



SPECIFICATIONS FOR SMART THREE PHASE WHOLE CURRENT STATIC METERS FOR ACTIVE ENERGY

SPECIFICATION

for

SMART WHOLE CURRENT (DIRECT CONNECTED) STATIC METERS FOR ACTIVE ENERGY

for use on

SMALL COMMERCIAL AND LIGHT INDUSTRIAL INSTALLATIONS

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REVISION RECORD

REVISION	DESCRIPTION OF REVISION	DATE
1 st	1 st Issue	August 2013
2 nd	2 nd Issue	March 2014



**SPECIFICATIONS FOR SMART THREE PHASE WHOLE CURRENT STATIC
METERS FOR ACTIVE ENERGY**

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SPECIFICATIONS FOR SMART THREE PHASE WHOLE CURRENT STATIC METERS FOR ACTIVE ENERGY

1. Scope

- 1.1 This specification is for newly manufactured smart whole current (Direct connected) static meters for measurement of alternating current active energy in 3 x 230/400 V, 50 Hz networks.
- 1.2 The meters are to be offered with different communication technologies to enable data communication between the meters and other external devices using various communication technologies.
- 1.3 The meters are to be used in a smart metering system whose architecture is shown in **Appendix A**.

2. References

The following documents were referred to during the preparation of this specification; in case of conflict, the requirements of this specification take precedence.

The following documents were referred to during the preparation of this specification:

- [1] IEC 62052-11:2003, Electricity Metering equipment (a.c.) – General Requirements, Tests and Test Conditions - PART 11: Metering equipment
- [2] IEC 62053-21:2003, Electricity metering equipment (a.c.) – Particular Requirements - Part 21: Static meters for active energy (class 1.0).
- [3] IEC 62053-23:2003, Electricity Metering equipment (a.c.) – Particular Requirements-Part 23: Static meters for reactive energy (classes 2 and 3).
- [4] IEC 62056-21:2003, Electricity Metering – Data exchange for meter reading, tariff, and load control – Part 21: Direct local data exchange.
- [5] IEC 61334, Distribution automation using distribution line carrier systems– Mains signaling requirements/ data communication protocols.



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Foreword

This specification was prepared by Kenya Power Smart Metering Pilot Project Technical Committee. It lays down requirements for newly manufactured smart whole current (Direct connected) static meters for active energy. The specification is intended for procurement of equipment and does not include provision of contract.

Introduction

This specification was prepared to establish and promote uniform requirements for smart meters. It lays down the minimum requirements for equipment acceptable for evaluation. It is the responsibility of the manufacturers/suppliers to familiarize themselves with the standards referred herein.

This specification is in two parts, one is a narrative clause-by-clause and the other is a summarized table of the same clauses located in the specifications and marked as **Appendix E**. Tenderers shall complete the schedule in **Appendix E** and this shall form the basis for the technical evaluation of their tender. **(See clause 4.5.5)**.

Appendix A gives the smart metering system architecture in which the meters are to be used. **Appendix B** is a snapshot of the technical data and tenderers shall indicate conformance or state any deviation from these requirements. **Appendix C** provides basic and extended list of EDIS codes and **Appendix D** provides specifications for a laptop computer to be supplied with the meters.



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- [6]ISO/IEC 14908-1:2012: Information technology – Control network protocol – Part 1: Protocol stack.
- [7]ISO/IEC 14908-2:2012: Information technology – Control network protocol – Part 2: Twisted pair communication.
- [8]ISO/IEC 14908-3:2012: Information technology – Control network protocol – Part 3: Power line channel specification.
- [9]ISO/IEC 14908-4:2012: Information technology – Control network protocol – Part 4: IP communication.
- [10]ETSI GS OSG 001(Open Smart Grid Protocol or OSGP)

3. Terms and definitions

In addition to terms and definitions given in IEC standards referred in section 2 above, the following terms shall apply:

CIU:	Customer Interface Unit
COSEM:	Companion Specification for Energy Metering
DLMS:	Device Language Message Specification
EDIS:	Energy Data Identification System
EMC:	Electromagnetic Compatibility
GPRS:	General Packets Radio Service
GSM:	Global System for Mobile communications
I_b:	Basic current of an electricity meter
I_{max}:	Maximum current of an electricity meter
I_n:	Nominal current of a transformer coupled electricity meter
IEC:	International Electro-technical Commission
ISO:	International Organization for Standardization
LED:	Light Emitting Diode
LCD:	Liquid Crystal Display
KP:	Kenya Power
PLC:	Power Line Communication
RF:	Radio Frequency
TCP/IP:	Transmission Control Protocol/Internet Protocol
TMR:	Energy Tele-Meter Reading system

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4. Requirements

In addition to the requirements in IEC standards in section 2 above, the smart meters shall fulfill the following requirements.

4.1 Operating conditions requirements

- 4.1.1 The meters shall be suitable for operation in tropical climate where temperatures may vary from -1 to + 45 degrees Celsius.
- 4.1.2 Average annual relative humidity reaching 90 % and altitude of up to 2,200 m above sea level.
- 4.1.3 The meters shall be used for measurement of active energy for small commercial and light industrial loads under tropical climate conditions.

4.2 Design and construction requirements

4.2.1 General

The design and construction requirements given in 2[1] shall apply.

4.2.2 Meter cover, base and terminals

- 4.2.2.1 The meters shall be constructed as 3 phase 4-wire meters.
- 4.2.2.2 The meters shall be of British Standard (BS) 5685-foot print for standardized mounting for asymmetrical (BS) wiring.
- 4.2.2.3 The meters shall be for front projection mounting.
- 4.2.2.4 The meters shall have terminals with bottom entry for cables and the arrangement shall be **L₁L₁: L₂L₂: L₃L₃: NN** for 3 phase 4-wire meters.
- 4.2.2.5 The meter's front cover may be of translucent material but shall have a window (clear glass or polycarbonate) for reading the display and for observation.
- 4.2.2.6 The meters shall have sealing provisions for the meter body, meter cover and terminal cover. If back-up battery is such connected that



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like in-home displays, water meter, home automation and monitoring over a distance of at least one hundred metres (100 m).

