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FOR ESKOM SMART METERING
SYSTEM**

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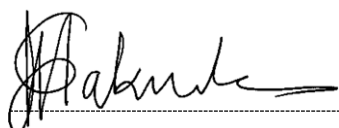
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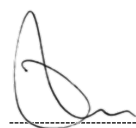


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1. Introduction

Eskom has adopted NRS049:2016 as its functional requirements specification for smart metering systems. While NRS049:2016 caters for Eskom's functional requirements, some clauses in NRS049:2016 apply only to municipalities and others are optional. It is therefore essential for Eskom to have a complementary standard that clarifies the applicability of various clauses of NRS049:2016 in Eskom to ensure that there is no confusion among potential vendors during the tendering process.

2. Supporting clauses

2.1 Scope

This document details the minimum functional requirements for smart metering systems and associated performance levels that will apply to metered electricity customer installations where a smart metering infrastructure roll out is considered.

In the context of this document smart metering system refers to a combination of the following components: Smart Meter, Network Gateway (NG)/Data Concentrator (DC), Customer Interface Unit (CIU) and Head End System (HES). The detailed requirements for the HES (which form part of the smart metering system) are not covered in this document and are covered in a separate document. All HES implementations offered to Eskom shall comply with the "Group IT Business Requirement Specification (BRS) AMI head-end solutions (AMI Project) - GCS20" and a limited set of applicable requirements stated herein.

The requirements in this document apply to the smart metering system excluding requirements for the HES. These requirements are minimum requirements only and do not limit the implementation of a smart metering system that have functionality and performance that exceed the requirements of this document.

This document shall be applied in conjunction with the latest version of NRS049.

2.1.1 Purpose

The purpose of this document is to ensure that while NRS049 is the de facto standards for smart metering systems, Eskom specific requirements deviating from NRS049 are clearly stated to ensure seamless integration of the smart metering system with legacy Eskom systems. The document further seeks to ensure that the smart metering technology implemented by Eskom is future proofed.

2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited Divisions.

2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

- [1] 240-61266818: Specification for GSM/GPRS Modems for Remote Metering
- [2] Group IT Business Requirement Specification (BRS) AMI head-end solutions (AMI Project) - GCS20".
- [3] IEC 62055-41 Electricity metering - Payment systems - Part 41: Standard transfer specification (STS) - Application layer protocol for one-way token carrier systems
- [4] NRS049:2016 Edition 2.1 Advanced metering infrastructure requirement for smart metering system
- [5] SANS 1524-1 Electricity payment systems - Part 1: Payment meters
- [6] STS101-2 Standard Transfer Specification – Physical Layer Protocol for a two-way virtual token carrier for remote connection over DLMS/COSEM

- [7] IDIS Interoperability specification – Package 2 – IP Profile Edition 2.0 (including G3-PLC), 03-09-2014
- [8] IDIS Interoperability specification – Package 2 – Smart Metering Objects Edition 2.0 (including G3-PLC), 03-09-2014

2.2.2 Informative

- [9] IEC 62051 Electricity metering - Glossary of terms
- [10] ISO 9001 Quality Management Systems.
- [11] SANS 1524-4 Electricity payment systems - Part 4: National prepayment electricity meter cards
- [12] SANS 15417 Information technology: Automatic identification and data capture techniques - Code 128 bar code symbology specification
- [13] ST 240-76619489 Eskom specification: Accelerated Environmental Stress Test for Solid State Electricity Metering Equipment

