THE KENYA POWER & LIGHTING COMPANY LIMITED

SPECIFICATION

for

THREE-PHASE SPLIT PREPAYMENT BS MOUNTING STATIC WATT-HOUR METERS FOR ACTIVE ENERGY (Using Radio Frequency (RF) as a medium of communication between MCU and UIU)

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CONTENTS

Foreword

This specification lays down requirements for three-phase split prepayment wall mounting for active energy, where the communication between MCU and UIU is by means of Radio frequency. 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 wall 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 radio waves 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 by radiofrequency (RF) communication link over a radius of not less than 100 meters.

4.2.1.4 The RF interface shall be in-built in the MCU.

4.2.1.5 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.**

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

4.2.1.7 The MCU shall be ultrasonically sealed for life to prevent access to the meter assembly screws.

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 vermin.

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 10-mm diameter.

4.2.1.11 The meter's terminal cover 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 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 meters shall have an electronic display given in Clause 5.10 [3] where multiple values are presented by a single display all relevant values shall be available via the display.

4.2.1.15 The meters shall have register codes to indicate information functions like Instantaneous power, Current credit register, Power interruption

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

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

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

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 have LED indicators for testing and indication of kWh consumption.

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

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

4.2.1.26 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.

4.2.1.27 The meters shall support two way communication and shall be used at the point of supply.

4.2.1.28 The MCU shall conform to the degree of protection **IP 51** 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 meter shall come fitted with a tamper switch capable of disconnecting supply when meter terminal cover is open even when there is no power supply.

4.2.2.1.7 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.

4.2.2.1.8 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.

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.

4.2.2.1.12 The MCU shall have an inbuilt RF interface that operates in the RF range, 433.05 to 434.790MHz SRD band within 10mW.

4.2.2.1.13 The MCU shall come preloaded with 30KWHr units

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 54** as given in **IEC 529.**

4.2.2.2.5 The UIU shall be capable of communicating to the MCU via RF signals over a distance 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 shall operate in the RF range, 433.05 to 434.790MHz SRD band within 10mW.

4.2.2.2.20 The UIU shall be powered by means of lithium battery whose life span shall be at least 5 years.

4.2.2.2.21 The UIU shall have a communication distance of at least 100m, for both line of sight and built environment.

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

4.3.3 The meter shall have reference standard currents of: -

$I_b \leq 10$ A, Imax ≥ □100 A

4.3.4 Power consumption

The requirement of [3] applies.

4.3.5 Influence of short-time over-currents

The requirement of [3] applies.

4.3.6 Influence of self-heating

The requirement of [3] applies.

4.3.7 Over-voltage

The requirement of [3] applies.

4.3.8 Insulation test

The requirement of [3] applies.

4.3.9 EMC tests

The requirement of [3] applies.

Requirements 4.3.4 to 4.3.9 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

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(2000) 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 Copies of DLMS/COSEM certificates to be supplied by tenderer.

4.5.10 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 only the bidder or any one supplier or manufacturer in its future procurement of prepayment meters, software or hardware

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 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 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.

5.6 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

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

5.8 The meters shall be packed in suitable groups and / or batches with consecutive serial numbers, provided by KPLC. Packaging shall be done only after the purchaser engineers' visit.

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.

6.0 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	$I_b \leq 10A$; $I_{max} \geq 100$ A.
Protective class	Class double insulated
Enclosure	
Mounting	wall mounting
Rating	IP51
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	-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	8 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	Protective class II 4kV rms for 1 minute
Over voltage withstand	400VAC for 48 hours
Surge immunity Voltage impulse withstand Current impulse withstand	In excess of 6kV, 1.2/50µs IEC 62052-11
Electromagnetic compatibility Electrostatic discharge Immunity to HF fields Immunity to FTB Radio interference Specification Compliance	 15kV air discharge 80 MHz to 2 GHz @ 10V/m with load 80 MHz to 2 GHz @ 30V/m no load 4kV Complies with requirements for CISPR 22 IEC 61000-4-2; IEC 61000-4-3; IEC 61000-4-4; IEC 61000-4-6 CISPR 22
Communication Circuitry	
Type Rated Impulse Voltage Insulation properties	Galvanically isolated, Non-polarized, 2-wire, and half-duplex. Meter is independent of UIU function Peak Voltage 6kV (1,2/50µs) waveform (According to IEC 62052-I I protective class II) 4kVrms (I 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	-10 °C to 45 °C
Storage Temperature Range	-10 °C to 55 °C
Relative Humidity	75%
Enclosure	
Type	Slimline, wall mounted

