of seasons are mentioned in Annexure - B.
- 24.4** It shall be possible to change the time for TOD recordings through CMRI in the meter itself with proper security.
- 24.5** Time of day register shall be provided for active energy/ apparent energy and demand data (kW, kVA). Meter should indicate activeness through the current time of day register on display.
- 24.6** It shall be possible to retrieve this data through communication port.
- 24.7** TOD time zone shall be programmable as per the requirement of LEC.

25. Load Survey and Daily Energy

- 25.1** The meter shall log energy and demand for active, reactive and apparent for each integration period of 30-minute, for a minimum of 70 days. However, the meter resident software shall be reconfigurable in order to select any one or a group of above parameters for load survey.
- 25.2** The meter shall log the following parameters in the load survey for each Integration period of 30-minute
- Average Voltage (R)
 - Average Voltage (Y)
 - Average Voltage (B)
 - Average Current (R)
 - Average Current (Y)
 - Average Current (B)
 - Active Energy (kWh)

- Apparent Energy (kVAh)
- Reactive Energy – Lag (kVArh)
- Reactive Energy – Lead (kVArh)

In addition, the BCS shall also display the following parameters in load survey

- Active Demand (kW)
- Apparent Demand (kVA)
- Reactive Demand – Lag (kVAr)
- Reactive Demand – Lead (kVAr)
- Power Factor

25.3 Following Daily energy/ data at midnight cross-over shall be recorded (cumulative values) for 90 days

- C-kWh
- C-kVAh
- C-kVArh-Lag
- C-kVArh-Lead

25.4 Data logging should be on first in first out basis.

25.5 It should be possible to transfer this data on computer and to a hand held Meter Reading Instrument / Data Collection Device.

26. Quantities to be Displayed

26.1 The meter shall be capable of measuring and displaying the electrical quantities mentioned in Annexure – A within specified accuracy limits for all loads and power factors.

26.2 It shall be possible to configure the display sequence either in auto-scroll mode or manual push button mode.

26.3 The meter shall have facility for a manual mode where the parameters can be read by push button operation. The manual display shall switch over to auto-display mode automatically after 30 idle minutes.

26.4 It shall be possible to lock/freeze the display of any parameter by long pressing of the pushbutton for monitoring the parameter.

26.5 It shall be possible to unlock the parameter by long pressing of the push button.

27. Anti-Tamper and Fraud Protection

The meter shall have the following special features to prevent / to detect tampering of metering system:

- 27.1** Meter should support password with 3 access levels:
- Meter Reading
 - Meter Configuration
 - Firmware upgrade

Each meter password should have inaccessible and protected codes

- 27.2** The meter shall not get affected by the action of any remote-control devices including injection of high frequency voltage surges / spikes. Meter shall log event with snap shot of parameters when meter accuracy or component's function get affected by such tampering attempts.
- 27.3** The meter shall record at rated voltage, unity power factor and I_{max} under the influence of external AC/DC/ permanent magnetic field irrespective of actual load. The meter shall run as per actual load once the external magnet is removed. Persistence time for magnetic tamper logging shall be 10 seconds. Event shall be logged with snap shot. Meter shall record energy in main register as well as in defraud register. Defraud register shall be available in BCS and meter display.
- 27.4** The meter shall record an event when average kW or kVA drawn by the consumer during an Integration period is more than the specified threshold value of kW and kVA. The event shall be supported by date & time and average load for that integration period.
- 27.5** The meter must be capable of recording & displaying tamper information along with the date and time of all tamper occurrence and restoration including initial & final tamper for the following:
- Phase wise voltage failure
 - Voltage unbalance
 - CT Short/ Bypass
 - Phase wise CT Open
 - Current Unbalance
 - Phase wise Current reversal
 - High Neutral Current (CT Bypass)
 - Over load
 - Meter cover open
 - Magnet tamper
 - Neutral Disturbance
 - HV / HF (ESD)
 - Power-Off
 - Meter reprogramming
 - Tariff change
 - Time & Date change
 - Existence of current, despite absence of one or two phases
 - Relay is disconnected but customer is not disconnected from power network
 - Meter cabinet door open
- 27.6** The meter shall work accurately irrespective of phase sequence of the mains supply.
- 27.7** The meter shall remain powered up and functional in presence of any two wires.

- 27.8 The meter shall continue to record accurately even if the neutral of supply gets disconnected.
- 27.9 The meter shall record correct energy in forward direction in case of current reversal of one or more phases.
- 27.10 The meter shall be capable of recording incidences of excess neutral current (if it is in excess of 10% of I_b for more than 5 minutes).
- 27.11 The meter shall record the total duration of the above abnormalities, time and date of occurrences and restorations with snapshot of instantaneous electrical conditions viz. System voltages, Phase Currents and System PF.
- 27.12 The measurement by meter shall not get influenced by injection of AC Voltage/Chopped signal/DC signal and Harmonics
- 27.13 Minimum 300 tamper events with date and time shall be stored on first in first out basis and made available through the CMRI. The total number of tamper events shall also be available. The tamper events shall be registered in sequential block storage. The size of the block for each of the tamper shall be as follows:

S/N	Tamper Type	Block
1	PT Missing, Invalid voltage, Low Voltage, Voltage Unbalance, Neutral disturbance	100
2	CT Reversal, CT bypass/ CT Short, CT Open, Current Imbalance, Over Load	100
3	Magnet	5
4	Power On/ Off	90
5	Cover open, ESD	5

- 27.14 Meter shall record all the above mentioned events on first in first out basis along with date & time and snapshots (Occurrence and Restoration) of instantaneous parameters (Individual Voltage, Individual Current and Power factor), Active energy, Reactive & Apparent energy for Phase wise voltage failure, Voltage unbalance, CT short / Bypass, Phase wise CT open, Current unbalance, Phase wise current reversal, Over load, Meter cover open, Magnet, Neutral Disturbance, HV / HF & Meter working without load.
- 27.15 All this information shall be available in simple and easily understandable format and shall be possible to export in industry standard office suites. The software shall include various summary reports on tamper events.
- 27.16 It shall be possible to retrieve the tamper data through optical port to a common meter-reading instrument or directly to the computer.