2.3 Definitions

2.3.1 General

Definition	Description
Customer interface Unit (CIU)	The portion of a meter that contains interfaces (input and/or output) to interact with the meter. The Customer interface Unit is sometimes included with the Measurement Unit to form a self-contained meter, but it may also exist as a separate Unit e.g., as in the implementation of a split meter.
Data Concentrator	Intelligent device in hierarchical communications network where incoming data (generated by multiple meters) is processed as appropriate and then repackaged, relayed, retransmitted, discarded, responded to, consolidated, prioritized and / or increased to multiple messages. The data concentrator acts as a DLMS/COSEM client and may hold DLMS security keys.
DLMS	Device Language Message specification” - a generalised concept for abstract modelling of communication entities
IDIS	IDIS is a publicly available technical interoperability specification based on open standards and supports the implementation in interoperable products. The specification is for smart metering companies who are committed to providing interoperable products based on open standards.
Interoperability	Interoperability is the ability of a system to exchange data with other systems of different types and/or from different manufacturers.
Measurement Unit (MU or MCU)	Measurement Unit (or Measurement Control Unit) as defined in SANS 1524-1 with the additional meaning that the term Measurement Unit may also be used to describe a complete meter where the Measurement Unit and Customer interface Unit are contained inside a single device.
Network Gateway	Device that fully implements the ISO-OSI model for all layers and is used to convert data protocols between different communication systems and standards. In NRS 049 Ed.2 this device contains additional functionality as outlined under clause 6.7 of that specification. Note: Gateways work on all seven layers of ISO-OSI architecture. The main job of a gateway is to convert protocols between communications networks.

Definition	Description
PLC	Power line communication or power line carrier (PLC), also known as Power line Digital Subscriber Line (PDSL), mains communication, power line telecom (PLT), power line networking (PLN), or Broadband over Power Lines (BPL) are systems for carrying data on a conductor also used for electric power transmission.
Power Limiting	An automatic load disconnection function provided in prepayment meters to limit the average power consumed, to the value programmed in the meter with the relevant STS management token. The average power consumed is calculated over a number of pulses and is therefore not suitable to serve as input for any protection feature.
Split Meter	Meter where the Measurement Unit and Customer interface Unit are contained in separate enclosures.
Modular on-board cellular/GSM modem	Modular on-board modem is defined as a hot swappable modem that is mounted internally to the network gateway or meter. It obtains its power internally from the meter or the network gateway and its data communications are also routed internally.

2.3.2 Disclosure classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Description
ACD	Appliance Control Device
COSEM	Companion Specification for Energy Metering
DC	Data Concentrator
DLMS	Device Language Message Specification
DLMS UA	DLMS User Association
ERPS	Enterprise Resource Planning System
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HAS	Home Automation System
HES	Head-End System
HHU	Handheld Unit
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
LNAP	Local Network Access Point
NG	Network Gateway
NN	Neighbourhood Network
NNAP	Neighbourhood Network Access Point
NRS	National Rationalised Specification

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Abbreviation	Description
NTC	Numeric Token Carrier
PLC	Power Line Carrier
RF	Radio Frequency
POS	Point Of Sale
SANS	South African National Standard
STS	Standard Transfer Specification
VS	Vending System
VTC	Virtual Token Carrier

2.5 Roles and responsibilities

Not Applicable

2.6 Process for monitoring

Not Applicable

2.7 Related/supporting documents

Not Applicable

3. Requirements for smart metering system

- Where the requirements in this document deviate from the requirements in NRS049:2016, the requirements in this document shall prevail.
- Where a specific requirement in this document is not a minimum requirement but stipulated as a future requirement the supplier shall ensure that the hardware of supplied devices (meters and NG/DC) has the capability (e.g., sufficient memory and processing power) to host and process of future requirements without the need to upgrade the hardware of installed devices.

3.1 Communication requirements

3.1.1 Network reference architecture

The requirements of clause 4.1 in NRS 049 shall apply. In reference to Table 1 in NRS049:2016; the G1 interface shall be mandatory for point-to-point meters.