- 4.2.3.6** The default communication between the meters and the data concentrator shall be through Power Line Carrier (PLC) technology over a distance at least one thousand metres (1000 m). The details of the PLC technology to be used are contained in a separate document on Smart Meter Data Concentrators specifications.
- 4.2.3.7** In addition, the meters shall be offered with different communication technologies to enable data communication between the meters and the concentrators.
- 4.2.3.8** The meter shall have provision for an internal IP-based WAN/LAN option to include Fiber Optics, Ethernet(WIFI) and GPRS.
- 4.2.3.9** The meter communication devices shall be field replaceable by means of hot-swappable modules.
- 4.2.3.10** The meter shall support manual meter reading in case of loss of communication to the meter.
- 4.2.3.11** The meter shall have, depending on physical communication constraints, a “last gasp” mechanism to inform the system of outages.

4.2.4 Meter display

- 4.2.4.1** The meters shall have a **backlight seven-segment Liquid Crystal Display (LCD)** for displaying parameters and measured values.
- 4.2.4.2** The meter LCD shall have **at least seven (7)**-numerical characters comprising of selectable integers and **NO** decimals points for energy measurement. The minimum character height shall be eight (8) mm.
- 4.2.4.3** The meters LCD shall have at least **4**-digit ID codes (*see appendix C*).

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its replacement does not require opening meter cover, then provision be provided for sealing the battery cover.

4.2.2.7 The meters shall be equipped with lockable/sealable push buttons where such buttons are used to change some meter parameters.

4.2.2.8 The meter terminal cover shall be of the long type with **cable entry knock-offs**.

4.2.2.9 The meter potential links shall be inside the meter body and **CAN ONLY** be accessed by opening meter body cover.

4.2.2.10 Terminal holes shall be of sufficient size to accommodate the cables of at least **10mm** diameter.

4.2.2.11 The meters **terminal holes** and **screws** shall be made of **brass** or **nickel-plated brass** for high strength and good conductivity.

4.2.2.12 The meters shall conform to the degree of protection of at least **IP 51** as given in **IEC 60529:1989** Degrees of protection provided by enclosures (IP Code) Amendment 1:1999.

4.2.3 Communications

4.2.3.1 The meters shall have LED indicators for testing and indication of kWh and kvarh-measurement.

4.2.3.2 The meters shall be equipped with an infrared optical port compliant with the IEC 62056-21 standard for meter programming and data downloading.

4.2.3.3 The meters shall support two-way communication.

4.2.3.4 The meters shall be compliant with the DLMS/COSEM or equivalent communication protocol.

4.2.3.5 The meter should have an internal Multipurpose Expansion Port or Module (MEP) to enable the secure communication with other devices



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- 4.2.4.4** The meters LCD shall be capable of displaying the current state of the disconnecter control unit via symbols.
 - 4.2.4.5** The meters LCD shall be capable of displaying various tampering conditions of the meter.
 - 4.2.4.6** The display parameters shall be configurable by software action.
 - 4.2.4.7** The LCD display shall operate in at least two modes, namely, **basic** and **extended** data list display using push buttons on meter front.
 - 4.2.4.8** Meters shall have provision for reading the meter at site even when mains power supply fails.
- 4.2.5 Consumer Interface Unit (CIU)**
- 4.2.5.1** The bidder shall demonstrate the ability for the user to interrogate the meter remotely by use of CIU or any other device.
- 4.2.6 Real time clock and memory**
- 4.2.6.1** The meters shall have a real-time clock controlled by a quartz crystal oscillator. It shall be possible to reset the clock without loss of billing data.
 - 4.2.6.2** The accuracy of the clock shall meet the requirements of IEC 62054-21.
 - 4.2.6.3** The meters shall have remote and local synchronization capability.
 - 4.2.6.4** The meters shall have a back-up power supply.
 - 4.2.6.5** If the backup supply is by means of Lithium battery, it shall have a shelf life of ten (10) years.
 - 4.2.6.6** The meters shall have a non-volatile memory capable of data storage and with long-term data retention for the certified life of the meter or fifteen (15) years, whichever is greater without an electrical supply being supplied to the meter.

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4.2.7 Load control and management

- 4.2.7.1** The meters shall be capable of disconnecting/reconnecting load remotely.
- 4.2.7.2** The meters shall have a facility to enable automatic disconnection of whole of customer load when the set/authorized demand is exceeded.
- 4.2.7.3** The meters shall have a facility to enable automatic disconnection of part(s) of customer load when the set/authorized demand is exceeded.
- 4.2.7.4** The meters shall be configurable as post payment or prepayment meters remotely.
- 4.2.7.5** The meters shall have provision for entering credit tokens when meters are operated in the prepayment mode.
- 4.2.7.6** The load disconnect switch shall have the following characteristics:
- a) Mechanical life at maximum power, PF=1: At least 3,000 cycles
 - b) Maximum switching current per phase: At least 100 A
 - c) Maximum overload current per phase: 120 A (30 min)
 - d) Maximum switching voltage per phase: At least 265 V AC
 - e) Short circuit < 3mS: 3,000 A
 - f) Insulation strength (4kV, 50 Hz, 1 min):
 - Contact to contact: 2 kV
 - Coil to contact: 4 kV
 - g) Impulse strength (1.2 / 50 μ S to IEC 62052-11):
 - Contact to contact: > 4 kV
 - Coil to contact: > 8 kV
- 4.2.7.7** It should provide local or remote demand reset.

4.2.8 Time-of-use tariff measurements



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- 4.2.7.1** The meters shall be capable of measuring and displaying time-of-day active and reactive energy consumption up to four tariff registers.
- 4.2.7.2** The meters shall be capable of measuring and displaying time-of-day demand (kW and kVA) consumption up to four tariff registers.
- 4.2.7.3** Each tariff register shall be set to operate over defined time periods during a 24-hour day.
- 4.2.7.4** The meters shall have at least two seasons and four day types namely weekday, Saturday, Sunday and Special/Holiday with switching times set independently.
- 4.2.7.5** The meters shall have at least forty (40) special days to take care of national holidays, world days and Easter holidays.