- 27.17** The details as to how their meter is able to detect / protect / recording the above tamper along with the threshold values and fraud features with sketches and phasor diagram wherever necessary should be furnished.
- 27.18** Moreover, the meter should give information of instantaneous voltages, currents, power factor, frequency, power etc. while downloading the meter data through Meter Reading Instruments/Data Collection Device.

28. Event Log

- 28.1** The meter shall be capable of been programmed with a minimum of 5 configurable events log
- 28.2** Trigger event to be recorded by the system are:
- Power Break
 - Phase Failure
 - Phase Voltage Loss
 - High Voltage
 - Under Voltage
 - Current Imbalance
 - Over-Current
 - Reverse Current Flow
 - Reverse Power
 - Reverse Energy
 - Phase Reversal
 - High Neutral Current (CT Bypass)
 - Overload
 - Terminal Cover Open
 - Meter Top Cover Open
 - Meter Cabinet Door Open

29. Compatibility to External Influencing Signals

- 29.1** The meter shall be capable to protect against adverse effect of AC/DC/ Permanent abnormal external magnetic field of minimum 0.5 Tesla. Meter shall log event with snap shot when meter accuracy or component's function get affected by such event.
- 29.2** The meter shall be capable to protect against the action of any remote-control devices including injection of high frequency, high voltage surges / spikes, Electro Static Discharge more than 35 KV & HF up to 10 GHz
- 29.3** The meter shall be capable of protecting and archiving all the data in case of any tamper which affects the memory, power supply units, microcontroller, RTC etc.
- 29.4** The meter shall be designed in such a way that conducted or radiated electromagnetic disturbance as well as electrostatic discharge do not damage or substantially influence the meter and its performance. The disturbance to be considered are: -

- Harmonics
- Voltage dips and short interruptions
- Conducted transients
- DC and AC magnetic fields
- Electromagnetic fields
- Electrostatic discharges
- High voltage/ High Frequency sparks

29.5 The performance of meter should be as per IEC: 62053-21 and latest version thereof.

29.6 The meter shall not generate noise, which could interfere with other equipment.

30. Self-Diagnostic Features

30.1 Indications to show the satisfactory performance of the meter shall be provided in the meter. The meter shall have capability to check its circuits for any malfunctioning. There should be a defined diagnostic cycle, for instance every one hour, and if some malfunctioning occurs, the meter may display the malfunctioning of the meter.

30.2 The meter shall have internal diagnosis feature to monitor micro control functions to ensure correct operation of demand interval time by quartz crystal timer.

30.3 Minimum features of internal diagnosis to be provided are Time, calendar, RTC, RTC battery and NVM.

30.4 The meter shall also have self-diagnostic feature to detect any increment in energy registers on no-load.

31. Software

31.1 The following software shall be supplied along with the Meter.

31.1.1 Software for downloading data from meter through meter reading instrument / computer/ AMR (PSTN/ GSM / GPRS/ CDMA).

31.1.2 Exclusive software for changing date of monthly MD reset

31.1.3 Exclusive software for changing the display sequence

31.1.4 Exclusive software for changing Integration period for max demand

31.1.5 Exclusive Software module for changing TOD / seasonal tariff timings.

31.1.6 Exclusive Software module for resetting tamper data and tamper counts

- 31.1.7 Software module for adjustment of real time of the meter through meter reading instrument with proper password protection.
- 31.1.8 Base Computer Software for accepting data from MRI and uploading instructions from base computer to MRI.
- 31.1.9 The BCS shall give complete details of the Energy and demand pattern both in numeric data form and in graphic form.
- 31.1.10 Energy and Demand data shall be displayed starting from 0000 to 2400 hours on daily basis in graphic form. Graphic software shall be capable of displaying different quantities in cumulative form and in any combination as per requirement. Graphic software shall be capable of displaying data in monthly, weekly and daily combinations.
- 31.1.11 BCS shall have facility to export data to ASCII and Spreadsheet compatible format.
- 31.2 The meter shall be capable to communicate directly with meter reading instrument and laptop computers.
- 31.3 The meter shall support automated meter reading through optical port/RS 232 communication port. Details of all such software and facilities shall be furnished with the meter.
- 31.4 All the software modules shall have to be password protected and compliant with Microsoft Windows 7 and latest operating system.
- 31.5 All the software shall have to be hardware independent and any changes in software at a later date shall not be restricted by hardware used in the meter.
- 31.6 Software shall be suitable for all type of printers.
- 31.7 All the communications shall have to be done through open protocol. The details of protocol used for the communication to be provided.
- 31.8 The copies of all necessary software on compact discs & communication

Note: The Server-Client (AMI) application needs to be purchased as well as the basic meter reading software. These items are very important.

32. Modular Communication modem for LAN and Direct Connection from Meter to Central System

- 32.1 Adding or exchanging the communication modem should be done without turning off the meter.
Note: Responsibility of communication module is limited only to establish communication with LAN or WAN and other capabilities of Smart Meter should be deployed on meter base.

- 32.2 Existence or absence of communication modem should have no impact on meter measurements.
- 32.3 Meter should be able to support different communication modems (such as: PLC, RF, GSM/GPRS...) and all these modems should be addible to meter.
- 32.4 By turning on the Modem it should be able to communicate directly or indirectly with data concentrator and complete the Self Registration step
- 32.5 Communication modem should be industrial type and has watch dog mechanism and also it has the ability to retrieve itself when it is hanged
- 32.6 Communication modem should be manufactured according to industrial equipment standards.
- 32.7 Meter should be in such way that no needs to unseal the terminal cover to add the communication modem and modem should be sealed in meter body.
- 32.8 Plugging and unplugging communication modem should be recorded as event in meter. Meter should record at least 10 recent events for plugging and unplugging of communication modem.