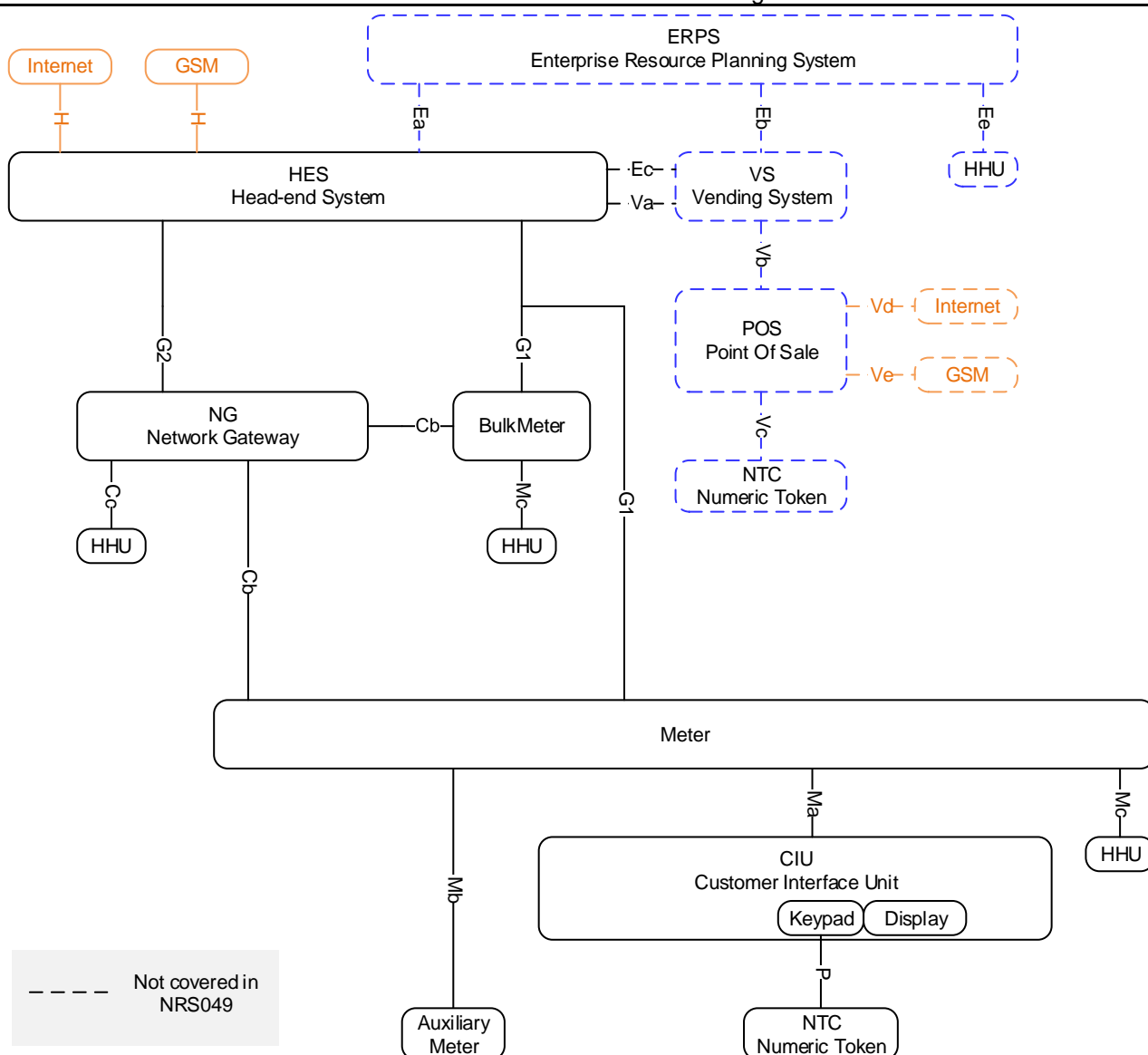


Figure 1: Network Reference Architecture

3.1.2 Network routing

The requirements of NRS049:2016 clause 4.2 shall apply.

3.1.3 Network topologies

Clause 4.3. of NRS049:2016 provides a guideline for network topologies.

3.1.4 Standard interfaces

The requirements of NRS049:2016 clause 4.4 shall apply with the augmentations here.

