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Kenya Power

POWER QUALITY ANALYZER

Part 1: PORTABLE POWER QUALITY ANALYZER — SPECIFICATION

A Document of the Kenya Power & Lighting PLC

June 2021

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0.1 Circulation List

COPY NO.	COPY HOLDER
1	Manager, Standards
Electronic copy (pdf) on Kenya Power server (http://172.16.1.40/dms/browse.php?fFolderId=23)	

REVISION OF KPLC STANDARDS

In order to keep abreast of progress in the industry, KPLC Standards shall be regularly reviewed. Suggestions for improvements to approved Standards, addressed to the Manager, Standards department, are welcome.

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Users are reminded that by virtue of Section 25 of the Copyright Act, 2001 (Revised 2009) Cap 130 of the Laws of Kenya copyright subsists in all KPLC Standards and except as provided under section 26 of this Act, no KPLC Standard produced by KPLC may be reproduced, stored in retrieval system by any means without prior permission from the Managing Director & CEO, KPLC.

0.2 Amendment Record

Rev No.	Date (YYYY-MM-DD)	Description of Change	Prepared by (Name & Signature)	Approved by (Name & Signature)
-	2010-11-08	New Issue	Moses Muthoka	Eng. Rosemary Gitonga
Issue 1 Rev 0	2018-06-26	Revised to capture new technology development	S. Nguli	Dr. Eng. P. Kimemia
Issue 2 Rev 0	2021-06-29	i. Changed the specification code from TSP/09/013 to TSP/09/108-1. ii. Changed the title of specification from *'Power Quality Analyzer'* to *'Portable Power Quality Analyzer'*.	Rotich Benard	Dr. Eng. P. Kimemia

FOREWORD

This specification has been prepared by the Standards Department in collaboration with Technical Services Department, both of the Kenya Power and Lighting Company PLC herein called 'Kenya Power'. It lays down requirements for a Portable Power Quality Analyzer herein called 'PQA'.

A power quality analyzer is a test PQA that evaluates the quality of power by measuring currents, and voltages, dips in power, swells, transients, harmonics, power factor, etc.

This specification is in this series:

KP1/6C/4/1/TSP//09108-2: Power Quality Analyzer. Part 2: Online Power Quality Analyzer — Specification

The specification stipulates the minimum requirements for a PQA acceptable for use in the company. It shall be the responsibility of the suppliers and manufacturer to ensure that the offered design is of the highest quality and guarantees excellent service to KPLC. The supplier/manufacturer shall exhibit good workmanship and good engineering practice in the manufacture of the PQA for KPLC.

The following are members of the team that developed this specification:

Name	Department
Stephen Nguli	Standards
Rotich Benard	Standards
Adriano O. Sagwe	Technical Services

1. SCOPE

The specification is for a portable Power Quality Analyzer, herein referred to as the PQA, a high accuracy, intelligent and fully automated digital harmonics Analyzer equipment. The PQA shall be used in the following (but not limited) configurations:

i) Single phase with neutral.
ii) Split phase.
iii) Single phase system with two phase voltages without neutral.
iv) Three phases four wire systems.
v) Three phases three wire systems.
vi) Three phase systems without neutral.
vii) Four wires three phase delta system with centre tapped high leg.
viii) Open delta three wire system with two transformer windings.
ix) Three phases three wire systems without current sensor on phase L2/B (2-Watt meter method)
x) Three phases four wire systems without voltage sensor on phase L2/B.

2. REFERENCES (NORMATIVE)

The following standards contain provisions which through reference in this text constitute provisions of this specification. For dated editions, the cited edition shall apply; for undated editions, the latest edition of the referenced document shall apply.

EN 61326-1:2013: Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements

IEC 60529: Degrees of protection provided by enclosures (IP Code)

IEC 60950: Information technology equipment –Safety – Part 1: General requirements

IEC 61000-3-2:2014: Electromagnetic compatibility (EMC). Limits. Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

IEC 61000-3-3:2013: Electromagnetic compatibility (EMC). Limits. Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection.