Rating	IP 54
Material	UV stable polycarbonate/ABS blend with flame retardant
Terminals	
Type	2-way screw terminal
Maximum cable size	$2.5mm^2$
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 cable 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 RF, at least100 meters		
4.2.1.4	In built RF interface		
4.2.1.5	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.		
4.2.1.6	The meter terminal cover shall be of short length type, flush to the meter base.		
4.2.1.7	MCU ultrasonically sealed for life.		
4.2.1.8	MCU sealable against vermin ingress		
4.2.1.9	Brass or nickel plated brass terminal holes		
4.2.1.10	Terminal holes, 10mm		
4.2.1.11	Terminal screw sealability		
4.2.1.12	Double insulation, class II		
4.2.1.13	Non -volatile memory, 10 years		
4.2.1.14	Electronic display		
4.2.1.15	Meter register codes for multi functions		
4.2.1.16	kWh as principal unit of energy measurement		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.2.1.17	Means of reading credit register with a 0.1 kWh		
4.2.1.18	Tamper sensor on meters		
4.2.1.19	Detection of Significant Reverse Energy (SRE)		
4.2.1.20	Correct Operation or trip of MCU during SRE detection		
4.2.1.21	Meter scalable to smart		
4.2.1.22	LED indicators for testing and indication of kWh		
4.2.1.23	Prepaid/postpaid mode of operation.		
4.2.1.24	Optical communication port.		
4.2.1.25	DLMS/COSEM compliant.		
4.2.1.26	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.		
4.2.1.27	Support 2 way communication and be used for the point of supply		
4.2.1.28	MCU IP51 protection		
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	Tamper switch for terminal cover		
4.2.2.1.7	Programmable power limit setting		
4.2.2.1.8	LED indication for communication between MCU & UIU		
4.2.2.1.9	MCU continuous metering regardless of communications interface or UIU state		
4.2.2.1.10	MCU shall come fitted with an SCSSCAAA9 (MC171) compliant data port.		
4.2.2.1.11	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.		
4.2.2.1.12	The MCU shall have an RF interface that operates in the RF range, 433.05 to 434.790MHz SRD band within 10mW.		
4.2.2.1.13	Preloaded 30KWHr units		
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, 8 characters		
4.2.2.2.4	UIU shall conform to IP54 degree of protection		
4.2.2.2.5	UIU to communicate with MCU through RF link, not less than 100 metres		
4.2.2.2.6	UIU, interchangeable unit		
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 shall operate in the RF range, 433.05 to 434.790MHz SRD band within 10mW.		
4.2.2.2.20	The UIU shall be powered by means of lithium battery whose life span shall be at least 5 years.		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.2.2.2.21	The UIU shall have a communication distance of at least 100m, for both line of sight and built environment.		
4.2.2.2.22	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		
4.3.2	3-phase 4-wire systems		
4.3.3	Reference currents: $I_b \leq 10$ A ; $I_{max} \geq 100$ A		
4.3.4	Power consumption		
4.3.5	Influence of short time over-currents		
4.3.6	Influence of self-heating		
4.3.7	Over-voltage test		
4.3.8	Insulation test		
4.3.9	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		
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4.5.8	List of at least 4 previous utilities		
4.5.9	Copies of DLMS/COSEM. Certificates.		
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	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.		
5.4	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.		
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, provided by KPLC. Packaging shall be done only after the purchaser engineers' visit.		
5.7	The supplier shall 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
5.8	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. The test certificates shall bear the product serial no. of meter on offer		
5.9	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.		

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 .....

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
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REVISION RECORD

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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.*

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 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 wall 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 cable over a distance 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
UIU: User Interface Unit

4. Requirements

Prepayment meters shall comply with the requirements of [1] and [3] for indoor 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 standardized mounting.

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

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 with bottom entry for cables and the arrangement shall be: **$L1_{in}$: $L1_{out}$: $L2_{in}$: $L2_{out}$: $L3_{in}$: $L3_{out}$: NN.**

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

4.2.1.7 The MCU shall be ultrasonically sealed for life to prevent access to the meter assembly screws.

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 vermin.

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 10-mm diameter.

4.2.1.11 The meter's terminal cover 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 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 meters shall have an electronic display given in Clause 5.10 [3] where multiple values are presented by a single display all relevant values shall be available via the display.

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

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

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

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 have LED indicators for testing and indication of kWh consumption.

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

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

4.2.1.26 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.

4.2.1.27 The meters shall support two way communication and shall be used at the point of supply.

4.2.1.28 The MCU shall conform to the degree of protection IP **51** 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 meter shall come fitted with a tamper switch capable of disconnecting supply when meter terminal cover is open even when there is no power supply.

4.2.2.1.7 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.

4.2.2.1.8 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.

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.

4.2.2.1.12 The MCU shall come with preloaded 30KWhr units.

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 **54** as given in **IEC 529.**

4.2.2.2.5 The UIU shall be capable of communicating to the MCU via cable over a distance 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 shall have a communication distance of at least 100m, for both line of sight and built environment.

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

4.3.3 The meter shall have reference standard currents of: -

$I_b \leq 10$ A, Imax ≥ □100 A

4.3.4 Power consumption

The requirement of [3] applies.

4.3.5 Influence of short-time over-currents

The requirement of [3] applies.

4.3.6 Influence of self-heating

The requirement of [3] applies.

4.3.7 Over-voltage

The requirement of [3] applies.