4.2.9 Energy measurements

- 4.2.8.1** The meters shall be capable of measuring and displaying active, reactive and apparent energy consumption in both import and export modes.
- 4.2.8.2** The meters' principal unit for the measured values shall be the kilowatt-hour (kWh).
- 4.2.8.3** The meters shall measure Energy correctly even when the phase rotation/sequence is incorrect.
- 4.2.8.4** The meters shall be capable of recording of active and reactive energy in all four (4) quadrants with up to four (4) tariffs.
- 4.2.8.5** The meter shall have at least four (4) registers for energy.
- 4.2.8.6** The meters shall be capable of measuring energy in security mode and also record reversed units.
- 4.2.8.7** Meters shall have a facility to indicate reverse energy consumption.

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- 4.2.8.8 The meters shall have capability of closing end of billing period on any selected date of the month selectable by software.
- 4.2.8.9 The meter's billing registers shall **NOT** be re-settable to zero readings.
- 4.2.8.10 The meters shall have at least twelve (12) billing historical data stored in memory and retrievable by software action.

4.2.10 Demand measurements

- 4.2.9.1 The meters shall be capable of measuring and displaying active, reactive and apparent demand consumption in both import and export modes.
- 4.2.9.2 The meters shall display demand values and their time and date stamps.
- 4.2.9.3 The meters shall measure demand correctly even when the phase rotation/sequence is incorrect.
- 4.2.9.4 The meter shall have at least four (4) registers for demand.
- 4.2.9.5 The meters shall have a capability of closing end of billing period on any selected date of the month selectable by software.
- 4.2.9.6 The meters shall have at least twelve (12) billing historical data stored in memory and retrievable by software action. The current and billing/historical data shall be available on meter display for reading and billing purposes.

4.2.11 Instrumentation data measurements

- 4.2.11.1 The meters shall be capable of displaying instrumentation data namely instantaneous phase voltages and currents, phase angles, and power factor.



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4.2.11.2 The meters shall be capable of measuring and displaying instantaneous power (active, reactive and apparent).

4.2.11.3 The meters shall be capable of continuous display of the presence or absence of individual phase voltages.

4.2.12 Load profiling

4.2.12.1 The meters shall be capable of profiling multiple channels of energy, demand (KVA, KW, KVA_r), voltage, current, power factor, harmonics, for a period of at least six (6) months.

4.2.12.2 The load profile integration period shall be programmable between 1 minute up to a maximum of sixty (60) minutes.

4.2.13 Power Quality Analysis

4.2.13.1 The meter shall collect and record basic power quality information – overcurrent, total no. of alarms, power outages, voltage and current, average power factor and line frequency, etc.

4.2.12.2 The meter shall be able to provide voltage sag and swell detection.

4.2.12.3 The meters shall provide Total Harmonic Distortion (THD) event detection at least up to the 10th harmonic with analysis for unusual system conditions.

4.2.2 Security features

4.2.2.1 The meters shall be capable of event recording and communication, which shall include but not be limited to the following:

1. Power ups and power downs with date and time stamp;
2. Individual phase failure, with date and time stamps;
3. Over- and under-voltages based on a pre-set threshold with date & time stamp;

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4. Battery voltage status (if applicable);
5. Memory status;
6. Meter errors,
7. Date and time of last programming/parameterization;
8. Date and time of the last end of billing period;
9. Firmware upgrades
10. Prepayment events
11. Terminal cover removal, even during a power failure
12. Main meter cover removal, even during a power failure
13. Communications removal
14. Magnetic detection, at least 0.5 mT
15. Bypassing neutral
16. Interchanging incoming and outgoing leads

4.2.11.2 The LCD shall display events that have occurred. The events displayed shall include but not be limited to the following:

- 1) Meter errors;
- 2) Phase failures;
- 3) Battery voltage status (if applicable);
- 4) Alarms
- 5) Warning messages;
- 6) Prepayment mode;
- 7) Terminal cover removal
- 8) Communications removal;
- 9) Magnetic detection, at least 0.5 mT.

4.2.2.2 The meters shall have the relevant software for programming and reading out data.

4.2.2.3 The meter software/program shall be capable of tracking user access to the meter.

4.2.2.4 Access to meter parameters and programming information shall only be through user-level password(s).



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- 4.2.2.5** The meters shall have sealing provisions for meter cover, terminal cover and any other opening whose access would compromise the meter security.
- 4.2.2.6** The meters shall have provision for sensing and displaying the opening of meter terminal cover.
- 4.2.2.7** A Laptop computer and two optical probes, (see **appendix D** for the Laptop computer specifications), for programming and down-loading the meter data shall be provided at no extra cost.

4.3 Electrical requirements

- 4.3.1 The meters shall be operated from mains supply with reference values of: -
3 x 230/400 V at 50 Hz.
- 4.3.2 The meters shall be connectable for **three phase four wire systems**, drawing of which shall be **printed** on the terminal cover or on the meter front cover.
- 4.3.3 The meter shall have reference standard currents of: -
 $I_b = 10 \text{ A}$; $I_{max} \geq 100 \text{ A}$ for the operating conditions stated in clause 4.1.
- 4.3.4 Power consumption
The requirement of 2[2] applies.
- 4.3.5 Influence of short-time over-currents
The requirement of 2[2] applies.
- 4.3.6 Influence of self-heating
The requirement of 2[2] applies.
- 4.3.7 AC voltage test
The requirement of 2[2] applies.
- 4.3.8 EMC Tests
The requirement of 2[2] applies.

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Requirements 4.3.4 to 4.3.8 shall form part of the type test approval to be issued by an international/ national (of the country of manufacture) meter certifying body.

4.4 Accuracy requirements

Tests and test conditions given in 2[1] shall apply.

4.4.1 The meter's accuracy shall be class 1.0 for active energy and class 2 for reactive energy measurements as per accuracy requirements given in 2[2] and 2[3] respectively.