IEC 61000-4-2:2009: Electromagnetic compatibility (EMC). Testing and measurement techniques. Electrostatic discharge immunity test.

IEC 61000-4-3:2006+A2:2010: Electromagnetic compatibility (EMC). Testing and measurement techniques. Radiated, radio-frequency, electromagnetic field immunity test.

IEC 61000-4-3:2006+AMD1:2007+AMD2:2010 CSV: Electromagnetic compatibility (EMC) - Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test.

IEC 61000-4-4:2012: Electromagnetic compatibility (EMC). Testing and measurement techniques. Electrical fast transient/burst immunity test

IEC 61000-4-5:2014: Electromagnetic compatibility (EMC). Testing and measurement techniques. Surge immunity test

IEC 61000-4-6:2014: Electromagnetic compatibility (EMC). Testing and measurement techniques. Immunity to conducted disturbances, induced by radio-frequency fields

IEC 61000-4-8:2010: Electromagnetic compatibility (EMC). Testing and measurement techniques. Power frequency magnetic field immunity test

IEC 61000-4-11:2004: Electromagnetic compatibility (EMC). Testing and measurement techniques. Voltage dips, short interruptions and voltage variations immunity tests

IEC 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements

3. DEFINITIONS AND ABREVIATION

For this specification, the definitions and abbreviations given in the reference standards shall apply.

4. REQUIREMENTS

4.1. Service conditions

The PQA shall be suitable for continuous operation outdoors in tropical areas and harsh climatic conditions including areas exposed to:

a) Altitudes of up to 2200m above sea level

b) Humidity of up to 95%

c) Average ambient temperature of +30°C with a minimum of -1°C and a maximum of +40°C, in direct sunlight,

d) Pollution: Design pollution level to be taken as "Heavy" (Pollution level III) for inland and "Very Heavy" (Pollution level IV) for coastal applications in accordance with IEC 60815.

e) *Isokeraunic* levels of up to 180 thunderstorm days per year.

4.2. **General Requirements**

4.2.1. The PQA shall be manufactured and tested in accordance with IEC 61010-1, CAT III and EN 61326-1-2012 and the requirements of this specification.

4.2.2. The PQA shall be compact and of light weight (Not more than 4kgs) and portable.

4.2.3. The PQA's measurement circuitry shall be automatic, fully programmable numerical/digital testing shall have direct digital readings (no conversion scales required).

4.2.4. The PQA shall be rugged shock proof with integrated protective holster.

4.2.5. The PQA shall be dust proof, IP67 according to IEC 60529 when used in tilt stand position.

4.2.6. The PQA shall withstand a shock wave of at least 30g and a vibration of at least 3 g sinusoidal.

4.2.7. The PQA's display screen shall be four-line monochrome back lit LCD.

4.2.8. The size of display screen shall be at least 115.2mm by 86.4mm.

4.2.9. The PQA's display resolution shall be at least 320 by 240 pixels.

4.2.10. The PQA's screen contrast and brightness shall be user adjustable and temperature compensated.

4.2.11. The PQA shall have at least 50 screen memories.

4.2.12. The PQA shall have not less than 10 data memories for storing data and recordings.

4.2.13. The real-time clock of the PQA shall be time and date stamp for auto trend, transient display and system monitor.

4.2.14. The PQA shall use both line power and stored power (batteries).

4.2.15. The PQA shall have a sampling frequency of not less than 128 samples per cycle.

4.2.16. The PQA shall have user selectable demand period storage rate.

4.2.17. The PQA shall record the following power parameters; V, I, W, VA, Var, PF, Tan, Wh, Vah, Varh, THD (V and I), Crest factor (Cf), DPF.

4.2.18. The PQA shall have a storage capacity of not less than 32GB.

4.2.19. The PQA shall have 5 input voltage channels via 4mm² safety banana jacks and 4 input current channels.

4.3. Electrical Specifications

4.3.1. Voltage Measurement.

The voltage measurement range of the PQA shall be as detailed in table 1 below:

Table 1: Voltage measurement.