4.3.8 Insulation test

The requirement of [3] applies.

4.3.9 EMC tests

The requirement of [3] applies.

Requirements 4.3.4 to 4.3.9 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

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(2000) 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 Copies of DLMS/COSEM certificates to be supplied by tenderer.

4.5.10 **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 only the bidder or any one supplier or manufacturer in its future procurement of prepayment meters, software or hardware

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 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 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.

5.6 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

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

5.8 The meters shall be packed in suitable groups and / or batches with consecutive serial numbers, provided by KPLC. Packaging shall be done only after the purchaser engineers' visit.

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.

6.0 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	$I_b \leq 10A$; $I_{max} \geq 100$ A.
Protective class	Class double insulated
Enclosure	
Mounting	Wall mounting
Rating	IP51
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	-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	8 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	Protective class II 4kV rms for 1 minute
Over voltage withstand	400VAC for 48 hours
Surge immunity Voltage impulse withstand Current impulse withstand	In excess of 6kV, 1.2/50µs IEC 62052-11
Electromagnetic compatibility Electrostatic discharge Immunity to HF fields Immunity to FTB Radio interference Specification Compliance	15kV air discharge 80 MHz to 2 GHz @ 10V/m with load 80 MHz to 2 GHz @ 30V/m no load 4kV Complies with requirements for CISPR 22 IEC 61000-4-2; IEC 61000-4-3; IEC 61000-4-4; IEC 61000-4-6 CISPR 22
Communication Circuitry	
Type Rated Impulse Voltage Insulation properties	Cable, galvanically isolated , 2 wire, Meter is independent of UIU function Peak Voltage 6kV (1,2/50µs) waveform (According to IEC 62052-11 protective class II) 4kVrms (1 Minute) (According to IEC 62052-11 protective class II)
Communication Distance	≥ 100 metres
User Interface Unit	
Type	Isolated, non-polarized,
Operating Range (Com)	At least 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 54
Material	UV stable polycarbonate/ABS blend with flame retardant
Terminals	
Type	2-way screw terminal
Maximum cable size	2.5mm^2
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 cable 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 over cable, at least100 meters		
4.2.1.4	Comm, cable galvanically isolated.		
4.2.1.5	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.		
4.2.1.6	The meter terminal cover shall be of short length type, flush to the meter base.		
4.2.1.7	MCU ultrasonically sealed for life.		
4.2.1.8	MCU sealable against vermin ingress		
4.2.1.9	Brass or nickel plated brass terminal holes		
4.2.1.10	Terminal holes, 10mm		
4.2.1.11	Terminal screw sealability		
4.2.1.12	Double insulation, class II		
4.2.1.13	Non -volatile memory, 10 years		
4.2.1.14	Electronic display		
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	Tamper sensor on meters		
4.2.1.19	Detection of Significant Reverse Energy (SRE)		
4.2.1.20	Correct Operation or trip of MCU during SRE detection		
4.2.1.21	Meter scalable to smart		
4.2.1.22	LED indicators for testing and indication of kWh		
4.2.1.23	Prepaid/postpaid mode of operation.		
4.2.1.24	Optical communication port.		
4.2.1.25	DLMS/COSEM compliant.		
4.2.1.26	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.		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.2.1.27	Support 2 way communication and be used for the point of supply		
4.2.1.28	MCU IP51protection		
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	Tamper switch for terminal cover		
4.2.2.1.7	Programmable power limit setting		
4.2.2.1.8	LED indication for communication between MCU & UIU		
4.2.2.1.9	MCU continuous metering regardless of communications interface or UIU state		
4.2.2.1.10	MCU shall come fitted with an SCSSCAAA9 (MC171) compliant data port.		
4.2.2.1.11	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.		
4.2.2.1.12	Preloaded 30KWHr units		
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	UIU shall conform to IP54 degree of protection		
4.2.2.2.5	UIU to communicate with MCU via cable, not less than 100 metres		
4.2.2.2.6	UIU, interchangeable unit		
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		
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4.2.2.2.13	UIU indication of meter software		
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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 shall have a communication distance of at least 100m, for both line of sight and built environment.		
4.2.2.2.20	The UIU mounting shall be wall mountable cradle (handheld).		
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4.3.1	Reference values of 3x230/400 V, 50 Hz, Load switch voltage range shall be 0.5-1.15 U_n		
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CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.4.5	Meter constant		
4.4.6	Accuracy test conditions		
4.5	INSTRUCTIONS & MARKINGS		
4.5.1	Requirement of marking [1]		
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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	Copies of DLMS/COSEM. Certificates.		
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	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.		
5.4	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.		
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, provided by KPLC. Packaging shall be done only after the purchaser engineers' visit.		
5.7	The supplier shall indicate the delivery time versus quantities of each type of meter and his production capacity.		
5.8	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. The test certificates shall bear the product serial no. of meter on offer		
5.9	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.		

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 .....

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
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REVISION RECORD

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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.*

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
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 shall be ultrasonically sealed for life to prevent access to the meter assembly screws.

