THE KENYA POWER & LIGHTING COMPANY LIMITED

SPECIFICATION

for

SINGLE-PHASE SPLIT PREPAYMENT DIN RAIL MOUNTING
STATIC WATT-HOUR METERS FOR ACTIVE ENERGY
(Using PLC as medium of communication between MCU and UIU)

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REVISION RECORD

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0	6th Issue	September 2011
1	Exclusion of clause 5.3 and 5.4	May 2014.
2	Inclusion of clause 4.2.1.7, 4.2.1.23&23, 4.5.8	August 2014
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Foreword

This specification lays down requirements for single-phase DIN rail mounting split prepayment meters for active energy, where the communication between MCU and UIU is by means of PLC. 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 single-phase split prepayment meters for active energy to be used at Kenya Power and Lighting Company Ltd. The specification lays down the minimum requirements for equipment acceptable for evaluation.

1.   Scope

This specification applies to newly manufactured, single-phase Din rail mounting static watt-hour prepayment meters for direct connection, for measurement of alternating current electrical energy consumption at a nominal frequency of 50 Hz.

The method of credit transfer shall be through encrypted numeric tokens complying with the 20-digit STS encryption algorithms. The meters shall include a load switch for the purpose of interruption or restoration of the electricity supply to the load in accordance with the current value of the available credit maintained in the prepayment meter.

The Measurement and Control Unit (MCU) shall be separated from the User Interface Unit (UIU) and method of communication between them shall be over power line carrier for a distance not less than one hundred (100) metres.

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.

[1]   IEC 62055-31:2005 Electricity metering – Payment systems – Part 31: Particular requirements – Static payment meters for active energy (classes 1 and 2).

[2]   IEC 62052-11:2003, Electricity Metering equipment (a.c.) – General Requirements, Tests and Test Conditions- PART 11: Metering equipment.

[3]   IEC 62053-21:2003, Electricity metering equipment (a.c.) –
        Particular Requirements - Part 21: Static meters for active
        energy (class 1.0).

[4]   SANS1524-1:2004 Electricity prepayment Systems, Part 1:
        Prepayment meters.

3.   Terms and definitions

The definitions given in [1], [2] and [4] shall apply.

MCU: Measurement and Control Unit

UIU: User Interface Unit

4.   Requirements

Prepayment meters shall comply with the requirements of [1] and [3] for
outdoor meters. The prepayment meters shall be mounted as for normal
service.

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 up to 90% and altitude of up to 2,200m.

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

4.2.1.1   The requirements given in [1] shall apply.

4.2.1.2   The Measurement and Control Unit (MCU) shall be of DIN rail
           mounting with locking clip, to fit to a 35 mm Din rail.

4.2.1.3   The MCU and UIU shall communicate via PLC for a distance of not
           less than one hundred (100) meters.

4.2.1.4   The meters shall have terminals as follows: i) Top: Live-in, Neutral-in;
           Bottom: Live-out or ii) Top: Live-in, Neutral-in: Bottom: Live-out,
           Neutral-out. The meter terminals shall have a protection cover against
           ingress of water.

4.2.1.5 The MCU dimensions shall not exceed: Height = 170 mm; Width = 60 mm; and Depth = 130 mm; and meter base shall be on the width side where the Din rail mount shall be located.

4.2.1.6 The MCU body shall be ultrasonically sealed for life and there should be no screws on the MCU body except for the termination of cables.

4.2.1.7 The meter shall have terminal cover open detection. Once the terminal cover is opened, the load shall be disconnected.

4.2.1.7.1 The MCU shall be supplied with loading switch in open mode and installer can open terminal cover when MCU is not activated by commissioning code (token).

4.2.1.7.2 After installation of MCU, the installer will input a commission code (token) to close the loading switch and activate terminal cover open detection function.

4.2.1.7.3 After commissioning token in put into the MCU and loading switch closes, opening of the terminal cover will lead to tamper. When MCU has power and terminal cover is opened, MCU will disconnect immediately. When MCU has no power and terminal cover is opened, MCU will detect and record the event and disconnect immediately power resumes.

4.2.1.8 The MCU shall be sealed and its printed circuit boards conformal coated in a manner so as not to allow malfunction due to ingress of moisture, vermin, dust, chemicals and temperature extremes.

4.2.1.9 The meters terminal holes and screws shall be made of brass or nickel-plated brass for high conductivity and corrosion resistance.

4.2.1.10 Terminal holes shall be of sufficient size to accommodate the cables of at least 8-mm diameter and allow a minimum 15mm length of stripped cable for firm grip.

4.2.1.11 The meter's terminal screw inserts shall be sealable with utility wire seals.

4.2.1.12 The meters protection class shall be class II (Double insulated).

4.2.1.13 The meters shall have a non-volatile memory capable of data storage and with long-term data retention period of not less than 10 years or for the certified life of the meter or whichever is greater without an electrical supply being supplied to the meter.

4.2.1.14 The meters shall have register codes to indicate information functions like Instantaneous power, Current credit register, Power fail counter, Last credit token number, Value of last credit token, etc. These values shall be available on the UIU display.

4.2.1.15 The principal unit for the measured values shall be the kilowatt-hour (kWh).

4.2.1.16   The meter shall have a means of reading the credit register to within a resolution of at least 0.01 kWh for testing purposes.

4.2.1.17   The meters shall detect significant reverse energy (SRE) when the line and load wires are swapped.

4.2.1.18   The meters shall continue to operate correctly and decrement credit or trip during SRE detection.

4.2.1.19   The meters shall have LED indicators for testing and indication of kWh consumption.

4.2.1.20   The meters shall have an optical communication port, compliant to IEC62055-52 for accessing information stored inside the meter through a hand held unit.

4.2.1.21   The meters shall be scalable/ upgradable to smart prepayment meters via use of software. This shall be done by programming via the optical port.

4.2.1.22   The meters shall work under postpaid mode or prepaid mode. The switch of mode shall be done via token or optical communication.

4.2.1.23   The meters shall be supplied together with three copies of software for interrogating the meter data; and it shall not be possible to reprogram the meters using this software.

4.2.1.24   The meters shall be compliant with DLMS/COSEM communication protocol.

4.2.1.25   The MCU shall conform to the degree of protection IP 51 as given in IEC 529. The terminals shall be so designed so as to ensure protection from ingress of water and dust.

4.2.1.26   The meters shall support two way communication.

4.2.2 Functionality

4.2.2.1 Measurement and Control Unit (MCU)

4.2.2.1.1   The MCU shall have a load switch to automatically interrupt the load circuit on the expiry of credit balance.

4.2.2.1.2   The load switch shall automatically restore the load circuit after top up.

4.2.2.1.3   The meter load switch shall comply with the requirements given in [1].

4.2.2.1.4   The meters shall be able to indicate absence or presence of continuous power.

4.2.2.1.5   The meters shall disconnect the load if power failure is detected and connect the load after normalization.

4.2.2.1.6 The meters shall have a programmable power limit setting that shall disconnect the load once exceeded and reconnect once the load falls below the set limit.

4.2.2.1.7 The MCU shall support two elements double-circuit measurement. In case there is an imbalance between the phase circuit and the neutral circuit, The MCU will take it as a tamper event and disconnect the loading switch.

4.2.2.1.8 The MCU shall have a diagnostic LED to indicate the presence of communication between the MCU and the UIU.

4.2.2.1.9 The MCU shall continue metering and decrement credit, regardless of the state of the communications interface or the UIU.

4.2.2.1.10 The MCU shall come fitted with an SCSSCAAA9 (MC171) compliant data port for programming and interrogating the meter. Two (2) sets of data interrogating and programming probes and software (1 each for optical and SCSSCAAA9 ports) shall be provided with the meter sample for evaluation. For the winning bidders, each delivery of 100,000 meters shall have 100 sets of probes and software for use with the optical and the SCSSCAAA9 ports.

4.2.2.1.11 The MCU shall be supplied together with a plastic card of dimension 85mm X 54 (length X height) mm and material similar to that of a credit card indicating the meter number. The meter serial number shall be engraved on the card together with its bar code version and also stored in a magnetic medium with capability of being read out when the card is swiped.

4.2.2.1.12 The MCU shall be with pre-loaded 0 (Zero) kWh.

4.2.2.2 User Interface Unit (UIU)

4.2.2.2.1 The UIU shall comply with 20-digit (STS) encryption algorithms. All correctly entered tokens shall be registered to eliminate fraud.

4.2.2.2.2 The UIU's keypad shall be user friendly with a LCD display for numeric credit display and language independent pictograms to identified operational features. The height of the display characters for the numeric values shall not be less than 4.5 mm.

4.2.2.2.3 The UIU display shall have at least seven 7-numerical characters comprising of five integers and two decimals.

4.2.2.2.4 The UIU shall conform to the degree of protection IP 51 as given in IEC 529.

4.2.2.2.5 The UIU shall communicate with MCU through (PLC) communication link for distance not less than one hundred (100) meters.

4.2.2.2.6 The UIU shall be an interchangeable unit and it shall be possible to view the mated MCU on the UIU.

4.2.2.2.7   The UIU shall enable loading the meter with a number of pre-purchased units of credit, without loss of any existing credit balance.

4.2.2.2.8   The UIU shall, upon acceptance of a valid token credit the exact amount contained on the token to the appropriate register in the meter and shall increment the register by this amount.

4.2.2.2.9   The UIU shall transfer the credit in kWh.

4.2.2.2.10   The UIU shall display the cumulative kilowatt-hour register.

4.2.2.2.11   The UIU shall have a means to remove digits from a partially entered number sequence-backspace key.

4.2.2.2.12   The UIU shall have the ability to recall the last five successful credit tokens entered and the associated dates and time.

4.2.2.2.13   The UIU shall be able to indicate the meter software.

4.2.2.2.14   The UIU shall indicate the status of the incoming supply.

4.2.2.2.15   The UIU shall indicate the credit status.

4.2.2.2.16   The UIU shall indicate token acceptance or rejection.

4.2.2.2.17   The UIU shall give low credit warning by means of a flag on UIU display and audio alarm. The UIU shall have option of muting the low credit warning sound by entering a code on the UIU.

4.2.2.2.18   The UIU keypad shall have backlight to enable keying of tokens in the dark.

4.2.2.2.19   The UIU shall be wall mountable

4.3   Electrical requirements

4.3.1   The meters shall be operated from mains with reference values of 230V , 50 Hz, with a load switching voltage range from $0.5U_n$ to $1.15U_n$.

4.3.2   The load switch shall interrupt the supply when the voltage is below $0.4\ U_n$ and above $1.15U_n$.

4.3.3   The load switch shall automatically restore supply within a minute when the voltage falls within $0.4 - 1.15\ U_n$.

4.3.4   The meters shall be connectable for 2-wire systems, drawing of which shall be printed on the meter body.

4.3.5   The meter shall have reference standard currents of: -

- $I_b = 5\ A,\ I_{max} \geq 80\ A$

4.3.6   Power consumption

- The requirement of [3] applies.

4.3.7   Influence of short-time over-currents

- The requirement of [3] applies.

4.3.8 Influence of self-heating

- The requirement of [3] applies.

4.3.9 Over-voltage

- The requirement of [3] applies.

4.3.10 Insulation test

- The requirement of [3] applies.

4.3.10 Insulation test

- The requirement of [3] applies.

4.3.11 EMC test

- The requirement of [3] applies.

Requirements 4.3.6 to 4.3.11 shall form part of the type test approval to be issued by an international or the national (of the country of manufacture) meter certifying body.

4.4 Accuracy requirements

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

4.4.1 The meter's accuracy shall be of class 1 for active energy.

4.4.2 Limits of errors due to variation of the current.

- The requirement of [3] applies.

4.4.3 Limits of error due to influence quantities

- The requirement of [3] applies.

4.4.4 Test of starting and no-load condition

- The requirement of [3] applies.

4.4.5 Meter constant

- The requirement of [3] applies.

4.4.6 Accuracy test conditions

- The requirement of [3] applies.

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

4.5 Instructions and Marking

4.5.1 General

The requirements given in [1] shall apply. The information shall be in legible English, indelibly marked on the meter and of at least 4mm figure height.

4.5.2 Specific marking requirements

The following information shall be marked on each meter.

a) The standard transfer specification (STS) compliant serial number, in the preferred format known as a national meter number,

b) The STS compliance logo,

c) The inscription "Property of K.P. &. L. Co Ltd.",

d) Bar Coded information without blank spaces.

4.5.3 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 of the meter being offered;

d) Users and operational manuals.