Description	Range	Resolution/Accuracy
Frequency Nominal 50hz	42.5 to 69Hz	±0.1hz
Single phase rms Voltages	0 to 1000V rms	0.1V/±0.2% Rdg ±0.2V
Phase to phase rms voltages	0 to 1000V rms	0.1 to 1V/±0.2% Rdg ±0.4V
DC	0 to 1000V	0.1V/±1% Rdg ±3v

4.3.2. Current Measurement

The current measurement range of the PQA shall be as detailed in table 2 below

Table 2: Current measurement

Current	Range
Nominal range for the device current probes	200mA to 1000A
CT ratios	Programmable from 1:1 to 25000:1 (probe dependent)

4.3.3. Power Measurements.

The power measurement range of the PQA shall be as detailed in table 3 below

Table 3: Power measurement.

Power	Range	Resolution	Accuracy
Active power	-2 to 2GW	0.001W	±0.5% Rdg ±0.005% Pnom
Reactive power	-2 to 2GVar	0.001Var	±1% Rdg ± 0.01% Qnom
Apparent power	0 to 2 GVA	0.001Va	±0.5% Rdg ±0.005% Snom
Power Factor	-1 to 1	0.001	±0.05%
TanΦ P/Q Ratio	-3.2 to 3.2	0.001	±0.02

4.3.4. **Energy Measurements.**

The energy measurement range of the PQA shall be as detailed in table 4 below

Table 4: Energy measurement.

Energy	Range	Resolution	Accuracy
Active Energy	0 to 4x10Ƀ;4Ewh	1Wh	±0.5% Rdg
Reactive Energy	0 to 4x10Ƀ;4Evarh	1varh	±2% Rdg
Apparent Energy	0 to 4x10Ƀ;4Evah	1vah	±0.5%
THD (Total harmonic distortion)		± 655%	
Individual harmonics		1 to 50 displayed in percentages	
External power supply		230V ± 10% at 50Hz.	
Battery charge time, max.		5 hours	
Battery life		10 hours continuous	

Where Ƀ= terawatt

4.3.5. **Computer Communication Interface**

The PQA shall be provided with USB port and Ethernet RJ45 communication port for purposes of communication with personal computers and the PC software provided it shall also have provision for communication on the latest version of Bluetooth.

4.3.6. **PC Software**

4.3.6.1. The PQA shall be provided with a Window-based software that enables the user to record the measurands while the PQA is connected to the PC.

4.3.6.2. The Windows software shall provide easy access to connection instructions, test instructions and advance preparation using standard word processing packages.

4.3.6.3. The settings made by a user during a test shall be saved in a file, and shall be retrievable for future use.

4.3.6.4. The PC software shall run on Windows® 7 / 8 / 10 or higher platforms.

4.3.6.5. It shall also provide test results that are reportable directly with table and graph as well as being exported to an external program, such as Microsoft® EXCEL.

4.3.7. **Transportation Casing**

Transportable box, provided with cover and handles for ease of transportation, and sized appropriately, shall allow carrying of the PQA with no concern about shocks up to a fall of 1 meter.

4.4. Characteristic Values/ Ratings

The specification requirement ratings for the various parameters are as per Table 5:

Table 5: Ratings

No	Item	Requirements
1.	Power supply	230 V AC, 50 Hz single phase
2.	Protection	Thermal cut-outs, automatic overload protection
3.	Weight	< 4kg with accessories and transport case
4.	Test lead sets	Provide as follows: Voltage Leads: 3.5 mm^2 x 4M stackable safety plugs or equivalent: Current leads: 4 mm^2 x 4M stackable safety plugs or equivalent
5.	Display	LCD
6.	Regulations and standards	Electrical safety: IEC 61010-2 Contamination degree: 4 Circuit insulation Voltage: 600V
7.	Operation environment	Application field: high-voltage substations and industrial environments. Temperature: Operating: 0°C to +50°C Humidity: 5% – 95% RH, non-condensing Vibration: IEC 60068-2-6 Shock: IEC 60068-2-27 Altitude: Up to 2200 metres
8.	Electromagnetic Compatibility:	Applicable Standard: EN 61326-1
9.	Inputs/outputs protection:	IP 2X – IEC 60529.