Note: GPRS is the preferred communication method between the meter and the central system. A communication modem is to be retrofitted in each meter cabinet.

33. Local and Remote Meter Reading

Below parameters should be collectable locally and remotely:

- Meter status
- Meter reading parameters (schedules and on demand parameter)
- Meter configuration
- Time & Date
- Log information
- Events and alarms

34. Internal Relay's Connection/Disconnection

- 34.1 Internal Relay should have the ability to be opened and closed.
- 34.2 Meter should record status of internal relay and its remote evaluation should be possible.
- 34.3 Internal relay's status reading should be on schedule or on-demand.
- 34.4 Meter should be able to display status of internal relay (connection/disconnection) clearly

- 34.5** Above-mentioned status should be programmable on meter locally and remotely

Note: The meter will not be performing the disconnect per say. A disconnect signal will be sent from the prepaid meters internal relay to the breaker to cut off the customer from supply when their credit has been exhausted.

If in the future it is decided that this meter is to be used in the post-paid metering mode, the meter should be able to receive a disconnect signal sent from the central system when a customer defaults on paying his/her bills thus effecting a disconnection of supply.

34.6 Internal Relay's Operation

- 34.6.1** Internal relay's remote disconnection (open): In case of remote disconnection and lock out the operator cannot connect internal relay manually.
Internal relay should be able to move from open position to "ready for reconnection" or close position by remote command.
- 34.6.2** Remote "ready for reconnection" position of internal relay: It should be possible to put internal relay in "ready for reconnection" position, remotely. In this case the internal relay is open but there is a possibility to close it manually or by internal processes.
Internal relay should be able to move from "ready for reconnection" position to open and locked out position by remote command.
This status should be shown in meter display.
- 34.6.3** Internal relay's remote re-closing: It should be possible to close the internal relay remotely. Internal relay should be able to move from close position to open and locked out position, remotely. Internal relay should be able to move from close position to "ready for reconnection" position, by manual or internal commands.
- 34.6.4** Internal relay's manually re-closing: Internal relay manually re-closing should be only possible to allowed persons.
Meter should only allow manually closing of internal relay if it is in "ready for reconnection" position otherwise (open + locked out) it is not allowed.

34.7 Internal Relay's Settings

- 34.7.1** Internal relay should be adjustable remotely or locally to answer connection/disconnection commands.
- 34.7.2** Connection/disconnection times for each meter are adjustable manually or remotely.
- 34.7.3** For meter, remote commands have the highest priority then there are manual commands and meter internal settings consecutively.

34.7.4 Internal relay should be adjustable remotely or locally to answer connection/disconnection commands.

34.8 Technical Specification of Internal Relay

34.8.1 Internal relay should be Impulse relay or Latching relay

34.8.2 Contact Specification according to IEC6205-21 and IEC61810-1:

- Support general and safety requirements
- Contact material should be AgSnO₂
- Min. switching power 2.5 kVA
- Min. switching voltage 400 V
- Min. switching current 10 A
- Mechanical life time >100.000 cycles off load
- Mechanical life time >10.000 cycles by load of 10A and cos phi=1
- Short circuit rating more than 300A for 10 msec.

34.8.3 Insulation Specification:

Dielectric strength, open contact 2kV peak/1kV RMS Dielectric strength, coil contact

Tamper protection against magnetic DC fields

35. Prepaid and Connect/Disconnect Features

The meter should support automatic disconnection and reconnection mechanisms.

35.1 Disconnection Mechanism:

The meter should support disconnection under the following conditions:

- Over current
- Load control limit (Programmable and set by LEC)
- Disconnection signal from prepaid engine (Remote disconnection on demand)

35.2 Reconnection Mechanism:

The meter should support reconnection under the following condition:

- Local reconnection due to disconnection under over current and load control limit.
- Remote reconnection after receipt of command from prepaid engine when the customer recharges or a command is sent from the control center.

36. Installation Check

36.1 After installation, the meter shall have a facility to check the correctness of connections to the meter and their polarity.

- 36.2** The meter shall also capable of checking phase sequence of voltage and current as well as phase association between voltage and current.

37. Type Tests

- 37.1** The meter should have type test certificate that include details of test results according to IEC 62053-23, IEC62052-11, IEC62053-22, IEC62054-21 from international accredited laboratory. The type test should include all test that mentioned in the standards
Some important tests are:
- Environment test include Cool, Heat, Dryness, Wet, heat, Random vibration and stroke
 - EMC tests consisting of electrical discharging and electromagnetic waves
 - Surge, Fast Transient/Burst
 - High voltage, Insulation and Error changes tests
- 37.2** Meter should have certificate for IEC62056 DLMS/COSEM from international accredited laboratory.
- 37.3** Communication modem should have certificate for industrial equipment's from international accredited laboratory.

38. Extra Capabilities

- 38.1** Meter should have 12 registers of billing for 12 periods (monthly) for energy and Max. Demand.
Meter should have 31 register of billing for 31 period(daily) for energy.
- 38.2** Insulation protection class should be 2.
- 38.3** Specified Operating Range ranges from -25 to +60°C and tolerable humidity is 95%
Limit Range of Operation ranges from -40 to +70°C.
Limit Range for Storage and Transport ranges that meter work by maintaining its accuracy class without any failure from -40 to +70°C.
If the meter is used in cold or hot climate areas, these ranges will be change according to standard.
- 38.4** Meter's failure rate should be less than 0.5% per year and MTBF will be specified and guaranteed by manufacturer.
- 38.5** Meter life time should be more than 20 years
- 38.6** Meter and its power supply should be protected against surge voltages of network
- 38.7** Meter should be protected against Electromagnetic Compatibility (EMC).