4.5.4 A sample of the meter offered shall be submitted together with test tokens for; different Power Limit Settings and resets for the same, Credit and Clear Credit Tokens to aid in the testing of the meters. The manufacturer might be required to provide more tokens at no extra cost.

4.5.5 Copies of type approval certificate (s) with test and calibration results of the meter being offered 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 accreditation, under ISO/IEC 17025 from the national or an international certification body.

4.5.6 **The bidder shall complete clearly, all the clauses in both columns of the Schedule in Appendix B. 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.**

4.5.7 The manufacturer shall provide proof of conformance to ISO 9001(2008) standards by attaching valid copy certificates.

4.5.8 The manufacturer shall provide a list and contact details of at least four previous utilities to which the meter being offered has been supplied.

4.5.9 The manufacturer should have supplied a minimum of 200,000 pieces of the meter type offered to similar utilities in the past two years.

4.5.10 Copies of DLMS/COSEM certificates shall be submitted with this tender

4.5.11 **The manufacturer shall produce meters that fully meet the requirements of the IEC standard, IEC 62055-51:2007 - Electricity metering - Payment systems Part 51: Standard transfer specifications and hence :**

- **Facilitates interoperability** amongst hardware, software and meters supplied by other manufacturers

- **Does not lock KPLC** to only the bidder or any one supplier or manufacturer in its future procurement of prepayment meters, software or hardware.

5. Information and Warranty (In Case of Tender Award)

5.1   Drawings and technical details shall be submitted to KPLC for approval before manufacture of the meters commences. KPLC undertakes to submit their comments or approval for the drawings within three weeks of receiving the draft copies.

5.2   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 months from the date of delivery. All defective meters shall be replaced at the supplier's cost.

5.3   KPLC shall meet the full costs of two engineers, for meter inspection and acceptance testing at the manufacturer's facility.

5.4   **Samples**

     (a)   The tenderer shall submit one MCU and two (2) UIU samples 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 -requirements of this specification. Samples 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
     Email: info@kebs.org

     Web:http://www.kebs.org

5.5   The meters shall be packaged in such a manner as to minimize damage and entry of moisture during transportation and handling.

5.6   The meters shall be packed in suitable groups and / or batches with consecutive serial numbers. Packaging shall be done only after KPLC approval

5.7 The meters shall be packaged in multiples of ten unless where the number of meters in a group/batch does not make a multiple of ten.

5.8 The number of meters packaged in a group and/or batch for handling/lifting/carrying by an operator manually shall be such that their weight does not exceed 15 kg.

5.9 The supplier shall indicate the delivery time versus quantities of each type of meter and his production capacity.

5.10 Where test and / or calibration certificates/ reports are issued by a laboratory other than the International / National Standards and Testing Authority, a copy of accreditation certificate, under ISO/IEC 17025 from the International/ National meter certification body shall be attached together with the tender documents.

5.11 The manufacturer shall provide current e-mail addresses, fax and telephone numbers of the national / international testing / calibration laboratories and meter certification bodies. The test certificates shall bear the product serial number of meter on offer.

6. Appendices

Appendix A: Summary of Technical Data

Measurement and Control Unit - General information	
Type	Single phase, 2-wire, direct connected prepayment meter
Compatible networks	Single phase, 2-wire, earthed neutral
Electrical ratings	
Accuracy	kWh Class 1 (IEC 62053-21)
Voltage measurement (U_n)	230V; 50Hz
Load switching voltage range	$0.5\ U_n$ to $1.15\ U_n$
Voltage circuit burden	≤ 1.5 W and 10 VA
Current circuit burden	≤ 4.5 VA @ Base reference current I_b
Current measurement	$I_b \leq 5$ A; $I_{max} \geq 80$ A.
Protective class	Class II double insulated
MCU Enclosure	
Mounting	Rail mounting, with locking clip compatible with 35 mm DIN standard rail
Rating	IP54, suitable for installation in a pole-top or outdoor kiosk housing
Material	UV stable polycarbonate/ABS blend with flame retardant
Resistance to heat and fire	As per IEC 60695-2-1 (glow-wire)
Resistance to spread of fire	UL94-VO rated @ 1.5mm
Terminals	
Type	Moving-cage terminal
Material	Mild steel/nickel/brass
Maximum Cable Size	$10\ mm^2$
Operating environment	
Area of application	Indoor meter
Operating temperature range	$-1\ ^{\circ}C$ to $45\ ^{\circ}C$
Storage temperature range	$-10\ ^{\circ}C$ to $55\ ^{\circ}C$
Relative humidity	Maximum 90%, annual mean 75%
Operation	
General	Credit store with decrement-on-use
Credit entry mechanism	Keypad; encrypted numeric tokens
Credit encryption method	20-digit STS
Metrological performance	
Measurement direction	Forward and reverse detection and metering
Consumption indicator	Visible LED
Status indication	Visible LED
Liquid Crystal Display (LCD)	8 digits + icons; icon information, numeric information
Accurate metering range	$0.05\ I_b$ to $1.2\ I_{max}$

Starting current	≤0.004 I_b
Short circuit current	30 I_{max}
Disconnection Device	
Type	Single pole latching contactor, 100 A.
Insulation; Over voltage and Surge Protection	
Insulation system classification	Protective class II
Insulation level	4 kV rms for 1 minute
Over voltage withstand	400 VAC for 48 hours
Surge immunity	
Voltage impulse withstand	In excess of 6 kV, 1.2/50µs (IEC 62052-11)
Current impulse withstand	5kA/20 µs
Electromagnetic compatibility	
Electrostatic discharge	15 kV air discharge
Immunity to HF fields	80 MHz to 2 GHz @ 10V/m with load 80 MHz to 2 GHz @ 30V/m no load
Immunity to FTB	4 kV
Radio interference	Complies with requirements for CISPR 22
Specification Compliance	IEC 61000-4-2; IEC 61000-4-3; IEC 61000-4-4; IEC 61000-4-6 CISPR 22
Communication Circuitry	
Type	PLC
Rated Impulse Voltage	Peak Voltage 6 kV (1,2/50µs) waveform (According to IEC 62052-11 protective class II)
Insulation properties	4 kVrms (1 Minute) (According to IEC 62052-11 protective class II)
Communication Distance	≥ 100 metres
User Interface Unit	
Type	PLC
Operating Range (Com)	≥100 metres
Operating Environment	
Operating Temperature	-10 °C to 45 °C
Storage Temperature Range	-10 °C to 55 °C
Relative Humidity	75 %
UIU Enclosure	
Type	Wall mounted
Rating	IP 51
Material	UV stable polycarbonate/ABS blend with flame retardant
Sealing	

Enclosure	Factory sealed, no user serviceable parts
Type	Language-independent
Components	Pictographic/Numeric LCD display, keypad, LED rate of consumption indicator, audio feedback
Liquid Crystal Display (LCD) Size	At least 7 digits + 11 icons; icon information; numeric information display of various meter information such as credit levels, token entry, etc
Keypad	12-key, international standard layout including "information" and "backspace" keys
Buzzer	Feedback on key press, Token Accept and Reject melodies, low-credit alarms as a factory-programmable option
Light emitting Diode (LED)	Rate of consumption indicator (pulse rate proportional to current rate of consumption)

Appendix B: Specifications Matrix for Split Prepayment Static Meters for active Energy - Guaranteed Technical Particulars (GTP)

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.1	OPERATING CONDITIONS		
4.1.1	Suitable for operation in tropical climate where temperatures may vary from -1 to + 45 degrees Celsius.		
4.1.2	Suitable for operation with average Annual Relative humidity reaching 90% and altitude of up to 2,200m.		
4.1.3	Used for measurement of active energy for domestic loads under tropical climate conditions.		
4.2	DESIGN AND CONSTRUCTION		
4.2.1	General		
4.2.1.1	The requirements given in [1] shall apply.		
4.2.1.2	MCU of DIN rail mounting with locking clip, to fit to a 35 mm Din rail.		
4.2.1.3	The MCU and UIU communicate via PLC for a distance of not less than one hundred (100) meters.		
4.2.1.4	Meters with terminals as follows: i) Top: Live-in, Neutral-in; Bottom: Live-out or ii) Top: Live-in; Bottom: Live-out, Neutral-out. Terminals protected against ingress of water		
4.2.1.5	MCU dimensions: Height = 170 mm; Width = 60 mm; and Depth = 130 mm; and meter base shall be on the width side where the Din rail mount shall be located.		
4.2.1.6	The MCU body ultrasonically sealed for life and there should be no screws on the MCU body except for the termination of cables		
4.2.1.7	Terminal cover open detection (Load switch) and commissioning token		
4.2.1.8	The MCU printed circuit boards conformal coated		
4.2.1.9	Terminal holes and screws made of brass or nickel-plated brass		
4.2.1.10	Terminal holes accommodate cables of at least 8-mm diameter and allow a minimum 15mm length of stripped cable		
4.2.1.11	Meter's terminal screw inserts sealable with utility wire seals.		
4.2.1.12	Protection class shall be class II (Double insulated).		
4.2.1.13	Meters with non-volatile memory capable of data storage and with long-term data retention period of not less than 10 years or for the certified life of the meter or whichever is greater without an electrical supply being supplied to the meter.		
4.2.1.14	The meters with register codes to indicate information functions like Instantaneous power, Current credit register, Power fail counter, Last credit token number, Value of last credit token, etc.		
4.2.1.15	Principal unit for the measured values shall be the kilowatt-hour (kWh).		
4.2.1.16	Meter with means of reading the credit register to within a resolution of at least 0.01 kWh for testing purposes.		
4.2.1.17	Detect significant reverse energy (SRE) when the line and load wires are swapped.		
4.2.1.18	The meters shall continue to operate correctly and decrement credit or trip during SRE detection.		
4.2.1.19	LED indicators for testing and indication of kWh consumption.		
4.2.1.20	Meters with an optical communication port, compliant to IEC62055-52		
4.2.1.21	Scalable/ upgradable to smart prepayment meters by adding a concentrator and via use of software.		
4.2.1.22	Work under postpaid mode or prepaid mode. The switch of mode shall be done via token or optical communication.		
4.2.1.23	Supplied together with three copies of software for interrogating the meter data; and it shall not be possible to reprogram the meters using this software.		
4.2.1.24	Compliant with DLMS/COSEM communication protocol.		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.2.1.25	The MCU conforms to the degree of protection IP 51 as given in IEC 529.		
4.2.1.26	Support two way communication		
4.2.2	FUNCTIONALITY		
4.2.2.1	Measurement & Control Unit (MCU)		
4.2.2.1.1	The MCU with load switch to automatically interrupt the load circuit on the expiry of credit balance.		
4.2.2.1.2	Load switch to automatically restore the load circuit after top up.		
4.2.2.1.3	The meter load switch shall comply with the requirements given in [1].		
4.2.2.1.4	Indicate absence or presence of continuous power.		
4.2.2.1.5	Disconnect the load if power failure is detected and connect the load after normalization.		
4.2.2.1.6	With programmable power limit setting that shall disconnect the load once exceeded and reconnect once the load falls below the set limit.		
4.2.2.1.7	Two measurement elements		
4.2.2.1.8	With diagnostic LED to indicate the presence of communication between the MCU and the UIU.		
4.2.2.1.9	Continue metering and decrement credit, regardless of the state of the communications interface or the UIU.		
4.2.2.1.10	Fitted with a data port for interrogating and programming of meter. 1 set of data interrogating and programming probe and software submitted with sample		
4.2.2.1.11	Supplied together with a plastic card of dimension 85mm X 54 (length X height) mm and material similar to that of a credit card indicating the meter number. The meter serial number shall be engraved on the card together with its bar code version and also stored in a magnetic medium with capability of being read out when the card is swiped.		
4.2.2.1.12	The MCU shall be pre-loaded with 0 (Zero) kWh		
4.2.2.2	User Interface Unit (UIU)		
4.2.2.2.1	Comply with 20-digit (STS) encryption algorithms. Registers correctly all entered tokens		
4.2.2.2.2	Keypad user friendly with a LCD display for numeric credit display and language independent pictograms to identified operational features. Height of the display characters for the numeric values not to be less than 4.5 mm.		
4.2.2.2.3	Display with at least seven 7-numerical characters comprising of five integers and two decimals.		
4.2.2.2.4	Conforms to the degree of protection IP 51 as given in IEC 529.		
4.2.2.2.5	Communicate with MCU through (PLC) communication link for distance not less than one hundred (100) meters.		
4.2.2.2.6	Interchangeable unit and possible to view the mated MCU on the UIU.		
4.2.2.2.7	Enables loading the meter with a number of pre-purchased units of credit, without loss of any existing credit balance.		
4.2.2.2.8	Upon acceptance of a valid token credit the exact amount contained on the token to the appropriate register in the meter and shall increment the register by this amount.		
4.2.2.2.9	Transfer credit in kWh.		
4.2.2.2.10	Display the cumulative kilowatt-hour register.		
4.2.2.2.11	With means to remove digits from a partially entered number sequence-Backspace key		
4.2.2.2.12	Recall the last five successful credit tokens entered.		
4.2.2.2.13	Indicate the meter software.		
4.2.2.2.14	Indicate the status of the incoming supply.		
4.2.2.2.15	Indicate the credit status.		
4.2.2.2.16	Indicate token acceptance or rejection.		
4.2.2.2.17	Give low credit warning		
4.2.2.2.18	With backlight		
4.2.2.2.19	Wall mountable		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.3	ELECTRICAL REQUIREMENTS		
4.3.1	Reference values of 230V, 50 Hz; load switching voltage range of 0.5-1.15 U_n		
4.3.2	Load switch to interrupt the supply when the voltage is below 0.4 Un and above 1.15Un		
4.3.3	The load switch will automatically restore supply within a minute when the voltage falls within 0.4 – 1.15 Un		
4.3.4	2-wire systems		
4.3.5	Reference currents: I_b = 5 A ; I_{max} ≥ 80 A		
4.3.6	Power consumption		
4.3.7	Influence of short time over-currents		
4.3.8	Influence of self-heating		
4.3.9	Over-voltage test		
4.3.10	Insulation test		
4.3.11	EMC tests		
4.4	ACCURACY REQUIREMENTS		
4.4.1	Class 1 accuracy		
4.4.2	Limits of error due to variation of current		
4.4.3	Limits of error due to influence quantities		
4.4.4	Test of starting and no load condition		
4.4.5	Meter constant		
4.4.6	Accuracy test conditions		
4.5	INSTRUCTIONS & MARKINGS		
4.5.1	Requirement of marking [1]		
4.5.2	Specific markings requirements		
4.5.3	Drawings and information required		
4.5.4	Sample meter and test tokens		
4.5.5	Copies of type approval certificates		
4.5.6	Filling of matrix		
4.5.7	ISO 9001 certification		
4.5.8	Copy of DLMS/COSE certificates.		
4.5.9	List of at least 4 previous utilities.		
4.5.10	Supplied 200,000 pieces of the meter type offered to similar utilities		
4.5.11	Meters that meets fully the requirements of the IEC standard, IEC 62055-51:2007 - Electricity metering - Payment systems Part 51: Standard transfer specifications		
5	INFORMATION AND WARRANTY (In case of Tender award)		
5.1	Drawings and technical details submitted to KPLC for approval before manufacture of the meters commences.		
5.2	Warranty against any defects, which may develop due to faulty material, calibration, transportation or workmanship for a period of eighteen months from the date of delivery. All defective meters shall be replaced at the supplier's cost.		
5.3	KPLC shall meet the full costs of two engineers, for meter inspection and acceptance testing at the manufacturer's facility		
5.4	Submit one MCU and two (2) UIU samples together with the tender documents. Samples shall not be returned to the tenderers.		
5.5	Meters packaged in such a manner as to minimize damage and entry of moisture during transportation and handling.		
5.6	Packed in suitable groups and / or batches with consecutive serial numbers, provided by KPLC.		
5.7	Packaged in multiples of ten unless where the number of meters in a group/batch does not make a multiple of ten.		
5.8	Packaged in a group and/or batch for handling/lifting/carrying by an operator manually shall be such that their weight does not exceed 15 kg.		
5.9	Indicate the delivery time versus quantities of each type of meter and his production capacity.		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
5.10	Where test and / or calibration certificates/ reports are issued by a laboratory other than the International / National Standards and Testing Authority, a copy of accreditation certificate, under ISO/IEC 17025 from the International/ National meter certification body attached together with the tender documents.		
5.11	Provided current e-mail addresses, fax and telephone numbers of the national / international testing / calibration laboratories and meter certification bodies. The test certificates shall bear the product serial number of meter on offer.		