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.

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

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

4.2.1.12 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.

4.2.1.13 The meters shall have an electronic display given in Clause 5.10 [3] where multiple values are presented by a single display all relevant values shall be available via the display.

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 0.1 kWh for testing purposes.

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

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

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

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

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

4.2.1.25 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.

4.2.1.26 The meters shall support two way communication and shall be used at the point of supply.

4.2.1.27 The MCU shall conform to the degree of protection **IP 51** 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 meter shall come fitted with a tamper switch capable of disconnecting supply when meter terminal cover is open even when there is no power supply.

4.2.2.1.7 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.

4.2.2.1.8 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.

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.

4.2.2.1.12 The MCU shall come with preloaded 30 KWhr units

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 54** 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 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 shall have a communication distance of at least 100m, for both line of sight and built environment.

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

4.3.3 The meter shall have reference standard currents of: -

$I_b \leq 10$ A, Imax ≥ 100A

4.3.4 Power consumption

The requirement of [3] applies.

4.3.5 Influence of short-time over-currents

The requirement of [3] applies.

4.3.6 Influence of self-heating

The requirement of [3] applies.

4.3.7 Over-voltage

The requirement of [3] applies.

4.3.8 Insulation test

The requirement of [3] applies.

4.3.9 EMC tests

The requirement of [3] applies.

Requirements 4.3.4 to 4.3.9 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

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(2000) 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 Copies of DLMS/COSEM certificates to be supplied by tenderer.

4.5.10 **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 only the bidder or any one supplier or manufacturer in its future procurement of prepayment meters, software or hardware

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 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 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.

5.6 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

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

5.8 The meters shall be packed in suitable groups and / or batches with consecutive serial numbers, provided by KPLC. Packaging shall be done only after the purchaser engineers' visit.

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.

6.0 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	$I_b \leq 10A$; $I_{max} \geq 100$ A.
Protective class	Class double insulated
Enclosure	
Mounting	Wall mounting
Rating	IP51
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	-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	8 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	Protective class II 4kV rms for 1 minute
Over voltage withstand	400VAC for 48 hours
Surge immunity Voltage impulse withstand Current impulse withstand	 In excess of 6kV, 1.2/50µs IEC 62052-11
Electromagnetic compatibility Electrostatic discharge Immunity to HF fields Immunity to FTB Radio interference Specification Compliance	 15kV air discharge 80 MHz to 2 GHz @ 10V/m with load 80 MHz to 2 GHz @ 30V/m no load 4kV Complies with requirements for CISPR 22 IEC 61000-4-2; IEC 61000-4-3; IEC 61000-4-4; IEC 61000-4-6 CISPR 22
Communication Circuitry	
Type Rated Impulse Voltage Insulation properties	PLC, Meter is independent of UIU function Peak Voltage 6kV (1,2/50µs) waveform (According to IEC 62052-11 protective class II) 4kVrms (1 Minute) (According to IEC 62052-11 protective class II)
Communication Distance	≥ 100 metres
User Interface Unit	
Type	Isolated, non-polarized,
Operating Range (Com)	At least 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 54
Material	UV stable polycarbonate/ABS blend with flame retardant
Terminals	
Type	2-way screw terminal
Maximum cable size	$2.5mm^2$
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 cable 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 least100 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 ultrasonically sealed for life.		
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, 10mm		
4.2.1.10	Terminal cover screw sealability		
4.2.1.11	Double insulation, class II		
4.2.1.12	Non -volatile memory, 10 years		
4.2.1.13	Electronic display		
4.2.1.14	Meter register codes for multi functions		
4.2.1.15	kWh as principal unit of energy measurement		
4.2.1.16	Means of reading credit register with a 0.1 kWh		
4.2.1.17	Tamper sensor on meters		
4.2.1.18	Detection of Significant Reverse Energy (SRE)		
4.2.1.19	Correct Operation or trip of MCU during SRE detection		
4.2.1.20	Meter scalable to smart		
4.2.1.21	LED indicators for testing and indication of kWh		
4.2.1.22	Prepaid/postpaid mode of operation.		
4.2.1.23	Optical communication port.		
4.2.1.24	DLMS/COSEM compliant.		
4.2.1.25	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.		
4.2.1.26	Support 2 way communication and be used for the point of supply		
4.2.1.27	MCU IP51 protection		
4.2.2	FUNCTIONALITY		
4.2.2.1	Measurement & Control Unit (MCU)		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
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	Tamper switch for terminal cover		
4.2.2.1.7	Programmable power limit setting		
4.2.2.1.8	LED indication for communication between MCU & UIU		
4.2.2.1.9	MCU continuous metering regardless of communications interface or UIU state		
4.2.2.1.10	MCU shall come fitted with an SCSSCAAA9 (MC171) compliant data port.		
4.2.2.1.11	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.		
4.2.2.1.12	Preloaded 30KWhr units		
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	UIU shall conform to IP54 degree of protection		
4.2.2.2.5	UIU to communicate with MCU through PLC link, not less than 100 metres		
4.2.2.2.6	UIU, interchangeable unit		
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 shall have a communication distance of at least 100m, for both line of sight and built environment.		
4.2.2.2.20	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		
4.3.2	3-phase 4-wire systems		
4.3.3	Reference currents: $I_b \leq 10$ A ; $I_{max} \geq 100$ A		
4.3.4	Power consumption		
4.3.5	Influence of short time over-currents		
4.3.6	Influence of self-heating		
4.3.7	Over-voltage test		
4.3.8	Insulation test		
4.3.9	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**		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
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	Copies of DLMS/COSEM. Certificates.		
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	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.		
5.4	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.		
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, provided by KPLC. Packaging shall be done only after the purchaser engineers' visit.		
5.7	The supplier shall indicate the delivery time versus quantities of each type of meter and his production capacity.		
5.8	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. The test certificates shall bear the product serial no. of meter on offer		
5.9	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.		

