



**SPECIFICATIONS FOR SMART SINGLE PHASE STATIC METERS FOR
ACTIVE ENERGY**

SPECIFICATIONS

FOR

SMART SINGLE PHASE STATIC METERS

FOR ACTIVE ENERGY

	NAME	DESIGNATION	SIGNATURE	DATE
Compiled by	Patricia Ngaanga	Ag. Senior Engineer		27-03-2014
Checked by	Thagichu Kiiru	Deputy Manager, Installation Inspection & Fraud Control		27-03-2014
Counter Checked by	Thomas Ogutu	Ag. Customer Service Manager		27/03/2014
Approved by	Joshua Mutua	Ag. Chief Manager, Commercial Services		29/3/2014

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SPECIFICATIONS FOR SMART SINGLE PHASE STATIC METERS FOR ACTIVE ENERGY

Foreword

This specification was prepared by the Kenya Power Smart Metering Pilot Project Technical Committee. It lays down requirements for newly manufactured smart single phase 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. The specification 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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1. Scope

- 1.1 This specification is for newly manufactured Smart single-phase static meters for measurement of alternating current active energy in 230 V, 50 Hz single phase 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:

- [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.
- [6]ISO/IEC 14908-1:2012: Information technology – Control network protocol – Part 1: Protocol stack.



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

In case of conflict, the requirements of this specification take precedence.

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 electric 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

4. Requirements

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In addition to the requirements in IEC standards highlighted in section 2 above, the 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 Relative humidity reaching 95 % and altitude of up to 2,200 m.
- 4.1.3 The meters shall be used for measurement of active energy for domestic 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 1 phase 2-wire meters.
- 4.2.2.2 The meters shall have terminals with bottom entry for cables and the arrangement shall be **L: N: N: L (Live In: Neutral In: Neutral Out: Live out)** respectively).
- 4.2.2.3 The meter base and cover shall be of non-metallic, non-hygroscopic, flame retardant, polished material having high impact-resilience and low dirt absorption properties.
- 4.2.2.4 The front cover may be of translucent material but shall have a window (clear glass or polycarbonate) for reading the display and for observation.



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- 4.2.2.5** The meters shall conform to the degree of protection of at least **IP 51** as given in **IEC 529:1989** Degrees of protection provided by enclosures (IP Code) Amendment 1:1999.
- 4.2.2.6** The material of which the terminal block is made shall be capable of passing the tests given in **ISO 75**.
- 4.2.2.7** The meters shall be for front projection mounting.
- 4.2.2.8** The meters shall have sealing provisions for the meter body, meter cover and terminal cover
- 4.2.2.9** The meters shall be equipped with lockable/sealable push buttons where such buttons are used to change some meter parameters.
- 4.2.2.10** The potential link of the meters shall be internal (inside the sealed part of the meter).
- 4.2.2.11** The meters shall have a sealing provision for terminal cover.
- 4.2.2.12** The meter terminal cover shall be such that it will not be possible to access meter installation screws without breaking the meter cover seal(s).
- 4.2.2.13** Terminal holes shall be of sufficient size to accommodate the cables of at least **8 -mm** diameter.
- 4.2.2.14** The meters **terminal holes** and **screws** shall be made of **brass** or **nickel-plated brass** for high strength and good conductivity.
- 4.2.3 Communication**
- 4.2.3.1** The meters shall have LED indicators for testing and indication of kWh and kvarh-measurement.

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- 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 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 meters (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.



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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.

4.2.4.4 The meters LCD shall be capable of displaying the current state of the disconnect 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 meters shall have provision for scrolling through the display parameters.

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

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- 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 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.

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.



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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: At least 80 A
- c) Maximum overload current: At least 96 A (30 min)
- d) Maximum switching voltage: 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

4.2.8 Time-of-use tariff measurements

4.2.8.1 The meters shall be capable of measuring and displaying time-of-day active and reactive energy consumption up to four tariff registers.

4.2.8.2 The meters shall be capable of measuring and displaying time-of-day demand (kW and/or kVA) consumption up to four tariff registers.

4.2.8.3 Each tariff register shall be set to operate over defined time periods during a 24-hour day.

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4.2.8.4 The meters shall have at least two seasons and four day types namely weekday, Saturday, Sunday and Special/Holiday with switching times set independently.