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

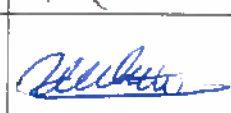Signature & Stamp ....

THE KENYA POWER & LIGHTING COMPANY LIMITED

SPECIFICATION

for

THREE-PHASE SPLIT PREPAYMENT BS MOUNTING STATIC WATT-HOUR METERS FOR ACTIVE ENERGY

(Using cable as a medium of communication between MCU and UIU)

	NAME	DESIGNATION	SIGNATURE	DATE
Compiled by	Patricia Ngaanga	1st A. Engineer, MCL		14-04-2015
	Peter Wanyonyi	1st A.E. Installations Management		14:04:15
Checked	Eng. Margaret Kanini	Chief Engineer, DSM & Metering solutions		14:04:15
Recommended by	Aggrey Machasio	Ag. Manager, Energy Management		14/4/15
Approved by	Joshua Mutua	General Manager, Customer Service		20/4/15

REVISION RECORD

REVISION	DESCRIPTION OF REVISION	DATE
0	4th Issue	October 2010
1	5th issue, inclusion of clauses 4.2.1.7, 4.2.1.21, 4.2.1.23, 4.2.1.27. 4.5.9.	August 2014.
2	6th Issue – ammendments- 4.2.1.7, 4.2.1.10, 4.2.1.12, 4.2.1.29, 4.2.2.1.11, 4.2.2.2.4, 4.3.2, 4.5.9 & 5.8	April 2015

THE KENYA POWER & LIGHTING COMPANY LIMITED

SPECIFICATION

for

THREE-PHASE SPLIT PREPAYMENT BS MOUNTING STATIC WATT-HOUR METERS FOR ACTIVE ENERGY

(Using PLC link as a medium of communication between MCU and UIU)

	NAME	DESIGNATION	SIGNATURE	DATE
Compiled by	Patricia Ngaanga	Ag.Senior Engineer, MCL		14.04.2015
	Peter Wanyonyi	1st A.E. Installations Management		14.04.2015
Checked	Eng. Margaret Kanini	Chief Engineer, DSM & Metering solutions		14:04:2015
Recommended by	Aggrey Machasio	Ag. Manager, Energy Management		14/04/15
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2	6th Issue- Ammendments – clauses - 4.2.1.6, 4.2.1.9, 4.2.1.11, 4.2.1.28, 4.3.2, 4.3.3, 4.3.4, 4.5.8, 5.4,	April 2015

Table of Contents

Foreword

This specification lays down requirements for three-phase split prepayment wall mounting meters for active energy, where the communication between MCU and UIU is by means of PLC cable. 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 three-phase split prepayment meters for active energy to be used at Kenya Power and Lighting Company Ltd. The specification lays down the minimum requirements for equipment acceptable for evaluation.

The manufacturer shall stipulate any extra and enhanced features above the requirements of this specification.

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 B.

Tenderers shall complete the schedule in Appendix B and this shall form the basis for the technical evaluation of their tender. (See clause 4.5.6). Appendix A is a snapshot of the technical data and tenderers shall indicate conformance or state any deviation from these requirements.

1. Scope

This specification applies to newly manufactured, three-phase split DIN rail mounting static watt-hour prepayment meters for direct connection, for measurement of alternating current electrical energy consumption at a nominal frequency of 50 Hz. The method of credit transfer shall be through encrypted numeric tokens complying with the 20-digit STS encryption algorithms.

The meters shall include a load switch for the purpose of interruption or restoration of the electricity supply to the load in accordance with the current value of the available credit maintained in the prepayment meter.

The Measurement and Control Unit (MCU) shall be separated from the User Interface Unit (UIU) and method of communication between them shall be by PLC communication link over a radius of not less than 100 metres.

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.

[1]   IEC 62055-31:2005 Electricity metering – Payment systems – Part 31: Particular requirements – Static payment meters for active energy (classes 1 and 2).

[2]   IEC 62052-11:2003, Electricity Metering equipment (a.c.) – General Requirements, Tests and Test Conditions- PART 11: Metering equipment

[3]   IEC 62053-21:2003, Electricity metering equipment (a.c.) – Particular Requirements - Part 21: Static meters for active energy (class 1.0).

[4]   SANS1524-1:2004 Electricity prepayment Systems, Part 1: Prepayment meters

3. Terms and definitions

The definitions given in [1], [2], and [4] shall apply.

MCU: Measurement & Control Unit
UIU: User Interface Unit

4. Requirements

Prepayment meters shall comply with the requirements of [1] and [3] for outdoor meters. The prepayment meters shall be mounted as for normal service.

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 2,200m.

4.1.3 The meters shall be used for measurement of active energy for Light commercial and industrial loads under tropical climate conditions.

4.2 Design and construction requirements

4.2.1 General

4.2.1.1 The requirements given in [1] shall apply. The product serial number for particular meter being tendered shall be indicated.

4.2.1.2 The meters shall be of British Standard (BS) 5685 footprint for standardised mounting.

4.2.1.3 The MCU and UIU shall communicate over a PLC link for a distance of not less than 100 meters.

4.2.1.4 The meters shall have terminals with bottom entry for cables and the arrangement shall be: $L1_{in}$: $L1_{out}$: $L2_{in}$: $L2_{out}$: $L3_{in}$: $L3_{out}$: NN.

4.2.1.5 The meter terminal cover shall be of short length type, flush to the meter base.

4.2.1.6 The MCU body shall be ultrasonically sealed for life and there should be no screws on the MCU body except for the termination of cables.

4.2.1.7 The MCU shall be sealed and its printed circuit boards conformal coated in a manner so as not to allow malfunction due to ingress of vermin.

4.2.1.8 The meters terminal holes and screws shall be made of brass or nickel-plated brass for high conductivity and corrosion resistance.

4.2.1.9 Terminal holes shall be of sufficient size to accommodate the cables of at least 10-mm diameter and allow a minimum 15mm length of stripped cable for firm grip.

4.2.1.10 The meter's terminal cover screw inserts shall be sealable with utility wire seals.

4.2.1.11 The MCU dimensions shall not exceed: Height = 240 mm; Width = 172 mm; and Depth = 73 mm. Terminal cover shall not be more than 113mm.flash type

4.2.1.12 The meters protection class shall be class II (Double insulated).

4.2.1.13 The meters shall have a non-volatile memory capable of data storage and with long-term data retention period for a period of not less than 10 years or for the certified life of the meter or whichever is greater without an electrical supply being supplied to the meter.

4.2.1.14 The MCU shall have a backlight LED display for displaying parameters such as time/date, remaining credit, total units consumed, instrumentation parameters..

4.2.1.15 The meters shall have register codes to indicate information functions like Instantaneous power, Current credit register, Power fail counter, Last credit token number, Value of last credit token, etc. These values shall be available on the UIU display.

4.2.1.16 The principal unit for the measured values shall be the kilowatt-hour (kWh).

4.2.1.17 The meter shall have a means of reading the credit register to within a resolution of at least 0.1 kWh for testing purposes.

4.2.1.18 The meter shall have terminal cover open detection. Once the terminal cover is opened, the load shall be disconnected.

4.2.1.18.1 The MCU shall be supplied with loading switch in open mode and installer can open terminal cover when MCU is not activated by commissioning code (token).

4.2.1.18.2 After installation of MCU, the installer will input a commission code (token) to close the loading switch and activate terminal cover open detection function.

4.2.1.18.3 After commissioning token in put into the MCU and loading switch closes, opening of the terminal cover will lead to tamper. When MCU has power and terminal cover is opened, MCU will disconnect immediately. When MCU has no power and terminal cover is opened, MCU will detect and record the event and disconnect immediately power resumes.

4.2.1.19 The meters shall be equipped with tamper sensors that shall automatically disconnect the power to the load in the event of tampering.

4.2.1.20 The meters shall detect significant reverse energy (SRE) when the line and load wires are swapped.

4.2.1.21 The meters shall continue to operate correctly and decrement credit or trip during SRE detection.

4.2.1.22 The meters shall be scalable/ upgradable to smart prepayment meters via use of software. This shall be done by programming via the optical port.

4.2.1.23 The meters shall have LED indicators for testing and indication of kWh consumption.

4.2.1.24 The meters shall work under postpaid mode or prepaid mode. The switch of mode shall be done via token or optical communication.

4.2.1.25 The meters shall have an optical communication port, compliant to IEC62056-21 for accessing information stored inside the meter through a hand held unit.

4.2.1.26 The meters shall be compliant with DLMS/COSEM communication protocol.

4.2.1.27 The meters shall be supplied together with three copies of software for interrogating the meter data; and it shall not be possible to reprogram the meters using this software.