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 .....

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)

	NAME	DESIGNATION	SIGNATURE	DATE
Compiled by	Patricia Ngaanga	1st Assistant Engineer		25/09/2014
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REVISION RECORD

REVISION	*DESCRIPTION OF REVISION*	*DATE*
0	*6th Issue*	*September 2011*
1	*Exclusion of clause 5.3 and 5.4*	*May 2014.*
1	*Inclusion of clause 4.2.1.7, 4.2.1.23&23, 4.5.8*	*August 2014*

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 power line carrier for a distance 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 reaching 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 and to insure a grip of not less than 150mmstripped cable.

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 shall be ultrasonically sealed for life to prevent access to the meter assembly screws.

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 8-mm diameter.

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

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

4.2.1.12 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.

4.2.1.13 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.

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

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

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

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

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

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

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

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

4.2.1.22 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.

4.2.1.23 The meters shall be used at the point of supply.

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.

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.

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 In addition to an optical port, the MCU shall be fitted with a data port for interrogating and programming of meter.

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. 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.

4.2.2.1.11 The MCU shall come with preloaded 30KWhr units.

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.

4.3 Electrical requirements

4.3.1 The meters shall be operated from mains with reference values of 230V – 240 V, 50 Hz, with a load switching voltage range from $0.5U_n$ to $1.15U_n$.

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

4.3.3 The meter shall have reference standard currents of: -

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

4.3.4 Power consumption

The requirement of [3] applies.

4.3.5 Influence of short-time over-currents

The requirement of [3] applies.

4.3.6 Influence of self-heating

The requirement of [3] applies.

4.3.7 Over-voltage

The requirement of [3] applies.

4.3.8 Insulation test

The requirement of [3] applies.

4.3.9 EMC tests

The requirement of [3] applies.

Requirements 4.3.4 to 4.3.9 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

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(2000) standards by attaching valid 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 Copies of DLMS/COSEM certificates shall be submitted with this tender

4.5.10 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 only the bidder or any one supplier or manufacturer in its future procurement of prepayment meters, software or hardware

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 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 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.

5.6 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

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

5.8 The meters shall be packed in suitable groups and / or batches with consecutive serial numbers, provided by KPLC. Packaging shall be done only after the purchaser engineers' visit.

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.

6.0 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 Resistance to heat and fire Resistance to spread of fire	UV stable polycarbonate/ABS blend with flame retardant As per IEC 60695-2-1 (glow-wire) UL94-VO rated @ 1.5mm
Terminals	

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	-1 to 45 ^{0}c (operational)		
4.1.2	Humidity: 0-90 %; Altitude: 0-2200 M		
4.1.3	Domestic loads under tropical climate		
4.2	DESIGN AND CONSTRUCTION		
4.2.1	General		
4.2.1.1	Requirements of [1]. Product number of meter being tendered shall be indicated.		
4.2.1.2	DIN rail mounting		
4.2.1.3	Communication PLC, at least 100 metres		
4.2.1.5	Meter terminals configuration		
4.2.1.6	MCU dimensions		
4.2.1.7	MCU ultrasonically sealed for life.		
4.2.1.8	MCU sealable against vermin ingress		
4.2.1.9	Brass or nickel plated brass terminal holes		
4.2.1.10	Terminal holes, 8mm		
4.2.1.11	Terminal screw sealability		
4.2.1.12	Double insulation, class II		
4.2.1.13	Non -volatile memory, 10 years		
4.2.1.14	Meter register codes displayed on UIU		
4.2.1.15	kWh as principal unit of energy measurement		
4.2.1.16	Means of reading credit register with a 0.01 kWh		
4.2.1.17	Detection of Significant Reverse Energy (SRE)		
4.2.1.18	Correct Operation or trip of MCU during SRE detection		
4.2.1.19	LED indicators for testing and indication of kWh		
4.2.1.20	Optical communication port, IEC62055-52 compliant		
4.2.1.21	Meter scalable to smart.		
4.2.2.22	Postpaid /prepaid mode.		
4.2.1.23	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	Meters for the point of supply		
4.2.1.25	DLMS/COSEM compliant.		
4.2.1.26	MCU shall conform to IP 51 degree of protection.		
4.2.1.27	Two way communication		
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	In addition to an optical port, the MCU shall be fitted with a data port for interrogating and programming of meter.		
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. 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.		
4.2.2.1.11	Preloaded 30KWHr units		
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		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
4.2.2.2.3	UIU display, 7 characters		
4.2.2.2.4	UIU shall conform to IP 51 degree of protection		
4.2.2.2.5	UIU to communicate with MCU through cable of length not less than 100 metres		
4.2.2.2.6	UIU, interchangeable unit		
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	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.		
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4.5.9	Copy of DLMS/COSEM certificates		
4.5.10	Membership to STSA – at least ordinary member. A copy of STSA Membership Certificate shall be attached. STSA certification for the meter being offered shall be attached.		
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.		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
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	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.		
5.4	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.		
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, provided by KPLC. Packaging shall be done only after the purchaser engineers' visit.		
5.7	The supplier shall indicate the delivery time versus quantities of each type of meter and his production capacity.		
5.8	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. The test certificates shall bear the product serial no. of meter on offer		
5.9	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.		