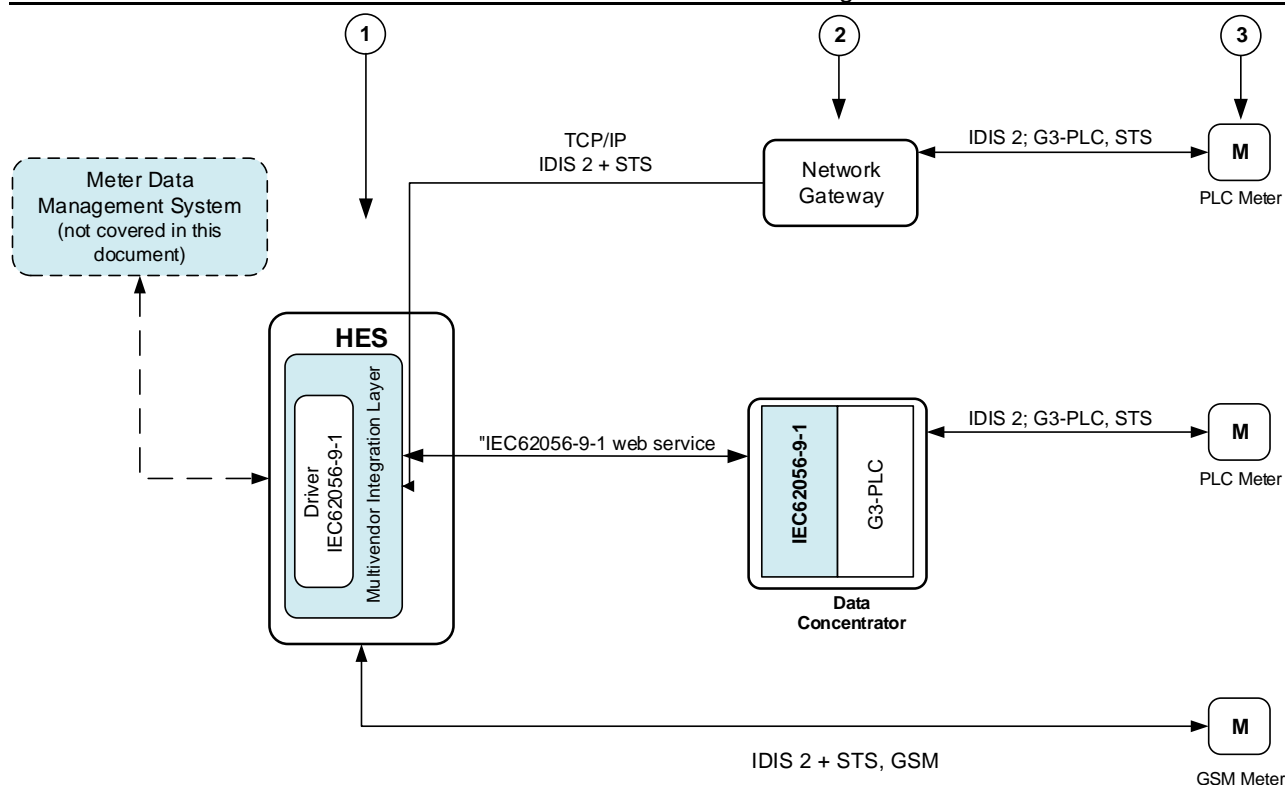


Figure 2: Interoperability requirements between HES and field devices

3.1.4.1 General

For smart meters and CIUs the implementation of interfaces H2, Mb, H2b, H2a, P1c and P1c is not mandatory.

3.1.4.2 Interface G1 between HES and meter

Clause 4.4.12 of NRS 049 shall apply.

A Cb interface is not mandatory for meters with a G1 interface.