- 38.8** Meter input voltage range for normal operation should be from 80% to 115% of nominal voltage.
Meter should be on and work with at least connection of one phase and neutral.
- 38.9** Meter should be protected against steady state voltage more than 400V between terminals.
- 38.10** In case of software hanging, the meter should retrieve itself in minimum time without any damage to saved data (meter should be equipped with watch dog mechanism).
- 38.11** Max. error permission range for Voltage, Current, Frequency, Power factor, Asymmetric Loads and temperature changes should be according to latest version of IEC standard for electricity meters.
- 38.12** In case of power cut off, basic data like consumed energy, tariffs, customer ref. no and meter serial No, calendar, settings and tariff time intervals should be saved in non volatile memory.
- 38.13** Meter should be self-check and Diagnostic. So, if an error appears in internal components (such as RAM, EPROM, RTC ...etc) meter should record and report it to central system through communication port.
- 38.14** Meter should record at least one User ID With 16 characters.
- 38.15** Meter calibration should be kept during its life time and there should be no need for re- calibration.
- 38.16** It should be possible to apply CT ratios to the meter through software.
- 38.17** Meter should support read without power (RWP) capability with flowing situations:
 - LCD of meter should be readable at least for 3 times
 - RWP capability should not have effect on RTC battery life time
- 38.18** Meter's firmware should be upgradable remotely and locally. Upgrading of firmware should not stop and affect meter's metrology.
- 38.19** Power terminal layout, distance between power terminals and the other requirements should be according to DIN Standard.

39. Meter's Backup Supply

- 39.1** Meter's clock and date shall be fed for 7 days after presentation of battery alarm.
- 39.2** Beside the super cap, the meter should have backup lithium battery. The life cycle of the battery should be more than 10 years and after 5 years from

production of battery, the battery should keep meter time & date without power up to 2 years.

- 39.3 Replacement of battery should be easy with no need to solder and access to meter's internal circuits.
- 39.4 It should be possible to seal the battery in meter case.
- 39.5 In the case of meter installation and terminal cover removal the meter's time & date should not stop.

40. Communicating with HHU (Hand Held Unit)

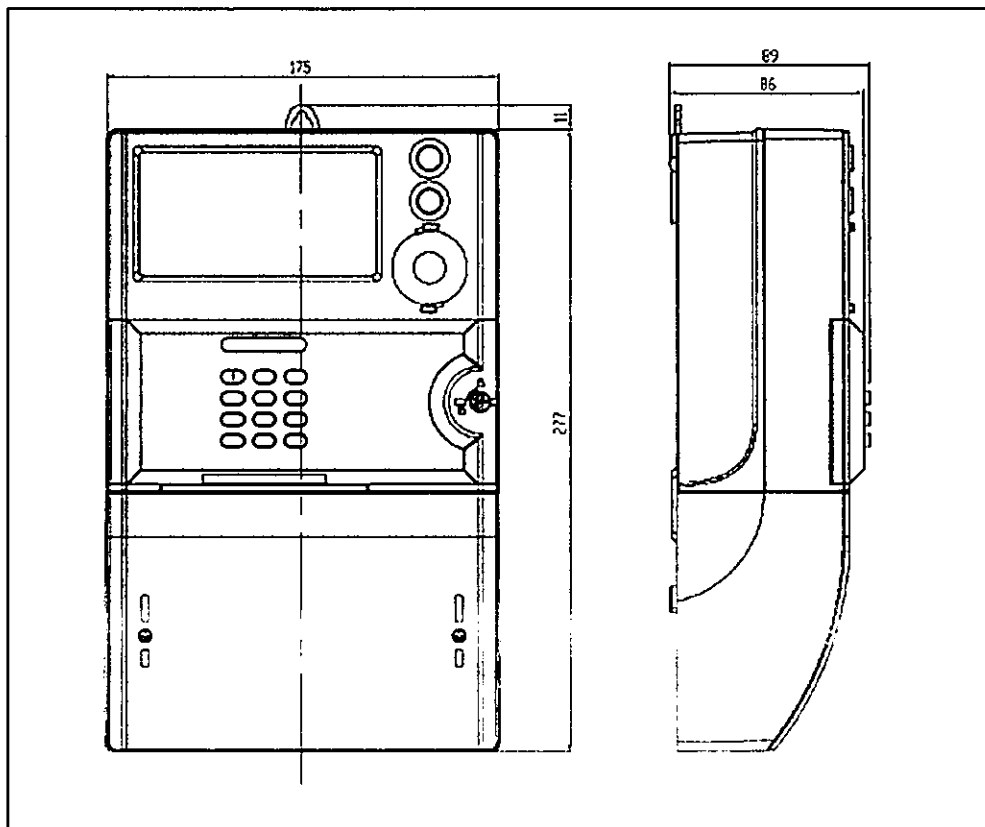
- 40.1 HHU should have all capabilities of configuration (including tariff change, connect, disconnect, etc.) and meter reading in format of information package (like configuration file) in suitable access levels.
- 40.2 Connection to the meter for sending and receiving data should be possible through Handy terminal and optical port with password and different access levels.
- 40.3 Data communicating between optical port and HHU should be according to latest version of standard on data communication.
- 40.4 After setting (configuration) is done by HHU system, date, time and Hand terminal Id. Code should be recorded in the meter and make sure all the changes are done from software point of view. The recorded data should be readable locally or remotely.
- 40.5 Delivery of software for computer and HHU with no time limitation is mandatory. The number of its licenses or copies will be on mutual agreement.
- 40.6 It should be possible to read load profile through HHU.
- 40.7 If use asymmetrical system to update key, corresponding meter public key should be downloaded from master station to HHU. If use symmetrical key system, corresponding master key of symmetrical key Should be downloaded to HHU.