4.2.8.5 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 be capable of recording of active energy in all 4 quadrants with up to 4 tariffs.

4.2.8.4 The meter shall have at least four (4) registers for energy.

4.2.8.5 The meters shall be capable of measuring energy in security mode and also record reversed units.

4.2.8.6 Meters shall have a facility to indicate reverse energy consumption.

4.2.8.7 The meters shall have capability of closing end of billing period on any selected date of the month selectable by software.

4.2.8.8 The meter's billing registers shall **NOT** be re-settable to zero readings.

4.2.8.9 The meters shall have at least twelve (12) billing historical data stored in memory and retrievable by software action.

4.2.10 Demand measurements



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- 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.
 - 4.2.9.7** It should provide local or remote demand reset.
- 4.2.11 Instrumentation data measurements**
- 4.2.10.1** The meters shall be capable of displaying instrumentation data namely instantaneous phase voltages and currents, phase angles, and power factor.
 - 4.2.10.2** The meters shall be capable of measuring and displaying instantaneous power (active, reactive and apparent).
 - 4.2.10.3** The meters shall be capable of continuous display of the presence or absence of individual phase voltages.
- 4.2.12 Load profiling**

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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.

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

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

4.2.14 Security features

4.2.14.1 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;
4. Battery voltage status, (if applicable);
5. Memory status;



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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

4.2.14.2 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.

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

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

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

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4.2.14.6 The meters shall have sealing provisions for meter cover, terminal cover and any other opening whose access would compromise the meter security.

4.2.14.7 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 with reference values of: -

230 V, 50 Hz.

4.3.2 The meters shall be connectable for single phase two wire systems, drawing of which shall be indicated on the terminal cover or on the meter base (**stickers will not be acceptable**).

4.3.3 The meter shall have reference standard currents of: -

$I_b = 5 \text{ A}$; $I_{\max} \geq 80 \text{ A}$.

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



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The requirement of 2[2] applies.

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

4.4.3 Limits of error due to influence quantities

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

4.4.4 Test of starting and no-load condition

The requirement 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 requirement 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.

4.5 Instructions and marking

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4.5.1 In addition to 2[1] 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) Bar code with meter number information
- f) The inscription "Property of K.P. & L. Co Ltd."
- g) Standard to which the meter complies;
- h) Year of manufacture.

All markings to be written in English and with at least 4 mm figure height.

4.5.2 Every meter shall be indelibly marked with diagrams of connections and phase sequence 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) User's and service 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 with copies of certificates of**



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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 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
- 4.5.7 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.
- 4.5.8 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 with the tender to facilitate confirmation of this information by the procuring entity.

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

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- 5.1 Drawings and technical details shall be submitted to Kenya Power (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 **eighteen (18) 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 a minimum of three (3) working days each.
- 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:



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- 1) Meter features;
 - 2) Meter metrology;
 - 3) Meter installation;
 - 4) Meter anti tamper features
- 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 KP'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

Kenya Bureau of Standards,

P.O. Box 54974, 00200 Nairobi, Kenya.