3.1.4.3 Interface G2 between HES and network gateway/data concentrator

The IEC 62056-9-1 is the preferred adaption layer for G2 interface for implementation in the HES and the data concentrator. However initially, if a proprietary adaptation layer is implemented for the G2 interface, the DC manufacturer/supplier shall declare their proprietary API for use by third party HES suppliers to enable systems integration. The DC manufacturer/supplier shall ensure that their proprietary adaptation layer is upgraded to IEC 62056-9-1 within 12 months of contract award without need for change of existing hardware design.

3.1.4.4 Interface Cb between NG/Data concentrator and meter

Clause 4.4.15 of NRS 049 shall apply however the RF interface is not required.

A G1 interface is not mandatory for meters with a Cb interface.

3.1.4.5 Interface Ma between CIU and meter

Clause 4.4.18 of NRS 049 shall apply.

However, the Ma interface can alternatively be implemented using a proprietary application layer protocol (not DLMS/COSEM) with the lower layer protocol layers as specified in clause 4.4.18. of NRS 049.

3.1.4.6 Interface Mc between HHU and meter

Clause 4.4.24 of NRS 049 shall apply. Object = IDIS2

3.1.5 Interface certification

The requirements of NRS 049 clause 4.5 shall apply.

3.2 Security requirements

3.2.1 Security requirements for HES

The requirements of NRS 049 clause 5.1.1. shall apply.

3.2.2 Security requirements for field devices

The requirements of NRS 049 clauses 5.1.2, 5.1.3 and 5.1.4 shall apply.

Furthermore, Security Suite 1 of IEC 62056-5-3 is preferred as per clause 5.1.2 of NRS 049 however Security Suite 0 shall also be accepted on condition that it shall be possible to upgrade to Security Suite 1 through a remote firmware upgrade without a need to upgrade the hardware of the field devices.

3.3 Functional requirements

3.3.1 Performance and availability requirements

The requirements of NRS 049 clause 6.1 shall apply at system level.

3.3.2 Use cases

The requirements of NRS 049 clause 6.2 shall apply except subclauses 6.2.7., 6.2.10., 6.2.15. and 6.2.16.

Furthermore, the following augmentations and/or deviations to clause 6.2. of NRS 049 shall apply:

- a) The requirements of NRS 049 clause 6.2 shall apply to both currency and kWh credit when the meter is operating in prepayment mode.
- b) In addition to the requirements of NRS049:2016 clause 6.2.6.1, the default integration period shall be 30 minutes. Six (6) channels of load profiling memory shall be provided for: kWh import, kWh export, kVArh Q1, kVArh Q2, kVArh Q3 and kVArh Q4.
- c) The requirements of NRS 049 clause 6.2.9.13 are optional where implemented in the smart meter, it shall be possible for the utility to enable/disable such functionality.
- d) Under clause 6.2.14.5 of NRS 049, Ma is mandatory and P1d is optional. Manual pairing of the CIU and the meter is preferred.
- e) The requirements of NRS 049 clauses 6.2.14.16 shall not apply. The HES downloads a new firmware image to the CIU. Restart of the new firmware shall be scheduled to automatically occur on a future date and time.
- f) In addition to the clause 6.2.17 of NRS 049, the requirements stipulated in the utility URS documents for the HES and MDMS shall apply.
- g) With reference to clause 6.2.11.1 of NRS049, capability to measure voltage flicker and voltage harmonics is not required.
- h) With reference to clause 6.2.13.1.2 of NRS049, item oo), pp), qq), rr), ss), tt) and uu) is not required.
- i) It shall be possible to switch a meter mode between prepaid and post-paid using DLMS/COSEM objects without having to visit the meter (remotely).
- j) DLMS/COSEM objects shall be used to configure the power limit of a meter.

3.3.3 Meter COSEM interface objects

The requirements of NRS049 clause 6.3 shall not apply. However, the smart meter shall comply with at least with the IDIS Package 2 specification and object model including extension D objects and functionality.