4.4.2 Limits of errors due to variation of the current.

The requirements of 2[2] and 2[3] apply.

4.4.3 Limits of error due to influence quantities

The requirements of 2[2] and 2[3] apply.

4.4.4 Test of starting and no-load condition

The requirements of 2[2] and 2[3] apply.

4.4.5 Meter constant

The requirement of 2[2] and 2[3] apply.

4.4.6 Accuracy test conditions

The requirements of 2[2] and 2[3] apply

Requirements of clause 4.4 shall form part of the type test approval to be issued by an international/ national (of the country of manufacture) meter certifying body.



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4.5 Instructions and marking requirements

4.5.1 In addition to IEC 62052-11:2003 nameplate requirements, each meter shall be marked **legibly and indelibly** with the following information:

- a) Name or trade mark of the manufacturer;
- b) Country of origin;
- c) Type/model;
- d) Meter number up to ten digits;
- e) Barcode comprising of meter serial no;
- f) The inscription "Property of K.P. & L. Co Ltd";
- g) Standard(s) to which the meter complies;
- h) Year of manufacture.

All markings to be written in English and with c), d) and e) **at least 4 mm** figure height.

4.5.2 Every meter shall be **indelibly** marked with diagrams of connections for which the meter is intended.

4.5.3 In addition, the following drawings and information shall be required with the tender:

- (a) Meter drawing giving all the relevant dimensions;
- (b) Wiring diagrams;
- (c) Description leaflet including details of programming of the meters;
- (d) Service and Operational manuals.

4.5.4 Copies of type approval certificate(s) with test and calibration results of the meter being offered (see clauses 4.3 & 4.4) obtained from an international or the national meter certification body shall be provided. **If type approval certificate(s) is (are) from accredited meter certification laboratories (and not national or international body), then it (they) shall be accompanied**

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with copies of certificates of accreditation from the national or an international certification body.

- 4.5.5 **The Tenderer shall complete clearly, all the clauses in both columns of the schedule in Appendix E.** This shall form the basis of evaluation of the submitted tender. Failure to complete this appendix shall render the tender non-responsive. The tenderers shall indicate the details of their offer where it is different from these requirements. Where the requirement is the same, they shall indicate what is offered. **Insertions such as “noted”, “agreed” etc. shall be considered as non-responsive where a specific response is called for.**
- 4.5.6 The tenderer shall submit with the tender, **a sample meter, meter software, operating manual(s), and an optical interface** for interrogating the meter.
- 4.5.7 The **sample meter** submitted shall have **basic and extended data display sequences as specified in appendix C** of this document.
- 4.5.8 The manufacturer shall provide proof of conformance to the following International standards:
- a) ISO 9001(2008) standard
 - b) ISO 14001(2004) standard
 - c) ISO 17025(2005) standard
- 4.5.9 The manufacturer shall provide a list of at **least three previous utilities outside the country of manufacture** to which the meter being offered has been supplied including addresses and contact person(s) of the utilities.
- 4.5.10 The tenderer shall give proof that the number of smart meters using PLC technology (**single and three phase**) sold and installed in **utilities outside the country of manufacture** over a period of last **5 years** shall not be less than **50,000 meters**. The addresses and contact person(s) shall be provided



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with the tender to facilitate confirmation of this information by the procuring entity.

5. Information and warranty (*In case of tender award*)

- 5.1 Drawings and technical details shall be submitted to KP for approval before manufacture of the meters commences. KP undertakes to submit their comments or approval for the drawings within three weeks of receiving the draft copies.
- 5.2 Original software, software manuals and operation manuals shall be submitted in 3 copies. Description leaflets (brochures) shall be submitted in copies of 100 for each meter type.
- 5.3 The meter shall have a warranty against any defects, which may develop due to faulty material, calibration, transportation or workmanship for a period of thirty-six months from the date of delivery. **All defective meters shall be replaced at the supplier's cost.**
- 5.4 The manufacturer shall make a commitment in writing on the availability of essential spares and other consumables for the certified life of the meter.
- 5.5 KP Engineers will inspect meter-manufacturing facilities intending to supply meters to the company for the first time at no extra cost, excepting the cost of the engineers' transportation to the nearest major airport. Such inspection shall not in any way prejudice the purchaser's rights and privileges.
- 5.6 The manufacturer shall meet the full costs of two Engineers, for meter inspection and acceptance testing at the manufacturer's facility, excepting the cost of Engineers' transportation from Kenya to the nearest major airport. The factory inspection and factory acceptance tests shall run for duration of three (3) working days each.

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- 5.7 After delivery of meters to KP, the manufacturer shall conduct training for at least 3 days for twenty people in Nairobi, Kenya. The training shall cover and not be limited to:
- 1) Meter features;
 - 2) Meter metrology;
 - 3) Meter installation;
 - 4) Meter software;
 - 5) Meter programming and data downloading, etc.
- 5.8 The manufacturer shall meet the cost of the training described in clause (5.7).

5.9 Samples

- (a) The tenderer shall submit one sample together with the tender documents. The submitted meter samples shall be subjected to accuracy tests at KPLC's Meter Central Laboratory to verify the requirements of IEC 62053-21:2003 clause 8.1 and to verify responsiveness to other clauses of this specification. Sample meters shall not be returned to the tenderers.
- (b) Bidders are advised that the Laws of Kenya require that the Kenya Bureau of Standards must approve any new meter being introduced in the country. To this end Bidders shall furnish the Bureau with 4 (four) samples of each meter type to be supplied. Bids submitted without the meter type approval from the Bureau will **NOT** be considered non-responsive. However the winning Bidder must submit this approval before the signing of the supply contract. Bidders may communicate directly with the Kenya Bureau of Standards on this matter through the following address:

The Managing Director



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Kenya Bureau of Standards,

P.O. Box 54974, 00200 Nairobi

Kenya.