4.2.1.28 The meters shall support two way communication.

4.2.1.29 The MCU shall conform to the degree of protection IP 54 as given in IEC 529

4.2.2 Functionality

4.2.2.1 Measurement and Control Unit (MCU)

4.2.2.1.1 The MCU shall have a load switch to automatically interrupt the load circuit on the expiry of credit balance.

4.2.2.1.2 The load switch shall automatically restore the load circuit.

4.2.2.1.3 The meter load switch shall comply with the requirements given in [1].

4.2.2.1.4 The meters shall be able to indicate absence or presence of continuous power.

4.2.2.1.5 The meters shall disconnect the load if power failure is detected and connect the load after normalization.

4.2.2.1.6 The meters shall have a programmable power limit setting that shall disconnect the load once exceeded and reconnect once the load falls below the set limit.

4.2.2.1.7 The MCU shall have a diagnostic LED to indicate the presence of communication between the MCU and the UIU.

4.2.2.1.8 The MCU shall continue metering and decrement credit, regardless of the state of the communications interface or the UIU.

4.2.2.1.9 The MCU shall come fitted with an SCSSCAAA9 (MC171) compliant data port for programming and interrogating the meter. Two (2) sets of data interrogating and programming probes and software (1 each for optical and SCSSCAAA9 ports) shall be provided with the meter sample for evaluation. For the winning bidders, each delivery of 100,000 meters shall have 100 sets of probes and software for use with the optical and the SCSSCAAA9 ports.

4.2.2.1.10 The MCU shall be supplied together with a plastic card of dimension 85mm X 54 (length X height) mm and material similar to that of a credit card indicating the meter number.

4.2.2.1.11 The MCU shall come preloaded with 0 (zero) kWh.

4.2.2.2 User Interface Unit (UIU)

4.2.2.2.1 The UIU shall comply with 20-digit (STS) encryption algorithms. All correctly entered tokens shall be registered to eliminate fraud.

4.2.2.2.2 The UIU's keypad shall be user friendly with a LCD display for numeric credit display and a language independent pictograms to

identified operational features. The height of the display characters for the numeric values shall not be less than 4.5 mm.

4.2.2.2.3   The UIU display shall have at least seven 7-numerical characters comprising of five integers and two decimals.

4.2.2.2.4   The UIU shall conform to the degree of protection IP 51 as given in IEC 529.

4.2.2.2.5   The UIU shall be capable of communicating to the MCU via PLC link over a distance of not less than 100 metres.

4.2.2.2.6   The UIU shall be an interchangeable unit and it shall be possible to view the mated MCU on the UIU.

4.2.2.2.7   The UIU shall enable loading the meter with a number of pre-purchased units of credit, without loss of any existing credit balance.

4.2.2.2.8   The UIU shall, upon acceptance of a valid token credit the exact amount contained on the token to the appropriate register in the meter and shall increment the register by this amount.

4.2.2.2.9   The UIU shall transfer the credit in kWh.

4.2.2.2.10   The UIU shall display the cumulative kilowatt-hour register.

4.2.2.2.11   The UIU shall have a means to remove digits from a partially entered number sequence-Backspace key.

4.2.2.2.12   The UIU shall have the ability to recall the last five successful credit tokens entered.

4.2.2.2.13   The UIU shall be able to indicate the meter software.

4.2.2.2.14   The UIU shall indicate the status of the incoming supply.

4.2.2.2.15   The UIU shall indicate the credit status.

4.2.2.2.16   The UIU shall indicate token acceptance or rejection.

4.2.2.2.17   The UIU shall give low credit warning.

4.2.2.2.18   The UIU shall have a backlight to enable keying of tokens in the dark.

4.2.2.2.19   The UIU mounting shall be wall mountable cradle (handheld).

4.3   Electrical requirements

4.3.1   The meters shall be operated from mains with reference values of 3x230V/400V, 50 Hz, with a load switching voltage operating range from $0.5U_n$ to $1.15U_n$.

4.3.2   The load switch shall interrupt the supply when the voltage is below 0.4 U_n and above $1.15U_n$.

4.3.3   The load switch should not interrupt supply if only two (2) or one (1) phase(s) voltage is/are at 0 V.

4.3.4   The load switch shall automatically restore supply within a minute when the voltage falls within $0.4 - 1.15\ U_n$.

4.3.5   The meters shall be connectable for 3 phase 4 wire systems, drawing of which shall be printed on the meter body.

4.3.6   The meter shall have reference standard currents of: -

$I_b \leq 10\ A$, Imax $\geq \square 100\ A$

4.3.7   Power consumption

The requirement of [3] applies.

4.3.8   Influence of short-time over-currents

The requirement of [3] applies.

4.3.9   Influence of self-heating

The requirement of [3] applies.

4.3.10   Over-voltage

The requirement of [3] applies.

4.3.11   Insulation test

The requirement of [3] applies

4.3.12   EMC tests

The requirement of [3] applies.

Requirements 4.3.7 to 4.3.12 shall form part of the type test approval to be issued by an international or the national (of the country of manufacture)) meter certifying body.

4.4   Accuracy requirements

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

4.4.1   The meter's accuracy shall be of class 1 for active energy.

4.4.2   Limits of errors due to variation of the current.

The requirement of [3] applies.

4.4.3   Limits of error due to influence quantities

The requirement of [3] applies.

4.4.4   Test of starting and no-load condition

The requirement of [3] applies.

4.4.5   Meter constant

The requirement of [3] applies.

4.4.6   Accuracy test conditions

The requirement of [3] applies.

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

4.5 Instructions and Marking

4.5.1 General

The requirements given in [1] shall apply. The information shall be in legible English, indelibly marked on the meter and of at least 4mm figure height.

4.5.2 Specific marking requirements

The following information shall be marked on each meter.

 a) The standard transfer specification (STS) compliant serial number, in the preferred format known as a national meter number,

 b) The STS compliance logo,

 c) The inscription "Property of K.P. &. L. Co Ltd.",

 d) Bar Coded information without blank spaces

4.5.3 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 of the meter being offered;

 d) Users and operational manuals.

4.5.4 A sample of the meter offered shall be submitted together with test tokens for; different Power Limit Settings and resets for the same, Credit and Clear Credit Tokens to aid in the testing of the meters. The manufacturer might be required to provide more tokens at no extra cost.

4.5.5 Copies of type approval certificate (s) with test and calibration results of the meter being offered 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 accreditation, under ISO/IEC 17025 from the national or an international certification body.

4.5.6 The Tenderer shall complete clearly, all the clauses in both columns of the schedule in Appendix B. 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.

4.5.7 The manufacturer shall provide proof of conformance to ISO 9001(2008) standards by attaching copy certificates.

4.5.8 The manufacturer shall provide a list of at least four previous utilities to which the meter being offered has been supplied.

4.5.9 The manufacturer should have supplied at least 5,000 pieces of the meter type offered to similar utilities.

4.5.10 Copies of DLMS/COSEM certificates to be supplied by tenderer

4.5.11 The manufacturer shall produce meters that meets fully the requirements of the IEC standard, IEC 62055-51:2007 - Electricity metering - Payment systems Part 51: Standard transfer specifications and hence :

- **Facilitates interoperability** amongst hardware, software and meters supplied by other manufacturers

- **Does not lock KPLC** to the bidder or any one supplier or manufacturer in its future procurement of prepayment meters, software or hardware

5. Information and Warranty (In case of Tender award)

5.1 Drawings and technical details shall be submitted to KPLC for approval before manufacture of the meters commences. KPLC undertakes to submit their comments or approval for the drawings within three weeks of receiving the draft copies.

5.2 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 months from the date of delivery. All defective meters shall be replaced at the supplier's cost.

5.3 KPLC shall meet the full costs of two engineers for meter inspection and acceptance testing at the manufacturer's facility.

5.4 **Samples**

(a) The tenderer shall submit one MCU and two (2) UIU samples 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
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

5.5 The meters shall be packaged in such a manner as to minimize damage and entry of moisture during transportation and handling.

5.6 The meters shall be packed in suitable groups and / or batches with consecutive serial numbers. Packaging shall be done only after KPLC approval

5.6 The meters shall be packed in suitable groups and / or batches with consecutive serial numbers. Packaging shall be done only after KPLC approval

5.7 The meters shall be packaged in multiples of ten unless where the number of meters in a group/batch does not make a multiple of ten.

5.8 The number of meters packaged in a group and/or batch for handling/lifting/carrying by an operator manually shall be such that their weight does not exceed 15 kg.

5.9 The supplier shall indicate the delivery time versus quantities of each type of meter and his production capacity.

5.10 Where test and / or calibration certificates/ reports are issued by a laboratory other than the International / National Standards and Testing Authority, a copy of accreditation certificate, under ISO/IEC 17025 from the International/ National meter certification body shall be attached together with the tender documents.

5.11 The manufacturer shall provide current e-mail addresses, fax and telephone numbers of the national / international testing / calibration laboratories and meter certification bodies.

6. Appendices

Appendix A: Summary of Technical Data

Measurement and control unit - General information	
Type	Three phase, 4-wire, direct connected prepayment meter
Compatible networks	Three phase, 4-wire, earthed neutral
Electrical ratings	
Accuracy	kWh class1 (IEC 62053-21)
LCD display	8 digits
Voltage measurement (U_n)	3x230/400 V; 50Hz
Load switching Voltage range	0.5 U_n to 1.15 U_n
Voltage circuit burden	≤ 1.5 W and 10 VA
Current circuit burden	≤ 4.5 VA @ Base reference current I_b
Current measurement	I_b ≤ 10A; I_{max} ≥ 100 A.
Protective class	Class double insulated
Enclosure	
Mounting	Wall mounting
Rating	IP54
Material	UV stable polycarbonate/ABS blend with flame retardant
Resistance to heat and fire	As per IEC 60695-2-1 (glow-wire)
Resistance to spread of fire	UL94-VO rated @ 1.5mm
Terminals	
Type	Moving-cage terminal
Material	Mild steel/nickel/brass
Maximum Cable Size	10mm^2
Operating environment	
Area of application	Indoor meter
Operating temperature range	-1 °C to 45 °C
Storage temperature range	-10 °C to 55 °C
Relative humidity	Maximum 75%
Operation	
General	Credit store with decrement-on-use
Credit entry mechanism	Keypad; encrypted numeric tokens
Credit encryption method	20-digit STS
Metrological performance	
Measurement direction	Forward and reverse detection and metering
Consumption indicator	Visible LED, 1000 impulse / kWh
Status indication	Visible LED
Liquid Crystal Display (LCD)	7 digits + icons; icon information, numeric information
Accurate metering range	0.05 I_b to 1.2 Imax
Starting current	≤0.004 I_b

Accuracy class index	Class 1
Power threshold	6.5W
Short circuit current	30 I_{max}
Disconnection Device	
Type	Three pole latching contactor. 100A.
Insulation; Over voltage and Surge Protection	
Insulation system Classification Insulation level	Protective class II 4kV rms for 1 minute
Over voltage withstand	400VAC for 48 hours
Surge immunity Voltage impulse withstand	In excess of 6kV, 1.2/50 s
Current impulse withstand	IEC 62052-11
Electromagnetic Compatibility	
Electrostatic discharge	15kV air discharge
Immunity to HF fields	80 MHz to 2 GHz @ 10V/m with load 80 MHz to 2 GHz @ 30V/m no load
Immunity to FTB	4kV
Radio interference	Complies with requirements for CISPR 22
Specification Compliance	IEC 61000-4-2; IEC 61000-4-3; IEC 61000-4-4; IEC 61000-4-6 CISPR 22
Communication Circuitry	
Type	PLC, Meter is independent of UIU function
Rated Impulse Voltage	Peak Voltage 6kV (1,2/50 s) waveform (According to IEC 62052-11 protective class II) 4kVrms (1 Minute)
Insulation properties	(According to IEC 62052-11 protective class II)
Communication Distance	≥ 100 metres
User Interface Unit	
Type	Isolated, non-polarized,
Operating Range (Com)	≥ 100 metres
Operating Environment	
Operating Temperature	-10 °C to 45 °C
Storage Temperature Range	-10 °C to 55 °C
Relative Humidity	75%
Enclosure	
Type	Slimline, wall mounted
Rating	IP 51
Material	UV stable polycarbonate/ABS blend with flame retardant
Sealing	
Enclosure	Factory sealed, no user serviceable parts