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 .....

THE KENYA POWER & LIGHTING COMPANY LIMITED

SPECIFICATION

for

SINGLE-PHASE SPLIT PREPAYMENT DIN RAIL MOUNTING STATIC WATT-HOUR METERS FOR ACTIVE ENERGY

(Using Radio Frequency (RF) as a medium of communication between MCU and UIU)

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0	*4th Issue*	*October 2010*
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CONTENTS

Foreword

This specification lays down requirements for single-phase split prepayment DIN rail mounting meters for active energy, where the communication between MCU and UIU is by means of wireless, radio frequency (RF). 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.

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, single-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 radio waves for a distance of not less than 80 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: Wireless User Interface Unit
RF: Radio Frequency

4. Requirements

Prepayment meters shall comply with the requirements of [1] and [3] for indoor 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 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. The product serial number for particular meter being tendered shall be indicated.

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 by Radio frequency (RF) over a distance of not less than 100 meters.

4.2.1.4 The RF interface shall be in-built in the MCU.

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.

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 shall be ultrasonically sealed for life to prevent access to the meter assembly screws.

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 vermin.

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 be able to accommodate atleast 1500mm length of striped cable.

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 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 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 IEC62056-21 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 support two way communication and shall be used at the point of supply.

4.2.1.25 The meter shall be compliant with the DLMD/COSEM compliant protocol and relevant certificates of compliance shall be submitted.

4.2.1.26 The MCU shall conform to the degree of protection **IP 51** 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.

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 have an in-built RF interface that operates in the RF range, 433.05 to 434.790MHz SRD band within 10mW.

4.2.2.1.12 The MCU shall come with preloaded 30KWhr units.

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 54** as given in **IEC 529.**

4.2.2.2.5 The UIU shall communicate with MCU through RF signal for a radius not less than 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.

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 backlight enable keying of tokens in the dark.

4.2.2.2.19 The UIU shall operate in the RF range, 433.05 to 434.790MHz SRD band within 10mW.

4.2.2.2.20 The UIU shall be powered by means of lithium battery whose life span shall be at least 5 years.

4.2.2.2.21 The UIU shall have a communication radius of at least 100m, for both line of sight and built environment.

4.2.2.2.22 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 230 / 240V, 50 Hz, with an operating range from 0.5 to 1.15 U_n.

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

4.3.3 The meter shall have reference standard currents of: -

I_b = 5 A, Imax = □80 A

4.3.4 Power consumption

The requirement of [3] applies.

4.3.5 Influence of short-time over-currents

The requirement of [3] applies.

4.3.6 Influence of self-heating

The requirement of [3] applies.

4.3.7 Over-voltage

The requirement of [3] applies.

4.3.8 Insulation test

The requirement of [3] applies.

4.3.9 EMC tests

The requirement of [3] applies.

Requirements 4.3.4 to 4.3.9 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

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(2000) standards by attaching copy certificates.

4.5.8 Copies of DLMS and STS certificates for the meter type being offered shall accompany this tender.

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

4.5.10 **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 only the bidder or any one supplier or manufacturer in its future procurement of prepayment meters, software or hardware

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 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 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.

5.6 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.

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

5.8 The meters shall be packed in suitable groups and / or batches with consecutive serial numbers, provided by KPLC. Packaging shall be done only after the purchaser engineers' visit.

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.