41. Information to be Submitted with the Meter

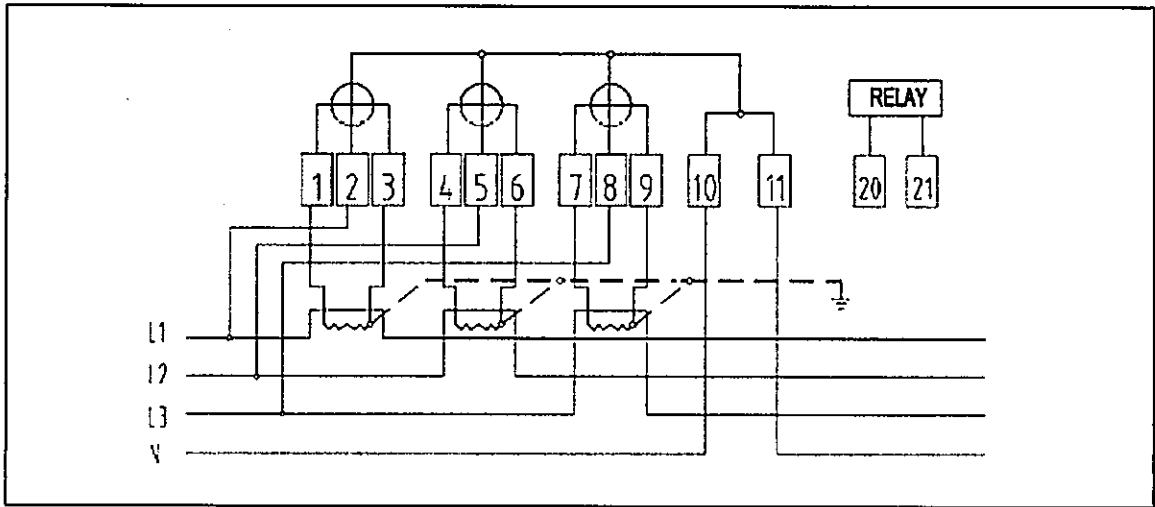
The following shall be furnished with the Meter:

- 41.1 Catalogues describing the equipment and indicating the type and model number
- 41.2 Constructional features, materials used and relevant technical literature
- 41.3 Complete dimensional drawings

- 41.4 The details of the information indicated on the rating plate
- 41.5 Type Test Certificates from a recognized independent testing authority
- 41.6 Wiring diagram
- 41.7 Service manual
- 41.8 Quality systems and Quality Assurance Plan



Outline Dimensions of Meter



Connection Diagram of meter

Annexure A – (Display Indicators)

The following shall be displayed permanently by LED/LCD as a minimum and shall be visible from the front of the smart meter.

- a. Supply indication
- b. Quadrant Indicator (active, reactive direction)
- c. Energy Value
- d. Battery Status
- e. Network (GPRS) Status
- f. Relay Status
- g. Phase voltages Indication
Phase mark disappears when corresponding phase is lost and all should flash together if there is phase sequence error.
- h. Phase Currents Indication
Flashes when phase current reversal is detected
- i. Meter cover forcibly open tamper event

The meter shall be provided with LEDs to indicate communication in progress. Two separate LED indicators should be provided for data transmission (TxD) mode and data receiving (RxD) mode.

1. Auto Display Mode: (10sec for each parameter)

1. LCD Display segment test (3 Sec)
2. Meter Serial number
3. Real Date & Time
4. Active Energy
 - 4.1 Cumulative kWh
 - 4.2 Units in kWh
5. Maximum Demand kVA
6. Three Phase Power Factor (Average P.F. based on kVAh)
7. Tariff Index
8. Cumulative Tamper Count
9. Tamper event of Meter Cover Open with date and time "C-Open"

Note: All the above parameters shall be displayed for a minimum 10 seconds including LCD

test.

2. Manual (Demand) Display through Push Bottom

1. LCD Display segment Test
2. Meter Serial number
3. Software version of meter
4. Real Time Clock - Date & Time
5. Frequency
6. Voltages
 - i. V_{RN}
 - ii. V_{YN}
 - iii. V_{BN}
7. Primary Currents
 - i. I_R
 - ii. I_Y
 - iii. I_B
8. Secondary Currents (S1)
 - i. I_R
 - ii. I_Y
 - iii. I_B
9. Signed Power Factor
 - i. R-Ph
 - ii. Y-Ph
 - iii. B-Ph
10. Phase sequence
11. Cumulative Energy kWh
12. Cumulative Energy kVAh
13. Cumulative kVArh lag
14. Cumulative kVArh lead
15. Power ON Hours
16. No. of switch open or close operations
17. Instantaneous Tamper Status
18. First occurrence of Tamper ID
19. Date & Time of first occurrence
20. Last occurrence of Tamper ID
21. Date & Time of Last occurrence
22. Last restoration of Tamper ID
23. Date & Time of Last restoration
24. Cumulative tamper count
25. Connection Check (PT LO / CT LO / Circuit OK)
26. Cumulative Defraud Energy (6 +1 digits)
27. Tariff details (MD Reset date)

Note: The meter display shall return to Default Display Mode if the "On Demand Push Button" is not operated for 15 secs. The meter shall display the tamper meter cover open with date and time in auto scroll mode along with other parameters.

Annexure B – (Metering Enclosure and Accessories)

The LV Smart Metering Enclosures and Accessories shall be suitable for use outdoors in tropical areas and harsh climatic conditions including areas exposed to altitude of up to 2200m above sea level and humidity of up to 95% non-condensing.

These enclosure and accessories are:

1. LV metering enclosures
2. Isolation circuit breakers
3. Current Transformers
4. Test Terminal Blocks

The LV enclosures and accessories shall be used in 3-Phase 400V Whole Current and CT connected customers with various CT ratios.