Type	Language-independent
Components	Pictographic/Numeric LCD display, keypad, LED rate of consumption indicator, audio feedback
Liquid Crystal Display (LCD) Size	8 digits + 11 icons; icon information; numeric information display of various meter information such as credit levels, token entry, etc
Keypad	12-key, international standard layout including "information" and "backspace" keys
Buzzer	Audio feedback on key press, Token Accept and Reject melodies, low-credit alarms as a factory-programmable option
Light emitting Diode (LED)	Rate of consumption indicator (pulse rate proportional to current rate of consumption)

Appendix B:

Specifications Matrix for Three phase Split Prepayment Static Meters for active Energy (Using PLC for communication between MCU and UIU) - Guaranteed Technical Particulars (GTP)

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.1	OPERATING CONDITIONS		
4.1.1	-1 to 45 °c (operational)		
4.1.2	Humidity: 0-90 %; Altitude: 0-2200 M		
4.1.3	Light Commercial & Industrial loads under tropical climate		
4.2	DESIGN AND CONSTRUCTION		
4.2.1	General		
4.2.1.1	Requirements of [1] The product serial number for particular meter being tendered shall be indicated.		
4.2.1.2	Meters shall be of British Standard (BS) 5685 footprint for standardised mounting.		
4.2.1.3	Communication PLC, at least 100 meters		
4.2.1.4	Meters shall have terminals with bottom entry for cables and the arrangement shall be: L1$_{in}$: L1$_{out}$: L2$_{in}$: L2$_{out}$: L3$_{in}$: L3$_{out}$ NN.		
4.2.1.5	The meter terminal cover shall be of short length type, flush to the meter base.		
4.2.1.6	MCU body shall be ultrasonically sealed for life. No screws except for termination of cables		
4.2.1.7	MCU sealable against vermin ingress		
4.2.1.8	Brass or nickel plated brass terminal holes		
4.2.1.9	Terminal holes shall be of sufficient size to accommodate the cables of at least 10-mm diameter and allow a minimum 15mm length of stripped cable for firm grip.		
4.2.1.10	Terminal cover screw sealability		
4.2.1.11	The MCU dimensions shall not exceed: Height = 240 mm; Width = 172 mm; and Depth = 73 mm.Terminal cover shall not be more than 113mm..flash type		
4.2.1.12	Double insulation, class II		
4.2.1.13	Non -volatile memory, 10 years		
4.2.1.14	LED display with backlight		
4.2.1.15	Meter register codes for multi functions		
4.2.1.16	kWh as principal unit of energy measurement		
4.2.1.17	Means of reading credit register with a 0.1 kWh		
4.2.1.18	Terminal cover open detection. Once the terminal cover is opened, the load shall be disconnected.		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.2.1.19	Tamper sensors on meters		
4.2.1.20	Detection of Significant Reverse Energy (SRE)		
4.2.1.21	Correct Operation or trip of MCU during SRE detection		
4.2.1.22	Meter scalable to smart		
4.2.1.23	LED indicators for testing and indication of kWh		
4.2.1.24	Prepaid/postpaid mode of operation.		
4.2.1.25	Optical communication port.		
4.2.1.26	DLMS/COSEM compliant.		
4.2.1.27	The meters shall be supplied together with three copies of software for interrogating the meter data; and it shall not be possible to reprogram the meters using this software.		
4.2.1.28	Support 2 way communication		
4.2.1.29	MCU IP54 protection IEC 529		
4.2.2	FUNCTIONALITY		
4.2.2.1	Measurement & Control Unit (MCU)		
4.2.2.1.1	Automatic interruption of Load by load switch in MCU		
4.2.2.1.2	Automatic restoration of load		
4.2.2.1.3	Load switch requirements of [1]		
4.2.2.1.4	Indication of absence or presence of power		
4.2.2.1.5	Automatic power connection and disconnection		
4.2.2.1.6	Programmable power limit setting		
4.2.2.1.7	LED indication for communication between MCU & UIU		
4.2.2.1.8	MCU continuous metering regardless of communications interface or UIU state		
4.2.2.1.9	MCU shall come fitted with an SCSSCAAA9 (MC171) compliant data port.		
4.2.2.1.10	The MCU shall be supplied together with a plastic card of dimension 85mm X 54 mm (length X height) and material similar to that of a credit card indicating the meter number.		
4.2.2.1.11	MCU preloaded with 0 (zero) kWh		
4.2.2.2	User Interface Unit (UIU)		
4.2.2.2.1	UIU, 20- digit STS encryption algorithm		
4.2.2.2.2	UIU keypad user friendly with a 4.5 mm figure height		
4.2.2.2.3	UIU display, 7 characters		
4.2.2.2.4	The UIU shall conform to the degree of protection IP 51 as given in IEC 529.		
4.2.2.2.5	UIU to communicate with MCU through PLC link, of not less than 100 metres		
4.2.2.2.6	t The UIU shall be an interchangeable unit and it shall be possible to view the mated MCU on the UIU.		
4.2.2.2.7	UIU loading of credit to existing balance		
4.2.2.2.8	UIU credit of register to existing register		
4.2.2.2.9	UIU transfer of credit in kWh		
4.2.2.2.10	UIU display cumulative kWh register		
4.2.2.2.11	UIU re-entering of credit/ token number		
4.2.2.2.12	UU ability to recall at least last 5 successful credit tokens entered		
4.2.2.2.13	UIU indication of meter software		
4.2.2.2.14	UIU indication of incoming supply		
4.2.2.2.15	UIU indication of credit status		
4.2.2.2.16	UIU indication of token acceptance/rejection		
4.2.2.2.17	UIU low credit warning		
4.2.2.2.18	The UIU shall have backlight to enable keying of tokens in the dark.		
4.2.2.2.19	The UIU mounting shall be wall mountable cradle (handheld).		
4.3	ELECTRICAL REQUIREMENTS		
4.3.1	Reference values of 3x230/400 V, 50 Hz, Load switch voltage range shall be 0.5-1.15 U_n		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.3.2	The load switch shall interrupt the supply when the voltage is below 0.4 U_n and above 1.15U_n.		
4.3.3	load switch not to interrupt supply if only two (2) or one (1) phase(s) voltage is/are at 0 V.		
4.3.4	The load switch shall automatically restore supply within a minute when the voltage falls within 0.4 – 1.15 U_n.		
4.3.5	The meters shall be connectable for 3 phase 4 wire systems, drawing of which shall be printed on the meter body.		
4.3.6	Reference currents: $I_b \le 10$ A ; $I_{max} \ge 100$ A		
4.3.7	Power consumption		
4.3.8	Influence of short time over-currents		
4.3.9	Influence of self-heating		
4.3.10	Over-voltage test		
4.3.11	Insulation test		
4.3.12	EMC tests		
4.4	ACCURACY REQUIREMENTS		
4.4.1	Class 1 accuracy		
4.4.2	Limits of error due to variation of current		
4.4.3	Limits of error due to influence quantities		
4.4.4	Test of starting and no load condition		
4.4.5	Meter constant		
4.4.6	Accuracy test conditions		
4.5	INSTRUCTIONS & MARKINGS		
4.5.1	Requirement of marking [1]		
4.5.2	Specific markings requirements		
4.5.3	Drawings and information required		
4.5.4	Sample meter and test tokens		
4.5.5	Copies of type approval certificates		
4.5.6	Filling of matrix		
4.5.7	ISO 9001 certification		
4.5.8	List of at least 4 previous utilities		
4.5.9	Should have supplied at least 5,000 pieces of the meter type offered to similar utilities.		
4.5.10	Copies of DLMS/COSEM. Certificates.		
4.5.11	Meters that meets fully the requirements of the IEC standard, IEC 62055-51:2007 - Electricity metering - Payment systems Part 51: Standard transfer specifications		
5	INFORMATION AND WARRANTY (In case of Tender award)		
5.1	Drawings and technical details shall be submitted to KPLC for approval before manufacture of the meters commences. KPLC undertakes to submit their comments or approval for the drawings within three weeks of receiving the draft copies.		
5.2	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 months from the date of delivery. All defective meters shall be replaced at the supplier's cost.		
5.3	KPLC shall meet the full costs of two engineers for meter inspection and acceptance testing at the manufacturer's facility.		
5.4	Submit one MCU and two (2) UIU samples together with the tender documents. Samples shall not be returned to the tenderers.		
5.5	Meters packaged in such a manner as to minimize damage and entry of moisture during transportation and handling.		
5.6	Packed in suitable groups and / or batches with consecutive serial numbers, provided by KPLC.		
5.7	Packaged in multiples of ten unless where the number of meters in a group/batch does not make a multiple of ten.		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
5.7	Packaged in multiples of ten unless where the number of meters in a group/batch does not make a multiple of ten.		
5.8	Packaged in a group and/or batch for handling/lifting/carrying by an operator manually shall be such that their weight does not exceed 15 kg.		
5.9	Indicate the delivery time versus quantities of each type of meter and his production capacity.		
5.10	Where test and / or calibration certificates/ reports are issued by a laboratory other than the International / National Standards and Testing Authority, a copy of accreditation certificate, under ISO/IEC 17025 from the International/ National meter certification body attached together with the tender documents.		
5.11	Provided current e-mail addresses, fax and telephone numbers of the national / international testing / calibration laboratories and meter certification bodies. The test certificates shall bear the product serial number of meter on offer.		

Manufacturer's Declaration: I ……………………………………………… on behalf of ……………………………………….. declare that the above specifications matrix conforms to a typical tender meter, type ………………………………….. being offered for this tender.

Signature & Stamp ………………………………………….

THE KENYA POWER AND LIGHTING CO. LTD

SPECIFICATION

For

WHOLE CURRENT (DIRECT CONNECTED) STATIC METERS FOR ACTIVE ENERGY

for use on

SMALL COMMERCIAL AND LIGHT INDUSTRIAL INSTALLATIONS

	NAME	DESIGNATION	SIGNATURE	DATE
Compiled by	Patricia Ngaanga	1st Assistant Engineer, Meter Central Laboratory		02-04-2015
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REVISION RECORD

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WHOLE CURRENT (DIRECT CONNECTED) STATIC METERS FOR ACTIVE ENERGY FOR USE ON SMALL COMMERCIAL AND LIGHT INDUSTRIAL INSTALLATIONS

CONTENTS

Foreword

This specification lays down requirements for newly manufactured 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 meters. It lays down the minimum requirements for equipment acceptable for evaluation. It is the responsibility of the Manufacturer to familiarize himself with the standards referred herein.

The 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 D**. Tenderers shall complete the schedule in **Appendix C** and this shall form the basis for the technical evaluation of their tender. **(See clause 4.5.5).**

Appendix A is a snapshot of the technical data and tenderers shall indicate conformance or state any deviation from these requirements. **Appendix B** provides basic and extended list of EDIS codes .

1. Scope

This specification is for newly manufactured whole current (Direct connected) static meters for measurement of alternating current active energy in 50 Hz networks.

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.

[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)

3. Terms and definitions

The definitions given in IEC 62052-11:2003 apply.

4. Requirements

In addition to the requirements in IEC 62052-11:2003 and IEC 62053-21:2003, 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 Average Annual Relative humidity reaching 90 % and altitude of up to 2,200m.

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 The requirements given in 5.1 to 5.11 of 2[1] shall apply.

4.2.2 The meters shall be constructed as 3 phase 4-wire meters.

4.2.3 The meters shall have terminals with bottom entry for cables and the arrangement shall be L_1L_1: L_2L_2: L_3L_3: NN.

4.2.4 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.

4.2.5 The meters shall conform to the degree of protection IP 54 as given in IEC 60529:1989 Degrees of protection provided by enclosures (IP Code) Amendment 1:1999

4.2.6 The meters shall be of British Standard (BS) 5685-foot print for standardized mounting for asymmetrical (BS) wiring.

4.2.7 The meters shall be for front projection mounting.

4.2.8 The meters shall have sealing provisions for the meter body, meter cover and terminal cover and Reset button if the button is outside meter cover. If back-up battery is such

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

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

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

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

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

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

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

4.2.15 The meters shall be equipped with auxiliary terminals for inputs and outputs signals.

4.2.16 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.

4.2.17 The meters shall have a back up power supply to run the calendar clock for a minimum of 1 year without mains voltage. If the back up is by means of Lithium battery it shall have a shelf life of ten years.

4.2.18 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 15 years, whichever is greater without an electrical supply being supplied to the meter.