Tel: (+254 020) 605490, 602350

Fax: (+254 020) 604031



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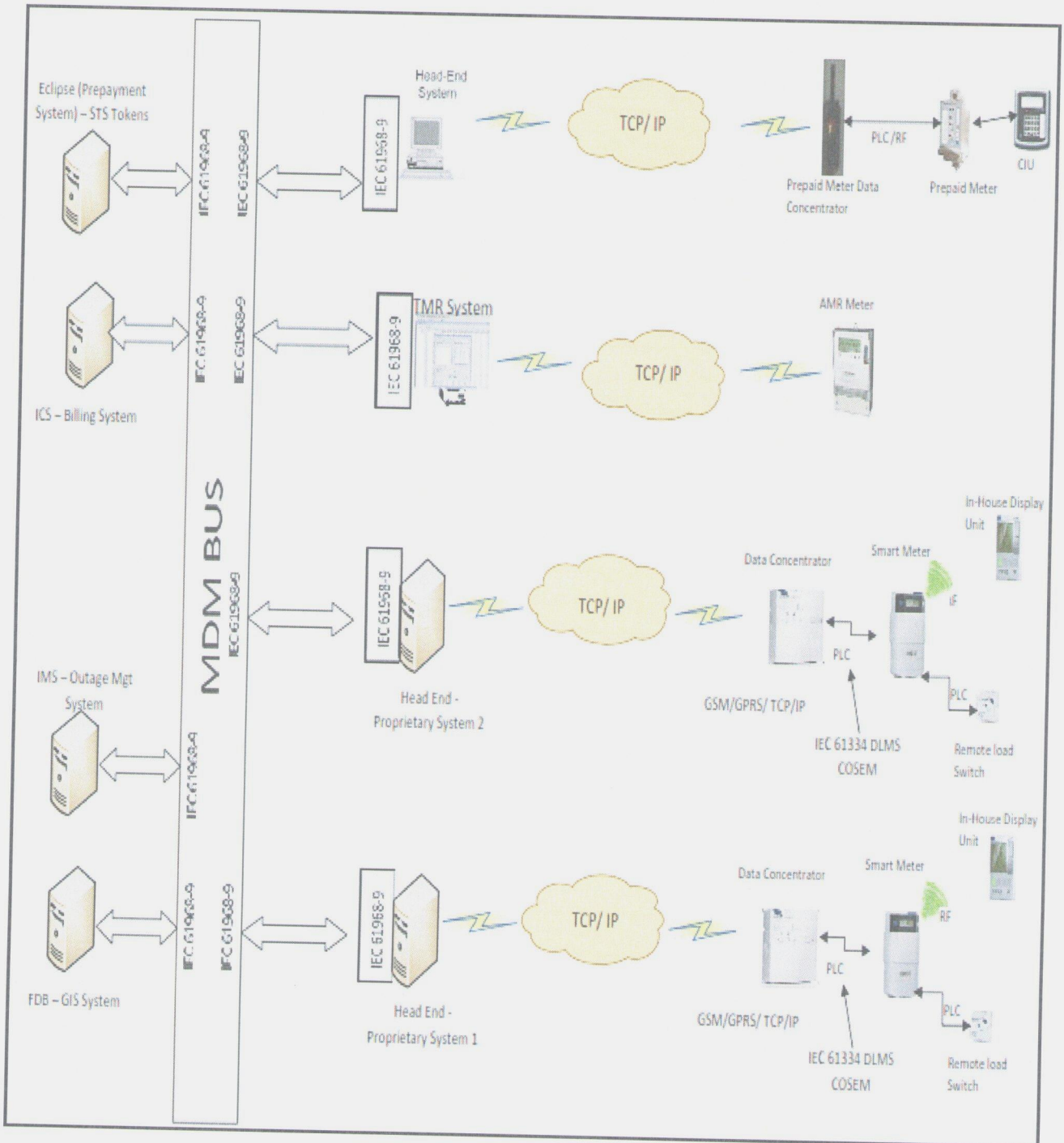
Email: info@kebs.org

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. The range of meter serial numbers shall be indicated on the outside of the packaging material.
- 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
EMC Tests	IEC 61000-4-3; EN 55014/55022
Degree of protection	IP51
Measurement Base	Active
Network type	2-wire
Connection type	Direct
Accuracy	kWh class 1.0 (IEC 62053-21:2003) and kvarh class 2.0 (IEC 62053-23:2003)
Humidity:	Reaching 90%
Altitude	Up to 2,200m
Temperature range (operating)	-1 to +45 ° C
Voltage measurement (U_n)	230 V 50 Hz
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	$I_b = 5$ A; $I_{max} = 80$ A
Short circuit current	30 I_{max}
Starting current	0.004 I_b
Current circuit burden	≤ 4 VA
LCD display	At least 7 digits, Nil decimals
Dielectric strength	4 kV, 50 Hz., 1 min
Terminal entry diameter	8.0 mm
Indications	Reverse current, Earth loop and Power ON
System interface	PLC Interface GSM/GPRS (Optional)
Local interface	Optical (IEC 62053-21)
Local interface (Meter and HAN)	Wireless, at least 100 metres



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Disconnecter	1-pole disconnecter (live only)
Default communication between meter & Data concentrator;	OFDM