Tel: (+254 020) 605490, 602350

Fax: (+254 020) 604031

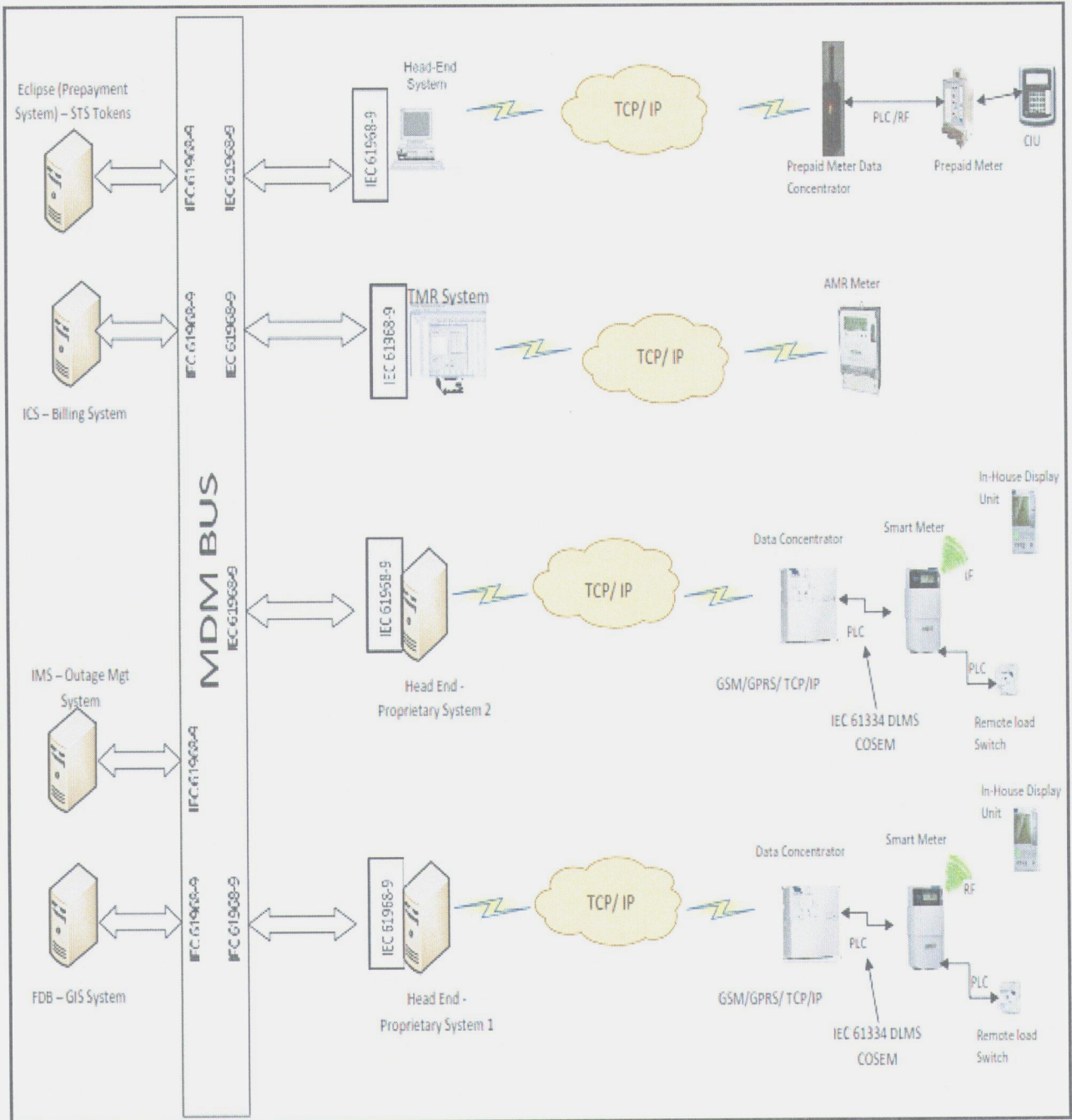
Email: info@kebs.org

Web:<http://www.kebs.org>

- 5.10 The meters shall be packaged in such a manner as to minimize damage and entry of moisture during transportation and handling.
- 5.11 The meters shall be packed in suitable groups and/or batches with consecutive serial numbers provided by KP.
- 5.12 The supplier shall indicate the delivery time versus quantities of each type of meter and his production capacity.
- 5.13 Where test and/or calibration certificates/reports are issued by a laboratory other than the **International/National Meter Certification Authority**, a copy of accreditation certificate shall be attached together with the tender documents.
- 5.14 The manufacturer shall provide current e-mail addresses, fax and telephone numbers of the national/international testing/calibration laboratories and meter certification bodies to facilitate confirmation of the submitted test reports & certificates.

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Appendix A: SMART METERING ARCHITECTURE





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Appendix B: SCHEDULE OF TECHNICAL DATA

Standard and type tests	
General requirements, tests and test conditions	IEC 62052-11:2003
Particular requirements for static meters for active energy	IEC 62053-21:2003
Power consumption and voltage requirements	IEC 62053-21:2003
Shock test	IEC 62052-11:2003
Plastic-determination of temperature deflection under load	IEC 62052-11:2003
Degree of protection	IP51
Measurement Base	Active / Reactive energy, 3 element, 4 quadrant
Network type	3 phase 4-wire
Connection type	Direct connected
Accuracy	kWh class 1.0 (IEC 62053-21:2003) ; kvarh class 2 (IEC 62053-23:2003)
Humidity:	Reaching 90 %
Altitude	Up to 2,200 m
Temperature range (operating)	-1 to +45 ° C
Voltage measurement (U_n)	3x 230/400 V 50Hz, 3 phase 4-wire
Voltage range	0.8 U_n to 1.15 U_n
Voltage circuit burden	≤ 2 W and 10 VA
Burst test	4 kV
Impulse voltage	6 kV, 1.2/50 μ s
Current measurement	$I_b = 10$ A; $I_{max} = 100$ A
Short circuit current	30 I_{max}
Starting current	0.004 I_b
Current circuit burden	< 4 VA
LCD	7 Measurement and 5 ID (EDIS) digits