1. LV Metering Enclosure

1.1 General Requirements

- 1.1.1 The Enclosure shall house the controllable circuit breaker, smart meter, communication devices, current transformers, terminal test block and connection cables.
- 1.1.2 The Enclosure shall be a smart equipment. The data from the meter shall be accessed both locally and remotely.
- 1.1.3 The smart meter, controllable circuit breaker, communication devices, CTs, terminal test block and connection cables shall be pre-wired such that the installer shall connect only the supply and load cables at the site the equipment is to be installed.

1.2 Technical Requirements

- 1.2.1 The meter enclosure along with the doors shall be fabricated from stainless steel and capable of withstanding mechanical, electrical and thermal stress as well as the effects of humidity as per IEC 62262.
- 1.2.2 The meter enclosure shall be made from stainless steel plate of designation 1.4404 (ASTMA240's 316L) as per EN 10088-2 or its equivalent and have adequate mechanical strength to withstand rough handling as may be expected in normal use.
- 1.2.3 The stainless steel of the meter enclosure shall have a minimum thickness of 1mm.
- 1.2.4 The Enclosure shall be contrasted with a roof tapering down for easy flow of rainwater.
- 1.2.5 The Enclosure shall be constructed to IP65 degree of protection as per IEC 60529 and IEC 62208.2011 standards
- 1.2.6 The Enclosure shall be constructed to allow adequate dissipation of heat.

- 1.2.7** The Enclosure door shall be vandal proof. The Enclosure shall be fixed with inside hinges such that door hinges cannot be removed from outside.
- 1.2.8** The Enclosure shall allow for over 120° (degrees) door opening. The Enclosure shall be easy to operate when the door is open on hinges. A suitable lever to hold the door in open position shall be installed.
- 1.2.9** The Enclosure shall be fitted with suitable fixing brackets with provision for pole mounting, free standing on a concrete plinth or wall mounting.
- 1.2.10** The free-standing Enclosure shall be suitably designed with 4-member support.
- 1.2.11** The Enclosure shall be equipped with at least one earth terminal.
- 1.2.12** The Enclosure shall have a provision for locking (double lock both up and down) and sealing, and shall be able to send an alert if opened. The door shall be equipped with pivot, outer lead bonder is unacceptable.
- 1.2.13** The Enclosure shall be fitted with a lockable and sealable bottom window for manual operation of the controllable circuit breaker.
- 1.2.14** The enclosure shall be fitted with a lockable and sealable front window for recharging and status check.
- 1.2.15** The copper busbars in the enclosure shall be arranged so that it is easy to connect incoming and outgoing cables.
- 1.2.16** The busbar installation in the enclosure shall always be stable when open/closed and heat stabilised.
- 1.2.17** The Enclosure shall leave enough space to install meters, LV CTs, Controllable breaker, and related equipment's. space between meter and cabinet shall be more than 60mm, space between meter and controllable breaker shall be more than 80mm.
- 1.2.18** The Enclosure shall have a nameplate at the bottom of the front, the nameplate shall be durable and clearly marked with the following details:
- Manufacturers name and mark
 - Model
 - Date of manufacture
- 1.2.19** The Enclosure shall have a warning of electrical hazard: DANGER! Also, a sign of CCTV inside the meter
- 1.2.20** The Enclosure shall have a front transparent provision window for viewing the meter LCD display screen
- 1.2.21** The Enclosure shall accessories to meet different installation scenarios such as hang, embed, ground and pole.

2. LV Circuit Breaker

2.1 General Requirements

- 2.1.1 The LV circuit breaker to be fitted in the enclosure shall be a Smart Molded Case Circuit Breaker (iMCCB) that can handle signals and realise intelligent control.
- 2.1.2 The iMCCB shall comply with the IEC 60898 standard.
- 2.1.3 The iMCCB shall support both manual and automatic mode.
- 2.1.4 The rated current of the iMCCB shall be configured to be 1.5-2 times of rated capacity.
- 2.1.5 The iMCCB shall be able to realise remote communication, measure, control and adjust.
- 2.1.6 The iMCCB shall have a friendly interface through LCD and should be easy to operate.

2.2 Technical Specifications

- 2.2.1 **Poles:** 3P-N
- 2.2.2 **Type (wave form of the earth leakage):** AC
- 2.2.3 **Frame Current:** 125A, 250A, 400A, 630A
- 2.2.4 **Rated Current:** 100A, 200A, 300A, 500A, 600A
- 2.2.5 **Rated Voltage:** 400V_{ac}
- 2.2.6 **Insulation Voltage:** 800V_{ac}
- 2.2.7 **Frequency:** 50Hz
- 2.2.8 **Rated Impulse withstand voltage:** 8000V_{ac}
- 2.2.9 **Arcing Distance:** >50mm (<200A), >100mm (>200A)
- 2.2.10 **Rated ultimate short-circuit breaking capacity:** >50kA (<200A), >65 (>200A)
- 2.2.11 **Rated Residual Current (I Δ n):** 100mA, 200mA, 300mA, 400mA, 500mA, 800mA, 1000mA, AUTO, OFF
- 2.2.12 **Breaking Time under I Δ n for Delay Type:** 0.06s/0.1s/0.2s for options 2 I Δ n