4.5. Accessories (To be supplied with the PQA)

The PQA shall be supplied complete with the following accessories:

(i) 4 No voltage leads 4 meters 3.5 mm².
(ii) 4 No Current probe (current sensors-clamp on) leads 4 meters 4 mm²
(iii) Operating software.
(iv) Communication cable.
(v) Power adaptor cable.
(vi) Carrying case
(vii) Operation Manual (Soft copy and Hard copy).
(viii) SD card 32GB.
(ix) USB SD card reader
(x) Current sensors.

4.5.1. Laptop

4.5.1.1. The laptop shall be designed and manufactured as per the requirements of IEC 60950 with minimum requirements as per Table 6. The supplier shall be required to declare in Annex D the offered values for the laptop.

Table 6: Technical data for a Laptop

No	Item	Minimum Specification
1.	Brand	Specify
2.	Model	Specify
3.	Year of manufacture	Specify
4.	Processor	Intel® Core™ i7-920 Processor
5.	Clock speed	2.2 GHz or higher
6.	Chipset	Compatible – (specify)
7.	Motherboard	Compatible – (specify)
8.	Memory	2GB DDR3, 1333MHz (Upgradable up to 6 GB)
9.	Cache memory	3MB L2 or higher
10.	Graphics	256MB Dedicated DDR3 Memory
11.	Hard disk controller	Serial ATA
12.	Hard disk	250 GB or higher 5400RPM SATA Hard Drive
13.	Shock resistant	Anti-shock mounting design to protect screen and hard disk drive from damage and data loss
14.	Keyboard	Spill resistant keyboard
15.	Mouse	2- or 3-button with scroll wheel optical PC Mouse with pad – USB 3.0
16.	Touch pad	Intelligent Touch with configurable vertical and horizontal scroll functions

No	Item	Minimum Specification
17.	Power supply	Input – 220V – 250V Auto-sensing, 50 Hz
18.	Battery life	4 hours or higher
19.	Optical drive	Dual Layer DVD +/-RW
20.	Card slots	Secured Digital Card Reader
21.	Display	115.2mm by 86.4mm.or smaller WXGA with 1280 x 800 or higher resolution
22.	Integrated Web Camera	2 Mega Pixels or higher
23.	Network/Wireless Interfaces	Integrated 10/100/1000Mbps Ethernet LAN, Integrated 802.11 a/b/g/n WLAN, Bluetooth
24.	Security	Booting/HDD User Password Protection and Fingerprint Recognition
25.	I/O Inputs	Minimum 3 x USB 3.0 Hi-Speed, 1 x RJ45, 1 VGA
26.	Operating system	MS Windows 7 Professional OEM Version with original Media kit, & manuals (firewall enabled and all security updates and patches and fixes up-to-date) or equivalent higher version.
27.	Productivity software	Latest versions of Open Office AND Genuine Microsoft Office 2010 Standard or better, OEM, Full or Suitable licensing scheme.
28.	Anti-virus	Anti-Virus software should be installed with licenses (Specify) * The supplier shall quote the unit price of the Anti-Virus software
29.	Carrying bag	Include with the same brand of the computer.
30.	Manufacturer Authorization and warranty	Attach Authorization letter and 3 years comprehensive on-site manufacturer authorized warranty (labour & parts).

4.6. **Warranty and Training**

4.6.1. The power Quality Analyzer shall be backed by a minimum 24-months factory warranty.

4.6.2. Technical support and software upgrades, where applicable, shall be provided free of charge to Kenya Power for a period of not less than 36 months.

4.6.3. The manufacturer shall conduct complete training on the PQA to Kenya Power engineers/Technicians, in Nairobi Kenya. The supplier shall meet the cost of the trainer and any materials required for the training.