APPENDIX C: LIST OF ID 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)

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

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- 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 voltage
- 31.7.0 Phase Current

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



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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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APPENDIX E: Specifications matrix for Smart single phase static meters for active energy

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	1 phase 2- wire configuration		
4.2.2.2	L:N:N:L terminal configuration		
4.2.2.3	Meter base and cover of non-metallic, non-hygroscopic, flame retardant, polished material		
4.2.2.4	Clear glass or polycarbonate window		
4.2.2.5	Degree of protection: At least IP 51		
4.2.2.6	Material of Terminal block to pass tests of ISO 75		
4.2.2.7	Front projection mounting		
4.2.2.8	The meters shall have sealing provisions for the meter body, meter cover and terminal cover.		
4.2.2.9	The meters shall be equipped with lockable/sealable push buttons where such buttons are used to change some meter parameters		
4.2.2.10	Potential link of meter internal		
4.2.2.11	Sealing provisions for terminal cover		
4.2.2.12	Terminal cover requirement		
4.2.2.13	Terminal holes to accommodate 8 mm diameter cables		
4.2.2.14	Brass and Nickel plated terminal holes		
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 or equivalent compliant protocol		



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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 IEC62054-21		
4.2.6.3	Remote and local clock synchronization		
4.2.6.4	Clock back-up power supply		
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		

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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: 80 A		
c)	Maximum overload current: 96 A (30 min)		
d)	Maximum switching voltage: 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	Local or remote demand reset function		
4.2.8	Time-of-use tariff measurements		
4.2.8.1	Measurement and display of TOU active energy		
4.2.8.2	Measurement and display of TOU kW and/or 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 forty (40) special days		
4.2.9	Energy measurements		
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	The meters shall be capable of recording of active and reactive energy in all 4 quadrants with up to 4 tariffs		
4.2.9.4	The meter shall have at least four (4) registers for energy		
4.2.9.5	The meters shall be capable of measuring energy in security mode and also record reversed units		
4.2.9.6	Meters shall have a facility to indicate reverse energy consumption		



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4.2.9.7	The meters shall have capability of closing end of billing period on any selected date of the month selectable by software		
4.2.9.8	The meter's billing registers shall NOT be re-settable to zero readings		
4.2.9.9	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		
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	Multiple channels of energy, demand, voltage, current, etc profiling		
4.2.12.2	Integration period, 1 min up to 60 mins		
4.2.13	Power Quality Analysis		

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4.2.13.1	Collection and recording of PQ information – overcurrent, alarms, power outages, etc		
4.2.13.2	Voltage sag and swell detection		
4.2.13.3	THD event detection up to 10 th harmonic		
4.2.14	Security features		
4.2.14.1	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		
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 even during power failure		
11	Main meter cover removal even during power failure		
12	Communications removal		
13	Magnetic detection, at least 0.5 mT		
14	Neutral Bypass		
15	Incoming & outgoing lead interchange		
4.2.14.2	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.		
4.2.14.3	The meters shall have the relevant software for programming and reading out data		

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4.2.14.4	The meter software/program shall be capable of tracking user access to the meter		
4.2.14.5	Access to meter parameters and programming information shall only be through user-level password(s)		
4.2.14.6	The meters shall have sealing provisions for meter cover, terminal cover and any other opening whose access would compromise the meter security		
4.2.14.7	Provision of a Laptop computer and two optical probes		
4.3	Electrical requirements		
4.3.1	Mains reference, 230 V, 50 Hz		
4.3.2	2-wire system connection		
4.3.3	$I_b = 5 \text{ A}$; $I_{max} \geq 80 \text{ A}$		
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		
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 IEC 62053-21:2003 and IEC 62053-23:2003		
4.4.3	Limits of errors due to influence quantities as per IEC 62053-21:2003 and IEC 62053-23:2003		
4.4.4	Test of starting and no-load current as per IEC 62053-21:2003 and IEC 62053-23:2003		
4.4.5	Meter constant as per IEC 62053-21:2003 and IEC 62053-23:2003		
4.4.6	Accuracy test conditions as per IEC 62053-21:2003 and IEC 62053-23:2003		
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		

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(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 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		

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

Signature.....

Date..... Stamp/Seal