4.2.19 The meters principal unit for the measured values shall be the kilowatt-hour (kWh).

4.2.20 The meter shall be capable of measuring maximum demand in kVA and kW.

4.2.21 The meters shall **measure Energy and Demand correctly even when the phase rotation/sequence is incorrect.**

4.2.22 The meter shall have at least 3 registers for energy.

4.2.23 The meters shall have at least 2 registers for demand.

4.2.24 The meters shall be able to measure energy in forward register when   in security(reversed) mode

4.2.25 Meters shall have a facility to indicate reverse connection and also record reversed units

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

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

4.2.28 The meters shall have at least twelve **billing historical data** stored in memory and retrievable by software The current billing and historical data shall be available on meter display for reading and billing purposes.

4.2.29 The stored data in the memory shall be retrievable even when the display of the meter goes blank.

4.2.30 The meters shall have a **backlight Liquid Crystal Display (LCD).**

4.2.31 The meter LCD shall have **at least seven (7)**-numerical characters comprising of selectable integers and **NO** decimals points for measurement.

4.2.32 The meters LCD shall have at least **4** digit ID codes that are EDIS compliant (*see appendix B*).

4.2.33 The LCD display shall operate in at least two modes, namely, **basic and extended** data list display.

4.2.34 Meters shall have provision for reading the meter at site even when mains power supply fails.

4.2.35 The meters shall also be capable of displaying the instrumentation data namely instantaneous phase voltages and currents, phase angles (voltage and currents) etc.

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

4.2.37 The meters shall be capable of event recording which shall include but not be limited to:

     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;

     5) Memory status;

     6) Meter Errors,

     7) Date and time of last programming/parameterization;

8) Date and time of the last billing reset;

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

1)   Meter errors;   2)   Individual Phase failure;

3)   Battery voltage status;   4)   Alarms

5)   Warning messages etc

4.2.39 The meters shall have the relevant software and hardware.

4.2.40 The meters shall be equipped with an infrared optical port for meter programming and data downloading.

4.2.41 **A Lap top computer and two optical probes**, for programming and down loading the meter data shall be provided **at no extra cost**.

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

4.2.43 The meter program shall be capable of tracking user access to the meter.

4.2.44 The dimensions of the meter in a vertical position must not exceed 178mm*280mm*89mm

4.3   Electrical requirements

4.3.1   The meters shall be operated from mains with reference values of: -

3 x 240/415 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. **(See clause 4.2.3).**

4.3.3   The meter shall have reference standard currents of: -

I_b= 10 A; I_{max} = 100 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.

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.

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 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 D.** 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 B** of this document.

4.5.8 The manufacturer shall provide proof of conformance to **ISO 9001(2008)** 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 electronic meters (**single** and **three phase**) sold to **utilities outside the country of manufacture** over a period of last **5 years** shall not be less than **150,000 meters.** The addresses and contact person(s) shall be provided with the tender to facilitate confirmation of this information by the procuring entity.

5.0 INFORMATION AND WARRANTY *(In case of Tender Award)*

5.1 Drawings and technical details shall be submitted to KPLC for approval before manufacture of the meters commences. KPLC 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 KPLC 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.

5.7   After delivery of meters to KPLC, 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
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 KPLC. The range of meter serial numbers including the barcode information for each meter shall be indicated on the outside of the packaging material.

5.12   The meters shall be packaged in multiples of ten unless where the number of meters in a group/batch does not make a multiple of ten.

5.13   The number of meters packaged in a group and/or batch for handling/lifting/carrying by an operator manually shall be such that their weight does not exceed 15 kg.

5.14   Each meter shall be packaged in a paper carton with an open window to allow reading of meter number manually and electronically by barcode scanning without need to remove the meter from the carton.

5.15   The supplier shall indicate the delivery time versus quantities of each type of meter and his production capacity.

5.16   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.

5.17   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.

Appendix A: 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	IP54
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 2,200m
Temperature range (operating)	-1 to +45 ^{0} C
Voltage measurement (U_n)	3x 240/415 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 µs
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
Dielectric strength	4 kV, 50 Hz., 1 min

APPENDIX B: 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)

9.6.0 Maximum Demand kVA & date and time stamp (Current)

9.6.0.1 Maximum Demand kVA & date and time stamp (Historical)

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)

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

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

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.1	**Operating Conditions requirements**		
4.1.1	-1 to 45 ^{0}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 & Construction requirements**		
4.2.1	IEC 62052-11:2003 requirements given in 5.1 to 5.11		
4.2.2	3 phase 4 wire configuration		
4.2.3	L_1L_1:L_2L_2:L_3L_3:NN terminal configuration		
4.2.4	Clear glass or polycarbonate window		
4.2.5	Degree of protection: IP54		
4.2.6	BS 5685 mounting with symmetrical wiring		
4.2.7	Front projection mounting		
4.2.8	Sealing provisions for body, cover and terminal cover		
4.2.9	Lockable/sealable push buttons		
4.2.10	Long terminal cover with knock-offs		
4.2.11	Meter potential link inside meter body		
4.2.12	Terminal holes to accommodate **10 mm** diameter cables		
4.2.13	Brass and Nickel plated terminal holes		
4.2.14	LED indicators for testing		
4.2.15	Auxiliary input/output terminals		
4.2.16	RTC by quartz crystal oscillator		
4.2.17	Back-up supply (without mains) for 1 year, 10 year shelf		
4.2.18	Non-volatile memory; data retention period equivalent to meter certified period or 15 years, whichever is longer		
4.2.19	Kilowatt-hour (kWh) principal unit; kWh, kvarh, kVAh, kW, kVA, kvar		
4.2.20	Measurement of kVA and kW demand		
4.2.21	Measurement Energy & Demand at incorrect phase rotation/sequence		
4.2.22	3 Energy Registers		
4.2.23	2 Demand Registers		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.2.24	Recording in security mode & reverse units		
4.2.25	Indication of reverse connection		
4.2.26	Closing of end of billing period		
4.2.27	Non Resettable billing registers		
4.2. 28	Twelve billing historical data		
4.2. 29	Retrieval of data even when no display		
4.2. 30	Backlight LCD display		
4.2. 31	LCD with at least 7 digits		
4.2. 32	5 ID; EDIS digits- as appendix B		
4.2. 33	Basic and extended data display		
4.2. 34	Mains power fail reading facility		
4.2. 35	Display of instrumentation data		
4.2.36	Display of present/ absence of phase voltages		
1)	Events recording		
2)	LCD event display		
3)	Meter Errors		
4)	Individual Phase failure		
4.2. 37	Battery voltage status		
4.2. 38	Alarms		
4.2. 39	Relevant software and hardware		
4.2. 40	Infra red optical port		
4.2.41	Provision of laptop as appendix C and optical probes		
4.2.42	User level passwords		
4.2.43	Tracking of user access		
4.2.44	Dimensions of meter(mm)178*280*89		
4.3	Electrical requirements		
4.3.1	Mains reference, 3 x 240/415 V; 3 x 10 A at 50 Hz		
4.3.2	3P4W system; connection diagram		
4.3.3	I_b = 10 A; I_{max} = 100 A		
4.3.4	As per IEC 62053-21:2003		
4.3.5	As per IEC 62053-21:2003		
4.3.6	As per IEC 62053-21:2003		
4.3.7	As per IEC 62053-21:2003		
4.3.8	As per IEC 62053-21:2003		
4.4	Accuracy requirements		
4.4.1	As per IEC 62053-21: & 23:2003		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.4.2	As per IEC 62053-21: & 23:2003		
4.4.3	As per IEC 62053-21: & 23:2003		
4.4.4	As per IEC 62053-21: & 23:2003		
4.4.5	As per IEC 62053-21: & 23:2003		
4.4.6	As per IEC 62053-21: & 23:2003		
4.5	**Instructions and marking requirements**		
4.5.1	Name plate marking with /Manufacturer/Country/ Model[4mm]/ Digits[4mm]/ K.P. & L. Co. Ltd.[4mm] / Standard /Year		
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	Submission of **a sample meter, a 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 B** of this document		
4.5.8	Conformance to ISO 9001(2008)		
4.5.9	Meter type export details		
4.5.10	Number of electronic meters (**single** and **three phase**) sold to **utilities outside the country of manufacture** over a period of last **5 years** shall not be less than **75,000 meters**		

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 ....

THE KENYA POWER & LIGHTING COMPANY LIMITED

SPECIFICATION

for

SINGLE-PHASE SPLIT PREPAYMENT DIN RAIL MOUNTING
STATIC WATT-HOUR METERS FOR ACTIVE ENERGY
(Using cable as medium of communication between MCU and UIU)

	NAME	DESIGNATION	SIGNATURE	DATE
Compiled by	Patricia Ngaanga	1st.A. Engineer, MCL		14-04-2015
	Peter Wanyonyi	1st A.E. Installations Management		14:04:15
Checked	Eng. Margaret Kanini	Chief Engineer, DSM & Metering solutions		14:04:15
Recommended by	Aggrey Machasio	Ag. Manager, Energy Management		14/4/15
Approved by	Joshua Mutua	General Manager, Customer Service		20/4/5

REVISION RECORD

REVISION	DESCRIPTION OF REVISION	DATE
0	6th Issue	September 2011
1	Exclusion of clause 5.3 and 5.4	May 2014.
2	Inclusion of clause 4.2.1.7, 4.2.1.23 & 4.5.8	

Table of Contents

Foreword

This specification lays down requirements for single-phase DIN rail mounting split prepayment meters for active energy, where the communication between MCU and UIU is by means of cable. 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 single-phase split prepayment meters for active energy to be used at Kenya Power and Lighting Company Ltd. The specification lays down the minimum requirements for equipment acceptable for evaluation.

1. Scope

This specification applies to newly manufactured, single-phase Din rail mounting static watt-hour prepayment meters for direct connection, for measurement of alternating current electrical energy consumption at a nominal frequency of 50 Hz.

The method of credit transfer shall be through encrypted numeric tokens complying with the 20-digit STS encryption algorithms. The meters shall include a load switch for the purpose of interruption or restoration of the electricity supply to the load in accordance with the current value of the available credit maintained in the prepayment meter.

The Measurement and Control Unit (MCU) shall be separated from the User Interface Unit (UIU) and method of communication between them shall be over cable for a distance not less than one hundred (100) metres.

2. References

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

[1]   IEC 62055-31:2005 Electricity metering – Payment systems – Part 31: Particular requirements – Static payment meters for active energy (classes 1 and 2).

[2]   IEC 62052-11:2003, Electricity Metering equipment (a.c.) – General Requirements, Tests and Test Conditions- PART 11: Metering equipment.

[3]   IEC 62053-21:2003, Electricity metering equipment (a.c.) – Particular Requirements - Part 21: Static meters for active energy (class 1.0).

[4]   SANS1524-1:2004 Electricity prepayment Systems, Part 1: Prepayment meters.

3.   Terms and definitions

The definitions given in [1], [2] and [4] shall apply.

MCU: Measurement and Control Unit

UIU: User Interface Unit

4.   Requirements

Prepayment meters shall comply with the requirements of [1] and [3] for outdoor meters. The prepayment meters shall be mounted as for normal service.

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 up to 90% and altitude of up to 2,200m.

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

4.2.1.1   The requirements given in [1] shall apply.

4.2.1.2   The Measurement and Control Unit (MCU) shall be of DIN rail mounting with locking clip, to fit to a 35 mm Din rail.

4.2.1.3   The default communication between the MCU and the UIU shall be over cable for a distance of not less than 100 meters. However, the meter shall support PLC as an alternate communication mode for purposes of scalability to Smart Metering.

4.2.1.4   The communication cables shall be galvanically isolated from the mains to ensure customer safety.

4.2.1.5   The meters shall have terminals as follows: i) Top: Live-in, Neutral-in; Bottom: Live-out or ii) Top: Live-in, Neutral-in: Bottom: Live-out,

Neutral-out. The meter terminals shall have a protection cover against ingress of water.

4.2.1.6   The MCU dimensions shall not exceed: Height = 170 mm; Width = 60 mm; and Depth = 130 mm; and meter base shall be on the width side where the Din rail mount shall be located.

4.2.1.7   The MCU body shall be ultrasonically sealed for life and there should be no screws on the MCU body except for the termination of cables.

4.2.1.8   The meter shall have terminal cover open detection. Once the terminal cover is opened, the load shall be disconnected.

4.2.1.8.1   The MCU shall be supplied with loading switch in open mode and installer can open terminal cover when MCU is not activated by commissioning code (token).

4.2.1.8.2   After installation of MCU, the installer will input a commission code (token) to close the loading switch and activate terminal cover open detection function.

4.2.1.8.3   After commissioning token in put into the MCU and loading switch closes, opening of the terminal cover will lead to tamper. When MCU has power and terminal cover is opened, MCU will disconnect immediately. When MCU has no power and terminal cover is opened, MCU will detect and record the event and disconnect immediately power resumes.