SPECIFICATIONS FOR SMART THREE PHASE WHOLE CURRENT STATIC METERS FOR ACTIVE ENERGY

Appendix B: SCHEDULE OF TECHNICAL DATA

Standard and type tests	
General requirements, tests and test conditions	IEC 62052-11:2003
Particular requirements for static meters for active energy	IEC 62053-21:2003
Power consumption and voltage requirements	IEC 62053-21:2003
Shock test	IEC 62052-11:2003
Plastic-determination of temperature deflection under load	IEC 62052-11:2003
Degree of protection	IP51
Measurement Base	Active / Reactive energy, 3 element, 4 quadrant
Network type	3 phase 4-wire
Connection type	Direct connected
Accuracy	kWh class 1.0 (IEC 62053-21:2003) ; kvarh class 2 (IEC 62053-23:2003)
Humidity:	Reaching 90 %
Altitude	Up to 2,200 m
Temperature range (operating)	-1 to +45 ° C
Voltage measurement (U_n)	3x 230/400 V 50Hz, 3 phase 4-wire
Voltage range	0.8 U_n to 1.15 U_n
Voltage circuit burden	≤ 2 W and 10 VA
Burst test	4 kV
Impulse voltage	6 kV, 1.2/50 μ s
Current measurement	$I_b = 10$ A; $I_{max} = 100$ A
Short circuit current	30 I_{max}
Starting current	0.004 I_b
Current circuit burden	< 4 VA
LCD	7 Measurement and 5 ID (EDIS) digits

SPECIFICATIONS FOR SMART THREE PHASE WHOLE CURRENT STATIC METERS FOR ACTIVE ENERGY

Dielectric strength	4 kV, 50 Hz., 1 min
System interface	PLC Interface GSM/GPRS (Optional)
Local interface	Optical (IEC 62053-21)
Local interface (Meter and HAN)	Wireless, at least 100 metres
Disconnecter	3-pole disconnecter (live wires only)

APPENDIX C: LIST OF EDIS CODE REGISTERS FOR BASIC AND EXTENDED DISPLAY

LIST OF REGISTERS TO BE DISPLAYED ON BASIC (AUTO SCROLL) DISPLAY MODE

0.0.0 Display check

F: Meter’s warning Codes (logging event Flags)

E: Meter’s Error Codes (Flags)

1.8.0 Total active import energy, kWh (Current)

2.8.0 Total active export energy, kWh (Current)

LIST OF REGISTERS TO BE DISPLAYED ON EXTENDED (ALTERNATE) DISPLAY MODE

0.9.1 Current time

0.9.2 Current date

1.8.0 Total active import energy, kWh (Current)

1.8.0.1 Total active import energy, kWh (Historical)

1.8.1 Total active import energy, Tariff 1, kWh (Current)

1.8.1.1 Total active import energy, Tariff 1, kWh (Historical)

1.8.2 Total active import energy, Tariff 2, kWh (Current)



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- 1.8.2.1** Total active import energy, Tariff 2, kWh (Historical)
- 9.6.0** Maximum Demand kVA & date and time stamp (Current)
 - 9.6.0.1** Maximum Demand kVA & date and time stamp (Historical)
 - 9.6.1** Maximum Demand kVA & date and time stamp (Current), Tariff 1
 - 9.6.1.1** Maximum Demand kVA & date and time stamp (Historical), Tariff 1
 - 9.6.2** Maximum Demand kVA & date and time stamp (Current), Tariff 2
 - 9.6.2.1** Maximum Demand kVA & date and time stamp (Historical), Tariff 2
 - 1.5.0** Coincidental Maximum Demand kW & date and time stamp (Current)
 - 1.5.0.1** Coincidental Maximum Demand kW & date and time stamp (Historical)
 - 1.5.1** Coincidental Maximum Demand kW & date and time stamp (Current), Tariff 1
 - 1.5.1.1** Coincidental Maximum Demand kW & date and time stamp (Historical), Tariff 1
 - 1.5.2** Coincidental Maximum Demand kW & date and time stamp (Current), Tariff 2
 - 1.5.2.1** Coincidental Maximum Demand kW & date and time stamp (Historical), Tariff 2
 - 2.8.0** Total active export energy, kWh (Current)
 - 2.8.0.1** Total active export energy, kWh (Historical)
 - 32.7.0** Phase A voltage
 - 52.7.0** Phase B voltage
 - 72.7.0** Phase C voltage
 - 31.7.0** Phase A Current
 - 51.7.0** Phase B Current
 - 71.7.0** Phase C Current

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APPENDIX D: LAPTOP COMPUTER SPECIFICATIONS

Laptop Computer make/ Model	
Microprocessor	Intel® Core™ Duo processor 2.4 GHz
Memory	4 GB (1600 MHz DDR3 SDRAM)
Cache	6 MB L3 Cache
Hard Drive:	500 GB SATA II
Multimedia Drive	DVD+/-RW Super Multi DL
Video Graphics	AMD Radeon™ HD 7650 , 2GB Dedicated
Display	15.6-inch Full HD anti-glare LED (1920 x 800 resolution)
Network Card	Integrated 10/100/1000 Ethernet LAN
Wireless Connectivity	Intel 802.11b/g/n WLAN
Sound	Altec Lansing speakers with Dolby Advanced Audio
Keyboard	Full-Size Keyboard with wireless mouse
Pointing Device	Touch Pad with Multi-Gesture Support and On/Off Button
External Ports	Digital Media Card Reader for Secure Digital and Multimedia cards
	1 Universal Serial Bus (USB) 2.0
	2 Universal Serial Bus (USB) .3.0
	1 VGA (15-pin)
	1 RJ -45 (LAN)
	1 Headphone-out
	1 Microphone-in
Webcam	HD Webcam with integrated digital microphone
Security	Kensington MicroSaver lock slot
	Power-on password
	Accepts 3rd party security lock devices
Operating system	Windows 7
Warranty	1 Year or more warranty
Power	6-cell lithium ion Battery; External AC adapter
Power Supply	240V AC, 50Hz, British plugs
Carrying Case	Leather case