6.0 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	IP51, 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	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 range	-1 °C to 45 °C
Storage temperature range	-10 °C to 55 °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	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 4 kV rms for 1 minute
Over voltage withstand	400 VAC for 48 hours
Surge immunity Voltage impulse withstand Current impulse withstand	 In excess of 6 kV, 1.2/50µs (IEC 62052-11) 5kA/20 µs
Electromagnetic compatibility Electrostatic discharge Immunity to HF fields Immunity to FTB	 15 kV air discharge 80 MHz to 2 GHz @ 10V/m with load 80 MHz to 2 GHz @ 30V/m no load 4 kV Complies with requirements for CISPR 22 IEC 61000-4-2; IEC 61000-4-3; IEC 61000-4-4; IEC 61000-4-6 CISPR 22
Communication Circuitry	

Type	RF, 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	Wireless (RF).
Operating Range (Com)	At least 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 54
Material	UV stable polycarbonate/ABS blend with flame retardant
Terminals	
Type	2-way screw terminal
Maximum cable size	2.5 mm^2
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. Keypad shall have back light to enable keying of tokens
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)
MCU RF Interface	Degree of protection – IP65 RF range, 433.05 to 434.790MHz SRD band within 10mW.

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	-1 to 45 °c (operational)		
4.1.2	Humidity: 0-90 %; Altitude: 0-2200 M		
4.1.3	Domestic loads under tropical climate		
4.2	DESIGN AND CONSTRUCTION		
4.2.1	General		
4.2.1.1	Requirements of [1]. Product number of meter being tendered shall be indicated.		
4.2.1.2	DIN rail mounting		
4.2.1.3	Communication by RF signal , at least 80 metres		
4.2.1.4	RF interface in – built in the MCU		
4.2.1.5	Meter terminals configuration		
4.2.1.6	MCU dimensions		
4.2.1.7	MCU ultrasonically sealed for life.		
4.2.1.8	MCU sealable against vermin ingress		
4.2.1.9	Brass or nickel plated brass terminal holes		
4.2.1.10	Terminal holes, 8mm		
4.2.1.11	Terminal screw sealability		
4.2.1.12	Double insulation, class II		
4.2.1.13	Non -volatile memory, 10 years		
4.2.1.14	Meter register codes displayed on UIU		
4.2.1.15	kWh as principal unit of energy measurement		
4.2.1.16	Means of reading credit register with a 0.01 kWh		
4.2.1.17	Detection of Significant Reverse Energy (SRE)		
4.2.1.18	Correct Operation or trip of MCU during SRE detection		
4.2.1.19	LED indicators for testing and indication of kWh		
4.2.1.20	Optical communication port		
4.2.1.21	Scalable to smart meter		
4.2.1.22	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		
4.2.1.23	Postpaid and prepaid modes		
4.2.1.24	Meters support 2way communication and for the point of supply		
4.2.1.25	DLMS/COSEM compliant.		
4.2.1.26	MCU shall conform to IP51 degree of protection		
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	The MCU shall have an RF interface that operates in the RF range, 433.05 to 434.790MHz SRD band within 10mW.		
4.2.2.1.12	Preloaded 30KWhr units		
4.2.2.2	User Interface Unit (UIU)		
4.2.2.2.1	UIU, 20- digit STS encryption algorithm		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
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	UIU shall conform to IP 54 degree of protection		
4.2.2.2.5	UIU to communicate with MCU through RF signal, not less than 80 metres		
4.2.2.2.6	UIU, interchangeable unit		
4.2.2.2.7	UIU loading of credit to existing balance		
4.2.2.2.8	UIU credit of register to existing register		
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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 numerals in white colour to enable keying of tokens in the dark.		
4.2.2.2.19	The UIU shall operate in the RF range, 433.05 to 434.790MHz SRD band within 10mW.		
4.2.2.2.20	The UIU shall be powered by means of lithium battery whose life span shall be at least 5 years.		
4.2.2.2.21	The UIU shall have a communication distance of at least 100m, for both line of sight and built environment.		
4.2.2.2.22	The UIU mounting shall be wall mountable cradle (handheld).		
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4.5.8	Copy of DLMS/COSE certificates.		
4.5.9	List of at least 4 previous utilities.		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
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	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.		
5.4	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.		
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, provided by KPLC. Packaging shall be done only after the purchaser engineers' visit.		
5.7	The supplier shall indicate the delivery time versus quantities of each type of meter and his production capacity.		
5.8	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. The test certificates shall bear the product serial no. of meter on offer		
5.9	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.		

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 .....

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
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REVISION RECORD

REVISION	*DESCRIPTION OF REVISION*	*DATE*
0	*6th Issue*	*September 2011*
1	*Exclusion of clause 5.3 and 5.4*	*May 2014.*
1	*Inclusion of clause 4.2.1.7, 4.2.1.23&23, 4.5.8*	

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 more 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 reaching 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 over cable for a distance of not less than one hundred (100) metres.

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 to ensure a grip of atleast 150mm of stripped cable.

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 shall be ultrasonically sealed for life to prevent access to the meter assembly screws.

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 vermin.

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.

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 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 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 used at the point of supply.

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.

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 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 In addition to an optical port, the MCU shall be fitted with a data port for interrogating and programming of meter.

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. 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.

4.2.2.1.11 The MCU shall come with preloaded 30KWhr units.

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 – 240 V, 50 Hz, with a load switching voltage range from $0.5U_n$ to $1.15U_n$.