4.2.1.9   The MCU shall be sealed and its printed circuit boards conformal coated in a manner so as not to allow malfunction due to ingress of vermin.

4.2.1.10   The meters terminal holes and screws shall be made of brass or nickel-plated brass for high conductivity and corrosion resistance.

4.2.1.11   Terminal holes shall be of sufficient size to accommodate the cables of at least 8-mm diameter and at least 15 mm length of stripped cable for firm grip.

4.2.1.12   The meter terminal screw inserts shall be sealable with utility wire seals.

4.2.1.13   The meters protection class shall be class II (Double insulated).

4.2.1.14   The meters shall have a non-volatile memory capable of data storage and with long-term data retention period for a period of not less than 10 years or for the certified life of the meter or whichever is greater without an electrical supply being supplied to the meter.

4.2.1.15   The meters shall have register codes to indicate information functions like Instantaneous power, Current credit register, Power fail counter, Last credit token number, Value of last credit token, etc. These values shall be available on the UIU display.

4.2.1.16 The principal unit for the measured values shall be the kilowatt-hour (kWh).

4.2.1.17 The meter shall have a means of reading the credit register to within a resolution of at least 0.01 kWh for testing purposes.

4.2.1.18 The meters shall detect significant reverse energy (SRE) when the line and load wires are swapped.

4.2.1.19 The meters shall continue to operate correctly and decrement credit or trip during SRE detection.

4.2.1.20 The meters shall have LED indicators for testing and indication of kWh consumption.

4.2.1.21 The meters shall have an optical communication port, compliant to IEC62055-52 for accessing information stored inside the meter through a hand held unit.

4.2.1.22 The meters shall be scalable/ upgradable to smart prepayment meters via use of software. This shall be done by programming via the optical port.

4.2.1.23 The meters shall work under postpaid mode or prepaid mode. The switch of mode shall be done via token or optical communication.

4.2.1.24 The meters shall be supplied together with three copies of software for interrogating the meter data; and it shall not be possible to reprogram the meters using this software.

4.2.1.25 The meters shall be compliant with DLMS/COSEM communication protocol.

4.2.1.26 The MCU shall conform to the degree of protection IP 51 as given in IEC 529. The terminals shall be so designed as to avoid ingress of water.

4.2.1.27 The meters shall support two way communication.

4.2.2 Functionality

4.2.2.1 Measurement and Control Unit (MCU)

4.2.2.1.1 The MCU shall have a load switch to automatically interrupt the load circuit on the expiry of credit balance.

4.2.2.1.2 The load switch shall automatically restore the load circuit.

4.2.2.1.3 The meter load switch shall comply with the requirements given in [1].

4.2.2.1.4 The meters shall be able to indicate absence or presence of continuous power.

4.2.2.1.5 The meters shall disconnect the load if power failure is detected and connect the load after normalization.

4.2.2.1.6   The meters shall have a programmable power limit setting that shall disconnect the load once exceeded and reconnect once the load falls below the set limit.

4.2.2.1.7   The MCU shall support two elements double-circuit measurement. In case there is an imbalance between the phase circuit and the neutral circuit, The MCU will take it as a tamper event and disconnect the loading switch.

4.2.2.1.8   The MCU shall have a diagnostic LED to indicate the presence of communication between the MCU and the UIU.

4.2.2.1.9   The MCU shall continue metering and decrement credit, regardless of the state of the communications interface or the UIU.

4.2.2.1.10 The MCU shall come fitted with an SCSSCAAA9 (MC171) compliant data port for programming and interrogating the meter. Two (2) sets of data interrogating and programming probes and software (1 each for optical and SCSSCAAA9 ports) shall be provided with the meter sample for evaluation. For the winning bidders, each delivery of 100,000 meters shall have <u>100</u> sets of probes and software for use with the optical and the SCSSCAAA9 ports.

4.2.2.1.11 The MCU shall be supplied together with a plastic card of dimension 85mm X 54 (length X height) mm and material similar to that of a credit card indicating the meter number. The meter serial number shall be engraved on the card together with its bar code version and also stored in a magnetic medium with capability of being read out when the card is swiped.

4.2.2.1.12 The MCU shall be pre-loaded with 0 (Zero) kWh.

4.2.2.2   User Interface Unit (UIU)

4.2.2.2.1   The UIU shall comply with 20-digit (STS) encryption algorithms. All correctly entered tokens shall be registered to eliminate fraud.

4.2.2.2.2   The UIU's keypad shall be user friendly with a LCD display for numeric credit display and language independent pictograms to identified operational features. The height of the display characters for the numeric values shall not be less than 4.5 mm.

4.2.2.2.3   The UIU display shall have at least seven 7-numerical characters comprising of five integers and two decimals.

4.2.2.2.4   The UIU shall conform to the degree of protection IP 51 as given in IEC 529.

4.2.2.2.5   The UIU shall communicate with MCU through cable of length not less than one hundred (100) metres.

4.2.2.2.6   The UIU shall be an interchangeable unit and it shall be possible to view the mated MCU on the UIU.

4.2.2.2.7 The UIU shall enable loading the meter with a number of pre-purchased units of credit, without loss of any existing credit balance.

4.2.2.2.8 The UIU shall, upon acceptance of a valid token credit the exact amount contained on the token to the appropriate register in the meter and shall increment the register by this amount.

4.2.2.2.9 The UIU shall transfer the credit in kWh.

4.2.2.2.10 The UIU shall display the cumulative kilowatt-hour register.

4.2.2.2.11 The UIU shall have a means to remove digits from a partially entered number sequence-backspace key.

4.2.2.2.12 The UIU shall have the ability to recall the last five successful credit tokens entered and the associated dates and time.

4.2.2.2.13 The UIU shall be able to indicate the meter software.

4.2.2.2.14 The UIU shall indicate the status of the incoming supply.

4.2.2.2.15 The UIU shall indicate the credit status.

4.2.2.2.16 The UIU shall indicate token acceptance or rejection.

4.2.2.2.17 The UIU shall give low credit warning by means of a flag on UIU display and audio alarm. The UIU shall have option of muting the low credit warning sound by entering a code on the UIU.

4.2.2.2.18 The UIU keypad shall have backlight to enable keying of tokens in the dark.

4.3 Electrical requirements

4.3.1 The meters shall be operated from mains with reference values of 230V V, 50 Hz, with a load switching voltage range from $0.5U_n$ to $1.15U_n$.

4.3.2 The load switch shall interrupt the supply when the voltage is below $0.4 U_n$ and above $1.15U_n$.

4.3.3 The load switch shall automatically restore supply within a minute when the voltage falls within $0.4 - 1.15 U_n$.

4.3.4 The meters shall be connectable for 2-wire systems, drawing of which shall be printed on the meter body.

4.3.5 The meter shall have reference standard currents of: -

- $I_b = 5 A$, $I_{max} \geq 80 A$

4.3.6 Power consumption:

- The requirement of [3] applies

4.3.7 Influence of short-time over-currents:

- The requirement of [3] applies

4.3.8 Influence of self-heating:

- The requirement of [3] applies

4.3.9 Over-voltage:

- The requirement of [3] applies

4.3.10 Insulation test:

- The requirement of [3] applies

4.3.11 EMC test:

- The requirement of [3] applies

Requirements 4.3.6 to 4.3.11 shall form part of the type test approval to be issued by an international or the national (of the country of manufacture) meter certifying body.

4.4 Accuracy requirements

Tests and test conditions given in [2] shall apply

4.4.1 The meter's accuracy shall be of class 1 for active energy

4.4.2 Limits of errors due to variation of the current.

- The requirement of [3] applies.

4.4.3 Limits of error due to influence quantities

- The requirement of [3] applies.

4.4.4 Test of starting and no-load condition

- The requirement of [3] applies.

4.4.5 Meter constant

- The requirement of [3] applies.

4.4.6 Accuracy test conditions

- The requirement of [3] applies.

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

4.5 Instructions and Marking

4.5.1 General

The requirements given in [1] shall apply. The information shall be in legible English, indelibly marked on the meter and of at least 4mm figure height.

4.5.2 Specific marking requirements

The following information shall be marked on each meter.

a) The standard transfer specification (STS) compliant serial number, in the preferred format known as a national meter number,

b) The STS compliance logo,

c) The inscription "Property of K.P. &. L. Co Ltd.",

d) Bar Coded information without blank space

4.5.3 Drawings

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 of the meter being offered;

(d)   Users and operational manuals.

4.5.4
A sample of the meter offered shall be submitted together with test tokens for; clear tamper, different Power Limit Settings and resets for the same, Credit and Clear Credit Tokens to aid in the testing of the meters. The manufacturer might be required to provide more tokens at no extra cost.

4.5.5 Test Reports

Copies of type approval certificate (s) with test and calibration results of the meter being offered 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 accreditation, under ISO/IEC 17025 from the national or an international certification body.

4.5.6 Guaranteed Technical Particulars

The Bidder shall complete clearly, all the clauses in both columns of the Schedule in Appendix B. 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.

4.5.5
The manufacturer shall provide proof of conformance to ISO 9001(2008) standards by attaching valid copy certificates.

4.5.6
Copies of DLMS/COSEM certificates shall be submitted with this tender.

4.5.7 The manufacturer shall provide a list and contact addresses of at least four previous utilities to which the meter being offered has been supplied.

4.5.8 The manufacturer should have supplied at least 400,000 pieces of the meter type offered to similar utilities in the past two years.

4.5.9 **The manufacturer shall produce meters that fully meet the requirements of the IEC standard, IEC 62055-51:2007 - Electricity metering - Payment systems Part 51: Standard Transfer Specifications and hence :**

- **Facilitates interoperability** amongst hardware, software and meters supplied by other manufacturers

- **Does not lock** KPLC to the winning bidder or any one supplier or manufacturer in its future procurement of prepayment meters, software or hardware.

5. Information and Warranty (In case of Tender award)

5.1 Drawings and technical details shall be submitted to KPLC for approval before manufacture of the meters commences. KPLC undertakes to submit their comments or approval for the drawings within three weeks of receiving the draft copies.

5.2 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.

5.3 KPLC shall meet the full costs of two engineers for meter inspection and acceptance testing at the manufacturer's facility.

5.4 **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 requirements 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
      Email: info@kebs.org

      http://www.kebs.org

5.5 The meters shall be packaged in such a manner as to minimize damage and entry of moisture during transportation and handling.

5.6 The meters shall be packed in suitable groups and / or batches with consecutive serial numbers. Packaging shall be done only after the KPLC approval.

5.7 The meters shall be packaged in multiples of ten unless where the number of meters in a group/batch does not make a multiple of ten.

5.8 The number of meters packaged in a group and/or batch for handling/lifting/carrying by an operator manually shall be such that their weight does not exceed 15 kg.

5.9 The supplier shall indicate the delivery time versus quantities of each type of meter and his production capacity.

5.10 Where test and/or calibration certificates/reports are issued by a laboratory other than the International/National Standards and Testing Authority, a copy of accreditation certificate, under ISO/IEC 17025 from the International/ National meter certification body shall be attached together with the tender documents.

5.11 The manufacturer shall provide current e-mail addresses, fax and telephone numbers of the national/international testing/calibration laboratories and meter certification bodies. The test certificates shall bear the product serial number of meter on offer.