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4.2.6.5	Lithium battery back-up shelf life 1 year		
4.2.6.6	Non-volatile memory; data retention period equivalent to meter certified period or 15 years, whichever is longer		
4.2.7	Load control and management		
4.2.7.1	Remote load disconnection/reconnection		
4.2.7.2	Automatic disconnection of whole customer load on exceeding set/authorized demand		
4.2.7.3	Automatic disconnection of part(s) of customer load on exceeding set/authorized demand		
4.2.7.4	The meters shall be configurable as post payment or prepayment meters remotely		
4.2.7.5	The meters shall have provision for entering credit tokens when meters are operated in the prepayment mode.		
4.2.7.6	The load disconnect switch shall have the following characteristics:		
	a) Mechanical life at maximum power, PF=1: At least 3,000 cycles		
	b) Maximum switching current/phase: 100 A		
	c) Maximum overload current/phase: 120 A (30 min)		
	d) Maximum switching voltage/phase: 265 V AC		
	e) Short circuit < 3mS: 3,000 A		
	f) Insulation strength (4kV, 50 Hz, 1 min): Contact to contact: 2 kV Coil to contact: 4 kV		
	g) Impulse strength (1.2/50 μ S to IEC 62052-11): Contact to contact: > 4 kV Coil to contact: > 8 kV		
4.2.7.7	Local or remote demand reset function		
4.2.8	Time-of-use tariff measurements		
4.2.8.1	Measurement and display of TOU active & reactive energy		
4.2.8.2	Measurement and display of TOU kW & kVA demand		
4.2.8.3	Tariff register setting on a 24-hour period		
4.2.8.4	Two seasons and four day types		
4.2.8.5	At least fifty (40) special days		
4.2.9	Energy measurements		

SPECIFICATIONS FOR SMART THREE PHASE WHOLE CURRENT STATIC METERS FOR ACTIVE ENERGY

4.2.9.1	Measurements & display of active, reactive and apparent energy in export/import modes		
4.2.9.2	kWh as principal unit of measurement		
4.2.9.3	Accurate energy measurements on incorrect phase rotation		
4.2.9.4	The meters shall be capable of recording of active and reactive energy in all 4 quadrants with up to 4 tariffs		
4.2.9.5	The meter shall have at least four (4) registers for energy		
4.2.9.6	The meters shall be capable of measuring energy in security mode and also record reversed units		
4.2.9.7	Meters shall have a facility to indicate reverse energy consumption		
4.2.9.8	The meters shall have capability of closing end of billing period on any selected date of the month selectable by software		
4.2.9.9	The meter's billing registers shall NOT be re-settable to zero readings		
4.2.9.10	The meters shall have at least twelve (12) billing historical data stored in memory and retrievable by software action		
4.2.10	Demand measurements		
4.2.10.1	The meters shall be capable of measuring and displaying active, reactive and apparent demand consumption in both import and export modes		
4.2.10.2	The meters shall display demand values and their time and date stamps		
4.2.10.3	The meters shall measure demand correctly even when the phase rotation/sequence is incorrect		
4.2.10.4	The meter shall have at least four (4) registers for demand		
4.2.10.5	The meters shall have a capability of closing end of billing period on any selected date of the month selectable by software		
4.2.10.6	The meters shall have at least twelve (12) billing historical data stored in memory and retrievable by software action. The current and billing/historical data shall be available on meter display for reading and billing purposes		
4.2.11	Instrumentation data measurements		



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4.2.11.1	The meters shall be capable of displaying instrumentation data namely instantaneous phase voltages and currents, phase angles, and power factor		
4.2.11.2	The meters shall be capable of measuring and displaying instantaneous power (active, reactive and apparent)		
4.2.11.3	The meters shall be capable of continuous display of the presence or absence of individual phase voltages		
4.2.12	Load profiling		
4.2.12.1	At least four (4) channels of energy and/or demand profiling		
4.2.12.2	Integration period, 1 min up to 60 mins		
4.2.13	Security features		
4.2.13.1	The meters shall be capable of event recording, which shall include but not be limited to the following:		
	1 Power ups and power downs with date and time stamp		
	2 Individual phase failure, with date and time stamps		
	3 Over- and under-voltages based on a pre-set threshold with date & time stamp		
	4 Battery voltage status, if applicable		
	5 Memory status, if applicable.		
	6 Meter errors		
	7 Date and time of last programming/parameterization		
	8 Date and time of the last end of billing period.		
	9 Prepayment events		
	10 Terminal cover removal		
	11 Main meter cover removal		
	12 Communications removal		
	13 Magnetic detection, at least 0.5 mT		
	14 Neutral Bypass		
	15 Incoming & outgoing lead interchange		

SPECIFICATIONS FOR SMART THREE PHASE WHOLE CURRENT STATIC METERS FOR ACTIVE ENERGY

4.2.13.2	The LCD shall display events that have occurred. The events displayed shall include but not be limited to the following: 1) Meter errors; 2) Phase failures; 3) Battery voltage status, if applicable. 4) Alarms; 5) Warning messages; 6) Prepayment mode; 7) Terminal cover removal 8) Communications removal; 9) Magnetic detection, at least 0.5 mT		
4.2.13.3	The meters shall have the relevant software for programming and reading out data		
4.2.13.4	The meter software/program shall be capable of tracking user access to the meter		
4.2.13.5	Access to meter parameters and programming information shall only be through user-level password(s)		
4.2.13.6	The meters shall have sealing provisions for meter cover, terminal cover and any other opening whose access would compromise the meter security		
4.2.13.6	The meters shall have provision for sensing and displaying the opening of meter terminal cover		
4.2.13.7	A laptop computer and two optical probes, (see appendix D for the Laptop computer specifications), for programming and down-loading the meter data shall be provided at no extra cost		
4.3	Electrical requirements		
4.3.1	Mains reference, 3 x 230/400 V, 50 Hz		
4.3.2	Three phase 4-wire system connection		
4.3.3	$I_b = 10 \text{ A}$; $I_{max} \geq 100 \text{ A}$		
4.3.4	Power consumption as per IEC 62053-21:2003		
4.3.5	Influence of short-time over-currents as per IEC 62053-21:2003		
4.3.6	Influence of self-heating as per IEC 62053-21:2003		
4.3.7	Ac voltage test as per IEC 62053-21:2003		
4.3.8	EMC tests as per IEC 62053-21:2003		
4.4	Accuracy requirements		



