



## SPECIFICATIONS FOR SMART METER DATA CONCENTRATORS

### SPECIFICATION

for

### SMART DATA CONCENTRATORS

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## SPECIFICATIONS FOR SMART METER DATA CONCENTRATORS

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### **Foreword**

This specification was prepared by Kenya Power Smart Metering Pilot Project Technical Committee. It lays down requirements for newly manufactured smart meter data concentrators. The specification is intended for procurement of equipment and does not include provision of contract.

### **Introduction**

This specification was prepared to establish and promote uniform requirements for smart meter data concentrators. The specification lays down the minimum requirements for equipment acceptable for evaluation. It is the responsibility of the Manufacturers/Suppliers to familiarize themselves with the standards referred herein.

This specification is in two parts, one is a narrative clause-by-clause and the other is a summarized table of the same clauses located in the specifications and marked as **Appendix A**.

Tenderers shall complete the schedule in **Appendix A** and this shall form the basis for the technical evaluation of their tender. **(See clause 4.3.5)**.

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### 1. Scope

This specification is for newly manufactured smart meter data concentrators. The concentrator handles two-way communication between the head end system (HES) and the smart meters. The default communication between smart meters and concentrators is by the Power line carrier (PLC) scalable to other communication options, while that between concentrators and HES is by GPRS/GSM, Fibre, RF, etc communication methods. The concentrator reads metering data automatically and can send data to the system or store data for later retrieval by HES.

### 2. References

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

- [1] IEC 61334-4-32: Distribution automation using distribution line carrier systems - Part 4: Data communication protocols - Section 32: Data link layer - Logical link control (LLC).
- [2] IEC 62056-21:2003, Electricity Metering – Data exchange for meter reading, tariff, and load control – Part 21: Direct local data exchange.
- [3] IEC 61334-5-1 Distribution automation using distribution line carrier systems - Part 5-1: Lower layer profiles - The spread frequency shift keying (S-FSK) profile.
- [4] ISO/IEC 14908-1:2012: Information technology – Control network protocol – Part 1: Protocol stack.
- [5] ISO/IEC 14908-2:2012: Information technology – Control network protocol – Part 2: Twisted pair communication.
- [6] ISO/IEC 14908-3:2012: Information technology – Control network protocol – Part 3: Power line channel specification.



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[7] ISO/IEC 14908-4:2012: Information technology – Control network protocol – Part 4: IP communication.

[8] ETSI GS OSG 001 (Open Smart Grid Protocol or OSGP)

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

### 3. Terms and definitions

The definitions given in [1] ... [8] apply.

<b>LAN:</b>	Local area network
<b>WAN:</b>	Wide area network
<b>GSM:</b>	General system of mobile communication
<b>GPRS:</b>	General packet radio service
<b>PLC:</b>	Power Line Communication
<b>TCP/IP:</b>	Transmission Control Protocol/Internet Protocol

### 4. Requirements

In addition to the requirements in IEC standards highlighted in section 2 above, the smart meter data concentrators shall fulfill the following requirements.

#### 4.1 Operating conditions requirements

4.1.1 The data concentrators shall be suitable for operation in tropical climate where temperatures may vary from -1 to +45 degrees Celsius.

4.1.2 Average annual relative humidity reaching 90 % and altitude of up to 2,200 m above sea level.

#### 4.2 Design and construction requirements

##### 4.2.1 Concentrator cover, base and terminals

4.2.1.1 The data concentrator cover shall be made of Polycarbonate material.

4.2.1.2 The data concentrators shall be for front projection mounting.

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- 4.2.1.3 The data concentrators shall conform to the degree of protection of least **IP 51** as given in **IEC 60529:1989** Degrees of protection provided by enclosures (IP Code) Amendment 1:1999.
- 4.2.1.4 The data concentrators shall have provision for sealing the terminal covers for power intake and interfaces, where such terminals may have negative effect on the operation of concentrators.
- 4.2.1.5 The data concentrators shall automatically discover meters, providing 100% accuracy on the assets. It should upload (tariff tables) and monitors and reports tampering. It should have broadcast capability to enable demand response and load shedding.
- 4.2.2.1** The concentrator shall have, depending on physical communication constraints, a 'last gasp' mechanism to inform the system of outages.