6. Appendices

Appendix A: Summary of Technical Data

Measurement and Control Unit - General Information	
Type	Single phase, 2-wire, direct connected prepayment meter
Compatible networks	Single phase, 2-wire, earthed neutral
Electrical ratings	
Accuracy	kWh Class 1 (IEC 62053-21)
Voltage measurement (Un)	230V; 50Hz
Load switching voltage range	$0.5\ U_n$ to $1.15\ U_n$
Voltage circuit burden	≤ 1.5 W and 10 VA
Current circuit burden	≤ 4.5 VA @ Base reference current I_b
Current measurement	$I_b \leq 5$ A; $I_{max} \geq 80$ A.
Protective class	Class II double insulated
MCU Enclosure	
Mounting	Rail mounting, with locking clip compatible with 35 mm DIN standard rail
Rating	IP54, suitable for installation in a pole-top or outdoor kiosk housing
Material	UV stable polycarbonate/ABS blend with flame retardant
Resistance to heat and fire	As per IEC 60695-2-1 (glow-wire)
Resistance to spread of fire	UL94-VO rated @ 1.5mm
Terminals	
Type	Moving-cage terminal
Material	Mild steel/nickel/brass
Maximum Cable Size	$10\ mm^2$
Operating environment	
Area of application	Outdoor meter
Operating temperature	$-1\,^{\circ}C$ to $45\,^{\circ}C$
Storage temperature range	$-10\,^{\circ}C$ to $55\,^{\circ}C$
Relative humidity	Maximum 90%, annual mean 75%
Operation	
General	Credit store with decrement-on-use
Credit entry mechanism	Keypad; encrypted numeric tokens
Credit encryption method	20-digit STS
Metrological performance	
Measurement direction	Forward and reverse detection and metering
Consumption indicator	Visible LED
Status indication	Visible LED
Liquid Crystal Display (LCD)	8 digits + icons; icon information, numeric information

Accurate metering range	$0.05\ I_b$ to $1.2\ I_{max}$
Starting current	$\leq 0.004\ I_b$
Short circuit current	$30\ I_{max}$
Disconnection Device	
Type	Single pole latching contactor, 100 A.
Insulation; Over voltage and Surge Protection	
Insulation system Classification	Protective class II
Insulation level	4 kV rms for 1 minute
Over voltage withstand	400 VAC for 48 hours
Surge immunity	
Voltage impulse withstand	In excess of 6 kV, 1.2/50µs (IEC 62052-11)
Current impulse withstand	5kA/20 µs
Electromagnetic compatibility	
Electrostatic discharge	15 kV air discharge
Immunity to HF fields	80 MHz to 2 GHz @ 10V/m with load 80 MHz to 2 GHz @ 30V/m no load
Immunity to FTB	4 kV
Radio interference	Complies with requirements for CISPR 22
Specification Compliance	IEC 61000-4-2; IEC 61000-4-3; IEC 61000-4-4; IEC 61000-4-6 CISPR 22
Communication Circuitry	
Type	Galvanically isolated, Non-polarized, 2-wire, and half-duplex. Meter is independent of UIU function
Rated Impulse Voltage	Peak Voltage 6 kV (1,2/50µs) waveform (According to IEC 62052-11 protective class II)
Insulation properties	4 kVrms (1 Minute) (According to IEC 62052-11 protective class II)
Communication Distance	≥ 100 metres
User Interface Unit	
Type	Isolated, non-polarized, 2 wire
Operating Range (Com)	At least 100 metres
Operating Environment	
Operating Temperature Range	-10 °C to 45 °C
Storage Temperature Range	-10 °C to 55 °C
Relative Humidity	Up to 90 %
UIU Enclosure	
Type	Wall mounted
Rating	IP 51

Material	UV stable polycarbonate/ABS blend with flame retardant
Terminals	
Type	2-way screw terminal
Maximum cable size	2.5 mm2
Sealing	
Enclosure	Factory sealed, no user serviceable parts
Type	Language-independent
Components	Pictographic/Numeric LCD display, keypad, LED rate of consumption indicator, audio feedback
Liquid Crystal Display (LCD) Size	At least 7 digits + 11 icons; icon information; numeric information display of various meter information such as credit levels, token entry, etc
Keypad	12-key, international standard layout including "information" and "backspace" keys
Buzzer	Feedback on key press, Token Accept and Reject melodies, low-credit alarms as a factory-programmable option
Light emitting Diode (LED)	Rate of consumption indicator (pulse rate proportional to current rate of consumption)

Appendix B: Specifications Matrix for Split Prepayment Static Meters for active Energy - Guaranteed Technical Particulars (GTP)

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.1	OPERATING CONDITIONS		
4.1.1	Suitable for operation in tropical climate where temperatures may vary from -1 to + 45 degrees Celsius.		
4.1.2	Suitable for operation with average Annual Relative humidity up to 90% and altitude of up to 2,200m.		
4.1.3	Used for measurement of active energy for domestic loads under tropical climate conditions.		
4.2	DESIGN AND CONSTRUCTION		
4.2.1	General		
4.2.1.1	The requirements given in [1] shall apply.		
4.2.1.2	MCU of DIN rail mounting with locking clip, to fit to a 35 mm Din rail.		
4.2.1.3	The MCU and UIU communicate via Cable for a distance of not less than one hundred (100) meters.		
4.2.1.4	Communication cables Galvanically isolated		
4.2.1.5	Meters with terminals as follows: i) Top: Live-in, Neutral-in; Bottom: Live-out or ii) Top: Live-in, Neutral-in: Bottom: Live-out, Neutral-out.		
4.2.1.6	MCU dimensions: Height = 170 mm; Width = 60 mm; and Depth = 130 mm; and meter base shall be on the width side where the Din rail mount shall be located.		
4.2.1.7	The MCU body ultrasonically sealed for life and there should be no screws on the MCU body except for the termination of cables		
4.2.1.8	Terminal Cover Detection, Load switch and commissioning token		
3.2.1.9	The MCU printed circuit boards conformal coated		
4.2.1.10	Terminal holes and screws made of brass or nickel-plated brass		
4.2.1.11	Terminal holes accommodate cables of at least 8-mm diameter and allow a minimum 15mm length of stripped cable		
4.2.1.12	Meter's terminal screw inserts sealable with utility wire seals.		
4.2.1.13	Protection class shall be class II (Double insulated).		
4.2.1.14	Meters with non-volatile memory capable of data storage and with long-term data retention period of not less than 10 years or for the certified life of the meter or whichever is greater without an electrical supply being supplied to the meter.		
4.2.1.15	The meters with register codes to indicate information functions like Instantaneous power, Current credit register, Power fail counter, Last credit token number, Value of last credit token, etc.		
4.2.1.16	Principal unit for the measured values shall be the kilowatt-hour (kWh).		
4.2.1.17	Meter with means of reading the credit register to within a resolution of at least 0.01 kWh for testing purposes.		
4.2.1.18	Detect significant reverse energy (SRE) when the line and load wires are swapped.		
4.2.1.19	The meters shall continue to operate correctly and decrement credit or trip during SRE detection.		
4.2.1.20	LED indicators for testing and indication of kWh consumption.		
4.2.1.21	Meters with an optical communication port, compliant to IEC62055-52		
4.2.1.22	Scalable/ upgradable to smart prepayment meters via use of software.		
4.2.1.23	Work under postpaid mode or prepaid mode. The switch of mode shall be done via token or optical communication.		
4.2.1.24	Supplied together with three copies of software for interrogating the meter data; and it shall not be possible to reprogram the meters using this software.		
4.2.1.25	Compliant with DLMS/COSEM communication protocol.		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.2.1.26	The MCU conforms to the degree of protection IP 51 as given in IEC 529.		
4.2.1.27	Support two way communication		
4.2.2	FUNCTIONALITY		
4.2.2.1	Measurement & Control Unit (MCU)		
4.2.2.1.1	The MCU with load switch to automatically interrupt the load circuit on the expiry of credit balance.		
4.2.2.1.2	Load switch to automatically restore the load circuit after top up.		
4.2.2.1.3	The meter load switch shall comply with the requirements given in [1].		
4.2.2.1.4	Indicate absence or presence of continuous power.		
4.2.2.1.5	Disconnect the load if power failure is detected and connect the load after normalization.		
4.2.2.1.6	With programmable power limit setting that shall disconnect the load once exceeded and reconnect once the load falls below the set limit.		
4.2.2.1.7	Supports two element double circuit measurement		
4.2.2.1.8	With diagnostic LED to indicate the presence of communication between the MCU and the UIU.		
4.2.2.1.9	Continue metering and decrement credit, regardless of the state of the communications interface or the UIU.		
4.2.2.1.10	Fitted with a data port for interrogating and programming of meter. 2 sets of data interrogating probes and operation software provided		
4.2.2.1.11	Supplied together with a plastic card of dimension 85mm X 54 (length X height) mm and material similar to that of a credit card indicating the meter number. The meter serial number shall be engraved on the card together with its bar code version and also stored in a magnetic medium with capability of being read out when the card is swiped.		
4.2.2.1.12	The MCU shall be preloaded with 0 (zero) kWh		
4.2.2.2	User Interface Unit (UIU)		
4.2.2.2.1	Comply with 20-digit (STS) encryption algorithms. Registers correctly all entered tokens		
4.2.2.2.2	Keypad user friendly with a LCD display for numeric credit display and language independent pictograms to identified operational features. Height of the display characters for the numeric values not to be less than 4.5 mm.		
4.2.2.2.3	Display with at least seven 7-numerical characters comprising of five integers and two decimals.		
4.2.2.2.4	Conforms to the degree of protection IP 51 as given in IEC 529.		
4.2.2.2.5	Communicate with MCU through cable for distance not less than one hundred (100) meters.		
4.2.2.2.6	Interchangeable unit and possible to view the mated MCU on the UIU.		
4.2.2.2.7	Enables loading the meter with a number of pre-purchased units of credit, without loss of any existing credit balance.		
4.2.2.2.8	Upon acceptance of a valid token credit the exact amount contained on the token to the appropriate register in the meter and shall increment the register by this amount.		
4.2.2.2.9	Transfer credit in kWh.		
4.2.2.2.10	Display the cumulative kilowatt-hour register.		
4.2.2.2.11	With means to remove digits from a partially entered number sequence-Backspace key		
4.2.2.2.12	Recall the last five successful credit tokens entered.		
4.2.2.2.13	Indicate the meter software.		
4.2.2.2.14	Indicate the status of the incoming supply.		
4.2.2.2.15	Indicate the credit status.		
4.2.2.2.16	Indicate token acceptance or rejection.		
4.2.2.2.17	Give low credit warning.		
4.2.2.2.18	With backlight		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.3	ELECTRICAL REQUIREMENTS		
4.3.1	Reference values of 230V, 50 Hz; load switching voltage range of 0.5-1.15 U_n		
4.3.2	Load switch to interrupt the supply when the voltage is below 0.4 Un and above 1.15Un		
4.3.3	The load switch will automatically restore supply within a minute when the voltage falls within 0.4 – 1.15 Un		
4.3.4	2-wire systems		
4.3.5	Reference currents: I_b = 5 A ; I_{max} ≥ 80 A		
4.3.6	Power consumption		
4.3.7	Influence of short time over-currents		
4.3.8	Influence of self-heating		
4.3.9	Over-voltage test		
4.3.10	Insulation test		
4.3.11	EMC tests		
4.4	ACCURACY REQUIREMENTS		
4.4.1	Class 1 accuracy		
4.4.2	Limits of error due to variation of current		
4.4.3	Limits of error due to influence quantities		
4.4.4	Test of starting and no load condition		
4.4.5	Meter constant		
4.4.6	Accuracy test conditions		
4.5	INSTRUCTIONS & MARKINGS		
4.5.1	Requirement of marking [1]		
4.5.2	Specific markings requirements		
4.5.3	Drawings and information required		
4.5.4	Sample meter and test tokens		
4.5.5	Copies of type approval certificates		
4.5.6	Filling of matrix		
4.5.7	ISO 9001 certification		
4.5.8	Copy of DLMS/COSE certificates.		
4.5.9	List of at least 4 previous utilities.		
4.5.10	Supplied 400,000 pieces of the meter type offered to similar utilities within the region.		
4.5.11	Meters that meets fully the requirements of the IEC standard, IEC 62055-51:2007 – Electricity metering - Payment systems Part 51: Standard transfer specifications		
5	INFORMATION AND WARRANTY (In case of Tender award)		
5.1	Drawings and technical details submitted to KPLC for approval before manufacture of the meters commences		
5.2	Warranty against any defects, which may develop due to faulty material, calibration, transportation or workmanship for a period of eighteen months from the date of delivery. All defective meters shall be replaced at the supplier's cost		
5.3	Meet the full costs of two engineers, for meter inspection and acceptance testing at the manufacturer's facility except the cost of engineers' transportation from Kenya to the nearest major airport		
5.4	Submit one sample		
5.5	Meters packaged in such a manner as to minimize damage and entry of moisture during transportation and handling.		
5.6	Packed in suitable groups and / or batches with consecutive serial numbers, provided by KPLC.		
5.7	Packaged in multiples of ten unless where the number of meters in a group/batch does not make a multiple of ten		
5.8	Packaged in a group and/or batch for handling/lifting/carrying by an operator manually shall be such that their weight does not exceed 15 kg		
5.9	Indicate the delivery time versus quantities of each type of meter and his production capacity.		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
5.10	Where test and / or calibration certificates/ reports are issued by a laboratory other than the International / National Standards and Testing Authority, a copy of accreditation certificate, under ISO/IEC 17025 from the International/ National meter certification body attached together with the tender documents.		
5.11	Provided current e-mail addresses, fax and telephone numbers of the national / international testing / calibration laboratories and meter certification bodies. The test certificates shall bear the product serial number of meter on offer.		

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

Signature & Stamp ....