4.6.4. The supplier to submit a detailed training program for at least three days with the bid.

4.6.5. The Training shall include theory on how the PQA works followed by practical demonstrations on operation, protection and control configuration and parameter settings. All the operational and control features of the PQA shall be exhaustively explained and demonstrated, including the operation of the software.

4.6.6. The Training shall be considered to have been successful once the Engineers/Technicians are able to: -

a) Competently carry out all the operations on the PQA;

b) Establish communication from a computer to the PQA and carry out complete configuration, parameter settings and download and analyse data from the PQA;

c) Trouble shoot and analyse and rectify any minor breakdowns that may occur.

5. TEST REQUIREMENTS

The Power Quality Analyzer shall be inspected and tested in accordance with the requirements of IEC 61010-1/2, IEC 61000-3-2/3-3/4-2/4-3/4-4/4-5/4-6/4-8/4-11 standards and this specification.

6. MARKING AND PACKING

6.1. Marking

6.1.1. The Power Quality Analyzer shall be marked in a permanent manner with the following information (in English Language):

a) Standard(s) to which the PQA complies
b) Name of manufacturer
c) Type of PQA (description of type, number and overall size of sections)
d) Year and month of manufacture and serial number
e) Maximum permissible measurement limits
f) Standard of manufacture
g) The words "**Property of The Kenya Power & Lighting Co. Ltd**" shall be engraved permanently on each the PQA unit
h) In addition, the PQA shall be marked with the necessary labels that conform to IEC 61010-1

6.2. Packaging

6.2.1. The PQA shall be packed in a standard-size case. The case shall be suitable for storage and long-term use.

6.2.2. The PQA shall be portable, rugged and light weight. Its carrying case shall be shockproof, and impact resistant.

APPENDICES

APPENDIX A: TESTS AND INSPECTION (NORMATIVE)

A.1. It shall be the responsibility of the manufacturer to perform or to have performed the tests specified in the manufacturing standard, and other tests performed at the factory. Copies of previous test certificates and test reports by the relevant International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted.

A.2. Copies of type test reports to be submitted with the tender (by bidder) for evaluation shall be as stated below: -

a) Type Tests for PQA Performance

i. Electromagnetic compatibility (EMC); (EN 61326; IEC 61000-6-4; IEC 61000-3-2/3)
ii. Switching tests on the PQA.
iii. Impulse overvoltage tests on the PQA - Clearances
iv. Dielectric voltage withstands tests on the PQA - Controlled overvoltage
v. Functional tests of the PQA.

b) Type Tests for Printed Circuit Board Coating Performance

i. Environmental, humidity and thermal conditioning tests
ii. Dielectric voltage withstand tests
iii. Comparative tracking index (CTI)
iv. Resistance to soldering heat
v. Flammability
vi. Coating adhesion
vii. Insulation resistance between conductors

A.3. Kenya Power may send two or more engineers to witness factory acceptance tests (FAT), inspection and certification of the PQA before shipment. Tests to be witnessed at the factory before shipment shall be in accordance with IEC 61010-1, IEC 60664- 1 & 3, IEC 61326, IEC 60112 and IEC 60529 standards and this specification, and shall include the following:

i. Insulation Resistance of the PQA
ii. Leakage Current
iii. Ground Continuity

iv. Dielectric Voltage Withstand Tests

v. Functional tests of the PQA.

A.4. During delivery of the PQA, Kenya Power shall inspect them and may perform or have performed any of the relevant tests to verify compliance with the specification. The supplier shall replace/rectify without charge to Kenya Power, PQAs which upon examination, test or use fail to meet any or all the requirements in the specification

APPENDIX B: QUALITY MANAGEMENT SYSTEM (NORMATIVE)

B.1. The supplier shall submit a quality assurance plan (QAP) that will be used to ensure that the PQA properties, tests and documentation, will fulfil the requirements stated in the contract documents, standards, specifications and regulations. The QAP shall be based on and include relevant parts to fulfil the requirements of ISO 9001:2008

B.2. The Manufacturer's Declaration of Conformity to applicable standards and copies of quality management certifications, including copy of valid and relevant ISO 9001: 2008 or 2015 certificate, shall be submitted with the tender for evaluation.