2.2.13 Breaking Time: $I_{\Delta n} \leq 0.5s$, $2 I_{\Delta n} \leq 0.2s$; $52 I_{\Delta n} \leq 0.15s$

2.2.14 Auto-recloser Time: 20-60s

2.2.15 Remote Control Delay Time: $\leq 40ms$

2.2.16 Communication Delay Time: $\leq 200ms$

2.2.17 Protections: Overload, Short-circuit, Earth leakage, Auto-reclose, Phase Loss, Over Voltage and Under Voltage

2.2.18 Monitoring of electrical circuit parameters: Current, Voltage, Power, Temperature, Frequency, Power Factor.

2.2.19 Connectivity: RS485, WIFI, TCP, GPS

2.2.20 Communication Protocol: TCP, Modbus

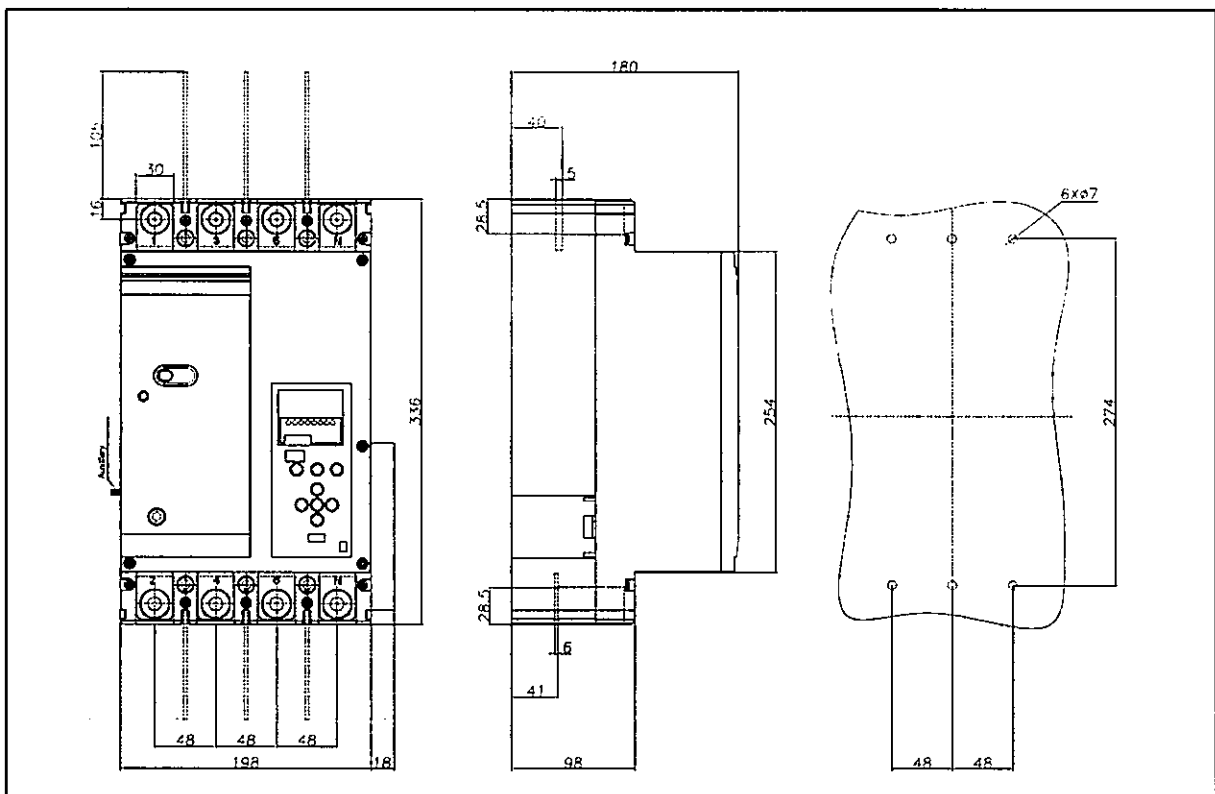
2.2.21 Ambient Temperature: -15 - +40

2.2.22 Storage Temperature: -25---+70

2.2.23 Humidity: $< 95\%$

2.2.24 Altitude: $\leq 2000m$

2.2.25 Connection: From top to bottom



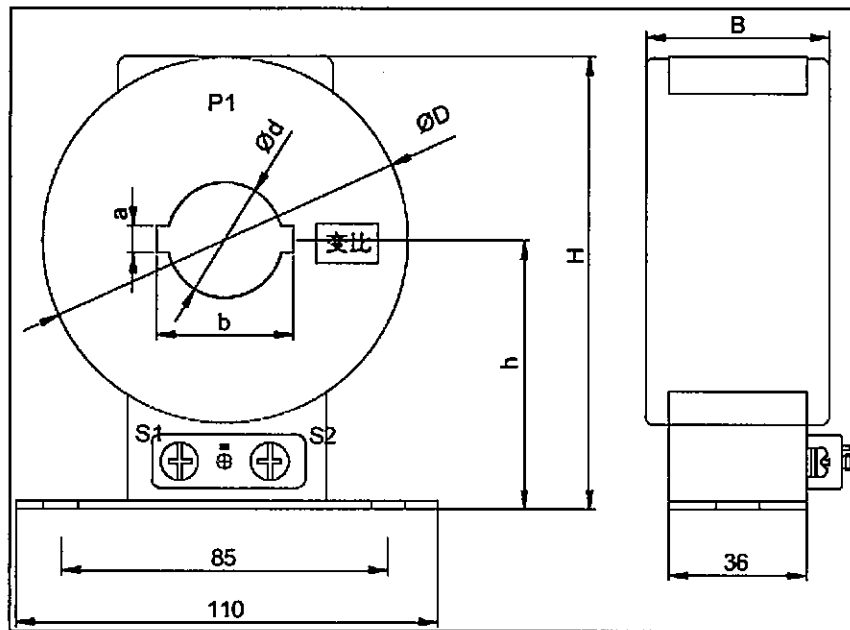
Schematics of the Smart MCCB

3. Current Transformers

- 3.1 One set of current transformers shall be exactly the same i.e. same manufacturer, item type, rated current (voltage), transformation ratio, accuracy class, secondary capacity.
- 3.2 The incoming cable polarity of the same stoichiometric point of current (voltage) shall be consistent.
- 3.3 The CTs shall be supported appropriately.
- 3.4 The nameplate of CTs shall be visible after installation and marked with the following information's:
 - Name of manufacturer
 - Serial number/type designation
 - Rated primary and secondary current
 - Rated frequency
 - Accuracy Class, Rated Burden, and instrument security factor
 - Rated Voltage
 - Rated Insulation Level
 - Rated Short-time current
- 3.5 The standard rated transformation ratio and the burden shall be as stipulated below:
 - 100/5A/15VA
 - 200/5A/15VA
 - 300/5A/15VA
 - 500/5A/15VA
 - 800/5A/15VA