### 4.2.2 Power supply

- |                                 |  |
|---------------------------------|--|
| a) Operating voltage:           | <b>1 x 230 V (with capability for connection for three phases)</b> |
| b) Voltage range:               | <b>0.8 Un to 1.15 Un</b>   |
| c) Frequency:                   | <b>50 Hz</b>   |
| d) Power consumption:           | <b>&lt; 12 W</b>   |
| e) Back up for real time clock: | <b>Lithium battery or supecap</b>                                  |

### 4.2.3 Communication

#### 4.2.3.1 General

- a) The concentrators shall have down-link communication mode that supports communication with the meters by PLC system, scalable to other communication options.
- b) In addition to the PLC system, the **down-link communication mode** of concentrators shall provide local concentrator maintenance facility through at least the following methods:
- RS 232 or 485 interface;
  - Infra red optical interface as per IEC 62056-21 standard;
  - Ethernet.



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- c) The concentrators shall have **up-link communication mode (WAN)** that enables communication with Head End System (HES) by using the wireless, Fibre and GSM/GPRS .
- d) The concentrators shall support TCP/IP server and client mode.
- e) The concentrators shall have facility for local and remote configuration to suit customers' requirements.
- f) The concentrators shall have remote and local clock synchronization capability.
- g) The concentrators shall have capability for local and remote firmware upgrade.
- h) Should offer the freedom to choose meters from various vendors and avoid being reliant on proprietary solutions from a single source.
- i) The data concentrator shall support meter data collection compliant with international standards IEC 62056 (DLMS)
- j) Offer data rate performance significantly which provides for a foundation for future integration of electric vehicles and distributed generation control.
- k) The data concentrators shall provide Smart grid firmware designed for interoperability with an open architecture.

### 4.2.3.2 Down link communication

- a) The data concentrators shall have PLC interface that satisfies the requirements below:
  - i) Modulation: **OFDM**
  - ii) Link layer: **IEC 61334 or higher**
  - iii) PLC: **On CENELEC A-band**
  - iv) Baud rate: **Minimum 1200 bps . at least 9600 bps**
  - v) Operation mode: **Plug and play installation**
  - vi) Communication distance: **At least one thousand (1,000) metres**
  - vii) Minimum number of meters to be connected: **1000**

### 4.2.3.3 Up-link communication

- a) The data concentrators shall have a GPRS modem that satisfies the requirements below:
  - i. Modem: **Pluggable GSM/GPRS modem**

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ii.	Quad-Band GSM:	<b>850/900/1800/1900 MHz</b>
iii.	GPRS multi-slot class:	<b>10</b>
iv.	GSM compliance:	<b>Phase 2/2+</b>
v.	SIM-card holder	<b>Yes</b>
vi.	SIM card interface	<b>1.8 V and 3 V</b>
vii.	SMA connector for the antenna	<b>Yes</b>
viii.	SMS capability:	<b>Yes</b>

### 4.2.4 Data storage and logging

- a) The data concentrators shall have a non-volatile memory capable of data storage and with long-term data retention for the certified life of the concentrator or ten (10) years, whichever is greater without an electrical supply being supplied to the concentrator.
- b) The meters shall be capable of profiling at least four channels of energy and/or demand for a period of at least six (6) months.
- c) The load profile integration period shall be programmable between 1 minute up to a maximum of sixty (60) minutes.
- d) The meters shall have at least twelve (12) billing historical data stored in memory and retrievable by software action.
- e) The concentrator shall be capable to log events and store upto 100 plus events.
- f) The concentrator shall have configurable data logging intervals i.e minutes, hours and days.,

### 4.2.5 Electromagnetic Compatibility

- a) Dielectric strength: **4 kV, 50 Hz, (IEC 62052-11)**
- b) Electrostatic discharge: **15 kV (IEC 610-0-4-2)**
- c) Burst: **4 kV (IEC 610-0-4-4)**
- d) Impulse voltage: **12kV, 1,2/50  $\mu$ s (IEC 62052-11)**
- e) Electromagnetic field: **10 V/m and 30 V/m (IEC 610-0-4-3)**

## 4.3 Instructions and marking requirements





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

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

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

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

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

- (a) Concentrator drawing giving all the relevant dimensions;
- (b) Wiring diagrams;
- (c) Description leaflet;
- (d) Service and operational manuals.