SPECIFICATIONS FOR SMART THREE PHASE WHOLE CURRENT STATIC METERS FOR ACTIVE ENERGY

4.4.1	Accuracy class 1 as per IEC 62052-11:2003		
4.4.2	Limits of errors due to variation of current as per 2[2] and 2[3]		
4.4.3	Limits of errors due to influence quantities as per 2[2] and 2[3]		
4.4.4	Test of starting and no-load current as per 2[2] and 2[3]		
4.4.5	Meter constant as per 2[2] and 2[3]		
4.4.6	Accuracy test conditions as per 2[2] and 2[3]		
4.5	Instructions and marking		
4.5.1	Name plate marking requirements (indelibly marked in English and at least 4 mm height		
	(a) Manufacturer name		
	(b) Country of origin		
	(c) Model/Type of meter		
	(d) Meter serial number		
	(e) Bar code information		
	(f) "Property of K.P. & L. Co. Ltd" inscription		
	(g) Standard to which meter complies		
	(h) Year of manufacture		
4.5.2	Indelible markings of connection diagram with phase sequence		
4.5.3	Information on meter markings/wiring diagram/manuals/description leaflets		
4.5.4	Type approval and calibration/test certificates		
4.5.5	Compliance matrix requirements		
4.5.6	Conformance to International standards:		
	a) ISO 9001(2008)		
	b) ISO 14001(2004)		
	c) ISO 17025(2005)		
4.5.7	Meter type export details		
4.5.8	The tenderer shall give proof that the number of smart meters using the same PLC technology (single and three phase) sold and installed in utilities outside the country of manufacture over a period of last 5 years shall not be less than 50,000 meters. The addresses and contact person(s) shall be provided with the tender to facilitate confirmation of this information by the procuring entity		



SPECIFICATIONS FOR SMART THREE PHASE WHOLE CURRENT STATIC METERS FOR ACTIVE ENERGY

I on behalf of
declare that the above specifications matrix conforms to a typical tender
meter, type..... being offered for this tender.

Signature DateStamp/Seal



SPECIFICATIONS FOR SMART THREE PHASE WHOLE CURRENT STATIC METERS FOR ACTIVE ENERGY

Appendix E: Specifications for Smart Whole Current (Direct Connected) Static Meters for Active Energy for use on Small Commercial and Light Industrial Installations

CLAUSE	KENYA POWER REQUIREMENT	MANUFACTURER'S COMPLIANCE/REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.1	Operating conditions requirements		
4.1.1	-1 to 45 °C (operational)		
4.1.2	Humidity: Average annual reaching 90 % and altitude of up to 2,200m		
4.1.3	Measurement of energy in tropical conditions		
4.2	Design and Construction requirements		
4.2.1	General		
	IEC 62052-11:2003 requirements given in 5.1 to 5.11		
4.2.2	Meter cover, base and terminals		
4.2.2.1	3 phase 4- wire configuration		
4.2.2.2	The meters shall be of British Standard (BS) 5685-foot print for standardized mounting for asymmetrical (BS) wiring		
4.2.2.3	The meters shall be for front projection mounting.		
4.2.2.4	The meters shall have terminals with bottom entry for cables and the arrangement shall be L₁L₁: L₂L₂: L₃L₃: NN for 3 phase 4-wire meters		
4.2.2.5	The meter's front cover may be of translucent material but shall have a window (clear glass or polycarbonate) for reading the display and for observation.		
4.2.2.6	The meters shall have sealing provisions for the meter body, meter cover and terminal cover.		
4.2.2.7	The meters shall be equipped with lockable/sealable push buttons where such buttons are used to change some meter parameters		
4.2.2.8	The meter terminal cover shall be of the long type with cable entry knock-offs .		
4.2.2.9	The meter potential links shall be inside the meter body and CAN ONLY be accessed by opening meter body cover		

SPECIFICATIONS FOR SMART THREE PHASE WHOLE CURRENT STATIC METERS FOR ACTIVE ENERGY

4.2.2.10	Terminal holes shall be of sufficient size to accommodate the cables of at least 10mm diameter		
4.2.2.11	The meters terminal holes and screws shall be made of brass or nickel-plated brass for high strength and good conductivity		
4.2.2.12	Degree of protection IP51		
4.2.3 Communications			
4.2.3.1	LED indicators for testing and indication		
4.2.3.2	Infra red optical port		
4.2.3.3	Two way communication		
4.2.3.4	DLMS/COSEM compliant or equivalent		
4.2.3.5	Wireless communication between meters and Home Area Network devices		
4.2.3.6	PLC communication between meters and data concentrator		
4.2.3.7	Scalable to other communication technologies		
4.2.3.8	Provision for internal IP-based WAN/LAN option – fibre optics, Ethernet (WIFI) & GPRS		
4.2.3.9	Hot swappable communication modules		
4.2.3.10	Manual meter reading support		
4.2.3.11	Last gasp mechanism		
4.2.4 Meter display			
4.2.4.1	LCD display with backlight		
4.2.4.2	LCD display with at least 7 digits Nil decimals		
4.2.4.3	LCD with at least 4-digit ID codes		
4.2.4.4	Display of disconnecter control unit status on LCD		
4.2.4.5	Tampering conditions status on LCD		
4.2.4.6	Display parameters configurable by software action		
4.2.4.7	Provision for scrolling through display parameters		
4.2.5 Consumer Interface Unit (CIU)			
4.2.5.1	Ability to query the Meter by use of CIU or other devices		
4.2.6 Real time clock & memory			
4.2.6.1	Real-time clock quartz crystal oscillator controlled		
4.2.6.2	Clock accuracy as per IEC 62054-21		
4.2.6.3	Remote and local clock synchronization		
4.2.6.4	Clock back-up power supply		