B.3. The manufacturer shall indicate the delivery time of the PQA; manufacturer's monthly & annual production capacity and experience in the production of the type and size of items being offered. A detailed list & contact addresses (including e-mail) of the manufacturer's previous customers for similar type of PQA sold in the last five years as well as reference letters from at least four of the customers shall be submitted with the tender for evaluation.

APPENDIX C: TECHNICAL DOCUMENTATION (NORMATIVE)

C.1. The bidder shall submit its tender complete with technical documents required for tender evaluation. The technical documents to be submitted (all in English language) for tender evaluation shall include the following:

a) Fully-filled clause by clause Guaranteed Technical Particulars (GTPs)- Appendix D - stamped and signed by the manufacturer.

b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data for the PQA;

c) Details of the manufacturer's experience; Sales records for the last five years and at least four customer reference letters.

d) Copies of previous test certificates and test reports (As given in Clause A.2) by the relevant International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation. A copy of accreditation certificate for the laboratory shall also be submitted (all in English Language);

e) Marking & Packaging details (including packaging materials).

C.2. The successful bidder (supplier) shall submit the following documents/details to The Kenya Power & Lighting Company for approval before manufacture:

a) Fully filled clause by clause Guaranteed Technical Particulars (GTPs) stamped and signed by the manufacturer **(these are not the ones submitted with the tender)**;

b) Technical details and drawings with details of portable single phase secondary injection set to be manufactured for KPLC.

c) Quality assurance plan (QAP) that will be used to ensure that the design, material; workmanship, tests, service capability, maintenance and documentation will fulfil the requirements stated in the contract documents, standards, specifications and regulations.

C.3. Routine and sample test reports for the PQA to be supplied shall be submitted to Kenya Power for approval before shipment/delivery of the goods.

C.4. Each PQA package shall be supplied with detailed user's manual printed in English language that includes the following among other information written in English language to Kenya Power stores. All information shall be unambiguous. All documentation necessary for safety of the PQA as specified in IEC 61010-1 clause 5.4 shall be provided with the PQA.

APPENDIX D: GUARANTEED TECHNICAL PARTICULARS (GTPS) — NORMATIVE

(to be filled, stamped and signed by the Supplier and submitted together with relevant copies of the Manufacturer's catalogues, brochures, drawings, technical data, sales records for previous five years, four customer reference letters, details of suppliers' capacity and experience; and copies of complete test certificates and test reports for tender evaluation or approval, all in English Language, as per clauses C.1 and C.2)

Tender No. .....

Bidder's name and Address.....

Clause number	KPLC requirement	Bidder's offer
Manufacturer's Name and address		Specify
Country of Manufacture		Name
Bidder's Name and address		Name
Name and make of PQA offered		Name
1.1	Scope	State
1.2	Tests carried out by the PQA	List
2.	Applicable Standards	Specify
3.	Definitions and abbreviation	Specify
4.	**REQUIREMENTS**	
4.1	Service conditions	Specify
4.2	**General Requirements**	
4.2.1	Applicable standards to be conformed to	State
4.2.2	Weight of the PQA and site use	State
4.2.3	Measurement circuitry characteristics	State
4.2.4	Ruggedness of the portable PQA	Specify
4.2.5	IP code	Specify
4.2.6	Shock wave resistance	Specify
4.2.7	Type of display screen	specify
4.2.8	Size of display screen	Specify
4.2.9	Resolution of screen	Specify
4.2.10.	The PQA's screen contrast and brightness	Specify
4.2.11	Minimum size of memory offered	Specify