Furthermore, the following requirements shall apply:

- The Consumer Information Push option (clause 6.11 of IDIS Package 2) shall not be implemented instead CIU functionality and communication interface described in this document shall be implemented.
- The minimum prepayment objects listed in the table below shall be implemented in the smart meter and supported by the CIU and DC/NG.

Table 1: Meter COSEM interface objects

Instance Name	OBIS	IC
Account	0-0:19.0.0.255	111
Account passive	1-0:19.0.0.255	111
Standing charge	0-0:19.20.1.255	113
Standing charge passive	0-1:19.20.1.255	113
Consumption charge – Energy import	0-0:19.20.0.255	113
Consumption charge – Energy export	0-0:19.20.2.255	113
Token credit	0-0:19.10.0.255	112
Emergency credit active	0-0:19.10.1.255	112
Emergency credit passive	0-1:19.10.1.255	112
STS token gateway	0-0:19.40.0.255	115
Max vend limit	0-0:19.50.2.255	1
Max credit limit	0-0:19.50.1.255	1
Charge collection history	0-0:99.14.14.255	7
Token credit history	0-0:99.14.15.255	7
Token transfer log	0-0:99.14.17.255	7
IEC 62055-41 attributes	0-0:19.60.0.255	116

- The *STS Token Gateway* as specified in STS 101-2.
- The prepayment functionality shall be implemented according to IEC 62055-41 (STS).

3.3.4 CIU application layer functions

The requirements of NRS049:2016 clause 6.6 shall not apply.

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3.3.5 Network gateway application layer functions

The requirements of NRS049:2016 clause 6.7 shall apply. In the context of NRS 049 Ed.2 the term Network Gateway refers to a Data Concentrator. The Network Gateway or Data Concentrator shall have some storage capacity to meter events and billing data.

3.3.6 Functional certification

The requirements of NRS049:2016 clause 6.8 shall apply.

Each implementation of IDIS 2 (or higher) shall be certified by the DLMS UA or the IDIS Association for conformance.

3.4 General requirements for meter, CIU and NG devices

3.4.1 General requirements for meter, CIU and NG devices

The requirements of NRS049:2016 clause 7.1 shall apply.

3.4.2 Mechanical requirements for meter, CIU and NG devices

The requirements of NRS049:2016 clause 7.2 shall apply.

3.4.3 Climatic requirements for meter, CIU and NG devices

The requirements of NRS049:2016 clause 7.3 shall apply.

3.4.4 Electrical requirements for meter, CIU and NG devices

The requirements of NRS049:2016 clause 7.4 shall apply.

3.5 Particular requirements for meters

3.5.1 General requirements for meters

The requirements of NRS049:2016 clause 8.1 shall apply.

3.5.2 Mechanical requirements for meters

The requirements of NRS049:2016 clause 8.2 shall apply.

3.5.3 Climatic requirements for meters

The requirements of NRS049:2016 clause 8.3 shall apply.

3.5.4 Electrical requirements for meters

The requirements of NRS049:2016 clause 8.4 shall apply.

In addition, the following requirements shall apply:

Single phase meters:

- Basic Current: 10A or less
- Maximum Current: at least 80A

Three phase meters (25 and 50kVA)

- Basic Current: 10A or less per phase
- Maximum Current: at least 80A per phase

Three phase meters (100 kVA)

- Basic Current: 20A or less per phase
- Maximum Current: at least 150A per phase

The withstand voltage for single phase shall be 400V.

3.5.5 Metering accuracy requirements

The requirements of NRS049:2016 clause 8.5 shall apply. In addition, accuracy class 1 or better according to IEC 62053-21:2020 is required for metering devices.

3.5.6 Time keeping requirements for meters

The requirements of NRS049:2016 clause 8.6 shall apply.

3.5.7 Handheld Unit for local interrogation of meter

When the meter is built and supplied without local display, the supplier shall provide Eskom with sample local interface devices that will be used by Eskom to communicate and interrogated the meters locally through an external port (e.g. optical port).