4.3.4 Copies of type approval certificate(s) with test and calibration results of the concentrator being offered obtained from an international or the national concentrator certification body shall be provided. **If type approval certificate(s) is (are) from accredited concentrator certification laboratories (and not national or international body), then it (they) shall be accompanied with copies of certificates of accreditation from the national or an international certification body.**

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4.3.5 **The Tenderer shall complete clearly, all the clauses in both columns of the schedule in Appendix D.** This shall form the basis of evaluation of the submitted tender. Failure to complete this appendix shall render the tender non-responsive. The tenderers shall indicate the details of their offer where it is different from these requirements. Where the requirement is the same, they shall indicate what is offered. **Insertions such as “noted”, “agreed” etc. shall be considered as non-responsive where a specific response is called for.**

4.3.6 The tenderer shall submit with the tender, **a sample concentrator, concentrator software (if any), operating manual(s), and appropriate interface** for interrogating the concentrator.

4.5.2 The manufacturer shall provide proof of conformance to the following International standards:

- a) ISO 9001 (2008) standard
- b) ISO 14001 (2004) standard
- c) ISO 17025 (2005) standard

4.3.7 The manufacturer shall provide a list of at **least three previous utilities outside the country of manufacture** to which the concentrator being offered has been supplied including addresses and contact person(s) of the utilities.

4.3.8 The tenderer shall give proof that the number of Data Concentrators sold and installed in **utilities outside the country of manufacture** over a period of last **5 years** shall not be less than **1,000**. The addresses and contact person(s) shall be provided with the tender to facilitate confirmation of this information by the procuring entity.

4.3.9

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

5.1 Drawings and technical details shall be submitted to KP for approval before manufacture of the concentrators commences. KP undertakes to submit their



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- comments or approval for the drawings within three weeks of receiving the draft copies.
- 5.2 Original software, software manuals and operation manuals shall be submitted in 3 copies. Description leaflets (brochures) shall be submitted in copies of 100.
- 5.3 The concentrator shall have a warranty against any defects, which may develop due to faulty material, calibration, transportation or workmanship for a period of thirty-six months from the date of delivery. **All defective concentrators shall be replaced at the supplier's cost.**
- 5.4 The manufacturer shall make a commitment in writing on the availability of essential spares and other consumables for the certified life of the concentrator.
- 5.5 KP Engineers will inspect concentrator-manufacturing facilities intending to supply concentrators to the company for the first time at no extra cost, except the cost of the engineers' transportation to the nearest major airport. Such inspection shall not in any way prejudice the purchaser's rights and privileges.
- 5.6 The manufacturer shall meet the full costs of two Engineers, for concentrator inspection and acceptance testing at the manufacturer's facility, except the cost of Engineers' transportation from Kenya to the nearest major airport. The factory inspection and factory acceptance tests shall run for duration of three (3) working days each.
- 5.7 After delivery of concentrators to KP, the manufacturer shall conduct training for at least 3 days for twenty people in Nairobi, Kenya. The training shall cover and not be limited to:
- 1) Concentrator features;
  - 2) Concentrator installation;
  - 3) Concentrator software;
  - 4) Concentrator communication features, etc.

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5.8 The manufacturer shall meet the cost of the training described in clause (5.7).

**5.9 Samples**

The tenderer shall submit one sample together with the tender documents. The submitted concentrator samples shall be subjected to accuracy tests at KP’s Meter Central Laboratory to verify the responsiveness to other clauses of this specification. Sample concentrators shall not be returned to the tenderers.

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

5.11 The concentrators shall be packed in suitable groups and/or batches with consecutive serial numbers provided by KP.

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

5.13 Where test and/or calibration certificates/reports are issued by a laboratory other than the **International/National Concentrator Certification Authority**, a copy of accreditation certificate shall be attached together with the tender documents.