Clause number	KPLC requirement				Bidder's offer
4.2.12	Minimum number of data recordings				Specify
4.2.13	The PQA is equipped with a time stamping facility				Specify
4.2.14	Is the PQA using both line power and batteries				Specify
4.2.15	Sampling Frequency of the PQA				Specify
4.2.16	Demand period storage rate.				specify
4.2.17	Parameters to be measured and analysed				List
4.2.18	Memory Capacity				Specify
4.2.19	Input channels				Specify
4.3	**Electrical Specifications**				
4.3.1	**Voltage Measurement**				
	Description	**Range**	**Resolution/Accuracy**		
	Frequency Nominal 50hz	42.5 to 69Hz	±0.1hz		Specify Range & Resolution
	Single phase rms Voltages	0 to 1000V rms	0.1V/±0.2% Rdg ±0.2V		Specify Range & Resolution
	Phase to phase rms voltages	0 to 1000V rms	0.1 to 1V/±0.2% Rdg ±0.4V		Specify Range & Resolution
	DC	0 to 1000V	0.1V/±1% Rdg ±3v		Specify Range & Resolution
4.3.2	**Current Measurement**				
	Nominal range for the device current probes				Specify Range
	CT ratios				Specify Range
4.3.3	**Power Measurements**				
	Power	**Range**	**Resolution**	**Accuracy**	
	Active power	-2 to 2GW	0.001W	±0.5% Rdg ±0.005% Pnom	Specify Range, Resolution & Accuracy
	Reactive power	-2 to 2GVar	0.001Var	±1% Rdg ± 0.01% Qnom	Specify Range, Resolution & Accuracy
	Apparent power	0 to 2 GVA	0.001Va	±0.5% Rdg ±0.005% Snom	Specify Range, Resolution & Accuracy
	Power Factor	-1 to 1	0.001	±0.05%	Specify Range, Resolution & Accuracy

Clause number	KPLC requirement				Bidder's offer
	TanΦ P/Q Ratio	-3.2 to 3.2	0.001	±0.02	Specify Range, Resolution & Accuracy
4.3.4	**Energy Measurements**				
	Energy	**Range**	**Resolution**	**Accuracy**	
	Active Energy	0 to 4x10ƀ;4Ewh	1Wh	±0.5% Rdg	Specify Range, Resolution & Accuracy
	Reactive Energy	0 to 4x10ƀ;4Evarh	1varh	±2% Rdg	Specify Range, Resolution & Accuracy
	Apparent Energy	0 to 4x10ƀ;4Evah	1vah	±0.5%	Specify Range, Resolution & Accuracy
	THD (Total harmonic distortion)		± 655%		Specify
	Individual harmonics		1 to 50 displayed in percentages		Specify
	External power supply		230V ± 10% at 50Hz.		Specify
	Battery charge time, max.		5 hours		Specify
	Battery life		10 hours continuous		Specify
4.3.5	Computer Communication Interface				**State**
4.3.6	**PC software**				
4.3.6.1	Type of software				Specify
4.3.6.2	Software ease of use				Specify
4.3.6.3	Saving and retrievability				Specify
4.3.6.4	PC software version				Specify
4.3.6.5	Testy results in form of tables and graphs, exportable				Specify
4.3.7	Provision of robust casing				Specify
4.4	**Characteristic Values/ Ratings**				
	1. Power supply				Specify
	2. Protection				Specify
	3. Weight				Specify
	4. Test lead sets				Specify
	5. Display				Specify
	6. Regulations and standards				Specify
	7. Operation environment				Specify
	8. Electromagnetic Compatibility				Specify

Clause number	KPLC requirement	Bidder's offer
	9. Inputs/outputs protection	Specify
4.5.1	**Accessories** (to be supplied with the PQA)	
	(i) 4 No voltage leads 4 meters 3.5 mm².	Specify
	(ii) 4 No Current probe (current sensors-clamp on) leads 4 meters 4 mm²	Specify
	(iii) Operating software.	Specify
	(iv) Communication cable.	Specify
	(v) Power adaptor cable.	Specify
	(vi) Carrying case	Specify
	(vii) Operation Manual (Soft copy and Hard copy).	Specify
	(viii) SD card 32GB.	Specify
	(ix) USB SD card reader	Specify
	(x) Current sensors	Specify
4.5.2	**Laptop**	
	1. Brand	Specify
	2. Model	Specify
	3. Year of manufacture	Specify
	4. Processor	Specify
	5. Clock speed	Specify
	6. Chipset	Specify
	7. Motherboard	Specify
	8. Memory	Specify
	9. Cache memory	Specify
	10. Graphics	Specify
	11. Hard disk controller	Specify
	12. Hard disk	Specify
	13. Shock resistant	Specify
	14. Keyboard	Specify
	15. Mouse	Specify
	16. Touch pad	Specify
	17. Power supply	Specify
	18. Battery life	Specify
	19. Optical drive	Specify
	20. Card slots	Specify
	21. Display	Specify
	22. Integrated Web Camera	Specify
	23. Network/Wireless Interfaces	Specify