3.5.8 Software

3.5.8.1 General Software Requirements

- a) The metering systems shall be supplied with configuration software.
- b) All software supplied with the system shall be documented comprehensively, with all the features and functions discussed, including a set of examples as to how the meters can be configured for different tariff structures and applications. Included in the documentation shall be a list of possible problems and how to solve them.
- c) Eskom shall be given an Eskom wide licence agreement for all software offered.
- d) Future revisions of software shall be supplied in terms of a contract but shall be submitted in accordance with Eskom standard 240-76624509.

3.5.8.2 Security within the software

- a) Security measures, such as a hierarchical password system shall prevent the configuration information, in the meter and the configuration software, from being changed by unauthorised personnel.
- b) Three levels of security will be provided within the software to enable the following functions:
 - 1) Read only mode whereby all the registers within the meter may be read.
 - 2) Reading and programming access to the meter.
 - 3) Reading, programming and configuration access.
- c) Within the access to programming of the meter it must be further possible to only configure the following parameters without changing any of the other parameters within the meter:
 - 1) Time and date

3.6 Particular requirements for customer interface units

3.6.1 General requirements for customer interface units

The requirements of NRS049:2016 clause 9.1 shall apply

3.6.2 Mechanical requirements for customer interface units

The requirements of NRS049:2016 clause 9.1 shall apply.

3.6.3 Electrical requirements for customer interface units

The requirements of NRS049:2016 clause 9.1 shall apply. Where the CIU make use of batteries, user replaceable batteries are required.

3.7 Particular requirements for network gateways

3.7.1 General

The requirements of NRS049:2016 clause 10.1 shall apply.

3.7.2 Mechanical requirements

- a) The requirements of NRS049:2016 clause 10.2 shall apply.
- b) The network gateway shall have two Ethernet ports for configuration purposes and future telecommunication requirements

3.7.3 Electrical requirements

The requirements of NRS049:2016 clause 10.3 shall apply.

3.8 Particular requirements for application control devices

3.8.1 General

The requirements of NRS049:2016 clause 11.1 shall apply.

3.8.2 Mechanical requirements

The requirements of NRS049:2016 clause 11.1 shall apply.

3.8.3 Electrical requirements

The requirements of NRS049:2016 clause 11.1 shall apply.

3.9 Particular requirements for cellular network modems

3.9.1 General

Cellular Network Modems are required for communication between the HES and network gateway as well as stand-alone metering installations. In order to provide a level of futureproofing, the modems for interfaces G1, G2 shall be modular and capable of being upgraded in the field.

3.9.2 External modems

The requirements as specified in the latest version of "240-61266818: Specification for Cellular Network Modems for Remote Metering" shall fully apply for external modems. However, the following is applicable:

- MV90 shall be replaced with HES throughout the document
- The word meter refers to both a meter and a network gateway when used in in section 3.9 of this document.
- Requirement 4.6.2 (a) of 240-61266818 also includes distinguishing indications between the different packet switched technologies, i.e. GPRS, Edge, 3G or LTE.

3.9.3 Modular on-board modems

Modular on-board modems For modular on-board modems, the requirements as stipulated in this document shall apply. Document 240-61266818 (latest version) shall be read in conjunction with the requirements below.

3.9.4 Transceiver (Section 4.1 of 240-61266818)

The requirements for both the GSM module and Modems under section 4.1 of 240-61266818 shall apply.

3.9.5 Network Communications (Section 4.2 of 240-61266818)

The requirements for network communications under section 4.2 of 240-61266818 shall apply.

3.9.6 Network Settings (Section 4.3 of 240-61266818)

The requirements for network settings under section 4.3 of 240-61266818 shall apply.

3.9.7 Identity Modules (Section 4.4 of 240-61266818)

The requirements for Identity modules under section 4.4 of 240-61266818 shall apply. In addition, the following requirements shall apply.

- 3.9.7.1** The SIM card slot (s) of removable SIM modems shall be easily accessible and located such that the SIM(s) can be easily replaced.