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

4.3.3 The meter shall have reference standard currents of: -

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

4.3.4 Power consumption

The requirement of [3] applies.

4.3.5 Influence of short-time over-currents

The requirement of [3] applies.

4.3.6 Influence of self-heating

The requirement of [3] applies.

4.3.7 Over-voltage

The requirement of [3] applies.

4.3.8 Insulation test

The requirement of [3] applies.

4.3.9 EMC tests

The requirement of [3] applies.

Requirements 4.3.4 to 4.3.9 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

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(2000) standards by attaching valid 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 Copies of DLMS/COSEM certificates shall be submitted with this tender

4.5.10 **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 only the bidder or any one supplier or manufacturer in its future procurement of prepayment meters, software or hardware

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 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 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.

5.6 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

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

5.8 The meters shall be packed in suitable groups and / or batches with consecutive serial numbers, provided by KPLC. Packaging shall be done only after the purchaser engineers' visit.

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.

6.0 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	Outdoor meter
Operating temperature range	-1 °C to 45 °C
Storage temperature range	-10 °C to 55 °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 melering 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 4 kV rms for 1 minute
Over voltage withstand	400 VAC for 48 hours
Surge immunity Voltage impulse withstand Current impulse withstand	 In excess of 6 kV, 1.2/50µs (IEC 62052-11) 5kA/20 µs
Electromagnetic compatibility Electrostatic discharge Immunity to HF fields Immunity to FTB Radio interference Specification Compliance	 15 kV air discharge 80 MHz to 2 GHz @ 10V/m with load 80 MHz to 2 GHz @ 30V/m no load 4 kV Complies with requirements for CISPR 22 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	-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
Terminals	
Type	2-way screw terminal
Maximum cable size	2.5 mm^2
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	-1 to 45 °c (operational)		
4.1.2	Humidity: 0-90 %; Altitude: 0-2200 M		
4.1.3	Domestic loads under tropical climate		
4.2	DESIGN AND CONSTRUCTION		
4.2.1	General		
4.2.1.1	Requirements of [1]. Product number of meter being tendered shall be indicated.		
4.2.1.2	DIN rail mounting		
4.2.1.3	Communication over cable, at least 100 metres		
4.2.1.4	Galvanic isolation of communication cable		
4.2.1.5	Meter terminals configuration		
4.2.1.6	MCU dimensions		
4.2.1.7	MCU ultrasonically sealed for life.		
4.2.1.8	MCU sealable against vermin ingress		
4.2.1.9	Brass or nickel plated brass terminal holes		
4.2.1.10	Terminal holes, 8mm		
4.2.1.11	Terminal screw sealability		
4.2.1.12	Double insulation, class II		
4.2.1.13	Non -volatile memory, 10 years		
4.2.1.14	Meter register codes displayed on UIU		
4.2.1.15	kWh as principal unit of energy measurement		
4.2.1.16	Means of reading credit register with a 0.01 kWh		
4.2.1.17	Detection of Significant Reverse Energy (SRE)		
4.2.1.18	Correct Operation or trip of MCU during SRE detection		
4.2.1.19	LED indicators for testing and indication of kWh		
4.2.1.20	Optical communication port, IEC62055-52 compliant		
4.2.1.21	Meter scalable to smart.		
4.2.2.22	Postpaid /prepaid mode.		
4.2.1.23	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	Meters for the point of supply		
4.2.1.25	DLMS/COSEM compliant.		
4.2.1.26	MCU shall conform to IP 51degree of protection.		
4.2.1.27	Two way communication		
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	In addition to an optical port, the MCU shall be fitted with a data port for interrogating and programming of meter.		
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. 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.		
4.2.2.1.11	Preloaded 30KWHr units		
4.2.2.2	User Interface Unit (UIU)		
4.2.2.2.1	UIU, 20- digit STS encryption algorithm		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
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	UIU shall conform to IP 51 degree of protection		
4.2.2.2.5	UIU to communicate with MCU through cable of length not less than 100 metres		
4.2.2.2.6	UIU, interchangeable unit		
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	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	Reference values of 230V, 50 Hz; load switching voltage range 0.5-1.15 U_n		
4.3.2	2-wire systems		
4.3.3	Reference currents: $I_b \leq 5$ A ; $I_{max} \geq 80$ A		
4.3.4	Power consumption		
4.3.5	Influence of short time over-currents		
4.3.6	Influence of self-heating		
4.3.7	Over-voltage test		
4.3.8	Insulation test		
4.3.9	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	Copy of DLMS/COSEM certificates		
4.5.10	Membership to STSA – at least ordinary member. A copy of STSA Membership Certificate shall be attached. STSA certification for the meter being offered shall be attached.		
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.		

CLAUSE	KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
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	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.		
5.4	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.		
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, provided by KPLC. Packaging shall be done only after the purchaser engineers' visit.		
5.7	The supplier shall indicate the delivery time versus quantities of each type of meter and his production capacity.		
5.8	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. The test certificates shall bear the product serial no. of meter on offer		
5.9	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.		

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 .....