Clause number	KPLC requirement	Bidder's offer
	24. Security	Specify
	25. I/O Inputs	Specify
	26. Operating system	Specify
	27. Productivity software	Specify
	28. Anti-virus	Specify
	29. Carrying bag	Specify
	30. Manufacturer Authorization and warranty	Specify
4.6	**Warranty and Training**	
4.6.1	Warranty period in months	No of months
4.6.2	Period of free technical support and software upgrades	No. of months
4.6.3	Complete training on the PQA will be conducted to Kenya Power engineers/Technicians, in Nairobi Kenya	Specify
4.6.4	Detailed training program is submitted with the bid	State
4.6.5	Training includes theory on how the PQA works followed by practical demonstrations on operation, protection and control configuration and parameter settings	Specify
4.6.6	Hallmarks of successful training	List
5.0	Test and standards for carrying out tests	List
6	**Marking and Packing**	
6.1	**Marking**	
6.1.1	Information to be marked legibly and indelibly on the PQA	Specify
6.2	**Packing**	
6.2.1	Carrying case protections class and standard	State
6.2.2	Carrying case is shockproof, and impact resistant	State
APPENDICES		
A	**TESTS AND INSPECTION (NORMATIVE)**	
A1	Responsibility of performing tests	State
A2	Copies of previous type test reports by the relevant independent /international testing laboratory submitted	State
A3	Tests to be witnessed at the factory	List
A4	The supplier will replace/rectify without charge to Kenya Power, PQA which upon examination, test or use fail to meet any or all the requirements in the specification	Accept
B	**QUALITY MANAGEMENT SYSTEM**	
B1	QAP and ISO 9001:2008	State
B2	Copies of quality management certifications attached	State

Clause number	KPLC requirement	Bidder's offer
B3	Delivery time, Production capacity & experience of the manufacturer	State
C	**TECHNICAL DOCUMENTATION**	
C1	Technical documents to be submitted with tender documents	
	a) Fully-filled clause by clause Guaranteed Technical Particulars (GTPs)- Appendix D - stamped and signed by the manufacturer.	state
	b) Copies of the Manufacturer's catalogues, brochures, drawings and technical data for the PQA;	state
	c) Details of the manufacturer's experience; Sales records for the last five years and at least four customer reference letters.	state
	d) Copies of previous test certificates and test reports (As given in Clause A.2) by the relevant International or National Testing/Standards Authority of the country of manufacture (or ISO/IEC 17025 accredited independent laboratory) shall be submitted with the offer for evaluation. A copy of accreditation certificate for the laboratory shall also be submitted (all in English Language);	state
	e) Marking & Packaging details (including packaging materials).	State
C2	Documents to be submitted Kenya Power for approval before manufacture/supply	
	a) Fully filled clause by clause Guaranteed Technical Particulars (GTPs) stamped and signed by the manufacturer (these are not the ones submitted with the tender);	State
	b) Technical details and drawings with details of portable single phase secondary injection set to be manufactured for KPLC.	State
	c) Quality assurance plan (QAP	State
C3	Routine and sample test reports to be submitted to Kenya Power for approval before shipment/delivery of the goods	State
C4	Each package is supplied with detailed user's installation guide printed in English language	Specify

** Words like 'agreed', 'confirmed', 'As per KPLC specifications', etc. shall not be accepted and shall be considered non-responsive.*

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Manufacturer's Name, Signature, Stamp and Date