3.9.8 Firmware (Section 4.5 of 240-61266818)

The requirements for firmware under section 4.5 of 240-61266818 shall apply.

3.9.9 User Indication (Section 4.6 of 240-61266818)

The requirements for user indication under section 4.6 of 240-61266818 shall apply. The following clarification applies for 4.6.2 a):

Indications of the various cellular network mode statuses also includes distinguishing between the different packet switched technologies, i.e. GPRS, Edge, 3G or LTE.

3.9.10 Diagnostics (Section 4.7 of 240-61266818)

The requirements for diagnostics under section 4.7 of 240-61266818 shall apply.

3.9.11 Modem Security (Section 4.8 of 240-61266818)

The requirements for modem security under section 4.8 of 240-61266818 shall apply.

3.9.12 Power Supply

The requirements below shall apply for modular on-board modems:

- a) The modem shall be internally powered from the meter or network gateway power supply.
- b) It is preferred that the modem, either through the power supply of the meter or network gateway, offers some type of power-down delay through a super-cap or similar, to enable alarm reporting under a power failure.

3.9.13 Modem Enclosure

3.9.13.1 Only modular on-board modems shall be acceptable.

3.9.13.2 The modem shall be easily mountable and accessible.

3.9.13.3 The insertion and removal of the modular on-board modem shall be such that it does not interfere with the wiring and or live operations of the NG and meter.

3.9.14 Modem Markings (Section 4.11 of 240-61266818)

The requirements for modem markings under section 4.11 of 240-61266818 shall apply.

3.9.15 External Connections

The requirements below shall apply for modular on-board modems:

3.9.15.1 The RF connector shall be of SMA type (female) and be easily accessible.

3.9.15.2 The RF connector shall have a non-reactive impedance of 50 Ω .

3.9.15.3 The modem shall be configurable through the meter's or the network gateway's configuration port. Where this is not possible, the modem shall offer a configuration/diagnostic port that shall either be RS232 via an RJ12 or RJ45 connector or Ethernet.

3.9.15.4 The meter and network gateway shall offer a data communication port for future connectivity of an external modem. It is preferred that this data communication port will be a serial port (RS232/RS485) for meters and an Ethernet port for the network gateway.

3.9.15.5 The communication speed of the serial links shall be selectable as a minimum between 2 400 bps to a maximum of at least 57 600 bps.

3.9.15.6 The supplier shall specify the connector to be used for programming, configuration, and diagnostics.

3.9.15.7 The supplier shall provide full details of any additional connectors the modem may have.

3.9.16 Tests (Section 5 of 240-61266818)

The requirements for type and functional tests under section 5 of 240-61266818 shall apply.

3.9.17 Product Support (Section 6 of 240-61266818)

The requirements for product support under section 6 of 240-61266818 shall apply.

3.9.18 Documentation (Section 7 of 240-61266818)

The requirements for documents under section 7 of 240-61266818 shall apply.

3.9.19 Warranty (Section 8 of 240-61266818)

The requirements for warranty under section 8 of 240-61266818 shall apply.

4. Authorization

This document has been seen and accepted by:

Name and surname	Designation
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5. Revisions

Date	Rev	Compiler	Remarks
Sept 2022	2	ME Makwarela	Document revised to aligned with requirements of the NRS049:2016 Edition 2.1. The following changes were made in NRS049: <ul style="list-style-type: none">• Removed requirements for “route-over” routing and RPL protocol as exclusive routing protocol.• Replaced IEEE 1901.2 and IEEE 18.15.4g with G3-PLC and Wi-SUN FAN, respectively.• Update normative references and certification requirements.• Simplify security requirements.• Removed references to a future national companion specification• Removed ACD and kiosk controller from metering document
March 2018	1	ME Makwarela	Document revised to include requirements for the Head end System and modems

6. Development team

The following people were involved in the development of this document:

- Andre Le Roux
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7. Acknowledgements

Not Applicable