5.14 The manufacturer shall provide current e-mail addresses, fax and telephone numbers of the national/international testing/calibration laboratories and concentrator certification bodies to facilitate confirmation of the submitted test reports & certificates.

**Appendix A: Specifications for Smart meter data concentrators**

CLAUSE	KENYA POWER REQUIREMENT	MANUFACTURER’S COMPLIANCE/REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
<b>4.1</b>	<b>Operating conditions requirements</b>		
4.1.1	-1 to 45 °C (operational)		
4.1.2	Humidity: Average annual reaching 90 % and altitude of up to 2,200m		



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<b>4.2</b>	<b>Design and construction requirements</b>		
<b>4.2.1</b>	<b>Concentrator cover, base and terminals</b>		
4.2.1.1	The data concentrator cover shall be made of Polycarbonate material		
4.2.1.2	The data concentrators shall be for front projection mounting		
4.2.1.3	The data concentrators shall conform to the degree of protection <b>IP 51</b> as given in <b>IEC 60529:1989</b> Degrees of protection provided by enclosures (IP Code) Amendment 1:1999		
4.2.1.4	The data concentrators shall have provision for sealing the terminal covers for power intake and interfaces, where such terminals may have negative effect on the operation of concentrators		
4.2.1.5	The data concentrator shall automatically discover meters, providing 100% accuracy on the assets. It should upload (tariff tables) and monitors and reports tampering. It should have broadcast capability to enable demand response and load shedding		
4.2.1.6	The concentrator shall have, depending on physical communication constraints, a 'last gasp' mechanism to inform the system of outages.		
<b>4.2.2</b>	<b>Power supply</b>		
(a)	Operating voltage: <b>1 x 230 V (with capability for connection for three phase)</b>		
(b)	Voltage range: <b>0.8 Un to 1.15 Un</b>		
(c)	Frequency: <b>50 Hz</b>		
(d)	Power consumption: <b>&lt; 12 W</b>		
(e)	Back-up power: <b>Lithium battery or supercap</b>		
<b>4.2.3</b>	<b>Communication</b>		
<b>4.2.3.1</b>	<b>General</b>		

**SPECIFICATIONS FOR SMART METER DATA CONCENTRATORS**

a)	The concentrators shall have down-link communication mode that supports communication with the meters by PLC System. However they shall be Wireless and Ethernet ready.		
b)	In addition to the PLC System, the <b>down-link communication mode</b> of concentrators shall provide local concentrator maintenance facility through at least the following methods:		
i)	RS 232 or 485 interface;		
ii)	Infra red optical interface as per IEC 62056-21 standard;		
iii)	Ethernet.		
c)	The concentrators shall have <b>up-link communication mode</b> that enables communication with Head End System (HES) by using the wireless , Fibre, and GSM/GPRS.		
d)	The concentrators shall support TCP/IP server and client mode		
e)	The concentrators shall have facility for local and remote configuration to suit customers' requirements		
f)	The concentrators shall have remote and local clock synchronization capability		
g)	The concentrators shall have capability for local and remote firmware upgrade		
h)	Should offer the freedom to choose meters from various vendors and avoid being reliant on proprietary solutions from a single source.		
i)	The data concentrator shall support meter data collection compliant with international standards IEC 62056 (DLMS)		
j)	Offer data rate performance significantly which provides for a foundation for future integration of electric vehicles and distributed generation control.		



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k)	The data concentrators shall provide Smart grid firmware designed for interoperability with an open architecture.		
<b>4.2.3.2</b>	<b>Down link communication</b>		
a)	The data concentrators shall have PLC interface that satisfies the requirements below:		
i)	Modulation: <b>OFDM, IEC 61334</b>		
ii)	Link layer: <b>IEC 61334-4-32 or higher</b>		
iii)	PLC: <b>On CENELEC A-band</b>		
iv)	Baud rate: <b>At least 9600 bps</b>		
v)	Operation mode: <b>Plug and play installation according to IEC 61334-4-511</b>		
vi)	Communication distance: <b>At least one thousand (1,000) metres</b>		
vii)	Minimum number of meters to be connected: <b>256</b>		
<b>4.2.3.3</b>	<b>Up-link communication</b>		
a)	The data concentrators shall have a GPRS modem that satisfies the requirements below:		
i)	Modem: <b>Pluggable GSM/GPRS modem</b>		
ii)	Quad-Band GSM: <b>850/900/1800/1900 MHz</b>		
iii)	GPRS multi-slot class: <b>10</b>		
iv)	GSM compliance: <b>phase 2/2+</b>		
v)	SIM-card holder: <b>Yes</b>		
vi)	SIM card interface: <b>1.8 V and 3 V</b>		
vii)	SMA connector for the antenna: <b>Yes</b>		
<b>4.2.4</b>	<b>Data storage</b>		