- 3.6 The Rated Burden of the CTs shall not be less than 15VA as stipulated above.
- 3.7 The relative polarities of the CTs shall be permanently marked on them as per IEC60044-1. Brass bolts, nuts and washers shall be provided at the secondary terminal to accommodate 2.5sqmm wire leads.
- 3.8 The secondary terminals shall be provided with a transparent protective cover that must be sealable.
- 3.9 The internal diameter of the ring current transformer not be less than the value specified below:
 - 100/5A25mm
 - 200/5A45mm

- 300/5A50mm
- 500/5A75mm
- 800/5A80mm

- 3.10 The CTs rated current shall be 1.5 times of load current when device is normal running.
- 3.11 The accuracy class of the CTs shall be of either class 0.2 or class 0.5.
- 3.12 The type of CTs to be used shall be cast resin ring type of CTs.

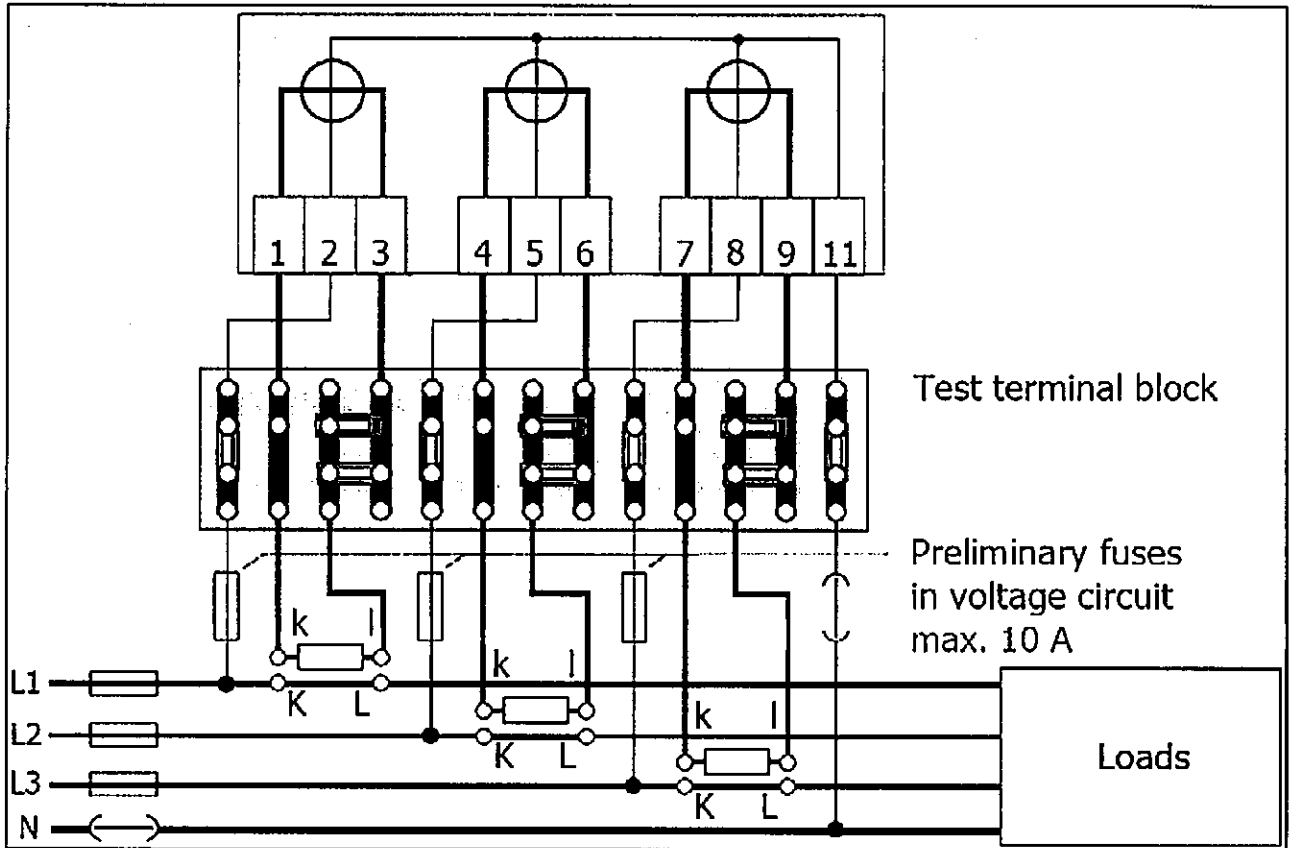


CT Type

4. Test Terminal Block

- 4.1 The Enclosure shall be fitted with a Test Terminal Block (TTB) to allow for easy testing of the smart meter without interrupting the load circuits.
- 4.2 The type of TTB to be fitted shall be the 13way 3Phase 4 Wire FC (Extended Cover) type.
- 4.3 This should be mounted right underneath the smart meter.
- 4.4 The TTB shall be made of superior grade Bakelite moulding material with 5mm diameter hole for cable entry.
- 4.5 Barriers shall be provided to completely protect against flashback.
- 4.6 The top cover of the TTB shall be a transparent, sturdy and flame retardant (UV94V0) polycarbonate cover and shall be secured in place by knurled knobs provided with a sealing arrangement.

- 4.7 All terminal and screws shall be made of brass and nickel plated to prevent corrosion.
- 4.8 Each Terminal shall have a 5mm hole for cable entry and 2nos of 4BA screw for clamping.



Connection Diagram of Test Terminal Block