**SPECIFICATIONS FOR SMART METER DATA CONCENTRATORS**

a)	The data concentrators shall have a non-volatile memory capable of data storage and with long-term data retention for the certified life of the concentrator or ten (10) years, whichever is greater without an electrical supply being supplied to the concentrator		
b)	The meters shall be capable of profiling at least four channels of energy and/or demand for a period of at least six (6) months		
c)	The load profile integration period shall be programmable between 1 minute up to a maximum of sixty (60) minutes		
d)	The meters shall have at least twelve (12) billing historical data stored in memory and retrievable by software action		
e)	The concentrator shall be capable to log events and store upto 100 plus events.		
f)	The concentrator shall have configurable data logging intervals i.e minutes, hours and days.,		
<b>4.2.5</b>	<b>Electromagnetic Compatibility</b>		
(a)	Dielectric strength: <b>4 kV, 50 Hz, (IEC 610-0-4-5)</b>		
(b)	Electrostatic discharge: <b>15 kV (IEC 610-0-4-2)</b>		
(c)	Burst: <b>4 kV (IEC 610-0-4-4)</b>		
(d)	Impulse voltage: <b>12kV, 1,2/50 μs (IEC 62052-11)</b>		
(e)	Electromagnetic field: <b>10 V/m and 30 V/m (IEC 610-0-4-3)</b>		
<b>4.3</b>	<b>Instructions and marking requirements</b>		
4.3.1	In addition to <b>IEC 6205211:2003</b> nameplate requirements, each data concentrator shall be marked <b>legibly and indelibly</b> with the following information:		
(a)	Name or trade mark of the manufacturer		
(b)	Country of origin		



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(c)	Type/model		
(d)	Serial number up to ten digits		
(e)	Barcode comprising of serial no		
(f)	The inscription "Property of K.P. & L. Co Ltd"		
(g)	Standard(s) to which the concentrator complies		
(h)	Year of manufacture. All markings to be written in English and with c), d) and e) <b>at least 4 mm</b> figure height		
4.3.2	Every concentrator shall be <b>indelibly</b> marked with diagrams of connections for which the concentrator is intended		
4.3.3	In addition, the following drawings and information shall be required with the tender: (a) Concentrator drawing giving all the relevant dimensions; (b) Wiring diagrams; (c) Description leaflet; (d) Service and operational manuals		
4.3.4	Copies of type approval certificate(s) with test and calibration results of the concentrator being offered obtained from an international or the national concentrator certification body shall be provided. <b>If type approval certificate(s) is (are) from accredited concentrator certification laboratories (and not national or international body), then it (they) shall be accompanied with copies of certificates of accreditation from the national or an international certification body</b>		
4.3.5	The Tenderer shall complete clearly, all the clauses in both columns of the schedule in Appendix A		
4.3.6	The tenderer shall submit with the tender, <b>a sample concentrator, concentrator software (if any), operating manual(s), and appropriate interface</b> for interrogating the concentrator		
4.3.6	Conformance to International standards:		
a)	ISO 9001(2008)		
b)	ISO 14001(2004)		

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c)	ISO 17025(2005)		
4.3.9	The tenderer shall give proof that the number of concentrators sold to <b>utilities outside the country of manufacture</b> over a period of last <b>5 years</b> shall not be less than <b>1,000 concentrators</b> . The addresses and contact person(s) shall be provided with the tender to facilitate confirmation of this information by the procuring entity		

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

**Signature ..... Date .....Stamp/Seal .....**